2024 Evolent Clinical Guidelines for Medical Necessity Review - HMSA

ADVANCED IMAGING & CARDIAC GUIDELINES

Effective April 1, 2024 – March 31, 2025

Guidelines for Clinical Review Determination

Preamble

Evolent is committed to the philosophy of supporting safe and effective treatment for patients. The medical necessity criteria that follow are guidelines for the provision of diagnostic imaging. These criteria are designed to guide both providers and reviewers to the most appropriate diagnostic tests based on a patient's unique circumstances. In all cases, clinical judgment consistent with the standards of good medical practice will be used when applying the guidelines. Determinations are made based on both the guideline and clinical information provided at the time of the request. It is expected that medical necessity decisions may change as new evidence-based information is provided or based on unique aspects of the patient's condition. The treating clinician has final authority and responsibility for treatment decisions regarding the care of the patient.

Guideline Development Process

These medical necessity criteria were developed by Evolent for the purpose of making clinical review determinations for requests for therapies and diagnostic procedures. The developers of the criteria sets included representatives from the disciplines of radiology, internal medicine, nursing, cardiology, and other specialty groups. Evolent's guidelines are reviewed yearly and modified when necessary following a literature search of pertinent and established clinical guidelines and accepted diagnostic imaging practices.

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Clinical guidelines **CARDIAC RESYNCHRONIZATION THERAPY (CRT)**	**Original Date: February 2013**
CPT Codes: 33221, 33224, 33225, 33231	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_320	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CARDIAC RESYNCHRONIZATION THERAPY (CRT)[1-8]

Indications for CRT for patients are based upon LV ejection fraction (LVEF), QRS duration, New York Heart Association (NYHA) functional class (presence or absence of symptoms) and need for ventricular pacing regardless of etiology (ischemic or non-ischemic cardiomyopathy). The beneficial effects of CRT have been extensively proven in patients with NYHA class II, III, and IV; there is limited evidence of CRT benefit in patients with NYHA functional class I. Other special situations, such as patients with atrial fibrillation or who require an upgrade from a conventional pacing or ICD system, will be addressed below as well.

Patients with cardiomyopathy on GDMT for 3 months or on GDMT and 40 days after MI; or with implantation of pacing or defibrillation device for special indications

CRT-D Indications by NYHA Heart Failure Class (see full definitions further below in document). See Background for Algorithm for CRT Indications/Recommendations in patients with cardiomyopathy or HFrEF chart.

- Class II- Ambulatory IV
  - LVEF ≤ 35%, QRS ≥ 120ms, LBBB, Sinus Rhythm
  - LVEF ≤ 35%, QRS ≥ 150ms, non-LBBB, Sinus Rhythm

Special Situations

- Independent/Regardless of NYHA Heart Failure Class
    - Patients who have an indication for ventricular pacing and high degree AV block or are expected to be paced more than 40% of the time; this includes patients with Atrial fibrillation
- Atrial fibrillation and LVEF ≤ 35% if:
    - Patient requires ventricular pacing or otherwise meets CRT criteria; **AND**
    - AV nodal ablation or pharmacologic rate control will allow nearly 100% ventricular pacing with CRT
    - For patients with atrial fibrillation and LVEF≤ 50%, if a rhythm control strategy fails and ventricular rates remain rapid despite medical therapy, atrioventricular nodal ablation with implantation of a CRT device is reasonable
- In patients with nonobstructive HCM who have NYHA class II to IV heart failure with LBBB, LVEF < 50%, CRT therapy for symptom reduction is reasonable

NOT Indicated for Cardiac Resynchronization Therapy (CRT)

- NYHA class I and non-LBBB pattern with QRS duration < 150 ms,[3] except as in Special Situations section above
- Inotrope-dependent patients who have a higher risk need for cardiac transplant and LVAD support, are less likely to benefit from CRT
- Comorbidities and/or frailty expected to limit survival with good functional capacity to <1 year
- Active bloodstream infection
- Reversible causes are present such as toxic-, metabolic- or tachycardic-mediated cardiomyopathy, would require reassessment once the situation is corrected
- CRT has not been studied in ATTR-CM with HFrEF

Indications for CRT in Adult Congenital Heart Disease[9-11]

Systemic LV

- Systemic LV EF ≤ 35%, sinus rhythm, wide QRS complex ≥ 130 ms NYHA function Class II— IV

Any Systemic V

- Systemic ventricle any EF (not restricted to ≤ 35%), intrinsic narrow QRS complex, NYHA function Class I—IV and are undergoing new device placement or replacement with anticipated requirement for significant (>40%) ventricular pacing.

Any CHD

- CRT may be considered for patients with a severe subpulmonary RV dysfunction and dilatation despite interventions to decrease RV volume overload, NYHA function Class II—ambulatory IV and wide QRS complex ≥ 150 ms due to a complete RBBB
- NYHA function Class IV and severe ventricular dysfunction who would otherwise be candidates for heart transplantation or mechanical circulatory support

NOT Indicated for CRT in Adult Congenital Heart Disease

- Patients whose co-morbidities and/or frailty limit survival with good functional capacity to less than 1 year

INDICATIONS FOR CRT AS THE APPROPRIATE PACING MODALITY IN SPECIAL SITUATIONS WITH < 3 MONTHS OF GDMT[5, 12, 13]

Criteria are met for a non-elective implantable cardioverter defibrillator (ICD) or pacemaker and based upon the low likelihood of improvement in symptoms and adequate recovery of LVEF, despite less than 3 months GDMT for heart failure or < 40 days post myocardial infarction or 3 months post revascularization, criteria for CRT are otherwise met. This avoids a second implantation procedure within less than 3 months.

BACKGROUND[1, 3-5, 8]

CRT, which paces the left and right ventricle in rapid sequence, also known as biventricular pacing, improves coordination of ventricular contraction in the presence of a wide QRS complex in systolic heart failure.

CRT improves cardiac function and quality of life, and it decreases cardiac events and mortality among appropriately chosen patients. In the proper patient population, improved survival in patients with CRT can be greater than that provided by ICD insertion alone.

Guiding principles in the consideration of CRT:

- NYHA class is an important qualifying factor, with candidacy based on functional class, EF, and QRS duration.
- Bundle branch block or intraventricular conduction delay should be persistent, not rate related.[5]
- GDMT should have been in place continuously for at least 3 months[3, 4, 8] and recovery of LVEF from myocardial infarction (40 days) if no intervening revascularization or > 3 months if revascularization was performed. Reversible causes (e.g., ischemia) should be excluded.
- The patient should have expected survival with reasonably good functional status for more than 1 year.[3, 4, 10]

OVERVIEW

NYHA Class Definitions[5, 14]

- Class I: No limitation of functional activity. Ordinary physical activity does not cause symptoms of HF
- Class II: Slight limitation of activity. Comfortable at rest but ordinary physical activity results in symptoms of HF
- Class III: Marked limitation of activity. Comfortable at rest but less than ordinary activity causes symptoms of HF
- Class IV: Unable to continue any physical activity without symptoms of HF, or symptoms of HF at rest

Heart Block Definitions[3]

- First Degree: All atrial beats are conducted to the ventricles, but with a delay of > 200 ms.
- Second Degree: Intermittent failure of conduction of single beats from atrium to ventricles.
    - Type I: Conducted beats have variable conduction times from atrium to ventricles.
    - Type II: Conducted beats have uniform conduction times from atrium to ventricles.
    - Advanced: Two or more consecutive non-conducted beats (premature atrial beats might not normally be conducted).
- Third Degree: No atrial beats are conducted from atrium to ventricle.

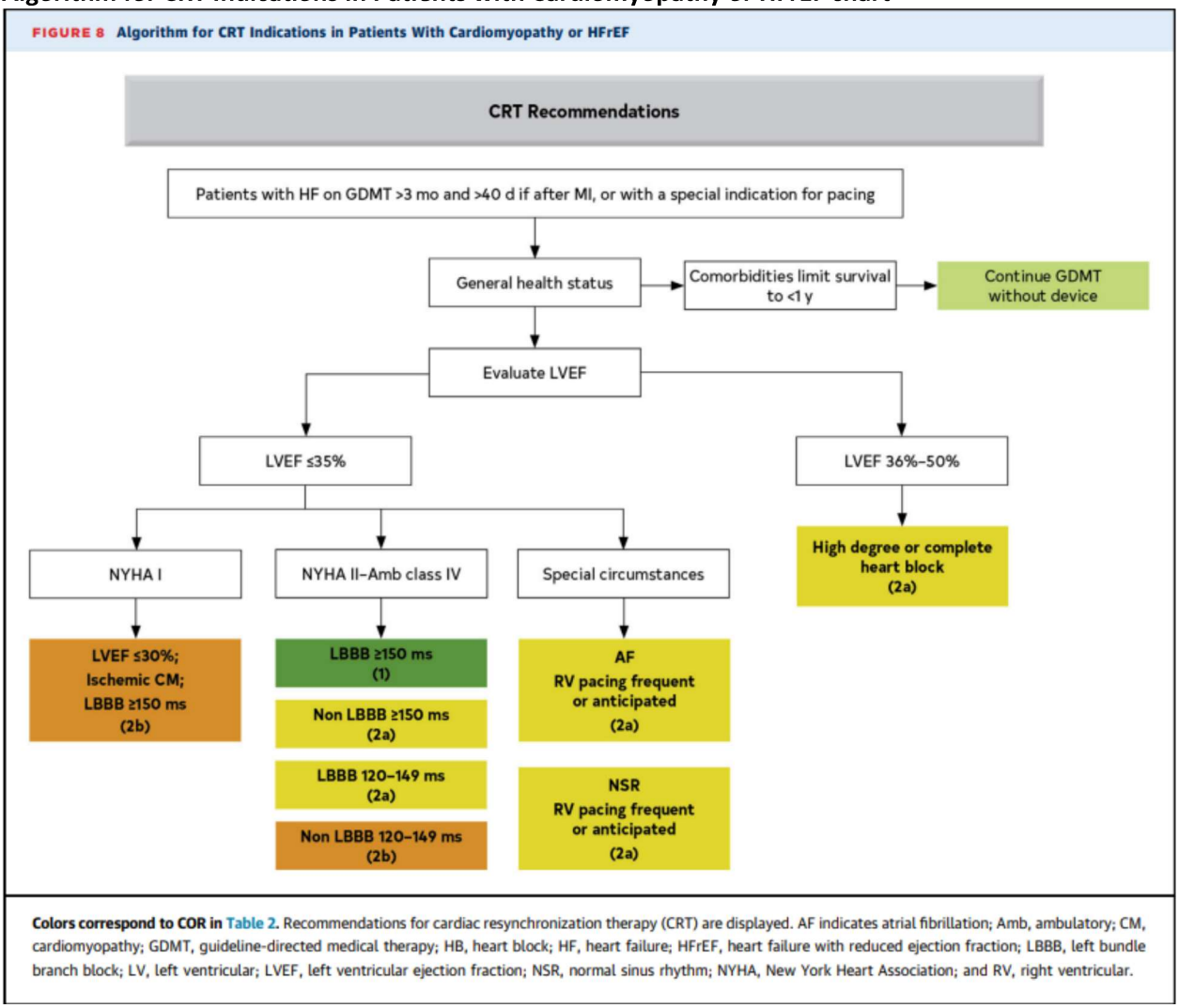
Guideline-Directed (or Optimal) Medical Therapy in Heart Failure[8]

- Angiotensin converting enzyme inhibitor (ACE-I), angiotensin receptor blocker (ARB), or combined angiotensin receptor inhibitor and neprilysin inhibitor (ARNI)
- Beta blocker

Other options/considerations for GDMT

- Addition of loop diuretic for all NYHA class II – IV patients
- Addition of hydralazine and nitrate for persistently symptomatic African Americans, NYHA class III-IV
- Addition of an aldosterone antagonist, provided eGFR is ≥ 30 ml/min/1.73m2 and K+ < 5.0, NYHA class II-IV
- Not required for consideration of CRT: Ivabradine for NYHA class II – III, when a beta blocker has failed to reduce a sinus rate to < 70 bpm.

Algorithm for CRT Indications in Patients with Cardiomyopathy or HFrEF chart[15]



Colors correspond to COR in Table 2. Recommendations for cardiac resynchronization therapy (CRT) are displayed. AF indicates atrial fibrillation; Amb, ambulatory; CM, cardiomyopathy; GDMT, guideline-directed medical therapy; HB, heart block; HF, heart failure; HFrEF, heart failure with reduced ejection fraction; LBBB, left bundle branch block; LV, left ventricular; LVEF, left ventricular ejection fraction; NSR, normal sinus rhythm; NYHA, New York Heart Association; and RV, right ventricular.

Abbreviations

ACE-I	Angiotensin converting enzyme inhibitor
ARB	Angiotensin receptor blocker
ARNI	Combined angiotensin receptor inhibitor and neprilysin inhibitor
AV	Atrioventricular
CAD	Coronary artery disease, same as ischemic heart disease
CHD	Congenital heart disease
CHF	Congestive heart failure
CRT	Cardiac resynchronization therapy (also known as biventricular pacing)
CRT-D	Cardiac resynchronization therapy defibrillator
ECG	Electrocardiogram
EF	Ejection Fraction
eGFR	Estimated glomerular filtration rate
EPS	Electrophysiologic Study
GDMT	Guideline-Directed Medical Therapy
HCM	Hypertrophic Cardiomyopathy
HF	Heart failure
HFrEF	Heart failure with reduced ejection fraction
HV	His-ventricular
ICD	Implantable cardioverter-defibrillator
LBBB	Left bundle branch block
LV	Left ventricular/left ventricle
LVEF	Left ventricular ejection fraction
MI	Myocardial infarction
ms	Milliseconds
NYHA	New York Heart Association
RBBB	Right bundle branch block
RV	Right ventricle
SND	Sinus node dysfunction
SR	Sinus rhythm
STEMI	ST-Elevation Myocardial Infarction
VT	Ventricular tachycardia

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POLICY HISTORY

Date	Summary
April 2023	• Added additional statement on atrial fibrillation • Added statement on ATTR • Added additional contraindication for patients with LVAD • Removed indication for Class I and CRT • Combined Class II- IV indications • Removed EF value for requirement for pacer • Added statement on clinical indications not addressed in this guideline
February 2022	• Added blood stream infection and reversibility as contraindication • Reworded NYHA • Removed single ventricle and RV

Reviewed / Approved by Clinical Guideline Committee

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Clinical guideline **IMPLANTABLE CARDIOVERTER DEFIBRILLATOR (ICD)**	**Original Date: February 2013**
CPT Codes: 33230, 33240, 33249	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_321	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

All indications are predicated on a meaningful life expectancy of greater than one year if the ICD is implanted.

INDICATIONS FOR ICD INSERTION[1-7]

ISCHEMIC HEART DISEASE (CAD)[1, 4, 5]

Primary Prevention of SCD (prophylactic ICD implantation)

- LVEF ≤ 35% due to nonischemic or ischemic heart disease and NYHA class II or III, despite guideline-directed medical therapy (GDMT), and at least 40 days post-myocardial infarction (MI) who have reasonable expectation of meaningful survival of > 1 year
- LVEF ≤ 30% due to ischemic heart disease, NYHA class I, GDMT, and at least 40 days post-MI who have reasonable expectation of meaningful survival of > 1 year
- LVEF ≤ 40% with prior MI, NSVT, and inducible sustained ventricular tachycardia (VT) or ventricular fibrillation (VF) at electrophysiological testing

Secondary Prevention of SCD

- Patients with documented ventricular fibrillation (VF), hemodynamically unstable ventricular tachycardia (VT), or sustained VT, after exclusion of reversible causes
- Syncope of undetermined origin, with inducible VF or sustained VT at electrophysiological study (EPS)
- Syncope of undetermined origin, with EF ≤ 35%

NONISCHEMIC CARDIOMYOPATHY (NICM)[1]

Primary Prevention of SCD (prophylactic ICD implantation)

- Lamin A/C gene mutation, with ≥ 2 risk factors from the following: NSVT, LVEF < 45%, male sex, missense mutation
- LVEF ≤ 35% and NYHA functional Class II or III, despite at least 3 months of GDMT: Recommended
- LVEF ≤ 35% and NYHA functional Class I despite at least 3 months of GDMT: May be considered

Secondary Prevention of SCD

- Patients with documented VF, hemodynamically unstable VT, or sustained VT, after exclusion of reversible causes
- LVEF ≤ 50% with unexplained syncope presumed to be due to VA and who do not meet indications for primary prevention ICD implantation

ADVANCED HEART FAILURE & TRANSPLANTATION[1, 5]

- In non-hospitalized patients with NYHA class IV who are candidates for cardiac transplantation or left ventricular assist device (LVAD)[1, 4, 5]
- In a patient with an LVAD, sustained ventricular arrhythmias[1]
- In NYHA ambulatory class IV, with appropriate indications for CRT (see Background Information section for definition of ambulatory NYHA class IV)

MYOCARDIAL DISEASES

Hypertrophic cardiomyopathy (HCM)

- Previously documented cardiac arrest or sustained ventricular tachycardia
- Adult patients with HCM with at least 1 risk factor for SCD as follows:
    - Sudden death attributable to HCM in at least 1 first-degree relative who is ≤ 50 years of age
    - LVH ≥ 30 mm
    - At least 1 recent episode of syncope suspected by history to be arrhythmic (unlikely neurocardiogenic (vasovagal) and especially occurring within 6 months of evaluation (events beyond 5 years do not appear to have relevance))
    - LV apical aneurysm
    - LV systolic dysfunction (EF < 50%)

- Pediatric patients with HCM with at least 1 risk factor for SCD as follows:
    - Including unexplained syncope
    - LVH ≥ 30 mm
    - Nonsustained ventricular tachycardia
    - Family history of HCM-related SCD

NOTE: **ICD placement for the sole purpose of participation in competitive athletics should not be performed**

- **Cardiac Sarcoidosis** with one of the following[1, 3, 5]:
    - Cardiac arrest or documented sustained VT
    - LVEF ≤ 35%
    - LVEF > 35% with inducible sustained ventricular arrhythmia at EPS
    - Syncope and/or scar on CMR or positron emission tomography (PET)
    - Requires a permanent pacemaker
- **Neuromuscular Disorders (including but not limited to Duchenne, Becker, Limb-girdle type 1B, Limb-girdle type 2C-2F, Limb-girdle type 2I, Myotonic type 1, Myotonic type 2, Emery-Dreifuss, Facioscapulohumeral)** with one of the following[1]:
    - Primary and secondary prevention, with same indications as for NICM[5]
    - Emery-Dreifuss or limb-girdle type I-B muscular dystrophy with progressive cardiac involvement
- **Arrhythmogenic right ventricular cardiomyopathy** and **at least 1** of the following risk factors for SCD[1-3, 8, 9]:
    - Resuscitated sudden cardiac arrest
    - Sustained VT
    - Right or left ventricular systolic dysfunction with an ejection fraction ≤ 35%
    - Syncope with documented or presumed ventricular arrhythmia

CHANNELOPATHIES

- **Congenital long QT syndrome** with **one** of the following[1, 2, 5, 10, 11]
    - Sudden cardiac arrest
    - Sustained VT or recurrent syncope when beta blocker is ineffective or not tolerated
    - QTc > 500 ms on a beta blocker[1]
    - Strong family history of SCD
    - High risk genotype
- **Brugada syndrome and spontaneous type 1 Brugada electrocardiographic pattern** with **one** of the following[1, 2, 5, 12]:
    - Cardiac arrest
    - Documented sustained ventricular arrhythmia
    - Syncope presumed to be due to ventricular arrhythmia
- **Catecholaminergic polymorphic VT** with **one** of the following[1, 2, 4, 13]:
    - Sudden cardiac arrest

    - Syncope or sustained VT
    - Inducible VT or VF
- **Early Repolarization ("J-wave Syndrome") or Short QT Syndrome** with **one** of the following[1, 5]:
    - Cardiac arrest
    - Sustained ventricular arrhythmia
- **Idiopathic Polymorphic VT/VF** with **one** of the following[1]:
    - Cardiac arrest due to polymorphic VT or VF

ADULT & PEDIATRIC CONGENITAL HEART DISEASE (CHD)[1, 3, 5, 14-16]

- Cardiac arrest due to VF or VT, or unstable VT, after exclusion of a reversible etiology
- Systemic LVEF ≤ 35%, biventricular physiology, and NYHA class II or III on GDMT
- Tetralogy of Fallot with one of the following[1, 3]:
    - Spontaneous sustained VT
    - Inducible VF or sustained VT
    - ≥ 1 risk from the following list:
        - Prior palliative systemic to pulmonary shunts
        - Unexplained syncope
        - Frequent PVCs (Premature Ventricular Contractions)
        - Atrial tachycardia
        - Left ventricular dysfunction or diastolic dysfunction
        - NSVT
        - QRS duration ≥ 180 ms
        - Dilated right ventricle
        - Residual pulmonary regurgitation or stenosis
        - RV Hypertension
- Single or systemic right ventricular ejection fraction (RVEF) < 35%, in the presence of an additional risk factor such as:
    - NSVT
    - Unexplained syncope
    - NYHA class II or III, despite GDMT[1, 5]
    - QRS duration ≥ 140 ms
    - Severe systemic AV valve regurgitation
- Syncope of unknown origin in the presence of either at least moderate ventricular dysfunction or marked hypertrophy or inducible sustained VT or VF[1, 3]
- Syncope and moderate or severe complexity CHD, with high clinical suspicion of ventricular arrhythmias
- Non-hospitalized patients with CHD awaiting heart transplantation
- Left ventricular non-compaction that meets same indications as NICM, including a familial history of SCD[4, 17]

EXEMPTIONS

Indications for ICD with an Appropriate Pacing Modality in Special Situations[4, 18] *

- ICD criteria met, and elevated troponin is deemed not due to a myocardial infarction[1]
- ICD criteria met, except for myocardial infarction within 40 days or revascularization within 3 months, but a non-elective permanent pacemaker (new or replacement) is required, and recovery of left ventricular function to LVEF > 35% is uncertain or not expected[4] **
- ICD criteria met, except NICM or ischemic cardiomyopathy has not had 3 months' time for LVEF to improve on medical therapy, a non-elective permanent pacemaker is required, and recovery of LVEF is uncertain or not expected**
- Patient met primary prevention criteria for an ICD prior to coronary revascularization, and it is unlikely that LVEF will recover to > 35% despite a 90-day wait[18]

*** With these ICD indications, CRT would sometimes be the appropriate pacing modality. CRT is likely to be the appropriate modality** with anticipated requirement for significant (> 40%) ventricular pacing

**** These indications avoid a second implantation procedure within less than 3 months**

BACKGROUND[1-7]

The implantable cardioverter defibrillator (ICD) has become valuable in the management of patients with ventricular arrhythmias (VA) capable of causing syncope, cardiac arrest, and sudden cardiac death (SCD).

Patient eligibility for an ICD presumes all the following:

- Anticipated reasonable quality of life for ≥ 1-year post implantation[12]
- Patient's ability to live with a shock-delivering device that requires management
- Absence of a completely reversible cause that led to VA for which an ICD is being considered
- Completion of ≥ 3 months of guideline-directed medical therapy (GDMT) for heart failure (HF), unless an intervening indication for pacemaker implantation arises (see Overview Information section for definition of GDMT)
- ICD indications are present in most scenarios in which cardiac resynchronization therapy (CRT) is appropriate
- Sustained VT is defined as having duration > 30 seconds or requiring termination due to hemodynamic compromise in < 30 seconds

Guidelines for the pediatric population are extrapolated from the adult population due to a lack of relevant trials.[5, 14]

OVERVIEW

General[1-7]

Implantable cardioverter defibrillators (ICDs) are indicated for the treatment of life-threatening ventricular tachycardia and ventricular fibrillation. An ICD system includes a pulse generator and one or more leads. ICDs are indicated both for patients who have survived life threatening rhythm disturbances (secondary prevention) and for those who are at risk for them (primary prevention).

- An ICD continually monitors heart rhythm. If a rapid rhythm is detected, the device delivers electrical therapy directly to the heart muscle to terminate the rapid rhythm and restore a normal heart rhythm. There are two types of therapy that can be delivered:
    - Rapid pacing OR
    - High-voltage shocks are necessary for ventricular fibrillation and when rapid pacing has failed to correct the abnormal rhythm
- In addition, all ICDs have pacing capability, and deliver pacing therapy for slow heart rhythms (bradycardia)
- The parameters defining limits for pacing therapy and for tachycardia therapy are programmable using noninvasive radio signals on all available ICDs

NYHA Class Definitions[4, 19, 20]

- **Class I:** No limitation of functional activity or only at levels of exertion that would limit normal individuals
- **Class II:** Slight limitation of activity. Fatigue, palpitation, or dyspnea with moderate exercise
- **Class III:** Marked limitation of activity. Fatigue, palpitation, or dyspnea with minimal activity
- **Class IV:** Severe limitation of activity. Symptoms even at rest, worse with activity
- **Ambulatory Class IV:** Class IV heart failure with 1) no active acute coronary syndrome; 2) no inotropes; and 3) on GDMT

Guideline-Directed (or Optimal) Medical Therapy for Heart Failure[7]

- Angiotensin converting enzyme (ACE-I), angiotensin receptor blockers (ARB), or combined angiotensin receptor inhibitor and neprilysin inhibitor (ARNI)
- Beta blockers
- Addition of loop diuretic for all NYHA class II – IV patients
- Addition of hydralazine and nitrate for persistently symptomatic African Americans
- Addition of an aldosterone antagonist, provided eGFR is > 30 ml/mi
- Normal serum sodium and potassium

- Not required for consideration of ICD: Ivabradine for NYHA class II – III, when a beta blocker has failed to reduce a sinus rate to < 70 bpm. Ivabradine listed as a class IIa recommendation, while others are class I recommendations. CRT trials antedated routine use of Ivabradine.

Abbreviations

ACE-I	Angiotensin converting enzyme inhibitor
ARNI	Combined angiotensin receptor inhibitor and neprilysin inhibitor
ARVD/C	Arrhythmogenic right ventricular dysplasia/cardiomyopathy
AV	Atrioventricular
CAD	Coronary artery disease, same as ischemic heart disease
CHD	Congenital heart disease
CHF	Congestive heart failure
CRT	Cardiac resynchronization therapy
CRT-D	Cardiac resynchronization therapy ICD system
DCM	Dilated cardiomyopathy
ECG	Electrocardiogram
EF	Ejection fraction
EPS	Electrophysiologic Study
GDMT	Guideline-Directed Medical Therapy
HCM	Hypertrophic cardiomyopathy
HF	Heart failure
HV	His-ventricle
ICD	Implantable cardioverter-defibrillator
LBBB	Left bundle-branch block
LV	Left ventricular/left ventricle
LVAD	Left ventricular assist device, mechanical heart
LVEF	Left ventricular ejection fraction
LVH	Left ventricular hypertrophy
MI	Myocardial infarction
ms	Milliseconds
NICM	Nonischemic cardiomyopathy
NSVT	Nonsustained ventricular tachycardia
NYHA	New York Heart Association
PET	Positron emission tomography
PVC	Premature Ventricular Contraction
RV	Right ventricular/right ventricle
RVEF	Right ventricular ejection fraction
SCD	Sudden Cardiac Death
STEMI	ST-elevation myocardial infarction
SND	Sinus node dysfunction
VT	Ventricular tachycardia
VF	Ventricular fibrillation

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POLICY HISTORY

Date	Summary
April 2023	• Added nonischemic CM indication for EF ≤ 35% and removed statement about requirement of 90-day post revascularization • Added statement on clinical indications not addressed in this guideline
February 2022	• Removed statement about hypertrophic cardiomyopathy being reasonable with family history of SCD

Reviewed / Approved by Clinical Guideline Committee

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HMSA

Specific policy administered by Evolent

Clinical Guidelines Pacemaker	
CPT Codes: 33206, 33207, 33208, 33212, 33213	**Original Date:** February 2013
Guideline Number: HMSA_CG_322	**Last Revised Date (by HMSA):** February 2024
	Last Reviewed Date (by Evolent): April 2023
	Implementation Date: April 2024

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR PACEMAKERS – ADULT (Excludes conditions that are expected to resolve)[1, 2]

Sinus Node Dysfunction (SND)

- Documented symptomatic sinus bradycardia, including frequent sinus pauses
- Symptomatic chronotropic incompetence (broadly defined as an inability to increase heart rate commensurate with activity or demand), documented by stress test or cardiac monitoring data (Holter/MCOT/Electrocardiography (ECG)) recording data
- Symptomatic sinus bradycardia that results from required guideline-directed medical therapy (GDMT) for which there is no alternative treatment
- Heart rate less than 40 while awake, even without definite association with significant symptoms consistent with bradycardia

- Tachycardia-bradycardia syndrome and symptoms attributable to bradycardia[2]
- Syncope of unexplained origin with clinically significant SND, either documented or provoked in electrophysiologic study (EPS)

Acquired Atrioventricular (AV) Block

First-Degree AV Block

- Marked first-degree Mobitz Type 1 AV block with symptoms clearly attributable to the AV block
- First-degree AV block with "pacemaker syndrome" symptoms (chronic fatigue, dyspnea on exertion, symptomatic hypotension) or hemodynamic compromise

Second-Degree AV Block (Mobitz Types I and II)

- Marked second-degree Mobitz Type 1 AV block with symptoms clearly attributable to the AV block
- Second-degree AV block with "pacemaker syndrome" symptoms (chronic fatigue, dyspnea on exertion, symptomatic hypotension) or hemodynamic compromise
- Second-degree Mobitz Type II AV block regardless of symptoms
- Advanced second-degree AV block
- Second-degree AV block associated with a wide QRS, or EPS-documented intra- or infra-His conduction
- Symptomatic bradycardia associated with second-degree AV block, either Mobitz I or II

Third-Degree/Complete AV Block

- Third-degree (complete) AV block, intermittent or persistent, regardless of symptoms
- High-grade AV block, regardless of symptoms

AF/Other

- Atrial fibrillation while awake, with pauses ≥ 5 seconds, or symptomatic bradycardia
- In sinus rhythm (with AV block) while awake, pauses ≥ 3 seconds or heart rates less than 40 beats per minute or an escape rhythm below the AV node
- Following catheter ablation of the AV junction
- Symptomatic AV block that results from required medical therapy for which there is no alternative treatment
- Exercise-induced second- or third-degree AV block without myocardial ischemia

Neuromuscular Disorders

- Marked first-degree or higher AV block, or an H-V interval ≥ 70 ms, associated with neuromuscular diseases, such as myotonic muscular dystrophy, Erb's dystrophy, Kearns-

Sayre syndrome, and peroneal muscular atrophy, regardless of symptoms

Chronic Fascicular (Including any of RBBB, LBBB, LAHB, LPHB) Block

- Alternating bundle-branch block
- Syncope of unexplained origin when other likely causes have been excluded, specifically ventricular tachycardia[3]
- Syncope and bundle branch block with an HV interval ≥ 70 ms, or evidence of infranodal block at EPS[2]
- Incidental findings at EPS study of an H-V interval ≥ 100 milliseconds, or non-physiological, pacing-induced infra-His block in asymptomatic patients

Hypersensitive Carotid Sinus Syndrome and Neurocardiogenic Syncope

- Recurrent syncope due to spontaneously occurring carotid sinus stimulation AND carotid sinus pressure induced ventricular asystole ≥ 3 seconds, or AV block, or ≥ 50 mmHg drop in systolic BP[1, 3]
- Syncope without clear, provocative events and with a hypersensitive cardioinhibitory response (asystole) ≥ 3 seconds
- Recurrent syncope and asystole ≥ 3 seconds with syncope or ≥ 6 seconds without symptoms or with presyncope, documented by ECG recording data[4, 5]

Pacing to Terminate or Prevent Tachycardia

- Symptomatic recurrent supraventricular tachycardia documented to be terminated by pacing in the setting of failed catheter ablation and/or drug treatment
- Prevention of pause-dependent ventricular tachycardia (VT)

INDICATIONS FOR PEDIATRIC AND ADULT CONGENITAL HEART DISEASE PACING[1, 4, 6]

Children, Adolescents (< 19 years), and ADULT Patients with Congenital Heart Disease (CHD)

Sinus Node Dysfunction (SND)

- SND with symptomatic age- and activity-inappropriate bradycardia
- Sinus bradycardia with complex CHD AND a resting heart rate < 40 bpm **OR** pauses in ventricular rate > 3 seconds
- CHD and impaired hemodynamics due to sinus bradycardia or loss of AV synchrony
- Asymptomatic sinus bradycardia following repair of CHD with an awake resting heart rate < 40 bpm or pauses in ventricular rate > 3 seconds
- CHD and SND or junctional bradycardia, for the prevention of recurrent episodes of intra-atrial reentrant tachycardia[4, 6, 7]

AV Block

- Second- or third-degree AV block with symptomatic bradycardia, ventricular dysfunction, or low cardiac output
- Congenital third-degree AV block with a wide QRS escape rhythm, complex ventricular ectopy, or ventricular dysfunction
- Congenital third-degree AV block in the infant with a ventricular rate < 55 bpm or with congenital heart disease and a ventricular rate < 70 bpm
- Congenital third-degree AV block after 1 year of age with an average heart rate < 50 bpm, abrupt pauses in ventricular rate that are 2 or 3 times the basic cycle length, or associated with symptoms due to chronotropic incompetence
- Adults with congenital complete AV block with symptomatic bradycardia, wide QRS escape rhythm, mean daytime heart rate < 50 bpm, complex ventricular ectopy, or ventricular dysfunction[2]
- Adults with congenital complete AV block, regardless of symptoms[2]
- Unexplained syncope after prior congenital heart surgery complicated by transient complete heart block, with residual fascicular block after excluding other causes of syncope
- Congenital third-degree AV block in asymptomatic children or adolescents with an acceptable rate, a narrow QRS, and normal ventricular function

Scenarios in which Pacemakers are Not Indicated

- SND in patients that are asymptomatic, or symptoms occur without documented bradycardia
- Asymptomatic first-degree AV block or Mobitz I second-degree AV block with a narrow QRS
- Asymptomatic fascicular block (Including any of RBBB, LBBB, LAHB, LPHB)
- Asymptomatic bifascicular block (RBBB/LAHB or RBBB/LPHB) with or without first-degree AVB where a higher degree of heart block has not been demonstrated
- Hypersensitive cardioinhibitory response to carotid sinus stimulation without symptoms or with vague symptoms
- Asymptomatic bifascicular block (RBBB/LAHB or RBBB/LPHB) with or without first-degree AVB after surgery for CHD without prior transient complete AV block

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BACKGROUND[1]

Pacemaker implantation generally serves to address bradycardia, with the intention of ameliorating related symptoms, preventing complications of syncope, and/or reducing mortality risk.

This guideline is not intended to cover the type of bradycardia pacing device. CRT (cardiac resynchronization therapy or biventricular pacing) and ICD (implantable cardioverter defibrillator) implantation are covered in separate guidelines.

OVERVIEW

General

A pacemaker system is composed of a pulse generator and one or more leads. The pulse generator is implanted under the skin, usually below one of the collarbones (clavicles). It contains a battery, a microprocessor that governs timing and function, and a radio antenna to allow for noninvasive interrogation and reprogramming. The leads are insulated cables that conduct electricity from the pulse generator to the heart. Leads are most commonly inserted into a vein and then advanced under fluoroscopy (x-ray guidance) to within one or more heart chambers. The leads are fastened within the chambers to the heart muscle using either hooks or retractable/extendable screws, which are built into their tips. Timed electrical impulses are delivered from the pulse generator via the leads to the heart, where stimulation results in heart muscle contraction.

Leadless pacemakers are sometimes used as an alternative to transvenous pacemakers when no upper extremity venous access exists or when risk of device pocket infection is particularly high, such as previous infection and patients on hemodialysis.[8]. The prevalence of leadless device infections is low as the principal source of infection.

Heart Block Definitions[1]

- First-Degree: All sinus or atrial beats are conducted to the ventricles, but with a delay (PR interval of > 200 ms)
- Second-Degree: Intermittent failure of conduction of single beats from atrium to ventricles
    - (Mobitz) Type I: Conducted beats have variable conduction times from atrium to ventricles
    - (Mobitz) Type II: Conducted beats have uniform conduction times from atrium to ventricles
    - Advanced or high degree: Two or more consecutive non-conducted sinus or (non-premature) atrial beats with some conducted beats
- Third-Degree: No atrial beats are conducted from atrium to ventricle

Abbreviations

AV	Atrioventricular
CHF	Congestive heart failure
CRT	Cardiac resynchronization therapy (same as biventricular pacing)
ECG	Electrocardiogram
EPS	Electrophysiologic Study
GDMT	Guideline-Directed Medical Therapy
HV	His-ventricular
ICD	Implantable cardioverter-defibrillator
LAHB	Left Anterior Hemiblock
LBBB	Left bundle-branch block
LPHB	Left Posterior Hemiblock
LV	Left ventricular/left ventricle
LVEF	Left ventricular ejection fraction
MI	Myocardial infarction
ms	Milliseconds
RBBB	Right Bundle Branch Block
s	Seconds
STEMI	ST-elevation Myocardial Infarction
SND	Sinus node dysfunction
VT	Ventricular tachycardia

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POLICY HISTORY

Date	Summary
February 2024	• Removed leadless pacemakers capacity to pace ventricle only in background section • Removed CPT codes 33214, 33227, 33228 to align with Matrix for HMSA
April 2023	• Additional statement on leadless pacemaker • Added statement on clinical indications not addressed in this guideline
February 2022	• Added section on leadless pacemakers

Reviewed / Approved by Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **TEMPOROMANDIBULAR JOINT (TMJ) MRI**	**Original Date: May 2003**
CPT Code: 70336	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_007	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR TEMPOROMANDIBULAR JOINT (TMJ) MRI

For evaluation of temporomandibular joint dysfunction (TMD) with suspected internal joint derangement with[1-3]:

- Persistent symptoms of facial or jaw pain, restricted range of motion, pain and/or noise with TMJ function (i.e., chewing) **AND**
- Conservative therapy with a trial of anti-inflammatory **AND** behavioral modification* has been unsuccessful for at least four (4) weeks

* Behavioral modification includes patient education, self-care, cognitive behavior therapy, physical therapy, and occlusal devices. Muscle relaxants can be used for spasm.

Note: X-ray should be the initial study if there is recent trauma, dislocation, malocclusion, or dental infection

For evaluation of juvenile idiopathic arthritis (JIA)[3, 4]

Abnormal initial x-ray or ultrasound needing additional imaging[1]

Pre-operative evaluation in candidates for orthognathic surgery

Post-operative evaluation[5]

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BACKGROUND

Temporomandibular joint (TMJ) dysfunction causes pain and dysfunction in the jaw joint and muscles controlling jaw movement. Symptoms may include jaw pain, masticator muscle stiffness, limited movement or locking of the jaw, clicking or popping in jaw joint when opening or closing the mouth, and a change in how the upper and lower teeth fit together. The cause of the condition is not always clear but may include acute or chronic trauma to the jaw or temporomandibular joint, e.g., grinding of teeth, clenching of jaw, or impact in an accident. Osteoarthritis or rheumatoid arthritis may also contribute to the condition.

Etiologies of TMJ dysfunction (TMD) include intra-articular (intracapsular) and extra-articular (extracapsular pathology). Intra-articular (intracapsular pathology), such as disc displacement and coexisting osteoarthritis or degenerative joint disease, is considered the most common cause of serious TMJ pain and dysfunction and the most likely to be treated surgically. Extra-articular (extracapsular pathology) includes musculoskeletal (bone, masticatory muscles and tendons) and central nervous system/peripheral nervous system.[6]

Imaging can assist in the diagnosis of TMD when history and physical examination findings are equivocal. The initial study should be plain radiography (transcranial and transmaxillary views) or panoramic radiography when there is recent trauma, dislocation, malocclusion, or dental infection.[2] Ultrasound is an inexpensive and easily performed imaging modality that can also be used to evaluate the TMJ.[7] CT is useful to evaluate the bony structures of the TMJ when there is suspicion of bony involvement (i.e., fractures, erosions, infection, invasion by tumor, as well as congenital anomalies).[1] Magnetic resonance imaging (MRI) has the highest sensitivity, specificity, and accuracy in the evaluation of temporomandibular joint dysfunction and provides tissue contrast for visualizing the soft tissue and periarticular structures of the TMJ.

Conservative care for TMD includes patient education, self-care, behavioral modification, cognitive behavioral therapy/biofeedback, medication, physical therapy, and occlusive devices. Medications include NSAIDS and muscle relaxants and in chronic cases, benzodiazepines, or antidepressants. There is lack of high-quality evidence and uncertainty about the effectiveness of manual therapy and therapeutic physical therapy in treating TMJ dysfunction.[8] The use of occlusive splints is thought to alleviate some of the degenerative forces on the TMJ which may be helpful in patients with bruxism or nocturnal teeth clenching. Preferred devices are unclear from the literature and dental consultation is required.[2] In systematic reviews, there has been short-term benefit observed from splinting but no clear role in the overall long-term treatment of TMD patients.[9, 10]

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POLICY HISTORY

Date	Summary
April 2023	• Updated references • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
May 2022	Updated background and references

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **BRAIN (HEAD) CT**	**Original Date: September 1997**
CPT Codes: 70450 70460 70470	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_002	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

REDUCING RADIATION EXPOSURE

Brain CT/CTA are not approvable simultaneously unless they meet the criteria described below in the Indications for Brain CT/Brain CTA combination studies section. If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- Inconclusive or show a need for additional or follow up imaging evaluation OR
- The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.

(*Unless approvable in the combination section as noted in the guidelines)

Important Note: Brain MRI is preferred to Brain CT in most circumstances where the patient can tolerate MRI and sufficient time is available to schedule the MRI examination. Assessment of subarachnoid hemorrhage, acute trauma, or bone abnormalities of the calvarium (fracture, etc.) may be better imaged with CT. CT is also appropriate in an urgent situation where MRI is not readily available (stroke, increased ICP, CNS infection).

‡‡ — *Designates CT is indicated only when MRI is contraindicated or cannot be performed*

INDICATIONS FOR BRAIN CT

For evaluation of headache[1-5]

- Chronic headache with a change in character/pattern (e.g., more frequent, increased severity or duration) ‡‡
- Cluster headaches or other trigeminal-autonomic cephalgias, i.e., paroxysmal hemicrania, hemicrania continua, short-lasting unilateral neuralgiform headache attacks (SUNCT/SUNA) imaging is indicated once to eliminate secondary causes[6] ‡‡
- Acute headache, sudden onset:
    - With a personal or family history (brother, sister, parent, or child) of brain aneurysm or AVM (arteriovenous malformation)
    - < 48 hours of "worst headache in my life" or "thunderclap" headache
        - Note: The duration of a thunderclap type headache lasts more than 5 minutes. Sudden onset new headache reaching maximum intensity within 2-3 minutes.
    - Prior history of stroke or intracranial bleed
    - Known coagulopathy or on anticoagulation
- New onset of headache with any of the following[1, 7, 8]:
    - Acute, new, or fluctuating neurologic deficits, such as sensory deficits, limb weakness, abnormal reflexes (pathological, asymmetric, hyperreflexia), speech difficulties, visual loss, lack of coordination, or mental status changes or with signs of increased intracranial pressure (papilledema). See background ‡‡
    - History of cancer or significantly immunocompromised ‡‡
    - Fever
    - Subacute head trauma
    - Age ≥ 50 ‡‡
    - New severe unilateral headache with radiation to or from the neck, associated with suspicion of carotid or vertebral artery dissection ‡‡
    - Related to activity or event (sexual activity, exertion, Valsalva, position) and (new or progressively worsening ‡‡
    - Persistent or worsening during a course of physician-directed treatment[1, 9, 10] ‡‡

Note: Neuroimaging warranted for atypical/complex migraine aura, but not for a typical migraine aura (see background)

- Special considerations in the pediatric population with persistent headache[11]
    - Occipital location ‡‡
    - Age < 6 years ‡‡
    - Symptoms indicative of increased intracranial pressure, such as recurring headaches after waking with or without associated nausea/vomiting ‡‡
    - Documented absence of family history of headache ‡‡

- Severe headache in a child with an underlying disease that predisposes to intracranial pathology (e.g., immune deficiency, sickle cell disease, neurofibromatosis, history of neoplasm, coagulopathy, hypertension, congenital heart disease)

For evaluation of neurologic symptoms or deficits[12]

- Acute, new, or fluctuating neurologic symptoms or deficits, such as sensory deficits, limb weakness, abnormal reflexes (pathological, asymmetric, hyperreflexia), speech difficulties, visual loss, lack of coordination, or mental status changes (see background)

For evaluation of known or suspected stroke or vascular disease[13-15]

- Known or suspected stroke with any acute, new, or fluctuating symptoms or deficits such as sensory deficits, limb weakness, speech difficulties, visual loss, lack of coordination, or mental status changes (see background)
- Suspected stroke with first-degree family history of aneurysm (brother, sister, parent, or child) or known coagulopathy or on anticoagulation
- Symptoms of transient ischemic attack (TIA) (episodic neurologic symptoms such as sensory deficits, limb weakness, speech difficulties, visual loss, lack of coordination, or mental status changes) ‡‡
- Suspected acute subarachnoid hemorrhage (SAH)
- Follow-up for known hemorrhage, hematoma, or vascular abnormalities
- Suspected central venous thrombosis - see background[14, 16] ‡‡
- Evaluation of neurological signs or symptoms in sickle cell disease[17-19] ‡‡
- High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity >200 ‡‡[19]

For evaluation of known or suspected trauma[20-24]

- Known or suspected trauma or injury to the head with documentation of one or more of the following acute, new, or fluctuating:
  - Focal neurologic findings
  - Motor changes
  - Mental status changes
  - Amnesia
  - Vomiting
  - Seizures
  - Headache
  - Signs of increased intracranial pressure
- Known coagulopathy or on anticoagulation
- Known or suspected skull fracture by physical exam and/or prior imaging
- Repeat scan 24 hours post head trauma for anticoagulated patients with suspected diagnosis of delayed subdural hematoma

- Post concussive syndrome if persistent or disabling symptoms and imaging has not been performed
- Subacute or chronic traumatic brain injury with new cognitive and/or neurologic deficit ‡‡

For evaluation of suspected brain tumor, mass, or metastasis[25-27]

- Suspected brain tumor with any acute, new, or fluctuating neurologic symptoms or deficits such as sensory deficits, abnormal reflexes (pathological, asymmetric, hyperreflexia), limb weakness, speech difficulties, visual loss, lack of coordination or mental status changes ‡‡ (see background)
- Suspected brain metastasis or intracranial involvement in patients with a history of cancer based on symptoms or examination findings (may include new or changing lymph nodes) ‡‡
- Lesion with atypical features for further evaluation or follow up
- Suspected Pituitary Tumors (Brain MRI is the study of choice if indicated) or Sella CT if MRI is contraindicated or cannot be performed
- Histiocytic Neoplasms for screening and/or with neurological signs or symptoms[28,29]
    - Erdheim-Chester Disease
    - Langerhans Cell Histiocytosis
    - Rosai-Dorfman Disease
- Screening for known non-CNS Cancer and for screening of hereditary cancers syndromes (Brain MRI is the study of choice if indicated)

For evaluation of known brain tumor, mass, or metastasis

- Follow-up of known CNS cancer (either primary malignant brain tumor or secondary brain metastasis) undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer[27] ‡‡
- Suspected recurrence with prior history of CNS cancer (either primary or secondary) based on neurological symptoms or examination findings ‡‡
- Follow-up of known low grade tumor (WHO I-II) (i.e., meningioma, glioma, astrocytoma, oligodendroglioma) ‡‡
    - For surveillance as per as per professional society recommendations[27]
    - If symptomatic, new/changing signs or symptoms or complicating factors
- Known pituitary tumors (Brain MRI is the study of choice if indicated) or Sella CT if MRI is contraindicated or cannot be performed
- Tumor monitoring in neurocutaneous syndromes as per tumor type ‡‡
- Bone tumor or abnormality of the skull[28]
- Histiocytic Neoplasms to assess treatment response and surveillance of known brain/skull lesions[29, 30]
    - Erdheim-Chester Disease
    - Langerhans Cell Histiocytosis
    - Rosai-Dorfman Disease [31]

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated, OR evaluation of suspected metastases[27] ‡‡

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine, or Lumbar Spine

For evaluation of known or suspected seizure disorder[32-36]

- New onset of seizures or newly identified change in seizure activity/pattern ‡‡ (Brain MRI is the study of choice if indicated)

For evaluation of known or suspected inflammatory disease or infection (e.g., meningitis or abscess)[37, 38] ‡‡

- Suspected intracranial abscess or brain infection with acute altered mental status OR positive lab findings (such as elevated WBCs) OR follow-up assessment during or after treatment completed ‡‡
- Meningitis with positive signs and symptoms (such as fever, headache, mental status changes, stiff neck) OR positive lab findings (such as elevated white blood cells or abnormal lumbar puncture fluid exam) ‡‡
- Suspected encephalitis with headache and altered mental status OR follow-up as clinically warranted ‡‡
- Endocarditis with suspected septic emboli ‡‡
- Central Nervous System (CNS) involvement in patients with known or suspected vasculitis or autoimmune disease with abnormal inflammatory markers or autoimmune antibodies ‡‡
- Suspected primary CNS vasculitis based on neurological signs and symptoms with completed infectious/inflammatory lab work-up ‡‡ [39, 40]
- Immunocompromised patient (e.g., transplant recipients, HIV with CD4 < 200, primary immunodeficiency syndromes, hematologic malignancies) with focal neurologic symptoms, headaches, behavioral, cognitive, or personality changes ‡‡ [41]

For evaluation of clinical assessment documenting cognitive impairment of unclear cause[42-44]

- Change in mental status with a mental status score of either MMSE or MoCA of less than 26 or other similar mental status instruments */formal neuropsychological testing showing at least mild cognitive impairment AND a completed basic metabolic workup (such as thyroid function testing, liver function testing, complete blood count, electrolytes, and B12) ‡‡

* Other examples include Mini-Cog, Memory Impairment Screen, Saint Louis University Mental Status Examination (SLUMS), Brief Alzheimer's Screen (BAS), Blessed Dementia Scale (BDS), Clinical Dementia Rating (CDR)[45, 46]

For evaluation of movement disorders[47, 48]

- Acute onset of a movement disorder with concern for stroke or hemorrhage ‡‡
- For evaluation of Parkinson's disease with atypical feature or other movement disorder (i.e., suspected Huntington disease, chorea, parkinsonian syndromes, hemiballismus, atypical dystonia) to exclude an underlying structural lesion ‡‡

Note: CT has limited utility in the chronic phases of disease. Brain MRI is the study of choice if indicated. Imaging is not indicated in essential tremor, Tourette' syndrome or isolated focal dystonia (e.g., blepharospasm, cervical dystonia, laryngeal dystonia, oromandibular dystonia, writer's dystonia).[49-51]

For evaluation of cranial nerve and visual abnormalities (Brain MRI is the study of choice if indicated)

- Abnormal eye findings on physical or neurologic examination (papilledema, nystagmus, ocular nerve palsies, new onset anisocoria, visual field deficit, etc.)[52] ‡‡
  Note: See background
- Binocular diplopia with concern for intracranial pathology[53] after comprehensive eye evaluation ‡‡
- Childhood strabismus with development delay or abnormal fundoscopic exam to rule out intracranial abnormalities[54, 55] ‡‡
- Horner's syndrome with symptoms localizing the lesion to the central nervous system[56] ‡‡
- Evaluation of cranial nerve palsy/neuropathy/neuralgia when thought to be due to tumor, stroke, or bony abnormalities of the skull base or when MRI is contraindicated or cannot be performed[57]
- Bulbar symptoms, i.e., difficulty in chewing, weakness of the facial muscles, dysarthria, palatal weakness, dysphagia, and dysphonia and/or signs, i.e., atrophy and fasciculations of the tongue and absent gag reflex[58]‡‡
- Pseudobulbar symptoms, i.e., dysphagia, dysarthria, facial weakness, sudden, stereotyped emotional outbursts that are not reflective of mood and/or signs, i.e., spastic tongue and exaggerated gag/jaw jerk[59]‡‡

For evaluation of known or suspected congenital abnormality (such as craniosynostosis, neural tube defects)[60-62]

- Known or suspected congenital abnormality with any acute, new, or fluctuating neurologic, motor, or mental status changes
- Evaluation of macrocephaly in an infant/child <18 with previously abnormal US, abnormal neurodevelopmental examination,[63] signs of increased ICP or closed anterior fontanelle ‡‡
- Microcephaly in an infant/child < 18 ‡‡
- Craniosynostosis and other head deformities
- Evaluation of the corticomedullary junction in Achondroplasia[64, 65] ‡‡

- Cerebral palsy if etiology has not been established in the neonatal period, there is change in the expected clinical or developmental profile or concern for progressive neurological disorder[66, 67]
- Prior treatment or planned treatment for congenital abnormality
  Note: For evaluation of known or suspected hydrocephalus please see section on CSF abnormalities.

Cerebral Spinal Fluid (CSF) Abnormalities

- Evaluation of suspected hydrocephalus with any acute, new, or fluctuating neurologic, motor, or mental status changes
- Known hydrocephalus**†**
- For initial evaluation of a suspected Arnold Chiari malformation **‡‡**
- Follow-up imaging of a known type II or type III Arnold Chiari malformation **‡‡**. For Arnold Chiari type I, follow-up imaging only if new or changing signs/symptoms[68, 69]
- Initial evaluation for a known syrinx or syringomyelia**‡‡**
- Known or suspected normal pressure hydrocephalus (NPH)[70]
  - With symptoms of gait difficulty, cognitive disturbance, and urinary incontinence
- Follow-up shunt evaluation[71-73]
  - Post operativity if indicated based on underlying disease and pre-operative radiographic findings and/or
  - 6-12 months after placement and/or
  - With neurologic symptoms that suggest shunt malfunction
- Evaluation of known or suspected cerebrospinal fluid (CSF) leakage[74]
- Cisternography for intermittent and complex CSF rhinorrhea/otorrhea. CSF fluid should always be confirmed with laboratory testing (Beta-2 transferrin assay)[75, 76]
- Suspected spontaneous intra-cranial hypotension with distinct postural headache other symptoms include: nausea, vomiting, dizziness, tinnitus, diplopia neck pain or imbalance[77] **‡‡**
  †Often congenital, but can present later in life; or less commonly acquired secondary to tumor, stroke, trauma, infection, etc.[78]

Further evaluation of indeterminate or questionable findings on prior imaging:

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Pre-operative/procedural evaluation for brain/skull surgery

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Other Indications[19, 79-81]

- Vertigo associated with any of the following: ‡‡
    - Signs or symptoms suggestive of a CNS lesion (ataxia, visual loss, double vision, weakness or a change in sensation)[82, 83]
    - Progressive unilateral hearing loss
    - Risk factors for cerebrovascular disease with concern for stroke
    - After full neurologic examination and vestibular testing with concern for central vertigo (i.e., skew deviation, vertical nystagmus, head thrust test, videonystagmography (VNG)/ electronystagmography (ENG))
- Diagnosis of central sleep apnea on polysomnogram ‡‡
    - Children > 1 year[84]
    - Adults in the absence of heart failure, chronic opioid use, high altitude, or treatment emergent central sleep apnea AND concern for a central neurological cause (Chiari malformation, tumor, infectious/inflammatory disease) OR with an abnormal neurological exam[85]
- Syncope with clinical concern for seizure or associated neurological signs or symptoms[86-88] ‡‡
- Cyclical vomiting syndrome or abdominal migraine with any localizing neurological symptoms[89-91] ‡‡
- Soft tissue mass of the head with nondiagnostic initial evaluation (ultrasound and/or radiograph)[92-94]‡‡
- Psychological changes with neurological deficits on exam or after completion of a full neurological assessment that suggests a possible neurologic cause[95] ‡‡
- Global developmental delay or developmental delay with abnormal neurological examination in a child < 18 years[96, 97] ‡‡
- Unexplained event (BRUE) formerly apparent life-threatening event (ALTE) in infants < 1 year with concern for neurological cause based on history and exam[98] ‡‡
  Note: Imaging is not indicated in low-risk patients
- Prior to lumbar puncture in patients with suspected increased intracranial pressure or at risk for herniation

Indications for Combination Studies[13, 14]

Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the neuroaxis), patient history, and other available information, including prior imaging.

Exception: Approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology[99]

- **Brain CT/Neck CTA**
    - Recent ischemic stroke or transient ischemic attack
    - Suspected carotid or vertebral artery dissection with focal or lateralizing neurological deficits
- **Brain CT/Brain CTA**
    - Recent ischemic stroke or transient ischemic attack
    - Acute, sudden onset of headache with personal history of a vascular abnormality or first-degree family history of aneurysm
    - Headache associated with exercise, exertion, Valsalva or sexual activity[6] ‡‡
    - Suspected venous thrombosis (dural sinus thrombosis) – Brain CTV (see background) ‡‡
    - Neurological signs or symptoms in sickle cell patients ‡‡
    - High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200 ‡‡ [19]
- **Brain CT/Brain CTA/Neck CTA**
    - Recent stroke or transient ischemic attack (TIA)
    - Suspected carotid or vertebral artery dissection with focal or lateralizing neurological deficits

*Note: MRA and CTA are generally comparable noninvasive imaging alternatives each with their own advantages and disadvantages. Brain MRI can alternatively be combined with Brain CTA/Neck CTA.

- **Brain CT/Orbit CT**
    - Optic neuropathy or unilateral optic disk swelling of unclear etiology to distinguish between a compressive lesion of the optic nerve, optic neuritis, ischemic optic neuropathy (arteritic or non-arteritic), central retinal vein occlusion, or optic nerve infiltrative disorders[100] ‡‡
    - Bilateral optic disk swelling (papilledema) with visual loss[101] ‡‡
- **Brain CT/Cervical CT/Thoracic CT/Lumbar CT (any combination) ‡‡**
    - For initial evaluation of a suspected Arnold Chiari malformation
    - Follow-up imaging of a known type II or type III Arnold Chiari malformation. For Arnold Chiari type I, follow-up imaging only if new or changing signs/symptoms[68, 69]
    - Oncological Applications (e.g., primary nervous system, metastatic)
        - Drop metastasis from brain or spine (CT spine imaging in this scenario is usually CT myelogram) see background
        - Suspected leptomeningeal carcinomatosis (see background)[102]
        - Tumor evaluation and monitoring in neurocutaneous syndromes

- CSF leak highly suspected and supported by patient history and/or physical exam findings (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula - CT spine imaging in this scenario is usually CT myelogram)[103]

BACKGROUND

Computed tomography (CT) is an imaging technique used to view the structures of the brain and is useful in evaluating pathologies in the brain. It provides more detailed information on head trauma, brain tumors, stroke, and other pathologies in the brain than regular radiographs.

CT scan for Headache – Generally, magnetic resonance imaging is the preferred imaging technique for evaluating the brain parenchyma, and CT is preferable for evaluating subarachnoid hemorrhage. CT is faster and more readily available than MRI and is often used in urgent clinical situations. Neurologic imaging is warranted in individuals with headache disorders along with abnormal neurologic examination results or predisposing factors for brain pathology.

Headache timeframes and other characteristics – Generally, acute headaches are present from hours to days, subacute from days to weeks, and chronic headaches for more than 3 months. Acute severe headaches are more likely to be pathological (e.g., SAH, cerebral venous thrombosis) than non-acute (e.g., migraine, tension-type). Headaches can also be categorized as new onset or chronic/recurrent. Non-acute, new onset headaches do not require imaging unless there is a red flag as delineated above. Incidental findings lead to additional medical procedures and expense that do not improve individual well-being. Primary headache syndromes, such as migraine and tension headaches, are often episodic with persistent or progressive headache not responding to treatment, requiring further investigation (e.g., new daily persistent headache). Imaging is indicated in chronic headaches if there is a change in the headache frequency (number of headaches episodes/month), duration of each episode, severity of the headaches or new characteristics, such as changing aura or associated symptoms.[1, 6, 104-106]

Migraine with Aura[6, 7, 107] – The headache phase of a migraine is preceded and/or accompanied by transient neurological symptoms, referred to as aura, in at least a third of migraine attacks. The most common aura consists of positive and/or negative visual phenomena, present in up to 99% of the individuals. Somatosensory is the secondary most common type of aura (mostly paresthesia in an upper limb and/or hemiface). Language/speech (mainly paraphasia and anomic aphasia) can also be affected. These neurological symptoms typically evolve over a period of minutes and may last up to 20 minutes or more. The gradual evolution of symptoms is thought to reflect spreading of a neurological event across the visual and somatosensory cortices. Characteristically, the aura usually precedes and terminates prior to headache, usually within 60 minutes. In others, it may persist or begin during the headache phase. ICHD-3 definition of the aura of migraine with typical aura consists of visual and/or sensory and/or speech/language symptoms, but no motor, brainstem, or retinal symptoms and is characterized by gradual development, duration of each symptom no longer than one hour, a mix of positive and negative features and complete reversibility. Atypical or complex aura includes motor,

brainstem, monocular visual disturbances, or ocular cranial nerve involvement (hemiplegic migraine, basilar migraine/brainstem aura, retinal migraine, ophthalmoplegic migraine) and secondary causes need to be excluded. Additional features of an aura that raise concern for an underlying vascular etiology include late age of onset, short duration, evolution of the focal symptoms, negative rather than positive visual phenomenon, and history of vascular risk factors.

Neurological Deficits – Examples of abnormal reflexes related to upper motor neuron lesion/central pathology include hyperreflexia, clonus, Hoffman sign and Babinski, snout, palmar grasp, and rooting reflexes.

Visual loss has many possible etiologies, and MRI or CT is only indicated in suspected neurological causes of visual loss based on history and exam. Visual field defects, such as bitemporal hemianopsia, homonymous hemianopsia, or quadranopsia, require imaging as well as does suspected optic nerve pathology. Subjective symptoms such as blurred vision or double vision with no clear correlate on neurological examination requires a comprehensive eye evaluation to exclude more common causes, such as cataracts, refractive errors, retinopathy, glaucoma, or macular degeneration. Transient visual loss with history consistent with TIA but normal exam at time of examination also should be imaged. Positive visual phenomena, such as photopsias or scintillations that march across the visual field, suggest migraine whereas negative phenomenon, such as shaded or blurred, is more characteristic of ischemia.

Imaging for Stroke – Individuals presenting with symptoms of acute stroke should receive prompt imaging to determine whether they are candidates for treatment with tissue plasminogen activator. Non-contrast CT can evaluate for hemorrhage that would exclude the individual from reperfusion therapy. Functional imaging can be used to select individuals for thrombolytic therapy by measuring the mismatch between "infarct core" and "ischemic penumbra" and may define ischemic areas of the brain with the potential to respond positively to reperfusion therapy. Contrast-enhanced CT angiography (CTA) may follow the non-contrast CT imaging to identify areas of large vessel stenosis or occlusion which may be a target for therapy.

Recent stroke or transient ischemic attack – A stroke or central nervous system infarction is defined as "brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury. … Ischemic stroke specifically refers to central nervous system infarction accompanied by overt symptoms, whereas silent infarction causes no known symptoms."[108] If imaging or pathology is not available, a clinical stroke is diagnosed by symptoms persisting for more than 24 hours. Ischemic stroke can be further classified by the type and location of ischemia and the presumed etiology of the brain injury. These include large-artery atherosclerotic occlusion (extracranial or intracranial), cardiac embolism, small-vessel disease and less commonly dissection, hypercoagulable states, sickle cell disease and undetermined causes.[109] TIAs in contrast, "are a brief episode of neurological dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction on imaging."[110] On average, the annual risk of future ischemic stroke after a TIA or initial ischemic stroke is 3–4%, with an incidence as high as 11% over the next 7 days and 24–29% over the following 5 years. This has significantly decreased in the last half century due to advances in secondary prevention.[111]

Therefore, when revascularization therapy is not indicated or available in individuals with an ischemic stroke or TIA, the focus of the work-up is on secondary prevention. This includes noninvasive vascular imaging to identify the underlying etiology and to assess immediate complications and risk of future stroke. The majority of stoke evaluations take place in the inpatient setting. Admitting TIA individuals is reasonable if they present within 72 hours and have an ABCD (2) score ≥3, indicating high risk of early recurrence, or the evaluation cannot be rapidly completed on an outpatient basis.[110] Minimally, both stroke and TIA should have an evaluation for high-risk modifiable factors, such as carotid stenosis atrial fibrillation, as the cause of ischemic symptoms.[109] Diagnostic recommendations include neuroimaging evaluation as soon as possible, preferably with MRI, including DWI; noninvasive imaging of the extracranial vessels should be performed; and noninvasive imaging of intracranial vessels is reasonable.[112]

Individuals with a history of stroke and recent workup with new signs or symptoms indicating progression or complications of the initial CVA should have repeat brain imaging as an initial study. Individuals with remote or silent strokes discovered on imaging should be evaluated for high-risk modifiable risk factors based on the location and type of the presumed etiology of the brain injury.

CT and Central Venous Thrombosis – A CTV or MRV is indicated for the definite evaluation of a central venous thrombosis/dural sinus thrombosis. The most frequent presentations are isolated headache, intracranial hypertension syndrome (headache, nausea/vomiting, transient visual obscurations, pulsatile tinnitus, CN VI palsy, papilledema),[113] seizures, focal neurological deficits, and encephalopathy. Risk factors are hypercoagulable states inducing genetic prothrombotic conditions, antiphospholipid syndrome and other acquired prothrombotic diseases (such as cancer), oral contraceptives, pregnancy, puerperium (6 weeks postpartum), infections, and trauma. Since venous thrombosis can cause SAH, infarctions, and hemorrhage, parenchymal imaging with MRI/CT is also appropriate.[16, 114, 115]

CT scan for Head Trauma – Most types of head injury are minor injuries; clinical signs and symptoms help predict the need for brain CT following injury. CT has advantages in evaluating head injury due to its sensitivity for demonstrating mass effect, ventricular size and configuration, bone injuries, and acute hemorrhage. An individual who presents with certain clinical risk factors may be more likely to benefit from CT imaging. Some of the clinical risk factors that may be used as a guide to predict the probability of abnormal CT following minor head injury are vomiting, skull fracture, and age greater than 60 years. Individuals with a Glasgow Coma Scale of 15 or less who also have been vomiting or have a suspected skull fracture are likely to show abnormal results on CT scan. CT is also useful in detecting delayed hematoma, hypoxic-ischemic lesions, or cerebral edema in the first 72 hours after head injury.

CT and tumors – MRI is the ideal modality to follow-up meningioma, pituitary tumors, low grade tumors, neurocutaneous syndromes, and staging/surveillance for non-CNS cancers. CT should only be used when MRI is contraindicated or is unable to be obtained. Surveillance timelines should follow NCCN guidelines. Imaging is also warranted if the individual is symptomatic or there are new/changing signs or symptoms or complicating factors.

MMSE – The Mini Mental State Examination (MMSE) is a tool that can systematically and thoroughly assess mental status. It is an 11-question measure that tests five areas of cognitive function: orientation, registration, attention and calculation, recall, and language. The MMSE has been the most commonly used measure of cognitive function in dementia research, but researchers have recognized that it is relatively insensitive and variable in mildly impaired individuals. The maximum score is 30. A score of 23 or lower is indicative of cognitive impairment. The MMSE takes only 5-10 minutes to administer and is, therefore, practical to use repeatedly and routinely.

MoCA – The Montreal Cognitive Assessment (MoCA) was designed as a rapid screening instrument for mild cognitive dysfunction. It assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation. MoCA differs from the MMSE mainly by including tests of executive function and abstraction, and by putting less weight on orientation to time and place. Ten of the MMSE's 30 points are scored solely on the time-place orientation test, whereas the MoCA assigns it a maximum of six points. The MoCA also puts more weight on recall and attention-calculation performance, while de-emphasizing language skill. Time to administer the MoCA is approximately 10 minutes. The total possible score is 30 points; a score of 26 or above is considered normal.

CT for evaluation of the cranial nerves – Magnetic resonance imaging (MRI) is considered the gold standard in the study and evaluation of the cranial nerves. Computed tomography (CT) allows, usually, an indirect view of the nerve and is useful to demonstrate the intraosseous segments of cranial nerves, the foramina through which they exit skull base, and their pathologic changes. In optic neuritis, CT has limited utility. Contrast-enhanced CT scanning of the orbits may help exclude other orbital pathology. CT scanning of the brain, regardless of whether intravenous contrast material is administered or not, does not yield prognostic and treatment-altering information. In Bell's Palsy temporal bone CT is useful in the evaluation of the caliber and the course of the IAC and bony facial nerve canal in the temporal bone. When using CT to evaluate the facial nerve, pathology often can only be inferred by visualization of erosion or destruction of the adjacent bony facial nerve canal. In contrast, MRI visualizes soft tissues well and so is better suited for evaluating soft tissue facial nerve abnormalities.

Anosmia – There is no relevant literature to support the use of CT head in the evaluation of the olfactory nerve.

CT scan for congenital abnormalities – While MRI is preferred to CT for evaluation of most congenital CNS abnormalities, in some clinical situations CT is preferred (craniosynostosis) or equivalent to MRI. CT is appropriate in the follow-up of hydrocephalus or VP shunt function where the etiology of hydrocephalus has been previously determined or in individuals for which MRI evaluation would require general anesthesia.

CT for Macrocephaly – Consider ultrasound in infants with macrocephaly and a normal neurological examination, no evidence of increased ICP, and an open anterior fontanelle. If head US is normal, the infant should be monitored closely.[116] The anterior fontanelle generally closes between 10 and 24 months of age, with 3% closing between 5-9 months and 11% after 24 months.[117]

CT and Normal Pressure Hydrocephalus (NPH) – Although diagnosis can be made based on CT findings alone, MRI is more accurate for disclosing associated pathologies (such as cerebrovascular disease), excluding other potential etiologies, and for detecting NPH typical signs of prognostic value. A CT scan can exclude NPH and is appropriate for screening purposes and in individuals who cannot undergo MRI.

CT and Vertigo – The most common causes of vertigo seen are benign paroxysmal positional vertigo (BPPV), vestibular neuronitis (VN) and Ménière's disease. These peripheral causes of vertigo are benign, and treatment involves reassurance and management of symptoms. Central causes of vertigo, such as cerebrovascular accidents (CVAs), tumors and multiple sclerosis (MS), need to be considered if the individual presents with associated neurological symptoms, such as weakness, diplopia, sensory changes, ataxia or confusion. Magnetic resonance imaging is appropriate in the evaluation of individuals with vertigo who have neurologic signs and symptoms, progressive unilateral hearing loss or risk factors for cerebrovascular disease. MRI is more appropriate than CT for diagnosing vertigo due to its superiority in visualizing the posterior portion of the brain, where most central nervous system disease that causes vertigo is found. A full neurologic and otologic evaluation including provocative maneuvers, vestibular function testing and audiogram can help evaluate vertigo of unclear etiology and differentiate between central and peripheral vertigo.

CT and developmental delay – Significant developmental delay is defined as significant delay (more than two standard deviations below the mean) in one or more developmental domains: gross/fine motor, speech/language, cognition, social/personal, and activities of daily living. Isolated delay in social/language development is characteristic of autism spectrum disorders or hearing loss. Isolated delay in motor development is characteristic of cerebral palsy (a static encephalopathy) or myopathy. Global developmental delay (GDD) is a subset of developmental delay defined as significant delay (by at least 2 SD's) in two or more developmental categories. Note that the term "GDD" is usually reserved for children < 5 years old, whereas in older children > 5 years, disability is quantifiable with IQ testing.

CT scan and Meningitis – In suspected bacterial meningitis, CT with contrast may be performed before lumbar puncture (LP) to show preliminary meningeal enhancement. It is important to evaluate for a mass lesion or cause of elevated ICP that would contraindicate an LP. CT may be used to define the pathology of the base of the skull and that may require therapeutic intervention and surgical consultation. Some causes of an intracranial infection include fractures of the paranasal sinus and inner ear infection.

Leptomeningeal Carcinomatosis[118-121] – Leptomeningeal metastasis is an uncommon and typically late complication of cancer with poor prognosis and limited treatment options. Diagnosis is often challenging with nonspecific presenting symptoms ranging from headache and confusion to focal neurologic deficits such as cranial nerve palsies. Standard diagnostic evaluation involves a neurologic examination, MRI of the brain and spine with gadolinium, and cytologic evaluation of the cerebral spinal fluid (CSF). Hematologic malignancies (leukemia and lymphoma), primary brain tumors as well as solid malignancies can spread to the leptomeninges. The most common solid tumors giving rise to LM are breast cancer (12 - 35 %), small and non-small cell lung cancer (10-26 %), melanoma (5 -25 %), gastrointestinal malignancies (4-14 %), and cancers of unknown primary (1-7 %).

Drop Metastases – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas and less commonly choroid plexus neoplasms and teratomas.[122]

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POLICY HISTORY

Date	Summary
May 2023	Updated and reformatted references Updated background section Reorganized indications General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline Added: • Indeterminate imaging section • Lesion with atypical features for further evaluation or follow up • Initial evaluation for a known syrinx or syringomyelia • Bulbar and Pseudobulbar symptoms to match Brain MRI Clarified: • Abnormal reflexes (pathological, asymmetric, hyperreflexia) • New onset headache - Related to activity or event (sexual activity, exertion, Valsalva, position), new or progressively worsening • Tumor surveillance as per professional society recommendations • Brain CT/Brain CTA - Headache associated with exercise, exertion, Valsalva or sexual activity Deleted: • Anosmia (loss of smell) or dysosmia documented by objective testing that is persistent and of unknown origin
May 2022	Updated and reformatted references Updated background section Combo statement added Reorganized indications Changed visual deficits section added to background Clarified: • Acute headache, sudden onset • New onset headache related to activity or event (sexual activity, exertion, position), new or progressively worsening • Visual loss in background/removed note • Histiocytic Neoplasms (Erdheim-Chester Disease, Langerhans Cell Histiocytosis, and Rosai-Dorfman Disease) for screening and/or with neurological signs or symptoms • Follow-up of known CNS cancer (either primary malignant brain tumor or secondary brain metastasis) as per NCCN • Tumor monitoring in neurocutaneous syndromes as per tumor type • Histiocytic Neoplasms (Erdheim-Chester Disease, Langerhans Cell Histiocytosis, and Rosai-Dorfman Disease) To assess treatment response and surveillance of known brain/skull lesions

	• Examples of mental status instruments to screen for cognitive impairment • Binocular diplopia with concern for intracranial pathology after comprehensive eye evaluation • Evaluation of cranial nerve palsy/neuropathy/neuralgia. Brain MRI is the study of choice if indicated Added: • Abnormal reflexes to neurologic deficit sections • High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200 when MRI is contraindicated or cannot be performed (Also in Combo Brain CT/CTA) • Suspected Pituitary Tumors Brain MRI is the study of choice if indicated or Sella CT if MRI is contraindicated or cannot be performed • For screening for known non-CNS Cancer and for screening of hereditary cancers syndromes Brain MRI is the study of choice if indicated • Follow-up of known low grade tumor (WHO I-II) (i.e., meningioma, glioma, astrocytoma, oligodendroglioma) o For surveillance as per NCCN o If symptomatic, new/changing signs or symptoms or complicating factors • Known pituitary tumors Brain MRI is the study of choice if indicated or Sella CT if MRI is contraindicated or cannot be performed • Seizure disorder, Movement disorders: Brain MRI is the study of choice if indicated • Tourette syndrome to list of movement disorders in which MRI is not indicated • Bulbar or pseudobulbar symptoms when MRI is contraindicated or cannot be performed • For initial evaluation of a suspected Arnold Chiari malformation • Follow-up imaging of a known type II or type III Arnold Chiari malformation. For Arnold Chiari type I, follow-up imaging only if new or changing signs/symptoms • **General Combo statement** Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the neuroaxis), patient history, and other available information, including prior imaging.

	• **Combo Brain CT/CTA**: o Neurological signs or symptoms in sickle cell patients o Note: MRA and CTA are generally comparable noninvasive imaging alternatives each with their own advantages and disadvantages. ▪ Brain MRI can alternatively be combined with Brain CTA/Neck CTA. • **Combo Brain CT/ Cervical CT/Thoracic CT/Lumbar CT** (mirrors MRI) o Arnold Chiari o Oncological Applications o CSF leak Deleted: • Patient with history of CNS cancer (either primary or secondary) and a recent course of chemotherapy, radiation therapy (to the brain), or surgical treatment within the last two (2) years • Follow-up of known meningioma section/background

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **TEMPORAL BONE, MASTOID, ORBITS, SELLA, INTERNAL AUDITORY CANAL CT**	**Original Date: September 1997**
CPT Codes: 70480, 70481, 70482	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_006 - 1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR ORBIT CT

Note: CT is preferred for visualizing bony detail and calcifications. MRI is superior for the evaluation of the visual pathways, globe, and soft tissues.[1, 2]

- Abnormal external or direct eye exam[1]:
  - Exophthalmos (proptosis) or enophthalmos
  - Ophthalmoplegia with concern for orbital pathology[3]
  - Unilateral optic disk swelling if MRI is contraindicated or cannot be performed[4-6]
  - Documented visual defect if MRI is contraindicated or cannot be performed[7-10]
    - Unilateral or with abnormal optic disc(s) (i.e., optic disc blurring, edema, or pallor); **AND**
    - Not explained by an underlying diagnosis, glaucoma, or macular degeneration
- Optic Neuritis if MRI is contraindicated or cannot be performed
  - If atypical presentation (bilateral, absence of pain, optic nerve hemorrhages, severe visual impairment, lack of response to steroids, poor recovery or recurrence)[11-14]

    - If needed to confirm optic neuritis and rule out compressive lesions
- Orbital trauma
    - Physical findings of direct eye injury
    - Suspected orbital trauma with indeterminate x-ray
    - For further evaluation of a fracture seen on x-ray for treatment or surgical planning
- Orbital or ocular mass/tumor, suspected, or known[1, 7]
- Clinical suspicion of orbital infection[15, 16]
- Clinical suspicion of osteomyelitis[17, 18]
    - Direct visualization of bony deformity **OR**
    - Abnormal x-rays
- Clinical suspicion of Orbital Inflammatory Disease (e.g., eye pain and restricted eye movement with suspected orbital pseudotumor) if MRI is contraindicated or cannot be performed[19]
- Congenital orbital anomalies[20]
- Complex strabismus (with ophthalmoplegia or ophthalmoparesis) to aid in diagnosis, treatment and/or surgical planning[21-23]

Combination Studies with Orbit CT

- Brain CT/Orbit CT if MRI is contraindicated or cannot be performed
    - Optic neuropathy or unilateral optic disk swelling of unclear etiology to distinguish between a compressive lesion of the optic nerve, optic neuritis, ischemic optic neuropathy (arteritic or non-arteritic), central retinal vein occlusion, or optic nerve infiltrative disorders[24]
    - Bilateral optic disk swelling (papilledema) with vision loss[5]
    - Approved indications as noted above and being performed in high-risk populations and will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology[25]

INDICATIONS FOR SELLA CT[26]

When MRI is contraindicated or cannot be performed[27, 28]

- For further evaluation of known sellar and parasellar masses
- Suspected pituitary gland disorder[29] based on any of the following:
    - Documented visual field defect suggesting compression of the optic chiasm; **OR**
    - Laboratory findings suggesting pituitary dysfunction[30]; **OR**
    - Pituitary apoplexy with sudden onset of neurological and hormonal symptoms; **OR**
    - Other imaging suggesting sella (pituitary) mass

INDICATIONS FOR TEMPORAL/MASTOID/INTERNAL AUDITORY CANAL CT

Hearing loss (documented on audiogram)[31, 32]

- Asymmetric sensorineural when MRI is contraindicated[33, 34]
- Conductive or mixed[35]
- Congenital[35]
- Cochlear implant evaluation[36-39]

Note: For congenital/childhood sensorineural hearing loss suspected to be due to a structural abnormality, CT is the preferred imaging modality for the osseous structures and malformations of the inner ear. MRI is used for evaluating CNVIII, the brain parenchyma, or the membranous labyrinth.

Tinnitus[40-42]

- Pulsatile tinnitus with concern for osseous pathology of the temporal bone
- Unilateral non-pulsatile tinnitus and MRI is contraindicated or cannot be performed

Ear Infection

- Clinical suspicion of acute mastoiditis as a complication of acute otitis media[43-46]
    - Systemic illness or toxic appearance
    - Signs of extracranial complications (e.g., postauricular swelling/erythema, auricular protrusion, retro-orbital pain, hearing loss, tinnitus, vertigo, nystagmus)
    - Not responding to treatment

Note: MRI is also indicated if there are signs of intracranial complications (e.g., meningeal signs, cranial nerve deficits, focal neurological findings, altered mental status). This is most common in the pediatric population

- Chronic Otitis Media (with or without cholesteatoma on exam)[45, 47]
    - Failed treatment for acute otitis media

Cholesteatoma[48, 49]

CSF Otorrhea[50, 51]

- When looking to characterize a bony defect (for intermittent leaks and complex cases consider CT/MR/Nuclear Cisternography). There should be a high suspicion or confirmatory CSF fluid laboratory testing (Beta-2 transferrin assay)

Temporal Bone Fracture[52-54]

- Suspected based on mechanism of injury **OR**
- Indeterminate findings on initial imaging **OR**
- For further evaluation of a known fracture for treatment or surgical planning

Vascular Indications[55, 56]

- Suspected or known with need for further evaluation
    - Dehiscence of the jugular bulb or carotid canal **OR**
    - Other vascular anomalies of the temporal bone (i.e., aberrant internal carotid artery, high jugular bulb, persistent stapedial artery, aberrant petrosal sinus)

Peripheral vertigo[32, 57, 58]

- Based on clinical exam (Head-Impulse with saccade, Spontaneous unidirectional horizontal nystagmus, Dix-Hallpike maneuver); **AND**
    - Persistent symptoms after a trial of medication and four weeks of vestibular therapy (e.g., Epley's maneuvers)

Bell's Palsy/hemifacial spasm if MRI is contraindicated or cannot be performed (for evaluation of the extracranial nerve course)

- If atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset[59]

OTHER INDICATIONS FOR TEMPORAL BONE, MASTOID, ORBIT, SELLA, INTERNAL AUDITORY CANAL CT

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post- operative/procedural evaluation

- When imaging, physical, or laboratory findings indicate surgical or procedural complications
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

BACKGROUND

Computed tomography's use of thin sections with multi-planar reconstruction (e.g., axial, coronal, and sagittal planes), along with its three-dimensional rendering, permits thorough diagnosis and management of ocular and orbital disorders. Brain CT is often ordered along with CT of the orbit for head injury with orbital trauma. MRI Orbits is preferred over CT Orbits except in the case of orbital trauma, infection, or bone abnormalities

Temporal bone, mastoid, and internal auditory canal computed tomography (CT) is a unique study performed for problems, such as conductive hearing loss, chronic otitis media, mastoiditis, cholesteatoma, congenital hearing loss and cochlear implants. It is a modality of choice because it provides 3D positional information and offers a high degree of anatomic detail. It is rarely used for evaluation of VIIth or VIIIth nerve tumors.

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ADDITIONAL RESOURCES

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POLICY HISTORY

Date	Summary
April 2023	Updated references Added: • Note on congenital hearing loss • Section on further evaluation of indeterminate or questionable findings on prior imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline Clarified: • There should be a high suspicion of CSF leak or confirmatory CSF fluid laboratory testing (Beta-2 transferrin assay)
March 2022	Updated References Re-ordered indications Clarified: • Optic neuritis If atypical presentation (bilateral, absence of pain, optic nerve hemorrhages, severe visual impairment, lack of response to steroids, poor recovery or recurrence • Clinical suspicion of Orbital Inflammatory Disease if MRI is contraindicated or cannot be performed • Pulsatile tinnitus with concern for osseous pathology of the temporal bone • Complex strabismus syndromes (with ophthalmoplegia or ophthalmoparesis)

Reviewed / Approved by NIA Clinical Guideline Committee

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HMSA

Specific policy administered by National Imaging Associates, Inc. (NIA)

Clinical guidelines SINUS & MAXILLOFACIAL CT LIMITED OR LOCALIZED FOLLOW UP SINUS CT	
CPT Codes: 70486, 70487, 70488, 76380, +0722T	**Original Date:** September 1997
Guideline Number: NIA_CG_009	**Last Revised Date (by HMSA):** February 2023
	Last Reviewed Date (by NIA Committee): May 2023
	Implementation Date: April 2024

"IMPORTANT NOTE": CBCT is not covered for maxillofacial indications with the exception of oral surgery treatment planning when ordered by an oral surgeon."

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

A single authorization for CPT codes 70486, 70487, 70488, or 76380 includes imaging of the entire maxillofacial area, including face and sinuses. Multiple authorizations are not required.

INDICATIONS FOR SINUS & MAXILLOFACIAL CT

Rhinosinusitis[1-5]

- Clinical suspicion of fungal infection[6, 7]
- Clinical suspicion of complications,[8] such as
    - Preseptal, orbital, or intracranial infection[9]
    - Osteomyelitis
    - Cavernous sinus thrombosis
- Acute (< 4 weeks) or subacute (4-12 weeks) sinusitis (presumed infectious)
    - Not responding to medical management including 2 or more courses of antibiotics in the past 3 months
- Recurrent acute rhinosinusitis with 4 or more annual episodes without persistent symptoms in-between
- Chronic recurrent sinusitis[3] (> 12 weeks)
    - Not responding to medical management*, and with at least two of the following:
        - mucopurulent discharge
        - nasal obstruction and congestion
        - facial pain, pressure, and fullness
        - decreased or absent sense of smell
    - With nasal polyps especially unilateral polyps, concern for polyps extending outside of the nasal cavity, or other atypical presentations[3]

*Note: Medical management for chronic sinusitis includes nasal saline irrigation and/or topical intranasal steroids. In chronic sinusitis, repeat imaging is not necessary unless clinical signs or symptoms have changed. Biologics such as dupilumab can be used to treat chronic sinusitis with nasal polyposis

- Allergic Rhinitis – sinus imaging usually not indicated unless there are signs of complicated infection, signs of neoplasm, or persistence of symptoms/chronic rhinosinusitis despite treatment (including antihistamines) and is a possible surgical candidate[10]
- If suspected as a cause of poorly controlled asthma (endoscopic sinus surgery improves outcomes)[11]
- To evaluate in the setting of unilateral nasal polyps or obstruction[3]

Note: Imaging may be indicated in those predisposed to complications, including diabetes, immune-compromised state, immotile cilia disorders, or a history of facial trauma or surgery.

Pediatrics Rhinosinusitis[12, 13]

- Persistent or recurrent sinusitis not responding to treatment (primarily antibiotics, treatment may require a change of antibiotics)
- Suspicion of orbital or central nervous system involvement (e.g., swollen eye, proptosis, altered consciousness, seizures, nerve deficit)
- Clinical suspicion of a fungal infection (more common in immunocompromised children)

Deviated nasal septum, polyp, or other structural abnormality seen on imaging or direct visualization

- Causing significant airway obstruction AND
- Imaging is needed to plan surgery or determine if surgery is appropriate[14, 15]

Suspected sinonasal mass based on exam, nasal endoscopy, or prior imaging [3, 16]

Refractory Asthma - these patients benefit from medical treatment and surgery together[11, 17, 18]

Anosmia or Dysosmia noted on objective testing, is persistent, of unknown origin for evaluation of peripheral sinonasal disease and/or bone-related pathology.[16,19-21]

Suspected infection

- Osteomyelitis (after x-rays and MRI cannot be performed)[22]
- Abscess based on clinical signs and symptoms of infection

Face mass[16, 23]

- Present on physical exam and remains non-diagnostic after x-ray or ultrasound is completed; **OR**
- Known or highly suspected head and neck cancer on examination; **OR**
- Failed 2 weeks of treatment for suspected infectious adenopathy[24]

Facial trauma[25-33]

- Serious facial injury with concern for fracture on exam (e.g., bony step off, ecchymosis, nasal deformity, depression, malocclusion)
  Note: x-rays should be performed for isolated dental/mandibular injury
- Suspected facial bone fracture with indeterminate x-ray
- For further evaluation of a known fracture for treatment or surgical planning

CSF (cerebrospinal fluid) rhinorrhea when looking to characterize a bony defect

Note: For intermittent leaks and complex cases, consider CT/MRI/Nuclear Cisternography. There should be a high suspicion or confirmatory CSF fluid laboratory testing (Beta-2 transferrin assay)

Salivary gland

- Sialadenitis (infection and inflammation of the salivary glands) with indeterminate ultrasound, bilateral symptoms or concern for abscess[34]

- Suspected or known salivary gland stones [35-37]

Granulomatosis with polyangiitis (Wegener's granulomatosis) disease[38]

Suspected Osteonecrosis of the Jaw[39]

- Possible etiologies: bisphosphonate treatment, dental procedures, Denosumab, radiation treatment

Trigeminal neuralgia/neuropathy if MRI is contraindicated or cannot be performed (for evaluation of the extracranial nerve course)

- If atypical features (i.e., bilateral, hearing loss, dizziness/vertigo, visual changes, sensory loss, numbness, pain > 2min, pain outside trigeminal nerve distribution, progression)[6, 40]

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- When imaging, physical, or laboratory findings indicate surgical or procedural complications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.[37]
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Cone Beam CT (CBCT)

- Can be used in the evaluation of rhinosinusitis for the above-mentioned indications and for surgical planning/pre-operative evaluation in non-neoplastic indications.

* Cone beam CT is not approvable in the evaluation of dentomaxillofacial imaging[16, 41-44]

COMBINATION OF STUDIES WITH SINUS & MAXILLOFACIAL CT

Sinus CT/Chest CT

- Granulomatosis with polyangiitis (Wegener's granulomatosis) disease (GPA)[45]

Sinus CT/Chest CT/Abdomen and Pelvis CT/Brain MRI[46, 47]

- For initial workup prior to Bone Marrow Transplant (BMT)

BACKGROUND

Computed tomography (CT) primarily provides information about bony structures but may also be useful in evaluating soft tissue masses. It can help document the extent of facial bone fractures, facial infections, and abscesses, and can aid in diagnosing salivary stones. Additionally, CT may be useful in characterizing and identifying tumor extent in the face and may be used in the assessment of chronic osteomyelitis.

CT scans can provide more detailed information about the anatomy and abnormalities of the paranasal sinuses than plain films. A CT scan provides greater definition of the sinuses and is more sensitive than plain radiography for detecting sinus pathology, especially within the sphenoid and ethmoid sinuses. CT scan findings can be nonspecific, however, and should not be used routinely in the diagnosis of acute sinusitis. The primary role of CT scans is to aid in the diagnosis and management of recurrent and chronic sinusitis, or to define the anatomy of the sinuses prior to surgery.

CT vs MRI - MRI allows better differentiation of soft tissue structures within the sinuses. It is used occasionally in cases of suspected tumors or fungal sinusitis. Otherwise, MRI has no advantages over CT scanning in the evaluation of sinusitis. Disadvantages of MRI include high false-positive findings, poor bony imaging, and higher cost. MRI scans take considerably longer to accomplish than CT scans and may be difficult to obtain in patients who are claustrophobic.

Rhinosinusitis - Society consensus recommendation is not to order sinus computed tomography (CT) or indiscriminately prescribe antibiotics for uncomplicated acute rhinosinusitis.[42] Viral infections cause the majority of acute rhinosinusitis and only 0.5 percent to 2 percent progress to bacterial infections. Most acute rhinosinusitis resolves without treatment in two weeks. Uncomplicated acute rhinosinusitis is generally diagnosed clinically and does not require a sinus CT scan or other imaging. Antibiotics are not recommended for patients with uncomplicated acute rhinosinusitis who have mild illness and assurance of follow-up. If a decision is made to treat, amoxicillin with clavulanate should be first-line antibiotic treatment for most acute rhinosinusitis. If improvement is not demonstrated, it is recommended to change antibiotics to either high-dose amoxicillin plus clavulanate, doxycycline, a fluoroquinolone such as moxifloxacin or levofloxacin, or a dual treatment of clindamycin plus a third-generation oral cephalosporin.[5]

Anosmia - Nonstructural causes of anosmia include post viral symptoms, medications (Amitriptyline, Enalapril, Nifedipine, Propranolol, Penicillamine, Sumatriptan, Cisplatin,

Trifluoperazine, Propylthiouracil). These should be considered prior to advanced imaging to look for a structural cause. Anosmia and dysgeusia have been reported as common early symptoms in patients with COVID-19, occurring in greater than 80 percent of patients. For isolated anosmia, imaging is typically not needed once the diagnosis of COVID has been made, given the high association. As such, COVID testing should be done prior to imaging.[48-50]
MRI Orbits, Face, and Neck MRI rather than MRI Brain is the mainstay for directly imaging the olfactory apparatus and sinonasal or anterior cranial fossa tumors that may impair or directly involve the olfactory apparatus.[6]

Suspected Osteonecrosis of the Jaw - CT scan characterize the extension of the lesions and in detecting cortical involvement. MRI should be reserved for those patients who have soft tissue extension of the disease.[51]

Trigeminal Neuralgia - According to the International Headache Society, TN is defined as "a disorder characterized by recurrent unilateral brief electric shock-like pain, abrupt in onset and termination, limited to the distribution of one or more divisions of the trigeminal nerve and triggered by innocuous stimuli."[52]

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POLICY HISTORY

Date	Summary
March 2024	Added HMSA "IMPORTANT NOTE”: CBCT is not covered for maxillofacial indications with the exception of oral surgery treatment planning when ordered by an oral surgeon."
May 2023	Updated references Updated background Added: • Nasal polyps as an indication for chronic recurrent sinusitis • Cone Beam CT (CBCT) • Can be used in the evaluation of rhinosinusitis for the above-mentioned indications and for surgical planning/pre-operative evaluation in non-neoplastic indications. * Cone beam CT is not approvable in the evaluation of dentomaxillofacial imaging • Section on further evaluation of indeterminate or questionable findings on prior imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Section on CSF rhinorrhea to characterize bony defect • Biologics such as dupilumab for chronic sinusitis with nasal polyposis Clarified: • Acute (<4weeks) or subacute (4-12 weeks) sinusitis (presumed infectious) - not responding to medical management including 2 or more courses of antibiotics in the past 3 months • When CT would be indicated for anosmia/dysosmia and removed when MRI is contraindicated • Serious facial injury with concern for fracture on exam (e.g. bony step off, ecchymosis, nasal deformity, depression, malocclusion) • Note: x-rays should be performed in isolated dental/mandibular injury • There should be a high suspicion of CSF leak or confirmatory CSF fluid laboratory testing (Beta-2 transferrin assay) Removed: • When MRI is contraindicated or if bony involvement suspected from suspected sinonasal mass • Lesion seen on x-ray or other study – covered in new indication
March 2022	Reformatted and update references

	Reformatted and updated background Reformatted-structural abnormality, salivary gland, and trauma sections Clarified: • Sialadenitis (infection and inflammation of the salivary glands) with indeterminate ultrasound, bilateral symptoms, or concern for abscess • acute vs subacute sinusitis • described medical management for acute (including 2 or more courses of antibiotics at least 5 days each course) and chronic sinusitis (includes nasal saline irrigation and/or topical intranasal steroids) • Abscess Added: • Note: Imaging may be indicated in those predisposed to complications, including diabetes, immune-compromised state, or a history of facial trauma or surgery (Acute sinusitis) • And is a surgical candidate- for chronic sinusitis and recurrent acute rhinosinusitis • In chronic sinusitis, repeat imaging is not necessary unless clinical signs or symptoms have changed. • Indications for allergic rhinitis Removed: • 4 weeks of medical management for acute and chronic sinusitis

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*National Imaging Associates, Inc.	
Clinical guidelines **NECK CT (Soft Tissue)**	**Original Date: September 1997**
CPT Codes: 70490, 70491, 70492	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_008-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR NECK CT[1, 2]

Suspected tumor or cancer

- Suspicious lesions in mouth or throat[3]
- Suspicious mass/tumor found on another imaging study and needing clarification[1]
- Neck mass or lymphadenopathy (not parotid region and not thyroid region):
    - Present on physical exam and remains non-diagnostic after ultrasound is completed[3]
    - Mass or abnormality found on other imaging study and needing further evaluation
    - Increased risk for malignancy[4] with one or more of the following findings[5]:
        - Fixation to adjacent tissues
        - Firm consistency
        - Size > 1.5 cm
        - Ulceration of overlying skin
        - Mass present ≥ two weeks (or uncertain duration) without significant fluctuation and not considered of infectious cause
        - History of cancer
    - Failed 2 weeks of treatment for suspected infectious adenopathy[6]

- Pediatric (≤ 18 years old) considerations[7]
    - Ultrasound should be inconclusive or suspicious unless there is a history of malignancy[8]

Note: For discrete cystic lesions of the neck, an ultrasound should be performed as initial imaging unless there is a high suspicion of malignancy

- Neck Mass (parotid region)[1]
    - Parotid mass found on other imaging study and needing further evaluation

Note: US is the initial imaging study of a parotid region mass to determine if the location is inside or outside the gland[1, 9, 10]

- Neck Mass (thyroid region)[2]
    - Staging and monitoring for recurrence of known thyroid cancer[2]
    - To assess extent of thyroid tissue when other imaging suggests extension through the thoracic inlet into the mediastinum or concern for airway compression[11, 12]

Note: US is the initial imaging study of a thyroid region mass. Biopsy is usually the next step. In the evaluation of known thyroid malignancy, CT is preferred over MRI since there is less respiratory motion artifact. Chest CT may be included for preoperative assessment in some cases.

Known or suspected deep space infections or abscesses of the pharynx or neck with signs or symptoms of infection[13]

Known tumor or cancer of skull base, tongue, larynx, nasopharynx, pharynx, or salivary glands[14]

- Initial staging[3]
- Restaging during treatment
- Areas difficult to visualize on follow-up examination
- Suspected recurrence or metastases based on symptoms or examination findings[15]
    - New mass
    - Change in lymph nodes

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation (e.g., post neck dissection)

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Other indications for a Neck CT

- Sialadenitis (infection and inflammation of the salivary glands) with indeterminate ultrasound, bilateral symptoms or concern for abscess[16]
- Suspected or known salivary gland stones [10, 16-19]
- To assess for foreign body when radiograph is inconclusive or negative[20]
- Vocal cord lesions or vocal cord paralysis[21]
- For evaluation of tracheal stenosis[22, 23]
- Dysphagia after appropriate work up including endoscopy and fluoroscopic studies (modified barium swallow, or biphasic Esophogram)[24, 25]
- Unexplained throat pain for more than 2 weeks when ordered by a specialist with all of the following[26-28]
    - Complete otolaryngologic exam and laryngoscopy
    - No signs of infection
    - Evaluation for and failed treatment of laryngopharyngeal reflux
    - Risk factor for malignancy, i.e., tobacco use, alcohol use, dysphagia, weight loss OR age older than 50 years
- Unexplained ear pain when ordered by a specialist and MRI is contraindicated with all of the following[29]
    - Otoscopic exam, nasolaryngoscopy, lab evaluation (ESR, CBC) AND
    - Risk factor for malignancy, i.e., tobacco use, alcohol use, dysphagia, weight loss OR age older than 50 years
- Diagnosed primary hyperparathyroidism when surgery is planned[30]
    - Previous nondiagnostic ultrasound or nuclear medicine scan[31]
- Bell's palsy/hemifacial spasm, if MRI is contraindicated or cannot be performed (for evaluation of the extracranial nerve course)

    - If atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset[32]
- Objective cranial nerve palsy (CN IX-XII) if MRI is contraindicated or cannot be performed (for evaluation of the extracranial nerve course)[33, 34]

BACKGROUND

High resolution CT can visualize both normal and pathologic anatomy of the neck. It is used in the evaluation of neck soft tissue masses, abscesses, and lymphadenopathy. For neck tumors, it defines the extent of the primary tumor and identifies lymph node spread. CT provides details about the larynx and cervical trachea and its pathology. Additional information regarding airway pathology is provided by three-dimensional images created from the CT dataset. Neck CT can also accurately depict and characterize tracheal stenoses.

With the rise of human papillomavirus-related oral, pharyngeal, and laryngeal cancers in adults, contrast-enhanced neck CT has become more important for the evaluation of a neck mass, deemed at risk for malignancy, surpassing ultrasound for the initial evaluation in many cases. The American Academy of Otolaryngology-Head and Neck Surgery recently issued strong recommendations for neck CT or MRI, emphasizing the importance of a timely diagnosis.[5]

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POLICY HISTORY

Date	Summary
April 2023	Updated references Removed additional resources Added: • Section on further evaluation of indeterminate or questionable findings on prior imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
March 2022	Reformatted indications Clarified: • Thyroid imaging • Abscess • Suspected or known salivary gland stones Added: Sialadenitis (infection and inflammation of the salivary glands) with indeterminate ultrasound, bilateral symptoms, or concern for abscess

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*National Imaging Associates, Inc.	
Clinical guidelines **BRAIN (HEAD) CTA**	**Original Date: September 1997**
CPT Codes: 70496	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_004-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR BRAIN CTA

Brain CT/CTA are not approvable simultaneously unless they meet the criteria described below in the Indications for Brain CT/Brain CTA combination studies section. If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- Inconclusive or show a need for additional or follow up imaging evaluation OR
- The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.

(*Unless approvable in the combination section as noted in the guidelines)

Patients with claustrophobia, limited ability to cooperate, an implanted device or in an urgent scenario may be better suited for CTA; whereas those with renal disease or iodine contrast allergy should have MRA.[1]

For evaluation of suspected intracranial vascular disease[2, 3]

Aneurysm screening

- Screening for intracranial aneurysm if two or more first-degree family members (parent, brother, sister, or child) of intracranial aneurysm

  Note: Repeat study is recommended every 5 years[4]

  - For one first degree relative with aneurysm, asymptomatic screening is not indicated - would require a neurological sign or symptom supporting clinical concern for aneurysm[5-7]
- Screening for aneurysm in polycystic kidney disease (in adults), Loeys-Dietz syndrome‡, fibromuscular dysplasia, spontaneous coronary arteries dissection (SCAD), or known aortic coarctation (after age 10)[8-14]

‡For Loeys-Dietz, imaging should be repeated at least every two years

Vascular abnormalities

- Suspected vascular malformation (arteriovenous malformation (AVM) or dural arteriovenous fistula) in patient with previous or indeterminate imaging study
- Thunderclap headache with continued concern for underlying vascular abnormality (i.e., aneurysm or reversible cerebral vasoconstriction syndrome) after initial negative brain imaging.[15-18]

Note: Negative brain CT < 6 hours after headache onset excludes subarachnoid hemorrhage in neurologically intact patients[15] MRI lacks sensitivity in excluding subarachnoid hemorrhage less than 24 hours after headache onset.[16, 19]

- Headache associated with exercise, exertion, Valsalva or sexual activity[16]
- Isolated third nerve palsy (oculomotor) with pupil involvement to evaluate for aneurysm[17]
- Pulsatile tinnitus to identify a suspected arterial vascular etiology[18, 20]

Note: MRI is the study of choice for detecting low flow malformations (see background)[21-23]

Cerebrovascular Disease

Ischemic

- Recent ischemic stroke or transient ischemic attack (See background section)[24, 25]
  Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management
- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[4, 26, 27]

Hemorrhagic

- Known subarachnoid hemorrhage (SAH)[28]

- Known cerebral intraparenchymal hemorrhage with concern for underlying vascular abnormality

Venous and MRV is contraindicated or cannot be performed[29]- CTV**

- Suspected venous thrombosis (dural sinus thrombosis)[30, 31]
- Distinguishing benign intracranial hypertension (pseudotumor cerebri) from dural sinus thrombosis[32, 33]

Sickle cells disease (ischemic and/or hemorrhagic) and MRA is contraindicated or cannot be performed[34]

- Neurological signs or symptoms in sickle cell disease
- Stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200

Vasculitis with initial laboratory workup (such as ESR, CRP, serology)[35]

- Suspected secondary CNS vasculitis based on neurological signs or symptoms in the setting of an underlying systemic disease with abnormal inflammatory markers or autoimmune antibodies
- Suspected primary CNS vasculitis based on neurological signs and symptoms with completed infectious/inflammatory lab work-up[36, 37]

Other intracranial vascular disease

- Suspected Moyamoya disease[38, 39]
- Suspected reversible cerebral vasoconstriction syndrome[40]
- Giant cell arteritis with suspected intracranial involvement[41]

For evaluation of known intracranial vascular disease[2, 3]

- Known intracranial aneurysm, treated aneurysm, or known vascular malformation (i.e., AVM or dural arteriovenous fistula)
- Known vertebrobasilar insufficiency with new or worsening signs or symptoms (VBI)[26, 27]
- Known vasculitis, reversible cerebral vasoconstriction syndrome or Moyamoya disease[36, 38-40]

Pre-operative/procedural evaluation for brain/skull surgery

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation[42, 43]

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Indications for Brain CTA/Neck CTA combination studies

- Recent ischemic stroke or transient ischemic attack[24] (see background)

Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management

- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[26, 27]
- Suspected carotid or vertebral artery dissection; secondary to trauma or spontaneous due to weakness of vessel wall[44, 45]
- Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment[46-48]
- Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 70%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[49-51]
- Symptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 50%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[49, 52]
- Pulsatile tinnitus to identify a suspected arterial vascular etiology[18, 20]

Indications for Brain CT/Brain CTA combination studies[2, 3]

- Recent ischemic stroke or transient ischemic attack (TIA) when MRI is contraindicated or cannot be performed
- Acute, sudden onset of headache with personal history of a vascular abnormality or first-degree family history of aneurysm

- Headache associated with exercise, exertion, Valsalva or sexual activity when MRI is contraindicated or cannot be performed[16]
- Suspected venous thrombosis (dural sinus thrombosis) and MRI is contraindicated or cannot be performed – CT/CTV**
- Neurological signs or symptoms in sickle cell patients when MRI is contraindicated or cannot be performed
- High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200 when MRI is contraindicated or cannot be performed

Indications for Brain CT/Brain CTA/Neck CTA combination studies

- Recent ischemic stroke or transient ischemic attack (TIA)[2, 3] when MRI is contraindicated or cannot be performed
- Approved indications as noted above and being performed in high-risk populations (in whom MRI is contraindicated or cannot be performed) and will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology

***Note**: CTA and MRA are generally comparable noninvasive imaging alternatives each with their own advantages and disadvantages. Brain MRI can be combined with Brain CTA/Neck CTA.

BACKGROUND

Computed tomography angiography (CTA) is recognized as a valuable diagnostic tool for the management of patients with cerebrovascular disease. With its three-dimensional reconstructions, CTA can simultaneously demonstrate the bony skull base and its related vasculature. CTA use of ionizing radiation and an iodine-based intravascular contrast medium is a disadvantage when compared to magnetic resonance angiography (MRA), but it is quicker and requires less patient cooperation than MRA. CTA is much less invasive than catheter angiography which involves injecting contrast material into an artery.

CTA for Evaluation of Aneurysm – CTA is useful in the detection of cerebral aneurysms. The sensitivity of CTA to detect cerebral aneurysms $\leq$ 5 mm is higher than that with digital subtraction angiography (DSA). Most aneurysms missed with CTA are $\leq$ 3mm. Aneurysms in the region of the anterior clinoid process may extend into the subarachnoid space where they carry the threat of hemorrhage. CTA can help delineate the borders of the aneurysm in relation to the subarachnoid space and may help detect acute ruptured aneurysms. It may be used in the selection of patients for surgical or endovascular treatment of ruptured intracranial aneurysms.

CTA for Screening of Patients with first-degree relative (parent, brother, sister or child) who have a history of aneurysm – Data has suggested that individuals with a parent, brother, sister, or child harboring an intracranial aneurysm are at increased risk of aneurysms. It is likely that multiple genetic and environmental risk factors contribute to the increased risk.

CTA and PCKD

Screening imaging every 5 years, and annual follow-up imaging in patients in with a known intracranial aneurysm is recommended. The current literature recommends initial screening by the age of 30 years and earlier if there is a strong family history of intracranial aneurysm. Screening is generally not recommended is the pediatric population (less than 18 years). No upper age limit for screening patients with ADPKD has been recommended.

CTA for evaluation of Arteriovenous Malformation (AVM) – A good correlation has been found between catheter angiography and CTA in the detection of arteriovenous malformations. CTA allows calculation of the volume of an AVM nidus and identifies and quantifies embolic material within it. CTA may be used for characterization and stereotactic localization before surgical resection or radiosurgical treatment of arteriovenous malformations.

CTA and non-aneurysmal vascular malformations – Non-aneurysmal vascular malformations can be divided in low flow vascular malformations and high flow vascular malformations. Low flow vascular malformations include dural venous anomalies (DVA), cavernomas, and capillary telangiectasias. High flow vascular malformations include AVM and dural arteriovenous fistulas (dAVF). For low flow malformations, MRI is the study of choice. There is limited medical literature to support vascular imagining (CTA or MRA). CTA plays a limited role in the assessment of cavernoma but may be used to demonstrate a DVA. MRA is not usually helpful in the assessment of cavernoma, capillary telangiectasia, and DVA. Vascular imaging is indicated in high flow vascular malformations.[2, 3, 23]

MRA vs CTA for CVA – Preferred vascular imaging of the head and neck includes non-contrast head MRA and contrast-enhanced neck MRA. MRA may not be able to be performed in patients with claustrophobia, morbid obesity, or implanted device, but it can be useful in patients with renal failure or contrast allergies. In patients with high radiation exposure, MRA as an alternative should be considered. For acute stroke, CTA is preferred after CT (to rule of hemorrhage) and to look for thrombus/possible intervention that is time-sensitive.[53]

CTA and recent stroke or transient ischemic attack – A stroke or central nervous system infarction is defined as “brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury. … Ischemic stroke specifically refers to central nervous system infarction accompanied by overt symptoms, whereas silent infarction causes no known symptoms”.[54] If imaging or pathology is not available, a clinical stroke is diagnosed by symptoms persisting for more than 24 hours. Ischemic stroke can be further classified by the type and location of ischemia and the presumed etiology of the brain injury. These include large-artery atherosclerotic occlusion (extracranial or intracranial), cardiac embolism, small-vessel disease and less commonly dissection, hypercoagulable states, sickle cell disease and undetermined causes.[55] TIAs in contrast, “are a brief episode of neurological dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction on

imaging".[56] On average, the annual risk of future ischemic stroke after a TIA or initial ischemic stroke is 3–4%, with an incidence as high as 11% over the next 7 days and 24–29% over the following 5 years. This has significantly decreased in the last half century due to advances in secondary prevention.[57]

When revascularization therapy is not indicated or available in patients with an ischemic stroke or TIA, the focus of the work-up is on secondary prevention. This includes noninvasive vascular imaging to identify the underlying etiology, assess immediate complications and risk of future stroke. The majority of stroke evaluations take place in the inpatient setting. Admitting TIA patients is reasonable if they present within 72 hours and have an ABCD (2) score ≥ 3, indicating high risk of early recurrence, or the evaluation cannot be rapidly completed on an outpatient basis.[56] Minimally, both stroke and TIA should have an evaluation for high-risk modifiable factors such as carotid stenosis atrial fibrillation as the cause of ischemic symptoms.[55] Diagnostic recommendations include neuroimaging evaluation as soon as possible, preferably with magnetic resonance imaging, including DWI; noninvasive imaging of the extracranial vessels should be performed, and noninvasive imaging of intracranial vessels is reasonable.[25]

Patients with a history of stroke and recent work-up with new signs or symptoms indicating progression or complications of the initial CVA should have repeat brain imaging as an initial study. Patients with remote or silent strokes discovered on imaging should be evaluated for high-risk modifiable risk factors based on the location and type of the presumed etiology of the brain injury.

CTA for Evaluation of Vertebrobasilar Insufficiency (VBI) – Multidetector CT angiography (MDCTA) may be used in the evaluation of vertebral artery pathologies. The correlation between MDCTA and color Doppler sonography is moderate. CTA is used for minimally invasive follow-up after intracranial stenting for VBI. It enables visualization of the patency of the stent lumen and provides additional information about all brain arteries and the brain parenchyma.

CTA and Intracerebral Hemorrhage – CTA is useful as a screening tool for an underlying vascular abnormality in the evaluation of spontaneous intracerebral hemorrhage (ICH). Etiologies of spontaneous ICH include tumor, vascular malformation, aneurysm, hypertensive arteriopathy, cerebral amyloid angiopathy, venous thrombosis, vasculitis, RCVS, drug-induced vasospasm, venous sinus thrombosis, Moyamoya disease, anticoagulant use and hemorrhagic transformation of an ischemic infarct. History can help point to a specific etiology. Possible risk factors for the presence of underlying vascular abnormalities include age younger than 65, female, lobar or intraventricular location, and the absence of hypertension or impaired coagulation.[58]

CTV and Central Venous Thrombosis** – a CT Venogram is indicated for the evaluation of a central venous thrombosis/dural sinus thrombosis. The most frequent presentations are isolated headache, intracranial hypertension syndrome, seizures, focal neurological deficits, and

encephalopathy. Risk factors are hypercoagulable states inducing genetic prothrombotic conditions, antiphospholipid syndrome and other acquired prothrombotic diseases, such as cancer, oral contraceptives, pregnancy, puerperium (6 weeks postpartum), infections, and trauma. Since venous thrombosis can cause SAH, infarctions, and hemorrhage, parenchymal imaging with MRI/CT is also appropriate.[29, 59-61]

CTA and dissection- Craniocervical dissections can be spontaneous or traumatic. Patients with blunt head or neck trauma who meet Denver Screening criteria should be assessed for cerebrovascular injury (although about 20% will not meet criteria). The criteria include: focal or lateralizing neurological deficits (not explained by head CT), infarct on head CT, face, basilar skull, or cervical spine fractures, cervical hematomas that are not expanding, Glasgow coma score less than 8 without CT findings, massive epistaxis, cervical bruit or thrill.[44, 62-64] Spontaneous dissection presents with headache, neck pain with neurological signs or symptoms. There is often minor trauma or precipitating factor (i.e., exercise, neck manipulation). Dissection is thought to occur due to weakness of the vessel wall, and there may be an underlying connective tissue disorder. Dissection of the extracranial vessels can extend intracranially and/or lead to thrombus which can migrate into the intracranial circulation causing ischemia. Therefore, vascular imaging of the head and neck is warranted.[45, 65]

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POLICY HISTORY

Date	Summary
May 2023	• Updated and reformatted references • Updated background section • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging Added: - Section on further evaluation of indeterminate or questionable findings on prior imaging - Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment - Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management (also in combo section) - Note on CTA VS MRA Clarified: - Screening for aneurysm in polycystic kidney disease (in *adults*) - Screening for intracranial aneurysm if *two or more* first-degree family members (parent brother, sister, or child) with history of intracranial aneurysm - *For one first degree relative with aneurysm, asymptomatic screening is not indicated - would require a neurological sign or symptom supporting clinical concern for aneurysm.* - Thunderclap headache with continued concern for underlying vascular abnormality (*i.e., aneurysm or reversible cerebral vasoconstriction syndrome) after initial negative brain imaging* - *Note: MRI lacks sensitivity in excluding subarachnoid hemorrhage less than 24 hours after headache onset* - Headache associated with exercise, *exertion, Valsalva* or sexual activity (Also in Combo Brain CT/CTA) Deleted: Vascular abnormality visualized on previous brain imaging that is equivocal or needs further evaluation
March 2022	Updated and reformatted references Added New combo statement Updated background Clarified:

	• Aneurysm screening in aortic coarctation after age 10 • MRI is the study of choice for detecting low flow vascular malformations (see background) • Follow-up of known intracranial aneurysm, treated aneurysm, or known vascular malformation • Pulsatile tinnitus to identify a suspected arterial vascular etiology • Combo studies- CVA/TIA when MRI is contraindicated or cannot be performed Changed: • Thunderclap headache with continued concern for underlying vascular abnormality after initial negative brain imaging > 6 hours after onset Added: • Brain MRI/Brain MRA combination (when MRI contraindicated) o Neurological signs or symptoms in sickle cell patients o High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **NECK CTA**	**Original Date: September 1997**
CPT Codes: 70498	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_012-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR NECK CTA

If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- Inconclusive or show a need for additional or follow up imaging evaluation **OR**
- The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.

(*Unless approvable in the combination section as noted in the guidelines)

Patients with claustrophobia, limited ability to cooperate, an implanted device or in an urgent situation may be better suited for CTA, whereas those with extensive calcification, renal disease iodine contrast allergy should have MRA.[1]

For evaluation of known or suspected extracranial vascular disease

Cerebrovascular Disease

- Recent ischemic stroke or transient ischemic attack (see Background)[2-4]

Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management

- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[5-7]
- Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 70%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries)[8-10]
- Symptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 50%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries)[8, 11, 12]

Aneurysm screening

- Screening for aneurysm in Loeys-Dietz syndrome**, fibromuscular dysplasia or spontaneous coronary arteries dissection (SCAD)[13-16]

**For Loeys-Dietz imaging should be repeated at least every two years

Tumor/pulsatile mass

- Pulsatile mass on exam[17]
- Known or suspected carotid body tumors, or other masses such as a paraganglioma, arteriovenous fistula pseudoaneurysm, atypical lymphovascular malformation[18]

Note: Ultrasound (US) may be used to identify a mass overlying or next to an artery in initial work up of a pulsatile mass.

Other extracranial vascular disease[19]

- Large vessel vasculitis (Giant cell or Takayasu arteritis) with suspected extracranial involvement[20-23]
- Subclavian steal syndrome when ultrasound is positive or indeterminate **OR** for planning interventions[24]
- Suspected carotid or vertebral artery dissection; secondary to trauma or spontaneous due to weakness of vessel wall[25, 26]
- To identity an arterial source of bleeding in patients with hemorrhage of the head and neck[27]
- Horner's syndrome (miosis, ptosis, and anhidrosis)[28]
- For evaluation of pulsatile tinnitus (subjective or objective) for suspected arterial vascular etiology[29]
- For further evaluation of a congenital vascular malformation of the head and neck
- Known extracranial vascular disease that needs follow-up or further evaluation

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation (e.g., carotid endarterectomy)

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

INDICATIONS FOR COMBINATION STUDIES

Neck CTA/Brain CTA

- Recent ischemic stroke or transient ischemic attack (TIA)(see Background) [2, 3, 30]

Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management

- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[5, 7]
- Suspected carotid or vertebral artery dissection; due to trauma or spontaneous due to weakness of vessel wall[25, 26]
- Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment[31, 32]
- Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 70%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[8-10]
- Symptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 50%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[8, 11, 12]
- Pulsatile tinnitus (subjective or objective) for suspected arterial vascular etiology[29]

BACKGROUND

For vascular disease, MRA and CTA are generally comparable. No current literature compares the efficacy of contrast enhanced CT to CTA or MRI and MRA for evaluation of pulsatile neck mass, so any are approvable.[33] CTA may be complementary to CT in the following settings: evaluation of a pulsatile neck mass to assess vascular detail when needed; assessment of relevant vascular anatomy for pre-procedural evaluation; vascular supply to tumors and vessel encasement and narrowing by tumors; extent of disease in vasculitis; and to help determine the nature and extent of congenital or acquired vascular anomalies.

MRA vs CTA for Carotid Artery Evaluation[34, 35] - MRA and CTA are generally comparable noninvasive imaging alternatives, each with their own advantages and disadvantages. Advantages of CTA over MRA include superior spatial resolution, rapid image acquisition, decreased susceptibility to motion artifacts and artifacts from calcification as well as being better able to evaluate slow flow and tandem lesions. However, CTA can also overestimate high-grade stenosis. Limitations of CTA include radiation exposure to the patient, necessity of IV contrast, and risk of contrast allergy and contrast nephropathy. MRA is an excellent screening test since it does not utilize ionizing radiation. Duplex US and contrast-MRA is a common choice for carotid artery evaluation. Limitations of MRA include difficulty in patients with claustrophobia and the risk of nephrogenic systemic sclerosis with gadolinium contrast agents in specific patients. In patients with high radiation exposure, MRA as an alternative imaging modality should be considered.

CTA and dissection - Craniocervical dissections can be spontaneous or traumatic. Patients with blunt head or neck trauma who meet Denver Screening criteria should be assessed for cerebrovascular injury (although about 20% will not meet criteria). The criteria include: focal or lateralizing neurological deficits (not explained by head CT), infarct on head CT, face, basilar skull, or cervical spine fractures, cervical hematomas that are not expanding, Glasgow coma score less than 8 without CT findings, massive epistaxis, cervical bruit or thrill.[25, 36-38] Spontaneous dissection presents with headache, neck pain with neurological signs or symptoms. There is often minor trauma or precipitating factor (e.g., exercise, neck manipulation). Dissection is thought to occur due to weakness of the vessel wall, and there may be an underlying connective tissue disorder. Dissection of the extracranial vessels can extend intracranially and/or lead to thrombus, which can migrate into the intracranial circulation causing ischemia. Therefore, MRA of the head and neck is warranted.[26, 39]

CTA and recent stroke or transient ischemic attack (TIA) - A stroke or central nervous system infarction is defined as “brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury. … Ischemic stroke specifically refers to central nervous system infarction accompanied by overt symptoms, whereas silent infarction causes no known symptoms.”[40] If imaging or pathology is not available, a clinical stroke is diagnosed by symptoms persisting for more than 24 hours. Ischemic stroke can be further classified by the type and location of ischemia and the presumed etiology of the brain injury. These include large-artery atherosclerotic occlusion (extracranial or

intracranial), cardiac embolism, small-vessel disease and less commonly dissection, hypercoagulable states, sickle cell disease and undetermined causes.[41] TIAs in contrast, "are a brief episode of neurological dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction on imaging."[42] On average, the annual risk of future ischemic stroke after a TIA or initial ischemic stroke is 3–4%, with an incidence as high as 11% over the next 7 days and 24–29% over the following 5 years. This has significantly decreased in the last half century due to advances in secondary prevention.[43]

When revascularization therapy is not indicated or available in patients with an ischemic stroke or TIA, the focus of the work-up is on secondary prevention. This includes noninvasive vascular imaging to identify the underlying etiology, assess immediate complications and risk of future stroke. The majority of stroke evaluations take place in the inpatient setting. Admitting TIA patients is reasonable if they present within 72 hours and have an ABCD(2) score ≥3, indicating high risk of early recurrence, or the evaluation cannot be rapidly completed on an outpatient basis.[42] Minimally, both stroke and TIA should have an evaluation for high-risk modifiable factors, such as carotid stenosis atrial fibrillation, as the cause of ischemic symptoms.[41] Diagnostic recommendations include neuroimaging evaluation as soon as possible, preferably with magnetic resonance imaging, including DWI; noninvasive imaging of the extracranial vessels should be performed, and noninvasive imaging of intracranial vessels is reasonable.[30]

Patients with a history of stroke and recent work up with new signs or symptoms indicating progression or complications of the initial CVA should have repeat brain imaging as an initial study. Patients with remote or silent strokes discovered on imaging should be evaluated for high-risk modifiable risk factors based on the location and type of the presumed etiology of the brain injury.[30, 40-43]

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POLICY HISTORY

Date	Summary
May 2023	Updated References Added • For further evaluation of a congenital vascular malformation of the head and neck • Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment (Combo Neck/Brain CTA) • Section on further evaluation of indeterminate or questionable findings on prior imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
March 2022	Updated and reformatted references Expanded background on CTA vs MRA Clarified • Pulsatile tinnitus to identify a suspected arterial vascular etiology • Large vessel vasculitis with suspected extracranial involvement Added: • To identity an arterial source of bleeding in patients with hemorrhage of the head and neck • New Combo statement

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **SINUS, FACE, ORBIT, NECK, and IAC MRI**	**Original Date: November 2007**
CPT Codes: 70540, 70542, 70543	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_014	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR ORBIT MRI

If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- Inconclusive or show a need for additional or follow up imaging evaluation OR
- The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.

(*Unless approvable in the combination section as noted in the guidelines)

MRI is superior for the evaluation of the visual pathways, globe and soft tissues; CT is preferred for visualizing bony detail and calcifications[1, 2]

- **Abnormal external or direct eye exam**
    - Exophthalmos (proptosis) or enophthalmos
    - Ophthalmoplegia with concern for orbital pathology
    - Unilateral optic disk swelling[3-5]
    - Documented visual field defect[6-9]

        - Unilateral or with abnormal optic disc(s) (e.g., optic disc blurring, edema, or pallor); **AND**
        - Not explained by underlying diagnosis, glaucoma, or macular degeneration

- **Optic neuritis**[10-14]
    - If atypical presentation (bilateral, absence of pain, optic nerve hemorrhages, severe visual impairment, lack of response to steroids, poor recovery or recurrence)[15, 16]
    - If needed to confirm optic neuritis and rule out compressive lesions

- **Orbital trauma**[17, 18]
    - Physical findings of direct eye injury
    - Suspected orbital trauma with indeterminate x-ray or ultrasound

- **Orbital or ocular mass/tumor, suspected or known**[1, 7]

- **Clinical suspicion of orbital infection**[1, 2]

- **Clinical suspicion of osteomyelitis**[19, 20]
    - Direct visualization of bony deformity **OR**
    - Abnormal x-rays

- **Clinical suspicion of Orbital Inflammatory Disease** (e.g., eye pain and restricted eye movement with suspected orbital pseudotumor)[21]

- **Congenital orbital anomalies**

- **Complex strabismus syndromes** (with ophthalmoplegia or ophthalmoparesis) to aid in diagnosis, treatment and/or surgical planning[22-24]

NOTE: FOR ADDITIONAL ONCOLOGIC ORBIT MRI INDICATIONS, CLICK HERE

INDICATIONS FOR ORBIT AND BRAIN MRI COMBINATION STUDIES:

- Optic neuropathy or unilateral optic disk swelling of unclear etiology to distinguish between a compressive lesion of the optic nerve, optic neuritis, ischemic optic neuropathy (arteritic or non-arteritic), central retinal vein occlusion or optic nerve infiltrative disorders[25]
- Bilateral optic disk swelling (papilledema) with vision loss[3]
- Optic neuritis

    - If atypical presentation (bilateral, absence of pain, optic nerve hemorrhages, severe visual impairment, lack of response to steroids, poor recovery or recurrence)[11-16]
    - If needed to confirm optic neuritis and rule out compressive lesions
- Known or suspected neuromyelitis optica spectrum disorder with severe, recurrent, or bilateral optic neuritis[26]
- Suspected retinoblastoma[27, 28]
- For approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology[29]

INDICATIONS FOR FACE/SINUS MRI:

- **Rhinosinusitis[30]**
    - Clinical suspicion of fungal infection[31]
    - Clinical suspicion of orbital or intracranial complications,[19, 20] such as
        - Preseptal, orbital, or central nervous system infection
        - Osteomyelitis
        - Cavernous sinus thrombosis
- **Sinonasal obstruction, suspected-mass,** based on exam, nasal endoscopy, or prior imaging[30, 32]
- **Anosmia or Dysosmia** based on objective testing that is persistent and of unknown origin[33-35]
- **Suspected infection**
    - Osteomyelitis (after x-rays)[36]
    - Abscess based on clinical signs and symptoms of infection
- **Face mass[30, 37, 38]**
    - Present on physical exam and remains non-diagnostic after x-ray or ultrasound is completed
    - Known or highly suspected head and neck cancer on examination[30]
    - Failed 2 weeks of treatment for suspected infectious adenopathy[39]
- **Facial trauma[17, 18, 40, 41]**
    - Concern for soft tissue injury to further evaluate for treatment or surgical planning[42]
- **Granulomatosis with polyangiitis (Wegener's granulomatosis) disease[31]**
- **Trigeminal neuralgia/neuropathy** (for evaluation of the extracranial nerve course)
    - If atypical features (e.g., bilateral, hearing loss, dizziness/vertigo, visual changes, sensory loss, numbness, pain > 2min, pain outside trigeminal nerve distribution, progression)[33, 43]

NOTE: FOR ADDITIONAL ONCOLOGIC FACE/SINUS MRI INDICATIONS, CLICK HERE

INDICATIONS FOR FACE/SINUS AND BRAIN MRI COMBINATION STUDIES:

- Granulomatosis with polyangiitis (Wegener's granulomatosis) disease[44]
- Trigeminal neuralgia that meets the above criteria[33, 43]
- For approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology[29]

INDICATIONS FOR NECK MRI:

Suspected tumor or cancer[45]:

- Suspicious lesions in mouth or throat[38]
- Suspicious mass/tumor found on another imaging study and needing clarification
- Neck mass or lymphadenopathy (non-parotid or non-thyroid)
    - Present on physical exam and remains non-diagnostic after ultrasound is completed[38]
    - Mass or abnormality found on other imaging study and needing further evaluation
    - Increased risk for malignancy with one or more of the following findings[46]:
        - Fixation to adjacent tissues
        - Firm consistency
        - Size >1.5 cm
        - Ulceration of overlying skin
        - Mass present ≥ two weeks (or uncertain duration) without significant fluctuation and not considered of infectious cause
        - History of cancer
    - Failed 2 weeks of treatment for suspected infectious adenopathy[39]
    - Pediatric (≤18 years old) considerations[10]
        - Ultrasound should be inconclusive or suspicious unless there is a history of malignancy[11]

Note: For discrete cystic lesions of the neck, an ultrasound should be performed as initial imaging unless there is a high suspicion of malignancy

- Neck Mass (parotid)[45]
    - Parotid mass found on other imaging study and needing further evaluation (US is the initial imaging study of a parotid region mass)
- Neck Mass (thyroid)[47]
    - Staging and monitoring for recurrence of known thyroid cancer[47]
        - To assess extent of thyroid tissue when other imaging suggests extension through the thoracic inlet into the mediastinum or concern for airway compression[48, 49]

Note: US is the initial imaging study of a thyroid region mass. Biopsy is usually the next step. In the evaluation of known thyroid malignancy, CT is preferred over MRI since there is less

respiratory motion artifact. Chest CT may be included for preoperative assessment in some cases

Known or suspected deep space infections or abscesses of the pharynx or neck with signs or symptoms of infection[50]

Other indications for a Neck MRI:

- MR Sialography to evaluate salivary ducts[51, 52]
- Vocal cord lesions or vocal cord paralysis[53]
- Unexplained ear pain when ordered by a specialist with all of the following[54]
    - Otoscopic exam, nasolaryngoscopy, lab evaluation (ESR, CBC) **AND**
    - Risk factor for malignancy i.e., tobacco use, alcohol use, dysphagia, weight loss **OR** age older than 50 years
- Diagnosed primary hyperparathyroidism when surgery is planned
    - Previous nondiagnostic ultrasound or nuclear medicine scan[55, 56]
- Bell's palsy/hemifacial spasm (for evaluation of the extracranial nerve course)
    - If atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset[57]
- Objective cranial nerve palsy (CN IX-XII) (for evaluation of the extracranial nerve course)[33, 58]
- Brachial plexopathy if mechanism of injury or EMG/NCV studies are suggestive[59, 60]

  Note: Chest MRI is preferred study, but neck and/or shoulder (upper extremity) MRI can be approved depending on the suspected location of injury

NOTE: FOR ADDITIONAL ONCOLOGIC NECK MRI INDICATIONS, CLICK HERE

INDICATIONS FOR NECK AND BRAIN MRI COMBINATION STUDIES:

- Objective cranial nerve palsy (CN IX-XII) (for evaluation of the extracranial nerve course)[33, 58]
- Bell's Palsy/hemifacial spasm that meets the above criteria[57]
- For approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology[29]

Indications for Internal Auditory Canal (IAC) MRI (Not including Brain)

- Unilateral non-pulsatile tinnitus
- Pulsatile tinnitus
- Suspected acoustic neuroma (Schwannoma) or cerebellar pontine angle tumor with any of the following signs and symptoms: unilateral hearing loss by audiometry, headache, disturbed balance or gait, unilateral tinnitus, facial weakness, or altered sense of taste

- Suspected cholesteatoma
- Suspected glomus tumor
- Asymmetric sensorineural hearing loss on audiogram
- Congenital/childhood sensorineural hearing loss suspected to be due to a structural abnormality[61-63] (CNVIII, the brain parenchyma, or the membranous labyrinth). CT is the preferred imaging modality for the osseous anatomy and malformations of the inner ear.
- CSF otorrhea (MRI/Nuclear Cisternography for intermittent leaks, CT for active leaks); there should be a high suspicion or confirmatory CSF fluid laboratory testing (Beta-2 transferrin assay)
- Bell's Palsy for evaluation of the extracranial nerve course -if atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset[57]

ADDITIONAL ONCOLOGIC INDICATIONS FOR ORBIT/FACE/SINUS/NECK MRI

Known tumor or cancer of skull base, orbits, sinuses, face, tongue, larynx, nasopharynx, pharynx, or salivary glands[64]

- Initial staging[38]
- Restaging during treatment
- Suspected recurrence or new metastases based on symptoms or examination findings
    - New mass
    - Change in lymph nodes[65]
- Surveillance appropriate for tumor type and stage

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- < 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post- operative/procedural evaluation

- When imaging, physical, or laboratory findings indicate surgical or procedural complications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.[37]
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

BACKGROUND:

Magnetic resonance imaging (MRI) is used in the evaluation of face and neck region masses, trauma, and infection. The soft tissue contrast between normal and abnormal tissues provided by MRI is sensitive for differentiating between inflammatory disease and malignant tumors and permits the precise delineation of tumor margins. MRI is used for therapy planning and follow-up of face and neck neoplasms. It is also used for the evaluation of neck lymphadenopathy and vocal cord lesions.

CT scanning remains the study of choice for the imaging evaluation of acute and chronic inflammatory diseases of the sinonasal cavities. MRI is not considered the first-line study for routine sinus imaging because of limitations in the definition of the bony anatomy and length of imaging time. MRI for confirmation of diagnosis of sinusitis is discouraged because of hypersensitivity (overdiagnosis) in comparison to CT without contrast. MRI, however, is superior to CT in differentiating inflammatory conditions from neoplastic processes. MRI may better depict intraorbital and intracranial complications in cases of aggressive sinus infection, as well as differentiating soft-tissue masses from inflammatory mucosal disease. MRI may also identify fungal invasive sinusitis or encephaloceles.

Anosmia – Nonstructural causes of anosmia include post viral symptoms, medications (Amitriptyline, Enalapril, Nifedipine, Propranolol, Penicillamine, Sumatriptan, Cisplatin, Trifluoperazine, Propylthiouracil). These should be considered prior to advanced imaging to look for a structural cause. Anosmia and dysgeusia have been reported as common early symptoms in patients with COVID-19, occurring in greater than 80 percent of patients. For isolated anosmia, imaging is typically not needed once the diagnosis of COVID has been made given the high association. As such, COVID testing should be done prior to imaging.[66-68]
MRI Orbits, Face, and Neck MRI rather than MRI Brain is the mainstay for directly imaging the olfactory apparatus and sinonasal or anterior cranial fossa tumors that may impair or directly involve the olfactory apparatus.[33]

CSF (cerebrospinal fluid) leaks – For CSF rhinorrhea, Sinus CT is indicated when looking to characterize a bony defect. For CSF otorrhea, Temporal Bone CT is indicated. For intermittent leaks and complex cases, consider CT/MRI/Nuclear Cisternography. There should be a high suspicion or confirmatory CSF fluid laboratory testing (Beta-2 transferrin assay).[69, 70]

Trigeminal Neuralgia – According to the International Headache Society, TN is defined as "a disorder characterized by recurrent unilateral brief electric shock-like pain, abrupt in onset and termination, limited to the distribution of one or more divisions of the trigeminal nerve and triggered by innocuous stimuli."[71]

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POLICY HISTORY

Date	Summary
May 2023	Updated references Updated background Added: • Combo Orbit/Brain MRI -Suspected retinoblastoma • Combo Neck/Brain MRI -Bell's Palsy/hemifacial spasm that meets the above criteria • Section on further evaluation of indeterminate or questionable findings on prior imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline Removed additional resources
March 2022	Updated references Added New Combo statement <u>Orbit</u> • Clarified: o Optic neuritis ▪ If atypical presentation (bilateral, absence of pain, optic nerve hemorrhages, severe visual impairment, lack of response to steroids, poor recovery or recurrence) ▪ If needed to confirm optic neuritis and rule out compressive lesions (combo section) o Complex strabismus syndromes (with ophthalmoplegia or ophthalmoparesis) <u>Sinus</u> • Re-ordered indications • Reformatted and updated backgrounds • Clarified: o Abscess o Facial trauma - Concern for soft tissue injury to further evaluate for treatment or surgical planning • Deleted: o Physical findings of direct facial bone injury <u>Neck</u> • Reformatted indications • Added: o Mass or abnormality found on other imaging study and needing further evaluation • Clarified

	○ Non thyroid masses ○ Thyroid imaging ○ Abscess

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **BRAIN (HEAD) MRA/MRV**	**Original Date: September 1997**
CPT Codes: 70544, 70545, 70546	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_004-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR BRAIN (HEAD) MR Angiography/MR Venography

Brain MRI/MRA are not approvable simultaneously unless they meet the criteria described below in the Indications for Brain MRI/Brain MRA combination studies section. If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- Inconclusive or show a need for additional or follow up imaging evaluation OR
- The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of suspected intracranial vascular disease[1, 2]

- **Aneurysm screening**
  - Screening for intracranial aneurysm if two or more first-degree family members (parent brother, sister, or child) with history of intracranial aneurysm
    - Repeat study is recommended every 5 years[3]

- For one first degree relative with aneurysm, asymptomatic screening is not indicated - would require a neurological sign or symptom supporting clinical concern for aneurysm.[4-6]
- Screening for aneurysm in polycystic kidney disease (in adults), Loeys-Dietz syndrome*, fibromuscular dysplasia, spontaneous coronary arteries dissection (SCAD), or known aortic coarctation (after age 10)[7-15]
  *For Loeys-Dietz imaging should be repeated at least every two years

- **Vascular abnormalities**
  - Suspected vascular malformation (arteriovenous malformation (AVM) or dural arteriovenous fistula) in patient with previous or indeterminate imaging study
  - Thunderclap headache with continued concern for underlying vascular abnormality (i.e. aneurysm or reversible cerebral vasoconstriction syndrome) after initial negative brain imaging [16]

    Note: Negative brain CT < 6 hours after headache onset excludes subarachnoid hemorrhage in neurologically intact patients. MRI lacks sensitivity in excluding subarachnoid hemorrhage less than 24 hours after headache onset.[17, 18]

  - Headache associated with exercise, exertion, Valsalva, or sexual activity[18]
  - Isolated third nerve palsy (oculomotor) with pupil involvement to evaluate for aneurysm[19]
  - Pulsatile tinnitus to identify a suspected arterial vascular etiology[20, 21]

    Note: MRI is the study of choice for detecting cavernomas, developmental venous anomalies and capillary telangiectasia (see background)[22]

- **Cerebrovascular Disease**
  - Ischemic
    - Recent ischemic stroke or transient ischemic attack (See background)[23, 24]

      Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management

    - Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[19, 25-27]
  - Hemorrhagic
    - Known subarachnoid hemorrhage (SAH) – CTA is favored over MRA
    - Known cerebral intraparenchymal hemorrhage with concern for underlying vascular abnormality
  - Venous-MRV†
    - Suspected central venous thrombosis (dural sinus thrombosis)[28, 29]
    - Distinguishing benign intracranial hypertension (pseudotumor cerebri) from dural sinus thrombosis[30, 31]

    - Sickle cells disease (ischemic and/or hemorrhagic)[32, 33]
        - Neurological signs or symptoms in sickle cell patients
        - High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200

- **Vasculitis with initial laboratory workup (such as ESR, CRP, serology)[34]**
    - Suspected secondary CNS vasculitis based on neurological sign or symptoms in the setting of an underlying systemic disease with abnormal inflammatory markers or autoimmune antibodies
    - Suspected primary CNS vasculitis based on neurological signs and symptoms with completed infectious/inflammatory lab work-up[35, 36]
    - Giant cell arteritis with suspected intracranial involvement[37-40]

- **Other intracranial vascular disease**
    - Suspected Moyomoya disease[41, 42]
    - Suspected reversible cerebral vasoconstriction syndrome[43]

For evaluation of known intracranial vascular disease[1, 2]

- Known intracranial aneurysm, treated aneurysm, or known vascular malformation (i.e., AVM or dural arteriovenous fistula)
- Known vertebrobasilar insufficiency with new or worsening signs or symptoms[25, 27]
- Known vasculitis, reversible cerebral vasoconstriction syndrome or Moyomoya disease[35, 41-44]

Pre-operative/procedural evaluation for brain/skull surgery

- Pre-operative evaluation for a planned surgery or procedure
- Refractory trigeminal neuralgia when done for surgical planning[45]

Post-operative/procedural evaluation[46, 47]

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested

Further evaluation of indeterminate or questionable findings on prior imaging:

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Indications for Brain MRA/Neck MRA combination studies[1, 2]

- Recent ischemic stroke or transient ischemic attack (TIA)[24] (also in combo section)
- Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management
- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[25-27]
- Suspected carotid or vertebral artery dissection; secondary to trauma or spontaneous due to weakness of vessel wall[48, 49]
- Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment[50-52]
- Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 70%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[53-55]
- Symptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 50%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[53, 56]
- Pulsatile tinnitus to identify a suspected arterial vascular etiology[20, 21]

Indications for Brain MRI/Brain MRA combination studies[1, 2]

- Recent ischemic stroke or transient ischemic attack (TIA)
- Thunderclap headache with continued concern for underlying vascular abnormality (i.e., aneurysm or reversible cerebral vasoconstriction syndrome) after initial negative brain imaging[16]

  Note: Negative brain CT < 6 hours after headache onset excludes subarachnoid hemorrhage in neurologically intact patients. MRI lacks sensitivity in excluding subarachnoid hemorrhage less than 24 hours after headache onset.[17, 18]

- Acute, sudden onset of headache with personal history of a vascular abnormality or first-degree family history of aneurysm
- Headache associated with exercise, exertion, Valsalva or sexual activity[18]
- Suspected venous thrombosis (dural sinus thrombosis) – MRI/MRV†
- Neurological signs or symptoms in sickle cell patients
- High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200

Indications for Brain MRI/Brain MRA/Neck MRA combination studies

- Recent ischemic stroke or transient ischemic attack (TIA)[1, 2, 57]
- Approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology[58]

Any Combination of Brain MRA/Neck MRA/Brain MRI with IAC

- Pulsatile tinnitus with concern for a suspected arterial vascular and/or intracranial etiology[20, 57]

***Note:** CTA and MRA are generally comparable noninvasive imaging alternatives each with their own advantages and disadvantages. Brain MRI can be combined with Brain CTA/Neck CTA.

BACKGROUND

Magnetic resonance angiography (MRA) or magnetic resonance venography (MRV) can be used as a first-line investigation of intracranial vascular disease. It is an alternative to invasive intra-catheter angiography that was once the mainstay for the investigation of intracranial vascular disease. MRA/MRV may use a contrast agent, gadolinium, which is non-iodine-based, for better visualization. It can be used in patients who have history of contrast allergy and who are at high risk of kidney failure. A single authorization covers both MRA and MRV.

The three different techniques of MRA/MRV include time of flight (both 2D and 3D TOF), phase contrast (PC), and contrast-enhanced angiography. Time of flight MRA takes advantage of the phenomena of flow-related enhancement and is the preferred MRA technique due to the speed at which the exam can be acquired.

MRA and Cerebral Aneurysms – Studies that compared MRA with catheter angiography in detecting aneurysms found that MRA could find 77% - 94% of the aneurysms previously diagnosed by catheter angiography that were larger than 5 mm. For aneurysms smaller than 5 mm, MRI detected only 10% - 60% of those detected with catheter angiography. On the other hand, aneurysms that were missed by catheter angiography in patients with acute subarachnoid hemorrhage were detected with MRA due to the much larger number of projections available with MRA.[59] The decrease in specificity, when compared with CTA, is reported to have false-positive cases related to normal vascular variants of infundibular origin of vessels and vessel loops. Limitations of MRA head include required safety screening and relatively long acquisition time in urgent clinical scenario.

MRA and PCKD[13-15, 60]

Screening imaging every 5 years, and annual follow-up imaging in patients in with a known intracranial aneurysm is recommended. The current literature recommends initial screening by the age of 30 years and earlier if there is a strong family history of intracranial aneurysm. Screening is generally not recommended is the pediatric population (less than 18 years). No upper age limit for screening patients with ADPKD has been recommended.

MRA and Cerebral Arteriovenous Malformations (AVM) – Brain arteriovenous malformation (AVM) may cause intracranial hemorrhage and is usually treated by surgery. 3D TOF-MRA is commonly used during the planning of radiosurgery to delineate the AVM nidus, but it is not highly specific for the

detection of a small residual AVM aft er radiosurgery. There is no evidence to support screening of first-degree relatives for AVMs[61]. The risk of having an AVM may be higher than in the general population, but absolute risk is low.

MRA and non-aneurysmal vascular malformations – Non-aneurysmal vascular malformations can be divided in low flow vascular malformations and high flow vascular malformations. Low flow vascular malformations include dural venous anomalies (DVA), cavernomas, and capillary telangiectasias. High flow vascular malformations include AVM and dural arteriovenous fistulas (dAVF). For low flow malformations, MRI is the study of choice. There is limited medical literature to support vascular imagining (CTA or MRA). CTA plays a limited role in the assessment of cavernoma but may be used to demonstrate a DVA. MRA is not usually helpful in the assessment of cavernoma, capillary telangiectasia, and DVA. Vascular imaging is indicated in high flow vascular malformations.[1, 2, 22]

MRA vs CTA for CVA – Preferred vascular imaging of the head and neck includes non-contrast head MRA and contrast-enhanced neck MRA. MRA may not be able to be performed in patients with claustrophobia, morbid obesity, or implanted device, but it can be useful in patients with renal failure or contrast allergies. For acute stroke, CTA is preferred after CT (to rule out hemorrhage) and to look for thrombus/possible intervention that is time sensitive.[62]

MRA and recent stroke or transient ischemic attack – A stroke or central nervous system infarction is defined as "brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury. … Ischemic stroke specifically refers to central nervous system infarction accompanied by overt symptoms, whereas silent infarction causes no known symptoms."[63] If imaging or pathology is not available, a clinical stroke is diagnosed by symptoms persisting for more than 24 hours. Ischemic stroke can be further classified by the type and location of ischemia and the presumed etiology of the brain injury. These include large-artery atherosclerotic occlusion (extracranial or intracranial), cardiac embolism, small-vessel disease and less commonly dissection, hypercoagulable states, sickle cell disease and undetermined causes.[64] TIAs in contrast, "are a brief episode of neurological dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction on imaging."[65] On average, the annual risk of future ischemic stroke after a TIA or initial ischemic stroke is 3–4%, with an incidence as high as 11% over the next 7 days and 24–29% over the following 5 years. This has significantly decreased in the last half century due to advances in secondary prevention.[66]

Therefore, when revascularization therapy is not indicated or available in patients with an ischemic stroke or TIA, the focus of the work-up is on secondary prevention. This includes noninvasive vascular imaging to identify the underlying etiology, assess immediate complications and risk of future stroke. The majority of stroke evaluations take place in the inpatient setting. Admitting TIA patients is reasonable if they present within 72 hours and have an ABCD(2) score ≥ 3, indicating high risk of early recurrence, or the evaluation cannot be rapidly completed on an outpatient basis (Easton, 2009). Minimally, both stroke and TIA should have an evaluation for high-risk modifiable factors, such as

carotid stenosis atrial fibrillation, as the cause of ischemic symptoms.[64] Diagnostic recommendations include neuroimaging evaluation as soon as possible, preferably with magnetic resonance imaging, including DWI; noninvasive imaging of the extracranial vessels should be performed, and noninvasive imaging of intracranial vessels is reasonable.[23]

Patients with a history of stroke and recent workup with new signs or symptoms indicating progression or complications of the initial CVA should have repeat brain imaging as an initial study. Patients with remote or silent strokes discovered on imaging should be evaluated for high-risk modifiable risk factors based on the location and type of the presumed etiology of the brain injury.

MRA and Intracerebral Hemorrhage – MRA is useful as a screening tool for an underlying vascular abnormality[67] in the evaluation of spontaneous intracerebral hemorrhage (ICH). Etiologies of spontaneous ICH include tumor, vascular malformation, aneurysm, hypertensive arteriopathy, cerebral amyloid angiopathy, venous thrombosis, vasculitis, RCVS, drug-induced vasospasm, venous sinus thrombosis, Moyomoya disease, anticoagulant use and hemorrhagic transformation of an ischemic infarct. History can help point to a specific etiology. Possible risk factors for the presence of underlying vascular abnormalities include age younger than 65, female, lobar or intraventricular location, and the absence of hypertension or impaired coagulation.

MRV – A pitfall of the TOF technique, particularly 3D TOF, is that in areas of slowly flowing blood, turbulence, or blood which flows in the imaging plane there can be regions of absent or diminished signal. The signal loss can be confused with vascular occlusion or thrombi. To avoid this pitfall, MRA performed after the intravenous administration of gadolinium-based contrast agents is utilized at many facilities.

Intracranial magnetic resonance venography (MRV) is used primarily to evaluate the patency of the venous sinuses. The study can be performed with TOF, Phase contrast and IV contrast-enhanced techniques. Delayed images to allow for enhancement of the venous system are required to obtain images when intravenous gadolinium-enhanced studies are undertaken.

Saturation pulses are utilized in studies not undertaken with intravenous contrast to help eliminate flow-related signal in a specified direction and thus display the desired arterial or venous structures on their own. In cranial applications, saturation pulses applied at the inferior margin of the imaging field eliminate signal from arterial flow in order to visualize the veins. Conversely, superior saturation pulses are used to eliminate venous flow-related enhancement when evaluation of the arterial structures is desired.[68]

†MRV and Central Venous Thrombosis – a MR Venogram is indicated for the evaluation of a central venous thrombosis/dural sinus thrombosis. The most frequent presentations are isolated headache, intracranial hypertension syndrome (headache, nausea/vomiting, transient visual obscurations, pulsatile tinnitus, CN VI palsy, papilledema),[69] seizures, focal neurological deficits, and encephalopathy. Risk factors are hypercoagulable states inducing genetic prothrombotic conditions, antiphospholipid

syndrome and other acquired prothrombotic diseases (such as cancer), oral contraceptives, pregnancy, puerperium (6 weeks postpartum), infections, and trauma. COVID-19 infection is associated with hypercoagulability, a thromboinflammatory response, and an increased incidence of venous thromboembolic events (VTE).[70, 71] Since venous thrombosis can cause SAH, infarctions, and hemorrhage, parenchymal imaging with MRI/CT is also appropriate.[72-74]

Combination MRI/MRA of the Brain – This is one of the most misused combination studies and other than what is indicated above these examinations should be ordered in sequence, not together. Vascular abnormalities can be visualized on the brain MRI.

Patients presenting with a new migraine with aura (especially an atypical or complex aura) can mimic a transient ischemic attack or an acute stroke. If there is a new neurologic deficit, imaging should be guided by concern for cerebrovascular disease, not that the patient has a headache.[16]

MRA and dissection- Craniocervical dissections can be spontaneous or traumatic. Patients with blunt head or neck trauma who meet Denver Screening criteria should be assessed for cerebrovascular injury (although about 20% will not meet criteria). The criteria include focal or lateralizing neurological deficits (not explained by head CT); infarct on head CT; face, basilar skull, or cervical spine fractures; cervical hematomas that are not expanding; Glasgow coma score less than 8 without CT findings; massive epistaxis; cervical bruit or thrill.[48, 75-77] Spontaneous dissection presents with headache, neck pain with neurological signs or symptoms. There is often minor trauma or precipitating factor (i.e., exercise, neck manipulation). Dissection is thought to occur due to weakness of the vessel wall, and there may be an underlying connective tissue disorder. Dissection of the extracranial vessels can extend intracranially and/or lead to thrombus which can migrate into the intracranial circulation, causing ischemia. Therefore, MRA of the head and neck is warranted.[49, 78]

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POLICY HISTORY

Date	Summary
May 2023	Updated and reformatted references Updated background section Added: - Section on further evaluation of indeterminate or questionable findings on prior imaging - Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment (Combo Brain/Neck MRA) - Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management (also in combo section) - Note on CTA VS MRA Clarified: - Screening for aneurysm in polycystic kidney disease (in *adults*) - Screening for intracranial aneurysm if *two or more* first-degree family members (parent brother, sister, or child) with history of intracranial aneurysm - *For one first degree relative with aneurysm, asymptomatic screening is not indicated - would require a neurological sign or symptom supporting clinical concern for aneurysm***.** - Thunderclap headache with continued concern for underlying vascular abnormality (*i.e. aneurysm or reversible cerebral vasoconstriction syndrome) after initial negative brain imaging* - *Note: MRI lacks sensitivity in excluding subarachnoid hemorrhage less than 24 hours after headache onset (also in Combo Brain MRI/MRA section)* - Headache associated with exercise, *exertion, Valsalva* or sexual activity (Also in Combo Brain MRI/MRA) - Known subarachnoid hemorrhage (SAH) – CTA is favored over MRA Deleted: - Vascular abnormality visualized on previous brain imaging that is equivocal or needs further evaluation
March 2022	Updated and reformatted references Updated background section Added New Combo statement Clarified: • Aneurysm screening in aortic coarctation after age 10

	• MRI is the study of choice for detecting cavernomas, developmental venous anomalies and capillary telangiectasia (see background) • Follow up of known intracranial aneurysm, *treated aneurysm*, or known vascular malformation • Pulsatile tinnitus to identify *a suspected arterial* vascular etiology • **MRI/MRA combo** - Thunderclap headache with continued concern for underlying vascular abnormality after initial negative work-up *Unless there is clear documentation of a contraindication to LP or that LP is unable to be performed due to extenuating circumstances Added: • Pulsatile tinnitus in new combo section (MRI Brain with IAC/MRA Head/MRA Neck) • Brain MRI/Brain MRA combination: o Neurological signs or symptoms in sickle cell patients o High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200 Changed: • Thunderclap headache with continued concern for underlying vascular abnormality after initial negative brain imaging > 6 hours after onset as well as in combo section

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **NECK MRA/MRV**	**Original Date: September 1997**
CPT Codes: 70547, 70548, 70549	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_012-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR NECK MRA

If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- Inconclusive or show a need for additional or follow up imaging evaluation OR
- The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of known or suspected extracranial vascular disease

Cerebrovascular Disease

- Recent ischemic stroke or transient ischemic attack (see Background)[1-3]

  Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management

- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[4-6]
- Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 70%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries)[7-9]
- Symptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 50%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries)[7, 10, 11]

Aneurysm screening

- Screening for aneurysm in Loeys-Dietz syndrome**, fibromuscular dysplasia or spontaneous coronary arteries dissection (SCAD)[12-15]

  ** For Loeys-Dietz imaging should be repeated at least every two years

Tumor/pulsatile mass

- Pulsatile mass on exam[16]
- Known carotid body tumors, or other masses such as a paraganglioma, arteriovenous fistula, pseudoaneurysm, atypical lymphovascular malformation[17, 18]

  Note: Ultrasound (US) may be used to identify a mass overlying or next to an artery in initial work up of a pulsatile mass.

Other extracranial vascular disease

- Large vessel vasculitis (Giant cell or Takayasu arteritis) with suspected extracranial involvement[19-23]
- Subclavian steal syndrome when ultrasound is positive or indeterminate OR for planning an intervention[24]
- Suspected carotid or vertebral artery dissection; secondary to trauma or spontaneous due to weakness of vessel wall[25, 26]
- Horner's syndrome (miosis, ptosis, and anhidrosis)[27]
- For evaluation of pulsatile tinnitus (subjective or objective) for suspected arterial vascular etiology[28]
- For further evaluation of a congenital vascular malformation of the head and neck
- Known extracranial vascular disease that needs follow-up or further evaluation[29-31]

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation (e.g., carotid endarterectomy)

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

INDICATIONS FOR COMBINATION STUDIES

Neck MRA/Brain MRA

- Recent ischemic stroke or transient ischemic attack (TIA) (see Background)[1, 2, 32]

  Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management

- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[4, 5]
- Suspected carotid or vertebral artery dissection secondary to trauma or spontaneous due to weakness of vessel wall[25, 26]
- Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment[33, 34]
- Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., internal carotid stenosis > 70%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[7-9]
- Symptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 50%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[7, 8, 10]
- For evaluation of pulsatile tinnitus (subjective or objective) for suspected arterial vascular etiology[28]

Neck MRA/Brain MRA/Brain MRI

- Recent ischemic stroke or transient ischemic attack (See Background)
- Suspected carotid or vertebral artery dissection with focal or lateralizing neurological deficits

- Approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent vascular and intracranial pathology[35]

Any Combination of Neck MRA/Brain MRA/Brain MRI with IAC

- Pulsatile tinnitus with concern for a suspected arterial vascular and/or intracranial etiology[28, 36]

BACKGROUND

For vascular disease, in general, MRA and CTA are comparable. No current literature compares the efficacy of contrast enhanced CT to CTA or MRI and MRA for evaluation of pulsatile neck mass, so any are approvable. MRA may be complementary to MRI in the following settings: evaluation of a pulsatile neck mass to assess vascular detail when needed; assessment of relevant vascular anatomy for pre-procedural evaluation; vascular supply to tumors and vessel encasement and narrowing by tumors; extent of disease in vasculitis; and to help determine the nature and extent of congenital or acquired vascular anomalies.[37]

MRA vs CTA for Carotid Artery Evaluation[38, 39] – MRA and CTA are generally comparable noninvasive imaging alternatives, each with their own advantages and disadvantages. MRA is an excellent screening test since it does not utilize ionizing radiation. Duplex US and contrast-MRA is a common choice for carotid artery evaluation. Limitations of MRA include difficulty in patients with claustrophobia and the risk of nephrogenic systemic sclerosis with gadolinium contrast agents in specific patients. Advantages of CTA over MRA include superior spatial resolution, rapid image acquisition, decreased susceptibility to motion artifacts and artifacts from calcification as well as being better able to evaluate slow flow and tandem lesions. However, it can also overestimate high-grade stenosis. Limitations of CTA include radiation exposure to the patient, necessity of IV contrast, and risk of contrast allergy and contrast nephropathy.

MRA and Carotid Body Tumor – Carotid body tumors are found in the upper neck at the branching of the carotid artery. Although most of them are benign, they may be locally aggressive with a small malignant potential. MRA may be used to identify a carotid body tumor due to its ability to define the extension of the tumor in relation to the carotid arteries, involvement of the base of the skull and bilateral tumors.

MRA and dissection – Craniocervical dissections can be spontaneous or traumatic. Patients with blunt head or neck trauma who meet Denver Screening criteria should be assessed for cerebrovascular injury (although about 20% will not meet criteria). The criteria include: focal or lateralizing neurological deficits (not explained by head CT), infarct on head CT, face, basilar skull, or cervical spine fractures, cervical hematomas that are not expanding, glasgow coma

score less than 8 without CT findings, massive epistaxis, cervical bruit or thrill.[25, 40-42] Spontaneous dissection presents with headache, neck pain with neurological signs or symptoms.

There is often minor trauma or precipitating factor (e.g., exercise, neck manipulation). Dissection is thought to occur due to weakness of the vessel wall, and there may be an underlying connective tissue disorder. Dissection of the extracranial vessels can extend intracranially and/or lead to thrombus, which can migrate into the intracranial circulation causing ischemia. Therefore, MRA of the head and neck is warranted.[26, 43]

Post-operative evaluation of carotid endarterectomy – Carotid endarterectomy is a vascular surgical procedure that removes plaque from the carotid artery. MRA with multiprojection volume reconstruction is a non-invasive imaging modality that is an alternative to postoperative angiography following carotid endarterectomy. It allows the surgeon to get informative and comparative data.

MRA and recent stroke or transient ischemic attack (TIA) – A stroke or central nervous system infarction is defined as "brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury. … Ischemic stroke specifically refers to central nervous system infarction accompanied by overt symptoms, whereas silent infarction causes no known symptoms."[44] If imaging or pathology is not available, a clinical stroke is diagnosed by symptoms persisting for more than 24 hours. Ischemic stroke can be further classified by the type and location of ischemia and the presumed etiology of the brain injury. These include large-artery atherosclerotic occlusion (extracranial or intracranial), cardiac embolism, small-vessel disease and less commonly dissection, hypercoagulable states, sickle cell disease and undetermined causes.[45] TIAs in contrast, "are a brief episode of neurological dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction on imaging."[46] On average, the annual risk of future ischemic stroke after a TIA or initial ischemic stroke is 3–4%, with an incidence as high as 11% over the next 7 days and 24–29% over the following 5 years. This has significantly decreased in the last half century due to advances in secondary prevention.[47]

When revascularization therapy is not indicated or available in patients with an ischemic stroke or TIA, the focus of the work-up is on secondary prevention. This includes noninvasive vascular imaging to identify the underlying etiology, assess immediate complications and risk of future stroke. The majority of stroke evaluations take place in the inpatient setting. Admitting TIA patients is reasonable if they present within 72 hours and have an ABCD(2) score >or=3, indicating high risk of early recurrence, or the evaluation cannot be rapidly completed on an outpatient basis.[46] Minimally, both stroke and TIA should have an evaluation for high-risk modifiable factors, such as carotid stenosis atrial fibrillation, as the cause of ischemic symptoms.[45] Diagnostic recommendations include neuroimaging evaluation as soon as possible, preferably with magnetic resonance imaging, including DWI; noninvasive imaging of the

extracranial vessels should be performed, and noninvasive imaging of intracranial vessels is reasonable.[32]

Patients with a history of stroke and recent work-up with new signs or symptoms indicating progression or complications of the initial CVA should have repeat brain imaging as an initial study. Patients with remote or silent strokes discovered on imaging should be evaluated for high-risk modifiable risk factors based on the location and type of the presumed etiology of the brain injury.

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POLICY HISTORY

Date	Summary
May 2023	• Updated references • Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment (Combo Neck/Brain MRA) • Section on further evaluation of indeterminate or questionable findings on prior imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
March 2022	Updated background on MRA Vs CTA Clarified • Pulsatile tinnitus to identify *a suspected arterial* vascular etiology • Large vessel vasculitis with suspected extracranial involvement Added: • For further evaluation of a congenital vascular malformation of the head and neck • Pulsatile tinnitus in new combo section (MRI Brain with IAC/MRA Head/MRA Neck) • New Combo statement

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **BRAIN (HEAD) MRI** **BRAIN (HEAD) MRI with IAC (Internal Auditory Canal)**	**Original Date: September 1997**
CPT Codes: **70551, 70552, 70553, +0698T – Brain MRI**	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_001	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations*

INDICATIONS FOR BRAIN MRI

Brain MR/MRA are not approvable simultaneously unless they meet the criteria described below in the Indications for Brain MR/Brain MRA combination studies section. If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- Inconclusive or show a need for additional or follow up imaging evaluation **OR**
- The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of headache[1-5]

- Chronic headache with a change in character/pattern (e.g., more frequent, increased severity, or duration)
- Cluster headaches or other trigeminal-autonomic cephalgias, i.e., paroxysmal hemicrania, hemicrania continua, short-lasting unilateral neuralgiform headache attacks (SUNCT/SUNA) imaging is indicated once to eliminate secondary causes[6]
- Acute headache, sudden onset:

    - With a personal or family history (brother, sister, parent, or child) of brain aneurysm or AVM (arteriovenous malformation) **OR**
    - < 48 hours of "worst headache in my life" or "thunderclap" headache.
        - Note: The duration of a thunderclap type headache lasts more than 5 minutes. Sudden onset new headache reaching maximum intensity within 2-3 minutes.
    - Prior history of stroke or intracranial bleed
    - Known coagulopathy or on anticoagulation
- New onset of headache with any of the following[1, 7, 8]:
    - Acute, new, or fluctuating neurologic deficits, such as sensory deficits, limb weakness, abnormal reflexes (pathological, asymmetric, hyperreflexia), speech difficulties, visual loss, lack of coordination, or mental status changes or with signs of increased intracranial pressure (papilledema). (See background)
    - History of cancer or significantly immunocompromised
    - Fever
    - Subacute head trauma
    - Pregnancy or puerperium[9, 10]
    - Age ≥ 50[1, 7, 11-13]
    - Severe unilateral headache with radiation to or from the neck, associated with suspicion of carotid or vertebral artery dissection
    - Related to activity or event (sexual activity, exertion, Valsalva, position), new or progressively worsening[14]
    - Persistent or progressively worsening during a course of physician-directed treatment[1, 15, 16]

  Note: Neuroimaging warranted for atypical/complex migraine aura, but not for a typical migraine aura (see background)

- Special considerations in the pediatric population with persistent headache[17-19]:
    - Occipital location
    - Age < 6 years
    - Symptoms indicative of increased intracranial pressure, such as recurring headaches after waking with or without associated nausea/vomiting
    - Documented absence of family history of headache
    - Severe headache in a child with an underlying disease that predisposes to intracranial pathology (e.g., immune deficiency, sickle cell disease, neurofibromatosis, history of neoplasm, coagulopathy, hypertension, congenital heart disease)

For evaluation of neurologic symptoms or deficits[20]

- Acute, new, or fluctuating neurologic symptoms or deficits such as, sensory deficits, limb weakness, abnormal reflexes (pathological, asymmetric, hyperreflexia), speech difficulties, visual loss, lack of coordination, or mental status changes (see background)

For evaluation of known or suspected stroke or vascular disease[21-23]

- Known or suspected stroke with any acute, new, or fluctuating symptoms or deficits such as sensory deficits, limb weakness, speech difficulties, visual loss, lack of coordination, or mental status changes (see background)
- Suspected stroke with a personal or first-degree family history (brother, sister, parent, or child) of aneurysm or known coagulopathy or on anticoagulation
- Symptoms of transient ischemic attack (TIA) (episodic neurologic symptoms such as sensory deficits, limb weakness, speech difficulties, visual loss, lack of coordination, or mental status changes)
- Evaluation of suspected acute subarachnoid hemorrhage (SAH)
- Follow-up for known hemorrhage, hematoma, or vascular abnormalities

  Note: MRI is the study of choice for detecting cavernous malformations (CCM) and other low flow vascular malformations (see background). Follow-up imaging of known CCM should be done only to guide treatment decisions or to investigate new symptoms. First-degree relatives of patients with more than one family member with a CCM should have a screening MRI as well as genetic counseling[24-26]

- Suspected central venous thrombosis - see background[21, 27]
- Screening for silent cerebral infarcts in early school age children and adults with HbSS sickle cell disease or HbSβ0 thalassemia[28]
- Evaluation of neurological signs or symptoms in sickle cell disease[29, 30]
- High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity >200[31, 32]

For evaluation of known or suspected trauma[33-35]

- Known or suspected trauma or injury to the head with documentation of one or more of the following acute, new, or fluctuating:
  - Focal neurologic findings
  - Motor changes
  - Mental status changes
  - Amnesia
  - Vomiting
  - Seizures
  - Headache
  - Signs of increased intracranial pressure
- Known coagulopathy or on anticoagulation
- Known or suspected skull fracture by physical exam and/or prior imaging
- Post concussive syndrome if persistent or disabling symptoms and MRI has not been performed[36]
- Subacute or chronic traumatic brain injury with new cognitive and/or neurologic deficit

For evaluation of suspected brain tumor, mass, or metastasis[37, 38]

- Suspected brain tumor with any acute, new, or fluctuating neurologic symptoms or deficits such as sensory deficits, limb weakness, abnormal reflexes (pathological, asymmetric, hyperreflexia), speech difficulties, visual loss, lack of coordination, or mental status changes (see background)
- Suspected brain metastasis or intracranial involvement in patients with a history of cancer based on neurological symptoms or examination findings (may include new or changing lymph nodes)
- Lesion with atypical features for further evaluation or follow up
- Suspected Pituitary Tumors[39-42]
    - Neurologic findings (e.g., visual field deficit suggesting compression of the optic chiasm, diplopia, gaze palsy)
    - Suspected hypofunctioning pituitary gland based on hormonal testing
        - Hypopituitarism
        - Growth hormone deficiency
        - Hypogonadotropic hypogonadism [low sex hormones and gonadotropins (FSH/LH)][43]
            - Total testosterone persistently < 150 with low or normal LH/FSH i.e., severe secondary hypogonadism **OR**
            - Total testosterone levels persistently borderline around the lower limits of normal range (200-400 ng/dL) with low or normal LH/FSH; **AND**
                - Neurological signs or symptoms; **OR**
                - Other pituitary hormonal abnormalities; **OR**
                - Low free testosterone and consideration and addressment of reversible functional causes of gonadotropin suppression (e.g., obesity, opioid use, diabetes, steroid use, or comorbid illness)
    - Suspected hyperfunctioning pituitary gland based on hormonal testing
        - Central hyperthyroidism (high TSH)
        - Cushing syndrome suspected (high ACTH (>5) with cortisol suppression on low or high dose dexamethasone suppression test)[44-47]
        - Acromegaly/gigantism (high GH/IGF-1)
        - Elevated prolactin[48-50]
            - ≥ 250 ng/mL **OR**
            - After evaluation for another cause (e.g., pregnancy, hypothyroidism, renal insufficiency, medication- see background)
                - ≥ 100 ng/mL **OR**
                - Persistently elevated **OR**
                - Neuroendocrine signs or symptoms (i.e., headache, galactorrhea, abnormal menses, infertility, or bitemporal hemianopsia) **OR**
                - Abnormal pituitary hormones (low testosterone/estrogen/ progesterone **AND** low or normal LH/FSH)
    - Central Diabetes Insipidus (low ADH)

    - Precocious puberty in a child (male < 9; female < 8), with hormonal studies suggesting a central cause [51]
    - Pituitary apoplexy with sudden onset of neurological and hormonal symptoms
- For screening for known non-CNS Cancer[52-61] - see background
    - Default screening for
        - Kidney cancer
        - Lung cancer
        - Merkel cell carcinoma
        - Mucosal melanoma of the head and neck, especially of the oral cavity
        - Poorly differential neuroendocrine cancer (Large or Small cell/Unknown primary of neuroendocrine origin)
    - Screening with preconditions
        - AML……. Suspicion of leukemic meningitis
        - Cutaneous melanoma……. Stage IIIC or higher
        - Testicular cancer-Seminoma……. High risk
        - Gestational Trophoblastic Neoplasia……. Pulmonary metastasis
        - Bladder cancer…… High risk, i.e., small cell
    - All other cancer if CNS symptoms present
- Histiocytic Neoplasms for screening and/or with neurological signs or symptoms[62, 63]
    - Erdheim-Chester Disease
    - Langerhans Cell Histiocytosis
    - Rosai-Dorfman Disease
- For screening of Hereditary Cancer Syndromes - see background
    - Li Fraumeni syndrome- Annually[64]
    - Von Hippel Lindau – Every 2 years, starting at age of 8 years[65]
    - Tuberous Sclerosis – Every 1-3 years, until the age of 25 years[66]
    - MEN1 – Every 3-5 years, starting at the age of 5 years[67]
    - NF-2- Brain IAC: Annually starting at the age of 10 years[68]
    - Sturge Weber Syndrome: Once, after age 1 to rule out intracranial involvement; in patients <1 year, only if symptomatic[69]

For evaluation of known brain tumor, mass, or metastasis

- Follow-up of known CNS cancer (either primary malignant brain tumor or secondary brain metastasis) undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer[38]
- Suspected recurrence with prior history of CNS cancer based on neurological symptoms or examination findings
- Follow-up of known low grade tumor (WHO I-II) (i.e., meningioma, glioma, astrocytoma, oligodendroglioma)
    - For surveillance as per professional society recommendations[38]
    - If symptomatic, new/changing signs or symptoms or complicating factors
- Follow-up of known pituitary adenoma

    - New neuroendocrine signs or symptoms
    - Functioning adenoma - to assess response to treatment and 1-year follow-up after drug holiday[70-73]
    - Asymptomatic Macroadenoma (≥ 10mm) follow-up every 6-18 months, post-surgical follow-up every 1-2 years after surgery[74]
    - Asymptomatic, non-functioning Microadenoma < 10mm repeat in one year; if stable, repeat every 2-3 years[75]
- Follow-up of known pineal cyst (≥ 5mm) if there are atypical features or symptoms (e.g., headaches, gaze paresis, ataxia, papilledema, nausea/vomiting)[76, 77]
- Follow up of known Rathke cleft cyst[78, 79]
    - If no symptoms, MRI at 1/3/5 years to stability
    - With new neurological symptoms or atypical imaging features
    - Post treatment, yearly for 5 years
- Follow-up of known arachnoid cyst[80-83]
    - In patients < 4 years old, serial imaging is warranted
    - In patients > 4 years old, repeat imaging only if newly symptomatic, i.e., headaches, increased intracranial pressure, hydrocephalus, local mass effect, seizures, visual/endocrine dysfunction
- Midline dermoid cysts/sinuses with concern for intracranial extension[41-43, 48]
- Tumor monitoring in neurocutaneous syndromes as per tumor type
- Histiocytic Neoplasms to assess treatment response and surveillance of known brain lesions[62, 63, 84]
    - Erdheim-Chester Disease
    - Langerhans Cell Histiocytosis
    - Rosai-Dorfman Disease

Indications for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated, OR evaluation of suspected metastases[38]

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of known or suspected seizure disorder[85-90]

- New onset of an unprovoked seizure
- Newly identified change in seizure activity/pattern
- Known seizure disorder without previous imaging
- Medically refractory epilepsy

Note: In the pediatric population, **imaging is not indicated in simple febrile seizures** or in idiopathic focal or generalized epilepsy with typical features [BECTS, childhood absence epilepsy (CAE), juvenile absence epilepsy (JAE), and juvenile myoclonic epilepsy (JME)][87, 91-93]

For evaluation of suspected multiple sclerosis (MS)[94-97]

- For evaluation of patient with neurologic symptoms or deficits suspicious for MS with
    - A clinically isolated syndrome (optic neuritis, transverse myelitis, or brain stem syndrome); **OR**
    - Recurrent episodes of variable neurological signs or symptoms not attributable to another cause
- To demonstrate dissemination in time for diagnosis (every 6-12 months)

For evaluation of known multiple sclerosis (MS)[94, 97, 98]

- To establish a new baseline (no recent imaging, postpartum, or 3-6 months after switching disease modifying therapy)
- Prior to starting or switching disease-modifying therapy
- 6-month repeat scan in patients with MRI disease activity that is not associated with new clinical symptoms on a routine follow-up scan (i.e., Radiographically isolated syndrome)[99]
- Every 1-2 years while on disease-modifying therapy to assess for subclinical disease activity, less frequently when stable for 2-3 years
- New signs or symptoms suggested of an exacerbation or unexpected clinical worsening
- Progressive Multifocal Leukoencephalopathy (PML) surveillance for patients on natalizumab (Tysabri)[100]
    - 12 months after the start of treatment in all patients
    - Further surveillance MRI scanning timing is based on risk
        - Annually, if anti-JCV antibody negative,
        - Every 3-4 months, if high risk of PML occurrence:
            - seropositive for JC virus and have been treated with natalizumab for ≥18 months **OR**
            - high anti-JC virus antibody index values (>0.9) **OR**
            - previously treated with immunosuppressive therapies
    - Brain MRI every 3–4 months for up to 12 months, in high-risk patients who switch from natalizumab to other therapeutics

Note: In the pediatric population, use a similar scan frequency for disease and therapeutic monitoring. Increase frequency of imaging (e.g., every 6 months) in children with highly active disease or in situations where imaging will change management.

For evaluation of known or suspected infectious or inflammatory disease (e.g., meningitis or abscess)[101, 102]

- Suspected intracranial abscess or brain infection with acute altered mental status or with positive lab findings (such as elevated WBCs) OR follow-up assessment during or after treatment completed

- Meningitis with positive signs and symptoms (such as fever, headache, mental status changes, stiff neck) **OR** with positive lab findings (such as elevated white blood cells or abnormal lumbar puncture fluid exam)
- Suspected encephalitis with headache and altered mental status or follow-up as clinically warranted
- Endocarditis with suspected septic emboli
- Suspected temporal arteritis in a patient ≥ 50 with temporal headache, abrupt visual changes, jaw claudication, temporal artery tenderness, constitutional symptoms or elevated ESR;[103-107] **AND**
    - Negative initial work-up (color Doppler ultrasonography or biopsy); **OR**
    - Atypical features, failure to response to treatment or concern for intracranial involvement

Note: Protocol should include high-resolution contrast-enhanced imaging the temporal artery

- Central Nervous System (CNS) involvement in patients with known or suspected vasculitis or autoimmune disease with abnormal inflammatory markers or autoimmune antibodies
- Suspected primary CNS vasculitis based on neurological signs and symptoms with completed infectious/inflammatory lab work-up[108, 109]
- Immunocompromised patient (e.g., transplant recipients, HIV with CD4<200, primary immunodeficiency syndromes, hematologic malignancies) with focal neurologic symptoms, headaches, behavioral, cognitive or personality changes
- Neurosarcoidosis[110-112]
    - Initial Evaluation:
        - Suspected based on neurological sign/symptoms and lab work (ACE, CSF analysis) **OR**
        - Known history of sarcoidosis with neurological signs or symptoms
    - Follow-up of known neurosarcoidosis:
        - To assess treatment response
        - Worsening signs or symptoms

For evaluation of clinical assessment documenting cognitive impairment of unclear cause[113-115]

- Mental status score of either MMSE or MoCA of less than 26 or other similar mental status instruments*/formal neuropsychological testing showing at least mild cognitive impairment **AND** a completed basic metabolic workup (such as thyroid function testing, liver function testing, complete blood count, electrolytes, and B12)

*Other examples include Mini-Cog, Memory Impairment Screen, Saint Louis University Mental Status Examination (SLUMS), Brief Alzheimer's Screen (BAS), Blessed Dementia Scale (BDS), Clinical Dementia Rating (CDR)[116, 117]

FDA labeling for the drug Aduhelm (for Alzheimer's disease) requires baseline imaging and monitoring with Brain MRI.[118, 119] Criteria for coverage includes the following:

- Baseline study within 1 year of initiating treatment unless the patient has a more recent exacerbation, traumatic event [e.g., falls, etc.], or co-morbidity necessitating an evaluation within one-month preceding initiation
- Prior to the 7th and 12th infusions
- Monitoring if radiographic severe Amyloid Related Imaging Abnormalities (ARIA) is suspected or observed

NOTE: Enhanced clinical vigilance for ARIA is recommended during the first 8 doses of treatment with Aduhelm, particularly during titration. If a patient experiences symptoms which could be suggestive of ARIA, clinical evaluation should be performed, including MRI testing if indicated.

For evaluation of movement disorders[120-125]

- For evaluation of suspected Parkinson's with atypical feature or unresponsive to levodopa
- For evaluation of new non-Parkinson neurological symptoms in known Parkinson's disease complicating the evaluation of the current condition
- For the evaluation of other movement disorder to exclude a structural lesion (i.e., suspected Huntington disease, chorea, atypical parkinsonian syndromes, hemiballismus, atypical dystonia)
  Note: MRI not indicated in essential tremor, Tourette' syndrome, or isolated focal dystonia (e.g., blepharospasm, cervical dystonia, laryngeal dystonia, oromandibular dystonia, writer's dystonia)[121, 125, 126]

For evaluation of cranial nerve and visual abnormalities

- Optic neuritis
- Abnormal eye findings on physical or neurologic examination (papilledema, pathologic nystagmus, optic atrophy, ocular nerve palsies, new onset anisocoria, visual field deficit, etc.)[127]

  Note: See background

- Binocular diplopia with concern for intracranial pathology[128] after comprehensive eye evaluation[129]
- Childhood strabismus with development delay or abnormal fundoscopic exam to rule out intracranial abnormalities[130, 131]
- Horner's syndrome with symptoms localizing the lesion to the central nervous system[132]
- Trigeminal neuralgia or neuropathy[5, 133, 134]
- Occipital Neuralgia to exclude a structural lesion, notably in atypical cases[135-137]
- Bell's Palsy- if atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset[138]
- Hemifacial spasm[139]
- Other objective cranial nerve palsy (CN IX-XII)[140, 141]
- Bulbar symptoms, i.e., difficulty in chewing, weakness of the facial muscles, dysarthria, palatal weakness, dysphagia, and dysphonia and/or signs, i.e., atrophy and fasciculations of the tongue and absent gag reflex[142]

- Pseudobulbar symptoms, i.e., dysphagia, dysarthria, facial weakness, sudden, stereotyped emotional outbursts that are not reflective of mood and/or signs, i.e., spastic tongue and exaggerated gag/jaw jerk[143]

For evaluation of known or suspected congenital abnormality (such as craniosynostosis, neural tube defects)[144, 145]

- Known or suspected congenital abnormality with any acute, new, or fluctuating neurologic, motor, or mental status changes
- Evaluation of macrocephaly in an infant/child <18 with previously abnormal US, abnormal neurodevelopmental examination, signs of increased ICP or closed anterior fontanelle[146]
- Evaluation of microcephaly in an infant/child < 18
- Evaluation of craniosynostosis and other skull deformities. CT is preferred imaging to assess bony structures; MRI imaging is preferred to assess intracranial soft tissue
- Evaluation of the corticomedullary junction in Achondroplasia[147, 148]
- Cerebral palsy if etiology has not been established in the neonatal period, there is change in the expected clinical or developmental profile or concern for progressive neurological disorder[149, 150]
- X-linked Adrenoleukodystrophy[151]
    - Baseline MRI between 12 and 18 months old
    - Second MRI 1 year after baseline
    - MRI every 6 months between 3 and 12 years old
    - Annual MRI after 12 years old
- Prior treatment **OR** treatment planned for congenital abnormality

Note: For evaluation of known or suspected hydrocephalus please see section on CSF abnormalities.

Cerebral Spinal Fluid (CSF) Abnormalities

- Evaluation of suspected hydrocephalus with any acute, new, or fluctuating neurologic, motor, or mental status changes
- Known hydrocephalus†
- For initial evaluation of a suspected Arnold Chiari malformation†
- Follow-up imaging of a known type II or type III Arnold Chiari malformation. For Arnold Chiari type I, follow-up imaging only if new or changing signs/symptoms[152]
- Initial evaluation for a known syrinx or syringomyelia†
- Known or suspected normal pressure hydrocephalus (NPH)[153]
    - With symptoms of gait difficulty, cognitive disturbance, and urinary incontinence
- Follow-up shunt evaluation[154-157]
    - Post operativity if indicated based on underlying disease or pre-operative radiographic findings and/or
    - 6-12 months after placement and/or
    - With neurologic symptoms that suggest shunt malfunction

- Evaluation of known or suspected cerebrospinal fluid (CSF) leakage[158]
- Cisternography for intermittent and complex CSF rhinorrhea/otorrhea. CSF fluid should always be confirmed with laboratory testing (Beta-2 transferrin assay)[159, 160]
- Suspected spontaneous intra-cranial hypotension with distinct postural headache (other symptoms include nausea, vomiting, dizziness, tinnitus, diplopia neck pain or imbalance)[161, 162]
- CSF flow study for evaluation and management of CSF flow disorders[163, 164]
  †Often congenital, but can present later in life; or less commonly acquired secondary to tumor, stroke, trauma, infection, etc.[165]

Pre-operative/procedural evaluation for brain/skull surgery

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Other Indications for a Brain MRI

- Vertigo associated with any of the following[166-168]
  - Signs or symptoms suggestive of a CNS lesion (ataxia, visual loss, double vision, weakness, or a change in sensation)
  - Progressive unilateral hearing loss
  - Risk factors for cerebrovascular disease with concern for stroke
  - After full neurologic examination and vestibular testing with concern for central vertigo (i.e., skew deviation, vertical nystagmus, head thrust test, videonystagmography (VNG)/ electronystagmography (ENG))
- Diagnosis of central sleep apnea on polysomnogram
  - Children > 1 year[169]
  - Adults in the absence of heart failure, chronic opioid use, high altitude, or treatment emergent central sleep apnea **AND** concern for a central neurological cause (Chiari malformation, tumor, infectious/inflammatory disease) **OR** with an abnormal neurological exam[170]

- Syncope with clinical concern for seizure or associated neurological signs or symptoms[171, 172]
- Cyclical vomiting syndrome or abdominal migraine with any localizing neurological symptoms[173-175]
- Soft tissue mass of the head with nondiagnostic initial evaluation (ultrasound and/or radiograph)[176-178]
- Psychological changes with neurological deficits on exam or after completion of a full neurological assessment that suggests a possible neurologic cause[179]
- Global developmental delay or developmental delay with abnormal neurological examination in a child < 18 years[180, 181]
- Unexplained event (BRUE) formerly apparent life-threatening event (ALTE) in infants < 1 year with concern for neurological cause based on history and exam[182]

  Note: Imaging is not indicated in low-risk patients

- Bone Marrow Transplant (BMT)
  - For initial workup of BMT (along with CT Chest[183], CT Sinus and CT Abdomen and Pelvis)[184]).

Indications for a Brain MRI with Internal Auditory Canal (IAC) (If only images of the IACs is needed w/o Brain imaging see Guideline Number: NIA_CG_014)

- Unilateral non-pulsatile tinnitus
- Pulsatile tinnitus
- Suspected acoustic neuroma (Schwannoma) or cerebellar pontine angle tumor with any of the following signs and symptoms: unilateral hearing loss by audiometry, headache, disturbed balance or gait, unilateral tinnitus, facial weakness, or altered sense of taste
- Suspected cholesteatoma
- Suspected glomus tumor
- Asymmetric sensorineural hearing loss on audiogram
- Congenital/childhood sensorineural hearing loss suspected to be due to a structural abnormality[185-187] (CNVIII, the brain parenchyma, or the membranous labyrinth). CT is the preferred imaging modality for the osseous anatomy and malformations of the inner ear.
- CSF otorrhea (MRI/Nuclear Cisternography for intermittent leaks, CT for active leaks)[188]; there should be a high suspicion or confirmatory CSF fluid laboratory testing (Beta-2 transferrin assay)
- Clinical suspicion of acute mastoiditis as a complication of acute otitis media with intracranial complications (i.e., meningeal signs, cranial nerve deficits, focal neurological findings, altered mental status)[189, 190]
- Bell's Palsy for evaluation of the extracranial nerve course -if atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset[138]

Indications for MR Perfusion Imaging[191]

- Neurovascular disease
  - Assessment of ischemic penumbra in acute stroke

- Assessment of cerebrovascular reserve
- Further evaluation of known vascular abnormality (stenosis, malformation, vasospasm, vasculitis, Moya-Moya)

- Mass lesions
  - Differentiating tumor from tumor mimic
  - Differentiating glioblastoma from brain metastasis[192]
  - Discriminating low- from high-grade gliomas[193]
  - Differentiating recurrent brain tumors from radiation/chemo necrosis[194, 195]
  - Surgical planning

Indications for Combination Studies[21, 22]

Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the neuroaxis), patient history, and other available information, including prior imaging.

Exception: For approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology[196]

- **Brain MRI/Neck MRA***
  - Recent ischemic stroke or transient ischemic attack
  - Suspected carotid or vertebral artery dissection with focal or lateralizing neurological deficits
- **Brain MRI/Brain MRA***
  - Recent ischemic stroke or transient ischemic attack
  - Thunderclap headache with continued concern for underlying vascular abnormality after initial negative brain imaging > 6 hours after onset[197-199]

    Note: Negative brain CT < 6 hours after headache onset excludes subarachnoid hemorrhage in neurologically intact patients[200]

  - Acute, sudden onset of headache with personal history of a vascular abnormality or first-degree family history of aneurysm
  - Headache associated with exercise, exertion, Valsalva or sexual activity[6, 14]
  - Suspected venous thrombosis (dural sinus thrombosis) – Brain MRV see background
  - Neurological signs or symptoms in sickle cell patients
  - High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200 [30]
- **Brain MRI/Brain MRA/Neck MRA***
  - Recent stroke or transient ischemic attack (TIA)
  - Suspected carotid or vertebral artery dissection with focal or lateralizing neurological deficits
- **Brain MRI with IAC/ Brain MRA/Neck MRA (any combination)***

- Pulsatile tinnitus with concern for a suspected arterial vascular and/or intracranial etiology[201, 202]

***Note:** MRA and CTA are generally comparable noninvasive imaging alternatives each with their own advantages and disadvantages. Brain MRI can alternatively be combined with Brain CTA/Neck CTA.

- **Brain MRI/Cervical MRI/Thoracic MRI (any combination)**
  - Combination studies for MS: These body regions might be evaluated separately or in combination as guided by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history (e.g., symptom(s), time course, and where in the CNS the likely localization(s) is/are), and other available information, including prior imaging.
    - For evaluation of neuromyelitis optica spectrum disorders (recurrent or bilateral optic neuritis; recurrent transverse myelitis)[203]
    - For known MS, prior to the initiation or change of disease modification treatments and assess disease burden (to establish a new baseline)[204]
    - Follow-up scans, including brain and spine imaging, if patients have known spine disease:
      - 6-12 months after starting/changing treatment
      - Every 1-2 years while on disease-modifying therapy to assess for subclinical disease activity, less frequently when stable for 2-3 years
- **Brain MRI/Cervical MRI/Thoracic MRI/Lumbar MRI (any combination)**
  - For initial evaluation of a suspected Arnold Chiari malformation
  - Follow-up imaging of a known type II or type III Arnold Chiari malformation. For Arnold Chiari type I, follow-up imaging only if new or changing signs/symptoms[152, 205]
  - Oncological Applications (e.g., primary nervous system, metastatic)
    - Drop metastasis from brain or spine (see background)
    - Suspected leptomeningeal carcinomatosis (see background)[206]
    - Tumor evaluation and monitoring in neurocutaneous syndromes - See background
  - CSF leak highly suspected and supported by patient history and/or physical exam findings (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula)
- **Brain MRI/Orbit MRI**
  - Optic neuropathy or unilateral optic disk swelling of unclear etiology to distinguish between a compressive lesion of the optic nerve, optic neuritis, ischemic optic neuropathy (arteritic or non-arteritic), central retinal vein occlusion or optic nerve infiltrative disorders[207]
  - Bilateral optic disk swelling (papilledema) with visual loss[208]
  - Optic Neuritis

        - If atypical presentation (bilateral, absence of pain, optic nerve hemorrhages, severe visual impairment, lack of response to steroids, poor recovery or recurrence)[209, 210]
        - If needed to confirm optic neuritis and rule out compressive lesions
    - Known or suspected neuromyelitis optica spectrum disorder with severe, recurrent, or bilateral optic neuritis[203]
    - Suspected retinoblastoma[211, 212]
- **Brain MRI/FACE/SINUS/NECK MRI**
    - Granulomatosis with polyangiitis (Wegener's granulomatosis) disease[213]
    - Trigeminal neuralgia or neuropathy with an atypical presentation (for evaluation of the extracranial nerve course) [140, 214] See background
    - Bell's Palsy/hemifacial spasm for evaluation of the extracranial nerve course -if atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset[138]
    - Objective cranial nerve palsy (CN IX-XII) (for evaluation of the extracranial nerve course)[140, 141]

BACKGROUND

Brain (head) MRI is the procedure of choice for most brain disorders. It provides clear images of the brainstem and posterior brain, which are difficult to view on a CT scan. It is also useful for the diagnosis of demyelinating disorders (such as multiple sclerosis (MS) that cause destruction of the myelin sheath of the nerve). The evaluation of blood flow and the flow of cerebrospinal fluid (CSF) is possible with this non-invasive procedure.

MRI for Headache – Generally, magnetic resonance imaging is the preferred imaging technique for evaluating the brain parenchyma, and CT is preferable for evaluating subarachnoid hemorrhage. CT is faster and more readily available than MRI and is often used in urgent clinical situations. Neurologic imaging is warranted in patients with headache disorders along with abnormal neurologic examination results or predisposing factors for brain pathology. Contrast-enhanced MRI is performed for evaluation of inflammatory, infectious, neoplastic, and demyelinating conditions.

Headache timeframes and other characteristics – Generally, acute headaches are present from hours to days, subacute from days to weeks and chronic headaches for more than 3 months. Acute severe headaches are more likely to be pathological (e.g., SAH, cerebral venous thrombosis) than non-acute (e.g., migraine, tension-type). Headaches can also be categorized as new onset or chronic/recurrent. Non-acute new onset headaches do not require imaging unless there is a red flag as delineated above. Incidental findings lead to additional medical procedures and expense that do not improve patient well-being. Primary headache syndromes, such as migraine and tension headaches, are often episodic with persistent or progressive headache not responding to treatment requiring further investigation (e.g., new daily persistent headache). Imaging is indicated in chronic headaches if there is a change in

the headache frequency (number of headaches episodes/month), duration of each episode, severity of the headaches or new characteristics, such as changing aura or associated symptoms.[1, 6, 215-217]

Migraine with aura[6, 7, 218] – The headache phase of a migraine is preceded and/or accompanied by transient neurological symptoms referred to as aura in at least a third of migraine attacks. The most common aura consists of positive and/or negative visual phenomena, present in up to 99% of the individuals. Somatosensory is the secondary most common type of aura (mostly paresthesia's in an upper limb and/or hemiface). Language/speech (mainly paraphasia and anomic aphasia) can also be affected. These neurological symptoms typically evolve over a period of minutes and may last up to 20 minutes or more. The gradual evolution of symptoms is thought to reflect spreading of a neurological event across the visual and somatosensory cortices. Characteristically, the aura usually precedes and terminates prior to headache, usually within 60 minutes. In others, it may persist or begin during the headache phase. ICHD-3 definition of the aura of migraine with typical aura consists of visual and/or sensory and/or speech/language symptoms, but no motor, brainstem or retinal symptoms and is characterized by gradual development, duration of each symptom no longer than one hour, a mix of positive and negative features and complete reversibility. Atypical or complex aura includes motor, brainstem, monocular visual disturbances, or ocular cranial nerve involvement (hemiplegic migraine, basilar migraine/brainstem aura, retinal migraine, ophthalmoplegic migraine) and secondary causes need to be excluded. Additional features of an aura that raise concern for an underlying vascular etiology include late age of onset, short duration, evolution of the focal symptoms, negative rather than positive visual phenomenon, and history of vascular risk factors.

Neurological Deficits – Examples of abnormal reflexes related to upper motor neuron lesion/central pathology include hyperreflexia, clonus, Hoffman sign and Babinski, snout, palmar grasp, and rooting reflexes.

Visual loss has many possible etiologies, and MRI is only indicated in suspected neurological causes of visual loss based on history and exam. Visual field defects, such as bitemporal hemianopsia, homonymous hemianopsia, or quadranopsia, require imaging as well as does suspected optic nerve pathology. Subjective symptoms such as blurred vision or double vision with no clear correlate on neurological examination requires a comprehensive eye evaluation to exclude more common causes, such as cataracts, refractive errors, retinopathy, glaucoma, or macular degeneration. Transient visual loss with history consistent with TIA but normal exam at time of examination also should be imaged. Positive visual phenomena, such as photopsias or scintillations that march across the visual field, suggest migraine whereas negative phenomenon, such as shaded or blurred, is more characteristic of ischemia.

Table 1: Gait and brain imaging[219-224]

Gait	Characteristic	Work up/Imaging
Hemiparetic	**Spastic unilateral, circumduction**	**Brain and/or, Cervical spine imaging based on associated symptoms**
Diplegic	**Spastic bilateral, circumduction**	**Brain, Cervical and Thoracic Spine imaging**
Myelopathic	**Wide based, stiff, unsteady**	**Cervical and/or Thoracic spine MRI based on associated symptoms**
Ataxic	**Broad based, clumsy, staggering, lack of coordination, usually also with limb ataxia**	**Brain imaging**
Apraxic	**Magnetic, shuffling, difficulty initiating**	**Brain imaging**
Parkinsonian	**Stooped, small steps, rigid, turning en bloc, decreased arm swing**	**Brain Imaging**
Choreiform	**Irregular, jerky, involuntary movements**	**Medication review, consider brain imaging as per movement disorder Brain MR guidelines**
Sensory ataxic	**Cautious, stomping, worsening without visual input (ie + Romberg)**	**EMG, blood work, consider spinal (cervical or thoracic cord imaging) imaging based on EMG**
Neurogenic	**Steppage, dragging of toes**	**EMG, if there is foot drop, Lumbar spine MRI Pelvis MR appropriate evidence of plexopathy**
Vestibular	**Insecure, veer to one side, worse when eyes closed, vertigo**	**Consider Brain/IAC MRI as per GL**

Non-neurological causes of gait dysfunction include pain (antalgic), side effects of drugs (analgesic, antihistamines, benzos, psych meds, antihypertensives), visual loss, hearing impairment, orthopedic disorders, rheumatologic disorders, psychogenic, and cardiorespiratory problems (orthostasis).[220, 222-224]

MRI and recent stroke or transient ischemic attack – A stroke or central nervous system infarction is defined as "brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury. … Ischemic stroke specifically refers to central nervous system infarction accompanied by overt symptoms, whereas silent infarction causes no known symptoms."[225] If imaging or pathology is not available, a clinical stroke is diagnosed by symptoms persisting for more than 24 hours. Ischemic stroke can be further classified by the type and location of ischemia and the presumed etiology of the brain injury. These include large-artery atherosclerotic occlusion (extracranial or intracranial), cardiac embolism, small-vessel disease

and less commonly dissection, hypercoagulable states, sickle cell disease and undetermined causes.[226] TIAs in contrast, "are a brief episode of neurological dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction on imaging."[227] On average, the annual risk of future ischemic stroke after a TIA or initial ischemic stroke is 3–4%, with an incidence as high as 11% over the next 7 days and 24–29% over the following 5 years. This has significantly decreased in the last half century due to advances in secondary prevention.[228]

Therefore, when revascularization therapy is not indicated or available in individuals with an ischemic stroke or TIA, the focus of the work-up is on secondary prevention. This includes noninvasive vascular imaging to identify the underlying etiology, assess immediate complications and risk of future stroke. The majority of stroke evaluations take place in the inpatient setting. Admitting TIA patients is reasonable if they present within 72 hours and have an ABCD(2) score ≥3, indicating high risk of early recurrence, or the evaluation cannot be rapidly completed on an outpatient basis.[227] Minimally, both stroke and TIA should have an evaluation for high-risk modifiable factors, such as carotid stenosis atrial fibrillation as the cause of ischemic symptoms.[226] Diagnostic recommendations include neuroimaging evaluation as soon as possible, preferably with magnetic resonance imaging, including DWI; noninvasive imaging of the extracranial vessels should be performed, and noninvasive imaging of intracranial vessels is reasonable.[229]
Individuals with a history of stroke and recent work-up with new signs or symptoms indicating progression or complications of the initial CVA should have repeat brain imaging as an initial study. Individuals with remote or silent strokes discovered on imaging should be evaluated for high-risk modifiable risk factors based on the location and type of the presumed etiology of the brain injury.

Non-aneurysmal vascular malformations – Non-aneurysmal vascular malformations can be divided in low flow vascular malformations and high flow vascular malformations. Low flow vascular malformations include dural venous anomalies (DVA), cavernomas, and capillary telangiectasias. High flow vascular malformations include AVM and dural arteriovenous fistulas (dAVF). For low flow malformations, MRI is the study of choice. Limited medical literature is available to support vascular imagining (CTA or MRA). CTA plays a limited role in the assessment of cavernoma but may be used to demonstrate a DVA. MRA is not usually helpful in the assessment of cavernoma, capillary telangiectasia, and DVA. Vascular imaging is indicated in high flow vascular malformations.[230-232]

MRI and Central Venous Thrombosis – a MR Venogram is indicated for the definite evaluation of a central venous thrombosis/dural sinus thrombosis. The most frequent presentations are isolated headache, intracranial hypertension syndrome (headache, nausea/vomiting, transient visual obscurations, pulsatile tinnitus, CN VI palsy, papilledema),[233] seizures, focal neurological deficits, and encephalopathy. Risk factors are hypercoagulable states inducing genetic prothrombotic conditions, antiphospholipid syndrome and other acquired prothrombotic diseases (such as cancer), oral contraceptives, pregnancy, puerperium (6-weeks postpartum), infections, and trauma. COVID-19 infection is associated with hypercoagulability, a thromboinflammatory response, and an increased incidence of venous thromboembolic events (VTE).[234, 235] Since venous thrombosis can cause SAH, infarctions, and hemorrhage, parenchymal imaging with MRI/CT is also appropriate.[27, 236, 237]

Galactorrhea and MRI – Isolated galactorrhea without elevated prolactin (normoprolactinemic) is usually due to breast pathology, i.e., breast feeding, trauma, ill-fitting undergarments. Consider mammogram, breast ultrasound, and serial dilution of the individual's prolactin sample to correct for possible hook effect.[238, 239]

Chart 1: Causes of Hyperprolactinemia[240]

Physiological	1) Coitus 2) Exercise 3) Lactation 4) Pregnancy 5) Sleep 6) Stress
Pathological	*1) Hypothalamic-pituitary stalk damage* a) Granulomas b) Infiltrations c) Irradiation d) Rathke's cyst e) Trauma: pituitary stalk section, suprasellar surgery f) Tumors: craniopharyngioma, germinoma, hypothalamic metastases, meningioma, suprasellar pituitary mass extension *2) Pituitary* a) Acromegaly b) Idiopathic c) Lymphocytic hypophysitis or parasellar mass d) Macroadenoma (compressive) e) Macroprolactinemia f) Plurihormonal adenoma g) Prolactinoma h) Surgery i) Trauma *3) Systematic Disorders* a) Chest – neurogenic chest wall trauma, surgery, herpes zoster b) Chronic renal failure c) Cirrhosis d) Cranial radiation e) Epileptic seizures f) Polycystic ovarian disease g) Pseudocyesis
Pharmacological	1) Anesthetics 2) Anticonvulsant 3) Antihistamines (H_2) 4) Antihypertensives 5) Cholinergic agonist 6) Drug-induced hypersecretion 7) Catecholamine depletory 8) Dopamine receptor blockers

	9) Dopamine synthesis inhibitor 10) Estrogens: oral contraceptives, oral contraceptive withdrawal 11) Neuroleptics/antipsychotics

Table 2: MRI and staging screening in Non-CNS Cancers[53, 54, 56, 58]

(NON-BRAIN/CNS) CANCER	PRECONDITION
Cutaneous melanoma	Stage IIIC or higher, default staging screening ≥ stage IIIC, surveillance with periodic brain MRI up to 3 years even if asymptomatic without prior brain mets; and if prior brain mets, surveillance every 3-6 months up to 3 years
Testicular cancer-Seminoma	If high risk, such as beta HCG >5000IU/L, or multiple lung or visceral mets, choriocarcinoma, neurological symptoms, or AFP>10,000ng/ml
Merkel cell carcinoma	Default staging screening, but especially for high risk (≥stage IIIb, immunosuppression)
Lung cancer	Default staging screening brain MRI also for surveillance in small cell every 3 months for 2 years if they have had no prophylactic cranial radiation

Surveillance for trilateral heritable retinoblastoma (Pineoblastoma surveillance)
Brain MRI at the time of retinoblastoma diagnosis; some centers recommend a brain MRI every 6 months until 5 years old[241, 242]

MRI and Neurocutaneous Syndromes

- In NF-1, clinical evaluation appears to be more useful to detect complications than is screening imaging in asymptomatic individuals. Imaging is indicated in evaluation of suspected tumors based on clinical evaluation and for follow-up of known intracranial tumors.[243]
- Conversely in NF-2, routine MR imaging screening is always indicated, given the high prevalence of CNS tumors, especially vestibular schwannomas. In individuals with NF-2, routine screening brain/IAC imaging is indicated annually starting from age 10 if asymptomatic or earlier with clinical signs/symptoms. Most individuals with NF2 eventually develop a spinal tumor, most commonly schwannomas, but meningioma and ependymomas are also seen. Spinal imaging at baseline and every 2 to 3 years is also advised with more frequent imaging, if warranted, based on sites of tumor involvement.[68]
- In individuals with Tuberous Sclerosis, Brain MRI should be obtained every 1-3 years up until age 25 for surveillance for CNS abnormalities.[66]
- In Von Hippel Lindau Syndrome, imaging of the brain and spinal cord for hemangioblastomas is recommended every 2 years.[65]
- In Sturge Weber Syndrome, Brain MRI can rule out intracranial involvement only after age 1 and is recommended in individuals <1 year only if symptomatic.[69]

Multiple Sclerosis[95, 244, 245] – The diagnosis of MS requires demonstration of lesions in the CNS disseminated in time and space and the absence of fever, infection, or other more likely etiologies. An expanding amount of available disease-modifying treatments are effective in slowing down disease progression, especially in the early stages. These treatments can have serious side effects and can be costly; therefore, the accurate and expeditious diagnosis of MS is critical.

The diagnosis of MS can be made on clinical presentation alone with 2 clinical attacks and objective clinical evidence of more than 2 lesions. Attacks may be individual-reported or objectively observed and must last for a minimum of 24 hours and be 30 days apart. However, corroborating magnetic resonance imaging (MRI) is the diagnostic standard and is used, as well, to rule out other disorders. Additionally, MRI findings can replace certain clinical criteria in a substantial number of individuals. In the revised McDonald Criteria, MRI findings can be used to establish dissemination in both time and space.

Table 3: Variable Symptoms and Signs of MS

Symptoms	***Signs***
Depressed mood	Ataxia
Memory loss/cognitive changes	Dysmetria
Dizziness or vertigo	Decreased sensation (pain, vibration, position)
Fatigue	Decreased strength
Hearing loss and tinnitus	Hyperreflexia, spasticity
Heat sensitivity (Uhthoff Phenomenon)	Nystagmus
Incoordination and gait disturbances	Lhermitte's sign
Sensory disturbances (dysesthesias, numbness, paresthesia's)	Visual defects (internuclear ophthalmoplegia, optic disc pallor, red color desaturation, reduced visual acuity)
Pain	
Urinary symptoms	
Visual disturbances (diplopia, oscillopsia)	
Weakness	

In the presence of a clear, clinically isolated syndrome such as optic neuritis, transverse myelitis, or brain stem syndrome, brain MRI is the next diagnostic step. MS can also have variable and often subjective symptoms that come and go (see Table 3). If there are recurrent episodes of variable neurological signs or symptoms not attributable to another cause with clinical concern for MS, imaging is warranted as well.

MRI and Neuromyelitis optica spectrum disorders (NMOSD)[203] – NMOSD are inflammatory disorders of the central nervous system characterized by severe, immune-mediated demyelination and axonal damage predominantly affecting the optic nerves and spinal cord, but also the brain and brainstem. NMOSD can be distinguished from multiple sclerosis and other inflammatory disorders by the presence of the aquaporin-4 (AQP4) antibody. Features of NMOSD include attacks of bilateral or sequential optic neuritis acute transverse myelitis and the area postrema syndrome (with intractable hiccups or nausea and vomiting). The evaluation of suspected NMOSD entails brain and spinal cord neuroimaging. In contrast to MS (in which spinal cord involvement tends to be incomplete and asymmetric), NMOSD have a longer extent of spinal cord demyelination generally involving three or more vertebral segments.

Temporal Arteritis – Giant cell arteritis (GCA) is an inflammatory disorder that should be considered in individuals over the age of 50 with the following signs or symptoms: new headaches, acute onset of visual disturbances (especially transient monocular visual loss), jaw claudication, constitutional symptoms, tenderness over the temporal artery, and elevated ESR and/or CRP. A diagnosis of polymyalgia rheumatica (PMR) is highly associated. Large vessel GCA denotes involvement of the aorta and its first-order branches, especially the subclavian arteries, and is common. Extra- and intracranial cerebral vasculitis can also be seen but is rarer, and strokes are related to vasculitis of extracranial cerebral arteries causing vertebral or internal carotid arteries stenosis. Gold standard for diagnosis of GCA is temporal artery biopsy. Color Doppler ultrasound (CDUS) can be used as a surrogate for temporal artery biopsy in some cases. High-resolution magnetic resonance imaging (MRI) can visualize the temporal arteries when used with contrast. The presence of clinical manifestations unusual in GCA should prompt consideration of alternative diagnoses. Examples of such include adenopathy, pulmonary infiltrates, digital cyanosis, ulceration or gangrene, mononeuritis multiplex, stroke in the distribution of the middle cerebral artery, glomerulitis, and/or rapidly rising creatinine.[103-107, 246]

MMSE – The Mini Mental State Examination (MMSE) is a tool that can be used to assess mental status systematically and thoroughly. It is an 11-question measure that tests five areas of cognitive function: orientation, registration, attention and calculation, recall, and language. The MMSE has been the most commonly used measure of cognitive function in dementia research, but researchers have recognized that it is relatively insensitive and variable in mildly impaired individuals. The maximum score is 30. A score of 23 or lower is indicative of cognitive impairment. The MMSE takes only 5-10 minutes to administer and is, therefore, practical to use repeatedly and routinely.

MoCA – The Montreal Cognitive Assessment (MoCA) was designed as a rapid screening instrument for mild cognitive dysfunction. It assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation. MoCA differs from the MMSE mainly by including tests of executive function and

abstraction, and by putting less weight on orientation to time and place. Ten of the MMSE's 30 points are scored solely on the time-place orientation test, whereas the MoCA assigns it a maximum of six points. The MoCA also puts more weight on recall and attention-calculation performance, while de-emphasizing language skill. Time to administer the MoCA is approximately 10 minutes. The total possible score is 30 points; a score of 26 or above is considered normal.

MRI and Movement disorders – Atypical parkinsonian syndromes include progressive supranuclear palsy (PSP), multiple system atrophy (MSA), corticobasal degeneration (CBD), and dementia with Lewy bodies.

Anosmia – Nonstructural causes of anosmia include post-viral symptoms, medications (Amitriptyline, Enalapril, Nifedipine, Propranolol, Penicillamine, Sumatriptan, Cisplatin, Trifluoperazine, Propylthiouracil). These should be considered prior to advanced imaging to look for a structural cause.

Anosmia and dysgeusia have been reported as common early symptoms in individuals with COVID-19, occurring in greater than 80 percent of individuals. For isolated anosmia, imaging is typically not needed once the diagnosis of COVID has been made given the high association. As such, COVID testing should be done prior to imaging.[247-249]

MRI Orbits, Face, and Neck MRI rather than MRI Brain is the mainstay for directly imaging the olfactory apparatus and sinonasal or anterior cranial fossa tumors that may impair or directly involve the olfactory apparatus.

Trigeminal Neuralgia (TN) – According to the International Headache Society, TN is defined as "a disorder characterized by recurrent unilateral brief electric shock-like pain, abrupt in onset and termination, limited to the distribution of one or more divisions of the trigeminal nerve and triggered by innocuous stimuli."[6] Atypical features include bilateral, hearing loss, dizziness/vertigo, visual changes, sensory loss, numbness, pain > 2min, pain outside trigeminal nerve distribution and progression.[140, 214]

Occipital Neuralgia – According to the International Headache Society, occipital neuralgia is defined "Unilateral or bilateral paroxysmal, shooting or stabbing pain in the posterior part of the scalp, in the distribution(s) of the greater, lesser and/or third occipital nerves, sometimes accompanied by diminished sensation or dysesthesia in the affected area and commonly associated with tenderness over the involved nerve(s). Pain is eased temporarily by local anesthetic block of the affected nerve(s). Occipital neuralgia must be distinguished from occipital referral of pain arising from the atlantoaxial or upper zygapophyseal joints or from tender trigger points in neck muscles or their insertions."[6]

MRI for Macrocephaly – Consider ultrasound in infants with macrocephaly and a normal neurological examination, no evidence of increased ICP and an open anterior fontanelle. If head US is normal, the infant should be monitored closely.[250] The anterior fontanelle generally closes between 10 and 24 months of age, with 3% closing between 5-9 months and 11% after 24 months.[251]

MRI and Normal Pressure Hydrocephalus (NPH) – Although diagnosis can be made based on CT findings alone, MRI is more accurate for disclosing associated pathologies (such as cerebrovascular disease), excluding other potential etiologies and for detecting NPH typical signs of prognostic value. A

CT scan can exclude NPH and is appropriate for screening purposes and in individuals who cannot undergo MRI.[153]

MRI and Vertigo – The most common causes of vertigo seen are benign paroxysmal positional vertigo (BPPV), vestibular neuronitis (VN) and Ménière's disease. These peripheral causes of vertigo are benign, and treatment involves reassurance and management of symptoms. Central causes of vertigo, such as cerebrovascular accidents (CVAs), tumors and multiple sclerosis (MS), need to be considered if the individual presents with associated neurological symptoms, such as weakness, diplopia, sensory changes, ataxia, or confusion. Magnetic resonance imaging is appropriate in the evaluation of individuals with vertigo who have neurologic signs and symptoms, progressive unilateral hearing loss or risk factors for cerebrovascular disease. MRI is more appropriate than CT for diagnosing vertigo due to its superiority in visualizing the posterior portion of the brain, where most central nervous system disease that causes vertigo is found. A full neurologic and otologic evaluation including provocative maneuvers, vestibular function testing and audiogram can help evaluate vertigo of unclear etiology and differentiate between central and peripheral vertigo.

MRI and developmental delay – Significant developmental delay is defined as significant delay (more than two standard deviations below the mean) in one or more developmental domains: gross/fine motor, speech/language, cognition, social/personal, and activities of daily living. Isolated delay in social/language development is characteristic of autism spectrum disorders or hearing loss. Isolated delay in motor development is characteristic of cerebral palsy (a static encephalopathy) or myopathy. Global developmental delay (GDD) is a subset of developmental delay defined as significant delay (by at least 2 SD's) in two or more developmental categories. Note that the term "GDD" is usually reserved for children <5 years old, whereas in older children >5 years, disability is quantifiable with IQ testing. The yield of magnetic resonance imaging is low in children with autism spectrum disorder and no other neurologic findings; therefore, MRI is not recommended as a part of routine evaluation.[252]

Low risk brief resolved unexplained event (BRUE) formerly apparent life-threatening event (ALTE) requires all the following:

- Age > 60 days
- Gestational age ≥ 32 weeks or older and corrected gestational age ≥ 45 weeks
- First brief event
- Event lasting < 1 minute
- No CPR required by the trained medical provider
- No concerning historical features or physical examination findings.

Combination MRI/MRA of the Brain – This is one of the most misused combination studies and other than what is indicated above these examinations should be ordered in sequence, not together. Vascular abnormalities can be visualized on the brain MRI.

Individuals presenting with a new migraine with aura (especially an atypical or complex aura) can mimic a transient ischemic attack or an acute stroke. If there is a new neurologic deficit, imaging should be guided by concern for cerebrovascular disease, not that the individual has a headache.[11, 197]

Leptomeningeal Carcinomatosis[253-256] – Leptomeningeal metastasis is an uncommon and typically late complication of cancer with poor prognosis and limited treatment options. Diagnosis is often challenging with nonspecific presenting symptoms ranging from headache and confusion to focal neurologic deficits such as cranial nerve palsies. Standard diagnostic evaluation involves a neurologic examination, MRI of the brain and spine with gadolinium, and cytologic evaluation of the cerebral spinal fluid (CSF). Hematologic malignancies (leukemia and lymphoma), primary brain tumors as well as solid malignancies can spread to the leptomeninges. The most common solid tumors giving rise to LM are breast cancer (12 - 35 %), small and non-small cell lung cancer (10-26 %), melanoma (5 -25 %), gastrointestinal malignancies (4-14 %), and cancers of unknown primary (1-7 %).

Drop Metastases – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas and less commonly choroid plexus neoplasms and teratomas.[257]

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POLICY HISTORY

Date	Summary
May 2023	Updated and reformatted references Updated background section Added: • Indeterminate imaging section • Follow up of known Rathke cleft cyst o If no symptoms, MRI at 1/3/5 years to stability o With new neurological symptoms or atypical imaging features o Post treatment, yearly for 5 years • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging Clarified: • Abnormal reflexes (*pathological, asymmetric, hyperreflexia)* • New onset headache - Related to activity or event (sexual activity, *exertion, Valsalva*, position), new or progressively worsening • Post concussive syndrome if persistent or disabling symptoms and *MRI* has not been performed • *Screening* for silent cerebral infarcts in early school age children and adults with *HbSS sickle cell disease or HbSβ0 thalassemia* • Cushing syndrome *suspected (high ACTH (>5) with cortisol suppression on low or high dose dexamethasone suppression test)* • Elevated prolactin after evaluation for another cause - neuroendocrine signs or symptoms (i.e., headache, galactorrhea, abnormal menses, infertility, or bitemporal hemianopsia) and/or *abnormal pituitary hormones (low testosterone /estrogen/ progesterone AND low or normal LH/FSH)* • Total testosterone levels persistently borderline around the lower limits of normal range (200-400 ng/dL) with low or normal LH/FSH; AND Low free testosterone and *consideration and addressment* of reversible functional causes of gonadotropin suppression (e.g., obesity, opioid use, diabetes, steroid use, or comorbid illness) • Tumor surveillance *as per professional society recommendations* • Note: In the pediatric population, imaging is not indicated in simple febrile seizures *or in idiopathic focal or generalized epilepsy with typical features [BECTS, childhood absence epilepsy (CAE), juvenile absence epilepsy (JAE), and juvenile myoclonic epilepsy (JME)]*

	• 6-month repeat scan in patients with MRI disease activity that is not associated with *new clinical symptoms on a routine follow-up scan (i.e., Radiographically isolated syndrome)* • Indications for MR Perfusion Imaging section • Brain MRI/Brain MRA - Headache associated with exercise, *exertion*, *Valsalva* or sexual activity Deleted: • Pediatric seizure indications and combined with adult • Anosmia (loss of smell) or dysosmia documented by objective testing that is persistent and of unknown origin (also in combo section)
May 2022	Updated and reformatted references Updated background section Combo statements added Reorganized indications Changed visual deficits section added to background Reorganized suspected tumor section Clarified: • Acute headache, sudden onset • New onset headache related to activity or event (sexual activity, exertion, position), new or progressively worsening • Visual loss in background/removed note • Low flow vascular malformations • Histiocytic Neoplasms (Erdheim-Chester Disease, Langerhans Cell Histiocytosis, and Rosai-Dorfman Disease) for screening and/or with neurological signs or symptoms • Total testosterone levels persistently borderline around the lower limits of normal range (200-400 ng/dL) with low or normal LH/FSH; o *Low free testosterone* and consideration of reversible functional causes of gonadotropin suppression (e.g., obesity, opioid use, diabetes, steroid use or comorbid illness) • Follow-up of known CNS cancer (either primary malignant brain tumor or secondary brain metastasis) as per NCCN • Tumor monitoring in neurocutaneous syndromes as per tumor type • Histiocytic Neoplasms (Erdheim-Chester Disease, Langerhans Cell Histiocytosis, and Rosai-Dorfman Disease) To assess treatment response and surveillance of known brain lesions • To demonstrate dissemination in time for diagnosis (every 6-12 months) • To establish a new baseline (3-6 months after switching disease modifying therapy)

	• PML surveillance - Every 3-4 months, if high risk of PML occurrence; Brain MRI every 3–4 months for up to 12 months, in high-risk patients who switch from natalizumab to other therapeutics • Examples of mental status instruments to screen for cognitive impairment • For evaluation of new non-Parkinson neurological symptoms • Binocular diplopia with concern for intracranial pathology after comprehensive eye evaluation • Trigeminal neuralgia or *neuropathy*, notably with an atypical presentation • **MRI Brain/MRI Orbit Combo** – Optic Neuritis if atypical presentation (bilateral, absence of pain, optic nerve hemorrhages, severe visual impairment, lack of response to steroids, poor recovery, or recurrence • **MRI Brain/MRI Face/Sinus/Neck Combo**- Trigeminal neuralgia or neuropathy with an atypical presentation (for evaluation of the extracranial nerve course) Added: • Abnormal reflexes to neurologic deficit sections • 1-time screening for silent cerebral infarcts in school age children and adults with sickle cell disease • High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200 • Midline dermoid cysts/sinuses with concern for intracranial extension • Elevated prolactin in the absence of other cause: ≥ 100, persistently elevated or neuroendocrine signs or symptoms • Follow-up of known low grade tumor (WHO I-II) (i.e., meningioma, glioma, astrocytoma, oligodendroglioma) o For surveillance as per NCCN o If symptomatic, new/changing signs or symptoms or complicating factors • 6-month repeat scan in patients with MRI disease activity that is not associated with clinical activity on a follow-up scan (MS) • Note about pediatric MS imaging – same as adults except Increase frequency of imaging (e.g., every 6 months) in children with highly active disease or in situations where imaging will change management • Neurosarcoidosis o Initial Evaluation: ▪ Suspected based on neurological sign/symptoms and lab work (ACE, CSF analysis) OR

	▪ Known history of sarcoidosis with neurological signs or symptoms o Follow up of known neurosarcoidosis: ▪ To assess treatment response ▪ Worsening signs or symptoms • Tourette syndrome to list of movement disorders in which MRI is not indicated • Occipital Neuralgia • X-linked Adrenoleukodystrophy o Baseline MRI between 12 and 18 months old o Second MRI 1 year after baseline o MRI every 6 months between 3 and 12 years old o Annual MRI after 12 years old • Congenital/childhood sensorineural hearing loss suspected to be due to a structural abnormality (CNVIII, the brain parenchyma, or the membranous labyrinth). CT is the preferred imaging modality for the osseous anatomy and malformations of the inner. • Pulsatile tinnitus to combo section (MRI Brain with IAC/MRA Head/MRA Neck) • **General Combo statement** Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the neuroaxis), patient history, and other available information, including prior imaging. • **Combo Brain MRI/MRA**: o Neurological signs or symptoms in sickle cell patients o High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200 • **Brain MRI with IAC/ Brain MRA/Neck MRA (any combination**) o Pulsatile tinnitus with concern for a suspected arterial vascular and/or intracranial etiology o Note: MRA and CTA are generally comparable noninvasive imaging alternatives each with their own advantages and disadvantages. Brain MRI can alternatively be combined with Brain CTA/Neck CTA. • **MRI Brain/MRI Face/Sinus/Neck Combo-** o Bell's Palsy/hemifacial spams for evaluation of the extracranial nerve course -if atypical signs, slow resolution beyond three

	weeks, no improvement at four months, or facial twitching/spasms prior to onset • **MRI Brain/Spine Combo section** o Drop metastasis from brain or spine o Combination studies for MS: These body regions might be evaluated separately or in combination as guided by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history (e.g., symptom(s), time course, and where in the CNS the likely localization(s) is/are), and other available information, including prior imaging Changed: • Thunderclap headache with continued concern for underlying vascular abnormality after initial negative brain imaging > 6 hours after onset (as well as in combo Brain MRI/MRA) Deleted: • Precocious puberty: and evidence of an accelerated bone age on x-y • Patient with history of CNS cancer (either primary or secondary) and a recent course of chemotherapy, radiation therapy (to the brain), or surgical treatment within the last two (2) years • Follow-up of known meningioma section/background

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **FUNCTIONAL BRAIN MRI**	**Original Date: June 2007**
CPT Codes: 70554, 70555	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_013	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR FUNCTIONAL BRAIN MRI[1, 2]

Pre-operative/procedural Evaluation[1]

In the following where fMRI may have a significant role in the mapping of a lesion in relation to eloquent cortex (i.e., language, motor, sensory and visual centers) to determine the appropriateness of surgical intervention

- Focal brain lesion (i.e., tumor or vascular malformation) for presurgical planning[3-6]
- Pre-operative evaluation for epilepsy surgery[7, 8]
- Brain tumor for radiation treatment planning[9, 10]

Post-operative/procedural Evaluation

- Therapeutic follow-up. A documented medical reason must clearly explain the medical necessity for follow up (i.e., evaluation of post-treatment eloquent cortex).

BACKGROUND

Functional MRI (fMRI) of the brain is a non-invasive imaging technique, using radio waves and a strong magnetic field, to image the brain activity of a patient prior to undergoing brain surgery

for tumors or epilepsy. It is based on the increase in blood flow to the local vasculature when parts of the brain are activated and helps to determine the location of vital areas of brain function. fMRI images capture blood oxygen levels in parts of the brain that are responsible for perception, cognition, and movement allowing neurosurgeons to operate with less possibility of harming areas that are critical to the patient's quality of life. fMRI is primarily used for presurgical planning, operative risk assessment and therapeutic follow-up.

Task vs Resting-state fMRI

During resting-state fMRI (rs-fMRI), unlike task-based functional MRI, the individual is not required[11-13] to perform any specific task. This is beneficial for patients who have difficulty performing tasks, such as pediatric and certain neurologic or psychiatric patients. This technique has been well-utilized in research, and its clinical use is increasing considerably, especially in presurgical planning (e.g., mapping epileptic foci) and neuropsychiatric diseases. For the above indications, non-tasked based fMRI such as resting state fMRI can also be performed.

fMRI as an Alternative to the Invasive Wada test and Direct Electrical Stimulation – fMRI is considered an alternative to the Wada test and direct electrical stimulation as it is a non-invasive method for location of vital brain areas. The Wada test is used for the pre-operative evaluations of patients with brain tumors and seizures to determine which side of the brain is responsible for vital cognitive functions, e.g., speech and memory. It can assess the surgical risk of damaging the vital areas of the brain. The Wada test is invasive, involving an angiography procedure to guide a catheter to the internal carotid where a barbiturate is injected, putting one hemisphere of the brain to sleep. Direct electrical stimulation mapping is invasive requiring the placement of electrodes in the brain. The electrodes are used to stimulate multiple cortical sites in the planned area of resection to allow the surgeons to identify and mark which areas can be safely resected.[14, 15]

fMRI and Brain Tumors – fMRI may significantly affect therapeutic planning in patients who have potentially resectable brain tumors. Due to its non-invasiveness, its relatively high spatial resolution, and its pre-operative results, fMRI is used before surgery in the evaluation of patients with brain tumors. fMRI may have a significant role in mapping lesions that are located in close proximity to vital areas of brain function (language, sensory motor, and visual). It can determine the precise spatial relationship between the lesion and adjacent functionally essential parenchyma, allowing removal of as much pathological tissue as possible during resection of brain tumors without compromising essential brain functions. fMRI provides an alternative to other invasive tests, such as the Wada test and direct electrical stimulation.[16]

fMRI and Seizures – Brain fMRI can influence the diagnostic and therapeutic decisions of the seizure team, thereby affecting the surgical approach and outcomes. Brain surgery is often the treatment for patients with refractory epilepsy, especially patients with a single seizure focus. fMRI can be used to image and localize abnormal brain function in patients with seizures. fMRI

can help determine brain functions (language, sensory motor, and visual) of areas bordering the lesion, resulting in better outcomes with less neurologic deficit.[8]

fMRI is increasingly being used to evaluate candidates for surgical treatment of intractable epilepsy (Phase 1 evaluation) and can aid in surgical decision-making. It can 1) help to improve functional outcome by enabling surgery that spares functional cortex, 2) guide surgical intervention by revealing when reorganization of function has occurred, and 3) show when abnormal cortex is also functionally active, and hence that surgery may not be the best option[17, 18].

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POLICY HISTORY

Date	Summary
May 2023	• Updated background and references • Added - to determine the appropriateness of surgical intervention • Background section regarding non-task-based fMRI • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
May 2022	Updated background and references

Reviewed / Approved by NIA Clinical Guideline Committee

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HMSA

Specific policy administered by National Imaging Associates, Inc. (NIA)

Clinical Guidelines Chest (Thorax) CT	
CPT Codes: 71250, 71260, 71270	**Original Date:** September 1997
Guideline Number: HMSA_CG_020	**Last Revised Date (by HMSA):** February 2024
	Last Reviewed Date (by NIA Committee): February 2024
	Implementation Date: April 2024

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

This Chest CT Guideline covers CPT codes 71250 (CT chest without contrast), CT chest with contrast (71260), CT chest without and with contrast (71270)

INDICATIONS FOR CHEST CT

Incidental Lung Nodules[1]

- Incidental pulmonary nodules detected on a non-screening (regular) Chest CT Age ≥ 35 years old – use Table 1: Fleischner table
    - **Excludes**
        - Lung cancer screening

- History of cancer (imaging follow-up for surveillance is 3 months to detect interval nodule growth)
- Immunosuppression (may require a shorter follow-up, such as 1 month, if suspicion of fulminant infection)

- **Incidental pulmonary nodules on non-chest CT** (such as a shoulder CT or abdomen CT)
  - If the nodule is non-calcified, a Chest CT is approvable immediately
  - If there is a history of malignancy, immunosuppression or <35 years old a chest CT is approvable immediately
  - If the nodule is irregular an immediate Chest CT is approvable
  - If the patient history notes a prior Chest CT was done, those results should be submitted prior to another CT chest approval
  - All other lung nodules should follow Fleischner society criteria chart below

Incidental pulmonary nodules on X-rays including portions of the chest (i.e., chest, ribs, shoulder, abdomen) that are indeterminate (not typical of granulomatous disease) as noted by the radiologist. No time delay between the x-ray and the subsequent Chest CT needed.

Table 1: 2017 Fleischner Society Guidelines for Management of Incidentally Detected Pulmonary Nodules[2]

A: Solid Nodules*

	Size			
Nodule Type	<6 mm (<100 mm³)	6–8 mm (100–250 mm³)	>8 mm (>250 mm³)	Comments
Single				
Low risk†	No routine follow-up	CT at 6–12 months, then consider CT at 18–24 months	Consider CT at 3 months, PET/CT, or tissue sampling	Nodules <6 mm do not require routine follow-up in low-risk patients (recommendation 1A).
High risk†	Optional CT at 12 months	CT at 6–12 months, then CT at 18–24 months	Consider CT at 3 months, PET/CT, or tissue sampling	Certain patients at high risk with suspicious nodule morphology, upper lobe location, or both may warrant 12-month follow-up (recommendation 1A).
Multiple				
Low risk†	No routine follow-up	CT at 3–6 months, then consider CT at 18–24 months	CT at 3–6 months, then consider CT at 18–24 months	Use most suspicious nodule as guide to management. Follow-up intervals may vary according to size and risk (recommendation 2A).
High risk†	Optional CT at 12 months	CT at 3–6 months, then at 18–24 months	CT at 3–6 months, then at 18–24 months	Use most suspicious nodule as guide to management. Follow-up intervals may vary according to size and risk (recommendation 2A).

B: Subsolid Nodules*

	Size		
Nodule Type	<6 mm (<100 mm³)	≥6 mm (>100 mm³)	Comments
Single			
Ground glass	No routine follow-up	CT at 6–12 months to confirm persistence, then CT every 2 years until 5 years	In certain suspicious nodules < 6 mm, consider follow-up at 2 and 4 years. If solid component(s) or growth develops, consider resection. (Recommendations 3A and 4A).
Part solid	No routine follow-up	CT at 3–6 months to confirm persistence. If unchanged and solid component remains <6 mm, annual CT should be performed for 5 years.	In practice, part-solid nodules cannot be defined as such until ≥6 mm, and nodules <6 mm do not usually require follow-up. Persistent part-solid nodules with solid components ≥6 mm should be considered highly suspicious (recommendations 4A-4C)
Multiple	CT at 3–6 months. If stable, consider CT at 2 and 4 years.	CT at 3–6 months. Subsequent management based on the most suspicious nodule(s).	Multiple <6 mm pure ground-glass nodules are usually benign, but consider follow-up in selected patients at high risk at 2 and 4 years (recommendation 5A).

Known Cancer[3-5]

- Cancer staging (includes unknown primary)
- Cancer restaging
- Suspicious signs or symptoms of recurrence
- Suspected cancer based on prior imaging[6]
- In a patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer

Chest Mass (non-lung parenchymal)[7]

- Mass or lesion, including lymphadenopathy, after inconclusive initial imaging; can allow one follow-up to ensure stability/benignity (additional follow up may be approved as needed if a bothersome change in the findings or symptoms persist post treatment)
- Thymoma screening in Myasthenia Gravis patients[8]

Known or Suspected Interstitial Lung Disease (often requested as high resolution CT) after initial chest x-ray excludes a more acute disease as the etiology for the concern, if clinically appropriate (if no concern for acute process recent CXR is not an absolute requirement)

- Based on restrictive pattern pulmonary function test
- In patients with known collagen vascular disease in whom ILD is suspected
- With signs or symptoms unresponsive to treatment such as:
    - Shortness of breath
    - Persistent dyspnea
    - Persistent cough
- Monitoring treatment response of known interstitial lung disease
- Guidance in selection of the most appropriate site for biopsy of diffuse lung disease[9]

Chronic Cough (> 8 weeks) and chest x-ray completed[10]

- After evaluation for other causes and failed treatment for those diagnosed with:
    - Asthma
    - Gastroesophageal Reflux Disease
    - Discontinuation of ACE inhibitors
    - Postnasal drip
- Clinical concern for bronchiectasis

Tuberculosis (TB)[11]

- Known or suspected tuberculosis and initial chest x-ray done

Infection Follow-up Imaging

- Abscess, empyema, or pleural effusions on chest x-ray[12]

- For evaluation of non-resolving pneumonia or inflammatory disease documented by **at least two** imaging studies:
    - Unimproved with 4 weeks of antibiotic treatment; **OR**
    - Unresolved at 8 weeks[13,14]

Pneumothorax on Chest X-ray[15]

Vocal Cord Paralysis on Endoscopic Exam[16]

- Neck and Chest CT is an approvable combo

Granulomatosis with Polyangiitis (Wegener's Granulomatosis)[17]

Vascular Disease

- CT chest is NOT the preferred study for vascular disease, CTA should be considered. See Chest CTA guideline.
- Chest CT can be used to detect and follow-up thoracic aortic aneurysms. See Background section.

Suspected Pulmonary Embolism (PE)[18]

- Chest CT NOT approvable for PE; should be CTA

Congenital Malformations

- Thoracic malformation on chest x-ray[19]
- Congenital Heart Disease with pulmonary hypertension[20]

Hemoptysis after x-ray completed[21,22]

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure
- Pre-operative evaluation for Electromagnetic Navigation Bronchoscopy[23] (this is a non-diagnostic CT)

Post-operative/procedural evaluation

- Post-surgical follow-up when records document medical reason requiring additional imaging

Lung Transplant imaging[24]

- All potential lung transplant recipients undergo pretransplant chest CT to delineate the extent of disease, assist in surgical planning, and possible contraindications
- CT is not routinely performed for donor evaluation

- Surveillance imaging varies in frequency and modality among various transplant centers, as there is no universal protocol. (A typical protocol may include surveillance CXR in the first year, spaced out monthly and then to every 3 months until 1 year after transplant. Surveillance Chest CT is then done annually.)
- Clinical concerns for complication at any time after transplant (while initial imaging typically begins with CXR, because many of the complications following transplant do not have classic XR findings, imaging can begin with CT)

Transplants

- Prior to solid organ transplantation
- For initial workup prior to Bone Marrow Transplant (BMT) (along with CT Abdomen and Pelvis[25], CT Sinus and Brain MRI)[26]).

Chest Wall

- Pain (after initial evaluation with chest x-ray and/or rib films)[27]
- History of known or suspected cancer
- Signs and symptoms of infection, such as: fever, elevated inflammatory markers, known infection at other sites
- Suspected chest wall injuries (including musculotendinous, costochondral cartilage, sternoclavicular joint, and manubriosternal joint injuries), when imaging will potentially alter management
- Malformations (such as pectus excavatum, pectus carinatum, scoliosis) in patients with cardiorespiratory symptoms for whom treatment is being considered
- Mass or lesion after inconclusive initial imaging ((MRI preferred over chest CT for chest wall mass)

Chest CT and COVID-19 (Coronavirus)

- Acute COVID
    - Imaging is indicated in a patient with COVID-19 and worsening respiratory status after chest X ray is shown to be insufficient for management or has indeterminant findings. (Imaging is NOT indicated in patients with Covid who have mild clinical features unless they are at risk for disease progression)
- Long (Chronic) COVID
    - Prior history of Covid with hypoxia or impaired lung function of follow-up[28]
        - Restricted diffusion on Pulmonary Function Test (would need a HRCT – High Resolution CT)
        - Low oxygen saturation and a Chest x-ray was done
    - Known fibrosis with continued symptoms

Pulmonary Hypertension[29]

Pulmonary artery diameter/ascending aortic diameter ≥ 1 measured on Chest CT can be used as a reliable method for early diagnosis of PH

Miscellaneous

- When clinical or laboratory findings remain unexplained after negative CXR and initial work up appropriate to the findings fail to determine their etiology, yet chest pathology remains as possible cause such as
    - Weight loss when initial workup and abdomen/pelvis CT/MR fail to identify the cause for weight loss can Chest CT be approved. If CXR suggests a malignancy and/or source of weight loss, then Chest CT would be approvable on the basis of abnormal CXR
    - For confirmed gestational trophoblastic disease when HCG fails to decline appropriately following surgery[30]
- Multiple Endocrine Neoplasia type 1 (MEN1) every 1-3 years (chest CT or MRI also approvable for this syndrome at same interval)[31]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Combination of studies with Chest CT

- **Abdomen CT/Pelvis CT/Chest CT/Neck MRI/Neck CT with MUGA** – known tumor/cancer for initial staging or evaluation before starting chemotherapy or radiation treatment
- **Neck and Chest CT -** Neck and Chest CT is an approvable combo with vocal cord paralysis and concern for recurrent laryngeal nerve lesion

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BACKGROUND

Computed tomography (CT) scans provide greater clarity than regular x-rays and are used to further examine abnormalities found on chest x-rays. They may be used for detection and evaluation of various disease and conditions in the chest, e.g., tumor, inflammatory disease, vascular disease, congenital abnormalities, trauma, and symptoms such as hemoptysis.

OVERVIEW

CT and Aneurysm

- Initial evaluation of aneurysm[32-34]
    - Echocardiogram shows aneurysm
    - Echocardiogram inconclusive of proximal aorta and first-degree relative with thoracic aneurysm
    - Chest x-ray shows possible aneurysm
- Follow-up after established Thoracic Aneurysm (above these sizes surgery is usually recommended)[32-34]
    - Aortic Root or Ascending Aorta
        - 3.5 to 4.5 - Annual
        - 4.5 to 5.4 - Every 6 months
    - Genetically mediated (Marfan syndrome, Aortic Root or Ascending Aorta)
        - 3.5 to 4.0 - Annual
        - 4.0 to 5.0 - Every 6 months
    - Descending Aorta
        - 4.0 to 5.0 - Annual
        - 5.0 to 6.0 - Every 6 months

CT and Interstitial Lung Disease[35] – Radiography of the chest is usually appropriate for the initial imaging of patients who undergo screening and surveillance for lung disease when occupational exposure is present.

Costochondritis[36] – If physical exam findings are suggestive of costochondritis but the pain is persistent despite conservative care, it should be kept in mind that costochondritis can be recurrent and persistent. It is associated with fibromyalgia. Chest CT should be considered if the findings are not consistent with typical costochondritis, such as fever or elevated inflammatory markers, suggestive of infection or a suspicion of cancer based on history or current findings.

CT for Management of Hemoptysis[21,22] – High-resolution CT (HRCT) is useful for estimating the severity of hemoptysis, localizing the bleeding site and determining the cause of the bleeding. Its results can be related to the severity of bleeding. The volume of expectorated blood and the amount of blood that may be retained within the lungs without being coughed up are important. HRCT is a way to evaluate the amount of bleeding and its severity. It may also help in the localization of bleeding sites and help in detecting the cause of bleeding.

CT and Solitary Pulmonary Nodules – Solitary Pulmonary nodules are abnormalities that are solid, semisolid and non-solid; another term to describe a nodule is focal opacity. CT makes it possible to find smaller nodules and contrast-enhanced CT is used to differentiate benign from malignant pulmonary modules. When a nodule is increasing in size or has spiculated margins or mixed solid and ground-glass attenuation, malignancy should be expected. Patients who have pulmonary nodules and who are immunocompromised may be subject to inflammatory processes.

CT and Empyema – Contrast-enhanced CT used in the evaluation of the chest wall may detect pleural effusion and differentiate a peripheral pulmonary abscess from a thoracic empyema. CT may also detect pleural space infections and help in the diagnosis and staging of thoracic empyema.

CT and Rib fractures[37] – Chest CT may be useful for characterizing a pathologic fracture, and some features may be helpful in differentiating a primary malignant tumor of bone from metastasis. CT may also be helpful to search for a primary malignancy in patients with a suspected pathologic fracture; however, there is no strong indication that CT serves a significant use as the initial imaging modality to detect pathologic rib fractures.

CT and Occupational Lung Disease[35] – The chest radiograph and CT are complementary in the initial workup of suspected occupational lung disease. When patients with occupational exposures present with respiratory symptoms, chest radiography serves as the primary function of excluding alternative diagnoses, such as infectious pneumonia or pulmonary edema, with HRCT findings offering the best characterization of lung disease.

CT and Tuberculosis – "The chest radiograph is usually the first study performed in patients suspected of having TB. Although frontal and lateral radiographs are often performed in this setting, it has been shown that the lateral radiograph does not improve the detection of findings related to TB. In those with signs or symptoms of disease, the radiographic pattern of upper-lobe or superior-segment lower-lobe fibrocavitary disease in the appropriate clinical setting is sufficient to warrant respiratory isolation and sputum culture for definitive diagnosis. Using radiographs in combination with clinical evaluation results in a high sensitivity for the diagnosis but a relatively low specificity for both latent and active TB. In addition, radiographs may reveal ancillary findings of TB such as pleural effusion or spondylitis. For immunocompromised hosts, particularly those with a low CD4 count, computed tomography (CT) should be considered."[38] CT may be of value in the severely immunocompromised patient with a normal or near-normal radiograph by revealing abnormal lymph nodes or subtle parenchymal disease. Finally, CT may also have a role in identifying patients with latent TB who will be at risk for reactivation disease.

CT and Superior Vena Cava (SVC) Syndrome – SVC is associated with cancer, e.g., lung, breast and mediastinal neoplasms. These malignant diseases cause invasion of the venous intima or an extrinsic mass effect. Adenocarcinoma of the lung is the most common cause of SVC. SVC is a clinical diagnosis with typical symptoms of shortness of breath along with facial and upper extremity edema. Computed tomography (CT), often the most readily available technology, may be used as confirmation and may provide information including possible causes.

CT and Family History of Lung Cancer[39] – Family history is equally important. Individuals with a family history of lung cancer among first-degree relatives have been consistently shown to have a two-fold higher risk of developing lung cancer themselves. Those with multiple affected family members diagnosed at younger age appear to be at greater risk.

CT and COVID-19 – Chest CT is **not** recommended as a screening test for COVID-19 or as a first-line test to diagnose COVID-19 due to its poor sensitivity and specificity.[40,41] It is only needed when expected to guide clinical management, such as for patients with moderate to severe disease who show lack of respiratory improvement, unexplained deterioration, or worsening gas exchange. In patients with associated co-morbidities (age >65 yr., diabetes, hypertension, obesity, cardiovascular disease, chronic respiratory disease, immune compromise, etc.), CT may be useful in these patients when they have mild symptoms and a normal or indeterminant CXR but have an oxygen saturation <93% at rest on room air or who de-saturate on a 6-minute walk test. In an acute setting, CT can assist in the determining the need for hospitalization. In subacute and chronic settings, it can help predict which patients are likely to have residual pulmonary involvement. CT can also help rule out lung fibrosis in patients recovered from COVID-19 infection that present with hypoxia/impaired lung function on follow up.[42,43]

Fever of Unknown Origin

Initial work up prior to CT would include a comprehensive history, repeated physical exam, complete blood count with differential, three sets of blood cultures, chest x-ray, complete metabolic panel, urinalysis, ESR, ANA, RA, CMV IgM antibodies, virus detection in blood, heterophile antibody test, tuberculin test, and HIV antibody test. Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for fever can Chest CT be approved. If CXR suggests a malignancy and/or source of fever, then Chest CT would be approved.

Suspected paraneoplastic syndromes with no established cancer diagnosis: laboratory evaluation and imaging

The laboratory evaluation for paraneoplastic syndrome is complex. If the appropriate lab test results are suspicious for malignancy, imaging is indicated.

For SIADH (hyponatremia + increased urine osmolality), there is a high association with small cell lung cancer, therefore imaging typically starts with chest CT. If other symptoms suggest a different diagnosis other than small cell lung cancer, different imaging studies may be reasonable.

For hypercalcemia (high serum calcium, low-normal PTH, high PTHrP) it is reasonable to start with bone imaging followed by a more directed evaluation such as mammogram, chest, abdomen and pelvis imaging as appropriate.

For Cushing syndrome (hypokalemia, normal-high midnight serum ACTH NOT suppressed with dexamethasone) abdominal and chest imaging is reasonable. If dexamethasone suppression test DOES suppress ACTH, pituitary MRI is reasonable.

For hypoglycemia, labs drawn during a period of hypoglycemia (glucose < 55, typically a 72 hour fast) (insulin level, C-peptide and IGF-2:IGF-1 ratio) should be done to evaluate for an insulinoma. An elevated insulin level, elevated C-peptide and/or normal IGF-2:IGF-1 ratio warrant CT or MRI abdomen to look for insulinoma. A low insulin, low C-peptide and/or elevated IGF-2:IGF-1 ratio warrant chest and abdominal imaging.

When a paraneoplastic neurologic syndrome is suspected, nuclear and cytoplasmic antibody panels are often ordered to further identify specific tumor types. Results are needed prior to imaging. Because these tests are highly specific, if an antibody highly associated with a specific cancer is positive, then further imaging for that cancer is reasonable. For example, anti-Hu has a high association with SCLC and chest CT would be reasonable. Anti-MA2 has a high association with testicular cancer and testicular ultrasound would be a reasonable next step.

Weight loss definitions and initial evaluation – Unintentional weight loss is considered clinically significant if the amount of weight lost over 12 months is ≥ 5%. Older age and higher percentage of weight loss correlate with higher likelihood of malignancy. A targeted evaluation is recommended when there are signs or symptoms suggestive of a specific source. For example, when there is clinically significant weight loss with abdominal pain that prompts an evaluation for an abdominal source of the weight loss; CXR and labs such as TSH would not be needed prior to abdominal imaging. Conversely a smoker with a cough and weight loss would not start with abdominal imaging, a chest x-ray (CXR) would be the first test to start with. When there is no suspected diagnosis, initial evaluation includes CXR, age-appropriate cancer screening (such as colonoscopy and mammography) and labs (including CBC, CMP, HbA1C, TSH, stool hemoccult, ESR/CRP, HIV, Hepatitis C). If this initial evaluation fails to identify a cause of weight loss, then the patient is monitored and if progressive weight loss is seen on subsequent visits/weights, then CT Abdomen/Pelvis is reasonable (MRI if there is a contraindication to CT such as contrast allergy or impaired renal function). Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for weight loss can Chest CT be approved. If CXR suggests a malignancy and/or source of weight loss, then Chest CT would be approved.

POLICY HISTORY

Date	Summary
February 2024	Removed LDCT language and CPT code 71271 from the guideline for HMSA Added incidental lung nodules discovered/not discovered on chest CT for HMSA HP to the July 1, 2024 NIA guideline
January 2024	Removed language about former smoker to align with the American Cancer Society recommendations
May 2023	• Added FUO, weight loss and paraneoplastic information to background • Updated Covid information in the background • Clarified details on nodules seen on other imaging such as non-chest CT or non CXR • Added transplant imaging • Clarified non cigarette smoking for LDCT • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
March 2022	• Clarified that no time delay required between chest x-ray and subsequent Chest CT for indeterminate incidental pulmonary nodules on chest x-ray (not typical of granulomatous disease) • Moved “Pre-operative evaluation for Electromagnetic Navigation Bronchoscopy” from Post-operative/procedural evaluation to Pre-operative/procedural evaluation • Added known fibrosis with continued symptoms to Long (Chronic) COVID

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Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **LOW-DOSE CT FOR LUNG CANCER SCREENING**	**Original Date: January 2015**
CPT Codes: 71271	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_020-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR LOW-DOSE CT (LDCT) FOR LUNG CANCER SCREENING

For Annual Lung Cancer Screening:

The use of low-dose, non-contrast spiral (helical) multi-detector CT imaging as a screening technique for lung cancer is considered **medically necessary ONLY** when used to screen for lung cancer for certain high-risk, **asymptomatic** individuals, i.e., no acute lung-related symptoms, when **ALL** of the following criteria are met[1]:

Group 1:

- Individual is between 50-80 years of age*; **AND**
- There is at least a 20 pack-year history of cigarette** smoking; **AND**
- If the individual is a former smoker, that individual had quit smoking within the previous 15 years.

*May approve for individuals over the age limit if the individual is a candidate for and willing to undergo curative treatment

** Annual screening refers to the use of cigarettes only; does not take other forms of smoking into the calculation (i.e., vaping, pipe, cigar, marijuana; see Background)

Group 2:
Yearly Low-Dose CT surveillance after completion of definitive treatment of non-small cell lung cancer as per these parameters[2]:

- Stage I-II (treated with surgery +/- chemotherapy)
    - Starts at year 2-3 of surveillance
- Stage I-II (treated primarily with radiation) or stage III-IV with all sites treated with definitive intent
    - Starts at year 5 of surveillance

Nodule on initial LDCT (Follow-up low dose CT is approvable)[3]:

- Table 1 shows the follow-up interval at which LDCT can be approved to reduce radiation dose[2]
- If multiple nodules, the largest and type is used for decision

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Table 1: Lung-RADS® Assessment Categories[2]

Category Descriptor	Lung-RADS Score	Findings	Management
Incomplete	**0**	Prior chest CT examination(s) being located for comparison Part or all of lungs cannot be evaluated	Additional lung cancer screening CT images and/or comparison to prior chest CT examinations is needed
Negative No nodules and definitely benign nodules	**1**	No lung nodules Nodule(s) with specific calcifications: complete, central, popcorn, concentric rings and fat containing nodules	Continue annual screening with LDCT in 12 months
Benign Appearance or Behavior Nodules with a very low likelihood of becoming a clinically active cancer due to size or lack of growth	**2**	**Perifissural nodule(s)** *(See Footnote 11)* < 10 mm (524 mm^3) **Solid nodule(s):** < 6 mm (< 113 mm^3) new < 4 mm (< 34 mm^3) **Part solid nodule(s):** < 6 mm total diameter (< 113 mm^3) on baseline screening **Non solid nodule(s) (GGN):** <30 mm (<14137 mm^3) **OR** ≥ 30 mm (≥ 14137 mm^3) and unchanged or slowly growing **Category 3 or 4 nodules unchanged for ≥ 3 months**	
Probably Benign Probably benign finding(s) - short term follow up suggested; includes nodules with a low likelihood of becoming a clinically active cancer	**3**	**Solid nodule(s):** ≥ 6 to < 8 mm (≥ 113 to < 268 mm^3) at baseline **OR** new 4 mm to < 6 mm (34 to < 113 mm^3) **Part solid nodule(s)** ≥ 6 mm total diameter (≥ 113 mm^3) with solid component < 6 mm (< 113 mm^3) **OR** new < 6 mm total diameter (< 113 mm^3) **Non solid nodule(s)** (GGN) ≥ 30 mm (≥ 14137 mm^3) on baseline CT or new	6 month LDCT
Suspicious Findings for which additional diagnostic testing is recommended	**4A**	**Solid nodule(s):** ≥ 8 to < 15 mm (≥ 268 to < 1767 mm^3) at baseline **OR** growing < 8 mm (< 268 mm^3) **OR** new 6 to < 8 mm (113 to < 268 mm^3) **Part solid nodule(s):** ≥ 6 mm (≥ 113 mm^3) with solid component ≥ 6 mm to < 8 mm (≥ 113 to < 268 mm^3) **OR** with a new or growing < 4 mm (< 34 mm^3) solid component **Endobronchial nodule**	3 month LDCT; PET/CT may be used when there is a ≥ 8 mm (≥ 268 mm^3) solid component
Very Suspicious Findings for which additional diagnostic testing and/or tissue sampling is recommended	**4B**	**Solid nodule(s)** ≥ 15 mm (≥ 1767 mm^3) **OR** new or growing, and ≥ 8 mm (≥ 268 mm^3) **Part solid nodule(s) with:** a solid component ≥ 8 mm (≥ 268 mm^3) **OR** a new or growing ≥ 4 mm (≥ 34 mm^3) solid component	Chest CT with or without contrast, PET/CT and/or tissue sampling depending on the *probability of malignancy and comorbidities. PET/CT may be used when there is a ≥ 8 mm (≥ 268 mm^3) solid component. *For new large nodules that develop on an annual repeat screening CT, a 1 month LDCT may be recommended to address potentially infectious or inflammatory conditions*
	4X	Category 3 or 4 nodules with additional features or imaging findings that increases the suspicion of malignancy	
Other Clinically Significant or Potentially Clinically Significant Findings (non lung cancer)	**S**	**Modifier - may add on to category 0-4 coding**	As appropriate to the specific finding

BACKGROUND

Smoking-related lung cancer is the leading cause of cancer deaths in both men and women in the United States. Treatment for most lung cancer is focused on surgery which is usually curative only when the tumors are very small. Screening for early lung cancer with sputum cytology and chest x-rays has not been successful in reducing deaths from lung cancer. However, in 2011, a large, prospective, multicenter trial was published that showed CT Chest screening identified early cancers better than other approaches and reduced the death rate from lung cancer. In 2014, the United States Preventive Service Task Force (USPSTF) recommended annual low-dose CT Chest screening (CPT® code 71271) for people with current or recent past smoking histories.

The health effects of smoking (tobacco) products other than cigarettes is limited. More research is needed to explore the cancer risk from these products to guide cancer prevention efforts; therefore, cancer screening guidelines have not been developed for them. Currently, the screening guidelines apply only to cigarettes smoking.

All screening and follow-up chest CT scans to be performed at low dose (100-120 kVp and 40-60 mAs), unless evaluating mediastinal findings or lymph nodes, where standard dose CT with IV contrast may be more appropriate.[4]

OVERVIEW

Screening should be discontinued once a person has not smoked for 15 years or develops a health problem that substantially limits life expectancy or the ability or willingness to have curative lung surgery.

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POLICY HISTORY

Date	Summary
April 2023	• Added that applies only to cigarette smoking • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
March 2022	• Reviewed data. No significant updates since prior revision.

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **CHEST CTA**	**Original Date: September 1997**
CPT Codes: 71275	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_022-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CHEST CTA

Chest Computed Tomography Angiography (CTA) is ordered for evaluation of the intrathoracic blood vessels. Chest CT and Chest CTA should not be approved at the same time.

Suspected Pulmonary Embolism (PE)[1-5]

- High risk for PE based on shock or hypotension, OR a validated pre-test high probability score (such as Well's >6, Modified Geneva score >11 -see Background),(D dimer is NOT needed for hi risk; can approve hi risk even with normal D dimer)
- Intermediate and Low risk require elevated D dimer(see Background)[6] (**NOTE**: A normal D-dimer obviates the need for PE imaging in hemodynamically stable patients with a low or intermediate clinical likelihood of PE.)

Vascular Disease

- Superior vena cava (SVC) syndrome[7]
- Subclavian Steal Syndrome after positive or inconclusive ultrasound[8, 9]
- Thoracic Outlet Syndrome[10, 11]
- Takayasu's arteritis[12]
- Clinical concern for Acute Aortic dissection[13, 14]

- Sudden painful ripping sensation in the chest or back and may include
    - New diastolic murmur
    - Cardiac tamponade
    - Distant heart sounds
    - Hypotension or shock

Initial/Screening for Thoracic Aortic Disease[15-17]

- Echocardiogram or chest x-ray show aneurysm
- Initial study for a suspected aneurysm
- Screening of first-degree relatives of individuals with a known thoracic aortic aneurysm (defined as > 50% above normal) or known dissection
- Evaluation in patients with known or suspected connective tissue disease or genetic condition that predisposes to aortic aneurysm or dissection, such as Marfan's, Ehlers Danlos, get a one-time study or for Loeys-Dietz syndrome- allow imaging at diagnosis and then every two years, or more frequently if abnormalities are found (Imaging may include head, neck, chest, abdomen and pelvis)14, 20 (MRA preferred due to cumulative radiation risk)
- Screening of the thoracic aorta after a diagnosis of a bicuspid aortic valve (dilation of the ascending aorta may not be seen on echocardiogram)[18]
    - If normal, re-image every three to five years
- Screening of first-degree relatives of patients with a bicuspid aortic valve
- Turner's syndrome – Screen for coarctation or aneurysm of the thoracic aorta
    - If normal results, screen every 5-10 years
    - If abnormal, screen annually
- Suspected vascular cause of dysphagia or expiratory wheezing with other imaging is suggestive or inconclusive

Follow-up after established Thoracic Aortic Aneurysm (TAA)[15-17]

- Six months follow-up after initial finding of a dilated thoracic aorta, for assessment of rate of change
    - Aortic Root or Ascending Aorta (in cm)
        - 3.5 to 4.4 Annual
        - 4.5 to 5.5 or growth rate ≥ 0.5 cm/year - Every 6 months
    - Genetically mediated (Marfan syndrome, Aortic Root or Ascending Aorta) (in cm)
        - 3.5 to 4.4 Annual
        - 4.5 to 5.0 or growth rate ≥ 0.5 cm/year Every 6 months
        - Surgery generally recommended over 5.0 cm
    - Descending Aorta (in cm)[19]
        - 4.0 to 5.0 Annual
        - 5.0 to 6.0 Every 6 months
- Follow-up post medical treatment of aortic dissection:
    - Acute dissection: 1 month, 6 months, then annually

    - Chronic dissection: annually
- Follow-up TEVAR surveillance at 1 month, then I year post op and if stable, then annually
- Follow up open repair if no residual aortopathy within first post op year, then every 5 years (if have residual aortopathy or abnormal findings on surveillance, annual follow up in then needed)
- Re-evaluation of known ascending aortic dilation or history of aortic dissection with a change in clinical status or cardiac exam or when findings may alter management.

Congenital Malformations (Chest Magnetic Resonance Angiography preferred if pediatrics or repeat imaging)

- Thoracic malformation on other imaging (chest x-ray, echocardiogram, gastrointestinal study, or inconclusive CT)[20-23]
- Congenital heart disease with pulmonary hypertension[24] or vascular anomalies
- Pulmonary sequestration[25]

Pulmonary Hypertension based on other testing[26, 27]

- Echocardiogram
- Right heart catheterization

Atrial fibrillation with ablation planned[28]

Preoperative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure
- Pre-transplant CT or CTA/MRA chest approvable for surgical planning (to evaluate for vascular anatomy, mediastinal pathology, malignancy screening etc.)

Post-operative/procedural evaluation

- Post-operative complications[29, 30]
- See above indications for TAA follow up

Chest CTA and Abdomen CTA, Abdomen/Pelvis CTA or Abdominal Arteries CTA

- Transcatheter Aortic Valve Replacement (TAVR)[14, 31]
- Acute aortic dissection
- Takayasu's arteritis[12]
- Post-operative complications[29, 30]
- To evaluate for an embolic source of lower extremity vascular disease (may also approved as a combination chest CTA and Abdominal Arteries CTA when LE runoff disease needs to be evaluated as well). Echocardiography is also often needed, since the

heart is the most commonly reported source of lower extremity emboli, accounting for 55 to 87 percent of events.[32]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BACKGROUND

Computed tomography angiography is a non-invasive imaging modality that may be used in the evaluation of thoracic vascular problems. Chest CTA (non-coronary) may be used to evaluate vascular conditions, e.g., pulmonary embolism, thoracic aneurysm, thoracic aortic dissection, aortic coarctation, or pulmonary vascular stenosis. The vascular structures as well as the surrounding anatomical structures are depicted by CTA.

Pulmonary embolism (PE) Methods utilizing clinical assessment to determine probability for PE include:

Wells Score[33]

▪ Clinical symptoms of DVT (leg swelling, pain with palpation)	3.0
▪ Other diagnosis less likely than pulmonary embolism	3.0
▪ Heart rate >100	1.5
▪ Immobilization (≥3 days) or surgery in the previous four weeks	1.5
▪ Previous DVT/PE	1.5
▪ Hemoptysis	1.0
▪ Malignancy	1.0
Probability	**Score**
Traditional clinical probability assessment (Wells criteria)	
High	>6.0
Moderate	2.0 to 6.0
Low	<2.0

Modified Geneva Score[34]

Modified Geneva score

	Variables	Points
Risk factors	Age >65 years	1
	Previous deep venous thrombosis or pulmonary embolism	3
	Surgery under general anesthesia or fracture of the lower limbs within one month	2
	Active malignancy (solid or hematologic; currently active or cured within the last year)	2
Symptoms	Unilateral lower-limb pain	3
	Hemoptysis	2
Signs	Heart rate 75 to 94 beats per minute	3
	≥95 beats per minute	5
	Pain on lower limb deep venous palpation and unilateral edema	4
		Total points
Pre-test probability assessment	Low	0 to 3
	Intermediate	4 to 10
	High	≥11

OVERVIEW

Coarctation of the Aorta – Coarctation of the aorta is a common vascular anomaly characterized by a constriction of the lumen of the aorta distal to the origin of the left subclavian artery near the insertion of the ligamentum arteriosum. The clinical sign of coarctation of the aorta is a disparity in the pulsations and blood pressures in the legs and arms. Chest CTA/MRA may be used to evaluate either suspected or known aortic coarctation and patients with significant coarctation should be treated surgically or interventionally. It may also assist in the identification of postoperative complications.

Central Venous Thrombosis – CTA/MRA is useful in the identification of venous thrombi. Venous thrombosis can be evaluated by gadolinium-enhanced 3D MRA as an alternative to CTA, which may not be clinically feasible due to allergy to iodine contrast media or renal insufficiency.

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POLICY HISTORY

Date	Summary
April 2023	• Simplified PE indications to high risk, no need for d dimer, all else requires d dimer (added Pretest probability tables and removed other details from background) • Clarified and updated follow up after repair of TAA • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
March 2022	• For Suspected Pulmonary Embolism, clarified 'intermediate or high risk' as determined by parameters detailed in Overview section and included hyperlink to Overview section

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **CHEST (THORAX) MRI**	**Original Date: September 1997**
CPT Codes: 71550, 71551, 71552	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_021	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CHEST MRI

The combination of superior soft tissue contrast and lack of ionizing radiation may make Chest Magnetic Resonance Imaging (MRI) preferable for the pediatric population, during pregnancy and also when frequent serial imaging is needed. This must be weighed against a longer acquisition time, greater likelihood of patient motion artifact as well as the lack of experience in obtaining and interpreting non-vascular chest MR. Recent technological advancements have made non-vascular thoracic MRI increasingly utilized, however **Chest Computed Tomography (CT) is generally better for lung parenchymal evaluation at this time**. Chest Magnetic Resonance Angiography (MRA) is ordered for evaluation of the intrathoracic blood vessels. Chest MRI and Chest MRA should not be approved at the same time.

Chest Mass (non-lung parenchymal)[1-7]

- Mass or lesion, including lymphadenopathy, after non-diagnostic x-ray or ultrasound (Chest CT indicated for pulmonary nodule)
- Thymoma screening in Myasthenia Gravis patients[8]
- Congenital thoracic malformation on other imaging (chest x-ray, echocardiogram, gastrointestinal study, or inconclusive CT)[9-12]

Chest Wall (MRI preferred over CT):

- Pain (after initial evaluation with chest x-ray and/or rib films)
- History of known or suspected cancer involving the chest wall
- Signs and symptoms of infection with concern for chest wall involvement, such as: fever, elevated inflammatory markers, known infection at other sites
- Suspected chest wall injuries (including musculotendinous, costochondral cartilage, sternoclavicular joint, and manubriosternal joint injuries) when imaging will potentially alter management
- Malformations (such as pectus excavatum, pectus carinatum, scoliosis) in patients with cardiorespiratory symptoms for whom treatment is being considered
- Mass or lesion after inconclusive initial imaging (MRI preferred over chest CT for chest wall mass)

Brachial Plexopathy[13, 14]

- If mechanism of injury or Electromyography/Nerve Conduction Velocity (EMG/NCV) studies are suggestive
- Chest MRI is preferred study, but neck and/or shoulder (upper extremity) MRI can be ordered depending on the suspected location of injury

Cystic Fibrosis[15]

- Can be an alternative to Chest CT to evaluate perfusion abnormalities, bronchiectasis, and mucus plugging if needed for treatment planning

Vascular Diseases are better evaluated with Chest CTA or MRA[16]

- Superior vena cava (SVC) syndrome[17]
- Subclavian Steal Syndrome after positive or inconclusive ultrasound[18, 19]
- Thoracic Outlet Syndrome[16, 20, 21]
- Takayasu's arteritis[22]
- Acute or chronic aortic dissection[23, 24]
- Pulmonary hypertension - To evaluate for cause after echocardiogram or right heart catheterization[25, 26]

Congenital Malformations

- Congenital heart disease with pulmonary hypertension[27]
- Pulmonary sequestration[28]

Atrial fibrillation with ablation planned[29]

Preoperative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- Post-surgical follow-up when records document medical reason requiring additional imaging

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BACKGROUND

Magnetic Resonance Imaging (MRI) is a noninvasive imaging technique for detection and evaluation of various disease and conditions in the chest, e.g., congenital anomalies and aneurysms. MRI may be used instead of computed tomography (CT) in patients with allergies to radiographic contrast or with impaired renal function. Also, to decrease radiation exposure, Chest MRI may be used rather than CT when repeated imaging is expected (i.e., surveillance).

OVERVIEW

MRI for Non-Parenchymal Masses[30]

CT and MRI are similar in usefulness when imaging the chest wall and pleura. The main advantages of MRI are lack or radiation, superior contrast resolution for delineation of anatomy, evaluation of local invasion, greater ability to image in “unconventional planes” and real time imaging capabilities. CT is still the gold standard for evaluation parenchymal disease; however, MR is also now being considered in the assessment of endometriosis, lung nodules and lung cancer staging. The lack of standardized protocols and experience in interpretation still limits the usefulness of non-vascular chest MRI.

Due to the capability of MR to distinguish certain fat and fluid characteristics, MR can be superior to CT for evaluating mediastinal masses. The presence of microscopic fat allows MR to distinguish thymic hyperplasia from mass. Similarly, because of macroscopic fat, MR is useful in evaluating dermoid cysts teratomas, thymolipomas, lipomas and liposarcomas.
MRI can also differentiate simple from complex cystic lesions better than CT, and is thus useful for evaluating cystic mediastinal masses, such as thymic, foregut duplication or pericardial cysts and lymphatic malformations.

Finally, MRI can help differentiate types of neurogenic tumors (schwannomas, neurofibromas and ganglioneuromas) that may have similar CT features, to evaluate of intraspinal and neural extension of the tumor, as well as to assess adherence or invasion of a mediastinal mass to adjacent structures.

MRI and Myasthenia Gravis – Myasthenia Gravis is a chronic autoimmune disease characterized by weakness of the skeletal muscles causing fatigue and exhaustion that is aggravated by activity and relieved by rest. It most often affects the ocular and other cranial muscles and is thought to be caused by the presence of circulating antibodies. Symptoms include ptosis, diplopia, chewing difficulties, and dysphagia. Thymoma has a known association with myasthenia. Contrast-enhanced MRI may be used to identify the presence of a mediastinal mass suggestive of myasthenia gravis in patients with renal failure or allergy to contrast material.

MRI and Thoracic Outlet Syndrome – Thoracic outlet syndrome is a group of disorders involving compression at the superior thoracic outlet that affects the brachial plexus, the subclavian artery, and veins. It refers to neurovascular complaints due to compression of the brachial plexus or the subclavian vessels. Magnetic resonance multi-plane imaging shows bilateral images of the thorax and brachial plexus and can demonstrate the compression of the brachial plexus and venous obstruction.

MRI and Brachial Plexus - MRI is the only diagnostic tool that accurately provides high resolution imaging of the brachial plexus. The brachial plexus is formed by the cervical ventral rami of the lower cervical and upper thoracic nerves which arise from the cervical spinal cord, exit the bony confines of the cervical spine, and traverse along the soft tissues of the neck, upper chest, and course into the arms.

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POLICY HISTORY

Date	Summary
April 2023	• Updates on mass imaging and chest wall imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
March 2022	• Updated references

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **CHEST MRA/MRV**	**Original Date: September 1997**
CPT Codes: 71555	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_022-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CHEST MRA

Chest Magnetic Resonance Angiography (MRA) is ordered for evaluation of the intrathoracic blood vessels. Chest MRI and Chest MRA should not be approved at the same time.

Vascular Disease

- Superior vena cava (SVC) syndrome[1]
- Subclavian Steal Syndrome after positive or inconclusive ultrasound[2, 3]
- Thoracic Outlet Syndrome[4-6]
- Takayasu's arteritis[7]
- Clinical concern for acute aortic dissection[8, 9]
    - Sudden painful ripping sensation in the chest or back and may include
        - New diastolic murmur
        - Cardiac tamponade
        - Distant heart sounds
        - Hypotension or shock
- For MRPA (MR Pulmonary Angiography) in patients with intermediate pretest probability with a positive D-dimer or high pretest probability (but only at centers that

routinely perform it well and only for patients for whom standard tests are contraindicated)
    - Risk can be determined by the parameters detailed in Background section

Initial/Screening for Thoracic Aortic Disease[10-12]

- Echocardiogram or chest x-ray show aneurysm
- Screening of first-degree relatives of individuals with a thoracic aortic aneurysm (defined as ≥ 50% above normal) or dissection
- Evaluation in patients with known or suspected connective tissue disease or genetic condition that predisposes to aortic aneurysm or dissection, such as Marfan's, Ehlers-Danlos, get a one-time study or for Loeys-Dietz syndrome- allow imaging at diagnosis and then every two years, or more frequently if abnormalities are found (Imaging may include head, neck, chest, abdomen and pelvis)(MRA preferred due to cumulative radiation risk)
- Screening of the thoracic aorta after a diagnosis of a bicuspid aortic valve (dilation of the ascending aorta may not be seen on echocardiogram)[13, 14]
    - If normal, reimage every three to five years
- Screening of first-degree relatives of patients with a bicuspid aortic valve
- Turner's syndrome – Screen for coarctation or aneurysm of the thoracic aorta
    - If normal results, screen every 5-10 years
    - If abnormal, screen annually
- Suspected vascular cause of dysphagia or expiratory wheezing with other imaging is suggestive or inconclusive

Follow-up after established Thoracic Aneurysm[14-16]

- Six months follow-up after initial finding of a dilated thoracic aorta, for assessment of rate of change
    - Aortic Root or Ascending Aorta (in cm)
        - 3.5 to 4.4 – annual
        - 4.5 to 5.5 or growth rate ≥ 0.5cm/year – every 6 months
    - Genetically mediated (Marfan syndrome, Aortic Root or Ascending Aorta) (in cm)
        - 3.5 to 4.4 – annual
        - 4.5 to 5.5 or growth rate ≥ 0.5cm/year – every 6 months
        - Surgery generally recommended over 5.0cm
    - Descending Aorta (in cm)[17]
        - 4.0 to 5.0 – annual
        - 5.0 to 6.0 – every 6 months
- Follow-up post medical treatment of aortic dissection:
    - Acute dissection: 1 month, 6 months, then annually
    - Chronic dissection: annually
- Follow-up TEVAR surveillance at 1 month, then 1 year post op if stable, then annually

- Follow-up open repair if no residual aortopathy within first post op year, then every 5 years (if have residual aortopathy or abnormal findings on surveillance, annual follow-up if needed)
- Re-evaluation of known ascending aortic dilation or history of aortic dissection with a change in clinical status or cardiac exam or when findings may alter management

Congenital Malformations

- Thoracic malformation on other imaging (chest x-ray, echocardiogram, gastrointestinal study, or inconclusive CT)[15-18]
- Congenital heart disease with pulmonary hypertension[19] or vascular anomalies
- Pulmonary Sequestration[20]

Pulmonary Hypertension based on other testing[21, 22]

- Echocardiogram
- Right heart catheterization

Atrial fibrillation with ablation planned[23]

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure
- Pre-transplant CT or CTA/MRA chest approvable for surgical planning (to evaluate for vascular anatomy, mediastinal pathology, malignancy screening etc.)

Post-operative/procedural evaluation

- Post-operative complications[24, 25]
- See above indications for TAA follow up

Chest MRA and Abdomen MRA or Abdomen/Pelvis MRA

- Transcatheter Aortic Valve Replacement (TAVR)
- Acute aortic dissection
- Takayasu's arteritis
- Post-operative complications
- To evaluate for an embolic source of lower extremity vascular disease (may also approved as a combination chest MRA, Abdominal MRA and a single LE MRA when LE runoff disease needs to be evaluated as well). Echocardiography is also needed, since the heart is the most commonly reported source of lower extremity emboli i, accounting for 55 to 87 percent of events.

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BACKGROUND

Magnetic resonance angiography (MRA) is a noninvasive technique used to provide cross-sectional and projection images of the thoracic vasculature, including large- and medium-sized vessels, e.g., the thoracic aorta. MRA provides images of both normal and diseased blood vessels, and it quantifies blood flow through these vessels. Successful vascular depiction relies on the proper imaging pulse sequences. MRA may use a contrast agent, gadolinium, which is non-iodine-based, for better visualization. It can be used in patients who have history of contrast allergy and who are at high risk of kidney failure.

OVERVIEW

Coarctation of the Aorta – One of the most common congenital vascular anomalies is coarctation of the aorta, characterized by obstruction of the juxtaductal aorta. Clinical symptoms, e.g., murmur, systemic hypertension, difference in blood pressure in upper and lower extremities, absent femoral or pedal pulses, may be present. Gadolinium-enhanced 3D MRA may assist in preoperative planning as it provides angiographic viewing of the aorta, the arch vessels, and collateral vessels. It may also assist in the identification of postoperative complications.

Pulmonary Embolism (PE) –Studies show mixed results regarding the value of MRA versus CTA in detecting pulmonary embolism. A systematic review and meta-analysis found MRA to be inferior to CTA in detecting PE. Therefore, MRA should be used only if CTA is not available or contraindicated in a specific patient.[26]

Central Venous Thrombosis – CTA/MRA is useful in the identification of venous thrombi. Venous thrombosis can be evaluated by gadolinium-enhanced 3D MRA as an alternative to CTA, which may not be clinically feasible due to allergy to iodine contrast media or renal insufficiency.

MRI and Patent Ductus Arteriosus – Patent ductus arteriosus (PDA) is a congenital heart problem in which the ductus arteriosus does not close after birth. It remains patent allowing oxygen-rich blood from the aorta to mix with oxygen-poor blood from the pulmonary artery. MRI can depict the precise anatomy of a PDA to aid in clinical decisions. It allows imaging in

multiple planes without a need for contrast administration. Patients are not exposed to ionizing radiation.

Other MRA Indications – MRA is useful in the assessment for postoperative complications of pulmonary venous stenosis.

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POLICY HISTORY

Date	Summary
April 2023	• Simplified PE indications and removed other details from background) • Clarified and updated follow up after repair of TAA • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
March 2022	• No significant changes

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guideline **CERVICAL SPINE CT**	**Original Date: September 1997**
CPT Codes: 72125, 72126, 72127	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_041	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CERVICAL SPINE CT

+If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months), the results of the prior study should be:

- **Inconclusive or show a need for additional or follow-up imaging evaluation OR**
- **The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.**

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of neurologic deficits when Cervical Spine MRI is contraindicated or inappropriate[1-4]

- With any of the following new neurological deficits documented on physical exam
    - Extremity muscular weakness (and not likely caused by plexopathy or peripheral neuropathy)
    - Pathologic (e.g., Babinski, Lhermitte's sign, Chaddock Sign, Hoffman's and other upper motor neuron signs); OR abnormal deep tendon reflexes (and not likely caused by plexopathy, or peripheral neuropathy)

    - Absent/decreased sensory changes along a particular cervical dermatome (nerve distribution): pin prick, touch, vibration, proprioception, or temperature (and not likely caused by plexopathy or peripheral neuropathy)
    - Upper or lower extremity increase muscle tone/spasticity
    - New onset bowel or bladder dysfunction (e.g., retention or incontinence)—not related to an inherent bowel or bladder process
    - Gait abnormalities (see Table 1 below for more details)
- Suspected cord compression with any neurological deficits as listed above

For evaluation of neck pain with any of the following when Cervical Spine MRI is contraindicated[5]

- With new or worsening objective neurologic deficits on exam, as above
- Failure of conservative treatment* for at least six (6) weeks within the last six (6) months[6]
- With progression or worsening of symptoms during the course of conservative treatment*
- With an abnormal electromyography (EMG) or nerve conduction study (if performed) indicating a cervical radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain)[7]
- Isolated back pain in pediatric population[8, 9] – conservative care not required if red flags present. Red flags that prompt imaging include any of the following:
    - Age 5 or younger, **OR**
    - Constant pain, **OR**
    - Pain lasting > 4 weeks, **OR**
    - Abnormal neurologic examination, **OR**
    - Early morning stiffness and/or gelling, **OR**
    - Night pain that prevents or disrupts sleep, **OR**
    - Radicular pain, **OR**
    - Fever or weight loss or malaise, **OR** [10, 11]
    - Postural changes (e.g., kyphosis or scoliosis), **OR**
    - Limp (or refusal to walk in a younger child)

As part of initial pre-operative/post-operative/procedural evaluation ("CT best examination to assess for hardware complication, extent of fusion and pseudarthrosis"[12, 13] and MRI for cord, nerve root compression, disc pathology, or post-op infection)

Note: If ordered by Neurosurgeon or orthopedic surgeon for purposes of surgical planning, a contraindication to MRI is not required.

- For preoperative evaluation/planning
- CT discogram
- Evaluation of post operative pseudoarthrosis after initial x-rays (CT should not be done before 6 months after surgery)

- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula -preferred exam CT myelogram))[14]
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery in the last 6 months. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested (routine surveillance post-op not indicated without symptoms)
- Surgical infection as evidenced by signs/symptoms, laboratory, or prior imaging findings
- New or changing neurological deficits or symptoms post-operatively[12, 15] - see neurological deficit section above.
- When combo requests (see above statement[+]) are submitted (i.e., MRI and CT of the spine), the office notes should clearly document the need for both studies to be done simultaneously (e.g., the need for both soft tissue and bony anatomy is required)[16]
    - Combination requests where both cervical spine CT and MRI cervical spine are both approvable (not an all-inclusive list):
        - OPLL (Ossification of posterior longitudinal ligament)[17]
        - Pathologic or complex fractures
        - Malignant process of spine with both bony and soft tissue involvement
        - Unstable craniocervical junction
        - Clearly documented indication for bony and soft tissue abnormality where assessment will change management for the patient

For evaluation of suspected myelopathy when Cervical Spine MRI is contraindicated[18-22]

- Does **NOT** require conservative care
- Progressive symptoms including hand clumsiness, worsening handwriting, difficulty with grasping and holding objects, diffuse numbness in the hands, pins and needles sensation, increasing difficulty with balance and ambulation
- Any of the neurological deficits as noted above

For evaluation of trauma or acute injury[23]

- Presents with any of the following neurological deficits as above
- With progression or worsening of symptoms during the course of conservative treatment*
- History of underlying spinal abnormalities (i.e., ankylosing spondylitis) (Both MRI and CT are approvable)[24, 25]
- When the patient is clinically unevaluable or there are preliminary imaging findings (x-ray or CT) needing further evaluation
- When office notes specify the patient meets NEXUS (National Emergency X-Radiography Utilization Study) or CCR (Canadian Cervical Rules) criteria for imaging[23]:
    - CT for initial imaging

- MRI when suspect spinal cord or nerve root injury or when patient is obtunded, and CT is negative
- CT or MRI for treatment planning of unstable spine

("MRI and CT provide complementary information. When indicated it is appropriate to perform both examinations"[23])

For evaluation of known fracture or new compression fractures with worsening neck pain[23, 26]

- To assess union of a fracture when physical examination, plain radiographs, or prior imaging suggest delayed or non-healing
- To determine the position of fracture fragments
- With history of malignancy (if MRI is contraindicated or cannot be performed)
- With an associated new focal neurologic deficit as above[27]
- Prior to a planned surgery/intervention or if the results of the CT will change management

CT myelogram: When MRI cannot be performed/contraindicated/surgeon preference[14, 28-32]

- When signs and symptoms inconsistent or not explained by the MRI findings
- Demonstration of the site of a CSF leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula)
- Surgical planning, especially regarding to the nerve roots or evaluation of dural sac
- Evaluation of suspected brachial plexus or nerve root injury in the neonate

For evaluation of tumor, cancer, or metastasis with any of the following:

(MRI is usually the preferred study- CT may be needed to further characterize solitary indeterminate lesions seen on MRI)[9, 33, 34]

- **Primary tumor**
  - Initial staging primary spinal tumor[35]
  - Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
  - Known spinal tumor with new signs or symptoms (e.g., new or increasing nontraumatic pain, physical, laboratory, and/or imaging findings)
  - With an associated new focal neurologic deficit as above[27]
- **Metastatic tumor**
  - With evidence of metastasis on bone scan needing further clarification OR inconclusive findings on a prior imaging exam
  - With an associated new focal neurologic deficit[27]
  - Known malignancy with new signs or symptoms (e.g., new or increasing nontraumatic pain, radiculopathy or neck pain that occurs at night and wakes the patient from sleep with known active cancer, physical, laboratory, and/or imaging findings) in a tumor that tends to metastasize to the spine[9, 36]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification. When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding[9]
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam). When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding.[9] When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding[9]

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine, or Lumbar Spine

For evaluation of known or suspected infection (osteomyelitis)/abscess when Cervical Spine MRI is contraindicated[37]

- As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings[38]
- Follow-up imaging of infection
    - With worsening symptoms/laboratory values (i.e., white blood cell count, ESR/CRP) or radiographic findings[39]

For evaluation of known or suspected inflammatory disease or atlantoaxial instability when MRI is contraindicated or for surgical treatment planning:

- In rheumatoid arthritis with neurologic signs/symptoms, or evidence of subluxation on radiographs (lateral radiograph in flexion and neutral should be the initial study)[40, 41]
    - Patients with negative radiographs but symptoms suggestive of cervical instability or in patients with neurologic deficits
- High-risk disorders affecting the atlantoaxial articulation, such as Down syndrome, Marfan syndrome with neurological signs/symptoms, abnormal neurological exam, or evidence of abnormal or inconclusive radiographs of the cervical spine[42]
- Spondyloarthropathies, known or suspected
    - Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and appropriate rheumatology workup

For evaluation of spine abnormalities related to immune system suppression, e.g., HIV, chemotherapy, leukemia, or lymphoma when Cervical Spine MRI is contraindicated[37, 43]

- As evidenced by signs/symptoms, laboratory, or prior imaging findings

Other Indications for a Cervical Spine CT when MRI is contraindicated or cannot be performed

(Note- See combination requests, below, for initial advanced imaging assessment and pre-operatively)

- Tethered cord or spinal dysraphism (known or suspected), based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata[44-46]
    - Known Arnold-Chiari syndrome (For initial imaging (one-time initial modality assessment) see combination below)
    - Known Chiari I malformation without syrinx or hydrocephalus, follow-up imaging after initial diagnosis with new or changing signs/symptoms or exam findings consistent with spinal cord pathology[47]
    - Known Chiari II (Arnold-Chiari syndrome), III, or IV malformation
    - Achondroplasia (one Cervical Spine MRI to assess the craniocervical junction, as early as possible (even in asymptomatic cases)[48, 49]
- Syrinx or syringomyelia (known or suspected)
    - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis)[50]
    - To further characterize a suspicious abnormality seen on prior imaging
    - Known syrinx with new/worsening symptoms
- Toe walking in a child with signs/symptoms of myelopathy localized to the Cervical Spine
- Suspected neuroinflammatory Conditions/Diseases (e.g., sarcoidosis, Behcet's)
    - After detailed neurological exam and appropriate initial work up

Initial evaluation of trigeminal neuralgia not explained on recent Brain imaging

COMBINATION STUDIES WITH CERVICAL SPINE CT WHEN MRI IS CONTRAINDICATED OR CANNOT BE PERFORMED OR SURGEON PREFERENCE

Brain CT/Cervical CT

- For evaluation of known Arnold-Chiari Malformation

Cervical and Thoracic CT

- Initial evaluation of known or suspected syrinx or syringomyelia
    - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis[50])
    - To further characterize a suspicious abnormality seen on prior imaging
    - Known syrinx with new/worsening symptom

Any combination of Cervical and/or Thoracic and/or Lumbar CTs:

Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history, and other available information, including prior imaging.

Exception- Indications for combination studies[51, 52]: Are approved indications as noted below and being performed in children who will need anesthesia for the procedure

- Any combination of these studies for:
    - Survey/complete initial assessment of infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10[53-55] (e.g., congenital scoliosis, idiopathic scoliosis, scoliosis with vertebral anomalies)
    - In the presence of neurological deficit, progressive spinal deformity, or for preoperative planning[56]
    - Back pain with known vertebral anomalies (hemivertebrae, hypoplasia, agenesis, butterfly, segmentation defect, bars, or congenital wedging) in a child on preliminary imaging
    - Scoliosis with any of the following[57]:
        - Progressive spinal deformity;
        - Neurologic deficit (new or unexplained);
        - Early onset;
        - Atypical curve (e.g., short segment, >30' kyphosis, left thoracic curve, associated organ anomalies);
        - Pre-operative planning; OR
        - When office notes clearly document how imaging will change management
- Arnold-Chiari malformations[58, 59]
    - Arnold-Chiari I
        - For evaluation of spinal abnormalities associated with initial diagnosis of Arnold-Chiari Malformation. (C/T/L spine due to association with tethered cord and syringomyelia), and initial imaging has not been completed[44, 53]
    - Arnold-Chiari II-IV - For initial evaluation and follow-up as appropriate
        - Usually associated with open and closed spinal dysraphism, particularly meningomyelocele)
- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata,[44-46] when anesthesia required for imaging[60] (e.g., meningomyelocele, lipomeningomyelocele, diastematomyelia, fatty/thickened filum terminale, and other spinal cord malformations)
- Oncological Applications (e.g., primary nervous system, metastatic)
    - Drop metastasis from brain or spine (imaging also includes brain; CT spine imaging in this scenario is usually CT myelogram)- See Overview
    - Suspected leptomeningeal carcinomatosis (LC)[61]- See Overview
    - Any combination of these for spinal survey in patient with metastases
    - Tumor evaluation and monitoring in neurocutaneous syndromes
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic

headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula -preferred exam CT myelogram))[14]
- CT myelogram when meets above guidelines and MRI is contraindicated or for surgical planning
- Post-procedure (discogram) CT

BACKGROUND

Computed tomography (CT) is performed for the evaluation of the cervical spine. CT may be used as the primary imaging modality, or it may complement other modalities. Primary indications for CT include conditions, e.g., traumatic, neoplastic, and infectious. CT is often used to study the cervical spine for conditions such as degenerative disc disease when MRI is contraindicated. CT provides excellent depiction of bone detail and is used in the evaluation of known fractures of the cervical spine and for evaluation of postoperative patients.

OVERVIEW

***Conservative Therapy** – (Spine) should include a multimodality approach consisting of a **combination of active and inactive components**. Inactive components such as rest, ice, heat, modified activities, medical devices, acupuncture and/or stimulators, medications, injections (epidural, facet, bursal, and/or joint, not including trigger point), and diathermy can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or osteopathic manipulative medicine (OMT) or chiropractic care when considered safe and appropriate.

****Home Exercise Program - (HEP)/ Therapy** – the following elements are required to meet guidelines for completion of conservative therapy[13, 62]:

- Information provided on exercise prescription/plan AND
- Follow-up with member with documentation provided regarding lack of improvement (failed) after completion of HEP (after suitable 6-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute “inability to complete” HEP).
- Dates and duration of failed PT, physician-supervised HEP, or chiropractic treatment should be documented in the original office notes or an addendum to the notes.

Cervical myelopathy – Symptom severity varies, and a high index of suspicion is essential for making the proper diagnosis in early cases. Symptoms of pain and radiculopathy may not be present. The natural history of myelopathy is characterized by neurological deterioration. The most frequently encountered symptom is gait abnormality (86%) followed by increased muscular reflexes (79.1%), pathological reflexes (65.1%), paresthesia of upper limb (69.8%) and pain (67.4%).[19]

Table 1: Gait and spine imaging[63-68]

Gait	Characteristic	Work up/Imaging
Hemiparetic	**Spastic unilateral, circumduction**	**Brain and/or, Cervical spine imaging based on associated symptoms**
Diplegic	**Spastic bilateral, circumduction**	**Brain, Cervical and Thoracic Spine imaging**
Myelopathic	**Wide based, stiff, unsteady**	**Cervical and/or Thoracic spine MRI based on associated symptoms**
Cerebellar Ataxic	**Broad based, clumsy, staggering, lack of coordination, usually also with limb ataxia**	**Brain imaging see Brain MRI Guideline**
Apraxic	**Magnetic, shuffling, difficulty initiating**	**Brain imaging see Brain MRI Guideline**
Parkinsonian	**Stooped, small steps, rigid, turning en bloc, decreased arm swing**	**Brain Imaging see Brain MRI Guideline**
Choreiform	**Irregular, jerky, involuntary movements**	**Medication review, consider brain imaging as per movement disorder Brain MR guidelines**
Sensory ataxic	**Cautious, stomping, worsening without visual input (ie + Romberg)**	**EMG, blood work, consider spinal (cervical or thoracic cord imaging) imaging based on EMG**
Neurogenic	**Steppage, dragging of toes**	• **EMG initial testing;** • **BUT if there is a foot drop, lumbar spine MRI is appropriate without EMG** • **Pelvis MR if there is evidence of plexopathy**
Vestibular	**Insecure, veer to one side, worse when eyes closed, vertigo**	**Consider Brain/IAC MRI see Brain MRI Guideline**

Ossification Posterior Longitudinal Ligament (OPLL)[17] – Most common in cervical spine (rare but more severe in thoracic spine).

Table 2: CT and Cutaneous Stigmata[69]

Risk Stratification for Various Cutaneous Markers		
High Risk	Intermediate Risk	Low Risk
• Hypertrichosis • Infantile hemangioma • Atretic meningocele • DST • Subcutaneous lipoma • Caudal appendage • Segmental hemangiomas in association with LUMBAR‡ syndrome	• Capillary malformations (also referred to as NFS or salmon patch when pink and poorly defined or PWS when darker red and well-defined)	• Coccygeal dimple • Light hair • Isolated café au lait spots • Mongolian spots • Hypo- and hypermelanotic macules or papules • Deviated or forked gluteal cleft • Nonmidline lesions
‡LUMBAR, lower body hemangioma and other cutaneous defects, urogenital abnormalities, ulcerations, myelopathy, bony defects, anorectal malformations, arterial anomalies, and renal anomalies.		

Neck and Back Pain with Cancer History – Bone is the third most common site of metastases after the liver and the lungs, and approximately two-thirds of all osseous metastases occur in the spine. Approximately 60–70% of patients with systemic cancer will have spinal metastasis. Radiographic (x-ray) examination should be performed in cases of back pain when a patient has a cancer history, but without known active cancer or a tumor that tends to metastasize to the spine. This can make a diagnosis in many cases. This may occasionally allow for selection of bone scan in lieu of MRI in some cases. When radiographs do not answer the clinical question, then MRI may be appropriate after a consideration of conservative care.

"Neoplasms causing VCF (vertebral compression fractures) include 1) primary bone neoplasms, such as hemangioma (aggressive type) or giant cell tumors, and tumor-like conditions causing bony and cellular remodeling, such as aneurysmal bone cysts, or Paget's disease (osteitis deformans); 2) primary malignant neoplasms including but not limited to multiple myeloma and lymphoma; and 3) metastatic neoplasms."[26]

Most common spine metastasis involving primary metastasis originate from the following tumors in descending order: breast (21%), lung (19%), prostate (7.5%), renal (5%), gastrointestinal (4.5%), and thyroid (2.5%). While all tumors can seed to the spine, the cancers mentioned above metastasize to the spinal column early in the disease process.[36]

CT Myelogram – Myelography is the instillation of intrathecal contrast media under fluoroscopy. Patients are then imaged with CT to evaluate for spinal canal pathology. Although this technique has diminished greatly due to the advent of MRI due to its non-invasiveness and

superior soft-tissue contrast, myelography is still a useful technique for conventional indications, such as spinal stenosis, when MRI is contraindicated or nondiagnostic or surgeon preference (see guidelines above), brachial plexus injury in neonates, radiation therapy treatment planning, and cerebrospinal fluid (CSF) leak.[70, 71]

Drop Metastases[72] – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas and less commonly choroid plexus neoplasms and teratomas.

Leptomeningeal Carcinomatosis[73] – Leptomeningeal carcinomatosis is a complication of cancer in which cancerous cells spread to the membranes (meninges) that covers the brain and spinal cord. The most common solid tumors that involve the leptomeninges are breast, lung, melanoma, gastrointestinal, and primary central nervous system tumors.

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POLICY HISTORY

Date	Summary
May 2023	• Updated references • Updated background section • Clarified pathological reflexes • Added pseudoarthrosis to surgery section • Added "Further evaluation of indeterminate or questionable findings on prior imaging": • Clarified cerebellar ataxia in gait table • Added: "Initial evaluation of trigeminal neuralgia not explained on recent Brain imaging" • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Removed Additional Resources
March 2022	• Added o Combination request for overlapping body part statement o Clarified muscle weakness no related to plexopathy or peripheral neuropathy o Clarified bowel and bladder dysfunction – not related to an inherent bowel or bladder problem o Clarified isolated neck pain in pediatric patient o Clarified CT myelogram section o Added subsection for cervical and thoracic spine section for syrinx and syringomyelia o Descriptions for tethered cord o Background section of Drop Metastases o Background section of Leptomeningeal Carcinomatosis o Clarified toe walking in pediatric patient with myelopathy for cervical spine • Removed o Removed from combination section syrinx and syringomyelia and added subsection for cervical and thoracic spine section o Removed pediatric back pain from the total spine combination section

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **THORACIC SPINE CT**	**Original Date: September 1997**
CPT Codes: 72128, 72129, 72130	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_043	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR THORACIC SPINE CT

+If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- **Inconclusive or show a need for additional or follow up imaging evaluation OR**
- **The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient (the entire spinal cord and/or autonomic postganglionic chain must be assessed)**

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of neurologic deficits when Thoracic Spine MRI is contraindicated or inappropriate[1-3]

- With any of the following new neurological deficits documented on physical exam
    - Extremity muscular weakness (and not likely caused by plexopathy, or peripheral neuropathy)[4, 5]
    - Pathologic (e.g., Babinski, Chaddock Sign) reflexes

- Pathologic (e.g., Babinski, Lhermitte's sign, Chaddock Sign, Hoffman's and other upper motor neuron signs); **OR** abnormal deep tendon reflexes (and not likely caused by plexopathy, or peripheral neuropathy)
- Absent/decreased sensory changes along a particular thoracic dermatome (nerve distribution): pin prick, touch, vibration, proprioception, or temperature weakness (and not likely caused by plexopathy, or peripheral neuropathy)
- Upper or lower extremity increase muscle tone/spasticity and likely localized to the thoracic spinal cord
- New onset bowel or bladder dysfunction (e.g., retention or incontinence) - not related to an inherent bowel or bladder process
- Gait abnormalities (see Table 1 for more details)

- Suspected cord compression with any neurological deficits as listed above

For evaluation of back pain with any of the following when Thoracic Spine MRI is contraindicated[6-9]

- With new or worsening objective neurologic deficits on exam, as above
- Failure of conservative treatment* for at least six (6) weeks within the last six (6) months[10]
- With progression or worsening of symptoms during the course of conservative treatment*
- With an abnormal electromyography (EMG) or nerve conduction study (if performed) indicating a thoracic radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain)[11]
- Isolated back pain in pediatric population[12] – conservative care not required if red flags present. Red flags that prompt imaging include any of the following:
  - Age 5 or younger, **OR**
  - Constant pain, **OR**
  - Pain lasting > 4 weeks, **OR**
  - Abnormal neurologic examination, **OR**
  - Early morning stiffness and/or gelling, **OR**
  - Night pain that prevents or disrupts sleep, **OR**
  - Radicular pain, **OR**
  - Fever or weight loss or malaise, **OR**
  - Postural changes (e.g., kyphosis or scoliosis), **OR**
  - Limp (or refusal to walk in a younger child < 5yo)

As part of initial pre-operative/post-operative/procedural evaluation ("CT best examination to assess for hardware complication, extent of fusion and pseudoarthrosis"[13, 14] and MRI for cord, nerve root compression, disc pathology, or post-op infection)

If ordered by Neurosurgeon or orthopedic surgeon for purposes of surgical planning. A contraindication to MRI is not required

- For preoperative evaluation/planning
- CT discogram
- Evaluation of post operative pseudoarthrosis after initial x-rays (CT should not be done before 6 months after surgery)
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula -preferred exam CT myelogram)[15]
- Prior to spinal cord stimulator to exclude canal stenosis if no prior imaging of the thoracic spine has been done recently and MRI is contraindicated
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery in the last 6 months. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested (routine surveillance post-op not indicated without symptoms)
- Surgical infection as evidenced by signs/symptoms, laboratory, or prior imaging findings
- New or changing neurological deficits or symptoms post-operatively [13, 16] - see neurological deficit section above
- When combo requests are submitted (i.e., MRI and CT of the spine), the office notes should clearly document the need for both studies to be done simultaneously, i.e., the need for both soft tissue and bony anatomy is required[17]
    - Combination requests where both thoracic spine CT and MRI thoracic spine are both approvable (not an all-inclusive list):
        - OPLL (Ossification of posterior longitudinal ligament)
            - Most common in cervical spine (rare but more severe in thoracic spine)[18]
        - Pathologic or complex fractures
        - Malignant process of spine with both bony and soft tissue involvement
        - Clearly documented indication for bony and soft tissue abnormality where assessment will change management for the patient

For evaluation of suspected myelopathy when Thoracic Spine MRI is contraindicated[19-23]

- Does NOT require conservative care
- Progressive symptoms including unsteadiness; broad-based gait; increased muscle tone; pins and needles sensation; weakness and wasting of the lower limbs; diminished sensation to light touch, temperature, proprioception, and vibration; limb hyperreflexia and pathologic reflexes; bowel and bladder dysfunction in more severe cases
- Any of the neurological deficits as noted above

For evaluation of trauma or acute injury[24]

- Presents with any of the following neurological deficits as above
- With progression or worsening of symptoms during the course of a trial of conservative treatment*
- History of underlying spinal abnormalities (i.e., ankylosing spondylitis, diffuse idiopathic skeletal hyperostosis) (Both MRI and CT would be approvable)[25-27]
- When the patient is clinically unevaluable or there are preliminary imaging findings (x-ray or CT) needing further evaluation

("MRI and CT provide complementary information. When indicated It is appropriate to perform both examinations")[24]

For evaluation of known fracture or known/new compression fractures with worsening back pain[24, 28]

- To assess union of a fracture when physical examination, plain radiographs, or prior imaging suggest delayed or non-healing
- To determine the position of fracture fragments
- With history of malignancy (if MRI is contraindicated or cannot be performed)
- With an associated new focal neurologic deficit as above[29]
- Prior to a planned surgery/intervention or if the results of the CT will change management

CT myelogram: When MRI cannot be performed/contraindicated/surgeon preference[30-34]

- When signs and symptoms are inconsistent or not explained by the MRI findings
- Demonstration of the site of a CSF leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula)
- Surgical planning, especially regarding to the nerve roots or evaluation of dural sac

For evaluation of tumor, cancer, or metastasis with any of the following:

(MRI is usually the preferred study- CT may be needed to further characterize solitary indeterminate lesions seen on MRI)[35]

- **Primary tumor**
    - Initial staging primary spinal tumor[36]
    - Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
    - Known spinal tumor with new signs or symptoms (e.g., new or increasing nontraumatic pain, physical, laboratory, and/or imaging findings)
    - With an associated new focal neurologic deficit as above[29]

- **Metastatic tumor**
    - With evidence of metastasis on bone scan needing further clarification OR inconclusive findings on a prior imaging exam
    - With an associated new focal neurologic deficit[29]
    - Known malignancy with new signs or symptoms (e.g., new or increasing nontraumatic pain, radiculopathy or neck pain that occurs at night and wakes the patient from sleep with known active cancer, physical, laboratory, and/or imaging findings) in a tumor that tends to metastasize to the spine[37, 38]

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification. When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.) (When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding.)

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated, OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine, or Lumbar Spine

For evaluation of known or suspected infection (osteomyelitis), abscess or inflammatory disease when Thoracic MRI is contraindicated or cannot be performed[39, 40]

- As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings[41]
- Follow-up imaging of infection
    - With worsening symptoms/laboratory values (i.e., white blood cell count, ESR/CRP) or radiographic findings[42]

Spondyloarthropathies

- Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and appropriate rheumatology workup

For evaluation of spine abnormalities related to immune system suppression, e.g., HIV, chemotherapy, leukemia, or lymphoma when Thoracic MRI is contraindicated[39]

- As evidenced by signs/symptoms, laboratory, or prior imaging findings

Other Indications for a Thoracic Spine CT when MRI is contraindicated or cannot be performed

(Note- See combination requests, below, for initial advanced imaging assessment and pre-operatively)

- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata[43-45]
- Known Arnold-Chiari syndrome (For initial imaging (one-time initial modality assessment) see combination below)
    - Known Chiari I malformation without syrinx or hydrocephalus, follow-up imaging after initial diagnosis with new or changing signs/symptoms or exam findings consistent with spinal cord pathology[46]
    - Known Chiari II (Arnold-Chiari syndrome), III, or IV malformation
- Syrinx or syringomyelia (known or suspected)
    - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis)[47]
    - To further characterize a suspicious abnormality seen on prior imaging
    - Known syrinx with new/worsening symptoms
- Toe walking in a child with signs/symptoms of myelopathy localized to the Thoracic Spine
- Suspected neuroinflammatory Conditions/Diseases (e.g., sarcoidosis, Behcet's)
    - After detailed neurological exam and appropriate initial work up

COMBINATION STUDIES WITH THORACIC SPINE CT WHEN MRI IS CONTRAINDICATED OR CANNOT BE PERFORMED OR SURGEON PREFERENCE

Cervical and Thoracic CT

- Initial evaluation of known or suspected syrinx or syringomyelia
    - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis[47])
    - To further characterize a suspicious abnormality seen on prior imaging
    - Known syrinx with new/worsening symptom

Any combination of Cervical and/or Thoracic and/or Lumbar CTs

Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history, and other available information, including prior imaging.

Exception- Indications for combination studies[48, 49]: Are approved indications as noted below and being performed in children who will need anesthesia for the procedure

- Any combination of these studies for:

    - Survey/complete initial assessment of infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10[50-52] (e.g., congenital scoliosis, idiopathic scoliosis, scoliosis with vertebral anomalies)
    - In the presence of neurological deficit, progressive spinal deformity, or for preoperative planning[53]
    - Back pain with known vertebral anomalies (hemivertebrae, hypoplasia, agenesis, butterfly, segmentation defect, bars, or congenital wedging) in a child on preliminary imaging
    - Scoliosis with any of the following[54]:
        - Progressive spinal deformity;
        - Neurologic deficit (new or unexplained);
        - Early onset;
        - Atypical curve (e.g., short segment, >30' kyphosis, left thoracic curve, associated organ anomalies);
        - Pre-operative planning; OR
        - When office notes clearly document how imaging will change management
- Arnold-Chiari malformations[55, 56]
    - Arnold-Chiari I
        - For evaluation of spinal abnormalities associated with initial diagnosis of Arnold-Chiari Malformation. (C/T/L spine due to association with tethered cord and syringomyelia), and initial imaging has not been completed[44, 50]
    - Arnold-Chiari II-IV - For initial evaluation and follow-up as appropriate
        - Usually associated with open and closed spinal dysraphism, particularly meningomyelocele)
- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata,[43-45] when anesthesia required for imaging[57] (e.g., meningomyelocele, lipomeningomyelocele, diastematomyelia, fatty/thickened filum terminale, and other spinal cord malformations)
- Oncological Applications (e.g., primary nervous system, metastatic)
    - Drop metastasis from brain or spine (imaging also includes brain; CT spine imaging in this scenario is usually CT myelogram)- See Overview
    - Suspected leptomeningeal carcinomatosis (LC)[58]- See Overview
    - Any combination of these for spinal survey in patient with metastases
    - Tumor evaluation and monitoring in neurocutaneous syndromes
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula -preferred exam CT myelogram))[15]

- CT myelogram when meets above guidelines and MRI is contraindicated or for surgical planning
- Post-procedure (discogram) CT

BACKGROUND

Computed tomography is used for the evaluation, assessment of severity, and follow-up of diseases of the spine. Its use in the thoracic spine is limited, however, due to the lack of epidural fat in this part of the body. CT myelography improves the contrast severity of CT, but it is also invasive. CT may be used for conditions, e.g., degenerative changes, infection, and immune suppression, when magnetic resonance imaging (MRI) is contraindicated. It may also be used in the evaluation of tumors, cancer, or metastasis in the thoracic spine, and it may be used for preoperative and post-surgical evaluations. CT obtains images from different angles and uses computer processing to show a cross-section of body tissues and organs. CT is fast and is often performed in acute settings. It provides good visualization of cortical bone.

OVERVIEW

***Conservative Therapy** – (Spine) should include a multimodality approach consisting of a **combination of active and inactive components**. Inactive components, such as rest, ice, heat, modified activities, medical devices, acupuncture and/or stimulators, medications, injections (epidural, facet, bursal, and/or joint, not including trigger point), and diathermy can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, regular osteopathic manipulative medicine treatments (OMT), and/or chiropractic care when considered safe and appropriate.

****Home Exercise Program - (HEP)/Therapy** – the following elements are required to meet guidelines for completion of conservative therapy[9, 14]:

- Information provided on exercise prescription/plan AND
- Follow-up with member with documentation provided regarding lack of improvement (failed) after completion of HEP (after suitable 6-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute "inability to complete" HEP).
- Dates and duration of failed PT, physician-supervised HEP, or chiropractic treatment should be documented in the original office notes or an addendum to the notes.

Table 1: Gait and spine imaging[59-64]

Gait	Characteristic	Work up/Imaging
Hemiparetic	**Spastic unilateral, circumduction**	**Brain and/or, Cervical spine imaging based on associated symptoms**
Diplegic	**Spastic bilateral, circumduction**	**Brain, Cervical and Thoracic Spine imaging**
Myelopathic	**Wide based, stiff, unsteady**	**Cervical and/or Thoracic spine MRI based on associated symptoms**
Cerebellar ataxic	**Broad based, clumsy, staggering, lack of coordination, usually also with limb ataxia**	**Brain imaging see Brain MRI Guideline**
Apraxic	**Magnetic, shuffling, difficulty initiating**	**Brain imaging see Brain MRI Guideline**
Parkinsonian	**Stooped, small steps, rigid, turning en bloc, decreased arm swing**	**Brain Imaging see Brain MRI Guideline**
Choreiform	**Irregular, jerky, involuntary movements**	**Medication review, consider brain imaging as per movement disorder Brain MR guidelines**
Sensory ataxic	**Cautious, stomping, worsening without visual input (ie + Romberg)**	**EMG, blood work, consider spinal (cervical or thoracic cord imaging) imaging based on EMG**
Neurogenic	**Steppage, dragging of toes**	• **EMG initial testing;** • **BUT if there is a foot drop, lumbar spine MRI is appropriate without EMG** • **Pelvis MR if there is evidence of plexopathy**
Vestibular	**Insecure, veer to one side, worse when eyes closed, vertigo**	**Consider Brain/IAC MRI see Brain MRI Guideline**

Myelopathy – Symptom severity varies, and a high index of suspicion is essential for making the proper diagnosis in early cases. Symptoms of pain and radiculopathy may not be present. The natural history of myelopathy is characterized by neurological deterioration. The most frequently encountered symptom is gait abnormality (86%), followed by increased muscular reflexes (79.1%), pathological reflexes (65.1%), paresthesia of upper limb (69.8%), and pain (67.4%).[65]

CT Myelogram – Myelography is the instillation of intrathecal contrast media under fluoroscopy. Patients are then imaged with CT to evaluate for spinal canal pathology. Although this technique has diminished greatly due to the advent of MRI and its non-invasiveness and

superior soft-tissue contrast, myelography is still a useful technique for conventional indications, such as spinal stenosis, when MRI is contraindicated, nondiagnostic or surgeon preference (see guidelines above), brachial plexus injury in neonates, radiation therapy treatment planning, and cerebrospinal fluid (CSF) leak.[66]

Back Pain with Cancer History – Bone is the third most common site of metastases after the liver and the lungs, and approximately two-thirds of all osseous metastases occur in the spine. Approximately 60–70% of patients with systemic cancer will have spinal metastasis. Radiographic (x-ray) examination should be performed in cases of back pain when a patient has a cancer history, but without known active cancer or a tumor that tends to metastasize to the spine. This can make a diagnosis in many cases. This may occasionally allow for selection of bone scan in lieu of MRI in some cases. When radiographs do not answer the clinical question, then MRI may be appropriate after a consideration of conservative care.

"Neoplasms causing VCF (vertebral compression fractures) include1) primary bone neoplasms, such as hemangioma (aggressive type) or giant cell tumors, and tumor-like conditions causing bony and cellular remodeling, such as aneurysmal bone cysts, or Paget's disease (osteitis deformans); ; 2) primary malignant neoplasms including but not limited to multiple myeloma and lymphoma; and 3) metastatic neoplasms, including and not limited to, multiple myeloma and lymphoma, and metastatic neoplasms."[28]

Most common spine metastasis involving primary metastasis originate from the following tumors in descending order: breast (21%), lung (19%), prostate (7.5%), renal (5%), gastrointestinal (4.5%), and thyroid (2.5%). While all tumors can seed to the spine, the cancers mentioned above metastasize to the spinal column early in the disease process.[37]
Drop Metastases[67] – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas and less commonly choroid plexus neoplasms and teratomas.

Leptomeningeal Carcinomatosis[68] – Leptomeningeal carcinomatosis is a complication of cancer in which cancerous cells spread to the membranes (meninges) that covers the brain and spinal cord. The most common solid tumors that involve the leptomeninges are breast, lung, melanoma, gastrointestinal, and primary central nervous system tumors.

Table 2: CT and Cutaneous Stigmata[69]

Risk Stratification for Various Cutaneous Markers		
High Risk	Intermediate Risk	Low Risk
• Hypertrichosis • Infantile hemangioma • Atretic meningocele • DST • Subcutaneous lipoma • Caudal appendage • Segmental hemangiomas in association with LUMBAR‡ syndrome	• Capillary malformations (also referred to as NFS or salmon patch when pink and poorly defined or PWS when darker red and well-defined)	• Coccygeal dimple • Light hair • Isolated café au lait spots • Mongolian spots • Hypo- and hypermelanotic macules or papules • Deviated or forked gluteal cleft • Nonmidline lesions
‡LUMBAR, lower body hemangioma and other cutaneous defects, urogenital abnormalities, ulcerations, myelopathy, bony defects, anorectal malformations, arterial anomalies, and renal anomalies.		

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POLICY HISTORY

Date	Summary
May 2023	• Updated references • Updated background section • Clarified pathological reflexes • Added pseudoarthrosis to surgery section • Added "Further evaluation of indeterminate or questionable findings on prior imaging": • Clarified cerebellar ataxia in gait table • Removed radicular pain and malaise from Isolated Back Pain in the Pediatric population: Red flags. • Removed Additional Resources • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
March 2022	Added • Combination request for overlapping body part statement • Clarified muscle weakness not related to plexopathy or peripheral neuropathy • Clarified bowel and bladder dysfunction – not related to an inherent bowel or bladder problem • Descriptions for tethered cord • Clarified CT myelogram section • Background section of Drop Metastases • Background section of Leptomeningeal Carcinomatosis • Clarified toe walking in pediatric patient with myelopathy for thoracic spine Removed • Removed from combination section syrinx and syringomyelia and added subsection for cervical and thoracic spine section • Removed pediatric back pain from the total spine combination section

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines: **LUMBAR SPINE CT**	**Original Date: September 1997**
CPT Codes: 72131, 72132, 72133	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_045	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR LUMBAR SPINE CT

+If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- **Inconclusive or show a need for additional or follow up imaging evaluation OR**
- **The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.**

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of neurologic deficits when Lumbar Spine MRI is contraindicated or inappropriate

- With any of the following new neurological deficits documented on physical exam
  - Extremity muscular weakness (and not likely caused by plexopathy, or peripheral neuropathy)[1, 2]
  - Pathologic or abnormal reflexes (and not likely caused by plexopathy, or peripheral neuropathy)

    - Absent/decreased sensory changes along a particular lumbar dermatome (nerve distribution): pin prick, touch, vibration, proprioception or temperature (and not likely caused by plexopathy, or peripheral neuropathy)
    - Lower extremity increased muscle tone
    - New onset bowel or bladder dysfunction (e.g., retention or incontinence)- not related to an inherent bowel or bladder process
    - Gait abnormalities (see Table 1 for more details)
    - New onset foot drop (Not related to a peripheral nerve injury, e.g., peroneal nerve)
- Cauda Equina Syndrome as evidence by severe back pain/sciatica along with one of the defined symptoms (see Overview section)

For evaluation of back pain with any of the following when Lumbar Spine MRI is contraindicated[3-11]

- With new or worsening objective neurologic deficits* on exam, as above
- Failure of conservative treatment* for at least six (6) weeks within the last six (6) months
- With progression or worsening of symptoms during the course of conservative treatment*
- With an abnormal electromyography (EMG) or nerve conduction study (if performed) indicating a lumbar radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain[12])
- Isolated back pain in pediatric population[13] - conservative care not required if red flags present. Red flags that prompt imaging include any of the following:
    - Age 5 or younger, **OR**
    - Constant pain, **OR**
    - Pain lasting > 4 weeks, **OR**
    - Abnormal neurologic examination, **OR**
    - Early morning stiffness and/or gelling, **OR**
    - Night pain that prevents or disrupts sleep, **OR**
    - Radicular pain, **OR**
    - Fever or weight loss or malaise, **OR**
    - Postural changes (e.g., kyphosis or scoliosis), **OR**
    - Limp (or refusal to walk in a younger child)[14, 15]

As part of initial pre-operative/post-operative/procedural evaluation ("CT best examination to assess for hardware complication, extent of fusion and pseudoarthrosis"[11, 16] and MRI for cord, nerve root compression, disc pathology, or post-op infection)

[Note: If ordered by Neurosurgeon or orthopedic surgeon for purposes of surgical planning, a contraindication to MRI is not required.]

- For preoperative evaluation/planning

- CT discogram
- Evaluation of post operative pseudoarthrosis after initial x-rays (CT should not be done before 6 months after surgery)
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula -preferred exam CT myelogram))[17]
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery in the last 6 months. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested (routine surveillance post-op not indicated without symptoms)
- Surgical infection as evidenced by signs/symptoms, laboratory, or prior imaging findings
- New or changing neurological deficits or symptoms post-operatively[16, 18] - see neurological deficit section above
- When combo requests are submitted (see above statement[+]) (i.e., MRI and CT of the spine), the office notes should clearly document the need for both studies to be done simultaneously, i.e., the need for both soft tissue and bony anatomy is required[19]
    - Combination requests where both lumbar spine CT and MRI lumbar spine are both approvable (not an all-inclusive list):
        - Pathologic or complex fractures
        - Malignant process of spine with both bony and soft tissue involvement
        - Clearly documented indication for bony and soft tissue abnormality where assessment will change management for the patient

For evaluation of trauma or acute injury[20]

- Presents with any of the following neurological deficits as above
- With progression or worsening of symptoms during the course of conservative treatment*
- History of underlying spinal abnormalities (i.e., ankylosing spondylitis or diffuse idiopathic skeletal hyperostosis) (Both MRI and CT would be approvable)[21]
- When the patient is clinically unevaluable or there are preliminary imaging findings (x-ray or CT) needing further evaluation

("MRI and CT provide complementary information. When indicated it is appropriate to perform both examinations")[20]

For evaluation of known fracture or new compression fractures with worsening back pain[20, 22]

- To assess union of a fracture when physical examination, plain radiographs, or prior imaging suggest delayed or non-healing
- To determine the position of fracture fragments

- With history of malignancy (if MRI is contraindicated or cannot be performed)
- With an associated new focal neurologic deficit as above[23]
- Prior to a planned surgery/intervention or if the results of the CT will change management

CT myelogram: When MRI cannot be performed/contraindicated/surgeon preference

- When signs and symptoms are inconsistent or not explained by the MRI findings[24-28]
- Demonstration of the site of a CSF leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula)
- Surgical planning, especially regarding to the nerve roots or evaluation of dural sac

Pars defect (spondylolysis) or spondylolisthesis

- Pars defect (spondylolysis) or spondylolisthesis in adults when Flexion/Extension x-rays show instability
- Clinically suspected Pars defect (spondylolysis) which is not seen on plain films in pediatric population (<18 yr) (flexion extension instability not required) and imaging would change treatment[29-31] when MRI is contraindicated/cannot be performed or surgeon preference

NOTE: Initial imaging (x-ray, or planar bone scan without SPECT; Bone scan with SPECT is superior to MRI and CT in the detection of pars interarticularis pathology including spondylolysis)[32]

For evaluation of tumor, cancer, or metastasis with any of the following:

(MRI is usually the preferred study- CT may be needed to further characterize solitary indeterminate lesions seen on MRI)[33, 34]

- **Primary tumor**
    - Initial staging primary spinal tumor[35]
    - Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
    - Known spinal tumor with new signs or symptoms (e.g., new or increasing nontraumatic pain, physical, laboratory, and/or imaging findings)
    - With an associated new focal neurologic deficit as above[23]
- **Metastatic tumor**
    - With evidence of metastasis on bone scan needing further clarification OR inconclusive findings on a prior imaging exam
    - With an associated new focal neurologic deficit[23]
    - Known malignancy with new signs or symptoms (e.g., new or increasing nontraumatic pain, radiculopathy or back pain that occurs at night and wakes

the patient from sleep with known active cancer, physical, laboratory, and/or imaging findings) in a tumor that tends to metastasize to the spine[36, 37]

Further evaluation of indeterminate or questionable findings on prior imaging.

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification. When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding [36]
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam (When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding [36]

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of known or suspected infection (osteomyelitis), abscess or inflammatory disease when Lumbar Spine MRI is contraindicated[4, 38, 39,42]

- **Infection:**
  - As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings[40]
  - Follow-up imaging of infection
    - With worsening symptoms/laboratory values (i.e., white blood cell count, ESR/CRP) or radiographic findings[41]
- **Spondyloarthropathies**
  - Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and rheumatology workup

For evaluation of spine abnormalities related to immune system suppression, e.g., HIV, chemotherapy, leukemia, or lymphoma, and Lumbar Spine MRI is contraindicated[38]

- As evidenced by signs/symptoms, laboratory, or prior imaging findings

Other Indications for a Lumbar Spine CT when MRI is contraindicated or cannot be performed

(Note- See combination requests, below, for initial advanced imaging assessment and pre-operatively)

- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata[42-44]
- Known anorectal malformations[45, 46]

- Suspicious sacral dimple (those that are deep, larger than 0.5 cm, located within the superior portion of the gluteal crease or above the gluteal crease, multiple dimples, or associated with other cutaneous markers) (D'Alessandro, 2009) or duplicated or deviated gluteal cleft[47]
    - in patients ≤ 3 months should have ultrasound
- Toe walking in a child when associated with upper motor neuron signs, including hyperreflexia, spasticity; or orthopedic deformity with concern for spinal cord pathology/tethered cord (e.g., pes cavus, clawed toes, leg, or foot length deformity (excluding tight heel cords))
- Known Chiari II (Arnold-Chiari syndrome), III, or IV malformation
- For follow-up/repeat evaluation of Arnold-Chiari I with new signs or symptoms suggesting recurrent spinal cord tethering (For initial diagnosis see below)
- Suspected neuroinflammatory Conditions/Diseases (e.g., sarcoidosis, Behcet's)
    - After detailed neurological exam and appropriate initial work up completed

COMBINATION STUDIES WITH LUMBAR SPINE CT WHEN MRI IS CONTRAINDICATED OR CANNOT BE PERFORMED OR SURGEON PREFERENCE

Any combination of Cervical and/or Thoracic and/or Lumbar CTs

Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history, and other available information, including prior imaging.

Exception- Indications for combination studies[48, 49]: Are approved indications as noted below and being performed in children who will need anesthesia for the procedure

- Any combination of these studies for:
    - Survey/complete initial assessment of infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10[50-52] (e.g., congenital scoliosis, idiopathic scoliosis, scoliosis with vertebral anomalies)
    - In the presence of neurological deficit, progressive spinal deformity, or for preoperative planning[53]
    - Back pain with known vertebral anomalies (hemivertebrae, hypoplasia, agenesis, butterfly, segmentation defect, bars, or congenital wedging) in a child on preliminary imaging
    - Scoliosis with any of the following[54]:
        - Progressive spinal deformity;
        - Neurologic deficit (new or unexplained);
        - Early onset;
        - Atypical curve (e.g., short segment, >30' kyphosis, left thoracic curve, associated organ anomalies);
        - Pre-operative planning; OR

        - When office notes clearly document how imaging will change management
- Arnold-Chiari malformations[55, 56]
    - Arnold-Chiari I
        - For evaluation of spinal abnormalities associated with initial diagnosis of Arnold-Chiari Malformation. (C/T/L spine due to association with tethered cord and syringomyelia), and initial imaging has not been completed[44, 50]
    - Arnold-Chiari II-IV - For initial evaluation and follow-up as appropriate
        - Usually associated with open and closed spinal dysraphism, particularly meningomyelocele)
- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata,[42-44] when anesthesia required for imaging[57] (e.g., meningomyelocele, lipomeningomyelocele, diastematomyelia, fatty/thickened filum terminale, and other spinal cord malformations)
- Oncological Applications (e.g., primary nervous system, metastatic)
    - Drop metastasis from brain or spine (imaging also includes brain; CT spine imaging in this scenario is usually CT myelogram)- See Overview
    - Suspected leptomeningeal carcinomatosis (LC)[58]- See Overview
    - Any combination of these for spinal survey in patient with metastases
    - Tumor evaluation and monitoring in neurocutaneous syndromes
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula -preferred exam CT myelogram))[17]
- CT myelogram when meets above guidelines and MRI is contraindicated or for surgical planning
- Post-procedure (discogram) CT

BACKGROUND

Computed tomography is used for the evaluation, assessment of severity, and follow-up of diseases of the spine. Its use in the thoracic spine is limited, however, due to the lack of epidural fat in this part of the body. CT myelography improves the contrast severity of CT, but it is also invasive. CT may be used for conditions, e.g., degenerative changes, infection, and immune suppression, when magnetic resonance imaging (MRI) is contraindicated. It may also be used in the evaluation of tumors, cancer, or metastasis in the thoracic spine, and it may be used for preoperative and post-surgical evaluations. CT obtains images from different angles

and uses computer processing to show a cross-section of body tissues and organs. CT is fast and is often performed in acute settings. It provides good visualization of cortical bone.

OVERVIEW

***Conservative Therapy** – This should include a multimodality approach consisting of a **combination of active and inactive components**. Inactive components, such as rest, ice, heat, modified activities, medical devices, acupuncture and/or stimulators, medications, injections (epidural, facet, bursal, and/or joint, not including trigger point), and diathermy can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, regular Osteopathic Manipulative medicine treatments or chiropractic care when considered safe and appropriate.

****Home Exercise Program - (HEP)/Therapy** – the following elements are required to meet guidelines for completion of conservative therapy[4, 11]:

- Information provided on exercise prescription/plan; AND
- Follow-up with member with documentation provided regarding lack of improvement (failed) after completion of HEP (after suitable 6-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute "inability to complete" HEP).
- Dates and duration of failed PT, physician-supervised HEP, or chiropractic treatment should be documented in the original office notes or an addendum to the notes.

Table 1: Gait and spine imaging[59-64]

Gait	Characteristic	Work up/Imaging
Hemiparetic	Spastic unilateral, circumduction	Brain and/or, Cervical spine imaging based on associated symptoms
Diplegic	Spastic bilateral, circumduction	Brain, Cervical and Thoracic Spine imaging
Myelopathic	Wide based, stiff, unsteady	Cervical and/or Thoracic spine MRI based on associated symptoms
Cerebellar ataxic	Broad based, clumsy, staggering, lack of coordination, usually also with limb ataxia	Brain imaging see Brain MRI Guideline
Apraxic	Magnetic, shuffling, difficulty initiating	Brain imaging see Brain MRI Guideline
Parkinsonian	Stooped, small steps, rigid, turning en bloc, decreased arm swing	Brain Imaging see Brain MRI Guideline
Choreiform	Irregular, jerky, involuntary movements	Medication review, consider brain imaging as per movement disorder Brain MR guidelines
Sensory ataxic	Cautious, stomping, worsening without visual input (ie + Romberg)	EMG, blood work, consider spinal (cervical or thoracic cord imaging) imaging based on EMG
Neurogenic	Steppage, dragging of toes	• EMG initial testing; • BUT if there is a foot drop, lumbar spine MRI is appropriate without EMG • Pelvis MR if there is evidence of plexopathy
Vestibular	Insecure, veer to one side, worse when eyes closed, vertigo	Consider Brain/IAC MRI see Brain MRI Guideline

Table 2: CT and Cutaneous Stigmata[65]

Risk Stratification for Various Cutaneous Markers		
High Risk	Intermediate Risk	Low Risk
• Hypertrichosis • Infantile hemangioma • Atretic meningocele • DST • Subcutaneous lipoma • Caudal appendage • Segmental hemangiomas in association with LUMBAR‡ syndrome	• Capillary malformations (also referred to as NFS or salmon patch when pink and poorly defined or PWS when darker red and well-defined)	• Coccygeal dimple • Light hair • Isolated café au lait spots • Mongolian spots • Hypo- and hypermelanotic macules or papules • Deviated or forked gluteal cleft • Nonmidline lesions
‡LUMBAR, lower body hemangioma and other cutaneous defects, urogenital abnormalities, ulcerations, myelopathy, bony defects, anorectal malformations, arterial anomalies, and renal anomalies.		

Tethered spinal cord syndrome – a neurological disorder caused by tissue attachments that limit the movement of the spinal cord within the spinal column. Although this condition is rare, it can continue undiagnosed into adulthood. The primary cause is myelomeningocele and lipomyelomeningocele; the following are other causes that vary in severity of symptoms and treatment.

- Dermal sinus tract (a rare congenital deformity)
- Diastematomyelia (split spinal cord)
- Lipoma
- Tumor
- Thickened/tight filum terminale
- History of spine trauma/surgery
- Arnold-Chiari Malformation

Sacral Dimples – Simple midline dimples are the most commonly encountered dorsal cutaneous stigmata in neonates and indicate low risk for spinal dysraphism. Only atypical dimples are associated with a high risk for spinal dysraphism, particularly those that are large (>5 mm), high on the back (>2.5 cm from the anus), or appear in combination with other lesions.[66] High-risk cutaneous stigmata in neonates include hemangiomas, upraised lesions (i.e., masses, tails, and hairy patches), and multiple cutaneous stigmata (**Table 2**).

Back Pain with Cancer History – Bone is the third most common site of metastases after the liver and the lungs, and approximately two-thirds of all osseous metastases occur in the spine.

Approximately 60–70% of patients with systemic cancer will have spinal metastasis. Radiographic (x-ray) examination should be performed in cases of back pain when a patient has a cancer history, but without known active cancer or a tumor that tends to metastasize to the spine. This can make a diagnosis in many cases. This may occasionally allow for selection of bone scan in lieu of MRI in some cases. When radiographs do not answer the clinical question, then MRI may be appropriate after a consideration of conservative care.

"Neoplasms causing VCF (vertebral compression fractures) include: 1) primary bone neoplasms, such as hemangioma (aggressive type) or giant cell tumors, and tumor-like conditions causing bony and cellular remodeling, such as aneurysmal bone cysts, or Paget's disease (osteitis deformans), 2) primary malignant neoplasms including but not limited to multiple myeloma and lymphoma and 3) metastatic neoplasms."[22]

Most common spine metastasis involving primary metastasis originate from the following tumors in descending order: breast (21%), lung (19%), prostate (7.5%), renal (5%), gastrointestinal (4.5%), and thyroid (2.5%). While all tumor can seed to the spine, the cancers mentioned above metastasize to the spinal column early in the disease process.[37]

CT Myelogram – Myelography is the instillation of intrathecal contrast media under fluoroscopy. Patients are then imaged with CT to evaluate for spinal canal pathology. Although this technique has diminished greatly due to the advent of MRI due to its non-invasiveness and superior soft-tissue contrast, myelography is still a useful technique for conventional indications, such as spinal stenosis, when MRI is contraindicated, nondiagnostic, or surgeon preference (see guidelines above) brachial plexus injury in neonates, radiation therapy treatment planning, and cerebrospinal fluid (CSF) leak.

Cauda Equina Syndrome

- Symptoms include severe back pain or sciatica along with one or more of the following:
    - Saddle anesthesia - loss of sensation restricted to the area of the buttocks, perineum and inner surfaces of the thighs (areas that would sit on a saddle).
    - Recent bladder/bowel dysfunction
    - Achilles reflex absent on both sides
    - Sexual dysfunction that can come on suddenly
    - Absent anal reflex and bulbocavernosus reflex
- This is a "Red Flag" situation and Lumbar Spine MRI is approvable.

Drop Metastases[67] – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas and less commonly choroid plexus neoplasms and teratomas.

Leptomeningeal Carcinomatosis[68] – Leptomeningeal carcinomatosis is a complication of cancer in which cancerous cells spread to the membranes (meninges) that covers the brain and spinal cord. The most common solid tumors that involve the leptomeninges are breast, lung, melanoma, gastrointestinal, and primary central nervous system tumors.

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POLICY HISTORY

Date	Summary
May 2023	• Updated references • Updated background section • Clarified pathological reflexes • Added pseudoarthrosis to surgery section • Added "Further evaluation of indeterminate or questionable findings on prior imaging": • Clarified cerebellar ataxia in gait table • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Removed Additional Resources
March 2022	Added • Combination request for overlapping body part statement • Clarified muscle weakness no related to plexopathy or peripheral neuropathy • Clarified bowel and bladder dysfunction – not related to an inherent bowel or bladder problem • Descriptions for tethered cord • Clarified CT myelogram section • Background section of Drop Metastases • Background section of Leptomeningeal Carcinomatosis • Clarified toe walking in pediatric patient • Added section on neuroinflammatory conditions Removed • Removed from combination section syrinx and syringomyelia and added subsection for cervical and thoracic spine section Removed pediatric back pain from the total spine combination section

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guideline **CERVICAL SPINE MRI**	**Original Date: September 1997**
CPT Codes: 72141, 72142, 72156, +0698T	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_040	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CERVICAL SPINE MRI

+ If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- **Inconclusive or show a need for additional or follow up imaging evaluation OR**
- **The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.**

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of neurologic deficits[1-6]

- With any of the following new neurological deficits documented on physical exam
  - Extremity muscular weakness (and not likely caused by plexopathy, or peripheral neuropathy)
  - Pathologic (e.g., Babinski, Lhermitte's sign, Chaddock Sign, Hoffman's and other upper motor neuron signs); **OR** abnormal deep tendon reflexes (and not likely caused by plexopathy, or peripheral neuropathy)
  - Absent/decreased sensory changes along a particular cervical dermatome (nerve distribution): pin prick, touch, vibration, proprioception, or temperature (and not likely caused by plexopathy, or peripheral neuropathy)

    - Upper or lower extremity increase muscle tone/spasticity
    - New onset bowel or bladder dysfunction (e.g., retention or incontinence)- not related to an inherent bowel or bladder process
    - Gait abnormalities (see Table 1 for more details)
- Suspected cervical cord compression with any neurological deficits as listed above

For evaluation of neck pain with any of the following[7-9]

- With new or worsening objective neurologic deficits (as listed above) on exam
- Failure of conservative treatment* for at least six (6) weeks within the last six (6) months[10]
- With progression or worsening of symptoms during the course of conservative treatment*
- With an abnormal electromyography (EMG) or nerve conduction study (if performed) indicating a cervical radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain.)[11]
- Isolated back pain in pediatric population[12, 13] – conservative care not required if red flags present.
  Red flags that prompt imaging include any of the following:
    - Age 5 or younger **OR**
    - Constant pain, **OR**
    - Pain lasting > 4 weeks, **OR**
    - Abnormal neurologic examination, **OR**
    - Early morning stiffness and/or gelling; **OR**
    - Night pain that prevents or disrupts sleep; **OR**
    - Radicular pain; **OR**
    - Fever or weight loss or malaise **OR**[14, 15]
    - Postural changes (e.g., kyphosis or scoliosis) **OR**
    - Limp (or refusal to walk in a younger child)

As part of initial pre-operative / post-operative / procedural evaluation ("CT best examination to assess for hardware complication, extent of fusion and pseudoarthrosis"[12, 16] and MRI for cord, nerve root compression, disc pathology or post-op infection)

- For preoperative evaluation/planning
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula))
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery in the last 6 months. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested (routine surveillance post-op not indicated without symptoms)
- Surgical infection as evidenced by signs/symptoms, laboratory, or prior imaging findings

- New or changing neurological deficits or symptoms post-operatively[16, 17] - see neurological deficit section above
- When combo requests (see above statement[+]) are submitted (e.g., MRI and CT of the spine), the office notes should clearly document the need for both studies to be done simultaneously (e.g., the need for both soft tissue and bony anatomy is required)[18]
    - Combination requests where both cervical spine CT and MRI cervical spine are both approvable (not an all-inclusive list):
        - OPLL (Ossification of posterior longitudinal ligament)[19]
        - Pathologic or complex fractures
        - Malignant process of spine with both bony and soft tissue involvement
        - Unstable craniocervical junction
        - Clearly documented indication for bony and soft tissue abnormality where assessment will change management (i.e., surgical approach) for the patient

For evaluation of suspected myelopathy[20-24]

- Does **NOT** require conservative care
- Progressive symptoms including hand clumsiness, worsening handwriting, difficulty with grasping and holding objects, diffuse numbness in the hands, pins and needles sensation, increasing difficulty with balance and ambulation
- Any of the neurological deficits as noted above

For evaluation of known or suspected multiple sclerosis (MS)[20, 25-27]

- Evidence of MS on recent baseline Brain MRI
- Suspected or known MS with new or changing symptoms consistent with cervical spinal cord disease (focal neurologic deficit or clinical sign, e.g., Lhermitte sign)
- Suspected or known pediatric demyelinating diseases (MS/ADEM)

Combination studies MS[28]

- **These body regions might be evaluated separately or in combination as guided by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history (e.g., symptom(s), time course, and where in the CNS the likely localization(s) is/are), and other available information, including prior imaging.**
    - Cervical **and/or** Thoracic MRI for evaluation of highly suspected multiple sclerosis (MS) when Brain MRI has indeterminate findings and/or does not fulfill the McDonald criteria for the diagnosis of MS[26]
    - Cervical **and/or** Thoracic MRI with suspected transverse myelitis - with appropriate clinical symptoms (e.g., bilateral weakness, sensory disturbance, and autonomic dysfunction which typically evolve over hours or days)
    - Brain MRI with Cervical **and/or** Thoracic MRI for evaluation of neuromyelitis optica spectrum disorders (recurrent or bilateral optic neuritis; recurrent transverse myelitis)[29]

- Known MS, entire CNS axis (Brain, **and/or** Cervical **and/or** Thoracic spine) is approvable prior to the initiation or change of disease modification treatments and assess disease burden (to establish a new baseline)
- Known MS- Follow-up scans, including brain and spine imaging, if patients have known spine disease:
  - 6-12 months after starting/changing treatment
  - Every 1-2 years while on disease-modifying therapy to assess for subclinical disease activity, less frequently when stable for 2-3 years

For evaluation of trauma or acute injury[12, 30]

- Presents with any of the following neurological deficits noted above
- With progression or worsening of symptoms during the course of conservative treatment*
- History of underlying spinal abnormalities (i.e., ankylosing spondylitis, diffuse idiopathic skeletal hyperostosis) (Both MRI and CT would be approvable)[31-33]
- When the patient is clinically unevaluable or there are preliminary imaging findings (x-ray or CT) needing further evaluation
- When office notes specify the patient meets NEXUS (National Emergency X-Radiography Utilization Study) or CCR (Canadian Cervical Rules) criteria for imaging:
  - CT for initial imaging
  - MRI when suspect spinal cord or nerve root injury or when patient is obtunded, and CT is negative
  - CT or MRI for treatment planning of unstable spine

("MRI and CT provide complementary information. When indicated it is appropriate to perform both examinations")[31]

For evaluation of known or new compression fractures with worsening neck pain[12]

- With history of malignancy
  - To aid in differentiation of benign osteoporotic fractures from metastatic disease
    - A follow-up MRI in 6-8 weeks after initial MRI when initial imaging cannot decipher (indeterminate) benign osteoporotic fracture from metastatic disease (Kumar, 2016)
- With an associated new focal neurologic deficit as above[34]
- Prior to a planned surgery/intervention or if the results of the MRI will change management

For evaluation of tumor, cancer, or metastasis with any of the following:

(MRI is usually the preferred study, but CT may be needed to further characterize solitary indeterminate lesions seen on MRI)[12, 35-37]

- **Primary tumor**
  - Initial staging primary spinal tumor[38]

    - Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
    - Known spinal tumor with new signs or symptoms (e.g., new or increasing nontraumatic pain, physical, laboratory, and/or imaging findings)
    - With an associated new focal neurologic deficit as above[34]
- **Metastatic tumor**
    - With evidence of metastasis on bone scan needing further clarification OR inconclusive findings on a prior imaging exam
    - With an associated new focal neurologic deficit[34]
    - Known malignancy with new signs or symptoms (e.g., new or increasing nontraumatic pain, radiculopathy or neck pain that occurs at night and wakes the patient from sleep with known active cancer, physical, laboratory, and/or imaging findings) in a tumor that tends to metastasize to the spine[12, 39]

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated, OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of known or suspected infection (osteomyelitis)/abscess[12,40]

- Infection
    - As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings[41]
    - Follow-up imaging of infection
        - With worsening symptoms/laboratory values (i.e., white blood cell count, ESR/CRP) or radiographic findings[42]

For evaluation of known or suspected inflammatory disease or atlantoaxial instability

- In rheumatoid arthritis with neurologic signs/symptoms, or evidence of subluxation on radiographs (lateral radiograph in flexion and neutral should be the initial study)[43, 44]

    - Patients with negative radiographs but symptoms suggestive of cervical instability or in patients with neurologic deficits MRI is indicated[45]
- High-risk disorders affecting the atlantoaxial articulation, such as Down syndrome, Marfan syndrome with neurological signs/symptoms, abnormal neurological exam, or evidence of abnormal or inconclusive radiographs of the cervical spine[46]
- Spondyloarthropathies, known or suspected
    - Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and appropriate rheumatology workup

For evaluation of spine abnormalities related to immune system suppression, e.g., HIV, chemotherapy, leukemia, or lymphoma[47, 48]

- As evidenced by signs/symptoms, laboratory, or prior imaging findings

Other Indications for a Cervical Spine MRI

(Note- See combination requests, below, for initial advanced imaging assessment and pre-operatively)

- Tethered cord or spinal dysraphism (known or suspected), based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata[49-51]
    - Known Arnold-Chiari syndrome (For initial imaging (one-time initial MRI-modality assessment) see combination below)
    - Known Chiari I malformation without syrinx or hydrocephalus, follow-up imaging after initial diagnosis with new or changing signs/symptoms or exam findings consistent with spinal cord pathology[52]
    - Known Chiari II (Arnold-Chiari syndrome), III, or IV malformation
- Achondroplasia (one Cervical Spine MRI to assess the craniocervical junction, as early as possible, even in asymptomatic cases)[53, 54]
- Syrinx or syringomyelia (known or suspected)
    - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis[55])
    - To further characterize a suspicious abnormality seen on prior imaging
    - Known syrinx with new/worsening symptoms
- Toe walking in a child with signs/symptoms of myelopathy localized to the Cervical Spine
- Suspected neuroinflammatory Conditions/Diseases (e.g., sarcoidosis, Behcet's)
    - After detailed neurological exam and appropriate initial work up
- Initial evaluation of trigeminal neuralgia[56] not explained on recent Brain imaging

COMBINATION OF STUDIES WITH CERVICAL SPINE MR

Brain MRI/Cervical MRI

- For evaluation of known Arnold-Chiari Malformation

Cervical and Thoracic MRI

- Initial evaluation of known or suspected syrinx or syringomyelia
    - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis[55])
    - To further characterize a suspicious abnormality seen on prior imaging
    - Known syrinx with new/worsening symptom

Any combination of Cervical and/or Thoracic and/or Lumbar MRIs

Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history, and other available information, including prior imaging.

Exception- Indications for combination studies[57, 58]: Are approved indications as noted below and being performed in children who will need anesthesia for the procedure

- Any combination of these studies for:
    - Survey/complete initial assessment of infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10[59-61] (e.g., congenital scoliosis, idiopathic scoliosis, scoliosis with vertebral anomalies)
    - In the presence of neurological deficit, progressive spinal deformity, or for preoperative planning[62]
    - Back pain with known vertebral anomalies (hemivertebrae, hypoplasia, agenesis, butterfly, segmentation defect, bars, or congenital wedging) in a child on preliminary imaging
    - Scoliosis with any of the following[63]:
        - Progressive spinal deformity
        - Neurologic deficit (new or unexplained)
        - Early onset
        - Atypical curve (e.g., short segment, > 30’ kyphosis, left thoracic curve, associated organ anomalies)
        - Pre-operative planning; OR
        - When office notes clearly document how imaging will change management
- Arnold-Chiari malformations[64, 65]
    - Arnold-Chiari I
        - For evaluation of spinal abnormalities associated with initial diagnosis of Arnold-Chiari Malformation. (C/T/L spine due to association with tethered cord and syringomyelia), and initial imaging has not been completed[51, 59]
    - Arnold-Chiari II-IV - For initial evaluation and follow-up as appropriate
        - Usually associated with open and closed spinal dysraphism, particularly meningomyelocele
- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata,[49-51] when anesthesia required for

imaging[66] (e.g., meningomyelocele, lipomeningomyelocele, diastematomyelia, fatty/thickened filum terminale, and other spinal cord malformations)

- Oncological applications (e.g., primary nervous system, metastatic)
    - Drop metastasis from brain or spine (imaging also includes brain)- see Overview section
    - Suspected leptomeningeal carcinomatosis (LC)[67] -see Overview section
    - Any combination of these for spinal survey in patient with metastases
    - Tumor evaluation and monitoring in neurocutaneous syndromes - See Overview section
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula))

BACKGROUND

Magnetic resonance imaging (MRI) produces high quality multiplanar images of organs and structures within the body without radiation. It is the preferred modality for evaluating the internal structure of the spinal cord, providing assessment of conditions such as degenerative disc pathology, osteomyelitis, and discitis.

OVERVIEW

***Conservative Therapy** – (Spine) should include a multimodality approach consisting of a **combination of active and inactive components**. Inactive components, such as rest, ice, heat, modified activities, medical devices, acupuncture and/or stimulators, medications, injections (epidural, facet, bursal, and/or joint, not including trigger point), and diathermy can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or osteopathic manipulative medicine (OMT) or chiropractic care when considered safe and appropriate.

****Home Exercise Program** – **(HEP)/ Therapy:** The following elements are required to meet guidelines for completion of conservative therapy[68, 69]:

- Information provided on exercise prescription/plan AND
- Follow-up with member with documentation provided regarding lack of improvement (failed) after completion of HEP (after suitable 6-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute “inability to complete” HEP).
- Dates and duration of failed PT, physician-supervised HEP, or chiropractic treatment should be documented in the original office notes or an addendum to the notes.

Cervical myelopathy – Symptom severity varies, and a high index of suspicion is essential for making the proper diagnosis in early cases. Symptoms of pain and radiculopathy may not be present. The natural history of myelopathy is characterized by neurological deterioration. The most frequently

encountered symptom is gait abnormality (86%) followed by increased muscular reflexes (79.1%), pathological reflexes (65.1%), paresthesia of upper limb (69.8%), and pain (67.4%).[24]

Table 1: Gait and spine imaging[70-75]

Gait	Characteristic	Work up/Imaging
Hemiparetic	**Spastic unilateral, circumduction**	**Brain and/or, Cervical spine imaging based on associated symptoms**
Diplegic	**Spastic bilateral, circumduction**	**Brain, Cervical and Thoracic Spine imaging**
Myelopathic	**Wide based, stiff, unsteady**	**Cervical and/or Thoracic spine MRI based on associated symptoms**
Cerebellar Ataxic	**Broad based, clumsy, staggering, lack of coordination, usually also with limb ataxia**	**Brain imaging - see Brain MRI Guideline**
Apraxic	**Magnetic, shuffling, difficulty initiating**	**Brain imaging - see Brain MRI Guideline**
Parkinsonian	**Stooped, small steps, rigid, turning en bloc, decreased arm swing**	**Brain Imaging - see Brain MRI Guideline**
Choreiform	**Irregular, jerky, involuntary movements**	**Medication review, consider brain imaging as per movement disorder Brain MR guidelines**
Sensory ataxic	**Cautious, stomping, worsening without visual input (ie + Romberg)**	**EMG, blood work, consider spinal (cervical or thoracic cord imaging) imaging based on EMG**
Neurogenic	**Steppage, dragging of toes**	• **EMG initial testing;** • **BUT if there is a foot drop, lumbar spine MRI is appropriate without EMG** • **Pelvis MR if there is evidence of plexopathy**
Vestibular	**Insecure, veer to one side, worse when eyes closed, vertigo**	**Consider Brain/IAC MR- see Brain MRI Guideline**

Table 2: MRI and Cutaneous Stigmata[OBJ]

Risk Stratification for Various Cutaneous Markers		
High Risk	Intermediate Risk	Low Risk
• Hypertrichosis • Infantile hemangioma • Atretic meningocele • DST • Subcutaneous lipoma • Caudal appendage • Segmental hemangiomas in association with LUMBAR‡ syndrome	• Capillary malformations (also referred to as NFS or salmon patch when pink and poorly defined or PWS when darker red and well-defined)	• Coccygeal dimple • Light hair • Isolated café au lait spots • Mongolian spots • Hypo- and hypermelanotic macules or papules • Deviated or forked gluteal cleft • Nonmidline lesions
‡LUMBAR, lower body hemangioma and other cutaneous defects, urogenital abnormalities, ulcerations, myelopathy, bony defects, anorectal malformations, arterial anomalies, and renal anomalies.		

Ossification Posterior Longitudinal Ligament (OPLL)[19] – Most common in cervical spine (rare but more severe in thoracic spine)

Neck and Back Pain with Cancer History – Bone is the third most common site of metastases after the liver and the lungs, and approximately two-thirds of all osseous metastases occur in the spine. Approximately 60–70% of patients with systemic cancer will have spinal metastasis. Radiographic (x-ray) examination should be performed in cases of back pain when a patient has a cancer history, but without known active cancer or a tumor that tends to metastasize to the spine. This can make a diagnosis in many cases. This may occasionally allow for selection of bone scan in lieu of MRI in some cases. When radiographs do not answer the clinical question, then MRI may be appropriate after a consideration of conservative care.

Most common spine metastasis involving primary metastasis originate from the following tumors in descending order: breast (21%), lung (19%), prostate (7.5%), renal (5%), gastrointestinal (4.5%), and thyroid (2.5%). While all tumors can seed to the spine, the cancers mentioned above metastasize to the spinal column early in the disease process. Spinal metastasis is more commonly found in the thoracic region, followed by the lumbar region, while the cervical region is the least likely site of metastasis.[39]

MRI and Neurocutaneous Syndromes

- In NF-1, clinical evaluation appears to be more useful to detect complications than is screening imaging in asymptomatic patients. Imaging is indicated in evaluation of suspected tumors based on clinical evaluation and for follow-up of known intracranial and intraspinal tumors.[76]

- Conversely in NF-2, routine MR imaging screening is always indicated, given the high prevalence of CNS tumors, especially vestibular schwannomas. In patients with NF-2, routine screening brain/IAC imaging is indicated annually starting from age 10, if asymptomatic, or earlier with clinical signs/symptoms. Most individuals with NF2 eventually develop a spinal tumor, mostly commonly schwannomas, but meningioma and ependymomas are also seen. Spinal imaging at baseline and every 2 to 3 years is also advised with more frequent imaging, if warranted, based on sites of tumor involvement.[77]
- In patients with Tuberous Sclerosis, Brain MRI should be obtained every 1-3 years up until age 25 for surveillance for CNS abnormalities.[78]
- In Von Hippel Lindau Syndrome, imaging of the brain and spinal cord for hemangioblastomas is recommended every 2 years.[79]
- In Sturge Weber Syndrome, Brain MRI can rule out intracranial involvement after only age 1 and is recommended in patients <1 year old only if symptomatic.[80]

Drop Metastases[81] – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas, and less commonly choroid plexus neoplasms and teratomas.

Leptomeningeal Carcinomatosis[82] – Leptomeningeal carcinomatosis is complication of cancer in which cancerous cells spread to the membranes (meninges) that covers the brain and spinal cord. The most common solid tumors that involve the leptomeninges are breast, lung, melanoma, gastrointestinal, and primary central nervous system tumors.

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POLICY HISTORY

Date	Summary
May 2023	• Updated references • Updated background section • Clarified pathological reflexes • Added trigeminal neuralgia • Added "Further evaluation of indeterminate or questionable findings on prior imaging": • Clarified cerebellar ataxia in gait table • Removed Additional Resources • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding clinical indications not addressed in the guideline.
March 2022	Added • Combination request for overlapping body part statement • Clarified muscle weakness no related to plexopathy or peripheral neuropathy • Clarified bowel and bladder dysfunction – not related to an inherent bowel or bladder problem • Clarified isolated neck pain in pediatric patient • Clarified combination MS for cervical and/or thoracic spine combination requests • Added subsection for cervical and thoracic spine section for syrinx and syringomyelia • Descriptions for tethered cord • Background section of Drop Metastases • Background section of Leptomeningeal Carcinomatosis • Clarified toe walking in pediatric patient with myelopathy for cervical spine Removed • Removed from combination section syrinx and syringomyelia and added subsection for cervical and thoracic spine section • Removed pediatric back pain from the total spine combination section

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **THORACIC SPINE MRI**	**Original Date: September 1997**
CPT Codes: 72146, 72147, 72157, +0698T	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_042	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR THORACIC SPINE MRI

[+]If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- **Inconclusive or show a need for additional or follow-up imaging evaluation OR**
- **The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient (the entire spinal cord and/or autonomic postganglionic chain must be assessed)**

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of neurologic deficits[1-4]

- With any of the following new neurological deficits documented on physical exam
  - Extremity muscular weakness (and not likely caused by plexopathy or peripheral neuropathy)[5, 6]
  - Pathologic (e.g., Babinski, Lhermitte's sign, Chaddock Sign, Hoffman's and other upper motor neuron signs); **OR** abnormal deep tendon reflexes (and not likely caused by plexopathy, or peripheral neuropathy)

    - Absent/decreased sensory changes along a particular thoracic dermatome (nerve distribution): pin prick, touch, vibration, proprioception, or temperature (and not likely caused by plexopathy, or peripheral neuropathy)
    - Upper or lower extremity increase muscle tone/spasticity, and likely localized to the thoracic spinal cord
    - New onset bowel or bladder dysfunction (e.g., retention or incontinence)- not related to an inherent bowel or bladder process
    - Gait abnormalities, most likely cause by a suspected or known myelopathy (see Table 1 for more details)
- Suspected thoracic cord compression with any neurological deficits as listed above

For evaluation of back pain with any of the following[7-9]

- With new or worsening objective neurologic deficits (as listed above) on exam
- Failure of conservative treatment* for at least six (6) weeks within the last six (6) months
- With progression or worsening of symptoms during the course of conservative treatment*
- With an abnormal electromyography (EMG) or nerve conduction study (if performed) indicating a thoracic radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain)[10]
- Isolated back pain in pediatric population[11] – conservative care not required if red flags present. Red flags that prompt imaging include any of the following:
    - Age 5 or younger, **OR**
    - Constant pain, **OR**
    - Pain lasting > 4 weeks, **OR**
    - Abnormal neurologic examination, **OR**
    - Early morning stiffness and/or gelling, **OR**
    - Night pain that prevents or disrupts sleep, **OR**
    - Radicular pain, **OR**
    - Fever or weight loss or malaise, **OR**
    - Postural changes (e.g., kyphosis or scoliosis), **OR**
    - Limp (or refusal to walk in a younger child)[12, 13]

As part of initial pre-operative / post-operative / procedural evaluation ("CT best examination to assess for hardware complication, extent of fusion and pseudoarthrosis"[14, 15] and MRI for cord, nerve root compression, disc pathology or post-op infection)

- For preoperative evaluation/planning
- Prior to spinal cord stimulator to exclude canal stenosis if no prior MRI imaging of the thoracic spine has been done recently[16, 17]
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension

(SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula or dural fistula))

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery in the last 6 months. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested (routine surveillance post-op not indicated without symptoms)
- Surgical infection as evidenced by signs/symptoms, laboratory, or prior imaging findings
- New or changing neurological deficits or symptoms post-operatively[14, 18]- see neurological deficit section above
- When combo requests (see above statement[+]) are submitted (i.e., MRI and CT of the spine), the office notes should clearly document the need for both studies to be done simultaneously, i.e., the need for both soft tissue and bony anatomy is required[19]
    - Combination requests where both thoracic spine CT and MRI thoracic spine are both approvable (not an all-inclusive list):
        - OPLL (Ossification of posterior longitudinal ligament)-
            - Most common in cervical spine (rare but more severe in thoracic spine)[20]
        - Pathologic or complex fractures
        - Malignant process of spine with both bony and soft tissue involvement
        - Clearly documented indication for bony and soft tissue abnormality where assessment will change management for the patient

For evaluation of suspected myelopathy[21-25]

- Does **NOT** require conservative care
- Progressive symptoms including unsteadiness, broad-based gait, increased muscle tone, pins and needles sensation, weakness and wasting of the lower limbs, and diminished sensation to light touch, temperature, proprioception, and vibration; limb hyperreflexia and pathologic reflexes; bowel and bladder dysfunction in more severe cases
- Any of the neurological deficits as noted above

For evaluation of known or suspected multiple sclerosis (MS)[25-28]

- Suspected or known MS with new or changing symptoms suggesting underlying thoracic spinal cord disease (i.e., transverse myelitis, progressive myelopathy)
- Suspected or known pediatric demyelinating diseases (MS/ADEM)

Combination studies for MS

- **These body regions might be evaluated separately or in combination as guided by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history (e.g., symptom(s), time course, and where in the CNS the likely localization(s) is/are), and other available information, including prior imaging.**

- Cervical **and/or** Thoracic MRI for evaluation of highly suspected multiple sclerosis (MS) when Brain MRI has indeterminate findings and/or does not fulfill the McDonald criteria for the diagnosis of MS[27]
- Cervical **and/or** Thoracic MRI with suspected transverse myelitis-with appropriate clinical symptoms (e.g., bilateral weakness, sensory disturbance, and autonomic dysfunction which typically evolve over hours or days)
- Brain MRI with Cervical **and/or** Thoracic MRI for evaluation of neuromyelitis optica spectrum disorders (recurrent or bilateral optic neuritis; recurrent transverse myelitis)[29]
- Known MS- entire CNS axis (Brain, **and/or** Cervical **and/or** Thoracic spine) is approvable prior to the initiation or change of disease modification treatments and assess disease burden (to establish a new baseline)
- Known MS- Follow-up scans, including brain and spine imaging, if patients have known spine disease:
  - 6-12 months after starting/changing treatment
  - Every 1-2 years while on disease-modifying therapy to assess for subclinical disease activity, less frequently when stable for 2-3 years

For evaluation of trauma or acute injury[30]

- Presents with any of the following neurological deficits as above
- With progression or worsening of symptoms during the course of a trial of conservative treatment*
- History of underlying spinal abnormalities (i.e., ankylosing spondylitis, diffuse idiopathic skeletal hyperostosis) (Both MRI and CT would be approvable)[31-33]
- When the patient is clinically unevaluable or there are preliminary imaging findings (x-ray or CT) needing further evaluation

("MRI and CT provide complementary information. When indicated it is appropriate to perform both examinations").[30]

For evaluation of known or new compression fractures with worsening back pain[30, 34]

- With history of malignancy
  - To aid in differentiation of benign osteoporotic fractures from metastatic disease
    - A follow-up MRI in 6-8 weeks after initial MRI when initial imaging cannot decipher (indeterminate) benign osteoporotic fracture from metastatic disease[35]
- With an associated new focal neurologic deficit as above
- Prior to a planned surgery/intervention or if the results of the MRI will change management

For evaluation of tumor, cancer, or metastasis with any of the following:

(MRI is usually the preferred study, but CT may be needed to further characterize solitary indeterminate lesions seen on MRI)[36-38]

- **Primary tumor**
  - Initial staging primary spinal tumor[39]
  - Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
  - Known primary tumor with new signs or symptoms (e.g., new or increasing nontraumatic pain, physical, laboratory, and/or imaging findings)
  - With an associated new focal neurologic deficit as above[40]
- **Metastatic tumor**
  - With evidence of metastasis on bone scan needing further clarification OR inconclusive findings on a prior imaging exam
  - With an associated new focal neurologic deficit[40]
  - Known malignancy with new signs or symptoms (e.g., new or increasing nontraumatic pain, radiculopathy or back pain that occurs at night and wakes the patient from sleep with known active cancer, physical, laboratory, and/or imaging findings) in a tumor that tends to metastasize to the spine [33-35]

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated, OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of known or suspected infection (osteomyelitis), abscess, or inflammatory disease[41, 42]

- **Infection**
  - As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings[43]
  - Follow-up imaging of infection
    - With worsening symptoms/laboratory values (i.e., white blood cell count, ESR/CRP) or radiographic findings[44]

- **Spondyloarthropathies**
    - Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and appropriate rheumatology workup

For evaluation of spine abnormalities related to immune system suppression, e.g., HIV, chemotherapy, leukemia, or lymphoma[42]

- As evidenced by signs/symptoms, laboratory, or prior imaging findings

Other Indications for a Thoracic Spine MRI

(Note- See combination requests, below, for initial advanced imaging assessment and pre-operatively)

- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata[45-47]
- Known Arnold-Chiari syndrome (For initial imaging (one-time initial MRI-modality assessment) see combination below)
    - Known Chiari I malformation without syrinx or hydrocephalus, follow-up imaging after initial diagnosis with new or changing signs/symptoms or exam findings consistent with spinal cord pathology[48]
    - Known Chiari II (Arnold-Chiari syndrome), III, or IV malformation
- Syrinx or syringomyelia (known or suspected)
    - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis[49])
    - To further characterize a suspicious abnormality seen on prior imaging
    - Known syrinx with new/worsening symptoms
- Toe walking in a child with signs/symptoms of myelopathy localized to the Thoracic Spine
- Suspected neuroinflammatory Conditions/Diseases (e.g., sarcoidosis, Behcet's)
    - After detailed neurological exam and appropriate initial work up

COMBINATION STUDIES WITH THORACIC SPINE MRI

Cervical and Thoracic MRI

- Initial evaluation of known or suspected syrinx or syringomyelia
    - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis[49])
    - To further characterize a suspicious abnormality seen on prior imaging
    - Known syrinx with new/worsening symptom

Any combination of Cervical and/or Thoracic and/or Lumbar MRIs

Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history, and other available information, including prior imaging.

Exception- Indications for combination studies[50, 51]: Are approved indications as noted below and being performed in children who will need anesthesia for the procedure

- Any combination of these studies for:
    - Survey/complete initial assessment of infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10[52-54] (e.g., congenital scoliosis, idiopathic scoliosis, scoliosis with vertebral anomalies)
    - In the presence of neurological deficit, progressive spinal deformity, or for preoperative planning[55]
    - Back pain with known vertebral anomalies (hemivertebrae, hypoplasia, agenesis, butterfly, segmentation defect, bars, or congenital wedging) in a child on preliminary imaging
    - Scoliosis with any of the following[56]
        - Progressive spinal deformity
        - Neurologic deficit (new or unexplained)
        - Early onset
        - Atypical curve (e.g., short segment, > 30' kyphosis, left thoracic curve, associated organ anomalies)
        - Pre-operative planning; OR
        - When office notes clearly document how imaging will change management
- Arnold-Chiari malformations[57, 58]
    - Arnold-Chiari I
        - For evaluation of spinal abnormalities associated with initial diagnosis of Arnold-Chiari Malformation. (C/T/L spine due to association with tethered cord and syringomyelia), and initial imaging has not been completed[46, 52]
    - Arnold-Chiari II-IV - For initial evaluation and follow-up as appropriate
        - Usually associated with open and closed spinal dysraphism, particularly meningomyelocele
- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata,[45-47] when anesthesia required for imaging[59] (e.g., meningomyelocele, lipomeningomyelocele, diastematomyelia, fatty/thickened filum terminale, and other spinal cord malformations)
- Oncological Applications (e.g., primary nervous system, metastatic)
    - Drop metastasis from brain or spine (imaging also includes brain)- see Overview
    - Suspected leptomeningeal carcinomatosis (LC)[60] -see Overview

    - Any combination of these for spinal survey in patient with metastases
    - Tumor evaluation and monitoring in neurocutaneous syndromes
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula))

BACKGROUND

Magnetic resonance imaging (MRI) produces high quality multiplanar images of organs and structures within the body without using ionizing radiation. It is used for evaluation, assessment of severity, and follow-up of diseases of the spine and is the preferred modality for imaging intervertebral disc degeneration. High contrast resolution (soft tissue contrast) and multiplanar imaging (sagittal as well as axial planes) are helpful in the evaluation of possible disc herniation and detecting nerve root compression. MRI is one of the most useful techniques to evaluate spine infection and is also used to evaluate tumors, cancer, and immune system suppression.

OVERVIEW

***Conservative Therapy** – (Spine) should include a multimodality approach consisting of a **combination of active and inactive components**. Inactive components, such as rest, ice, heat, modified activities, medical devices, acupuncture and/or stimulators, medications, injections (epidural, facet, bursal, and/or joint, not including trigger point), and diathermy can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or osteopathic manipulative medicine (OMT) or chiropractic care when considered safe and appropriate.

****Home Exercise Program - (HEP)/Therapy** – the following elements are required to meet guidelines for completion of conservative therapy[15, 61]:

- Information provided on exercise prescription/plan AND
- Follow-up with member with documentation provided regarding lack of improvement (failed) after completion of HEP (after suitable 6-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute “inability to complete” HEP).
- Dates and duration of failed PT, physician-supervised HEP, or chiropractic treatment should be documented in the original office notes or an addendum to the notes.

Table 1: Gait and spine imaging[62-67]

Gait	Characteristic	Work up/Imaging
Hemiparetic	Spastic unilateral, circumduction	Brain and/or, Cervical spine imaging based on associated symptoms
Diplegic	Spastic bilateral, circumduction	Brain, Cervical and Thoracic Spine imaging
Myelopathic	Wide based, stiff, unsteady	Cervical and/or Thoracic spine MRI based on associated symptoms
Cerebellar Ataxic	Broad based, clumsy, staggering, lack of coordination, usually also with limb ataxia	Brain imaging see Brain MRI Guideline
Apraxic	Magnetic, shuffling, difficulty initiating	Brain imaging see Brain MRI Guideline
Parkinsonian	Stooped, small steps, rigid, turning en bloc, decreased arm swing	Brain Imaging see Brain MRI Guideline
Choreiform	Irregular, jerky, involuntary movements	Medication review, consider brain imaging as per movement disorder Brain MR guidelines
Sensory ataxic	Cautious, stomping, worsening without visual input (ie + Romberg)	EMG, blood work, consider spinal (cervical or thoracic cord imaging) imaging based on EMG
Neurogenic	Steppage, dragging of toes	• EMG initial testing; • BUT if there is a foot drop, lumbar spine MRI is appropriate without EMG • Pelvis MR if there is evidence of plexopathy
Vestibular	Insecure, veer to one side, worse when eyes closed, vertigo	Consider Brain/IAC MRI see Brain MRI Guideline

Table 2: MRI and Cutaneous StigmataRisk Stratification for Various Cutaneous Markers		
High Risk	Intermediate Risk	Low Risk
• Hypertrichosis • Infantile hemangioma • Atretic meningocele • DST • Subcutaneous lipoma • Caudal appendage • Segmental hemangiomas in association with LUMBAR‡ syndrome	• Capillary malformations (also referred to as NFS or salmon patch when pink and poorly defined or PWS when darker red and well-defined)	• Coccygeal dimple • Light hair • Isolated café au lait spots • Mongolian spots • Hypo- and hypermelanotic macules or papules • Deviated or forked gluteal cleft • Nonmidline lesions
‡LUMBAR, lower body hemangioma and other cutaneous defects, urogenital abnormalities, ulcerations, myelopathy, bony defects, anorectal malformations, arterial anomalies, and renal anomalies.		

Myelopathy – Symptom severity varies, and a high index of suspicion is essential for making the proper diagnosis in early cases. Symptoms of pain and radiculopathy may not be present. The natural history of myelopathy is characterized by neurological deterioration. The most frequently encountered symptom is gait abnormality (86%) followed by increased muscular reflexes (79.1%), pathological reflexes (65.1%), paresthesia of upper limb (69.8%), and pain (67.4%).[68]

Ossification Posterior Longitudinal Ligament (OPLL)[20] – Most common in cervical spine (rare but more severe in thoracic spine)

Neck and Back Pain with Cancer History – Bone is the third most common site of metastases after the liver and the lungs, and approximately two-thirds of all osseous metastases occur in the spine. Approximately 60–70% of patients with systemic cancer will have spinal metastasis. Radiographic (x-ray) examination should be performed in cases of back pain when a patient has a cancer history, but without known active cancer or a tumor that tends to metastasize to the spine. This can make a diagnosis in many cases. This may occasionally allow for selection of bone scan in lieu of MRI in some cases. When radiographs do not answer the clinical question, then MRI may be appropriate after a consideration of conservative care.

Most common spine metastasis involving primary metastasis originate from the following tumors in descending order: breast (21%), lung (19%), prostate (7.5%), renal (5%), gastrointestinal (4.5%), and thyroid (2.5%). While all tumors can seed to the spine, the cancers mentioned above metastasize to the spinal column early in the disease process. Spinal

metastasis is more commonly found in the thoracic region, followed by the lumbar region, while the cervical region is the least likely site of metastasis.[69]

MRI and Neurocutaneous Syndromes

- In NF-1, clinical evaluation appears to be more useful to detect complications than is screening imaging in asymptomatic patients. Imaging is indicated in evaluation of suspected tumors based on clinical evaluation and for follow-up of known intracranial and intraspinal tumors.[70]
- Conversely in NF-2, routine MR imaging screening is always indicated, given the high prevalence of CNS tumors, especially vestibular schwannomas. In patients with NF-2, routine screening brain/IAC imaging is indicated annually starting from age 10, if asymptomatic, or earlier with clinical signs/symptoms. Most individuals with NF2 eventually develop a spinal tumor, mostly commonly schwannomas, but meningioma and ependymomas are also seen. Spinal imaging at baseline and every 2 to 3 years is also advised with more frequent imaging, if warranted, based on sites of tumor involvement.[71]
- In patients with Tuberous Sclerosis, Brain MRI should be obtained every 1-3 years up until age 25 for surveillance for CNS abnormalities.[72]
- In Von Hippel Lindau Syndrome, imaging of the brain and spinal cord for hemangioblastomas is recommended every 2 years.[73]
- In Sturge Weber Syndrome, Brain MRI can rule out intracranial involvement after only age 1 and is recommended in patients < 1 year old only if symptomatic.[74]

Drop Metastases[75] – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas and less commonly choroid plexus neoplasms and teratomas.

Leptomeningeal Carcinomatosis[76] – Leptomeningeal carcinomatosis is complication of cancer in which cancerous cells spread to the membranes (meninges) that covers the brain and spinal cord. The most common solid tumors that involve the leptomeninges are breast, lung, and melanoma, gastrointestinal, and primary central nervous system tumors.

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POLICY HISTORY

Date	Summary
May 2023	• Updated references • Updated background section • Clarified pathological reflexes • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Clarified cerebellar ataxia in gait table • Removed radicular pain and malaise from Isolated Back Pain in the Pediatric population: Red flags • Removed Additional Resources
March 2022	Added • Combination request for overlapping body part statement • Clarified muscle weakness not related to plexopathy or peripheral neuropathy • Clarified bowel and bladder dysfunction – not related to an inherent bowel or bladder problem • Clarified combination MS for cervical and/or thoracic spine combination requests • Descriptions for tethered cord • Background section of Drop Metastases • Background section of Leptomeningeal Carcinomatosis • Clarified toe walking in pediatric patient with myelopathy for thoracic spine Removed • Removed from combination section syrinx and syringomyelia and added subsection for cervical and thoracic spine section • Removed pediatric back pain from the total spine combination section

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **LUMBAR SPINE MRI**	**Original Date: September 1997**
CPT Codes: 72148, 72149, 72158, +0698T	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_044	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR LUMBAR SPINE MRI

+If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- **Inconclusive or show a need for additional or follow up imaging evaluation OR**
- **The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.**

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of neurologic deficits[1-4]

- With any of the following new neurological deficits documented on physical exam
    - Extremity muscular weakness (and not likely caused by plexopathy, or peripheral neuropathy)[5, 6]
    - Pathologic or abnormal reflexes (and not likely caused by plexopathy, or peripheral neuropathy)
    - Absent/decreased sensory changes along a particular lumbar dermatome (nerve distribution): pin prick, touch, vibration, proprioception or temperature (and not likely caused by plexopathy, or peripheral neuropathy)

    - Lower extremity increased muscle tone
    - New onset bowel or bladder dysfunction (e.g., retention or incontinence)- not related to an inherent bowel or bladder process
    - Gait abnormalities (see Table 1 for more details)
    - New onset foot drop (Not related to a peripheral nerve injury, e.g., peroneal nerve)
- Cauda Equina Syndrome as evidence by severe back pain/sciatica along with one of the defined symptoms (see Overview section)

For evaluation of back pain with any of the following[7-16]

- With new or worsening objective neurologic deficits on exam, as above
- Failure of conservative treatment* for at least six (6) weeks within the last six (6) months[16]
- With progression or worsening of symptoms during the course of conservative treatment
- With an abnormal electromyography (EMG) or nerve conduction study (if performed) indicating a lumbar radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain.)[15]
- Isolated back pain in pediatric population[17] – conservative care not required if red flags present. Red flags that prompt imaging should include the presence of:
    - Age 5 or younger, **OR**
    - Constant pain, **OR**
    - Pain lasting > 4 weeks, **OR**
    - Abnormal neurologic examination, **OR**
    - Early morning stiffness and/or gelling, **OR**
    - Night pain that prevents or disrupts sleep, **OR**
    - Radicular pain, **OR**
    - Fever or weight loss or malaise, **OR**
    - Postural changes (e.g., kyphosis or scoliosis), **OR**
    - Limp (or refusal to walk in a younger child < 5yo)[18, 19]

As part of initial pre-operative / post-operative / procedural evaluation ("CT best examination to assess for hardware complication, extent of fusion and pseudoarthrosis"[16, 20] and MRI for cord, nerve root compression, disc pathology or post-op infection)

- For preoperative evaluation/planning
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula))
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery in the last 6 months. Documentation requires a

medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested (routine surveillance post-op not indicated without symptoms)
- Surgical infection as evidenced by signs/symptoms, laboratory, or prior imaging findings
- New or changing neurological deficits or symptoms post-operatively [20, 21] - see neurological deficit section above
- When combo requests (see above statement[+]) are submitted (i.e., MRI and CT of the spine), the office notes should clearly document the need for both studies to be done simultaneously, i.e., the need for both soft tissue and bony anatomy is required[22]
    - Combination requests where both lumbar spine CT and MRI lumbar spine are both approvable (not an all-inclusive list)
        - Pathologic or complex fractures
        - Malignant process of spine with both bony and soft tissue involvement
        - Clearly documented indication for bony and soft tissue abnormality where assessment will change management for the patient

For evaluation of trauma or acute injury[23]

- Presents with any of the neurological deficits as above
- With progression or worsening of symptoms during the course of conservative treatment*
- History of underlying spinal abnormalities (i.e., ankylosing spondylitis or diffuse idiopathic skeletal hyperostosis) (Both MRI and CT would be approvable) [24]
- When the patient is clinically unevaluable or there are preliminary imaging findings (x-ray or CT) needing further evaluation

("MRI and CT provide complementary information. When indicated it is appropriate to perform both examinations").[23]

Pars defect (spondylolysis) or spondylolisthesis

- Pars defect (spondylolysis) or spondylolisthesis in adults when Flexion/Extension x-rays show instability
- Clinically suspected Pars defect (spondylolysis) which is not seen on plain films in pediatric population (< 18 yr) (flexion extension instability not required) and imaging would change treatment[25-27]

NOTE: Initial imaging (x-ray, or planar bone scan without SPECT; Bone scan with SPECT is superior to MRI and CT in the detection of pars interarticularis pathology including spondylolysis).[28]

For evaluation of known or new compression fractures with worsening back pain[29]

- With history of malignancy
    - To aid in differentiation of benign osteoporotic fractures from metastatic disease

        - A follow up MRI in 6-8 weeks after initial MRI when initial imaging cannot decipher benign osteoporotic fracture from metastatic disease
- With an associated new focal neurologic deficit as above
- Prior to a planned surgery/intervention or if the results of the MRI will change management.

For evaluation of tumor, cancer, or metastasis with any of the following:

(MRI is usually the preferred study, but CT may be needed to further characterize solitary indeterminate lesions seen on MRI)[30-32]

- **Primary tumor**
    - Initial staging primary spinal tumor[33]
    - Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
    - Known primary tumor with new signs or symptoms (e.g., new or increasing nontraumatic pain, physical, laboratory, and/or imaging findings)
    - With an associated new focal neurologic deficit as above[34]
- **Metastatic tumor**
    - With evidence of metastasis on bone scan needing further clarification OR inconclusive findings on a prior imaging exam
    - With an associated new focal neurologic deficit[34]
    - Known malignancy with new signs or symptoms (e.g., new or increasing nontraumatic pain, radiculopathy or back pain that occurs at night and wakes the patient from sleep with known active cancer, physical, laboratory, and/or imaging findings) in a tumor that tends to metastasize to the spine[35, 36]

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred**.** (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of known or suspected infection (osteomyelitis), abscess, or inflammatory disease[37, 38]

- **Infection**
    - As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings[39]
    - Follow-up imaging of infection
        - With worsening symptoms/laboratory values (i.e., white blood cell count, ESR/CRP) or radiographic findings[40]
- **Spondyloarthropathies**
    - Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and rheumatology workup

For evaluation of spine abnormalities related to immune system suppression, e.g., HIV, chemotherapy, leukemia, or lymphoma[38]

- As evidenced by signs/symptoms, laboratory, or prior imaging findings

Other Indications for a Lumbar Spine MRI

(Note: See combination request, below, for initial advanced imaging assessment and pre-operatively)

- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata[41-43]
- Known anorectal malformations[44, 45]
- Suspicious sacral dimple (those that are deep, larger than 0.5 cm, located within the superior portion of the gluteal crease or above the gluteal crease, multiple dimples, or associated with other cutaneous markers)[46] or duplicated or deviated gluteal cleft[47]
    - in patients ≤3 months should have ultrasound
- Toe walking in a child when associated with upper motor neuron signs, including hyperreflexia, spasticity; or orthopedic deformity with concern for spinal cord pathology and/or tethered cord (e.g., pes cavus, clawed toes, leg or foot length deformity (excluding tight heel cords))
- Known Chiari II (Arnold-Chiari syndrome), III, or IV malformation.
- For follow-up/repeat evaluation of Arnold-Chiari I with new signs or symptoms suggesting recurrent spinal cord tethering (For initial diagnosis see below)
- Suspected neuroinflammatory Conditions/Diseases (e.g**.,** sarcoidosis, Behcet's)
    - After detailed neurological exam and appropriate initial work up completed

COMBINATION OF STUDIES WITH LUMBAR SPINE MRI

Any combination of Cervical and/or Thoracic and/or Lumbar MRIs

Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history, and other available information, including prior imaging.

Exception- Indications for combination studies[48, 49]: Are approved indications as noted below and being performed in children who will need anesthesia for the procedure

- Any combination of these studies for:
    - Survey/complete initial assessment of infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10[50-52] (e.g., congenital scoliosis, idiopathic scoliosis, scoliosis with vertebral anomalies)
    - In the presence of neurological deficit, progressive spinal deformity, or for preoperative planning[53]
    - Back pain with known vertebral anomalies (hemivertebrae, hypoplasia, agenesis, butterfly, segmentation defect, bars, or congenital wedging) in a child on preliminary imaging
    - Scoliosis with any of the following[54]:
        - Progressive spinal deformity
        - Neurologic deficit (new or unexplained)
        - Early onset
        - Atypical curve (e.g., short segment, > 30' kyphosis, left thoracic curve, associated organ anomalies)
        - Pre-operative planning; OR
        - When office notes clearly document how imaging will change management
- Arnold-Chiari malformations[55, 56]
    - Arnold-Chiari I
        - For evaluation of spinal abnormalities associated with initial diagnosis of Arnold-Chiari Malformation. (C/T/L spine due to association with tethered cord and syringomyelia), and initial imaging has not been completed[42, 50]
    - Arnold-Chiari II-IV - For initial evaluation and follow-up as appropriate
        - Usually associated with open and closed spinal dysraphism, particularly meningomyelocele)
- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata,[41-43] when anesthesia required for imaging[57] (e.g., meningomyelocele, lipomeningomyelocele, diastematomyelia, fatty/thickened filum terminale, and other spinal cord malformations)
- Oncological Applications (e.g., primary nervous system, metastatic)
    - Drop metastasis from brain or spine (imaging also includes brain)- see Overview
    - Suspected leptomeningeal carcinomatosis (LC)[58] -see Overview
    - Any combination of these for spinal survey in patient with metastases
    - Tumor evaluation and monitoring in neurocutaneous syndromes - See Overview
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension

(SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula))

BACKGROUND

Magnetic resonance imaging (MRI) is used in the evaluation, diagnosis, and management of spine-related conditions, e.g., degenerative disc disease, cauda equine compression, radiculopathy, infections, or cancer in the lumbar spine. MRI provides high quality multiplanar images of organs and structures within the body without the use of x-rays or radiation. In the lumbar area where gonadal exposure may occur, MRI's lack of radiation is an advantage.

OVERVIEW

***Conservative Therapy** – (Spine) should include a multimodality approach consisting of a **combination of active and inactive components**. Inactive components, such as rest, ice, heat, modified activities, medical devices, acupuncture and/or stimulators, medications, injections (epidural, facet, bursal, and/or joint, not including trigger point), and diathermy can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or osteopathic manipulative medicine (OMT) or chiropractic care.

****Home Exercise Program - (HEP)/Therapy** – the following elements are required to meet guidelines for completion of conservative therapy[10, 59]:

- Information provided on exercise prescription/plan; **AND**
- Follow-up with member with documentation provided regarding lack of improvement (failed) after completion of HEP (after suitable 6-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute "inability to complete" HEP).
- Dates and duration of failed PT, physician-supervised HEP, or chiropractic treatment should be documented in the original office notes or an addendum to the notes.

Table 1: Gait and spine imaging[60-65]

Gait	Characteristic	Work up/Imaging
Hemiparetic	Spastic unilateral, circumduction	Brain and/or, Cervical spine imaging based on associated symptoms
Diplegic	Spastic bilateral, circumduction	Brain, Cervical and Thoracic Spine imaging
Myelopathic	Wide based, stiff, unsteady	Cervical and/or Thoracic spine MRI based on associated symptoms
Cerebellar taxic	Broad based, clumsy, staggering, lack of coordination, usually also with limb ataxia	Brain imaging see Brain MRI Guideline
Apraxic	Magnetic, shuffling, difficulty initiating	Brain imaging see Brain MRI Guideline
Parkinsonian	Stooped, small steps, rigid, turning en bloc, decreased arm swing	Brain Imaging see Brain MRI Guideline
Choreiform	Irregular, jerky, involuntary movements	Medication review, consider brain imaging as per movement disorder Brain MR guidelines
Sensory ataxic	Cautious, stomping, worsening without visual input (ie + Romberg)	EMG, blood work, consider spinal (cervical or thoracic cord imaging) imaging based on EMG
Neurogenic	Steppage, dragging of toes	• EMG initial testing; • BUT if there is a foot drop, lumbar spine MRI is appropriate without EMG • Pelvis MR if there is evidence of plexopathy
Vestibular	Insecure, veer to one side, worse when eyes closed, vertigo	Consider Brain/IAC MRI see Brain MRI Guideline

Table 2: MRI and Cutaneous Stigmata[66]

Risk Stratification for Various Cutaneous Markers		
High Risk	Intermediate Risk	Low Risk
• Hypertrichosis • Infantile hemangioma • Atretic meningocele • DST • Subcutaneous lipoma • Caudal appendage • Segmental hemangiomas in association with LUMBAR‡ syndrome	• Capillary malformations (also referred to as NFS or salmon patch when pink and poorly defined or PWS when darker red and well-defined)	• Coccygeal dimple Light hair • Isolated café au lait spots • Mongolian spots • Hypo- and hypermelanotic macules or papules • Deviated or forked gluteal cleft • Nonmidline lesions
‡LUMBAR, lower body hemangioma and other cutaneous defects, urogenital abnormalities, ulcerations, myelopathy, bony defects, anorectal malformations, arterial anomalies, and renal anomalies.		

Sacral Dimples – Simple midline dimples are the most commonly encountered dorsal cutaneous stigmata in neonates and indicate low risk for spinal dysraphism. Only atypical dimples are associated with a high risk for spinal dysraphism, particularly those that are large (>5 mm), high on the back (>2.5 cm from the anus) or appear in combination with other lesions.[46] High-risk cutaneous stigmata in neonates include hemangiomas, upraised lesions (i.e., masses, tails, and hairy patches), and multiple cutaneous stigmata (Table 2).

Tethered spinal cord syndrome – This is a neurological disorder caused by tissue attachments that limit the movement of the spinal cord within the spinal column. Although this condition is rare, it can continue undiagnosed into adulthood. The primary cause is myelomeningocele and lipomyelomeningocele; the following are other associations that vary in severity of symptoms and treatment.

- Dermal sinus tract (a rare congenital deformity)
- Diastematomyelia (split spinal cord)
- Lipoma
- Tumor
- Thickened/tight filum terminale
- History of spine trauma/surgery
- Arnold-Chiari malformation

Magnetic resonance imaging (MRI) can display the low level of the spinal cord and a thickened filum terminale, the thread-like extension of the spinal cord in the lower back. Treatment

depends upon the underlying cause of the tethering. If the only abnormality is a thickened, shortened filum, then limited surgical treatment may suffice.

Back Pain with Cancer History – Bone is the third most common site of metastases after the liver and the lungs, and approximately two-thirds of all osseous metastases occur in the spine. Approximately 60–70% of patients with systemic cancer will have spinal metastasis. Radiographic (x-ray) examination should be performed in cases of back pain when a patient has a cancer history, but without known active cancer or a tumor that tends to metastasize to the spine. This can make a diagnosis in many cases. This may occasionally allow for selection of bone scan in lieu of MRI in some cases. When radiographs do not answer the clinical question, then MRI may be appropriate after a consideration of conservative care.

"Neoplasms causing VCF (vertebral compression fractures) include 1) primary bone neoplasms, such as hemangioma or giant cell tumors, and tumor-like conditions causing bony and cellular remodeling, such as aneurysmal bone cysts, or Paget's disease (osteitis deformans); 2) primary malignant neoplasms including but not limited to multiple myeloma and lymphoma; and 3) metastatic neoplasms."[29]

Most common spine metastasis involving primary metastasis originate from the following tumors in descending order: breast (21%), lung (19%), prostate (7.5%), renal (5%), gastrointestinal (4.5%), and thyroid (2.5%). While all tumors can seed to the spine, the cancers mentioned above metastasize to the spinal column early in the disease process.[35]

Cauda Equina Syndrome

- Symptoms include severe back pain or sciatica along with one or more of the following:
    - Saddle anesthesia - loss of sensation restricted to the area of the buttocks, perineum, and inner surfaces of the thighs (areas that would sit on a saddle)
    - Recent bladder/bowel dysfunction
    - Achilles reflex absent on both sides
    - Sexual dysfunction that can come on suddenly
    - Absent anal reflex and bulbocavernosus reflex

MRI and Neurocutaneous Syndromes

- In NF-1, clinical evaluation appears to be more useful to detect complications than is screening imaging in asymptomatic patients. Imaging is indicated in evaluation of suspected tumors based on clinical evaluation and for follow-up of known intracranial and intraspinal l tumors.[67]
- Conversely in NF-2, routine MR imaging screening is always indicated, given the high prevalence of CNS tumors, especially vestibular schwannomas. In patients with NF-2, routine screening brain/IAC imaging is indicated annually starting from age 10, if asymptomatic, or earlier with clinical signs/symptoms. Most individuals with NF2

eventually develop a spinal tumor, mostly commonly schwannomas, but meningioma and ependymomas are also seen. Spinal imaging at baseline and every 2 to 3 years is also advised with more frequent imaging, if warranted, based on sites of tumor involvement.[68]

- In patients with tuberous sclerosis, brain MRI should be obtained every 1-3 years up until age 25 for surveillance for CNS abnormalities.[69]
- In Von Hippel Lindau syndrome, imaging of the brain and spinal cord for hemangioblastomas is recommended every 2 years.[70]
- In Sturge Weber Syndrome, brain MRI can rule out intracranial involvement only after age 1 and is recommended in patients < 1 year only if symptomatic.[71]

Drop Metastases[72] – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas and less commonly choroid plexus neoplasms and teratomas.

Leptomeningeal Carcinomatosis[73] – Leptomeningeal carcinomatosis is a complication of cancer in which cancerous cells spread to the membranes (meninges) that covers the brain and spinal cord. The most common solid tumors that involve the leptomeninges are breast, lung, melanoma, gastrointestinal, and primary central nervous system tumors.

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POLICY HISTORY

Date	Summary
May 2023	• Updated references • Updated background section • Clarified pathological reflexes • Added "Further evaluation of indeterminate or questionable findings on prior imaging": • Clarified cerebellar ataxia in gait table • Removed "radicular pain" and "malaise" from Isolated Back Pain in the Pediatric population: Red flags • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Removed Additional Resources
March 2022	Added • Combination request for overlapping body part statement • Clarified muscle weakness not related to plexopathy or peripheral neuropathy • Clarified bowel and bladder dysfunction – not related to an inherent bowel or bladder problem • Descriptions for tethered cord • Background section of Drop Metastases • Background section of Leptomeningeal Carcinomatosis • Clarified toe walking in pediatric patient • Added section on neuroinflammatory conditions Removed • Removed from combination section syrinx and syringomyelia and added subsection for cervical and thoracic spine section • Removed pediatric back pain from the total spine combination section

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **SPINAL CANAL MRA/MRV**	**Original Date: May 2008**
CPT Codes: 72159	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_046	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR SPINAL CANAL MAGNETIC RESONANCE ANGIOGRAPHY (MRA)

- For the evaluation of spinal arteriovenous malformation (AVM)[1-5]
- Myelopathy when the suspected etiology is a compromise of blood flow or drainage to the spinal cord[6, 7]
- For the evaluation of a known cervical spine fracture, disc herniation, infection, or venous thrombosis where there is concern for vascular pathology (compression or thrombosis) compromising spinal cord blood flow or venous drainage[6, 7]
- For the evaluation of known or suspected vertebral artery injury when there is also concern for vascular compromise to the spinal canal and its contents (otherwise neck MRA or CTA is sufficient to evaluate vertebral artery injury)[8, 9]
- Preoperative evaluation (e.g., localization of the spinal arteries prior to complex spinal surgery, aortic aneurysm repair, or characterization of suspected vascular lesion of the spinal canal and its contents)[10-12]
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.[2]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BACKGROUND

Application of spinal magnetic resonance angiography (MRA) allows for more effective and noninvasive screening for vascular lesions than magnetic resonance imaging (MRI) alone. It may improve characterization of normal and abnormal intradural vessels while maintaining good spatial resolution. Spinal MRA may be used for the evaluation of spinal arteriovenous malformations, as well as injuries to blood vessels supplying the spine and cord.

OVERVIEW

Spinal MR Angiography/MR Venography[13] - Typically, contrast-enhanced 3D time of flight techniques and contrast-enhanced CT angiography (CTA) are used for evaluation of the spinal arteries, veins, and related pathology as a non-invasive alternative to the gold standard catheter angiography. The detection rate of the Adamkiewicz artery (AKA) by MRA is in the range of 69-100%, but with modern equipment both MRA and CTA detection rates should approach 100%.[11] Magnetic resonance angiography is well suited to patients who cannot receive iodinated contrast and undergo CTA. CTA has the advantage over MRA of providing greater spatial resolution, can image the entire spine during one contrast bolus, and provides for a faster exam time that is less prone to motion artifact. MRA is limited by a finite field of view, typically ≤ 50 cm.[11] MRI has the advantage over CT of detecting areas of ischemia via diffusion weighted imaging. Mathur et al showed a 100% sensitivity in detecting recurrent spinal arteriovenous fistulas post-treatment.[2]

Spinal Arteriovenous Malformations (AVMs) – Spinal cord arteriovenous malformations are comprised of snarled tangles of arteries and veins that affect the spinal cord. They are fed by spinal cord arteries and drained by spinal cord veins. Spinal dural arteriovenous (AV) fistulas are the most encountered vascular malformation of the spinal cord and are a treatable cause of progressive paraparesis. Magnetic resonance angiography (MRA) can record the pattern and velocity of blood flow through vascular lesions as well as the flow of cerebrospinal fluid throughout the spinal cord. MRA can define the vascular malformation and may assist in determining treatment.[5]

Spinal Arteries/Veins - Vascular malformations, trauma, disc herniations, neoplasms, and coagulopathies or infection causing thrombosis can compromise the spinal cord blood supply

and drainage. The spinal cord arterial supply is derived from the anterior spinal artery, posterolateral spinal artery, and the arteria radicularis magna or artery of Adamkiewicz (AKA). The anterior spinal artery supplies the anterior two-thirds of the cord and arises from the vertebral arteries. It receives contributions from the ascending cervical artery, the inferior thyroid artery, the intercostal arteries, the lumbar artery, the iliolumbar artery, lateral sacral arteries, and the AKA. The AKA arises on the left side of the aorta between the T8 and L1 segments, to anastomose with the anterior spinal artery and supply the lower two-thirds of the spinal cord. Two posterolateral spinal arteries arise from the posteroinferior cerebellar arteries and supply the posterior third (posterior columns, posterior roots, and dorsal horns) of the spinal cord. The spinal venous system is divided into intrinsic and extrinsic veins differentiated by their location within the spinal canal or extrinsic to the canal, respectively. They drain into the radiculomedullary veins, subsequently to paravertebral and intervertebral plexuses, then to the segmental veins that eventually drain into the ascending lumbar veins, azygos system, and pelvic venous plexuses.[6]

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POLICY HISTORY

Date	Summary
May 2023	• Updated references • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
May 2022	Updated references

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*National Imaging Associates, Inc.	
Clinical guidelines **PELVIS CTA (Angiography)**	**Original Date: July 2008**
CPT Codes: 72191	**Last Revised Date: March 2023**
Guideline Number: NIA_CG_038	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR PELVIS CT Angiography / CT Venography (CTA/CTV)

IMPORTANT NOTE

When vascular imaging of the aorta and both legs, i.e., CTA aortogram and runoff is desired (sometimes incorrectly requested as Abd/Pelvis CTA & Lower Extremity CTA Runoff)**, only one authorization request is required, using CPT Code 75635 Abdominal Arteries CTA.** This study provides for imaging of the abdomen, pelvis, and both legs. The CPT code description is CTA aorto-iliofemoral runoff; abdominal aorta and bilateral ilio-femoral lower extremity runoff**.**

When separate requests for CTA abdomen and CTA Pelvis are encountered for processes involving both the abdomen and pelvis (but do NOT need to include legs/runoff), they need to be resubmitted as a single Abdomen/Pelvis CTA, using CPT Code 74174 (to avoid unbundling). Otherwise, the exam should be limited to the appropriate area (i.e., Abdomen OR Pelvis) that includes the area of concern.

Evaluation of known or suspected pelvic vascular disease
Abdominal Aortic Aneurysm (AAA) (needs to be resubmitted as CTA Abdomen and Pelvis unless there is a specific finding limited to the pelvis)

Other vascular abnormalities seen on prior imaging studies limited to the pelvis:

- Initial evaluation of inconclusive vascular findings on prior imaging
- Follow-up of known visceral vascular conditions in the pelvis (such as aneurysm, dissection, compression syndromes, arteriovenous malformations (AVMs), fistulas, intramural hematoma, and vasculitis)
- Vascular invasion or displacement by tumor (conventional CT or MRI also appropriate)[1]
- For known iliac vascular disease, e.g., aneurysm, dissection, arteriovenous malformations (AVMs), and fistulas, intramural hematoma, and vasculitis[2-4] when ultrasound is inconclusive (See background for ultrasound screening intervals). CTA/MRA rather than CT/MRI is needed for non-aortic disease when ultrasound is inconclusive.[5]
- Suspected complications of known aneurysm as evidenced by clinical findings such as new onset of pelvic pain

Vascular ischemia or hemorrhage needs to be resubmitted as CTA Abdomen and Pelvis unless there is a specific finding limited to the pelvis)

For patients at increased risk for vascular abnormalities (CTA or MRA): (needs to be resubmitted as CTA Abdomen and Pelvis unless there is a specific finding limited to the pelvis)

Venous

- For evaluation of suspected pelvic vascular disease or pelvic congestive syndrome when findings on ultrasound are indeterminate (MR or CT venography (CTV) may be used as the initial study for pelvic thrombosis or thrombophlebitis)[6, 7]
- For unexplained lower extremity edema (typically unilateral or asymmetric) with negative or inconclusive ultrasound[8]
- For evaluation of venous thrombosis in the inferior vena cava[9]
- Venous thrombosis if previous studies have not resulted in a clear diagnosis[10]
- Vascular invasion or displacement by tumor (Conventional CT or MRI also appropriate)[1, 11]
- For suspected May-Thurner Syndrome (iliac vein compression syndrome) (can include abdomen CTA)[12, 13]

Other vascular indications

- For evaluation of erectile dysfunction when a vascular cause is suspected and Doppler ultrasound is inconclusive[14]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Pre-operative evaluation[15, 16]

- Evaluation of interventional vascular procedures prior to endovascular aneurysm repair (EVAR), or for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Imaging of the deep inferior epigastric arteries for surgical planning (breast reconstruction surgery), if abdomen CTA is also needed, resubmit as abdomen and pelvis CTA[16]
- Prior to uterine artery embolization for fibroids (MRA preferred)[17]
- Prior to solid organ transplantation when vascular anatomy is needed

Post-operative or post-procedural evaluation

- Evaluation of post-operative complications of renal transplant allograft[18]
- Evaluation of endovascular/interventional vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Evaluation of post-operative complications, e.g., pseudoaneurysms related to surgical bypass grafts, vascular stents, and stent-grafts in the pelvis
- Follow-up for post-endovascular repair (EVAR) or open repair of abdominal aortic aneurysm (AAA)[5] or abdominal extent of iliac artery aneurysms. **CT preferred** unless MRA/CTA is needed for procedural planning or to evaluate complex anatomy.(Needs to be resubmitted as CTA Abdomen and Pelvis unless there is a specific finding limited to the pelvis)

When Pelvis CTA is requested in combination with Chest CTA, the Pelvis CTA needs to be resubmitted as an Abdomen/Pelvis CTA (see Abdomen/Pelvis CTA Guidelines for approvable combo indications)

BACKGROUND

Computed tomographic angiography (CTA) is used in the evaluation of many conditions affecting the veins and arteries of the pelvis or lower extremities. It is not appropriate as a screening tool for asymptomatic patients without a previous diagnosis.

OVERVIEW

CT/MRI and acute hemorrhage: MRI is not indicated. MRA/MRV is rarely indicated for evaluation of intraperitoneal or retroperitoneal hemorrhage, particularly in the acute setting.

CT is the study of choice due to its availability, speed of the study and less susceptibility to artifact from patient motion. Advances in technology have allowed conventional CT to not just detect hematomas but to also identify the source of acute vascular extravasation. In special cases, finer vascular detail to assess the specific vessel responsible for hemorrhage may require the use of CTA. CTA in diagnosis of lower gastrointestinal bleeding is such an example.[19] MRA/MRV can be utilized in non-acute situations to assess vascular structure involved in atherosclerotic disease and its complications, such as vasculitis, venous thrombosis, vascular congestion, or tumor invasion. Although some of these conditions may be associated with hemorrhage, bleeding is usually not the primary reason why MRI/MRA/MRV is selected for the evaluation. A special condition where MRI may be superior to CT for evaluating hemorrhage is to detect an underlying neoplasm as the cause of bleeding.[20]

Follow-up of asymptomatic, incidentally detected iliac artery aneurysms: The definition of an iliac artery aneurysm (IAA) is dilatation to more than 1.5 times its normal diameter; in general, a common iliac artery ≥ 18 mm in men and ≥ 15 mm in women; an internal iliac artery (IIA) > 8 mm is considered aneurysmal.

Iliac aneurysm ultrasound screening intervals:

- Aneurysm size 2.0 -2.9 cm, every 3 years
- Aneurysm size 3.0-3.4 cm, annually
- Aneurysm size > 3.5 cm, every 6 months[5]

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POLICY HISTORY

Date	Summary
March 2023	• Redirected vascular requests for abdomen alone or pelvis imaging alone to resubmit as abdomen and pelvis CTA required unless condition limited to pelvis • Other vascular abnormalities: clarified indication for non-aortic vascular conditions • Transplant: added section • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Aligned sections across body imaging guidelines
April 2022	• Removed follow-up intervals for EVAR and AAA since Abdomen Pelvis CTA is usually appropriate study

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guideline **PELVIS CT**	**Original Date: September 1997**
CPT Codes: 72192, 72193, 72194	**Last Revised Date: March 2023**
Guideline Number: NIA_CG_036	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

Note: For syndromes for which imaging starts in the pediatric age group, MRI preferred

Note: PELVIS CT **ALONE** SHOULD ONLY BE APPROVED WHEN DISEASE PROCESS IS SUSPECTED TO BE LIMITED TO THE PELVIS. CT Abdomen/Pelvis Combo (CPT Codes: 74176, 74177, 74178) is the correct study when the indication(s) include both the abdomen AND pelvis, such as CTU (CT Urography), CTE (CT Enterography), acute abdominal pain, widespread inflammatory disease or neoplasm.

When separate requests for CT abdomen and CT Pelvis are encountered for processes involving both the abdomen and pelvis, they need to be resubmitted as a single Abdomen/Pelvis CT (to avoid unbundling). Otherwise, the exam should be limited to the appropriate area (i.e., Abdomen OR Pelvis) which includes the specific organ, area of known disease/abnormality, or the area of concern.

INDICATIONS FOR PELVIS CT

Pelvic Pain for Unknown Etiology

- CT allowed after initial workup is inconclusive and must include results of the following:
    - Initial imaging, such as ultrasound (although ultrasound does have limitations, it is a common misconception that ultrasound is not a good tool in ALL obese patients, such that it is often useful even in obese patients and quite reasonable

to attempt as a first-line imaging modality particularly given the benefit of no radiation), scope study, or x-ray AND
    - Appropriate laboratory testing (chemistry profile, complete blood count, and urinalysis)
- For acute pelvic pain in a patient over the age of 65[1, 2]

Initial staging of prostate cancer (MRI Pelvis preferred)
(Abdomen CT can also be approved for staging if PSMA PET not requested)

- Unfavorable intermediate risk, high risk and very high-risk disease
    - Gleason 8, 9, 10 disease
    - Gleason 4+3=7 disease (primary pattern 4)
    - Gleason 3+4=7 disease AND PSA > 10 or clinical stage ≥ T2b
    - Gleason 3+3=6 disease AND PSA > 20 or clinical stage ≥ T3
    - >50% cores positive for cancer in a random (non-targeted) biopsy[4]

*Note: In patients who have been on a 5-alpha reductase inhibitor (such as Proscar) in the past 12 months, an "adjusted PSA" should be used. To adjust, multiply PSA by a factor of 2 (e.g., PSA 6 on finasteride adjusts to a PSA of 12)

Known prostate cancer for workup of recurrence and response to treatment when there is a contraindication for MRI and PSMA PET is not requested[5]

- Initial treatment by radical prostatectomy
    - Failure of PSA to fall to undetectable levels or PSA detectable and rising on at least 2 subsequent determinations
- Initial treatment radiation therapy
    - Post-radiation therapy (Post-RT) rising PSA on at least 2 subsequent determinations or positive digital exam and is candidate for local therapy
- Known metastatic disease with progression on therapy does not require CI to MRI if CT is requested

Evaluation of suspicious or known mass/tumors

- Initial evaluation of suspicious pelvic masses/tumors found only in the pelvis by physical exam and ultrasound has been performed
- Surveillance: One follow-up exam to ensure no suspicious change has occurred in a tumor in the pelvis. No further surveillance CT unless tumor(s) are specified as highly suspicious, or change was found on exam or last follow-up imaging
- Initial staging of known cancer
- Follow-up of known cancer[4, 5]
    - In a patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer.
        - Known cancer with suspected pelvis metastasis based on a sign, symptom (e.g., anorexia, early satiety, intestinal obstruction, night sweats, pelvic

pain, weight loss, vaginal bleeding), or an abnormal lab value (alpha-fetoprotein, CEA, CA 19-9, p53 mutation)

- For abnormal incidental pelvic lymph nodes when follow-up is recommended based on prior imaging (initial 3-month follow-up)[6]

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated, OR evaluation of suspected metastases

- < 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of suspected infection or inflammatory disease[7, 8]

- Suspected perianal fistula or occult anorectal abscess (MRI preferred)[9-11]
- Suspected infection in the pelvis (based on elevated WBC, fever, anorexia, or nausea and vomiting)
- CT cystourethrography (CTCUG) in the preoperative setting[12]
- For suspected urethral stricture or periurethral pathology only if MRI cannot be done[13, 14]
- Complications of diverticulitis limited to the pelvis (prior imaging study is not required for diverticulitis diagnosis) with severe abdominal pain or severe tenderness or mass, not responding to antibiotic treatment

For evaluation of known infection or inflammatory disease follow-up[15]

- Any known infection to have created an abscess in the pelvis that requires re-evaluation
- Any history of fistula limited to the pelvis that requires re-evaluation or is suspected to have recurred
- For patients with recurrent fistula in anal or perianal Crohn's disease (MRI preferred)[11]
- Abnormal fluid collection seen on prior imaging that needs follow-up evaluation and limited to the pelvis

For evaluation of Inflammatory Bowel Disease (IBD) such as Crohn's or Ulcerative Colitis (MRE should be considered for age < 35 to reduce radiation exposure). If only Pelvis CT is requested for IBD, requests should be resubmitted as CT Abdomen and Pelvis (see Guideline for criteria) unless it is known that the disease is limited to the pelvis.

For suspected or known hernia

- For pelvic pain due to a suspected occult, spigelian, or incisional hernia when physical exam and prior imaging are non-diagnostic or equivocal or if requested as a preoperative study
- For confirming the diagnosis of a recurrent hernia when ultrasound is negative or non-diagnostic

- Hernia with suspected complications (e.g., bowel obstruction or strangulation, or non-reducible) based on symptoms (e.g., diarrhea, hematochezia, vomiting, severe pain), physical exam (guarding, rebound) or prior imaging[16]
- Deep pelvic hernia is suspected (obturator, sciatic or perineal); does not require US first but this type of hernia needs to be specified in notes[17] (if CT Abdomen is also needed, resubmit as CT Abdomen and Pelvis)

For evaluation of known or suspected non-aortic vascular disease (e.g., aneurysms, hematomas)[18, 19], CTA/MRA is the preferred study when ultrasound is inconclusive

- If a contraindication to CTA/MRA has been provided, CT can be approved
- Follow-up for post-endovascular repair (EVAR) or open repair of iliac artery aneurysms (CT preferred unless MRA/CTA is needed for procedural planning or to evaluate complex anatomy)
    - Routine, baseline study (post-op/intervention) is warranted within the first month after EVAR:
        - Repeat in 6 months if type II endoleak is seen (continue every 6 months x 24 months, then annually)
        - Repeat in 12 months if no endoleak or sac enlargement is seen
        - If neither endoleak nor AAA enlargement is seen on imaging one year after EVAR, CT is needed only if US is not feasible for annual surveillance (until year 5 as below)
    - If symptomatic or imaging shows increasing, or new findings related to stent graft – more frequent imaging may be needed

Musculoskeletal Indications (all of the following require contraindication to MRI)

- Known or suspected aseptic/avascular necrosis of hip(s) after completion of initial x-ray[20] (CT or MRI can be approved for surgical planning)
- Sacroiliitis (infectious or inflammatory, such as Ankylosing Spondylitis/ Spondyloarthropathies) after completion of x-ray and rheumatology workup[21-23]
- Sacroiliac joint dysfunction (after initial x-ray) when there is:
    - Persistent back and/or sacral pain unresponsive to four (4) weeks of conservative treatment, received within the past six (6) months, including physical therapy or physician-supervised home exercise plan (HEP)
- Persistent Pain:
    - For evaluation of persistent pain unresponsive to four (4) weeks of conservative treatment received within the past six (6) months
    - For suspected piriformis syndrome after failure of 4 weeks conservative treatment[24]
- For evaluation of both hips when the patient meets hip CT guidelines (x-ray + persistent pain unresponsive to conservative treatment) for both the right and left hip, Pelvis CT is the preferred study.

    - If labral tear is suspected due to a positive anterior impingement sign or posterior impingement sign, then bilateral hip CTs are the preferred studies (not Pelvis CT)
    - If bilateral hip arthrograms are requested and otherwise meet guidelines, bilateral hip MRIs are the preferred studies (not Pelvis CT)
- When non-diagnostic imaging is requested for anatomic guidance for hip surgery, a CT Pelvis is approvable since measurements of both hips may be needed (only one non-diagnostic request can be approved and should include the surgical site)
- For further evaluation of congenital anomalies of the sacrum and pelvis and initial imaging has been performed

Transplants

- Prior to solid organ transplantation
- For initial workup prior to Bone Marrow Transplantation (BMT) (along with CT Chest[25], CT Abdomen, CT Sinus and Brain MRI)[26]). Alternatively, PET might be sufficient to evaluate the abdomen and pelvis if indicated based on that malignancy (see PET Guideline)

For evaluation of trauma[27]

- For evaluation of trauma with lab or physical findings of pelvic bleeding
- For evaluation of physical or radiological evidence of complex or occult pelvic fracture or for pre-operative planning of complex pelvic fractures

Other Indications for Pelvic CT:

- Persistent pelvic pain not explained by previous imaging
- For diffuse, unexplained lower extremity edema with negative or inconclusive ultrasound[28]
- For suspected May-Thurner syndrome (CTV/MRV preferred)[29, 30]
- For further evaluation of a new onset or non-reducible varicocele[31]
- For assessment of pelvic congestion syndrome when findings on ultrasound are indeterminate (CTA/MRA preferred)[32]
- To locate an intrauterine device after ultrasound and plain x-ray are equivocal or non-diagnostic (imaging of the abdomen may also be indicated)[33, 34]
- For diagnosis or to guide treatment of urachal anomalies when ultrasound is non-diagnostic[35, 36]

Other Indications for Pelvis CT when CI to MRI is provided:

- For follow-up of an indeterminate or inconclusive finding on ultrasound limited to the pelvis
- For location or evaluation of undescended testes in adults and in children, including determination of location of testes, if ordered by a specialist[37]

- For evaluation and characterization of uterine and adnexal masses, (e.g., fibroids, ovaries, tubes, and uterine ligaments) or congenital uterine or renal abnormality where ultrasound has been done previously[38]
- For evaluation of abnormal uterine bleeding when ultrasound findings are indeterminate[39]
    - Age ≤ 50 – Vascular stalk or focal doppler signal on US
    - Age > 50 – Thickened endometrium, vascular stalk or focal doppler signal on US
- For evaluation of uterus prior to and after embolization (CTA may be approved in addition to CT for preprocedural planning)[40]
- For evaluation of endometriosis when preliminary imaging has been completed or to follow up known endometriosis[41, 42]
- For further evaluation of suspected adenomyosis when ultrasound is inconclusive,[43] such as the following:
    - Uterine abnormality on US
        - Anechoic spaces/cysts in myometrium
        - Heterogeneous echotexture
        - Obscured endometrial/myometrial border
        - Sub-endometrial echogenic linear striations
        - Thickening of the transition zone
        - Uterine enlargement
        - Uterine wall thickening
- Prior to uterine surgery if there is abnormality suspected on prior ultrasound
- For suspected placenta accreta or percreta when ultrasound is indeterminate[44]
- For further assessment of a scrotal or penile mass when ultrasound is inconclusive[45, 46]
- For investigation of a malfunctioning penile prosthesis
- Suspected urethral diverticula and other imaging is inconclusive[47]
- For suspected patent urachus or other urachal abnormalities when ultrasound is non-diagnostic[35, 36]
- For transient or episodic hematospermia and age ≥ 40 with negative or inconclusive ultrasound
- For persistent hematospermia (duration > 1 month, any age) with negative or inconclusive ultrasound [48]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Pre-operative evaluation

- For diagnostic purposes prior to pelvic surgery or procedure

For post-operative/procedural evaluation

- Follow-up of known or suspected post-operative complication involving the hips or the pelvis[49, 50] within six months
- A follow-up study to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed

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BACKGROUND

CT provides direct visualization of anatomic structures in the abdomen and pelvis and is a fast-imaging tool used to detect and characterize disease involving the abdomen and pelvis. Pelvic imaging begins at the iliac crests through pubic symphysis. It has an ability to demonstrate abnormal calcifications or fluid/gas patterns in the viscera or peritoneal space.

In general, ionizing radiation from CT should be avoided during pregnancy. Ultrasound is clearly a safer imaging option and is the first imaging test of choice; although, CT after equivocal ultrasound has been validated for diagnosis. Clinicians should exercise increased caution with CT imaging in children, pregnant women, and young adults due to the risks of exposure to ionizing radiation. Screening for pregnancy as part of a work-up is suggested to minimize the number of unexpected radiation exposures for women of childbearing age.

OVERVIEW

***Conservative Therapy**: This should include a multimodality approach consisting of a **combination of active and inactive components**. Inactive components, such as rest, ice, heat, modified activities, medical devices, acupuncture and/or stimulators, medications, injections (epidural, facet, bursal, and/or joint, not including trigger point), and diathermy can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or chiropractic care.

****Home Exercise Program** - **(HEP)/Therapy:** the following elements are required to meet guidelines for completion of conservative therapy[51]:

- Information provided on exercise prescription/plan AND
- Follow-up with member with documentation provided regarding lack of improvement (failed) after completion of HEP (after suitable 4-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute "inability to complete" HEP).
- Dates and duration of failed PT, physician-supervised HEP, or chiropractic treatment should be documented in the original office notes or an addendum to the notes.

Ultrasound should be considered prior to a request for Pelvis CT for the following:

- Initial evaluation or follow-up of ovarian mass or abnormal physical finding

Combination request of Abdomen CT/Chest CT - A Chest CT will produce images to the level of L3. Documentation for combo is required.

Helical CT of Prostate Cancer – Conventional CT is not useful in detecting prostate cancer as it does not allow direct visualization. Contrast-enhanced MRI is more useful in detecting prostate cancer. MRI is recommended in patients with suspected cancer but prior negative biopsy because MRI alone can miss up to 26% of clinically significant cancers that would be detected on systemic biopsy.[52] Helical CT of the prostate may be a useful alternative to MRI in patients with an increasing PSA level and negative findings on biopsy but is not the imaging study of choice.

Pelvic Trauma and CT Imaging – Helical CT is useful in the evaluation of low- or high-flow vascular injuries in patient with blunt or penetrating pelvic trauma. It provides detailing of fractures and position of fracture fragments along with the extent of diastasis of the sacroiliac joints and pubic symphysis. CT helps determine whether pelvic bleeding is present and can identify the source of bleeding. With CT, high flow hemorrhage can be distinguished from low flow hemorrhage aiding the proper treatment.

Imaging of hernias – Most hernias are diagnosed clinically with imaging recommended for the diagnosis of occult hernias or in the evaluation of hernia complications, such as bowel obstruction or strangulation. Groin hernias are at increased risk for incarceration/strangulation in women, right femoral hernias, and when there is a hernia-related hospitalization in the year preceding hernia repair. Morbidity and mortality are increased for strangulated hernias in patients over 65, prolonged symptoms, incarceration of over 24 hours, symptoms of > 3 days, bowel obstruction, anticoagulant use.[53] To detect occult hernias, ultrasound is a first-line study with a sensitivity of 86% and specificity of 77% compared to 80% sensitivity and 65% specificity for CT.[54] According to Miller et al, "Magnetic resonance imaging is generally not considered a first- or even second-line evaluation modality for hernias…".[55] Based on this analysis MRI is recommended only when ultrasound and CT have been performed and fail to make a diagnosis.

Weight loss definitions and initial evaluation[56, 57] – Unintentional weight loss is considered clinically significant if the amount of weight lost over 12 months is ≥ 5%. Older age and higher percentage of weight loss correlates with higher likelihood of malignancy. A targeted evaluation is recommended when there are signs or symptoms suggestive of a specific source. For example, when there is clinically significant weight loss with abdominal pain that prompts an evaluation for an abdominal source of the weight loss; CXR and labs such as TSH would not be needed prior to abdominal imaging. Conversely a smoker with a cough and weight loss would not start with abdominal imaging, a chest x-ray would be the first test to start with. When there is no suspected diagnosis, initial evaluation includes CXR, age-appropriate cancer screening (such as colonoscopy and mammography) and labs (including CBC, CMP, HbA1C, TSH, stool

hemoccult, ESR/CRP, HIV, Hepatitis C). If this initial evaluation fails to identify a cause of weight loss, then the patient is monitored and if progressive weight loss is seen on subsequent visits/weights, then CT Chest/Abdomen/Pelvis is reasonable; MRI if there is a contraindication to CT such as contrast allergy or impaired renal function.[58]

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POLICY HISTORY

Date	Summary
March 2023	• Prostate cancer: updated guidance based on new NCCN criteria • IBD: eliminated indications for abdomen alone or pelvis imaging alone, resubmission as abdomen and pelvis CT required unless limited indication • Hernia: added indication for deep pelvic hernia • Aneurysm: eliminated indications for abdomen alone or pelvis imaging alone, resubmission as abdomen and pelvis CT required unless limited indication, updated guidance for imaging intervals post-repair • Musculoskeletal: additional guidance provided for hip imaging, non-diagnostic requests added, corrected statement requiring abnormal x-ray to requiring prior x-ray • Transplant: added section (added section from MRI if CI to MRI provided) • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Aligned sections across body imaging guidelines
April 2022	• Added abnormal incidental pelvic lymph nodes when follow-up is recommended based on prior imaging (initial 3-month follow-up) to "Evaluation of suspicious or known mass/tumors" • Within sacroiliitis, clarification of non-diagnostic or indeterminate findings

Reviewed / Approved by NIA Clinical Guideline Committee

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Clinical guidelines **PELVIS MRI**	**Original Date: September 1997**
CPT Codes: 72195, 72196, 72197, +0698T	**Last Revised Date: March 2023**
Guideline Number: NIA_CG_037	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

Note: There is no MRI Abdomen/Pelvis combo (comparable to a CT Abdomen/Pelvis) such that if imaging of both the abdomen and pelvis are indicated, two separate exams (and authorization) are required (i.e., MRI Abdomen and MRI Pelvis)

INDICATIONS FOR PELVIC MRI (Click here for Fetal MRI indications**)**

Initial pelvic imaging for staging of prostate cancer (if not recently performed for biopsy planning; Abdomen MRI can also be approved for staging if PSMA PET not requested)

- Unfavorable intermediate risk, high risk and very high-risk disease*
  - Gleason 8, 9 or 10 disease
  - Gleason 4+3=7 disease (primary pattern 4)
  - Gleason 3+4=7 disease AND PSA > 10 or clinical stage ≥ T2b
  - Gleason 3+3=6 disease AND PSA > 20 or clinical stage ≥ T3
  - > 50% cores positive for cancer in a random (non-targeted) biopsy[1,2]

Pelvis MRI can be approved in combination with PSMA PET (see PET GL) for initial staging if meets above criteria

* In patients who have been on a 5-alpha reductase inhibitor (such as Proscar) in the past 12 months, an "adjusted PSA" should be used. To adjust, multiply PSA by a factor of 2 (i.e., PSA 6 on finasteride adjusts to a PSA of 12)

Known prostate cancer for workup of recurrence and response to treatment[3]

- Initial treatment by active surveillance (asymptomatic very low, low, or intermediate risk with expected patient survival ≥ 10 years):
    - Initial multiparametric MRI (mpMRI) for patients who chose active surveillance
    - mpMRI to be repeated no more than every 12 months unless clinically indicated
- Initial treatment by radical prostatectomy:
    - Failure of PSA to fall to undetectable level or PSA detectable and rising on at least 2 subsequent determinations
- Initial treatment radiation therapy:
    - Post-radiation therapy (Post-RT) rising PSA on at least 2 subsequent determinations or positive digital exam and is candidate for local therapy

Indication for prostate MRI (suspected prostate cancer)[4-9]

- Prior to prostate biopsy when notes indicate that biopsy is planned[10]
- In individuals with previous negative biopsy and ongoing concerns of increased risk of prostate cancer (i.e., rising or persistently elevated PSA OR suspicious digital rectal exam (DRE))
- For evaluation of elevated PSA (on two separate levels) when PI-RADS classification needed to make decision on whether or not to perform a biopsy when ALL of the following has been provided[11]:
    - Digital rectal examination (DRE) findings
    - PSA elevation not attributed to benign disease
    - Biopsy has been discussed with the patient (Typically, this request would be from the person performing the biopsy (i.e., urologist) and imaging done at the facility where the fusion biopsy would be performed should a higher risk lesion be identified.)
- For evaluation of a very suspicious prostate nodule on exam when biopsy is under consideration[11]
- Follow up MRI can be approved at the following intervals[12, 13]:
    - PI-RADS 3-5 lesions: 12-month interval
    - PI-RADS 1-2 lesions: 24-month interval
        - Earlier for PI-RADS 1-2 if biopsy is clearly planned, progressive rise in PSA or other risk factors exist

Evaluation of masses seen on ultrasound or CT for further evaluation of indeterminate or questionable findings:

- Initial imaging (see organ specific guidance below)
- One follow-up exam to ensure no suspicious change has occurred in a tumor in the pelvis. No further surveillance MR unless tumor(s) is/are specified as highly suspicious, or change was found on exam or last follow-up imaging.
- For abnormal incidental pelvic lymph nodes when follow-up is recommended based on prior imaging (initial 3-month follow-up)[4]

Initial staging of known cancer

Follow-up of known cancer[3, 14]:

- In a patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
- With suspected pelvic metastasis based on a sign, symptom, (e.g., anorexia, early satiety, intestinal obstruction, night sweats, pelvic pain, weight loss, vaginal bleeding) or an abnormal lab value (alpha-fetoprotein, CEA, CA 19-9, p53 mutation)

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of suspected infection or inflammatory disease after preliminary imaging (such as CT, US, or nuclear medicine) has been performed or is contraindicated (includes MR urography (MRU) which includes abdomen MRI when indicated)[15-18]

- Suspected perianal fistula
- Suspected infection (based on elevated WBC, fever, anorexia, or nausea and vomiting) in the pelvis
- For suspected urethral stricture or periurethral pathology[19]
- Suspected peritonitis (would typically need to include MRI Abdomen), abdominal pain and tenderness to palpation is present, and at LEAST one of the following:
    - Rebound, guarding or rigid abdomen, OR
    - Severe tenderness to palpation over the entire abdomen
- Complications of diverticulitis with severe abdominal pain or severe tenderness or mass, not responding to antibiotic treatment (prior imaging study is not required for diverticulitis diagnosis)

For evaluation of known infection or inflammatory disease follow-up[16, 20, 21]

- Any known infection that is clinically suspected to have created an abscess in the pelvis and preliminary imaging has been performed or is contraindicated
- Any history of fistula limited to the pelvis that requires re-evaluation or is suspected to have recurred
- For patients with recurrent fistula or perianal Crohn's disease
- Abnormal fluid collection seen on prior imaging that needs follow-up evaluation and is limited to the pelvis

For evaluation of Inflammatory Bowel Disease (IBD) such as Crohn's or Ulcerative Colitis (includes MR enterography and can also approve Abdomen MRI/MRE)

- For suspected inflammatory bowel disease after complete work up including physical exam, labs, and recent colonoscopy[22-24]
- Known inflammatory bowel disease with recurrence or worsening signs/symptoms requiring re-evaluation or for monitoring therapy[25]

For suspected or known hernia

- For pelvic pain due to a suspected occult, spigelian, or incisional hernia when physical exam and prior imaging (ultrasound AND CT) are non-diagnostic or equivocal[26-29] and limited to the pelvis
- Hernia with suspected complications, such as strangulation or incarceration, based on physical exam (guarding, rebound) or prior imaging[30] (CT preferred)
- Suspected athletic pubalgia (sports hernia) in a patient with persistent groin pain that occurs with exertion, who has not responded to conservative treatment for four weeks, when other imaging is inconclusive[31, 32]
- Deep pelvic hernia is suspected (obturator, sciatic or perineal) (does not require US first but this type of hernia needs to be specified in notes)[33]

Indications for Musculoskeletal Pelvic MRI

- Initial evaluation of suspicious mass/tumor of the bones, muscles or soft tissues of the pelvis found on an imaging study, and needing clarification, or found by physical exam and after x-ray or ultrasound is completed
- Evaluation of suspected fracture and/or injury when initial imaging is completed or for confirmed stress (fatigue) fracture for "return to play" evaluation[34]
- For evaluation of known or suspected aseptic/avascular necrosis of hip(s) after completion of initial x-ray[35]
- Known or suspected sacroiliitis (infectious or inflammatory) after completion of x-ray[36] and rheumatologic workup
- Sacroiliac Joint Dysfunction (after initial X-ray) when there is[36]:

    - Persistent back and/or sacral pain unresponsive to four (4) weeks of conservative treatment, received within the past six (6) months, including physical therapy or physician supervised home exercise plan (HEP)
- For evaluating the lumbosacral plexus[37, 38]:
    - To confirm involvement in symptomatic patients with known tumor
    - To assess extent of injuries in the setting of pelvic trauma
    - To exclude the presence of masses in patients with unilateral changes, or inconclusive or abnormal findings on EMG when there are persistent symptoms
    - For evaluation when lumbar spine MRI is suspicious or indeterminate
- For suspicion of pudendal neuralgia in the setting of chronic pelvic pain with genital numbness and erectile dysfunction when other causes have been ruled out (see Background regarding diagnosis)[39]
- For suspicion of meralgia paresthetica when prior testing is inconclusive (diagnostic nerve block; electrodiagnostic testing; AND somatosensory evoked potentials)[40, 41]
- Persistent Pain:
    - For evaluation of persistent pain unresponsive to four (4) weeks of conservative treatment received within the past six (6) months
    - For suspected piriformis syndrome after failure of 4 weeks conservative treatment[42]
- For evaluation of both hips when the patient meets hip MRI guidelines (x-ray + persistent pain unresponsive to conservative treatment) for both the right and left hip, Pelvis MRI is the preferred study.
    - If labral tear is suspected due to a positive anterior impingement sign or posterior impingement sign, then bilateral hip MRIs are the preferred studies (not Pelvis MRI)
    - If bilateral hip arthrograms are requested and otherwise meet guidelines, bilateral hip MRIs are the preferred studies (not Pelvis MRI)
- For further evaluation of congenital anomalies of the sacrum and pelvis and initial imaging has been performed

For evaluation of known or suspected non-aortic vascular disease (e.g., aneurysms, hematomas)[43, 44], CTA/MRA is the preferred study when ultrasound is inconclusive

- If a contraindication to CTA/MRA has been provided, MRI can be approved

Other Indications for a Pelvic MRI when CT is inconclusive or cannot be completed

- Persistent abdominal/pelvic pain not explained by previous imaging
- For any of the following B symptoms: fevers more than 101° F, drenching night sweats, or unexplained weight loss of more than 10% of body weight over 6 months with documented concern for lymphoma/malignancy when CT is inconclusive or cannot be completed (can approve abdomen MRI, too, when appropriate)

- Clinically significant unintentional weight loss i.e., ≥ 5% of body weight in less than 12 months (or ≥ 2% in one month), with signs or symptoms suggestive of an abdominal cause (see Background for weight loss definitions and initial evaluation) , Abdomen MRI should also be approved)
- Ongoing unexplained clinically significant weight loss i.e., ≥ 5% of body weight in less than 12 months (or ≥ 2% in one month)[45-47], after initial workup (see Background) has been completed, no cause identified, and second visit documenting further decline in weight
- For fever of unknown origin (temperature of ≥ 101° degrees for a minimum of 3 weeks) after standard diagnostic tests are negative[48]
- For suspected or known retroperitoneal fibrosis after complete workup and ultrasound to determine extent of disease[49]
- For suspected paraneoplastic syndrome (including dermatomyositis) with high suspicion of abdominal malignancy and appropriate workup has been done (see Background for details)
- For diffuse, unexplained lower extremity edema with negative or inconclusive ultrasound[50]
- For suspected May-Thurner syndrome (CTV/MRV preferred)[51, 52]
- For further evaluation of a new onset or non-reducible varicocele[53]
- Prior to liver transplantation (Abdomen CT preferred, MRCP also approvable), may repeat studies immediately prior to transplantation with known HCC, PSC or cholangiocarcinoma
- Prior to Bone Marrow Transplant (BMT) (along with CT Chest[54], CT (or MR) Abdomen, CT Sinus and Brain MRI)[55]). Alternatively, PET might be sufficient to evaluate the abdomen and pelvis if indicated based on that malignancy (see PET Guideline)
- Prior to solid organ transplantation
- Von Hippel Lindau (VHL) at least every other year starting at age 16; can also approve abdomen MRI (abdomen and pelvis ultrasound starting at age 8)[56]
- Hereditary Paraganglioma syndromes every 2-3 years IF whole body MRI (unlisted MRI CPT 76498) not available. (WB MRI is the preferred study; if unable to do whole body MRI may approve abdomen MRI, pelvis MRI, skull base and neck MRI and chest CT. SDHB mutation may start at age 6, all other SDHx start at age 10).
- Multiple Endocrine Neoplasia type 1 (MEN1) every 1-3 years (chest CT or MRI also approvable for this syndrome at same interval) [57]

Other indications for a Pelvic MRI (MRI preferred over CT)

- Pelvic pain not explained by previous imaging/pre-procedure[58]
    - Appropriate laboratory testing (chemistry profile, complete blood count, and urinalysis) and initial imaging, such as ultrasound
- For location or evaluation of undescended testes in adults and in children, including determination of location of testes, if ordered by a specialist[59]

- For evaluation and characterization of uterine and adnexal masses, (e.g., fibroids, ovaries, tubes, and uterine ligaments) or congenital uterine or renal abnormality where ultrasound has been done previously[58]
- For evaluation of abnormal uterine bleeding when ultrasound findings are indeterminate[60]
    - Age ≤ 50 – Vascular stalk or focal doppler signal on US
    - Age > 50 – Thickened endometrium, vascular stalk or focal doppler signal on US
- For evaluation of uterus prior to and after embolization (MRA may be approved in addition to MRI for preprocedural planning)[61]
- For evaluation of endometriosis when preliminary imaging has been completed or to follow up known endometriosis[62, 63]
- For further evaluation of suspected adenomyosis when ultrasound is inconclusive,[64] such as the following:
    - Uterine abnormality on US
        - Anechoic spaces/cysts in myometrium
        - Heterogeneous echotexture
        - Obscured endometrial/myometrial border
        - Sub-endometrial echogenic linear striations
        - Thickening of the transition zone
        - Uterine enlargement
        - Uterine wall thickening
- Prior to uterine surgery if there is abnormality suspected on prior ultrasound
- For suspected placenta accreta or percreta when ultrasound is indeterminate[65]
- For further assessment of a scrotal or penile mass when ultrasound is inconclusive[66, 67]
- For investigation of a malfunctioning penile prosthesis
- Suspected urethral diverticula and other imaging is inconclusive[68]
  (MRI may be indicated without prior ultrasound in limited situations as suggested, such as when there is compelling evidence suggestive of urethral diverticulum (i.e., ostia on cystoscopy or tender cystic lesion on anterior vaginal wall overlying the urethra) or for surgical planning.)
- For suspected pelvic congestion syndrome in women with chronic pelvic pain when other imaging is non-diagnostic[69]
- For suspected patent urachus or other urachal abnormalities when ultrasound is non-diagnostic[70, 71]
- MR defecography for suspected structural cause of defecatory outlet obstruction to confirm diagnosis if other testing is equivocal (anorectal manometry and balloon expulsion testing)[72]
- For evaluation of enlargement of organ abnormality seen on previous imaging - to provide an alternative to an indeterminate or inconclusive ultrasound
- For diffuse, unexplained lower extremity edema with negative or inconclusive ultrasound

- Surveillance MRI (include abdomen) every 2-3 years for patients with Hereditary Paraganglioma syndromes Type 1-5[73]
- For transient or episodic hematospermia and age ≥ 40 with negative or inconclusive ultrasound
- For persistent hematospermia (duration > 1 month, any age) with negative or inconclusive ultrasound [74]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Pre-operative evaluation

- For diagnostic purposes prior to pelvic surgery or procedure

Post-operative/procedural evaluation

- Follow-up of known or suspected post-operative complication involving the hips or the pelvis[75, 76] within six months
- A follow-up study to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed.

Note: If an Abdomen/Pelvis MRI is indicated and the Abdomen MRI has already been approved, then the Pelvis MRI may be approved.

Fetal MRI (CPT codes 74712-74713) - To better define or confirm a known for suspected abnormality of the fetus after ultrasound has been performed during the second trimester[77] or when fetal surgery is planned and/or to make a decision about therapy, delivery or to advise the family about prognosis.[78] Also includes evaluation of the maternal pelvis and placenta.

BACKGROUND

Magnetic resonance imaging of the pelvis is a noninvasive technique for the evaluation, assessment of severity, and follow-up of diseases of the male and female pelvic organs. MRI

provides excellent contrast of soft tissues and provides multiplanar and 3D depiction of pathology and anatomy. Patients undergoing MRI do not have exposure to ionizing radiation or iodinated contrast materials. MRI techniques utilize body coils to image the entire pelvis or endoluminal coils for evaluation of the rectum, prostate, and genitourinary system.

OVERVIEW

PI-RADS Assessment Categories for Prostate Cancer[79]:

The assignment of a PI-RADS category is based on mpMRI findings only and does not incorporate other factors, including PSA testing, DRE (digital rectal exam), or clinical history.

PI-RADS 1 – Very low (clinically significant cancer is highly unlikely to be present)
PI-RADS 2 – Low (clinically significant cancer is unlikely to be present)
PI-RADS 3 – Intermediate (the presence of clinically significant cancer is equivocal)
PI-RADS 4 – High (clinically significant cancer is likely to be present)
PI-RADS 5 – Very high (clinically significant cancer is highly likely to be present)

***Conservative Therapy** – Conservative therapy should include a multimodality approach consisting of a **combination of active and inactive components**. Inactive components, such as rest, ice, heat, modified activities, medical devices, acupuncture and/or stimulators, medications, injections (epidural, facet, bursal, and/or joint, not including trigger point), and diathermy can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or chiropractic care.

****Home Exercise Program - (HEP)/Therapy** – the following elements are required to meet guidelines for completion of conservative therapy[80, 81]:

- Information provided on exercise prescription/plan AND
- Follow up with member with documentation provided regarding lack of improvement (failed) after completion of HEP (after suitable 4-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute "inability to complete" HEP).
- Dates and duration of failed PT, physician-supervised HEP, or chiropractic treatment should be documented in the original office notes or an addendum to the notes.

MRI and Undescended Testes – The most common genital malformation in boys is undescended testis. In one series, 70% of undescended testes are palpable. Despite the advances in ultrasound technology, ultrasound cannot reliably identify intra-abdominal testes, which comprise 20% of all undescended testes.[82] The timely management of undescended testis is important to potentially minimize the risk of infertility and lessen the risk of malignancy. MRI is used as a diagnostic tool in the detection of undescended testes and can

reveal information for both anatomic and tissue characterization. It is noninvasive, non-ionizing, and can obtain multiplanar images.

MRI and Adnexal Masses – MRI is used in the evaluation of adnexal masses. It can identify and characterize different neoplastic and nonneoplastic abnormalities, e.g., exophytic leiomyoma, endometrioma, dermoid cyst, and ovarian edema. It is a useful adjunct when sonography is inconclusive in the evaluation of adnexal masses.

MRI and Endometriosis – MRI manifestations of endometriosis vary including endometrioma, peritoneal endometrial implant, adhesion, and other rare features. The data obtained from imaging must be combined with clinical data to perform preoperative assessment of endometriosis.

MRI and Lumbosacral Plexopathy – Complete lumbar (L1-L4) or sacral plexopathy (L5-S3) may present with weakness, sensory loss, and flaccid loss of tendon reflexes. Clinical diagnosis is confirmed by EMG. Acute and chronic plexopathies may be caused by nerve sheath tumors; infectious, autoimmune, hereditary, or idiopathic neuropathies; extrinsic compression; or trauma.[38] There is no CPT® code specifically for imaging of the LS plexus.
Pudendal neuralgia may be considered in chronic pain patients who meet the Nantes criteria: pain in the area innervated by the pudendal nerve, pain more severe with sitting, pain that does not awaken the patient from sleep, pain with no objective sensory impairment, and pain relieved by pudendal block. All five criteria must be met for diagnosis.[39]

MRI and Prostate Cancer – Although prostate cancer is the second leading cause of cancer in men, most cases do not lead to a prostate cancer-related death. Aggressive treatment of prostate cancer can have side effects, such as incontinence, rectal injury, and impotence. It is very important to do an evaluation that will assist in making decisions about therapy or treatment. MRI can non-invasively assess prostate tissue, functionally and morphologically. MRI evaluation may use a large array of techniques, e.g., T1-weighted images, T2-weighted images, and dynamic contrast enhanced T1-weighted images.

MRI and Rectal Cancer – MRI is used in the evaluation of rectal cancer to visualize not only the intestinal wall but also the surrounding pelvic anatomy. MRI is an excellent imaging technique due to its high soft-tissue contrast, powerful gradient system, and high resolution. It provides accurate evaluation of the topographic relationship between lateral tumor extent and the mesorectal fascia.

Imaging of hernias – Most hernias are diagnosed clinically with imaging recommended for the diagnosis of occult hernias or in the evaluation of hernia complications, such as bowel obstruction or strangulation. To detect occult hernias, ultrasound is a first-line study with a sensitivity of 86% and specificity of 77%, compared to 80% sensitivity and 65% specificity for CT.[29] According to Miller et al, “Magnetic resonance imaging is generally not considered a first-

or even second-line evaluation modality for hernias…."[28] Both MRI and US can be valuable for diagnosing pathology in athletes with groin pain when a sports hernia is suspected. Pain usually occurs with exertion with tenderness over the pubic symphysis or tubercle and exquisite tenderness on direct palpation of the superficial inguinal ring (positive direct stress test).This term initially denoted a posterior inguinal wall deficiency due to disruption of fascia and/or muscle but more recently given the label "core injury" to also include adductor tendon tears, injury to the aponeurosis of the rectus abdominus and adductor longus tendons, and osteitis pubis.[31]

Elevated CA-125 and pelvic imaging – There is no evidence that isolated levels of CA-125 with no other clinical or radiologic evidence of pathology is sensitive or specific and should not be performed as an isolated test as it can lead to unnecessary studies and anxiety. It is elevated in most cases of epithelial ovarian cancer and is used in monitoring response to treatment as an adjunct to pelvic US. CA-125 has been shown to be increased in many conditions such as fibroids, adenomyosis, pancreatic cancer, endometriosis, tuberculosis, and interstitial lung disease. MRI is not indicated as a first-line test.[83]

Fever of Unknown Origin

Initial work up prior to CT would include a comprehensive history, repeated physical exam, complete blood count with differential, three sets of blood cultures, chest x-ray, complete metabolic panel, urinalysis, ESR, ANA, RA, CMV IgM antibodies, virus detection in blood, heterophile antibody test, tuberculin test, and HIV antibody test.[48] Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for fever can Chest CT be approved. If CXR suggests a malignancy and/or source of fever, then Chest CT would be approved.

Suspected paraneoplastic syndromes with no established cancer diagnosis: laboratory evaluation and imaging

The laboratory evaluation for paraneoplastic syndrome is complex. If the appropriate lab test results are suspicious for malignancy, imaging is indicated.

For **SIADH** (hyponatremia + increased urine osmolality), there is a high association with small cell lung cancer, therefore imaging typically starts with chest CT. If other symptoms suggest a different diagnosis other than small cell lung cancer, different imaging studies may be reasonable.

For **hypercalcemia** (high serum calcium, low-normal PTH, high PTHrP) it is reasonable to start with bone imaging followed by a more directed evaluation such as mammogram, chest, abdomen and pelvis imaging as appropriate.

For **Cushing syndrome** (hypokalemia, normal-high midnight serum ACTH NOT suppressed with dexamethasone) abdominal and chest imaging is reasonable. If dexamethasone suppression test DOES suppress ACTH, pituitary MRI is reasonable.

For **hypoglycemia**, labs drawn during a period of hypoglycemia (glucose < 55, typically a 72 hour fast) (insulin level, C-peptide and IGF-2:IGF-1 ratio) should be done to evaluate for an insulinoma. An elevated insulin level, elevated C-peptide and/or normal IGF-2:IGF-1 ratio warrant CT or MRI abdomen to look for insulinoma. A low insulin, low C-peptide and/or elevated IGF-2:IGF-1 ratio warrant chest and abdominal imaging.

When a **paraneoplastic neurologic syndrome** is suspected, nuclear and cytoplasmic antibody panels are often ordered to further identify specific tumor types. Results are needed prior to imaging. Because these tests are highly specific, if an antibody highly associated with a specific cancer is positive, then further imaging for that cancer is reasonable. For example, anti-Hu has a high association with SCLC and chest CT would be reasonable. Anti-MA2 has a high association with testicular cancer and testicular ultrasound would be a reasonable next step.

Weight loss definitions and initial evaluation
Unintentional weight loss is considered clinically significant if the amount of weight lost over 12 months is ≥ 5%. Older age and higher percentage of weight loss correlates with higher likelihood of malignancy. A targeted evaluation is recommended when there are signs or symptoms suggestive of a specific source. For example, when there is clinically significant weight loss with abdominal pain that prompts an evaluation for an abdominal source of the weight loss; CXR and labs such as TSH would not be needed prior to abdominal imaging. Conversely a smoker with a cough and weight loss would not start with abdominal imaging, a chest x-ray (CXR) would be the first test to start with. When there is no suspected diagnosis, initial evaluation includes CXR, age-appropriate cancer screening (such as colonoscopy and mammography) and labs (including CBC, CMP, HbA1C, TSH, stool hemoccult, ESR/CRP, HIV, Hepatitis C). If this initial evaluation fails to identify a cause of weight loss, then the patient is monitored and if progressive weight loss is seen on subsequent visits/weights, then CT Abdomen/Pelvis is reasonable (MRI if there is a contraindication to CT such as contrast allergy or impaired renal function). Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for weight loss can Chest CT be approved. If CXR suggests a malignancy and/or source of weight loss, then Chest CT would be approved.

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POLICY HISTORY

Date	Summary
March 2023	• Prostate cancer: updated guidance based on new NCCN criteria • IBD: clarified indications • Hernia: added indication for deep pelvic hernia • Musculoskeletal: additional guidance provided for hip imaging, non-diagnostic requests added, corrected statement requiring abnormal x-ray to requiring prior x-ray • Other: specified guidance for weight loss, paraneoplastic syndrome, edema; added indications for thrombocytopenia, gestational trophoblastic disease, cancer predisposition syndromes • Aneurysm: added section about non-aortic vascular disease • Transplant: added section • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Aligned sections across body imaging guidelines
March 2022	• Added when MRI is requested to potentially avoid a prostate biopsy • Added abnormal incidental pelvic lymph nodes when follow-up is recommended based on prior imaging (initial 3-month follow-up) • Within section concerning evaluation of suspected infection or inflammatory disease, added: o Suspected peritonitis (typically needing to include MRI Abd) with abd pain, tenderness to palpation, and at least one of the following: ▪ Rebound, guarding or rigid abdomen, OR ▪ Severe tenderness to palpation over entire abdomen o Complications of diverticulitis with severe abdominal pain or severe tenderness or mass, not responding to antibiotic treatment (prior imaging study is not required for diverticulitis diagnosis) • Removed “For MR Enterography (MRE) if CT or MRI of the abdomen and pelvis are inconclusive” from the section on evaluation of suspected IBD • Clarified pelvic pain due to suspected occult, spigelian, or incisional hernia • Clarified hernia with suspected complications • Added “after initial x-ray” to Sacroiliac Joint Dysfunction

	• Removed “For evaluation of suspected pelvic floor weakness in women with functional disorders, such as urinary or fecal incontinence, obstructed defecation, and pelvic organ prolapse” from “Other Indications for a Pelvic MRI” • Added B symptoms to “Other Indications for a Pelvic MRI”

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **PELVIS MRA/MRV (Angiography/Venography)**	**Original Date: May 2008**
CPT Codes: 72198	**Last Revised Date: March 2023**
Guideline Number: NIA_CG_039	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE: Abdomen/Pelvis Magnetic Resonance Angiography (MRA) with Lower Extremity MRA Runoff Requests: **Two authorization requests are required, one Abdomen MRA, CPT code 74185 and one for Lower Extremity MRA, CPT code 73725 (a separate Pelvic MRA request is not required). This will provide imaging of the abdomen, pelvis, and both legs.**

INDICATIONS FOR PELVIS MR ANGIOGRAPHY / MR VENOGRAPHY (MRA/MRV)

Arterial

Evaluation of known or suspected pelvic vascular disease

Abdominal Aortic Aneurysm (AAA) (also approve Abdomen MRA):

- For **asymptomatic** known or suspected abdominal aortic aneurysms, **ultrasound** should be done prior to advanced imaging. Only when the ultrasound is inconclusive, is advanced imaging with CT or MRI needed
- For **symptomatic** known or suspected AAA (such as recent-onset abdominal pain or back pain, particularly in the presence of a pulsatile or epigastric mass, suspected dissection, or significant risk factors for AAA) CTA/MRA is appropriate and generally preferred over CT/MRI. (If contrast is contraindicated or other clinical indications for

abdomen and/or pelvic imaging are present, then CT/MR may be approved rather than CTA/MRA)
- If there is known complex vascular anatomy, CTA/MRA may be needed.

Other vascular abnormalities seen on prior imaging studies:

- Initial evaluation of inconclusive vascular findings on prior imaging
- Follow-up of known visceral vascular conditions in the pelvis (such as aneurysm, dissection, compression syndromes, arteriovenous malformations (AVMs), fistulas, intramural hematoma, and vasculitis)
- For assessment in patients with spontaneous coronary artery dissection (SCAD), can be done at time of coronary angiography (also approve MRA abdomen)[1]
- Vascular invasion or displacement by tumor (conventional CT or MRI also appropriate)[2]
- For known large vessel diseases (inferior vena cava or iliac arteries/veins), e.g., aneurysm/dissection (non-aortic disease), arteriovenous malformations (AVMs), and fistulas, intramural hematoma, and vasculitis[3-5]
    - Surveillance is done with ultrasound at intervals similar to AAA, however, CTA/MRA rather than CT/MRI is needed for non-aortic disease when ultrasound is inconclusive[6]
- Follow-up of iliac artery aneurysm when ultrasound is inconclusive and CI to CTA is provided (see Background)
- Suspected complications of known aneurysm as evidenced by clinical findings such as new onset of pelvic pain

Vascular ischemia or hemorrhage:

- To determine the vascular source of retroperitoneal hematoma or hemorrhage when CT is insufficient to determine the source and CTA is contraindicated (may also approve Abdomen MRA; CT rather than MRA/CTA is the modality of choice for diagnosing hemorrhage)[7]
- For evaluation of known or suspected mesenteric ischemia/ischemic colitis when CTA is contraindicated (can approve MRA abdomen and pelvis)[8]

For patients at increased risk for vascular abnormalities (CTA or MRA):

- For patients with fibromuscular dysplasia (FMD), a one-time vascular study of the abdomen and pelvis[9]
- For patients with vascular Ehlers-Danlos syndrome or Marfan syndrome, a one-time vascular study of the abdomen and pelvis
- For Loeys-Dietz, imaging at diagnosis and then every two years, more frequently if abnormalities are found (Imaging may include head, neck, chest, abdomen and pelvis)[10, 11]

Venous

- For evaluation of suspected pelvic vascular disease or pelvic congestive syndrome when findings on ultrasound are indeterminate (MR or CT venography (CTV) may be used as the initial study for evaluating pelvic thrombosis or thrombophlebitis)[12, 13]
- For unexplained lower extremity edema (typically unilateral or asymmetric) with negative or inconclusive ultrasound[14]
- For evaluation of venous thrombus in the inferior vena cava[15]
- Venous thrombosis if previous studies have not resulted in a clear diagnosis[16]
- Vascular invasion or displacement by tumor (Conventional CT or MRI also appropriate)[2]
- For known/suspected May-Thurner Syndrome (iliac vein compression syndrome)[17, 18]

Pre-operative evaluation[19-21]

- Evaluation prior to interventional vascular for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Evaluation prior to endovascular aneurysm repair (EVAR)
- Imaging of the deep inferior epigastric arteries for surgical planning (breast reconstruction surgery) include CTA/MRA abdomen
- Prior to uterine artery embolization for fibroids[22]
- Prior to solid organ transplantation when vascular anatomy is needed

Post-operative or post-procedural evaluation

- Post-operative complications of renal transplant allograft[23]
- Endovascular/interventional vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Post-operative complications, e.g., pseudoaneurysms related to surgical bypass grafts, vascular stents, and stent-grafts in the pelvis
- Follow-up for post-endovascular repair (EVAR) or open repair of abdominal aortic aneurysm (AAA)[24] or abdominal extent of iliac artery aneurysms (**CT preferred** unless MRA/CTA is needed for procedural planning or to evaluate complex anatomy)
    - Routine, baseline study (post-op/intervention) is warranted within the first month after EVAR:
    - Repeat in 6 months if type II endoleak is seen (continue every 6 months x 24 months, then annually)
    - Repeat in 12 months if no endoleak or sac enlargement is seen
    - If neither endoleak nor AAA enlargement is seen on imaging one year after EVAR, CT is needed only if US is inconclusive for annual surveillance (until year 5 as below)
    - Non-contrast CT of entire aorta (abdomen and pelvis) is needed every 5 years after open repair of AAA or EVAR
    - If symptomatic or imaging shows increasing, or new findings related to stent graft – more frequent imaging may be needed

    - For suspected complication such as: new-onset lower extremity claudication, ischemia, or reduction in ABI after aneurysm repair
- Follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Chest MRA, Abdomen MRA, or Abdomen/Pelvis MRA combo

- Acute aortic dissection (CTA or CT preferred)
- Takayasu's arteritis
- Marfan syndrome
- Loeys-Dietz syndrome
- Spontaneous coronary artery dissection (SCAD)
- Vascular Ehlers-Danlos syndrome
- Post-operative complications
- Significant post-traumatic or post-procedural vascular complications reasonably expected to involve the chest and/or abdomen and/or pelvis

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BACKGROUND

Magnetic resonance angiography (MRA) generates images of the arteries that can be evaluated for evidence of stenosis, occlusion, or aneurysms. It is used to evaluate the arteries of the abdominal aorta and the renal arteries. Contrast-enhanced MRA requires the injection of a contrast agent which results in very high-quality images. It does not use ionizing radiation, allowing MRA to be used for follow-up evaluations.

OVERVIEW

Bruits: Blowing vascular sounds heard over partially occluded blood vessels. Abdominal bruits may indicate partial obstruction of the aorta or other major arteries such as the renal, iliac, or femoral arteries. Associated risks include but are not limited to; renal artery stenosis, aortic aneurysm, atherosclerosis, AVM, or coarctation of aorta.

MRA and Chronic Mesenteric Ischemia – Contrast-enhanced MRA is used for the evaluation of chronic mesenteric ischemia, including treatment follow-up. Chronic mesenteric ischemia is usually caused by severe atherosclerotic disease of the mesenteric arteries, e.g., celiac axis, superior mesenteric artery, inferior mesenteric artery. At least two of the arteries are usually affected before the occurrence of symptoms such as abdominal pain after meals and weight loss. MRA is the technique of choice for the evaluation of chronic mesenteric ischemia in patients with impaired renal function.

MRA and Abdominal Aortic Aneurysm Repair – MRA may be performed before endovascular repair of an abdominal aortic aneurysm. Endovascular repair of abdominal aortic aneurysm is a minimally invasive alternative to open surgical repair, and its success depends on precise measurement of the dimensions of the aneurysm and vessels. This helps to determine selection of an appropriate stent-graft diameter and length to minimize complications, such as endoleakage. MRA provides images of the aorta and branches in multiple 3D projections and may help to determine the dimensions needed for placement of an endovascular aortic stent graft. MRA is noninvasive and rapid and may be used in patients with renal impairment.

Iliac aneurysm ultrasound screening intervals:

- Aneurysm size 2.0-2.9 cm, every 3 years
- Aneurysm size 3.0-3.4 cm, annually
- Aneurysm size > 3.5 cm, every 6 months[6]

MRI/CT and acute hemorrhage: MRI is not indicated and MRA/MRV (MR Angiography/ Venography) is rarely indicated for evaluation of intraperitoneal or retroperitoneal hemorrhage, particularly in the acute setting. CT is the study of choice due to its availability, speed of the study, and less susceptibility to artifact from patient motion. Advances in technology have allowed conventional CT to not just detect hematomas but also the source of acute vascular extravasation. In special cases, finer vascular detail to assess the specific source vessel responsible for hemorrhage may require the use of CTA. CTA in the diagnosis of lower gastrointestinal bleeding is such an example.[25]

MRA/MRV is often utilized in non-acute situations to assess vascular structure involved in atherosclerotic disease and its complications, vasculitis, venous thrombosis, vascular congestion, or tumor invasion. Although some of these conditions may be associated with hemorrhage, it is usually not the primary reason why MRI/MRA/MRV is selected for the evaluation. A special condition where MRI may be superior to CT for evaluating hemorrhage is to detect an underlying neoplasm as the cause of bleeding.[7]

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POLICY HISTORY

Date	Summary
March 2023	• Aneurysm: specified guidance on initial imaging and screening intervals with emphasis on requiring ultrasound on initial imaging and indications for advanced imaging, specified guidance on post-repair imaging • Other vascular abnormalities: clarified indication for non-aortic vascular conditions • Transplant: added section • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
April 2022	• Added "(abdomen and pelvis MRA when CTA is inconclusive or cannot be performed)

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **UPPER EXTREMITY CT** **(Hand, Wrist, Elbow, Long bone, or Shoulder CT)**	**Original Date: September 1997**
CPT Codes: 73200, 73201, 73202	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_057-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR UPPER EXTREMITY CT (HAND, WRIST, ARM, ELBOW, OR SHOULDER) (Plain radiographs must precede CT evaluation)

Some indications are for MRI, CT, or MR or CT Arthrogram. More than one should not be approved at the same time.

If a CT Arthrogram fits approvable criteria below, approve as CT.

Joint or muscle pain without positive findings on an orthopedic exam as listed above, after x-ray completed[1,2] (does not apply to young children). If MRI contraindicated or cannot be performed or requested as a CT arthrogram.

- Persistent joint or musculotendinous pain unresponsive to conservative treatment*, within the last 6 months which includes active medical therapy (physical therapy, chiropractic treatments, and/or physician-supervised exercise**), of at least four (4) weeks, **OR**
- With progression or worsening of symptoms during the course of conservative treatment

Joint specific provocative orthopedic examination and MRI is contraindicated or cannot be performed or requested as a CT arthrogram

Note: With a positive orthopedic sign, an initial x-ray is always preferred. However, it is not required to approve advanced imaging. Any test that suggests joint instability requires further imaging (list is not all inconclusive)

Shoulder[3-6]

- Rotator cuff weakness on exam
- Subscapularis tendon tear
    - Belly press off test
    - Napoleon test
    - Bear Hug test
    - Internal rotation lag
    - Lift-off test
- Supraspinatus tendon tear
    - Drop Arm
    - Full Can test
    - Empty Can (aka Jobe or Supraspinatus test)
    - Hawkins or Neer test[7] (only when ordered by an orthopedic surgeon if there is clear documentation in the records that an actual rotator cuff tear is suspected, and NOT just for the evaluation of impingement)
- Infraspinatus / Teres Minor / Biceps tendon tear
    - External rotation lag sign at 0 and 90 degrees
    - Pain or weakness with resisted external rotation testing
    - Hornblower test
    - Popeye sign (if acute finding or for evaluation of surgical correction)
- Labral tear/ Instability
    - Grind test
    - Clunk test
    - Crank test, Compression-rotation test
    - O'Brien's test
    - Anterior load and shift
    - Apprehension test
    - Posterior load and shift test
    - Jerk Test
    - Sulcus sign

Elbow[8, 9]

- Biceps tendon
    - Bicipital aponeurosis (BA) flex test
    - Biceps squeeze test

    - Hook test
    - Passive forearm pronation test
    - Reverse Popeye sign (if acute finding or for evaluation of surgical correction)
- Instability
    - Posterolateral rotatory drawer test
    - Tabletop relocation test
        - Valgus stress
        - Varus stress
        - Milking maneuver
        - Push-up test

Wrist[10, 11]

- Lunotriquetral ligament
    - Derby Relocation test
    - Reagan test (lunotriquetral ballottement test)
- TFCC tear
    - Press test
    - Ulnar foveal sign/test
    - Ulnocarpal stress test
- Scaphoid ligament
    - Watson test (scaphoid shift test)
    - Scapholunate ballottement test

Tendon or Muscle Rupture after x-ray[12-14] **(not listed above)** If MRI contraindicated or cannot be performed.

- High clinical suspicion of a specific tendon rupture based on mechanism of injury and physical findings (i.e., triceps or pectorals tendon rupture)

Shoulder Dislocations[15, 16] If MRI contraindicated or cannot be performed unless requested as CT arthrogram or to evaluate glenoid bone stock or size of Hill- Sachs lesion.

- Recurrent
- First time in any of the situations below that increase the risk or repeated dislocation
    - Glenoid or humeral bone loss on x-ray
    - Bankart lesion on radiographs
    - 14 – 40-year-old
    - > 40 with exam findings concerning for rotator cuff tear (i.e., weakness on exam)

Bone Fracture (If MRI contraindicated or cannot be performed)

- Suspected occult scaphoid fracture with snuffbox pain after initial x-ray

- Non scaphoid suspected occult, stress or insufficiency fracture with a negative initial x-ray[17-19]
    - Repeat x-rays in 10-14 days if negative or non-diagnostic
- Pathologic fracture on x-ray or CT[20]
- Suspected ligamentous/tendon injury with known fractures on x-ray/CT that may require surgery

Fracture Nonunion

- Nonunion or delayed union as demonstrated by no healing between two sets of x-rays. If a fracture has not healed by 4-6 months, there is delayed union. Incomplete healing by 6-8 months is nonunion.[21]

Osteochondral Lesions (defects, fractures, osteochondritis dissecans) and x-ray completed[22-25]

- Clinical suspicion based on mechanism of injury and physical findings

Loose bodies or synovial chondromatosis and after x-ray or ultrasound completed

- In the setting of joint pain or mechanical symptoms [26]

Osteonecrosis (e.g., Avascular necrosis (AVN)[27-29] when MRI is contraindicated or cannot be preformed

- To further characterize a prior abnormal x-ray
- Normal x-rays but symptomatic and high-risk (e.g., glucocorticosteroid use, renal transplant recipient, glycogen storage disease, alcohol abuse,27 sickle cell anemia28)
- Known osteonecrosis to evaluate a contralateral joint after initial x-rays

Joint prosthesis/replacement

- Suspected joint prosthesis loosening or dysfunction, (i.e. pseudotumor formation) after initial x-rays [30, 31]

Extremity Mass[32]

- Mass or lesion after non-diagnostic x-ray or ultrasound[33] MRI preferred. CT is better than MRI to evaluate mass calcification or bone involvement and may complement or replace MRI[34]
    - If superficial mass, then ultrasound is the initial study
    - If deep mass, then x-ray is the initial study
- Vascular malformations
    - After initial evaluation with ultrasound and results will change management or for preoperative planning[35]
        - CTA is also approvable for initial evaluation

        - Follow up after treatment/embolization

Known Primary Cancer of the Extremity[36-40]

- Initial staging primary extremity tumor
- Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
- Signs or symptoms or imaging findings suspicious for recurrence
- Suspected metastatic disease with signs/symptoms and after initial imaging with radiographs

Further evaluation of indeterminate or questionable findings on prior imaging and MRI cannot be performed or CT is preferred (i.e., tumor matrix)

- For initial evaluation of an inconclusive finding on a prior imaging report (i.e., x-ray, ultrasound or MRI) that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam).

Infection of Bone, Joint or Soft tissue abscess[41, 42]

MRI and nuclear medicine studies are recommended for acute infection as they are more sensitive in detecting early changes of osteomyelitis.[43] CT is better at demonstrating findings of chronic osteomyelitis (sequestra, involucrum, cloaca, sinus tracts) as well as detecting soft tissue gas and foreign bodies.[44]

- Abnormal x-ray or ultrasound
- Negative x-ray but with a clinical suspicion of infection
    - Signs and symptoms of joint or bone infection include:
        - Pain and swelling
        - Decrease range of motion
        - Fever
    - Laboratory findings of infection include any of the following:
        - Elevated ESR or CRP
        - Elevated white blood cell count
        - Positive joint aspiration
- Ulcer (diabetic, pressure, ischemic, traumatic) with signs of infection (redness, warm, swelling, pain, discharge which may range from white to serosanguineous) that is not improving despite treatment and bone, or deep infection is suspected
    - Increased suspicion if size or temperature increases, bone is exposed/positive probe-to-bone test, new areas of breakdown, new smell[45]

Pre-operative/procedural evaluation:

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation:

- When imaging, physical, or laboratory findings indicate joint infection, delayed or non-healing, or other surgical/procedural complications

Inflammatory Arthropathy (e.g., rheumatoid arthritis) and MRI is contraindicated or cannot be performed[46, 47]

- Further evaluation of an abnormality or non-diagnostic findings on prior imaging
- Initial imaging of a single joint for diagnosis or response to therapy after plain films and appropriate lab tests (e.g., RF, ANA, CRP, ESR)
- To determine change in treatment or when diagnosis is uncertain prior to start of treatment
- Follow-up to determine treatment efficacy in the following:
    - Early rheumatoid arthritis
    - Advanced rheumatoid arthritis if x-ray and ultrasound are equivocal or noncontributory

Known or suspected inflammatory myopathies (If MRI contraindicated or cannot be performed): (Includes polymyositis, dermatomyositis, immune-mediated necrotizing myopathy, inclusion body myositis)[48, 49]

- For diagnosis
- For biopsy planning

Crystalline Arthropathy

- Dual-energy CT can be used to characterize crystal deposition disease (i.e. gout) after
    - Appropriate rheumatological work up and initial x-rays AND
    - After inconclusive joint aspiration or when joint aspiration cannot be performed OR[50]
    - In the setting of extra-articular crystal deposits (i.e., tendons or bursa)

Foreign Body[51]

- Indeterminate x-ray and ultrasound

Peripheral Nerve Entrapment (e.g., carpal tunnel) and MRI is contraindicated or cannot be performed, including any of the following[52-56]:

- Abnormal electromyogram or nerve conduction study
- Abnormal x-ray or ultrasound

- Clinical suspicion and failed 4 weeks conservative treatment including at least two of the following (active treatment with physical therapy is not required):
    - Activity modification
    - Rest, ice, or heat
    - Splinting or orthotics
    - Medication

Brachial Plexopathy and MRI is contraindicated or cannot be performed[57, 58]

- If mechanism of injury or EMG/NCV studies are suggestive
- Chest CT is preferred study, but neck and/or shoulder (upper extremity) CT can be approved depending on the suspected location of injury

Pediatrics

- Osteoid Osteoma after an x-ray is done[59]

BACKGROUND

Computed tomography (CT) may be used for the diagnosis, evaluation, and management of conditions of the hand, wrist, elbow, and shoulder. CT is not usually the initial imaging test, but it is performed after standard radiographs. CT is used for preoperative evaluation or to evaluate specific abnormalities of the bones, joints, and soft tissues of the upper extremities.

OVERVIEW

***Conservative Therapy** – (Musculoskeletal) should include a multimodality approach consisting of a combination of active and inactive components. Inactive components, such as rest, ice, heat, modified activities, medical devices, (including crutches, immobilizer, metal braces, orthotics, rigid stabilizer, or splints, etc. and not to include neoprene sleeves), medications, injections (bursal, and/or joint, not including trigger point), and diathermy, can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or chiropractic care.

****Home Exercise Program - (HEP)** – The following two elements are required to meet guidelines for completion of conservative therapy:

- Information provided on exercise prescription/plan AND
- Follow-up with member with information provided regarding completion of HEP (after suitable 4-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute “inability to complete” HEP).

Shoulder Dislocation – Glenoid bone loss occurs in anterior shoulder dislocation. Severe degrees of glenoid bone loss are shown on axial radiography, but it can be quantified more definitively using CT. This information is important as it helps to predict the likelihood of further dislocation and the need for bone augmentation surgery. The number of dislocations cannot reliably predict the degree of glenoid bone loss; it is important to quantify glenoid bone loss, initially by arthroscopy and later by CT.

American Academy of Pediatrics "Choosing Wisely" Guidelines advise against ordering advanced imaging studies (MRI or CT) for most musculoskeletal conditions in a child until all appropriate clinical, laboratory and plain radiographic examinations have been completed. **"**History, physical examination, and appropriate radiographs remain the primary diagnostic modalities in pediatric orthopedics, as they are both diagnostic and prognostic for the great majority of pediatric musculoskeletal conditions. Examples of such conditions would include, but not be limited to, the work up of injury or pain (spine, knees, and ankles), possible infection, and deformity. MRI examinations and other advanced imaging studies frequently require sedation in the young child (5 years old or less) and may not result in appropriate interpretation if clinical correlations cannot be made. Many conditions require specific MRI sequences or protocols best ordered by the specialist who will be treating the patient… if you believe findings warrant additional advanced imaging, discuss with the consulting orthopedic surgeon to make sure the optimal studies are ordered."[60]

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POLICY HISTORY

Date	Summary
May 2023	• Updated orthopedic signs • Modified background sections • Modified dual energy CT • Added known AVN to evaluate contralateral side • Added vascular malformations • Added indeterminate findings on prior imaging and follow up surveillance • Added Popeye sign and Reverse Popeye sign • Updated References • Removed Additional Resources • Added statement regarding clinical indications not addressed in the guideline. • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
March 2022	• Simplified orthopedic sign section to include only the most robust signs and removed Table 1 • Clarified the Supraspinatus Test • Moved the section on shoulder impingement, non-traumatic shoulder instability and glenoid labral tears to the background information section • Expanded Bone or Ligament Injury section to include triangular fibrocartilage injury and superior labral anterior to posterior complex lesions when MRI cannot be done • Removed occult wrist ganglion section • Added Snuff box pain after initial x-ray to wrist section and Popeye sign to elbow section

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **UPPER EXTREMITY CTA/CTV**	**Original Date: July 2008**
CPT Codes: 73206	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_061-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

When a separate CTA and CT exam is requested, documentation requires a medical reason that clearly indicates why additional CT imaging of the upper extremity is needed.

INDICATIONS FOR UPPER EXTREMITY CTA/CTV (Computed Tomography Angiogram/Computed Tomography Venogram)

Hand Ischemia[1, 2]

- Arterial Doppler not needed with any of these acute symptoms:
  - Ischemic ulceration without segmental temperature change
  - Ischemic ulceration with painful ischemia
  - Acute sustained loss of perfusion with or without acral ulceration
  - Imminent loss of digit
- Clinical symptoms without the above features; with abnormal arterial Doppler and will change management
  - Includes Raynaud's (can be associated with scleroderma), Buerger disease, and other vasculopathies[3]
- Clinical concern for vascular cause of ulcers with abnormal or indeterminate ultrasound[4]
- After stenting or surgery with signs of recurrence or indeterminate ultrasound[5]

Deep Venous Thrombosis or Embolism

- After abnormal ultrasound of arm veins if it will change management, or with negative or indeterminate ultrasound to rule out other causes
- For evaluation of central veins
- Clinical suspicion of upper arterial emboli[8, 9]

Clinical suspicion of vascular disease with abnormal or indeterminate ultrasound[8, 9]

- Tumor invasion[10, 11]
- Trauma[12]
- Vasculitis[1, 13]
- Aneurysm[14]
- Stenosis/occlusions[15, 16]

Hemodialysis Graft Dysfunction, after Doppler ultrasound not adequate for treatment decisions[17]

Vascular Malformation

- After initial evaluation with ultrasound and results will change management OR
- Inconclusive ultrasound OR
- If a known or suspected high flow lesion
- For preoperative planning (CT is also approvable for initial evaluation if MRI contraindicated)

(MRA preferred however CTA useful in delineating some high flow lesions such as an arteriovenous malformation)

Traumatic injuries with clinical findings suggestive of arterial injury[12]

Assessment/evaluation of known vascular disease/condition

Further evaluation of indeterminate findings on prior imaging (**unless follow up is otherwise specified within the guideline):**

- For initial evaluation of an inconclusive finding on a prior imaging report (i.e., x-ray, ultrasound or CT) that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure[20]

Post-operative/procedural evaluation

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.[21, 22]

Special Circumstances[23]

- High suspicion of an acute arterial obstruction - Arteriography preferred (the gold standard)
- Renal impairment
    - Not on dialysis
        - Mild to moderate, GFR 30-45 ml/min MRA with contrast can be performed
        - Severe, GFR < 30 ml/min MRA without contrast
    - On dialysis
        - CTA with contrast can be performed
- Doppler ultrasound can be useful in evaluating bypass grafts

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BACKGROUND

Computed tomography angiography (CTA) can visualize blood flow in arterial and venous structures throughout the upper extremity using a computerized analysis of x-ray images. It is enhanced by contrast material that is injected into a peripheral vein to promote visualization. CTA is much less invasive than catheter angiography which involves injecting contrast material into an artery. CTA is less expensive and carries lower risks than catheter angiography.

OVERVIEW

UPPER EXTREMITY DVT – "Secondary UEDVT is far more common. Indwelling venous devices, such as catheters, pacemakers, and defibrillators, put patients at the highest risk of thrombus. Other risk factors include advanced age, previous thrombophlebitis, postoperative state, hypercoagulability, heart failure, cancer, right-heart procedures, intensive care unit admissions, trauma, and extrinsic compression."[6]

CTA and Dialysis Graft – The management of the hemodialysis access is important for patients undergoing dialysis. With evaluation and interventions, the patency of hemodialysis fistulas may be prolonged. In selected cases, CTA is useful in the evaluation of hemodialysis graft dysfunction due to its speed and high resolution. Rapid data acquisition during the arterial phase, improved visualization of small vessels and lengthened anatomic coverage increase the usefulness of CTA.

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POLICY HISTORY

Date	Summary
April 2023	• Updated references • Modified background section • Added vascular malformations • Added indeterminate prior imaging findings • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
March 2022	• Added a background section for upper extremity DVT. • Clarified renal impairment, not on dialysis, mild to moderate, GFR 30-45 ml/min MRA with contrast can be performed

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **UPPER EXTREMITY MRI** **(Hand, Wrist, Arm, Elbow, Long bone, or Shoulder MRI)**	**Original Date: September 1997**
CPT Codes: 73218, 73219, 73220, 73221, 73222, 73223, +0698T	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_057-3	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR UPPER EXTREMITY MRI (HAND, WRIST, ARM, ELBOW or SHOULDER) (Plain radiographs must precede MRI evaluation)

Some indications are for MRI, CT, or MR or CT Arthrogram. More than one should not be approved at the same time.

If an MR Arthrogram fits approvable criteria below, approve as MRI.

Joint or muscle pain without positive findings on an orthopedic exam as listed above, after x-ray completed[1, 2] (does not apply to young children).

- Persistent joint or musculotendinous pain unresponsive to conservative treatment*, within the last 6 months which includes active medical therapy (physical therapy, chiropractic treatments, and/or physician-supervised exercise**), of at least four (4) weeks, **OR**
- With progression or worsening of symptoms during the course of conservative treatment

Joint specific approvable provocative orthopedic examination tests and suspected injuries

Note: With a positive orthopedic sign, an initial x-ray is always preferred. However, it is not required to approve advanced imaging. A positive sign is weakness or pain. Any test that suggests joint instability requires further imaging (list is not all inconclusive)

Shoulder[3-6]

- Rotator cuff weakness on exam
- Subscapularis tendon tear
    - Belly press off test
    - Napoleon test
    - Bear Hug test
    - Internal rotation lag
    - Lift-off test
- Supraspinatus tendon tear
    - Drop Arm
    - Full Can test
    - Empty Can (aka Jobe or Supraspinatus test)
    - Hawkins or Neer test[7] (only when ordered by an orthopedic surgeon if there is clear documentation in the records that an actual rotator cuff tear is suspected, and NOT just for the evaluation of impingement)
- Infraspinatus / Teres Minor / Biceps tendon tear
    - External rotation lag sign at 0 and 90 degrees
    - Pain or weakness with resisted external rotation testing
    - Hornblower test
    - Popeye sign (if acute finding or for evaluation of surgical correction)
- Labral tear/ Instability
    - Grind test
    - Clunk test
    - Crank test, Compression-rotation test
    - O'Brien's test
    - Anterior load and shift
    - Apprehension test
    - Posterior load and shift test
    - Jerk Test
    - Sulcus sign

Elbow[8, 9]

- Biceps tendon
    - Bicipital aponeurosis (BA) flex test
    - Biceps squeeze test
    - Hook test

    - Passive forearm pronation test
    - Reverse Popeye sign (if acute finding or for evaluation of surgical correction)
- Instability
    - Posterolateral rotatory drawer test
    - Tabletop relocation test
    - Valgus stress
    - Varus stress
    - Milking maneuver
    - Push-up test

Wrist[10, 11]

- Lunotriquetral ligament
    - Derby relocation test
    - Reagan test (lunotriquetral ballottement test)
- TFCC tear
    - Press test
    - Ulnar foveal sign/test
    - Ulnocarpal stress test
- Scaphoid ligament
    - Watson test (scaphoid shift test)
    - Scapholunate ballottement test

Tendon or Muscle Rupture after x-ray (not listed above)

- High clinical suspicion of a specific tendon rupture based on mechanism of injury and physical findings (i.e., triceps or pectorals tendon rupture)

Shoulder Dislocations[12, 13]

- Recurrent
- First time in any of the situations below that increase the risk or repeated dislocation
    - Glenoid or humeral bone loss on x-ray
    - Bankart lesion on radiographs[14]
    - 14-40 year-old[15]
    - > 40 with exam findings concerning for rotator cuff tear (i.e., weakness on exam)

Bone Fracture or Ligament Injury

- Suspected occult scaphoid fracture with snuffbox pain after initial x-ray
- Non scaphoid suspected occult, stress or insufficiency fracture with a negative initial x-ray[16-18]
    - Repeat x-rays in 10-14 days if negative or non-diagnostic
- Pathologic fracture on x-ray or CT[19]

- Suspected ligamentous/tendon injury with known fractures on x-ray/CT that may require surgery

Fracture Nonunion

- Nonunion or delayed union as demonstrated by no healing between two sets of x-rays. If a fracture has not healed by 4-6 months, there is delayed union. Incomplete healing by 6-8 months is nonunion. CT is the preferred study [20]

Osteochondral Lesions (defects, fractures, osteochondritis dissecans) and x-ray completed[21-24]

- Clinical suspicion based on mechanism of injury and physical findings

Loose bodies or synovial chondromatosis and after x-ray or ultrasound completed

- In the setting of joint pain or mechanical symptoms [25]

Osteonecrosis (e.g., Avascular necrosis (AVN))[26-28]

- To further characterize a prior abnormal x-ray or CT suggesting osteonecrosis
- Normal x-rays but symptomatic and high-risk (e.g., glucocorticosteroid use, renal transplant recipient, glycogen storage disease, alcohol abuse,[29] sickle cell anemia[30])
- Known osteonecrosis to evaluate a contralateral joint after initial x-rays

Joint prosthesis/replacement

- Suspected joint prosthesis loosening or dysfunction, (i.e., pseudotumor formation) after initial x-rays [31, 32]

Extremity Mass[33]

- Mass or lesion after non-diagnostic x-ray or ultrasound[14] CT is better than MRI to evaluate mass calcification or bone involvement and may complement or replace MRI[34]
    - If superficial mass, then ultrasound is the initial study
    - If deep mass, then x-ray is the initial study
- Vascular malformations
    - After initial evaluation with ultrasound and results will change management[35]
    - Inconclusive ultrasound
    - For preoperative planning
        - MRA is also approvable
    - Follow up after treatment/embolization

Known Primary Cancer of the Extremity[36-40]

- Initial staging primary extremity tumor

- Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
- Signs or symptoms or imaging findings suspicious for recurrence
- Suspected metastatic disease with signs/symptoms and after initial imaging with radiographs

Further evaluation of indeterminate or questionable findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report (i.e., x-ray, ultrasound or MRI) that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Infection of Bone, Joint or Soft tissue abscess[41-43]

- Abnormal x-ray or ultrasound
- Negative x-ray or ultrasound but with a clinical suspicion of infection based on either of the following:
    - Signs and symptoms of joint or bone infection include:
        - Pain and swelling
        - Decrease range of motion
        - Fever
    - Laboratory findings of infection include any of the following:
        - Elevated ESR or CRP
        - Elevated white blood cell count
        - Positive joint aspiration
- Ulcer (diabetic, pressure, ischemic, traumatic) with signs of infection (redness, warm, swelling, pain, discharge which may range from white to serosanguineous) that is not improving despite treatment and bone, or deep infection is suspected
    - Increased suspicion if size or temperature increases, bone is exposed/positive probe-to-bone test, new areas of breakdown, new smell[44]

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- When imaging, physical or laboratory findings indicate joint infection, delayed or non-healing or other surgical/procedural complications.

For evaluation of known or suspected autoimmune disease (e.g., rheumatoid arthritis)[45, 46]

- Further evaluation of an abnormality or non-diagnostic findings on prior imaging
- Initial imaging of a single joint for diagnosis or response to therapy after plain films and appropriate lab tests (e.g., RF, ANA, CRP, ESR)
- To determine change in treatment or when diagnosis is uncertain prior to start of treatment
- Follow-up to determine treatment efficacy in the following:
    - Early rheumatoid arthritis
    - Advanced rheumatoid arthritis if x-ray and ultrasound are equivocal or non-contributory

Foreign Body[47]

- Indeterminate x-ray and ultrasound

Peripheral Nerve Entrapment (e.g., carpal tunnel)[48-52]

- Abnormal electromyogram or nerve conduction study
- Abnormal x-ray or ultrasound
- Clinical suspicion and failed 4 weeks conservative treatment including at least two of the following (active treatment with physical therapy is not required):
    - Activity modification
    - Rest, ice, or heat
    - Splinting or orthotics
    - Medication

Brachial Plexopathy[53, 54]

- If mechanism of injury or EMG/NCV studies are suggestive
- Chest MRI is preferred study, but neck and/or shoulder (upper extremity) MRI may be approved depending on the suspected location of injury

Pediatrics

- Chronic Recurrent Multifocal Osteomyelitis after initial work-up (labs (i.e. CRP/ESR and x-ray).[55] (Whole body Bone Marrow MRI is more appropriate when multiple joints requested see **NIA_CG_059**)

BACKGROUND

Magnetic resonance imaging shows the soft tissues and bones. With its multiplanar capabilities, high contrast, and high spatial resolution, it is an accurate diagnostic tool for conditions affecting the joint and adjacent structures. MRI can positively influence clinicians' diagnoses

and management plans for patients with conditions such as primary bone cancer, fractures, abnormalities in ligaments/tendons/cartilage, septic arthritis, and infection/inflammation.

OVERVIEW

***Conservative Therapy** – (musculoskeletal) should include a multimodality approach consisting of a combination of active and inactive components. Inactive components such as rest, ice, heat, modified activities, medical devices, (including crutches, immobilizer, metal braces, orthotics, rigid stabilizer, or splints, etc. and not to include neoprene sleeves), medications, injections (bursal, and/or joint, not including trigger point), and diathermy, can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or chiropractic care.

****Home Exercise Program - (HEP)** – the following two elements are required to meet guidelines for completion of conservative therapy:

- Information provided on exercise prescription/plan AND
- Follow up with member with information provided regarding completion of HEP (after suitable 4-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute "inability to complete" HEP).

MRI and Brachial Plexus – MRI is the only diagnostic tool that accurately provides high resolution imaging of the brachial plexus. The brachial plexus is formed by the cervical ventral rami of the lower cervical and upper thoracic nerves which arise from the cervical spinal cord, exit the bony confines of the cervical spine, and traverse along the soft tissues of the neck, upper chest, and course into the arms.

The American Academy of Pediatrics "Choosing Wisely" Guidelines advise against ordering advanced imaging studies (MRI or CT) for most musculoskeletal conditions in a child until all appropriate clinical, laboratory and plain radiographic examinations have been completed. **"**History, physical examination, and appropriate radiographs remain the primary diagnostic modalities in pediatric orthopedics, as they are both diagnostic and prognostic for the great majority of pediatric musculoskeletal conditions. Examples of such conditions would include, but not be limited to, the work up of injury or pain (spine, knees, and ankles), possible infection, and deformity. MRI examinations and other advanced imaging studies frequently require sedation in the young child (5 years old or less) and may not result in appropriate interpretation if clinical correlations cannot be made. Many conditions require specific MRI sequences or protocols best ordered by the specialist who will be treating the patient. If you believe findings warrant additional advanced imaging, discuss with the consulting orthopedic surgeon to make sure the optimal studies are ordered."[56]

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POLICY HISTORY

Date	Summary
May 2023	• Updated: o Orthopedic signs o References • Added: o Indeterminate findings on prior imaging and follow up surveillance o Vascular malformations o Known AVN to evaluate contralateral side o Statement regarding clinical indications not addressed in the guideline o Popeye sign, reverse Popeye sign • Modified: o Background sections o CRMO • Removed: o Additional Resources
March 2022	• Simplified orthopedic sign section to include only the most robust signs and removed Table 1 • Clarified the Supraspinatus Test • Moved the section recommending active conservative care for shoulder impingement, non-traumatic shoulder instability and glenoid labral tears to the background information section • Removed occult wrist ganglion section • Added Snuff box pain after initial x-ray to wrist section and Popeye sign to Elbow section

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **UPPER EXTREMITY MRA/MRV**	**Original Date: July 2008**
CPT Codes: 73225	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_058-2	**Implementation Date: January 2024**

GENERAL INFORMATION

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- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

When a separate MRA and MRI exam is requested, documentation requires a medical reason that clearly indicates why additional MRI imaging of the upper extremity is needed.

INDICATIONS FOR UPPER EXTREMITY MRA/MRV

Hand Ischemia[1-3]

- Arterial Doppler not needed with any of these acute symptoms:
  - Ischemic ulceration without segmental temperature change
  - Ischemic ulceration with painful ischemia
  - Acute sustained loss of perfusion with or without acral ulceration
  - Imminent loss of digit
- Clinical symptoms without the above features with abnormal arterial Doppler and will change management
  - Includes Raynaud's (can be associated with scleroderma), Buerger disease, and other vasculopathies[4]
- Clinical concern for vascular cause of ulcers with abnormal or indeterminate ultrasound[5]
- After stenting or surgery with signs of recurrence or indeterminate ultrasound[6]

Deep Venous Thrombosis or Embolism[7, 8]

- After abnormal ultrasound of arm veins if it will change management, or with negative or indeterminate ultrasound to rule out other causes
- For evaluation of central veins
- Clinical suspicion of upper arterial emboli[9, 10]

Clinical suspicion of vascular disease with abnormal or indeterminate ultrasound or other imaging[9, 10]

- Tumor invasion[11, 12]
- Trauma[13]
- Vasculitis[2, 14]
- Aneurysm[15]
- Stenosis/occlusions[16]

Hemodialysis Graft Dysfunction, after Doppler ultrasound not adequate[17] for treatment decisions[18]

Vascular Malformation[19, 20]

- After initial evaluation with ultrasound and results will change management **OR**
- Inconclusive ultrasound **OR**
- For preoperative planning
    - MRI is also approvable for initial evaluation

Traumatic injuries with clinical findings suggestive of arterial injury – CTA preferred emergently[13]

Assessment/evaluation of known vascular disease/condition

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report (i.e., x-ray, ultrasound or CT) that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure[21]

Post-operative/procedural evaluations

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Special Circumstances[22]

- High suspicion of an acute arterial obstruction - Arteriography preferred (the gold standard)
- Renal impairment
    - Not on dialysis
        - Mild to moderate, GFR 30-45 ml/min MRA with contrast can be performed
        - Severe, GFR < 30 ml/min MRA without contrast
    - On dialysis
        - CTA with contrast can be performed
- Doppler ultrasound can be useful in evaluating bypass grafts

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BACKGROUND

Magnetic resonance angiography (MRA) is a noninvasive alternative to catheter angiography for evaluation of vascular structures in the upper extremity. Magnetic resonance venography (MRV) is used to image veins instead of arteries. MRA and MRV are less invasive than conventional x-ray digital subtraction angiography.

OVERVIEW

UPPER EXTREMITY DVT – "Secondary UEDVT is far more common. Indwelling venous devices, such as catheters, pacemakers, and defibrillators, put patients at the highest risk of thrombus. Other risk factors include advanced age, previous thrombophlebitis, postoperative state, hypercoagulability, heart failure, cancer, right-heart procedures, intensive care unit admissions, trauma, and extrinsic compression."[7]

MRA and Dialysis Graft – The management of the hemodialysis access is important for patients undergoing dialysis. With evaluation and interventions, the patency of hemodialysis fistulas may be prolonged. In selected cases, MRA is useful in the evaluation of hemodialysis graft dysfunction. MRA provides excellent image quality and accurately demonstrating significant stenosis with high sensitivity and specificity in the evaluation of hemodialysis graft[23] dysfunctions.

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POLICY HISTORY

Date	Summary
April 2023	• Updated references • Modified background section • Added vascular malformations • Added indeterminate prior imaging findings
March 2022	• Clarified renal impairment, not on dialysis, mild to moderate, GFR 30-45 ml/min MRA with contrast can be performed • Updated background section for upper extremity DVT

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **LOWER EXTREMITY CT** **(Foot, Ankle, Knee, Leg or Hip CT)**	**Original Date: September 1997**
CPT Codes: 73700, 73701, 73702	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_057-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR LOWER EXTREMITY CT (FOOT, ANKLE, KNEE, LEG or HIP)
(Plain radiographs must precede CT evaluation)

Some indications are for MRI, CT, or MR or CT Arthrogram. More than one should not be approved at the same time.

If a CT Arthrogram fits approvable criteria below, approve as CT.

Joint or muscle pain without positive findings on an orthopedic exam as listed below and , after x-ray completed[1-3] (does not apply to young children). If MRI contraindicated or cannot be performed or requested as a CT arthrogram

- Persistent joint or musculotendinous pain unresponsive to conservative treatment*, within the last 6 months which includes active medical therapy (physical therapy, chiropractic treatments, and/or physician supervised exercise**) of at least four (4) weeks, **OR**
- With progression or worsening of symptoms during the course of conservative treatment

Joint specific approvable provocative orthopedic examination tests and suspected injuries[4] (If MRI contraindicated or cannot be performed or requested as a CT arthrogram).

Note: With a positive orthopedic sign, an initial x-ray is always preferred, however, it is not required to approve advanced imaging **UNLESS** otherwise specified in **bold** below. Any test that suggests joint instability requires further imaging (list is not all inconclusive)

ANKLE[5-7]

- Syndesmotic injury (high ankle injury) with tenderness to palpation over the syndesmosis (AITFL – anterior inferior tibiofibular ligament) and any of the following:
    - Positive stress x-rays
    - Squeeze test
    - Cotton test
    - Dorsiflexion external rotation test.
- Unstable lateral injury to ATFL (anterior talofibular ligament) with suspicion of a possible associated fracture around the ankle or a possible osteochondral injury of the talus **AFTER non-diagnostic or inconclusive x-rays** and any ONE of the following:
    - Positive stress x-rays
    - Positive anterior drawer test
    - Positive posterior drawer test
- Achilles tendon tear
    - Thompson test

KNEE[1, 8-12]

- Anterior cruciate ligament (ACL) Injury
    - Positive testing:
        - Anterior drawer
        - Lachman's
        - Pivot shift test

  OR

- Suspected ACL Rupture - Acute knee injury with physical exam limited by pain and swelling **AFTER initial x-ray completed**[13, 14]
    - Based on mechanism of injury, i.e., twisting, blunt force
        - Normal x-ray:
    - Extreme pain, inability to stand, audible pop at time of injury, very swollen joint
    - Abnormal x-ray:
        - Large joint effusion on x-ray knee effusion
- Acute mechanical locking of the knee not due to guarding[15]
- Meniscal injury/tear (A positive test is denoted by pain or audible/palpable clunk)
    - McMurray's Compression
    - Apley's

    - Thessaly test
- Patellar dislocation (acute or recurrent)
    - Positive patellofemoral apprehension test
    - Radiographic findings compatible with a history of patellar dislocation (i.e., lipohemarthrosis or osteochondral fracture)
- Posterior cruciate ligament (PCL) injury
    - Posterior drawer
    - Posterior tibial sag (Godfrey or step-off test)
- Medial collateral ligament tear
    - Positive valgus stress testing/laxity
- Lateral Collateral ligament tear
    - Positive Varus stress testing/laxity

HIP

- Femoroacetabular impingement (FAI)/ Labral tear
    - Anterior Impingement sign (aka FADIR test)[16-18]
    - Posterior Impingement sign (Pain with hip extension and external rotation on exam)[19]
    - Persistent hip mechanical symptoms (**after initial radiographs completed)** including clicking, locking, catching, giving way or hip instability with a clinical suspicion of labral tear and/or **radiographic findings** suggestive of FAI (i.e cross over sign/pistol grip deformity) and suspected labral tear
    - To determine candidacy for hip preservation surgery for known FAI[20]

NOTE: For evaluation of both hips when the patient meets hip MRI guidelines (x-ray + persistent pain unresponsive to conservative treatment) for both the right and left hip, Pelvis MRI (**NIA_CG_037)** is the preferred study

    - If labral tear is suspected and fulfills above criteria, then bilateral hip MRIs are the preferred studies (not Pelvis MRI)
    - If bilateral hip arthrograms are requested and otherwise meet guidelines, bilateral hip MRIs are the preferred studies (not Pelvis MRI)

Tendon Rupture after x-ray[21-24] (not listed in above) - If MRI contraindicated or cannot be performed.

- High clinical suspicion of specific tendon rupture based on mechanism of injury and physical findings (i.e., palpable defect in quadriceps or patellar tendon rupture)

Trauma

Bone Fracture (If MRI contraindicated or cannot be performed)

- Hip and femur

    - Suspected occult, stress or insufficiency fracture with a negative or non-diagnostic initial x-ray[25]:
        - Approve an immediate CT if contraindication to MRI or MRI cannot be performed (no follow up radiographs required)
- Non-hip extremities: suspected occult, stress, or insufficiency fracture
    - If x-rays, taken 10-14 days after the injury or clinical assessment, are negative or nondiagnostic[26]
    - If at high risk for a complete fracture with conservative therapy (e.g., navicular bone), then immediate CT is warranted[27]
- Pathologic or concern for impending fracture on x-ray[28] - approve immediate CT
- Suspected ligamentous/tendon injury with known fractures on x-ray that may require surgery

Fracture Nonunion

- Nonunion or delayed union as demonstrated by no healing between two sets of x-rays. If a fracture has not healed by 4-6 months, there is delayed union. Incomplete healing by 6-8 months is nonunion

Osteochondral Lesions (defects, fractures, osteochondritis dissecans) and x-ray done [8, 29-32]

- Clinical suspicion based on mechanism of injury and physical findings

Joint prosthesis/replacement

- Suspected joint prosthesis loosening or dysfunction, (i.e. pseudotumor formation) after initial x-rays [33, 34]
- Suspected metallosis with painful metal on metal hip replacement after initial x-rays
    - After initial x-rays and Cobalt - chromium levels > 7ppb[35]
    - Abnormal joint aspiration

Extremity Mass

- Mass or lesion after non-diagnostic x-ray or ultrasound[36]. MRI preferred. CT is better than MRI to evaluate mass calcification or bone involvement and may complement or replace MRI[37]
    - Baker's cyst should be initially evaluated with ultrasound
    - If superficial, then ultrasound is the initial study
    - If deep, then x-ray is the initial study
- Vascular malformations
    - After initial evaluation with ultrasound and results will change management or for preoperative planning[38]
        - CTA is also approvable for initial evaluation
    - Follow up after treatment/embolization

Known Primary Cancer of the Extremity[39-43]

- Initial staging primary extremity tumor
- Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
- Signs or symptoms or imaging findings suspicious for recurrence
- Suspected metastatic disease with signs/symptoms and after initial imaging with radiographs

Further evaluation of indeterminate or questionable findings on prior imaging and MRI cannot be performed or CT is preferred (i.e., tumor matrix):

- For initial evaluation of an inconclusive finding on a prior imaging report (i.e., x-ray, ultrasound, MRI) that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam

Osteonecrosis (Avascular necrosis (AVN), Legg-Calve-Perthes Disease) when MRI is contraindicated or cannot be performed[44-46]

- To further characterize a prior abnormal x-ray
- Normal or indeterminate x-rays but symptomatic and high risk (e.g., glucocorticosteroid use, renal transplant recipient, glycogen storage disease, alcohol abuse,[47] sickle cell anemia[48])
- Known osteonecrosis to evaluate a contralateral joint after initial x-rays

Loose bodies or synovial chondromatosis and after x-ray or ultrasound completed (If MRI contraindicated or cannot be completed)

- In the setting of joint pain or mechanical symptoms[49]

Infection of Bone, Joint, or Soft tissue abscess[50, 51]

Note: MRI and nuclear medicine studies are recommended for acute infection as they are more sensitive in detecting early changes of osteomyelitis.[52, 53] CT is better at demonstrating findings of chronic osteomyelitis (sequestra, involucrum, cloaca, sinus tracts) as well as detecting soft tissue gas and foreign bodies.[54]

- Abnormal x-ray or ultrasound
- Negative x-ray but with a clinical suspicion of infection
    - Signs and symptoms of joint or bone infection include:
        - Pain and swelling
        - Decrease range of motion
        - Fevers

    - Laboratory findings of infection include any of the following:
        - Elevated ESR or CRP
        - Elevated white blood cell count
        - Positive joint aspiration
- Ulcer (diabetic, pressure, ischemic, traumatic) with signs of infection (redness, warm, swelling, pain, discharge which may range from white to serosanguineous) that is not improving despite treatment and bone or deep infection is suspected[55]
    - Increased suspicion if size or temperature increases, bone is exposed/positive probe-to-bone test, new areas of breakdown, new smell[56]
- Neuropathic foot with friable or discolored granulation tissue, foul odor, non-purulent discharge, and delayed wound healing[57]

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- When imaging, physical, or laboratory findings indicate joint infection, delayed or non-healing, or other surgical/procedural complications
- Trendelenburg sign or other indication of muscle or nerve damage after recent hip surgery

For evaluation of known or suspected autoimmune disease (e.g., rheumatoid arthritis) and MRI is contraindicated or cannot be performed[58]

- Further evaluation of an abnormality or non-diagnostic findings on prior imaging
- Initial imaging of a single joint for diagnosis or response to therapy after plain films and appropriate lab tests (e.g., RF, ANA, CRP, ESR)
- To determine change in treatment or when diagnosis is uncertain prior to start of treatment
- Follow-up to determine treatment efficacy of the following:
    - Early rheumatoid arthritis
    - Advanced rheumatoid arthritis if x-ray and ultrasound are equivocal or non-contributory

Known or suspected inflammatory myopathies (If MRI contraindicated or cannot be performed): (Includes polymyositis, dermatomyositis, immune-mediated necrotizing myopathy, inclusion body myositis)[59, 60]

- For diagnosis
- For biopsy planning

Crystalline Arthropathy

- Dual-energy CT can be used to characterize crystal deposition disease (i.e., gout) after
    - Appropriate rheumatological work up and initial x-rays AND
    - After inconclusive joint aspiration or when joint aspiration cannot be performed OR[61]
    - In the setting of extra-articular crystal deposits (i.e., tendons or bursa)

Peripheral Nerve Entrapment (e.g., tarsal tunnel, Morton's neuroma) and MRI is contraindicated or cannot be performed, including any of the following[62-65]

- Abnormal Electromyogram or Nerve conduction study
- Abnormal x-ray or ultrasound
- Clinical suspicion and failed 4 weeks conservative treatment including at least 2 of the following (active treatment with physical therapy is not required):
    - Activity modification
    - Rest, ice, or heat
    - Splinting or orthotics
    - Medication

Leg length discrepancy

- CT scanogram [66, 67]

Foreign Body[68]

- Indeterminate x-ray and ultrasound

Painful acquired or congenital flatfoot deformity in an adult, after x-ray completed and MRI is contraindicated or cannot be performed.

- After failure of active conservative therapy listed above[69, 70]

Pediatrics

- Osteoid Osteoma after an x-ray is done[71]
- Painful flatfoot (pes planus) deformity with suspected tarsal coalition, not responsive to active conservative care[72]
    - When MRI cannot be performed
    - Extra-articular coalition is suspected (bony bridges around the joints)
    - When needed for surgical planning[73]

BACKGROUND

Plain radiographs are typically used as the first-line modality for assessment of lower extremity conditions. Computed tomography (CT) is used for evaluation of tumors, metastatic lesions, infection, fractures, and other problems. Magnetic resonance imaging (MRI) is the first-line choice for imaging of many conditions, but CT may be used in these cases if MRI is contraindicated or unable to be performed.

OVERVIEW

***Conservative Therapy** – (musculoskeletal) should include a multimodality approach consisting of a combination of active and inactive components. Inactive components such as rest, ice, heat, modified activities, medical devices (such as crutches, immobilizer, metal braces, orthotics, rigid stabilizer, or splints, etc. and not to include neoprene sleeves), medications, injections (bursal, and/or joint, not including trigger point), and diathermy, can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or chiropractic care.

****Home Exercise Program (HEP)** – the following two elements are required to meet guidelines for completion of conservative therapy:

- Information provided on exercise prescription/plan AND
- Follow up with member with information provided regarding completion of HEP (after suitable 4-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute “inability to complete” HEP).

Joint Implants and Hardware – Dual-energy CT may be useful for metal artifact reduction if available but is also imperfect as the correction is based on a projected approximation of x-ray absorption, and it does not correct for scatter.[74] Dual-energy CT can be used to characterize crystal deposition disease, such as gout versus CPPD (calcium pyrophosphate deposition).[61]

CT and Osteolysis – Since computed tomography scans show both the extent and the location of lytic lesions, they are useful to guide treatment decisions, as well as to assist in planning for surgical intervention when needed, in patients with suspected osteolysis after Total Hip Arthroplasty (THA).

American Academy of Pediatrics “Choosing Wisely” Guidelines advise against ordering advanced imaging studies (MRI or CT) for most musculoskeletal conditions in a child until all appropriate clinical, laboratory and plain radiographic examinations have been completed. **“**History, physical examination, and appropriate radiographs remain the primary diagnostic modalities in pediatric orthopedics, as they are both diagnostic and prognostic for the great majority of pediatric musculoskeletal conditions. Examples of such conditions would include, but not be limited to, the work up of injury or pain (spine, knees and ankles), possible infection, and deformity. MRI examinations and other advanced imaging studies frequently require

sedation in the young child (5 years old or less) and may not result in appropriate interpretation if clinical correlations cannot be made. Many conditions require specific MRI sequences or protocols best ordered by the specialist who will be treating the patient…if you believe findings warrant additional advanced imaging, discuss with the consulting orthopedic surgeon to make sure the optimal studies are ordered."[75]

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POLICY HISTORY

Date	Summary
May 2023	• Updated orthopedic signs • Added o When contraindicated to MRI where appropriate o Metallosis o Evaluation of indeterminate findings on imaging reports o Non-diagnostic imaging o CPT code for leg length o Statement regarding clinical indications not addressed in the guideline • Clarified hip versus pelvis imaging • Updated DECT • Modified o References. o Background section o Cancer of the extremity section
March 2022	• Clarification of language for non-hip stress fractures • Deleted Thessaly sign based on updated literature

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **LOWER EXTREMITY CTA/CTV**	**Original Date: July 2008**
CPT Codes: 73706	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_061-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR LOWER EXTREMITY CTA/CTV (COMPUTED TOMOGRAPHY ANGIOGRAM / COMPUTED TOMOGRAPHY VENOGRAM)

Abdominal Arteries CTA (CT Angiography) (CPT Code 75635) includes run-off, so this is not approvable when done in conjunction with that exam.

When a separate CTA and CT exam is requested, documentation requires a medical reason that clearly indicates why additional CT imaging of the upper extremity is needed.

Peripheral Vascular Disease when Abdominal Arteries CTA (CT Angiography) (CPT Code 75635) has not been recently approved or when aortoiliac disease is not a concern or the state of the aorta and iliac arteries is already known.

- Critical Limb ischemia **ANY** of the below with clinical signs of peripheral artery disease. Ultrasound imaging is not needed. If done and negative, it should still be approved due to high false negative rate[1, 2]
    - Ischemic rest pain
    - Tissue loss
    - Gangrene
- Claudication with abnormal or indeterminate ankle/brachial index, pulse volume recording or arterial Doppler[3-5]

- Clinical concern for vascular cause of ulcers with abnormal or indeterminate ultrasound (ankle/brachial index, arterial Doppler)[6]
- After stenting or surgery with signs of recurrent symptoms OR abnormal ankle/brachial index; abnormal or indeterminate arterial Doppler, OR pulse volume recording)[5]

Popliteal Artery Entrapment Syndrome with abnormal arterial ultrasound[7]

Deep Venous Thrombosis with clinical suspicion of lower extremity DVT after abnormal or non-diagnostic ultrasound where a positive study would change management[8-10]

Clinical suspicion of vascular disease with abnormal or indeterminate ultrasound or other imaging

- Tumor invasion[11]
- Trauma[12]
- Vasculitis[13]
- Aneurysm[14]
- Stenosis/occlusions[15]

Hemodialysis Graft Dysfunction after Doppler ultrasound not adequate for treatment decisions[16]

Vascular Malformation[17, 18]

- After initial evaluation with ultrasound and results will change management **OR**
- Inconclusive ultrasound **OR**
- If a known or suspected high flow lesion
- For preoperative planning (CT is also approvable for initial evaluation if MRI contraindicated)

(MRA preferred however CTA useful in delineating some high flow lesions such as an arteriovenous malformation.)

Traumatic injuries with clinical findings suggestive of arterial injury[12]

Assessment/evaluation of known vascular disease/condition

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report (i.e., x-ray, ultrasound or CT) that requires further clarification.

- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure[3]

Post- operative/procedural evaluation

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested[19, 20]

Special Circumstances[2]

- High suspicion of an acute arterial obstruction - Arteriography preferred (the gold standard).
- Renal impairment
    - Not on dialysis
        - Mild to moderate, GFR 30-89 ml/min MRA can be done
        - Severe, GFR < 30 ml/min MRA without contrast
    - On dialysis
        - CTA with contrast can be done
- Doppler ultrasound can be useful in evaluating bypass grafts

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BACKGROUND

Lower extremity computed tomography angiography (CTA) is an effective, noninvasive and robust imaging modality that is used in the assessment of symptomatic lower extremity vascular disease. It has excellent spatial resolution and shows accurate details of peripheral vasculature. CTA is an effective alternative to catheter-based angiography and allows accurate planning of open surgical and endovascular interventions.

OVERVIEW

The ankle- brachial index (ABI) is the ratio of systolic blood pressure at the ankle divided by the systolic pressure of the upper arm. The normal range lies between 0.9-1.4. An ABI[21, 22] of less than 0.9 is a reliable indicator of the presence of lower extremity PAD, indicating athero-occlusive arterial disease. The upper limit of normal ABI should not exceed 1.40. An ABI >1.40 is suggestive of arterial stiffening (i.e., medial arterial calcification) and is also associated with a higher risk of cardiovascular events and is seen in elderly patients, typically in those with diabetes or chronic kidney disease (CKD).

CTA and screening for peripheral vascular disease: The USPSTF (U.S. Preventive Services Task Force) does not recommend routine screening for peripheral vascular disease in asymptomatic patients.[23] High risk patients (e.g., diabetics) may be screened with ABI (ankle brachial index) and duplex ultrasound.

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POLICY HISTORY

Date	Summary
April 2023	• Updated references • Modified background section • Added vascular malformations • Added indeterminate prior imaging findings • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
March 2022	No changes

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **LOWER EXTREMITY MRI** **(Foot, Ankle, Knee, Leg or Hip MRI)**	**Original Date: September 1997**
CPT Codes: 73718, 73719, 73720, 73721, 73722, 73723, +0698T	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_057-4	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR LOWER EXTREMITY MRI (FOOT, ANKLE, KNEE, LEG or HIP)
(Plain radiographs must precede MRI evaluation)

Some indications are for MRI, CT, or MR or CT Arthrogram. More than one should not be approved at the same time.

If an MR Arthrogram fits approvable criteria below, approve as MRI

Joint or muscle pain without positive findings on an orthopedic exam as listed below and , after x-ray completed[1-3] (does not apply to young children).

- Persistent joint or musculotendinous pain unresponsive to conservative treatment*, within the last 6 months which includes active medical therapy (physical therapy, chiropractic treatments, and/or physician supervised exercise**) of at least four (4) weeks
- With progression or worsening of symptoms during the course of conservative treatment

Joint specific approvable provocative orthopedic examination tests and suspected injuries[4]

Note: With a positive orthopedic sign, an initial x-ray is always preferred, however, it is not required to approve advanced imaging **UNLESS** otherwise specified in **bold** below. Any test that suggests joint instability requires further imaging (list is not all inconclusive)

ANKLE[5-7]

- Syndesmotic injury (high ankle injury) with tenderness to palpation over the syndesmosis (AITFL – anterior inferior tibiofibular ligament) and any of the following:
    - Positive stress X-rays
    - Squeeze test
    - Cotton test
    - Dorsiflexion external rotation test.
- Unstable lateral injury to ATFL (anterior talofibular ligament) with suspicion of a possible associated fracture around the ankle or a possible osteochondral injury of the talus **AFTER non-diagnostic or inconclusive X-rays** and any **ONE** of the following:
    - Positive stress x-rays
    - Positive anterior drawer test
    - Positive posterior drawer test
- Achilles tendon tear
    - Thompson test

KNEE[1, 8-12]

- Anterior cruciate ligament (ACL) Injury
    - Positive testing:
        - Anterior drawer
        - Lachman's
        - Pivot shift test
- Suspected ACL Rupture - acute knee injury with physical exam limited by pain and swelling **AFTER initial x-ray completed**[13, 14]
    - Based on mechanism of injury, i.e., twisting, blunt force
        - Normal x-ray:
    - Extreme pain, inability to stand, audible pop at time of injury, very swollen joint
    - Abnormal x-ray:
        - Large joint effusion on x-ray knee effusion
- Acute mechanical locking of the knee not due to guarding[15]
- Meniscal injury/tear (A positive test is denoted by pain or audible/palpable clunk)
    - McMurray's Compression
    - Apley's
    - Thessaly test
- Patellar dislocation (acute or recurrent)
    - Positive patellofemoral apprehension test
    - Radiographic findings compatible with a history of patellar dislocation

(i.e., lipohemarthrosis or osteochondral fracture)

- Posterior cruciate ligament (PCL) injury
  - Posterior drawer
  - Posterior tibial sag (Godfrey or step-off test)
- Medial collateral ligament tear
  - Positive valgus stress testing/laxity
- Lateral Collateral ligament tear
  - Positive Varus stress testing/laxity

HIP

- Femoroacetabular impingement (FAI) / Labral tear
  - Anterior Impingement sign (aka FADIR test)[16-18]
  - Posterior Impingement sign (Pain with hip extension and external rotation on exam)[19]
  - Persistent hip mechanical symptoms (**after initial radiographs completed)** including clicking, locking, catching, giving way or hip instability with a clinical suspicion of labral tear and/or **radiographic findings** suggestive of FAI (i.e., cross over sign/pistol grip deformity) and suspected labral tear
  - To determine candidacy for hip preservation surgery for known FAI[20]

NOTE: For evaluation of both hips when the patient meets hip MRI guidelines (x-ray + persistent pain unresponsive to conservative treatment) for both the right and left hip, Pelvis MRI (**NIA_CG_037)** is the preferred study.

- If labral tear is suspected and fulfills above criteria, then bilateral hip MRIs are the preferred studies (not Pelvis MRI)
- If bilateral hip arthrograms are requested and otherwise meet guidelines, bilateral hip MRIs are the preferred studies (not Pelvis MRI)

Tendon Rupture after X-Ray[21-24] (not listed in above)

- High clinical suspicion of specific tendon rupture based on mechanism of injury and physical findings (i.e., palpable defect in quadriceps or patellar tendon rupture)

Trauma
Bone Fracture

- Hip and Femur
  - Suspected occult, stress or insufficiency fracture with a negative or non-diagnostic initial x-ray[25]:
    - Approve an immediate MRI (no follow up radiographs required)- MRI preferred test
  - Suspicion of a hip fracture in a pregnant patient does not require an initial x-ray

- Non-hip extremities: Suspected occult, stress, or insufficiency fracture
    - If x-rays, taken 10-14 days after the injury or clinical assessment, are negative or non-diagnostic[26]
    - If at high risk for a complete fracture with conservative therapy (e.g., navicular bone), then immediate MRI is warranted[27]
- Pathologic or concern for impending fracture on x-ray or CT[28] – approve immediate MRI
- Suspected ligamentous/tendon injury with known fractures on x-ray/CT that may require surgery
- Nonunion or delayed union as demonstrated by no healing between two sets of x-rays. If a fracture has not healed by 4-6 months, there is delayed union. Incomplete healing by 6-8 months is nonunion, CT is the preferred study[29]

Osteochondral lesions (defects, fractures, osteochondritis dissecans) and x-ray completed[8, 30-32]

- Clinical suspicion based on mechanism of injury and physical findings

Joint prosthesis/replacement

- Suspected joint prosthesis loosening or dysfunction, (i.e., pseudotumor formation) after initial x-rays [33, 34]
- Suspected Metallosis with painful metal on metal hip replacement after initial x-rays

Extremity Mass[35]

- Mass or lesion after non-diagnostic x-ray or ultrasound.[36] CT is better than MRI to evaluate mass calcification or bone involvement and may complement or replace MRI[37]
    - Baker's cyst should be initially evaluated with ultrasound
    - If superficial mass, then ultrasound is the initial study
    - If deep mass, then x-ray is the initial study
- Vascular malformations
    - After initial evaluation with ultrasound and results will change management
    - Inconclusive ultrasound
    - For preoperative planning
        - MRA is also approvable
    - Follow up after treatment/embolization

Known Primary Cancer of the Extremity[38-42]

- Initial staging primary extremity tumor
- Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
- Signs or symptoms or imaging findings suspicious for recurrence

- Suspected metastatic disease with signs/symptoms and after initial imaging with radiographs

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report (i.e., x-ray, ultrasound or CT) that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Osteonecrosis (e.g., Avascular Necrosis (AVN), Legg-Calve-Perthes Disease)[43-45]

- To further characterize a prior abnormal x-ray or CT suggesting osteonecrosis
- Normal or Indeterminate X-rays, but symptomatic and high risk (such as glucocorticosteroid use, renal transplant, glycogen storage disease, alcohol abuse, sickle cell anemia)[46]
- Known osteonecrosis to evaluate a contralateral joint after initial x-rays

Loose bodies or synovial chondromatosis and after x-ray or ultrasound completed

- In the setting of joint pain or mechanical symptoms[47, 48]

Infection of Bone, Joint, or Soft tissue abscess[49-51]

- Abnormal x-ray or ultrasound
- Negative x-ray or ultrasound but with a clinical suspicion of infection based on either of the following:
    - Signs and symptoms of joint or bone infection include:
        - Pain and swelling
        - Decreased range of motion
        - Fevers
    - Laboratory findings of infection include any of the following:
        - Elevated ESR or CRP
        - Elevated white blood cell count
        - Positive joint aspiration
- Ulcer (diabetic, pressure, ischemic, traumatic) with signs of infection (redness, warm, swelling, pain, discharge which may range from white to serosanguineous) that is not improving despite treatment and bone, or deep infection is suspected
    - Increased suspicion if size or temperature increases, bone is exposed/positive probe-to-bone test, new areas of breakdown, new smell[52]
- Neuropathic foot with friable or discolored granulation tissue, foul odor, non-purulent discharge, and delayed wound healing[53]

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- When imaging, physical or laboratory findings indicate joint infection, delayed or non-healing or other surgical/procedural complications.
- Trendelenburg sign[54] or other indication of muscle or nerve damage after recent hip surgery

For evaluation of known or suspected autoimmune disease (e.g., rheumatoid arthritis)[55]

- Further evaluation of an abnormality or non-diagnostic findings on prior imaging
- Initial imaging of a single joint for diagnosis or response to therapy after plain films and appropriate lab tests (e.g., RF, ANA, CRP, ESR)
- To determine change in treatment or when diagnosis is uncertain prior to start of treatment
- Follow-up to determine treatment efficacy of the following:
    - Early rheumatoid arthritis
    - Advanced rheumatoid arthritis if x-ray and ultrasound are equivocal or noncontributory

Known or suspected inflammatory myopathies: (Includes polymyositis, dermatomyositis, immune-mediated necrotizing myopathy, inclusion body myositis)[56, 57]

- For diagnosis
- For biopsy planning

Peripheral Nerve Entrapment (e.g., tarsal tunnel, Morton's neuroma)[58-61]

- Abnormal electromyogram or nerve conduction study
- Abnormal x-ray or ultrasound
- Clinical suspicion and failed 4 weeks conservative treatment including at least two of the following (active treatment with physical therapy is not required):
    - Activity modification
    - Rest, ice, or heat
    - Splinting or orthotics
    - Medication

Foreign Body[62]

- Indeterminate x-ray and ultrasound

Painful acquired or congenital flatfoot deformity in an adult, after x-ray completed

- After failure of active conservative therapy listed above[63, 64]

Special pediatric considerations

- Painful flatfoot deformity with suspected tarsal coalition, not responsive to active conservative care[65]
- Slipped Capital Femoral Epiphysis with negative frog leg and AP x-rays of the hips but clinically suspected[66-68]
    - Drehmann sign
    - Limited internal rotation of the hip
    - Consider imaging the asymptomatic contralateral hip with a normal x-ray to detect early SCFE if prophylactic surgery is planned[69]
- Chronic Recurrent Multifocal Osteomyelitis after initial work-up (labs (i.e. CRP/ESR and x-ray)[70, 71] – (Whole body bone marrow MRI is more appropriate when multiple joints requested see NIA_CG_059)
- Acute limp in a child 5 or less years old
    - Concern for infection not localized to the hip (initial imaging not required)[72]
    - Concern for infection localized to the hip after initial evaluation with ultrasound[72]
- Osteoid Osteoma – MRI not usually done because x-ray and CT more accurate for diagnosis[73]

BACKGROUND

Magnetic resonance imaging shows the soft tissues and bones. With its multiplanar capabilities, high contrast, and high spatial resolution, it is an accurate diagnostic tool for conditions affecting the joint and adjacent structures. MRI can positively influence clinicians' diagnoses and management plans for patients with conditions such as primary bone cancer, fractures, abnormalities in ligaments/tendons/cartilage, septic arthritis, and infection/inflammation.

OVERVIEW

***Conservative Therapy** – (Musculoskeletal) should include a multimodality approach consisting of a combination of active and inactive components. Inactive components such as rest, ice, heat, modified activities, medical devices, (including crutches, immobilizer, metal braces, orthotics, rigid stabilizer, or splints, etc. and not to include neoprene sleeves), medications, injections (bursal, and/or joint, not including trigger point), and diathermy, can be utilized. Active modalities may consist of physical therapy, a physician supervised home exercise program**, and/or chiropractic care.

****Home Exercise Program (HEP)** – the following two elements are required to meet guidelines for completion of conservative therapy:

- Information provided on exercise prescription/plan AND
- Follow-up with member with information provided regarding completion of HEP (after suitable 4-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute "inability to complete" HEP).

American Academy of Pediatrics "Choosing Wisely" Guidelines advise against ordering advanced imaging studies (MRI or CT) for most musculoskeletal conditions in a child until all appropriate clinical, laboratory and plain radiographic examinations have been completed. **"**History, physical examination, and appropriate radiographs remain the primary diagnostic modalities in pediatric orthopedics, as they are both diagnostic and prognostic for the great majority of pediatric musculoskeletal conditions. Examples of such conditions would include, but not be limited to, the work up of injury or pain (spine, knees and ankles), possible infection, and deformity. MRI examinations and other advanced imaging studies frequently require sedation in the young child (5 years old or less) and may not result in appropriate interpretation if clinical correlations cannot be made. Many conditions require specific MRI sequences or protocols best ordered by the specialist who will be treating the patient…if you believe findings warrant additional advanced imaging, discuss with the consulting orthopedic surgeon to make sure the optimal studies are ordered."[74]

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POLICY HISTORY

Date	Summary
April 2023	• Updated orthopedic signs • Clarified hip versus pelvis imaging • Added: o Evaluation of indeterminate findings on imaging reports o Metallosis o Statement regarding clinical indications not addressed in the guideline • Modified: o References o Background section o CRMO • Removed Additional Resources
March 2022	• Clarification of language for non-hip stress fractures • Deleted Thessaly sign based on updated literature

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **LOWER EXTREMITY MRA/MRV**	**Original Date: September 1997**
CPT Code: 73725	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_058-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

When a separate MRA and MRI exam is requested, documentation requires a medical reason that clearly indicates why additional MRI imaging of the lower extremity is needed.

Lower Extremity MRA & Abdomen/Pelvis Magnetic Resonance Angiography (MRA) Runoff Requests: **Two authorization requests are required, one Abdomen MRA, CPT code 74185 and one for Lower Extremity MRA, CPT code 73725.** This will provide imaging of the abdomen, pelvis, and both legs.

INDICATIONS FOR LOWER EXTREMITY MRA/MRV

Peripheral Vascular Disease

- Critical Limb ischemia **ANY** of the below with clinical signs of peripheral artery disease. Ultrasound imaging is not needed. If done and negative, it should still be approved due to high false negative rate[1, 2]
    - Ischemic rest pain
    - Tissue loss
    - Gangrene
- Claudication with abnormal or indeterminate ankle/brachial index, pulse volume recording or arterial Doppler[3-5]

- Clinical concern for vascular cause of ulcers with abnormal or indeterminate ultrasound (ankle/brachial index, arterial Doppler)[6]
- After stenting or surgery with signs of recurrent symptoms OR abnormal ankle/brachial index; abnormal or indeterminate arterial Doppler, OR pulse volume recording)[4]

Popliteal Artery Entrapment Syndrome with abnormal arterial ultrasound[7]

Deep Venous Thrombosis with clinical suspicion of lower extremity DVT after abnormal or non-diagnostic ultrasound where a positive study would change management[8-10]

Clinical suspicion of vascular disease with abnormal or indeterminate ultrasound or other imaging

- Tumor invasion[11, 12]
- Trauma[13]
- Vasculitis[14]
- Aneurysm[15]
- Stenosis/occlusions[16]

Hemodialysis Graft Dysfunction, after Doppler ultrasound not adequate[17] for treatment decisions[18]

Vascular Malformation[18, 19]

- After initial evaluation with ultrasound and results will change management **OR**
- Inconclusive ultrasound **OR**
- For preoperative planning
    - MRI is also approvable for initial evaluation

Traumatic injuries with clinical findings suggestive of arterial injury – CTA preferred emergently[13]

Assessment/evaluation of suspected or known vascular disease/condition

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure[3]

Post-operative/procedural evaluation

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.[20, 21]

Special Circumstances[2]

- High suspicion of an acute arterial obstruction - Arteriography preferred (the gold standard).
- Renal impairment
    - Not on dialysis
        - Mild to moderate, GFR 30-45 ml/min MRA with contrast can be performed
        - Severe, GFR < 30 ml/min MRA without contrast
    - On dialysis
        - CTA with contrast can be done
- Doppler ultrasound can be useful in evaluating bypass grafts

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BACKGROUND

Magnetic resonance angiography (MRA) is a noninvasive alternative to catheter angiography for evaluation of vascular structures in the lower extremity. Magnetic resonance venography (MRV) is used to image veins instead of arteries. MRA and MRV are less invasive than conventional x-ray digital subtraction angiography.

OVERVIEW

Noninvasive testing - **Noninvasive hemodynamic testing** – "Noninvasive testing (NIVT), both before and after intervention, has been used for decades as a first-line investigatory tool in the diagnosis and categorization of PAD. It is widely available and provides a large amount of information at low cost without the use of ionizing radiation. NIVT can consist of one or more of the following components: the ABI, segmental pressure measurements (SPMs), pulse-volume recordings (PVRs), photoplethysmography (PPG), and transcutaneous oxygen pressure measurement (TcPO2)."[21] The ankle- brachial index (ABI) is the ratio of systolic blood pressure at the ankle divided by the systolic pressure of the upper arm. The normal range lies between 0.9-1.4. An ABI of less than 0.9 is a reliable indicator of the presence of lower extremity PAD, indicating athero-occlusive arterial disease. The upper limit of normal ABI should not exceed 1.40. An ABI >1.40 is suggestive of arterial stiffening (i.e., medial arterial calcification) and is also associated with a higher risk of cardiovascular events and is seen in elderly patients, typically in those with diabetes or chronic kidney disease (CKD).

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POLICY HISTORY

Date	Summary
April 2023	• Updated references • Modified background section • Added vascular malformations • Added graft evaluation • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added indeterminate prior imaging findings
March 2022	Clarified renal impairment, not on dialysis, mild to moderate, GFR 30-45 ml/min MRA with contrast can be performed

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **ABDOMEN CT**	**Original Date: September 1997**
CPT Codes: 74150, 74160, 74170	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_030	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

Note: For syndromes for which imaging starts in the pediatric age group, MRI preferred

NOTE: ABDOMEN CT **ALONE** SHOULD ONLY BE APPROVED WHEN DISEASE PROCESS IS SUSPECTED TO BE LIMITED TO THE ABDOMEN. Abdomen/Pelvis CT (CPT Codes: 74176, 74177, 74178) is the correct study when the indication(s) include both the abdomen AND pelvis, such as CTU (CT Urography), CTE (CT Enterography), acute abdominal pain, widespread inflammatory disease, or neoplasm.
When separate requests for CT abdomen and CT Pelvis are encountered for processes involving both the abdomen and pelvis, they need to be resubmitted as a single Abdomen/Pelvis CT (to avoid unbundling; CPT codes 74176, 74177, 74178). Otherwise, the exam should be limited to the appropriate area (i.e., Abdomen **OR** Pelvis) which includes the specific organ, area of known disease/abnormality, or the area of concern.

INDICATIONS FOR ABDOMEN CT

Abdominal Pain for Unknown Etiology

- CT allowed after initial workup is inconclusive and must include results of the following:
    - Appropriate laboratory testing (chemistry profile, complete blood count, and/or urinalysis) for the patient's presentation (e.g., suspected pancreatitis – amylase/lipase etc.) **AND**

    - Initial imaging (such as ultrasound, barium study, nuclear medicine, or scope study) appropriate to the symptoms
    - Not all of the above tests need to be performed, but both labs and initial imaging need to be performed
        - E.g., for GI bleeding, CBC and a scope study would be appropriate initial testing (however, a UA and ultrasound would not be)
- For acute abdominal pain in a patient over the age of 65[1, 2]
- Initial evaluation of abnormal findings seen on other imaging, such as ultrasound (US) or x-ray and limited to the abdomen, and CT is the most reasonable next step for that diagnosis

Evaluation of suspicious known mass/tumors (unconfirmed diagnosis of cancer) for further evaluation of indeterminate or questionable findings

- Initial evaluation of suspicious masses/tumors found by physical exam or imaging study, such as ultrasound (US), and only the abdomen is affected[3, 4]
- One follow-up exam to ensure no suspicious change has occurred in a tumor. No further surveillance imaging unless tumor(s) is/are specified as highly suspicious, or change was found on exam or last follow-up imaging.
- For abnormal incidental abdominal lymph nodes when follow-up is recommended based on prior imaging (initial 3-month follow-up)[5]

Follow-up of known cancer[6, 7]

- In a patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
- Known cancer with suspected abdominal metastasis based on a sign, symptom (e.g., anorexia, early satiety, intestinal obstruction, night sweats, pelvic pain, weight loss, vaginal bleeding) or an abnormal lab value (alpha-fetoprotein, CEA, CA 19-9, p53 mutation)

For evaluation of suspected infection or inflammatory disease based on exam or discovered on previous imaging[8-10]

- Right upper quadrant pain for suspected biliary disease with negative or equivocal ultrasound
- For epigastric or left upper quadrant pain if labs or other imaging are inconclusive[11]

For evaluation of suspected infection or for follow-up known infection limited to the abdomen

- Any known infection that is clinically suspected to have created an abscess limited to the abdomen. (If location unclear or unknown, CT Abdomen/Pelvis)
- Any history of fistula limited to the abdomen that requires re-evaluation or is suspected to have recurred
- Abnormal fluid collection limited to the abdomen seen on prior imaging that needs follow-up evaluation

For evaluation of Inflammatory Bowel Disease (IBD) such as Crohn's or Ulcerative Colitis (MRE should be considered for age < 35 to reduce radiation exposure). If only Abdomen CT is requested for IBD, the request should be resubmitted as CT Abdomen and Pelvis (see Guideline for criteria) unless it is known that the disease is limited to the abdomen.

For evaluation of an organ or abnormality seen on previous imaging

ADRENAL

- Indeterminate adrenal lesion seen on prior imaging
- For further evaluation of suspected adrenal tumors and/or endocrine disorders when there is clinical and laboratory evidence to suggest an adrenal source; see Background for specific laboratory testing that is needed based on suspected diagnosis[12]
- Adrenal mass < 4 cm incidentally discovered with benign characteristics, one follow-up at 6 months then annually x 2 years (no further imaging if stable, see Background for details)
- If adrenal mass ≥ 4 cm and no diagnosis of cancer, can approve for either pre-operative planning **OR** if surgery is not done, can repeat imaging in 6-12 months

LIVER

- Indeterminate liver lesion seen on prior imaging [11]
- For evaluation of rising AFP (requires a ≥7 ng/mL increased in AFP per month) in patients at high risk for HCC (known cirrhosis and/or chronic hepatitis B, see Background for additional risk categories)[13]
- For screening in patients at high risk for HCC (see above) every 6 months when prior ultrasound is insufficient to evaluate the liver due to steatosis/fatty liver or nodular liver
    - The finding of steatosis/fatty liver and/or nodular liver alone on an ultrasound report is insufficient for approval; the report must specify that those findings prevent adequate visualization of the liver by ultrasound
- For jaundice or abnormal liver function tests after equivocal or abnormal ultrasound[14]
- For surveillance of HCC (MRI or CT) in patients who have received liver-directed therapy, surgical resection, medical treatment, or transplant at one-month post treatment and then every 3 months for up to two years, then every 6 months[14, 15]
- For follow-up of suspected adenoma every 6-12 months
- For surveillance of patients with primary sclerosing cholangitis (also CA 19-9), every 6-12 months after the age of 20 (MRI and MRCP preferred over CT) [16]
- For follow-up of focal nodular hyperplasia (FNH), repeat imaging in 6-12 months to ensure stability. Additional imaging beyond that is needed only if atypical features or diagnosis is still in question. [17]
- For annual elastography[18] in chronic liver disease to stage hepatic fibrosis when MRI is contraindicated and transient elastography with ultrasound is insufficient

- In patients with Beckwith-Wiedemann syndrome and abnormal ultrasound or rising AFP and MRI is contraindicated [19]
- Pre-procedure for transjugular intrahepatic portosystemic shunt (TIPS)[20, 21]
- For evaluation and monitoring of Gaucher Disease at initial diagnosis and every 12 to 24 months when MRI is contraindicated [22]

Evaluation of iron overload in the following settings when MRI is contraindicated

- Initial evaluation of liver iron in Hemochromatosis diagnosed in lieu of liver biopsy [23]
- Annual evaluation for high-risk patients: transfusion-dependent thalassemia major, sickle cell disease, and other congenital anemias [24]when ultrasound is insufficient

PANCREAS

- Pancreatic cystic lesion found on initial imaging, approve for initial characterization of lesion
- For follow-up for pancreatic cyst as below AND MRI is contraindicated [25]:
    - For incidental and asymptomatic cysts <1.5 mm, **AND**:
        - Age < 65, image annually x 5 years, then every 2 years if stable
        - Age 65-79, imaging every 2 years x 5, then stop if stable
    - For cysts 1.5-1.9 cm with main pancreatic duct communication (MPD), image annually x 5 years, then every 2 years x 2, stop if stable at year 9.
    - For cysts 2.0-2.5 cm with MPD communication, image every 6 months x 4, then annually x 2, then every 2 years x 3, stop if stable at year 10.
    - For cysts 1.5-2.5 cm with NO MPD communication (or cannot be determined), image every 6 mos. x 4, then annually x 2 then every 2 years x 3, stop if stable at year 10.
    - For cyst > 2.5 cm on surveillance (i.e., intervention has not been chosen), image every 6 mos. x 4, then annually x 2 years, then every 2 years x 3. Stop if stable at year 10.
    - Patients > 80 years of age at presentation are imaged less frequently: image every 2 years x 2, stop if stable at year 4 (intervals are the same regardless of size if surveillance chosen)
    - GROWTH or suspicious change on a surveillance imaging scan may warrant more frequent surveillance
- For localization of a functional pancreatic tumor, see Background (endocrine) once diagnosis is confirmed (or highly suspected)
- Annual surveillance for individuals determined to have an increased lifetime risk of developing pancreatic cancer (if MRI/MRCP and EUS contraindicated), based on genetic predisposition or family history as below:
    - SKT11 variant (including Peutz-Jeghers): starting at age 30 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier)
    - CDKN2A variant: starting at age 40 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier)

    - Other variants and based on family history as detailed below: Starting at age 50 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier) for the following:
        - ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family as the identified variant AND known mutation in other pancreatic susceptibility genes (ATM, BRCA1, BRCA2, MLH1 (Lynch), MSH2, MSH6, EPCAM, PALB2, TP53)
        - ≥ 2 first-degree relatives with a history of pancreatic cancer from the same side of the family
        - ≥ 3 first- and/or second-degree relatives with a history of pancreatic cancer from the same side of the family
    - Hereditary Pancreatitis (such as PRSS1 variant) starting 20 years after onset of pancreatitis, or at age 40 years, whichever is earlier[1, 26-28]
    - Multiple Endocrine Neoplasia type 1 (MEN1) (to screen for PanNET (neuroendocrine tumor) every 1-3 years (chest CT or MRI also approvable for this syndrome at same interval)
- Initial imaging for suspected acute pancreatitis due to epigastric pain with elevated amylase and/or lipase:
    - For mild presentation when symptom improvement is not seen after 72 hours of treatment and either:
        - ultrasound has been performed and did not show an abnormality such as gallstones, dilated bile duct
        - ultrasound suggests complications (such as fluid collection)
    - For severe presentation (such as fever, elevated WBC)
    - For a decline in clinical status and/or suspected complication
- Pancreatitis by history, (including pancreatic pseudocyst) with abdominal pain suspicious for worsening, or re-exacerbation
- Known necrotizing pancreatitis requiring follow-up
- In patients > 40 years of age who have pancreatitis with no identifiable cause (see Background), CT is indicated to exclude neoplasm [29]

RENAL

- For an indeterminate renal mass on other imaging [30]

Active surveillance for indeterminate cystic renal mass, not a simple renal cyst (Bosniak IIF (6 mos., 12 mos. then annually), III and IV lesions - see Background)[31]

- Follow-up for solid renal masses under 3 cm at 6 and 12 months, then annually [32,33]
- Surveillance for known angiomyolipoma (AML): annually if known tuberous sclerosis (TSC) or AML size is > 4 cm; every 2 years if AML size is 3-4 cm[34-36] (if AML < 3 cm, CT or MRI not needed unless pt has TSC)

- For surveillance of patients with the following known genetic mutations at the following intervals (MRI preferred due to lifetime radiation risk, CT can be approved if needed for surgical planning or CI to MRI):
    - BAP1-TPDS (BAP-1 tumor predisposition syndrome) every 2 years starting at age 30
    - BHDS (Birt-Hogg-Dube) every 3 years starting at age 20
    - HLRCC (hereditary leiomyomatosis and renal cell cancer) annually starting at age 8
    - HPRC (hereditary papillary renal carcinoma) every 1-2 years starting at age 30
    - PGL/PCC (hereditary paraganglioma/pheochromocytoma) every 4-6 years starting at age 12
    - TSC (tuberous sclerosis complex) without known AML every 3-5 years starting at age 12
        - TSC + known AML annually
    - VHL (Von Hippel Lindau) every 2 years starting at age 15[37]
- For evaluation of total kidney volume in polycystic kidney disease when MRI is contraindicated[38]

SPLEEN

- Incidental findings of the spleen that are indeterminate on other imaging
- For evaluation and monitoring of Gaucher Disease at initial diagnosis and every 12 to 24 months when MRI is contraindicated [22]

For evaluation of a suspected or known hernia [39]

- Abdominal/pelvic pain suspected to be due to an occult, umbilical, Spigelian, or incisional hernia (including recurrent hernias) when physical exam and prior imaging (such as ultrasound) is non-diagnostic or equivocal or if requested as a preoperative study and limited to the abdomen
- Hernia with suspected complications (e.g., bowel obstruction or strangulation, or non-reducible) based on symptoms (e.g., diarrhea, hematochezia, vomiting, severe pain, or guarding), physical exam (guarding, rebound) or prior imaging[40]
- Lower esophageal hernias (such as hiatal, paraesophageal) for pre-operative planning (Abdomen CT preferred, only approve one study, chest CT can be approved instead of abdomen if specific reason given); CT is not a part of the typical workup for diagnosis [41]
- Deep intraabdominal hernia is suspected (post-Roux-en-Y, does not require US first; hernia type needs to be specified)

For evaluation of known or suspected non-aortic vascular disease (e.g., aneurysms, hematomas)[42, 43], CTA/MRA is the preferred study when ultrasound is inconclusive

- If a contraindication to CTA/MRA has been provided, CT can be approved

Transplants

- Prior to solid organ transplantation
- For initial workup prior to Bone Marrow Transplantation (BMT) (along with CT Chest[44], CT Pelvis, CT Sinus and Brain MRI)[45]). Alternatively, PET might be sufficient to evaluate the abdomen and pelvis if indicated based on that malignancy (see PET Guideline)

Pre-operative planning

- For abdominal surgery or procedure

Post-operative/procedural evaluation

- Follow-up of known or suspected post-operative complication involving only the abdomen
- A follow-up study to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Indication for combination studies for the initial pre-therapy staging of cancer, evaluation before starting treatment OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine, and MUGA

BACKGROUND

Abdominal imaging begins at the diaphragm and extends to the umbilicus or iliac crests. CT uses x-rays and multiple detectors to create cross-sectional images of the normal anatomy, as well as demonstrate abnormal soft tissue densities, calcifications or fluid/gas patterns in the viscera or peritoneal space.

Ultrasound is clearly a safe imaging option and is the first imaging test of choice. CT or MRI can then be done as needed after equivocal ultrasound. Clinicians should exercise increased caution with CT

imaging in children, pregnant women, and young adults due to the risks of exposure to ionizing radiation. Screening for pregnancy as part of a work-up is suggested to minimize the number of unexpected radiation exposures for women of childbearing age.

OVERVIEW

Ultrasound should be considered prior to a request for Abdomen CT for the following evaluations:

- Possible gallstones or abnormal liver function tests
- Evaluation of cholecystitis
- Follow up for aortic aneurysm

Liver

Hepatocellular carcinoma (HCC) Screening for Hepatocellular carcinoma (HCC) **–** AASLD (American Association for the Study of Liver Diseases) recommends screening for HCC with ultrasound every 6 months for patients with hepatitis C and B.[46] Advanced imaging is recommended when the AFP is rising, regardless of ultrasound results. The main risk factors for HCC are cirrhosis and Hepatitis B. Additional populations for which there is a benefit to surveillance for HCC include: Asian males Hepatitis B carriers ≥ 40 y, Asian female Hepatitis B carriers ≥50 y, Hepatitis B carriers with + family history of HCC and African and/or North American blacks with hepatitis B [13, 47].

Surveillance for HCC is required for patients who have received liver-directed therapy, surgical resection, medical treatment, or a transplant for HCC. However, because of the higher risk of tumor recurrence, US is not typically used for surveillance for HCC in the first 2 years after treatment. The European Association for the Study of the Liver recommends multiphase CT or MRI to assess response 1 month after resection or locoregional or systemic therapies, followed by one imaging technique every 3 months to complete at least 2 years, and then regular US every 6 months. This schedule is more frequent than some of the other society recommendations and the most common practice among interventional radiologists (every 3 months).

Imaging for pancreatitis – When acute pancreatitis is suspected, ultrasound is typically the first line imaging modality. The purpose of US is to identify other causes such as gallstones and/or biliary dilatation as well as help identify potential complications such as fluid collections. MRCP is preferred over CT for further evaluation of bile duct dilation. When a diagnosis other than pancreatitis is likely (such as when amylase and lipase are equivocal), CT or MRI may be indicated but would generally fall under indications for acute abdominal pain. In general, CT is not indicated in patients with mild pancreatitis who show rapid improvement with appropriate medical management. When a patient has or is at risk for severe pancreatitis, CT may be used after 72 hours to best assess the full extent of disease. CT should be repeated when the clinical picture drastically changes, such as with sudden onset of fever, decrease in hematocrit or sepsis. For prolonged symptoms (>4 weeks) with known fluid collection, CT or MRI is indicated. Common causes for pancreatitis include gallstones, alcohol,

hypertriglyceridemia, post-ERCP, trauma. In patients over 40 years old, when no cause for pancreatitis can be identified, advanced imaging is indicated to exclude neoplasm.

Adrenal incidentaloma – Adrenal masses detected on imaging for another reason (i.e., incidental finding) are becoming increasingly common. If there is no prior personal history of malignancy and no features concerning for malignancy on imaging, these patients should undergo hormonal (functional) evaluation and periodic imaging. If the mass is < 4 cm on imaging and has benign characteristic (homogenous, regular borders, HU < 10) a hormonal evaluation should be done. If that evaluation is negative, adrenal protocol/follow-up imaging can be performed at 6 months then annually for 1-2 years[12]. Repeat functional studies are recommended annually (or sooner if symptoms) for 5 years. If the mass exhibits growth or becomes hormonally active, then surgery is recommended [12]. Additional imaging beyond 2 years is reasonable if there has been growth and the mass is not resected; if stable, no further imaging is warranted unless the annual hormonal evaluation is positive. Masses ≥ 4cm generally are resected after hormonal evaluation is completed, additional imaging can be approved when needed for further characterization for surgical planning. If the decision is made not to resect the mass, then FU imaging in 6-12 months is reasonable.

Biochemically active tumors (adrenal and neuroendocrine): Laboratory evaluation prior to imaging - When neuroendocrine and hormonally active tumors are suspected, the required laboratory evaluation prior to advanced imaging is dependent on the tumor type that is suspected. The following list describes suspected syndrome/tumor and typical laboratory evaluation in parenthesis:

GI Carcinoid (24-hour urine or plasma 5-HIAA), Lung/Thymus Carcinoid (24-hour urine or plasma 5-HIAA AND one of the following: overnight dexamethasone suppression test, 2-3 midnight salivary cortisols, 24-hour urinary free cortisol), PPoma (serum pancreatic polypeptide), Insulinoma (serum insulin, pro-insulin and C-peptide all drawn during a period of hypoglycemia (i.e. 72 hour fast)), VIPoma (serum VIP), glucagonoma (serum glucagon), gastrinoma (serum gastrin), somatostatinoma (serum somatostatin), pheochromocytoma/paraganglioma (plasma free or 24-hour urine fractionated metanephrines and normetanephrines +/- serum or urine catecholamines), pituitary tumor (serum IGF-1, prolactin, LH/FSH, alpha subunits, TSH and ONE of the following: overnight dexamethasone suppression test, 2-3 midnight salivary cortisols, 24-hour urinary free cortisol), primary hyperaldosteronism (suppressed renin/renin activity in association with elevated plasma aldosterone (>10 ng/dL) and confirmatory testing if positive), adrenocortical carcinoma (testosterone, DHEA-S AND complete evaluation for hypercortisolemia or primary aldosteronism)[48].

If Cushing's (hypercortisolemia) is suspected, typical labs include a plasma ACTH AND one or more of the following: overnight dexamethasone suppression test, 2-3 midnight salivary cortisols, OR 24-hour urinary free cortisol. The results of the suppression test then indicate whether brain imaging is needed (pituitary source) OR chest and abdominal imaging is needed (CXR + Adrenal CT/MRI). ACTH > 20 after suppression > 20 is suggestive of Cushing's Disease and Pituitary MRI is indicated. ACTH after suppression < 5 is suggestive of Cushing's Syndrome and CXR + Adrenal CT/MRI is indicated [49]. If

indeterminate, a CRH or desmopressin test is then done. If there is no ACTH suppression with CRH/desmopressin, then adrenal imaging is indicated.

Genetic syndromes and adrenal tumors – Adrenal cortical carcinoma (ACC) diagnosed during childhood is known to be commonly associated with hereditary syndromes, including Beckwith-Wiedemann (BWS) and Li-Fraumeni syndrome (LFS). In adults, ACC may be associated with Multiple Endocrine Neoplasia 1 (MEN1), familial adenomatous polyposis coli and neurofibromatosis type 1 (NF1); however, there are currently no surveillance imaging recommendations.[50]

High risk characteristics for mucinous pancreatic cysts include all of the following: Symptoms, Jaundice secondary to the cyst, acute pancreatitis secondary to the cyst, elevated serum CA 19-9 and no benign cause present, an enhancing mural nodule or solid component within the cyst or pancreas, main pancreatic duct of > 5mm, change in duct caliber with upstream atrophy, size over 3 cm, high grade dysplasia or cancer on cytology. These patients should undergo EUS + -FNA or be referred to a multidisciplinary group for further recommendations.[51]

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CT of the kidney - Recommendations for follow up of a complex cystic renal mass are made using Bosniak criteria[52]:

- Bosniak I (water density 0-20 HU); no further follow-up
- Bosniak II (one or a few thin septations, small or fine calcifications, hyperdense cysts up to 3 cm); no further follow-up
- Bosniak IIF felt to be benign but too complex to be diagnosed with certainty; image at 6 and 12 months, then annually for 5 years if no progression
- Bosniak III thick-walled cystic lesions with wall or septal enhancement; resection favored vs conservative management and RFA in select cases[31]
- Bosniak IV malignant cystic renal mass with enhancing soft tissue components; resection favored, malignant until proven otherwise

Insulinomas are rare pancreatic tumors. Localization of the tumor by ultrasound and CT are the preferred initial options once a diagnosis has been made, followed by endoscopic ultrasound or arterial stimulation with hepatic venous sampling. Whipple's triad includes symptoms of hypoglycemia, low blood glucose relieved by ingestion of glucose, and benign 90%. Work-up prior to imaging should include: a 72-hour fast with serial glucose and insulin levels over this period until the patient becomes symptomatic. An insulin/glucose ration of greater than 0.3 has been found in virtually all patients with insulinoma or other islet cell disease.[53]

High risk characteristics for mucinous pancreatic cysts include all of the following: Symptoms, Jaundice secondary to the cyst, acute pancreatitis secondary to the cyst, elevated serum CA 19-9 and no benign cause present, an enhancing mural nodule or solid component within the cyst or pancreas, main pancreatic duct of > 5mm, change in duct caliber with upstream atrophy, size over 3 cm, high grade dysplasia or cancer on cytology. These patients should undergo EUS + -FNA or be referred to a multidisciplinary group for further recommendations.[54]

CT and elevated Liver Function Tests - For elevated bilirubin, or serum transaminases with or without bilirubin elevation, US is the initial recommended test to assess for duct dilatation which might lead to ERCP or MRCP, vs other causes which might necessitate further lab testing or liver biopsy.[55]

Combination request of Abdomen CT/Chest CT - A chest CT will produce images to the level of L3. Documentation for combo is required.

Imaging of hernias - Most hernias are diagnosed clinically with imaging recommended for the diagnosis of occult hernias or in the evaluation of hernia complications, such as bowel obstruction or strangulation. To detect occult hernias, ultrasound is a first-line study with a sensitivity of 86% and specificity of 77%, compared to 80% sensitivity and 65% specificity for CT.[56] According to Miller, et al "Magnetic resonance imaging is generally not considered a first- or even second-line evaluation modality for hernias…."[57] Based on this analysis, MRI is recommended only when ultrasound and CT have been performed and fail to make a diagnosis.

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POLICY HISTORY

Date	Summary
May 2023	• IBD: eliminated indications for abdomen alone or pelvis imaging alone, resubmission as abdomen and pelvis CT required unless limited indication • Adrenal: additional guidance provided for imaging intervals and background given for functional tumors • Liver: clarified guidance for HCC surveillance imaging, follow up of specific conditions such as hepatic steatosis and focal nodular hyperplasia • Pancreas: updated pancreatic cystic lesion guidance, specified guidance for increased lifetime risk for pancreatic cancer and pancreatitis • Renal: specified guidance for increased lifetime risk of renal cancer • Hernia: Added indications for lower esophageal and deep intraabdominal hernias • Aneurysm: eliminated indications for abdomen alone or pelvis imaging alone, resubmission as abdomen and pelvis CT required unless limited indication • Transplant: added section • Background: deleted some sections, added information to assist with adjudication/application of guideline statement • Aligned sections across body imaging guidelines • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
March 2022	• In Follow-up of known cancer, added per surveillance imaging of NCCN recommendations • Clarified IPMN and MCN surveillance imaging • Added total kidney volume in polycystic kidney disease when MRI is contraindicated to Renal section • Clarified “and/or” prior imaging (such as US) in abdominal/pelvic pain due to suspected hernia

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guideline **ABDOMEN/PELVIS CTA (Angiography)**	**Original Date: September 1997**
CPT Codes: 74174	**Last Revised Date: March 2023**
Guideline Number: NIA_CG_069	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE

When vascular imaging of the aorta and both legs, i.e., CTA aortogram and runoff is desired (sometimes incorrectly requested as Abd/Pelvis CTA & Lower Extremity CTA Runoff), only one authorization request is required, using CPT Code 75635 Abdominal Arteries CTA. **This study provides for imaging of the abdomen, pelvis, and both legs.** The CPT code description is CTA aorto-iliofemoral runoff; abdominal aorta and bilateral ilio-femoral lower extremity runoff**.**

When separate requests for CTA abdomen and CTA Pelvis are encountered for processes involving both the abdomen and pelvis (but do NOT need to include legs/runoff), they need to be resubmitted as a single Abdomen/Pelvis CTA (to avoid unbundling). Otherwise, the exam should be limited to the appropriate area (i.e., Abdomen OR Pelvis) that includes the area of concern. INDICATIONS FOR ABDOMEN/PELVIS CT ANGIOGRAPHY/CT VENOGRAPHY (CTA/CTV)

For evaluation of known or suspected abdominal/pelvis vascular disease

Arterial Disease

Abdominal Aortic Aneurysm (AAA):

- For **asymptomatic** known or suspected abdominal aortic aneurysms, ultrasound should be done prior to advanced imaging. Only when the ultrasound is inconclusive, is advanced imaging needed (see Background for ultrasound screening intervals)
- For **symptomatic** known or suspected AAA (such as recent-onset abdominal pain or back pain, particularly in the presence of a pulsatile or epigastric mass, suspected dissection or significant risk factors for AAA) CTA/MRA is appropriate and generally preferred over CT/MRI. (If contrast is contraindicated or other clinical indications for abdomen and/or pelvic imaging are present, then CT/MR may be approved rather than CTA/MRA)
- If there is known complex vascular anatomy, CTA/MRA may be needed.

Other vascular abnormalities seen on prior imaging studies:

- Initial evaluation of inconclusive vascular findings on prior imaging
- Follow-up of known visceral vascular conditions (such as aneurysm, dissection, compression syndromes, arteriovenous malformations (AVMs), fistulas, intramural hematoma, and vasculitis) (pelvis may also be approved if needed based on location of abnormality)
    - Hepatic vascular abnormalities after ultrasound has been performed to clarify or further evaluate findings
- For assessment in patients with spontaneous coronary artery dissection (SCAD), can be done at time of coronary angiography [5]
- Vascular invasion or displacement by tumor (conventional CT or MRI also appropriate)[6]
- For known large vessel diseases (inferior vena cava, superior/inferior mesenteric, celiac, splenic, renal or iliac arteries/veins), e.g., aneurysm/dissection (non-aortic disease), arteriovenous malformations (AVMs), and fistulas, intramural hematoma, and vasculitis[7-9]
    - Surveillance may be done with ultrasound at intervals similar to AAA, however, CTA/MRA rather than CT/MRI may be needed for non-aortic disease when ultrasound is inconclusive[10]

Vascular ischemia or hemorrhage:

- To determine the vascular source of retroperitoneal hematoma or hemorrhage when CT is insufficient to determine the source of hemorrhage [9, 12]
- For evaluation of suspected mesenteric ischemia/ischemic colitis [11]
- Lower gastrointestinal hemorrhage: Active bleeding in a hemodynamically stable patient or non-localized intermittent bleeding as an alternative to Tc-99m RBC scan when colonoscopy did not localize the bleeding, or is contraindicated or unavailable[5, 6, 14]
- For hemodynamically unstable patients[15, 16]

For patients at increased risk for vascular abnormalities (CTA or MRA):

- For patients with fibromuscular dysplasia (FMD), a one-time vascular study of the abdomen and pelvis [13]

- For patients with vascular Ehlers-Danlos syndrome or Marfan syndrome, a one-time study of the abdomen and pelvis
- For Loeys-Dietz, imaging at diagnosis and then every two years, more frequently if abnormalities are found (Imaging may include head, neck, chest, abdomen and pelvis)[14, 20] (MRA preferred due to cumulative radiation risk)

Venous disease

- Venous thrombosis if previous studies have not resulted in a clear diagnosis
- For suspected/known May-Thurner syndrome[24, 25]
- For evaluation of venous thrombosis in the inferior vena cava (IVC)[17]
- Vascular invasion or displacement by tumor (if involves both the abdomen and pelvis (otherwise limit to either abdomen or pelvis as appropriate)
- For evaluation of suspected pelvic vascular disease or pelvic congestive syndrome when findings on ultrasound are indeterminate (MR or CT venography may be used as the initial study for evaluating pelvic thrombosis or thrombophlebitis)
- For unexplained lower extremity edema (typically unilateral or asymmetric) with negative or inconclusive ultrasound[26]

Pre-operative evaluation

- Evaluation of interventional vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Prior to repair of abdominal aortic aneurysm (AAA)
- For imaging of the deep inferior epigastric arteries for surgical planning (breast reconstructive surgery)[27]
- Prior to solid organ transplantation when vascular anatomy is needed

Post-operative or post-procedural evaluation

- Evaluation of endovascular/interventional abdominal vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Evaluation of post-operative complications, e.g., pseudoaneurysms, related to surgical bypass grafts, vascular stents, and stent-grafts in the peritoneal cavity
- Suspected complications of inferior vena cava (IVC) filters
- Follow-up for post-endovascular repair (EVAR) or open repair of abdominal aortic aneurysm (AAA)[1] or abdominal extent of iliac artery aneurysms (**CT preferred** unless MRA/CTA is needed for procedural planning or to evaluate complex anatomy)
    - Routine, baseline study (post-op/intervention) is warranted within the first month after EVAR:
        - Repeat in 6 months if type II endoleak is seen (continue every 6 months x 24 months, then annually)

        - Repeat in 12 months if no endoleak or sac enlargement is seen
        - If neither endoleak nor AAA enlargement is seen on imaging one year after EVAR, CT is needed only if US is not feasible for annual surveillance (until year 5 as below)
    - Non-contrast CT of entire aorta (Abdomen and Pelvis) is needed every 5 years after open repair of AAA or EVAR
    - If symptomatic or imaging shows increasing or new findings related to stent graft – more frequent imaging may be needed
    - For suspected complication such as: new-onset lower extremity claudication, ischemia, or reduction in ABI after aneurysm repair,

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Chest CTA/Abdomen/Pelvis CTA combo

- For evaluation of extensive vascular disease involving the chest and abdominal cavities
- For pre-op or preprocedural evaluation for Transcatheter Aortic Valve Replacement (TAVR)[29, 31]
- Acute aortic dissection[32]
- Takayasu's arteritis[33]
- Marfan syndrome
- Loeys-Dietz syndrome
- Spontaneous coronary artery dissection (SCAD)
- Vascular Ehlers-Danlos syndrome
- Post-operative complications[34, 35]
- Significant post-traumatic or post-procedural vascular complications

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BACKGROUND

Body CTA is a method used to characterize vascular anatomy, diagnose vascular diseases, and plan treatment. Following contrast thin section CT acquisition is utilized and timed to coincide with peak arterial and venous enhancement. Both multiplanar and 3D reconstructions can be reformatted**.**

Bruits - blowing vascular sounds heard over partially occluded blood vessels. Abdominal bruits may indicate partial obstruction of the aorta or other major arteries such as the renal, iliac, or femoral

arteries. Associated risks include but are not limited to; renal artery stenosis, aortic aneurysm, atherosclerosis, AVM, or coarctation of aorta.

Peripheral Artery Disease (PAD) – Before the availability of computed tomography angiography (CTA), peripheral arterial disease was evaluated using CT and only a portion of the peripheral arterial tree could be imaged. Multi-detector row CT (MDCT) overcomes this limitation and provides an accurate alternative to CT and is a cost-effective diagnostic strategy in evaluating PAD. Abdominal Arteries CTA (including runoff to the lower extremities) is the preferred study when evaluation of arterial sufficiency to the legs is part of the evaluation.

Lower GI bleeding- Colonoscopy should be the initial diagnostic procedure for nearly all patients presenting with acute LGIB (strong recommendation, low-quality evidence). Hematochezia associated with hemodynamic instability should lead to consideration of a brisk UGIB source, especially in at-risk patients, such as those with a history of peptic ulcer disease or liver disease with portal hypertension and those using antiplatelet or anticoagulant medications, and an upper endoscopy should be performed. CTA is a reasonable first-line screening test if needed before angiography or emergent surgery.[5]

CTA and Abdominal Aortic Aneurysm – Endovascular repair is an alternative to open surgical repair of an abdominal aortic aneurysm. It has lower morbidity and mortality rates and is minimally invasive. In order to be successful, it depends on precise measurement of the aneurysm and involved vessels. CTA with 3D reconstruction is useful in obtaining exact morphologic information on abdominal aortic aneurysms. CTA is also used for the detection of postoperative complications of endovascular repair.

CTA and Abdominal Aortic Aneurysm – The normal diameter of the suprarenal abdominal aorta is 3.0 cm and that of the infrarenal is 2.0 cm. Aneurysmal dilatation of the infrarenal aorta is defined as diameter ≥ 3.0 cm or dilatation of the aorta ≥ 1.5x the normal diameter.[2] Evaluation of AAA can be accurately made by ultrasound. Ultrasound can detect and size AAA, with the advantage of being relatively inexpensive, noninvasive, and not requiring iodinated contrast. The limitations are that overlying bowel gas can obscure findings and the technique is operator dependent. Ultrasound is used to screen for and to monitor aneurysms*. CT is used when US is inconclusive or insufficient. When there are suspected complications, complex anatomy and/or surgery is planned, CTA/MRA is preferred. Risk factors for AAA include smoking history, age, male gender, family history of AAA (first degree relative) and personal history of vascular disease. Risk factors for rupture include female gender, large initial aneurysm diameter, low FEV, current smoking history, elevated mean blood pressure and patients on immunosuppression after major organ transplantation. The Society of Vascular Surgery recommends elective repair of AAA ≥ 5.5 cm in patients at low or acceptable surgical risk.[1]

Ultrasound screening intervals*:

- Aneurysm size 2.5–3 cm, every 10 years
- Aneurysm size 3.0–3.9 cm, every 3 years

- Aneurysm size 4.0-4.9 cm, annually[36]
- Aneurysm size 5.0-5.4 cm, every 6 months

Iliac Artery Aneurysms – Follow-up asymptomatic incidentally detected iliac artery aneurysms: The definition of an iliac artery aneurysm is dilatation to more than 1.5 times its normal diameter, in general ≥ 18 mm in men and ≥ 15 mm in women, an internal iliac artery > 8mm. Surveillance is extrapolated from AAA surveillance and can be done by Doppler ultrasound or CTA if hard to visualize by ultrasound.[4]

CTA and Thoracic Aorta Endovascular Stent-Grafts – CTA is an effective alternative to conventional angiography for postoperative follow-up of aortic stent grafts. It is used to review complications after thoracic endovascular aortic repair. CTA can detect luminal and extraluminal changes to the thoracic aortic after stent-grafting and can be performed efficiently with fast scanning speed and high spatial and temporal resolution.

MRI/CT and acute hemorrhage – MRI is not indicated and MRA/MRV (MR Angiography/Venography) is rarely indicated for evaluation of intraperitoneal or retroperitoneal hemorrhage, particularly in the acute setting. **CT is the study of choice** due to its availability, speed of the study and less susceptibility to artifact from patient motion. Advances in technology have allowed conventional CT to not just detect hematomas but also the source of acute vascular extravasation. In special cases finer vascular detail to assess the specific source vessel responsible for hemorrhage may require the use of CTA. CTA in diagnosis of lower gastrointestinal bleeding is such an example.[14] In this case, colonoscopy should be the initial diagnostic procedure.

MRA/MRV is often utilized in non-acute situations to assess vascular structure involved in atherosclerotic disease and its complications, such as vasculitis, venous thrombosis, vascular congestion or tumor invasion. Although some of these conditions may be associated with hemorrhage, it is usually not the primary reason why MRI/MRA/MRV is selected for the evaluation. A special condition where MRI may be superior to CT for evaluating hemorrhage is to detect an underlying neoplasm as the cause of bleeding.[37]

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POLICY HISTORY

Date	Summary
March 2023	• Aneurysm: specified guidance on initial imaging and screening intervals with emphasis on requiring ultrasound on initial imaging and indications for advanced imaging, specified guidance on post-repair imaging • Other vascular abnormalities: clarified indication for non-aortic vascular conditions • Transplant: added section • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Aligned sections across body imaging guidelines
April 2022	• Added "(abdomen and pelvis MRA when CTA is inconclusive or cannot be performed)" to follow-up for EVAR and AAA

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **ABDOMEN CTA (Angiography)**	**Original Date: September 1997**
CPT Codes: 74175	**Last Revised Date: March 2023**
Guideline Number: NIA_CG_034-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE

When vascular imaging of the aorta and both legs, i.e., CTA aortogram and runoff is desired (sometimes incorrectly requested as Abd/Pelvis CTA & Lower Extremity CTA Runoff), only one authorization request is required, using CPT Code 75635 Abdominal Arteries CTA. This study provides for imaging of the abdomen, pelvis, and both legs. The CPT code description is CTA aorto-iliofemoral runoff; abdominal aorta and bilateral ilio-femoral lower extremity runoff.

When separate requests for CTA abdomen and CTA Pelvis are encountered for processes involving both the abdomen and pelvis (but do NOT need to include legs/runoff), they need to be resubmitted as a single Abdomen/Pelvis CTA, using CPT 74174 (to avoid unbundling). Otherwise, the exam should be limited to the appropriate area (i.e., Abdomen OR Pelvis) that includes the area of concern.

INDICATIONS FOR ABDOMEN CT ANGIOGRAPHY/CT VENOGRAPHY (CTA/CTV)

For evaluation of known or suspected abdominal vascular disease

Arterial Disease

Abdominal Aortic Aneurysm (AAA) (should be CTA Abdomen and Pelvis if known or suspected aneurysm extends to the pelvis):

- For **asymptomatic** known or suspected abdominal aortic aneurysms, ultrasound should be done prior to advanced imaging. Only when the ultrasound is inconclusive, is advanced imaging with CT or MRI needed
- For **symptomatic** known or suspected AAA (such as recent-onset abdominal pain or back pain, particularly in the presence of a pulsatile or epigastric mass, suspected dissection, or significant risk factors for AAA) CTA/MRA is appropriate and generally preferred over CT/MRI. (If contrast is contraindicated or other clinical indications for abdomen and/or pelvic imaging are present, then CT/MR may be approved rather than CTA/MRA)
- If there is known complex anatomy, CTA/MRA may be needed.

Other vascular abnormalities seen on prior imaging studies:

- Initial evaluation of inconclusive vascular findings on prior imaging
- Follow-up of known visceral vascular conditions (such as aneurysm, dissection, compression syndromes, arteriovenous malformations (AVMs), fistulas, intramural hematoma, and vasculitis) (if pelvis is also needed, resubmit as CTA Abdomen and Pelvis)
    - Hepatic vascular abnormalities after ultrasound has been performed to clarify or further evaluate findings
- For assessment in patients with spontaneous coronary artery dissection (SCAD), can be done at time of coronary angiography (resubmit as CTA Abdomen and Pelvis if pelvis is needed)[1]
- Vascular invasion or displacement by tumor (conventional CT or MRI also appropriate)[2]
- For known large vessel diseases (inferior vena cava, superior/inferior mesenteric, celiac, splenic or renal arteries/veins), e.g., aneurysm/dissection (non-aortic disease), arteriovenous malformations (AVMs), and fistulas, intramural hematoma, and vasculitis[3-5]
- Surveillance may be done with ultrasound at intervals similar to AAA, however, CTA/MRA rather than CT/MRI may be needed for non-aortic disease when ultrasound is inconclusive[6]

Vascular ischemia or hemorrhage (needs to be resubmitted as CTA Abdomen and Pelvis unless there is a specific finding limited to the abdomen)

For patients at increased risk for vascular abnormalities (CTA or MRA): (needs to be resubmitted as CTA Abdomen and Pelvis unless there is a specific finding limited to the abdomen)

For evaluation of known or suspected renal artery stenosis or resistant hypertension in the setting of normal renal function (with impaired renal function, eGFR <30, use US with Doppler) unrelated to recent medication demonstrated by any of the following[2, 7-13]:

- Unsuccessful control after treatment with 3 or more (>2) anti-hypertensive medication at optimal dosing and one should be a diuretic
- Acute elevation of creatinine after initiation of an angiotensin converting enzyme inhibitor (ACE inhibitor) or angiotensin receptor blocker (ARB)
- Asymmetric kidney size noted on ultrasound

- Onset of hypertension in a person younger than age 30 without any other risk factors or family history of hypertension
- Significant hypertension (diastolic blood pressure > 110 mm Hg) in a young adult (i.e., younger than 35 years) suggestive of fibromuscular dysplasia[14]
- Diagnosis of a syndrome with a higher risk of vascular disease, such as neurofibromatosis, tuberous sclerosis, and Williams' syndrome
- New onset of hypertension after age 50
- Acute rise in blood pressure in a person with previously stable blood pressures
- Flash pulmonary edema without identifiable causes
- Malignant or accelerated hypertension
- Bruit heard over renal artery and hypertension
- Abnormal/inconclusive renal doppler ultrasound

Venous Disease

- Suspected renal vein thrombosis in patient with known renal mass or from other causes[15]
- Venous thrombosis if previous studies have not resulted in a clear diagnosis and limited to the abdomen
- Vascular invasion or displacement by tumor in the abdomen
- For evaluation of portal venous system (hepatic portal system) after doppler ultrasound has been performed
- For unexplained lower extremity edema (typically unilateral or asymmetric) with negative or inconclusive ultrasound[16]

Pre-operative evaluation

- For evaluation of transjugular intrahepatic portosystemic shunt (TIPS) when Doppler ultrasound indicates suspected complications[17-20]
- Evaluation prior to interventional vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Prior to solid organ transplantation when vascular anatomy is needed
- For surgical planning for UPJ (ureteropelvic junction) obstruction to look for a lower pole crossing vessel
- Planning prior Y90 radiation treatment for liver cancer in order to evaluate anatomic variation/shunts/determine best catheter placement/see if coil(s) needed[21]

Post-operative or post-procedural evaluation

- Evaluation of endovascular/interventional abdominal vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Evaluation of post-operative complications, e.g., pseudoaneurysms related to surgical bypass grafts, vascular stents, and stent-grafts in the peritoneal cavity

- Follow-up for post-endovascular repair (EVAR) or open repair of abdominal aortic aneurysm (AAA) or abdominal extent of iliac artery aneurysms typically needs to include pelvic imaging, therefore Abdomen Pelvis CT/CTA/MRA would usually be the appropriate study.

Other Vascular indications

- For evaluation of hepatic blood vessel abnormalities (aneurysm, hepatic vein thrombosis, stenosis post-transplant) after doppler ultrasound has been performed; to clarify or further evaluate ultrasound findings

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Chest CTA/Abdomen CTA combo

- For evaluation of extensive vascular disease involving the chest and abdominal cavities and pelvic imaging is not needed
- For pre-op or preprocedural evaluation for Transcatheter Aortic Valve Replacement (TAVR)[22, 23]
- Post-op complications[24, 25] and pelvic imaging is not needed
- Significant post-traumatic or post-procedural vascular complications and pelvic imaging is not needed

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BACKGROUND

Computed tomography angiography (CTA) generates images of the arteries that can be evaluated for evidence of stenosis, occlusion, or aneurysms. It is used to evaluate the arteries of the abdominal aorta and the renal arteries. CTA uses ionizing radiation and requires the administration of iodinated contrast agent, which is a potential hazard in patients with impaired renal function. Abdominal CTA is not used as a screening tool, e.g., evaluation of asymptomatic patients without a previous diagnosis.

Cross-sectional imaging (liver ultrasound with Doppler, CT or MRI) should be completed no more than a month prior to the transjugular intrahepatic portosystemic shunt (TIPS) to assess for vascular patency and look for hepatic masses or other problems that could complicate the procedure.

Post-procedure, an ultrasound of the liver is conducted a day after to assess shunt patency. Hepatic encephalopathy (HE) is the most common complication and usually occurs 2-3 weeks after insertion of

TIPS. Unique complications may include intravascular hemolysis and infection of the shunt. Other complications can include capsule puncture, intraperitoneal bleed, hepatic infarction, fistula, hematobilia, thrombosis of stent, occlusion, or stent migration and may require cross-sectional imaging.

Follow-up and maintenance imaging if complications suspected include Doppler ultrasound to assess shunt velocity. If asymptomatic sonogram performed at 4 weeks post placement, then every 6 months to a year. The gold standard for shunt patency is portal venography, usually reserved if concern for shunt occlusion.

OVERVIEW

CTA and Renal Artery Stenosis: Renal artery stenosis is the major cause of secondary hypertension. It may also cause renal insufficiency and end-stage renal disease. Atherosclerosis is one of the common causes of this condition, especially in older patients with multiple cardiovascular risk factors and worsening hypertension or deterioration of renal function. CTA is used to evaluate the renal arteries and detect renal artery stenosis.

NF1 may present with hypertension due to renal artery stenosis in children. All young patients (<30 year) with hypertension should be clinically screened for secondary causes of hypertension, including NF1, so that renal revascularization can be offered before permanent end organ damage has occurred.[26]

Abdominal Aneurysms and general guidelines for follow-up: The normal diameter of the suprarenal abdominal aorta is 3.0 cm and that of the infrarenal is 2.0 cm. Aneurysmal dilatation of the infrarenal aorta is defined as diameter ≥ 3.0 cm or dilatation of the aorta ≥ 1.5x the normal diameter.[27] Evaluation of AAA can be accurately made by **ultrasound.** Ultrasound can detect and size AAA, with the advantage of being relatively inexpensive, noninvasive, and not requiring iodinate contrast. The limitations are that overlying bowel gas can obscure findings and the technique is operator dependent. CT is used when US is inconclusive or insufficient. When there are suspected complications, complex anatomy and/or surgery is planned, CTA/MRA is preferred.

MRI/CT and acute hemorrhage: MRI is not indicated and MRA/MRV (MR Angiography/Venography) is rarely indicated for evaluation of intraperitoneal or retroperitoneal hemorrhage, particularly in the acute setting. **CT is usually the study of choice** due to its availability, speed of the study, and less susceptibility to artifact from patient motion. Advances in technology have allowed conventional CT to not just detect hematomas but also the source of acute vascular extravasation. In special cases finer vascular detail to assess the specific source vessel responsible for hemorrhage may require the use of CTA. CTA in diagnosis of lower gastrointestinal bleeding is such an example.[28]

MRA/MRV is often utilized in non-acute situations to assess vascular structure involved in atherosclerotic disease and its complications, vasculitis, venous thrombosis, vascular congestion, or tumor invasion. Although some of these conditions may be associated with hemorrhage, it is usually

not the primary reason why MRI/MRA/MRV is selected for the evaluation. A special condition where MRI may be superior to CT for evaluating hemorrhage is to detect an underlying neoplasm as the cause of bleeding.[29]

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POLICY HISTORY

Date	Summary
March 2023	• Redirected vascular requests for abdomen alone or pelvis imaging alone to resubmit as abdomen and pelvis CTA required unless condition limited to abdomen • Other vascular abnormalities: clarified indication for non-aortic vascular conditions • Transplant: added section • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Aligned sections across body imaging guidelines
April 2022	• Added indication for UPJ surgery • Clarified note regarding vascular imaging of the aorta and both legs (i.e., CTA aortogram and runoff) • Clarified evaluation of known or suspected aortic aneurysm • Removed follow-up intervals for EVAR and AAA since Abdomen Pelvis CTA is usually appropriate study • Added Y90 indication

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guideline **ABDOMEN/PELVIS CT COMBO**	**Original Date: September 1997**
CPT Codes: 74176, 74177, 74178	**Last Revised Date: March 2023**
Guideline Number: NIA_CG_068	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

Note: For syndromes for which imaging starts in the pediatric age group, MRI preferred

Note: CT Abdomen/Pelvis Combo (CPT Codes: 74176, 74177, 74178) is the better study when the indication(s) include both the abdomen AND pelvis, such as CTU (CT Urography), CTE (CT Enterography), acute abdominal pain, widespread inflammatory disease, or neoplasm**.**
When separate requests for CT Abdomen and CT Pelvis are encountered for processes involving both the abdomen and pelvis, they need to be resubmitted as a single Abdomen/Pelvis CT (to avoid unbundling). Otherwise, the exam should be limited to the appropriate area (i.e., Abdomen **OR** Pelvis) which includes the specific organ, area of known disease/abnormality, or the area of concern**.**

INDICATIONS FOR ABDOMEN/PELVIS COMPUTED TOMOGRAPHY (CT)

Evaluation of Abdominal and Pelvis Pain for Unknown Etiology

- CT allowed after initial workup is inconclusive and must include results of the following:
    - Appropriate laboratory testing (chemistry profile, complete blood count, and/or urinalysis) for the patient's presentation (e.g., suprapubic pain – UA, suspected pancreatitis – amylase/lipase etc.) **AND**
    - Initial imaging (such as ultrasound, barium study, nuclear medicine, or scope study) appropriate to the symptoms
    - Not all of the above tests need to be performed, but both labs and initial imaging need to be performed

        - E.g., for GI bleeding, CBC and a scope study would be appropriate initial testing (however, a UA and ultrasound would not be)
- For acute abdominal pain in a patient over the age of 65[1, 2]
- Initial evaluation of abnormal findings seen on other imaging, such as ultrasound (US) or x-ray, both the abdomen and pelvis are likely affected, and CT is the most reasonable next step for that diagnosis

Evaluation of suspicious or known mass/tumors (unconfirmed diagnosis of cancer) for further evaluation of indeterminate or questionable findings

- Initial evaluation of suspicious masses/tumors found by physical exam or imaging study, such as ultrasound (US), and both the abdomen and pelvis are likely affected[3, 4]
- One follow-up exam to ensure no suspicious change has occurred in a tumor. No further surveillance imaging unless tumor(s) is/are specified as highly suspicious, or change was found on exam or last follow-up imaging.
- For abnormal incidental abdominopelvic lymph nodes when follow-up is recommended based on prior imaging (initial 3-month FU)[5]
- For follow-up of mesenteric panniculitis[6-8] or lymphadenitis[9] when another diagnosis is suspected after initial imaging or there is a failure of symptom resolution

Evaluation of known cancer[10, 11] (see exception for prostate cancer*)

- Initial staging of known cancer
- Follow-up of known cancer
    - Follow-up of known cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
    - New evidence of an unknown primary[12]
    - Known cancer with suspected abdominal/pelvic metastasis based on a sign, symptom, (e.g., anorexia, early satiety, intestinal obstruction, night sweats, pelvic pain, weight loss, vaginal bleeding) or an abnormal lab value (alpha-fetoprotein, CEA, CA 19-9, p53 mutation)

***Initial staging of prostate cancer for the following risk groups:** (MRI Pelvis preferred for pelvic imaging; only consider CT Abdomen and Pelvis approval if PSMA PET not requested)

- Unfavorable intermediate risk, high risk and very high-risk disease:
    - Gleason 8, 9, 10 disease
    - Gleason 4+3=7 disease (primary pattern 4)
    - Gleason 3+4=7 disease **AND** PSA > 10 or clinical stage ≥T2b
    - Gleason 3+3=6 disease **AND** PSA > 20 or clinical stage ≥T3
    - >50% cores positive for cancer in a random (non-targeted) biopsy[1, 13]

Note: In patients who have been on a 5-alpha reductase inhibitor (such as Proscar) in the past 12 months, an "adjusted PSA" should be used. To adjust, multiply PSA by a factor of 2 (e.g., PSA 6 on finasteride adjusts to a PSA of 12)

***Known prostate cancer for workup of recurrence and response to treatment (**MRI Pelvis preferred for pelvic imaging; only consider CT Abdomen and Pelvis approval if PSMA PET not requested

- Initial treatment with radical prostatectomy
    - Failure of PSA to fall to undetectable levels or PSA detectable and rising on at least 2 subsequent determinations
- Initial treatment with radiation therapy
    - Post-RT rising PSA on at least 2 subsequent determinations or positive digital exam and is candidate for local therapy
    - Known metastatic disease with progression on therapy does not require CI to MRI or PET if CT is requested

Suspected or known recent peritonitis and at LEAST ONE of the following:

- Rebound, guarding (not voluntary) or rigid abdomen, **OR**
- Severe tenderness to palpation present over entire abdomen

For evaluation of suspected infection or inflammatory disease[14, 15]

- Suspected diverticulitis or acute appendicitis** for initial imaging with at least **ONE** of the following[16]:
    - WBC Elevated
    - Fever
    - Anorexia
    - Nausea and vomiting

  **Use ultrasound or MRI in pregnant women with suspected appendicitis[17]
- Suspected diverticulitis[18] when
    - Pain is present in the LLQ (<3 months duration), medical records note suspicion for diverticulitis, the patient has no prior history of diverticulitis, **AND** LLQ tenderness is present on exam; **OR**
    - Patient is immunocompromised; **OR**
    - Patient has a history of diverticulitis, symptoms are similar to prior episodes, **AND** patient has failed treatment currently (treatment could be liquid diet/anti-inflammatories or antibiotic)
- Suspected appendicitis in a child (< age 18)[19-23] when ultrasound is inconclusive or cannot be completed due to body habitus or inability to cooperate **OR** when peritoneal signs are present (guarding, rebound) or other red flags
- For acute non-localized abdominal pain and fever[24]
- For suspected retroperitoneal fibrosis after labs and ultrasound have been completed and other etiologies for symptoms have been excluded (is a diagnosis of exclusion)[25,26]

For follow-up evaluation of known infection or inflammatory disease involving the abdomen and pelvis[14, 27]

- Complications of diverticulitis (diagnosed either clinically or by imaging) with severe abdominal/pelvic pain or severe tenderness or mass not responding to antibiotic treatment[14, 15]
- Pancreatitis by history (including pancreatic pseudocyst) with continued abdominal pain, early satiety, nausea, vomiting, or signs of infection greater than 4 weeks from initial presentation[27] when there is reason to suspect extensive disease extending into the pelvis (otherwise CT abdomen)
- Any known infection that is clinically suspected to have created an abscess in the abdomen and pelvis
- Any history of fistula that requires re-evaluation or is suspected to have recurred in the abdomen and pelvis
- Abnormal fluid collection seen on prior imaging that needs follow-up evaluation
- For known retroperitoneal fibrosis to determine extent of disease

Suspected or known acute pancreatitis[27] when have reason to suspect extension beyond abdomen, into pelvis

- Initial imaging for suspected acute pancreatitis due to epigastric pain with elevated amylase and/or lipase:
    - For mild presentation when symptom improvement is not seen after 72 hours of treatment and either:
        - ultrasound has been performed and did not show an abnormality such as gallstones, dilated bile duct
        - ultrasound suggests complications (such as fluid collection)
    - For severe presentation (such as fever, elevated WBC)
    - For a decline in clinical status and/or suspected complication
- Pancreatitis by history, (including pancreatic pseudocyst) with abdominal pain suspicious for worsening, or re-exacerbation
- Known necrotizing pancreatitis requiring follow-up

For evaluation of Inflammatory Bowel Disease (IBD) such as Crohn's or Ulcerative Colitis, (includes CT enterography (CTE), however, MRE should be considered for age < 35 to reduce radiation exposure)[28-33]

- For suspected inflammatory bowel disease after complete work up including physical exam, labs, and recent colonoscopy
- Known inflammatory bowel disease with recurrence or worsening signs/symptoms requiring re-evaluation or for monitoring therapy

For evaluation of hematuria when stone is NOT suspected (includes CT urography (CTU))[34-36]

- Documented by 3 or more red blood cells (RBC) per high-power field on urinalysis and not based on a dipstick test[34] **AND ONE** or more of the following:
    - Age > 60; **OR**
    - 30+ pack year smoking history
- > 25 RBC/hpf and infection has been excluded
- If not high risk (based on age, smoking history or > 25 RBC/hpf as above) need equivocal or abnormal renal ultrasound prior to CT
- Gross hematuria
    - UA must be negative for infection
    - UA can be negative for blood if hematuria is witnessed by patient or provider

NOTE: If a previous "routine" CT abdomen/pelvis has been done (with or with/without contrast), and a CTU is later requested, the previous CT must show a clear reason that additional delayed post-contrast images of the collecting system are needed.

For evaluation of known or suspected kidney or ureteral stone in a patient with acute flank pain

- **CT is indicated if one or more of the following is present:**
    - Atypical presentation (i.e., fever or WBC >15,000)
    - Inadequate analgesia
    - Abnormal or indeterminate ultrasound (with findings needing further evaluation with CT)
    - KUB has been provided and is highly suggestive of kidney or ureteral stone (US is the preferred initial imaging test but if provided, information on KUB can be used to make decision)
- **Ultrasound should be performed PRIOR to CT in the following situations (CT is needed only if US is inconclusive or has findings that need further imaging):**
    - Pediatric and pregnant patients (MRU preferred if further imaging indicated)
    - Typical presentation without signs/symptoms of infection in a patient < 65
- **CT is allowed for acute abdominal pain, in general, for patients >65**

Preoperative urinary stone planning

- CT is indicated when no imaging has been done in the last 30 days, or if passage or movement of stones will change management[37]

Postoperative urinary stone follow-up CT

- Symptomatic patients following:
    - Ureteroscopic extraction of an intact stone[38]
    - Ureteroscopy with lithotripsy/fragmentation of a radiolucent stone[38]
- Further evaluation of hydronephrosis seen on post-operative ultrasound (following ureteroscopy or ESWL)[38]

For evaluation of pyelonephritis in the following situations[39]

- When other imaging such as ultrasound is abnormal
- For a patient who remains febrile after 72 hours of treatment[40] or has deterioration in clinical status[40]
- With the following co-morbid conditions: personal history of stone disease or renal obstruction, recurrent pyelonephritis, vesicoureteral reflux, immune compromise, prior renal transplant with native kidneys in place, advanced age[39] or lack of response to initial therapy (based on culture)

For evaluation of Complicated Urinary tract Infection: (see above section for pyelonephritis)

- **Women:** UTI is considered complicated (and therefore imaging (ultrasound and/or CT) is warranted) in any of the following situations (may be done after resolution of infection),
    - Immunocompromised host
    - Persistence of bacteria or symptoms after culture specific treatment,
    - Rapid recurrence with same bacteria after treatment,
    - Multidrug resistant bacteria
    - When there is suspicion of renal calculi or obstruction[40, 41]
- **Men:** Any UTI is considered complicated due to high likelihood of anatomic abnormalities,[42] therefore imaging (ultrasound and/or CT) is warranted

Suspected small bowel obstruction when there is a strong clinical suspicion

- Crampy pain, vomiting, distention, high pitched or absent bowel sounds, prior history of abdominal surgery, or based on initial x-ray[43, 44]

Suspected colonic or mesenteric ischemia[45] CTA also appropriate[46]

For suspected small bowel bleeding when endoscopy and capsule endoscopy are inconclusive or negative[47]

For known or suspected abdominal aneurysm

- For known or suspected, **asymptomatic** abdominal aortic aneurysms, ultrasound should be done prior to advanced imaging. Only when the ultrasound is inconclusive, is advanced imaging with CT or MRI needed
    - Aneurysm size 2.5–3 cm, every 10 years
    - Aneurysm size 3.0–3.9 cm, every 3 years
    - Aneurysm size 4.0-4.9 cm, annually
    - Aneurysm size 5.0-5.4 cm, every 6 months
- For **symptomatic** known or suspected AAA (such as recent-onset abdominal pain or back pain, particularly in the presence of a pulsatile or epigastric mass, suspected dissection, or significant risk factors for AAA) CTA/MRA is appropriate and generally preferred over CT/MRI. (If contrast

is contraindicated or other clinical indications for abdomen and/or pelvic imaging are present, then CT/MR may be approved rather than CTA/MRA)

- If there is known complex anatomy, CTA/MRA may be needed.
- Suspected complications of known aneurysm as evidenced by signs/symptoms such as new onset of abdominal or pelvic pain (MRA/CTA preferred)
- Follow-up for post-endovascular repair (EVAR) or open repair of abdominal aortic aneurysm (AAA)[48] or abdominal extent of iliac artery aneurysms (CT preferred unless MRA/CTA is needed for procedural planning or to evaluate complex anatomy)
    - Routine, baseline study (post-op/intervention) is warranted within the first month after EVAR:
        - Repeat in 6 months if type II endoleak is seen (continue every 6 months x 24 months, then annually)
        - Repeat in 12 months if no endoleak or sac enlargement is seen
        - If neither endoleak nor AAA enlargement is seen on imaging one year after EVAR, CT is needed only if US is not feasible for annual surveillance (until year 5 as below)
    - Non-contrast CT of entire aorta (Abdomen and Pelvis) is needed every 5 years after open repair of AAA or EVAR
    - If symptomatic or imaging shows increasing, or new findings related to stent graft – more frequent imaging may be needed
    - For suspected complication such as: new-onset lower extremity claudication, ischemia, or reduction in ABI after aneurysm repair
- Evaluation of endovascular/interventional abdominal vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Evaluation of post-operative complications, e.g., pseudoaneurysms, related to surgical bypass grafts, vascular stents, and stent-grafts in the peritoneal cavity
    - Symptomatic/complications related to stent graft – more frequent imaging may be needed
- Follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

For evaluation of trauma[49]

- Suspected retroperitoneal hematoma or hemorrhage based on lab or physical findings
- Blunt injury with suspicion of multisystem trauma and hematuria
- Penetrating abdominal injury with suspicion of multisystem trauma with or without hematuria[49]

For evaluation of a suspected or known hernia

- Abdominal/pelvic pain suspected to be due to an occult, umbilical, Spigelian, or incisional hernia when physical exam and prior imaging is non-diagnostic or equivocal or if requested as a preoperative study
    - If inguinal hernia, approve CT Pelvis only (needs reason to include abdomen)
    - If umbilical hernia, approve CT Abdomen (needs reason to include pelvis)
- Hernia with suspected complications (e.g., bowel obstruction or strangulation, or non-reducible) based on symptoms (e.g., diarrhea, hematochezia, vomiting, severe pain, or guarding), physical exam (guarding, rebound) or prior imaging[50]
- For confirming the diagnosis of a recurrent hernia when ultrasound is negative or non-diagnostic
- Complex ventral hernia that is ≥ 10 cm for pre-operative planning[50]
- Deep intraabdominal/pelvic hernia is suspected (post-Roux-en-Y, obturator, sciatic or perineal) (does not require US first but this type of hernia needs to be specified in notes)[51]

Transplants

- Prior to solid organ transplantation
- For initial workup prior to Bone Marrow Transplantation (BMT) (along with CT Chest[52], CT Sinus and Brain MRI)[53]). Alternatively, PET might be sufficient to evaluate the abdomen and pelvis if indicated based on that malignancy (see PET Guideline)

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Other Indications for Abdomen/Pelvic CT Combo

- To locate a pheochromocytoma once there is clear biochemical evidence
- For one or more of the following B symptoms: fevers more than 101° F, drenching night sweats, and/or unexplained weight loss of more than 10% of body weight over 6 months with documented concern for lymphoma/malignancy [54]
- Clinically significant unintentional weight loss i.e., ≥5% of body weight in less than 12 months, with signs or symptoms suggestive of an abdominal cause (see Background)
- Ongoing unexplained clinically significant weight loss i.e., ≥5% of body weight in less than 12 months,[55-57] after initial workup (see Background) has been completed, no cause identified, and second visit documenting further decline in weight [58]

- For suspected paraneoplastic syndrome (including dermatomyositis) with high suspicion of abdominal malignancy and appropriate workup has been done (see Background for details)
- For acute unilateral (or asymmetric) lower extremity edema with negative or inconclusive doppler US
- For chronic unilateral (or asymmetric) lower extremity edema and suspicion of malignant cause[59, 60]
- For evaluation of suspected May-Thurner syndrome (CTV/MRV preferred)[61, 62]
- For elevation of carcinoembryonic antigen (CEA) in a patient with no cancer history after completing clinical workup (including organ-specific investigations, such as colonoscopy, gastroscopy, mammography, cystoscopy, ultrasound) that fails to demonstrate a reason and CEA is >10 ng/ml, or fails to drop below 5 ng/ml after 3-6 months intervals (see Background section)
- For fever of unknown origin (temperature of ≥101 degrees for a minimum of 3 weeks) after standard diagnostic tests are negative (see Background section)[63]
- For evaluation of thrombocytosis or thrombocytopenia when one or more of the following are present:
    - Any additional cytopenia (i.e., leukopenia, anemia)
    - LDH elevation
    - Splenomegaly on exam or imaging
    - Palpable lymphadenopathy
    - Bone marrow biopsy has been completed and concern for myeloproliferative disorder persists
    - Genetic mutation increasing risk of myeloproliferative disorder (such as JAK-2 mutation) on peripheral smear or bone marrow[64-67] biopsy
- For further evaluation of a new onset or non-reducible varicocele[68, 69]
- For suspected gestational trophoblastic disease when chest x-ray suggests distant disease (may include Chest CT)[70]
- For confirmed gestational trophoblastic disease when hcg fails to decline appropriately following surgery (may include Chest CT)[70]
- For patients with MEN-1, surveillance of abdomen and pelvis every 1-3 years (MRI preferred)
- Multiple Endocrine Neoplasia type 1 (MEN1) every 1-3 years (chest CT or MRI also approvable for this syndrome at same interval) [8, 71]
- Hereditary Paraganglioma syndromes every 2-3 years IF whole body MRI (unlisted MRI CPT 76498) is not available and CI to MRI exists. (WB MRI is the preferred study; if unable to do whole body MRI may approve abdomen MRI, skull base and neck MRI and chest CT). SDHB mutation may start at age 6, all other SDHx start at age 10
- For patients with FAP (Familial Adenomatous Polyposis, annual screening of abdomen and pelvis with MRI or CT for one or more of the following: personal history of desmoid tumor, family history of desmoid tumor or abdominal symptoms suggestive of desmoid tumor [72]

Pre-operative evaluation

- For abdominal/pelvic surgery or procedure

Post-operative/procedural evaluation

- Follow-up of known or suspected post-operative complication
- A follow-up study to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed.

Indication for combination studies for the initial pre-therapy staging of cancer, evaluation before starting treatment OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine, or Lumbar Spine, and MUGA

BACKGROUND

CT provides direct visualization of anatomic structures in the abdomen and pelvis and is a fast-imaging tool used to detect and characterize disease. Abdomen/pelvis imaging begins at the diaphragmatic dome through pubic symphysis. CT uses x-rays and multiple detectors to create cross-sectional images of the normal anatomy as well as demonstrate abnormal soft tissue densities, calcifications or fluid/gas patterns in the viscera or peritoneal space.

In general, ionizing radiation from CT should be avoided during pregnancy. Ultrasound is clearly a safer imaging option and is the first imaging test of choice; although, CT or MRI after equivocal ultrasound has been validated for diagnosis. Clinicians should exercise increased caution with CT imaging in children, pregnant women, and young adults due to the risks of exposure to ionizing radiation. Screening for pregnancy as part of a work-up is suggested to minimize the number of unexpected radiation exposures for women of childbearing age.

OVERVIEW

CT Imaging for renal colic and hematuria

More than 2 million emergency visits in the US are for suspected renal colic, and CT is performed in over 90% of patients diagnosed with kidney stones.[73] Evidence now supports ultrasound or no further imaging in specific clinical scenarios as renal colic is often self-limited. CT can guide therapy in a subset of patients who require intervention or who have other conditions that mimic renal colic (i.e., appendicitis). CT protocols include: "stone protocol" for detecting urinary tract calculi, "renal mass protocol" for characterizing known renal masses, and CT urography for evaluating hematuria. Non-contrast CT can be used for detecting most ureteral and renal stones but sometimes an intravenous contrast agent is needed to determine the relationship of the calculus to the opacified ureter.

CT imaging for recurrent urinary tract infections

Imaging in patients without risk factors and less than two infections a year on average and who respond promptly to therapy, is of low yield. Risk factors include but are not limited to: Infection with urea-splitting organism, previous pyelonephritis, history of calculi or obstruction, obstructive symptoms, elevated creatinine, severe diabetes, childhood UTI, neurogenic bladder dysfunction, history of GU surgery, suspected bladder diverticula or urethral, urinary incontinence, pelvic floor dysfunction, post void residual.[74]

CT Imaging for abdominal aortic aneurysms

NOTE: For known or suspected abdominal aneurysm, CT/MRI should not be approvable without a contraindication to CTAngiography /MRAngiography, such as severe renal dysfunction, contrast allergy, or another specific reason CT/MRI (rather than CTA/MRA) is preferred.

If a pulsatile abdominal mass is found in an asymptomatic patient, **abdominal ultrasonography** is an inexpensive and noninvasive technique for **initial evaluation**. For further examination, CT may be performed to better define the shape and extent of the aneurysm and the local anatomic relationships of the visceral and renal vessels. CT has high level of accuracy in sizing aneurysms; however, CTA and MRA are the gold standards for imaging. The majority of evidence regarding AAA surveillance using CT is based on CTA data and is primarily related to contrast bolus timing. Contrast-enhanced CT is well established in the literature and is capable of identifying aortic aneurysms, with many papers discussing incidental AAA identification.[75, 76] Risk of rupture in 6 years for an AAA < 4 cm is 1%. For a 4-5 cm AAA, the risk of rupture increases to 1-3% per year and becomes 6-11% per year for AAA 5-7 cm in cross sectional diameter. For any AAA >7 cm, the risk of rupture goes to 7% per year.

Initial evaluation of abdominal aortic aneurysm (AAA)

Initial evaluation of AAA is accurately made by ultrasound.

****Abdominal aneurysms and general guidelines for follow-up**

The normal diameter of the suprarenal abdominal aorta is 3.0 cm and that of the infrarenal is 2.0 cm. Aneurysmal dilatation of the infrarenal aorta is defined as diameter ≥ 3.0 cm or dilatation of the aorta ≥ 1.5x the normal diameter. Ultrasound can detect and size AAA, with the advantage of being relatively inexpensive, noninvasive, and not require iodinate contrast. The limitations are that overlying bowel gas can obscure findings and the technique is operator dependent. Ultrasound is used to screen for and to monitor aneurysms*. CT is used when US is inconclusive or insufficient. When there are suspected complications, complex anatomy and/or surgery is planned, CTA/MRA is preferred. Risk factors for AAA include smoking history, age, male gender, family history of AAA (first degree relative) and personal history of vascular disease. Risk factors for rupture include female gender, large initial aneurysm diameter, low FEV, current smoking history, elevated mean blood pressure and patients on immunosuppression after major organ transplantation. The Society of Vascular Surgery recommends elective repair of AAA ≥ 5.5 cm in patients at low or acceptable surgical risk. [1]

Ultrasound screening intervals*:

- Aneurysm size 2.5–3 cm, every 10 years
- Aneurysm size 3.0–3.9 cm, every 3 years
- Aneurysm size 4.0-4.9 cm, annually[77]
- Aneurysm size 5.0-5.4 cm, every 6 months

CT for Mesenteric Ischemia

CT of the abdomen and pelvis with intravenous (IV) contrast performed during the venous phase has been less well-studied compared with CTA in diagnosing mesenteric ischemia. CT with IV contrast can assess nonvascular findings, major arterial lesions, and mesenteric veins; however, the lack of arterial phase may lead to suboptimal evaluation of the mesenteric arteries compared to CTA.[46]

CT for elevation of CEA with no history of a previous CEA-producing tumor

CEA is not normally elevated after birth, but elevated CEA levels increases the chance of finding colon cancer from 1.3% to 4.6%. It is also a predictor of other diseases, including other cancers (e.g., mucinous adenocarcinomas of the endocervix and ovary, as well as keratinising squamous cell carcinoma of the cervix), diabetes, chronic lung, and liver disease.

Evaluation should begin with a thorough history, including smoking history, and clinical exam. Investigation would include repeat CEA, full blood count, iron, liver function and renal function tests, CA 125 levels, and calcitonin. If CEA <10ng/ml and clinical review is negative, repeat the clinical evaluation in 3 months and CEA for changes. If level falls, repeat at 6-month intervals until normal or 2 consecutive decreases. If CEA level remains above 5 ng/ml after 3-6-month intervals or exceeds 10ng/ml at any stage, consider CT imaging.[78]

CT and Fever of Unknown Origin

Initial work up prior to CT would include a comprehensive history, repeated physical exam, complete blood count with differential, three sets of blood cultures, chest x-ray, complete metabolic panel, urinalysis, ESR, ANA, RA, CMV IgM antibodies, virus detection in blood, heterophile antibody test, tuberculin test, and HIV antibody test.[63] Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for fever can Chest CT be approved. If CXR suggests a malignancy and/or source of fever, then Chest CT would be approved.

Suspected paraneoplastic syndromes with no established cancer diagnosis: laboratory evaluation and imaging

The laboratory evaluation for paraneoplastic syndrome is complex. If the appropriate lab test results are suspicious for malignancy, imaging is indicated.

For SIADH (hyponatremia + increased urine osmolality), there is a high association with small cell lung cancer, therefore imaging typically starts with chest CT. If other symptoms suggest a different diagnosis other than small cell lung cancer, different imaging studies may be reasonable.

For hypercalcemia (high serum calcium, low-normal PTH, high PTHrP) it is reasonable to start with bone imaging followed by a more directed evaluation such as mammogram, chest, abdomen, and pelvis imaging as appropriate.

For Cushing syndrome (hypokalemia, normal-high midnight serum ACTH **NOT** suppressed with dexamethasone) abdominal and chest imaging is reasonable. If dexamethasone suppression test **DOES** suppress ACTH, pituitary MRI is reasonable.

For hypoglycemia, labs drawn during a period of hypoglycemia (glucose < 55, typically a 72 hour fast) (insulin level, C-peptide, and IGF-2:IGF-1 ratio) should be done to evaluate for an insulinoma. An elevated insulin level, elevated C-peptide and/or normal IGF-2:IGF-1 ratio warrant CT or MRI abdomen to look for insulinoma. A low insulin, low C-peptide and/or elevated IGF-2:IGF-1 ratio warrant chest and abdominal imaging.

When a paraneoplastic neurologic syndrome is suspected, nuclear and cytoplasmic antibody panels are often ordered to further identify specific tumor types. Results are needed prior to imaging. Because these tests are highly specific, if an antibody highly associated with a specific cancer is positive, then further imaging for that cancer is reasonable. For example, anti-Hu has a high association with SCLC and chest CT would be reasonable. Anti-MA2 has a high association with testicular cancer and testicular ultrasound would be a reasonable next step.

Weight loss definitions and initial evaluation

Unintentional weight loss is considered clinically significant[55, 79] if the amount of weight lost over 12 months is ≥ 5%. Older age and higher percentage of weight loss correlates with higher likelihood of malignancy. A targeted evaluation is recommended when there are signs or symptoms suggestive of a specific source. For example, when there is clinically significant weight loss with abdominal pain that prompts an evaluation for an abdominal source of the weight loss; CXR and labs such as TSH would not be needed prior to abdominal imaging. Conversely a smoker with a cough and weight loss would not start with abdominal imaging, a chest x-ray (CXR) would be the first test to start with. When there is no suspected diagnosis, initial evaluation includes CXR, age-appropriate cancer screening (such as colonoscopy and mammography) and labs (including CBC, CMP, HbA1C, TSH, stool hemoccult, ESR/CRP, HIV, Hepatitis C). If this initial evaluation fails to identify a cause of weight loss, then the patient is monitored and if progressive weight loss is seen on subsequent visits/weights, then CT Abdomen/Pelvis is reasonable (MRI if there is a contraindication to CT such as contrast allergy or impaired renal function)[80]. Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for weight loss can Chest CT be approved. If CXR suggests a malignancy and/or source of weight loss, then Chest CT would be approved.

Combination request of Abdomen CT/Chest CT

A Chest CT will produce images to the level of L3. Documentation for combo is required.

Evaluation for appendicitis following clinical and laboratory evaluation

Sonography of the right upper quadrant and pelvis followed by graded compression and color Doppler sonography of the right lower quadrant was used by Gaitini and colleagues as the initial imaging study in 420 consecutive patients referred for emergency evaluation of acute appendicitis. This method correctly diagnosed acute appendicitis in 66 of 75 patients (88%) and excluded it correctly in 312 of 326 patients (96%). It was inconclusive in 19 patients (<5%). Sensitivity, specificity, positive predictive value, negative predictive value and accuracy were 74.2%, 97%, 88%, 93%, and 92%, respectively and comparable to CT.[81]

Appropriate and timely diagnosis of acute appendicitis is needed. Negative laparotomy rates can range from 16% to 47% when based on clinical and laboratory data alone, while perforation rate can reach 35% when surgery is delayed. Appropriate initial imaging can lower the negative laparotomy rate to 6-10%. Ultrasound has a higher non-diagnostic rate (4%) vs. 0.8% for MDCT. In a prospective study operator experience and patient BMI did not affect diagnostic accuracy.[81, 82]

Consider alternatives to CT imaging in patients with Crohn disease

In facilities where the technical and clinical expertise exists, MR enterography is emerging as the study of choice (replacing CT) for patients requiring frequent follow-up examinations to determine disease extent or progression. The technique also allows evaluation of extramucosal and extraluminal disease.

Consider the role of capsule endoscopy

Small bowel capsule endoscopy allows for direct visualization of the mucosa of the small intestine and has been found to be superior to barium studies, CTE and ileocolonscopy. However, the specificity has been questioned. There is a high negative predictive value of 96%. Also, it may identify a site for selected biopsy to establish a diagnosis.

Lab tests used in diagnosing IBD

Anti-glycan antibodies are more prevalent in CD than UC, but this test has a low sensitivity. Fecal calprotectin is a helpful test that can help differentiate IBD from irritable bowel syndrome as well as in assessment of disease activity, including response to therapy. Data supports the use of fecal calprotectin to predict relapse in CD. Those who relapsed in one year had significantly higher levels at baseline. Fecal lactoferrin and fecal PMN-elastase are also used for monitoring disease activity in Crohn's.[83]

Imaging of hernias

Most hernias are diagnosed clinically with imaging recommended for the diagnosis of occult hernias or in the evaluation of hernia complications, such as bowel obstruction or strangulation. To detect occult hernias, ultrasound is a first-line study with a sensitivity of 86% and specificity of 77%, compared to 80% sensitivity and 65% specificity for CT.[84] According to Miller, et al "Magnetic resonance imaging is generally not considered a first- or even second-line evaluation modality for hernias…."[85] Based on this analysis, MRI is recommended only when ultrasound and CT have been performed and fail to make a diagnosis.

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POLICY HISTORY

Date	Summary
March 2023	• Prostate cancer: updated guidance based on new NCCN criteria • IBD: clarified indications • Pancreas: specified guidance on pancreatitis • Pyelonephritis: clarified risk factors and indications • Aneurysm: specified guidance on initial imaging and screening intervals with emphasis on requiring ultrasound on initial imaging and indications for advanced imaging, specified guidance on post-repair imaging • Hernia: clarified hernia types and indicated studies • Transplant: added section • Other: specified guidance for weight loss, paraneoplastic syndrome, edema; added indications for thrombocytopenia, gestational trophoblastic disease, cancer predisposition syndromes • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Aligned sections across body imaging guidelines
March 2022	• Moved “New evidence of an unknown primary” from Evaluation of suspicious or known mass section to Initial staging of known cancer. • Clarified suspected diverticulitis • Added immunocompromised patients to suspected diverticulitis • Added “OR when peritoneal signs are present (guarding, rebound) or other red flags” to suspected appendicitis in a child • Clarified note regarding MRE for patients under 35 years of age • Removed “For CT Enterography (CTE) if a CT scan is inconclusive” from section on Suspected IBD • Clarified evaluation of hematuria • Clarified concern for lymphoma/malignancy with B symptoms and removed if CXR, labs, and Abd/Pelvis US have been completed

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **ABDOMEN MRI** **MRCP (Magnetic Resonance Cholangiopancreatography)** **MRE (Magnetic Resonance Enterography)** **MRU (Magnetic Resonance Urography)**	**Original Date: September 1997**
CPT Codes: 74181, 74182, 74183, S8037, +0698T	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_031	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE: A single authorization for CPT codes 74181, 74182, 74183, S8037 covers imaging of the biliary tree and its attached organs, i.e., the liver, gallbladder (GB), and pancreas. These same codes also cover MRI abdomen, Magnetic Resonance Enterography (MRE), and Magnetic Resonance Urography (MRU). Multiple authorizations are not typically required. When both Magnetic Resonance Cholangiopancreatography (MRCP) and MRI abdomen are requested, documentation requires a medical reason clearly indicating why both are needed, i.e., that meets guidelines for imaging of bowel, kidneys, or areas other than liver, pancreas, GB, and biliary tree as well.

Note: There are no MRI Abdomen/Pelvis combo (comparable to a CT Abdomen/Pelvis) such that if imaging of both the abdomen and pelvis are indicated, two separate exams (and authorization) are required (i.e., MRI Abdomen and MRI Pelvis)

INDICATIONS FOR ABDOMEN MRI

Evaluation of masses seen on ultrasound or CT for further evaluation of indeterminate or questionable findings:

- Initial imaging (see organ specific guidance below)
- One follow-up exam to ensure no suspicious change has occurred in a tumor in the pelvis. No further surveillance MR unless tumor(s) is/are specified as highly suspicious, or change was found on exam or last follow-up imaging.[1]
- For abnormal incidental pelvic lymph nodes when follow-up is recommended based on prior imaging (initial 3-month follow-up)[2]

Initial staging of known cancer

Follow-up of known cancer[3, 4]:

- In a patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
- With suspected abdominal metastasis based on a sign, symptom, (e.g., anorexia, early satiety, intestinal obstruction, night sweats, pelvic pain, weight loss, vaginal bleeding) or an abnormal lab value (alpha-fetoprotein, CEA, CA 19-9, p53 mutation)

For evaluation of an organ or abnormality seen on previous imaging

ADRENAL

- Indeterminate adrenal lesion seen on prior imaging
- For further evaluation of suspected adrenal tumors and/or endocrine disorders when there is clinical and laboratory evidence to suggest an adrenal source; see Background for specific laboratory testing that is needed based on suspected diagnosis
- Adrenal mass < 4 cm incidentally discovered with benign characteristics, one follow-up at 6 months then annually x 2 years (no further imaging if stable, see Background for details)
- If adrenal mass ≥ 4 cm and no diagnosis of cancer, can approve for either pre-operative planning **OR** if surgery is not done, can repeat imaging in 6-12 months
- Multiple Endocrine Neoplasia type 1 (MEN1) every 1-3 years (chest CT or MRI also approvable for this syndrome at same interval) [5, 6]
- Von Hippel Lindau (VHL) at least every other year starting at age 16, can also approve pelvis MRI (abdomen and pelvis ultrasound starting at age 8)[7]
- Hereditary Paraganglioma syndromes every 2-3 years **IF** whole body MRI (unlisted MRI CPT 76498) not available (WB MRI is the preferred study; if unable to do whole body MRI may approve abdomen MRI, pelvis MRI, skull base and neck MRI and chest CT. SDHB mutation may start at age 6, all other SDHx start at age 10.

LIVER

- Indeterminate liver lesion seen on prior imaging[8, 9]

- For evaluation of rising AFP (requires a ≥7 ng/mL increased in AFP per month) in patients at high risk for HCC (known cirrhosis and/or chronic hepatitis B[10], see Background for additional risk categories)
- For screening in patients at high risk for HCC (see above) every 6 months when prior ultrasound is insufficient to evaluate the liver due to steatosis/fatty liver or nodular liver
    - The finding of steatosis/fatty liver and/or nodular liver alone on an ultrasound report is insufficient for approval; the report must specify that those findings prevent adequate visualization of the liver by ultrasound
- For jaundice or abnormal liver function tests after equivocal or abnormal ultrasound[11]
- For surveillance of HCC (MRI or CT) in patients who have received liver-directed therapy, surgical resection, medical treatment, or transplant at one-month post treatment and then every 3 months for up to two years, then every 6 months[11, 12]
- For follow-up of suspected adenoma every 6-12 months
- For surveillance of patients with primary sclerosing cholangitis (also CA 19-9), every 6-12 months after the age of 20 (MRI and MRCP preferred over CT)[13]
- For follow-up of focal nodular hyperplasia (FNH), repeat imaging in 6-12 months to ensure stability. Additional imaging beyond that is needed only if atypical features or diagnosis is still in question[14].
- For annual elastography in chronic liver disease to stage hepatic fibrosis when transient elastography with ultrasound is insufficient
- In patients with Beckwith-Wiedemann syndrome and abnormal ultrasound or rising AFP[15]
- For evaluation of known liver metastases (Dedicated liver MRI with Eovist is not considered overlapping to a PET if there are known metastases in the liver (see Background))
- For evaluation and monitoring of Gaucher Disease at initial diagnosis and every 12 to 24 months[16]

Evaluation of iron overload in the following settings

- Initial evaluation of liver iron in Hemochromatosis diagnosed in lieu of liver biopsy[17]
- Annual evaluation for high-risk patients: transfusion-dependent thalassemia major, sickle cell disease, Gaucher Disease, and other congenital anemias[18] when ultrasound is insufficient

PANCREAS

- Pancreatic cyst on initial imaging, approve for initial characterization of lesion
- Follow-up imaging for pancreatic cyst as below[19]
    - For incidental and asymptomatic cysts <1.5 mm, **AND**:
        - Age < 65, image annually x 5 years, then every 2 years if stable
        - Age 65-79, imaging every 2 years x 5, then stop if stable
    - For cysts 1.5-1.9 cm with main pancreatic duct communication (MPD), image annually x 5 years, then every 2 years x 2, stop if stable at year 9.

- For cysts 2.0-2.5 cm with MPD communication, image every 6 months x 4, then annually x 2, then every 2 years x 3, stop if stable at year 10.
- For cysts 1.5-2.5 cm with **NO MPD** communication (or cannot be determined), image every 6 mos. x 4, then annually x 2 then every 2 years x 3, stop if stable at year 10.
- For cysts > 2.5 cm on surveillance (i.e., intervention has not been chosen), image every 6 mos. x 4, then annually x 2 years, then every 2 years x 3. Stop if stable at year 10.
- Patients > 80 years of age at presentation are imaged less frequently: image every 2 years x 2, stop if stable at year 4 (intervals are the same regardless of size if surveillance chosen)
- GROWTH or suspicious change on follow-up imaging scan may warrant more frequent surveillance

- For localization of a functional pancreatic tumor, see Background (endocrine) once diagnosis is confirmed (or highly suspected)
- Annual surveillance for individuals determined to have an increased lifetime risk of developing pancreatic cancer based on the following:
  - SKT11 variant (including Peutz-Jeghers): starting at age 30 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier)
  - CDKN2A variant: starting at age 40 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier)
  - Other variants and based on family history as detailed below: Starting at age 50 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier) for the following:
    - ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family as the identified variant **AND** known mutation in other pancreatic susceptibility genes (ATM, BRCA1, BRCA2, MLH1 (Lynch), MSH2, MSH6, EPCAM, PALB2, TP53)
    - ≥ 2 first-degree relatives with a history of pancreatic cancer from the same side of the family
    - ≥ 3 first- and/or second-degree relatives with a history of pancreatic cancer from the same side of the family
  - Hereditary Pancreatitis (such as PRSS1 variant) starting 20 years after onset of pancreatitis, or at age 40 years, whichever is earlier[6, 20-22]
  - Multiple Endocrine Neoplasia type 1 (MEN1) (to screen for PanNET (neuroendocrine tumor) every 1-3 years (chest CT or MRI also approvable for this syndrome at same interval)

RENAL

- For an indeterminate renal mass on other imaging[23]
- Active surveillance for indeterminate cystic renal mass, not a simple renal cyst[24] (See Bosniak criteria in Background section).

- Follow-up for solid renal masses under 3 cm at 6 and 12 months, then annually[25, 26]
- Surveillance for known angiomyolipoma (AML): annually if known tuberous sclerosis (TSC) or AML size is > 4 cm; every 2 years if AML size is 3-4 cm[27-29] (if AML < 3 cm, CT or MRI not needed unless pt has TSC)
- For surveillance of patients with the following known genetic mutations at the following intervals (MRI preferred due to lifetime radiation risk, CT can be approved if needed for surgical planning or CI to MRI):
    - BAP1-TPDS (BAP-1 tumor predisposition syndrome) every 2 years starting at age 30
    - BHDS (Birt-Hogg-Dube) every 3 years starting at age 20
    - HLRCC (hereditary leiomyomatosis and renal cell cancer) annually starting at age 8
    - HPRC (hereditary papillary renal carcinoma) every 1-2 years starting at age 30
    - PGL/PCC (hereditary paraganglioma/pheochromocytoma) every 4-6 years starting at age 12
    - TSC (tuberous sclerosis complex) without known AML every 3-5 years starting at age 12
        - TSC + known AML annually
- VHL (Von Hippel Lindau) every 2 years starting at age 15[30]
- MRU (may also approve MR pelvis for MR urography) when ultrasound is inconclusive, and CT (CTU) cannot be done or is inconclusive and MRI is recommended
- Polycystic Kidney Disease
    - Total kidney volume (TKV) is an important measure for assessing disease progression as it can determine prognosis through its ability to predict decline in renal function
        - Abdomen MRI is approvable prior to treatment (an ultrasound is not required prior to MR)
        - If MR is contraindicated or cannot be performed, Abdomen CT is approvable

SPLEEN

- Incidental findings of the spleen on ultrasound or CT that are indeterminate[31]
- For evaluation and monitoring of Gaucher Disease at initial diagnosis and every 12 to 24 months[16]

Suspected Hernia

- Occult, spigelian, incisional or epigastric hernia when physical exam and prior imaging (ultrasound **AND** CT) is non-diagnostic or equivocal[32-35] and limited to the abdomen
- Suspected incarceration or strangulation based on physical exam (guarding, rebound) or prior imaging (CT preferred)[36]

For evaluation of suspected infection or inflammatory disease when a contraindication to CT has been provided (includes MR urography (MRU) which includes Pelvis MRI when indicated)[8, 37-39]

- Persistent abdominal pain not explained by previous imaging/procedure
- Any known infection that is clinically suspected to have created an abscess in the abdomen

- Abnormal fluid collection limited to the abdomen seen on prior imaging that needs follow-up evaluation
- Suspected peritonitis (would typically need to include MRI Pelvis) when abdominal pain and tenderness to palpation are present, and **at LEAST one** of the following:
    - Rebound, guarding or rigid abdomen, **OR**
    - Severe tenderness to palpation over the entire abdomen
- Complications of diverticulitis (diagnosed either clinically or by imaging) with severe abdominal pain or severe tenderness or mass, not responding to antibiotic treatment)[40]

For evaluation of Inflammatory Bowel Disease (IBD) such as Crohn's or Ulcerative Colitis (includes MR enterography and can also approve Pelvis MRI/MRE)[12, 41-45]

- For suspected inflammatory bowel disease after complete work up including physical exam, labs, and recent colonoscopy
- Known inflammatory bowel disease with recurrence or worsening signs/symptoms requiring re-evaluation or for monitoring therapy

Other indications for abdominal MRI (and pelvis where appropriate)

- For history of fistula in the abdomen that requires re-evaluation or is suspected to have recurred
- Prior to liver transplantation (MRCP also approvable), may repeat studies immediately prior to transplantation with known HCC, PSC, or cholangiocarcinoma
- Prior to solid organ transplantation

Other indications for abdominal MRI (and pelvis where appropriate) when CT is inconclusive or cannot be completed

- Persistent abdominal/pelvic pain not explained by previous imaging
- To locate a pheochromocytoma once there is clear biochemical evidence (See Background)
- For any B symptoms of fevers more than 101° F, drenching night sweats, or unexplained weight loss of more than 10% of body weight over 6 months with documented concern for lymphoma/malignancy when CT is inconclusive or cannot be completed (can also approve pelvis MRI, when appropriate)
- Clinically significant unintentional weight loss i.e., ≥5% of body weight in less than 12 months (or ≥2% in one month), with signs or symptoms suggestive of an abdominal cause (see Background)
- Ongoing unexplained clinically significant weight loss i.e., ≥5% of body weight in less than 12 months (or ≥ 2% in one month)[46-48] after initial workup (see Background) has been completed, no cause identified, and second visit documenting further decline in weight[49]
- For fever of unknown origin (temperature of ≥ 101 degrees for a minimum of 3 weeks) after standard diagnostic tests are negative (see Background)[50]

- For suspected or known retroperitoneal fibrosis after complete workup and ultrasound to determine extent of disease[51]
- For suspected paraneoplastic syndrome (including dermatomyositis) with high suspicion of abdominal malignancy and appropriate workup has been done (see Background for details)
- Prior to Bone Marrow Transplant (BMT) (along with CT Chest[52], CT Sinus and Brain MRI)[53]). Alternatively, PET might be sufficient to evaluate the abdomen and pelvis if indicated based on that malignancy (see PET Guideline)For diffuse, unexplained lower extremity edema with negative or inconclusive ultrasound[54]
- For suspected May-Thurner syndrome (CTV/MRV preferred)[55, 56]
- For further evaluation of a new onset or non-reducible varicocele[57]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine, or Lumbar Spine

INDICATIONS FOR MRCP[58-60]

- To confirm choledocholithiasis in patients in the acute setting after ultrasound has been completed[60-62]
- Suspected acute pancreatitis with atypical signs and symptoms, including equivocal amylase and lipase and diagnosis other than pancreatitis may be possible. (MRCP and CT/MRI may be ordered simultaneously in this setting and may be approved)[60, 63]
- Pancreatitis by history (greater than 4 weeks), (including pancreatic pseudocyst) with continued abdominal pain suspicious for worsening, or re-exacerbation. (MRCP and CT/MRI may be ordered simultaneously in this setting and may be approved)[60, 63]
- Evaluation of suspected congenital anomaly of the pancreaticobiliary tract, e.g., aberrant ducts, pancreas divisum or related complications[64]
- For confirmation of choledochal cyst after ultrasound has been done[65]
- For long-term postoperative surveillance for patients with history of choledochal cyst

- For post-surgical biliary anatomy and complications when ERCP is not possible or contraindicated
- For the assessment of benign or malignant biliary strictures
- Evaluation of persistent symptoms when abnormalities are identified on other imaging (e.g., ultrasound, CT, or MRI)
- Evaluation of abnormality related to the pancreatic or biliary tree based on symptoms or laboratory findings and initial imaging has been performed or is contraindicated (e.g., renal failure prevents contrast CT or body habitus limits US)
- Evaluation of pancreatobiliary disease in pregnant patients after ultrasound has been done
- Prior to liver transplantation (Abdomen MRI or Abdomen CT also approvable), may repeat studies immediately prior to transplantation with known HCC, PSC, or cholangiocarcinoma

INDICATIONS RELEVANT TO ABDOMEN MRI OR MRCP

Pre-operative evaluation

- For abdominal surgery or procedure

Post-operative/procedural evaluation

- Follow-up of known or suspected post-operative complication involving only the abdomen
- A follow-up study to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed

If both Abdomen and Pelvis MRI are indicated and the Pelvis MRI has already been approved, then the Abdomen MRI may be approved.

BACKGROUND

Abdominal Magnetic Resonance Imaging (MRI) is a proven and useful tool for the diagnosis, evaluation, assessment of severity, and follow-up of diseases of the abdomen and avoids exposing the patient to ionizing radiation. MRI may be the best imaging procedure for patients with allergy to radiographic contrast material or renal failure. It may also be the procedure of choice for suspected lesions that require a technique to detect subtle soft tissue contrast and provide a three-dimensional depiction of a lesion. Abdominal MRI studies are usually targeted for further evaluation of indeterminate or questionable findings, identified on more standard imaging exams such as ultrasound (US) and CT.

Magnetic Resonance Enterography is an excellent study for assessing submucosal pathology in inflammatory bowel disease. It generates highly reproducible images of the large and small bowel with

excellent sensitivity and specificity. It can determine the presence and extent of transmural inflammation, fibrotic disease, and other intra-abdominal complications. It is also useful in assessment of bowel obstruction, abscess formation, tethering and fistula and is less dependent on bowel distention than CT enterography.[12] MRE is similar overall to CTE and useful (reduce radiation burden) when multiple studies are likely.[42]

Magnetic Resonance Cholangiopancreatography (MRCP) is a non-invasive radiologic technique for imaging the biliary and pancreatic ducts in the clinical setting of cholestatic liver function tests, right upper quadrant pain, recurrent pancreatitis, and assessing postoperative complications. MRCP is reliable for the diagnosis of pancreatic ductal abnormalities, e.g., pancreas divisum. It is also used to diagnose bile duct stones and assess the level of biliary obstruction. MRCP is especially useful as an alternative to ERCP (Endoscopic retrograde cholangiopancreatography), when a noninvasive exam is desired or when there is a very small likelihood that the patient will need therapeutic intervention afforded by ERCP. MRCP is unwarranted in patients with known pathology requiring ERCP-mediated intervention. Due to the variable accuracy of ultrasound in detecting choledocholithiasis, preoperative MRCP prior to cholecystectomy has been advocated particularly in the setting of acute cholecystitis, near normal common bile duct diameter (where ultrasound is less accurate) and elevated liver functions, especially alanine amino transaminase (ALT).[66] Secretin-enhanced MR Cholangiopancreatography has been recently developed to improve the diagnostic quality of MRCP images.[67]

In diagnosing acute pancreatitis, MRI and MRCP are not as practical as CT. The latter can be performed more quickly and provide better images due to less motion artifact (if patient cannot cooperate with instructions for MRI) in acutely ill patients.[60] In selected patients, however, such as those who cannot receive iodinated contrast for CT, MRI/MRCP may be considered or used in a complementary fashion to CT. Complications of chronic pancreatitis using MRCP are well-imaged in cooperative patients.

Cross-sectional imaging (liver ultrasound with Doppler, CT, or MRI) should be completed no more than a month prior to the transjugular intrahepatic portosystemic shunt (TIPS) to assess for vascular patency and look for hepatic masses or other problems that could complicate the procedure.

Post procedure, an ultrasound of the liver is performed a day after to assess shunt patency. Hepatic encephalopathy (HE) is the most common complication and usually occurs 2-3 weeks after insertion of TIPS. Unique complications may include intravascular hemolysis and infection of the shunt. Other complications, which may require cross-sectional imaging, can include capsule puncture, intraperitoneal bleed, hepatic infarction, fistula, hematobilia, thrombosis of stent, occlusion, or stent migration.

Follow-up and maintenance imaging, if complications are suspected, include Doppler ultrasound to assess shunt velocity. If asymptomatic, a sonogram is performed at 4 weeks post placement, then

every 6 months to a year. The gold standard for shunt patency is portal venography, usually reserved if concern for shunt occlusion.

OVERVIEW

MRI of the liver – The liver is a common site of metastatic spread. Patients with a history of known or suspected malignancy, especially tumors from the colon, lung, pancreas, and stomach, are at risk for developing hepatocellular carcinoma. Patients with chronic liver disease are also at risk for developing liver cancer and undergo periodic liver screening for focal liver lesion detection, usually with ultrasonography (US). Liver-specific contrast agents (gadobenate dimeglumine (Gd-BOPTA, MultiHance) and gadoxetate disodium (Eovist) are taken up by functionally intact hepatocytes, allowing increased visualization of both tumors and liver metastases. As metastatic liver lesions do not take up these contrast agents, a dedicated liver MRI can help identify tumors as it allows more contrast differentiation between the tumor and normal liver tissue. In patients undergoing PET scans for active malignancies and there are either known liver metastases in need of restaging **OR** indeterminate liver lesions on other imaging (such as PET or CT), a dedicated liver MRI is considered complimentary **NOT** overlapping and can be approved in addition to PET if the patient otherwise meets criteria for PET approval (see PET Guideline for further guidance).

Screening for Hepatocellular carcinoma (HCC) – AASLD (American Association for the Study of Liver Diseases) recommends screening for HCC with ultrasound every 6 months for patients with hepatitis C and B.[37] Advanced imaging is recommended when the AFP is rising, regardless of ultrasound results. The main risk factors for HCC are cirrhosis and Hepatitis B. Additional populations for which there is a benefit to surveillance for HCC include: Asian males Hepatitis B carriers ≥ 40 y, Asian female Hepatitis B carriers ≥50 y, Hepatitis B carriers with + family history of HCC and African and/or North American blacks with hepatitis B.[10, 68]

MRI or MRCP for surveillance of cholangiocarcinoma in patients with PSC, other risk factors – Cholangiocarcinoma, a cancer with an increase in incidence globally, is very aggressive with 95% of patients dying within 5 years. Because of the superior sensitivity of MRI compared with ultrasound to detect cholangiocarcinoma, it is preferred for imaging surveillance. In a large study of PSC patients, regular surveillance was associated with a higher 5-year survival.[13]

The strongest risk factors for both intrahepatic (iCCA) and extrahepatic (eCCA) cholangiocarcinoma are choledochal cysts; cirrhosis is a stronger risk factor for iCCA (i.e., iCCA>eCCA); and choledocholithiasis is a stronger risk factor for eCCA (i.e., eCCA>iCCA).[69]

Adrenal incidentaloma – Adrenal masses detected on imaging for another reason (i.e., incidental finding) are becoming increasingly common. If there is no prior personal history of malignancy and no features concerning for malignancy on imaging, these patients should undergo hormonal (functional) evaluation and periodic imaging. If the mass is < 4 cm on imaging and has benign characteristic (homogenous, regular borders, HU < 10) a hormonal evaluation should be done. If that evaluation is negative, adrenal protocol/follow-up imaging can be performed at 6 months then annually for 1-2

years.[70] Repeat functional studies are recommended annually (or sooner if symptoms) for 5 years. If the mass exhibits growth or becomes hormonally active, then surgery is recommended.[71, 72] Additional imaging beyond 2 years is reasonable if there has been growth and the mass is not resected; if stable, no further imaging is warranted unless the annual hormonal evaluation is positive. Masses ≥ 4cm generally are resected after hormonal evaluation is completed, additional imaging can be approved when needed for further characterization for surgical planning. If the decision is made not to resect the mass, then FU imaging in 6-12 months is reasonable.

Biochemically active tumors (adrenal and neuroendocrine): Laboratory evaluation prior to imaging - When neuroendocrine and hormonally active tumors are suspected, the required laboratory evaluation prior to advanced imaging is dependent on the tumor type that is suspected. The following list describes suspected syndrome/tumor and typical laboratory evaluation in parenthesis:

GI Carcinoid (24-hour urine or plasma 5-HIAA), Lung/Thymus Carcinoid (24-hour urine or plasma 5-HIAA **AND** one of the following: overnight dexamethasone suppression test, 2-3 midnight salivary cortisols, 24-hour urinary free cortisol), PPoma (serum pancreatic polypeptide), Insulinoma (serum insulin, pro-insulin and C-peptide all drawn during a period of hypoglycemia (i.e. 72 hour fast)), VIPoma (serum VIP), glucagonoma (serum glucagon), gastrinoma (serum gastrin), somatostatinoma (serum somatostatin), pheochromocytoma/paraganglioma (plasma free or 24-hour urine fractionated metanephrines and normetanephrines +/- serum or urine catecholamines), pituitary tumor (serum IGF-1, prolactin, LH/FSH, alpha subunits, TSH and **ONE** of the following: overnight dexamethasone suppression test, 2-3 midnight salivary cortisols, 24-hour urinary free cortisol), primary hyperaldosteronism (suppressed renin/renin activity in association with elevated plasma aldosterone (>10 ng/dL) and confirmatory testing if positive), adrenocortical carcinoma (testosterone, DHEA-S **AND** complete evaluation for hypercortisolemia or primary aldosteronism)[72]

If Cushing's (hypercortisolemia) is suspected, typical labs include a plasma ACTH **AND** one or more of the following: overnight dexamethasone suppression test, 2-3 midnight salivary cortisols, **OR** 24-hour urinary free cortisol. The results of the suppression test then indicate whether brain imaging is needed (pituitary source) **OR** chest and abdominal imaging is needed (CXR + Adrenal CT/MRI). ACTH > 20 after suppression > 20 is suggestive of Cushing's Disease and Pituitary MRI +/- CXR is indicated. ACTH after suppression < 5 is suggestive of Cushing's Syndrome and CXR + Adrenal CT/MRI is indicated[73]. If indeterminate, a CRH or desmopressin test is then done. If there is no ACTH suppression with CRH/desmopressin, then adrenal imaging is indicated.[74]

Genetic syndromes and adrenal tumors – Adrenal cortical carcinoma (ACC) diagnosed during childhood is known to be commonly associated with hereditary syndromes, including Beckwith-Wiedemann (BWS) and Li-Fraumeni syndrome (LFS). In adults, ACC may be associated with Multiple Endocrine Neoplasia 1 (MEN1), familial adenomatous polyposis coli and neurofibromatosis type 1 (NF1); however, there are currently no surveillance imaging recommendations.[75]

High risk characteristics for mucinous pancreatic cysts include all of the following: Symptoms, Jaundice secondary to the cyst, acute pancreatitis secondary to the cyst, elevated serum CA 19-9 and no benign cause present, an enhancing mural nodule or solid component within the cyst or pancreas, main pancreatic duct of > 5mm, change in duct caliber with upstream atrophy, size over 3 cm, high grade dysplasia or cancer on cytology. These patients should undergo EUS + -FNA or be referred to a multidisciplinary group for further recommendations.[76]

MRI and elevated Liver Function Tests – For elevated bilirubin or serum transaminases with or without bilirubin elevation, US is the initial recommended test to assess for duct dilatation which might lead to ERCP or MRCP, vs other causes which might necessitate further lab testing or liver biopsy.[77]

MRI of the kidney – MRI in renal imaging has been used to differentiate benign lesions versus malignant lesions in patients unable to undergo CT scanning with contrast media or in cases where the CT findings were questionable. Initial evaluation of renal lesions is often undertaken with ultrasound. MRI can have additional diagnostic value in the evaluation of lesions with minimal amounts of fat or with intracellular fat. MRI may have a higher accuracy than CT in the evaluation of early lymph node spread. Although MRI of the kidney has not yet found broad clinical application, it may have an increasing role in the management of patients with renal disease.

Recommendations for follow up of a complex cystic renal mass are made using Bosniak criteria[78]:

- Bosniak I (water density 0-20 HU); no further follow-up
- Bosniak II (one or a few thin septations, small or fine calcifications, hyperdense cysts up to 3 cm); no further follow-up
- Bosniak IIF felt to be benign but too complex to be diagnosed with certainty; image at 6 and 12 months, then annually for 5 years if no progression
- Bosniak III thick-walled cystic lesions with wall or septal enhancement; resection favored vs conservative management and RFA in select cases[24]
- Bosniak IV malignant cystic renal mass with enhancing soft tissue components; resection favored; malignant until proven otherwise

MRI of the spleen – Among some radiologists, the spleen is considered a 'forgotten organ' although it is included and demonstrated on every abdominal CT and MRI. Malignant tumors of the spleen are rare; malignant lymphomas are the most common and are usually a manifestation of generalized lymphoma. Splenic metastases are predominantly hypointense on T1-weighted images and hyperintense on T2-weighted images, and MRI is used for the detection of necrotic or hemorrhagic metastases.

MRI for the evaluation of vascular abnormalities such as renal artery stenosis and celiac/superior mesenteric artery stenosis (in chronic mesenteric ischemia) – Doppler Ultrasound, MRA, or CTA should be considered as the preferred imaging modalities.

Imaging of hernias – Most hernias are diagnosed clinically with imaging recommended for the diagnosis of occult hernias or in the evaluation of hernia complications, such as bowel obstruction or strangulation. To detect occult hernias, ultrasound is a first-line study with a sensitivity of 86% and specificity of 77%, compared to 80% sensitivity and 65% specificity for CT.[35] According to Miller, et al "Magnetic resonance imaging is generally not considered a first- or even second-line evaluation modality for hernias…."[34] Based on this analysis, MRI is recommended only when ultrasound and CT have been performed and fail to make a diagnosis.

Fever of Unknown Origin

Initial work up prior to CT would include a comprehensive history, repeated physical exam, complete blood count with differential, three sets of blood cultures, chest x-ray, complete metabolic panel, urinalysis, ESR, ANA, RA, CMV IgM antibodies, virus detection in blood, heterophile antibody test, tuberculin test, and HIV antibody test.[65] Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for fever can Chest CT be approved. If CXR suggests a malignancy and/or source of fever, then Chest CT would be approved.

Suspected paraneoplastic syndromes with no established cancer diagnosis: laboratory evaluation and imaging

The laboratory evaluation for paraneoplastic syndrome is complex. If the appropriate lab test results are suspicious for malignancy, imaging is indicated.
For SIADH (hyponatremia + increased urine osmolality), there is a high association with small cell lung cancer, therefore imaging typically starts with chest CT. If other symptoms suggest a different diagnosis other than small cell lung cancer, different imaging studies may be reasonable.

For hypercalcemia (high serum calcium, low-normal PTH, high PTHrP) it is reasonable to start with bone imaging followed by a more directed evaluation such as mammogram, chest, abdomen, and pelvis imaging as appropriate.

For Cushing syndrome (hypokalemia, normal-high midnight serum ACTH **NOT** suppressed with dexamethasone) abdominal and chest imaging is reasonable. If dexamethasone suppression test **DOES** suppress ACTH, pituitary MRI is reasonable.

For hypoglycemia, labs drawn during a period of hypoglycemia (glucose < 55, typically a 72 hour fast) (insulin level, C-peptide, and IGF-2:IGF-1 ratio) should be done to evaluate for an insulinoma. An elevated insulin level, elevated C-peptide and/or normal IGF-2:IGF-1 ratio warrant CT or MRI abdomen to look for insulinoma. A low insulin, low C-peptide and/or elevated IGF-2:IGF-1 ratio warrant chest and abdominal imaging.

When a paraneoplastic neurologic syndrome is suspected, nuclear and cytoplasmic antibody panels are often ordered to further identify specific tumor types. Results are needed prior to imaging. Because these tests are highly specific, if an antibody highly associated with a specific cancer is positive, then further imaging for that cancer is reasonable. For example, anti-Hu has a high association with SCLC

and chest CT would be reasonable. Anti-MA2 has a high association with testicular cancer and testicular ultrasound would be a reasonable next step.

Weight loss definitions and initial evaluation – Unintentional weight loss is considered clinically significant if the amount of weight lost over 12 months is ≥ 5%. Older age and higher percentage of weight loss correlates with higher likelihood of malignancy. A targeted evaluation is recommended when there are signs or symptoms suggestive of a specific source. For example, when there is clinically significant weight loss with abdominal pain that prompts an evaluation for an abdominal source of the weight loss; CXR and labs such as TSH would not be needed prior to abdominal imaging. Conversely a smoker with a cough and weight loss would not start with abdominal imaging, a chest x-ray (CXR) would be the first test to start with. When there is no suspected diagnosis, initial evaluation includes CXR, age-appropriate cancer screening (such as colonoscopy and mammography) and labs (including CBC, CMP, HbA1C, TSH, stool hemoccult, ESR/CRP, HIV, Hepatitis C). If this initial evaluation fails to identify a cause of weight loss, then the patient is monitored and if progressive weight loss is seen on subsequent visits/weights, then CT Abdomen/Pelvis is reasonable (MRI if there is a contraindication to CT such as contrast allergy or impaired renal function). Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for weight loss can Chest CT be approved. If CXR suggests a malignancy and/or source of weight loss, then Chest CT would be approved.

Ultrasound – Ultrasound is the initial imaging technique used for screening suspected biliary or pancreatic disease, but it has limited ability to characterize abnormalities in the biliary and pancreatic ducts.

Endoscopic retrograde cholangiopancreatography (ERCP) – ERCP can combine diagnosis with therapeutic intervention, e.g., removal of stones, but it is an invasive procedure that carries significant risk of complications, e.g., pancreatitis. ERCP is also technically challenging in patients with post-surgical biliary and/or surgical anastomoses.

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POLICY HISTORY

Date	Summary
May 2023	• Adrenal: additional guidance provided for imaging intervals and background given for functional tumors • Liver: clarified guidance for HCC surveillance imaging, follow up of specific conditions such as hepatic steatosis and focal nodular hyperplasia • IBD: clarified indications • Pancreas: updated pancreatic cystic lesion guidance, specified guidance for increased lifetime risk for pancreatic cancer and pancreatitis • Renal: specified guidance for increased lifetime risk of renal cancer • Aneurysm: specified guidance on initial imaging and screening intervals with emphasis on requiring ultrasound on initial imaging and indications for advanced imaging, specified guidance on post-repair imaging • Transplant: added section • Other: specified guidance for weight loss, paraneoplastic syndrome, edema; added indications for cancer predisposition syndromes • Aligned sections across body imaging guidelines • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
March 2022	• Clarified coding note regarding MRE, MRU, MRCP, and MRI • Added Initial staging of known cancer • Under evaluation of suspicious known mass/tumor, added one follow-up surveillance MR to ensure to suspicious change occurring in tumor in pelvis with no further surveillance MR unless tumor(s) is/are highly suspicious or change was found on last exam or last follow-up imaging • Follow-up of known cancer o Clarified surveillance imaging per NCCN recommendations o Added For abnormal incidental abdominal lymph nodes with follow-up is recommended based on prior imaging (initial 3-month follow-up) • Clarified elastography in chronic liver disease to stage hepatic fibrosis • Added Gaucher disease to Liver and Spleen sections • Added Polycystic Kidney Disease to Renal section • Clarified suspected incarceration or strangulation based on physical exam in Suspected Hernia section • In Other indications for abdominal MRI, changed wording (replaced ‘and’ with ‘or’ and deleted “if CXR labs and an ultrasound of the abdomen and pelvis have been completed”) to state “For B symptoms of fevers more than

	101 F, drenching night sweats, or unexplained weight loss of more than 10% of body weight over 6 months”

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **ABDOMEN MRA/MRV (Angiography)**	**Original Date: September 1997**
CPT Codes: 74185	**Last Revised Date: March 2023**
Guideline Number: NIA_CG_034-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE:

Abdomen/Pelvis Magnetic Resonance Angiography (MRA) with Lower Extremity MRA Runoff Requests: Two authorization requests are required, one Abdomen MRA, CPT code 74185 and one for Lower Extremity MRA, CPT code 73725 (a separate Pelvic MRA request is not required). This will provide imaging of the abdomen, pelvis, and both legs.

INDICATIONS FOR ABDOMEN MR ANGIOGRAPHY/MR VENOGRAPHY (MRA/MRV)

Arterial Disease

For evaluation of known or suspected abdominal vascular disease
Abdominal Aortic Aneurysm (AAA) (also approve MRA Pelvis):

- For **asymptomatic** known or suspected abdominal aortic aneurysms, **ultrasound** should be done prior to advanced imaging. Only when the ultrasound is inconclusive, is advanced imaging with CT or MRI needed
- For **symptomatic** known or suspected AAA (such as recent-onset abdominal pain or back pain, particularly in the presence of a pulsatile or epigastric mass, suspected dissection or significant risk factors for AAA) CTA/MRA is appropriate and generally preferred over CT/MRI. (If contrast

is contraindicated or other clinical indications for abdomen and/or pelvic imaging are present, then CT/MR may be approved rather than CTA/MRA)
- If there is known complex anatomy, CTA/MRA may be needed.

Other vascular abnormalities seen on prior imaging studies:

- Initial evaluation of inconclusive vascular findings on prior imaging
- Follow-up of known visceral vascular conditions (such as aneurysm, dissection, compression syndromes, arteriovenous malformations (AVMs), fistulas, intramural hematoma, and vasculitis) (pelvis may also be approved if needed based on location of abnormality)
    - Hepatic vascular abnormalities after ultrasound has been performed to clarify or further evaluate findings
- For assessment in patients with spontaneous coronary artery dissection (SCAD), can be done at time of coronary angiography (also approve CTA pelvis)[1]
- Vascular invasion or displacement by tumor (conventional CT or MRI also appropriate)[2]
- For known large vessel diseases (inferior vena cava, superior/inferior mesenteric, celiac, splenic or renal arteries/veins), e.g., aneurysm/dissection (non-aortic disease), arteriovenous malformations (AVMs), and fistulas, intramural hematoma, and vasculitis[3-5]
    - Surveillance may be done with ultrasound at intervals similar to AAA, however, CTA/MRA rather than CT/MRI may be needed for non-aortic disease when ultrasound is inconclusive[6]

Vascular ischemia or hemorrhage:

- To determine the vascular source of retroperitoneal hematoma or hemorrhage when CT is insufficient to determine the source and CTA is contraindicated (CT rather than MRA/CTA is the modality of choice for diagnosing hemorrhage)[5]
- For evaluation of known or suspected mesenteric ischemia/ischemic colitis when CTA is contraindicated (can approve MRA abdomen and pelvis)[7]

For patients at increased risk for vascular abnormalities (CTA or MRA):

- For patients with fibromuscular dysplasia (FMD), a one-time vascular study of the abdomen and pelvis[8]
- For patients with vascular Ehlers-Danlos syndrome or Marfan syndrome, a one-time study of the abdomen and pelvis
- For Loeys-Dietz, imaging at diagnosis and then every two years, more frequently if abnormalities are found (Imaging may include head, neck, chest, abdomen and pelvis)[9, 10]

For evaluation of known or suspected renal artery stenosis or resistant hypertension in the setting of normal renal function (with impaired renal function, eGFR <30, use US with Doppler) unrelated to recent medication[11] demonstrated by any of the following[12, 13]:

- Unsuccessful control after treatment with 3 or more (>2) anti-hypertensive medication at optimal dosing
- Acute elevation of creatinine after initiation of an angiotensin converting enzyme inhibitor (ACE inhibitor) or angiotensin receptor blocker (ARB)
- Asymmetric kidney size noted on ultrasound
- Onset of hypertension in a person younger than age 30 without any other risk factors or family history of hypertension
- Significant hypertension (diastolic blood pressure > 110 mm Hg) in a young adult (i.e., younger than 35 years) suggestive of fibromuscular dysplasia
- Diagnosis of a syndrome with a higher risk of vascular disease, such as neurofibromatosis, tuberous sclerosis, and Williams' syndrome
- New onset of hypertension after age 50
- Acute rise in blood pressure in a person with previously stable blood pressures
- Flash pulmonary edema without identifiable causes
- Malignant hypertension
- Bruit heard over renal artery and hypertension
- Abnormal/inconclusive renal doppler ultrasound

Venous Disease

- Suspected renal vein thrombosis in patient with known renal mass or from other causes[14]
- Venous thrombosis if previous studies have not resulted in a clear diagnosis (add pelvis MRA/MRV when appropriate)
- For known/suspected May-Thurner syndrome (iliac vein compression syndrome include pelvic MRV)[4, 15]
- Vascular invasion or displacement by tumor (conventional CT or MRI also appropriate)[2]
- For evaluation of portal venous system (hepatic portal system) after doppler ultrasound has been performed
- For evaluation of suspected pelvic vascular disease or pelvic congestive syndrome (ordered in addition to Pelvis MRA) when findings on ultrasound are indeterminate (MR or CT venography may be used as the initial study for evaluating pelvic thrombosis or thrombophlebitis)
- For unexplained lower extremity edema (typically unilateral or asymmetric) with negative or inconclusive ultrasound[16]
- In pregnant women with suspected deep venous thrombosis (DVT) (vs serial compression ultrasound) (include pelvis MRV for iliac veins)[17]

Pre-operative evaluation

- For evaluation of transjugular intrahepatic portosystemic shunt (TIPS) when Doppler ultrasound indicates suspected complications
- Evaluation prior to interventional vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia

- Evaluation prior to endovascular aneurysm repair (EVAR)
- Imaging of the deep inferior epigastric arteries for surgical planning (breast reconstruction surgery), include pelvic MRA [18]
- Prior to solid organ transplantation when vascular anatomy is needed
- For surgical planning for UPJ (ureteropelvic junction) obstruction to look for a lower pole crossing vessel
- Planning prior Y90 radiation treatment for liver cancer in order to evaluate anatomic variation/shunts/determine best catheter placement/see if coil(s) needed[19]

Post-operative or post-procedural evaluation

- Follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested
- Evaluation of endovascular/interventional abdominal vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Evaluation of post-operative complications, e.g., pseudoaneurysms, related to surgical bypass grafts, vascular stents, and stent-grafts in the peritoneal cavity
- Follow-up for post-endovascular repair (EVAR) or open repair of abdominal aortic aneurysm (AAA)[20] or abdominal extent of iliac artery aneurysms (CT preferred unless MRA/CTA is needed for procedural planning or to evaluate complex anatomy)
    - Routine, baseline study (post-op/intervention) is warranted within the first month after EVAR:
        - Repeat in 6 months if type II endoleak is seen (continue every 6 months x 24 months, then annually)
        - Repeat in 12 months if no endoleak or sac enlargement is seen
        - If neither endoleak nor AAA enlargement is seen on imaging one year after EVAR, CT is needed only if US is not feasible for annual surveillance (until year 5 as below)
    - Non-contrast CT of entire aorta (Abdomen and Pelvis) is needed every 5 years after open repair of AAA or EVAR
    - If symptomatic or imaging shows increasing, or new findings related to stent graft – more frequent imaging may be needed
    - For suspected complication such as: new-onset lower extremity claudication, ischemia, or reduction in ABI after aneurysm repair.

Other Vascular indications

- For evaluation of hepatic blood vessel abnormalities (aneurysm, hepatic vein thrombosis, stenosis post-transplant) after doppler ultrasound has been performed; to clarify or further evaluate ultrasound findings

- Kidney failure or renal insufficiency if initial evaluation performed with ultrasound is inconclusive to evaluate for renal artery stenosis

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Chest MRA/Abdomen MRA/Pelvic MRA combo

- For evaluation of extensive vascular disease involving the chest and abdominal cavities
- For pre-op or preprocedural evaluation for Transcatheter Aortic Valve Replacement (TAVR)[21, 22]
- Acute aortic dissection (CTA or CT preferred)[23]
- Takayasu's arteritis[24]
- Marfan syndrome
- Loeys-Dietz
- Spontaneous coronary artery dissection (SCAD)
- Vascular Ehlers-Danlos syndrome
- Post-operative complications
- Significant post-traumatic or post-procedural vascular complications reasonably expected to involve the chest and/or abdomen and/or pelvis

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BACKGROUND

Magnetic resonance angiography (MRA) generates images of the arteries that can be evaluated for evidence of stenosis, occlusion, or aneurysms. It is used to evaluate the arteries of the abdominal aorta and the renal arteries. Contrast-enhanced MRA requires the injection of a contrast agent, resulting in very high-quality images. MRA does not use ionizing radiation, allowing MRA to be used for follow-up evaluations. Abdominal MRA is not used as a screening tool, e.g., evaluation of asymptomatic patients without a previous diagnosis.

OVERVIEW

MRI Follow-up for post-endovascular repair (EVAR) – Although studies have shown that MRA is as sensitive as CT in detecting endoleaks, CTA is generally the study of choice in this evaluation due to convenience, improved spatial resolution, and less artifact from components of the stent graft. MRA is most helpful in the postoperative evaluation of patients with impaired renal function, but not severe enough to have contraindication to gadolinium administration or when CTA is inconclusive.

MRA and Abdominal Aortic Aneurysm – Endovascular repair is an alternative to open surgical repair of an abdominal aortic aneurysm. It has lower morbidity and mortality rates and is minimally invasive. In order to be successful, it depends on precise measurement of the aneurysm and involved vessels. MRA with gadolinium allows visualization of the aorta and major branches and is effective and reliable for use in planning the placement of the endovascular aortic stent graft. MRA is also used for the detection of postoperative complications of endovascular repair.

Abdominal Aneurysms and general guidelines for follow-up – The normal diameter of the suprarenal abdominal aorta is 3.0 cm and that of the infrarenal is 2.0 cm. Aneurysmal dilatation of the infrarenal aorta is defined as diameter ≥ 3.0 cm or dilatation of the aorta ≥ 1.5x the normal diameter.[25] Evaluation of AAA can be accurately made by ultrasound. Ultrasound can detect and size AAA, with the advantage of being relatively inexpensive, noninvasive, and not requiring iodinated contrast. The limitations are that overlying bowel gas can obscure findings and the technique is operator dependent. Ultrasound is used to screen for and to monitor aneurysms*. CT is used when US is inconclusive or insufficient. When there are suspected complications, complex anatomy and/or surgery is planned, CTA/MRA is preferred. Risk factors for AAA include smoking history, age, male gender, family history of AAA (first degree relative) and personal history of vascular disease. Risk factors for rupture include female gender, large initial aneurysm diameter, low FEV, current smoking history, elevated mean blood pressure and patients on immunosuppression after major organ transplantation. The Society of Vascular Surgery recommends elective repair of AAA ≥ 5.5 cm in patients at low or acceptable surgical risk.[20]

Ultrasound screening intervals*:

- Aneurysm size 2.5–3 cm, every 10 years
- Aneurysm size 3.0–3.9 cm, every 3 years
- Aneurysm size 4.0-4.9 cm, annually[26]
- Aneurysm size 5.0-5.4 cm, every 6 months

MRA and Chronic Mesenteric Ischemia -"MRA has become increasingly accurate in depicting and grading stenosis of the mesenteric vessels, particularly for the celiac artery and SMA, with reported sensitivity and specificity in suspected chronic mesenteric ischemia up to 95% to 100%" and may be used for measuring flow in the SMA and superior mesenteric veins.[7]

MRA and Renal Artery Stenosis – Renal artery stenosis is the major cause of secondary hypertension. It may also cause renal insufficiency and end-stage renal disease. Atherosclerosis is one of the common causes of this condition, especially in older patients with multiple cardiovascular risk factors and worsening hypertension or deterioration of renal function. Navigator-gated MR angiography is used to evaluate the renal arteries and detect renal artery stenosis.

MRA and Renal Vein Thrombosis – Renal vein thrombosis is a common complication of nephrotic syndrome and often occurs with membranous glomerulonephritis. Gadolinium-enhanced MRA can

demonstrate both the venous and arterial anatomy and find filling defects within renal veins. The test can be used for follow-up purposes as it does not use ionizing radiation.

MRI/CT and acute hemorrhage – MRI is not indicated and MRA/MRV (MR Angiography/Venography) is rarely indicated for evaluation of intraperitoneal or retroperitoneal hemorrhage, particularly in the acute setting. **CT is usually the study of choice** due to its availability, speed of the study, and less susceptibility to artifact from patient motion. Advances in technology have allowed conventional CT to not just detect hematomas but also the source of acute vascular extravasation. In special cases, finer vascular detail to assess the specific source vessel responsible for hemorrhage may require the use of CTA. CTA in diagnosis of lower gastrointestinal bleeding is such an example.[27]

MRA/MRV is often utilized in non-acute situations to assess vascular structure involved in atherosclerotic disease and its complications, vasculitis, venous thrombosis, vascular congestion, or tumor invasion. Although some of these conditions may be associated with hemorrhage, it is usually not the primary reason why MRI/MRA/MRV is selected for the evaluation. A special condition where MRI may be superior to CT for evaluating hemorrhage is to detect an underlying neoplasm as the cause of bleeding.[5]

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POLICY HISTORY

Date	Summary
March 2023	• Aneurysm: specified guidance on initial imaging and screening intervals with emphasis on requiring ultrasound on initial imaging and indications for advanced imaging, specified guidance on post-repair imaging • Other vascular abnormalities: clarified indication for non-aortic vascular conditions • Transplant: added section • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Aligned sections across body imaging guidelines
April 2022	• Added indication for UPJ surgery • Added "(abdomen and pelvis MRA when CTA is inconclusive or cannot be performed)" to follow-up for EVAR and AAA • Added Y90 indication

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **CT (VIRTUAL) COLONOSCOPY DIAGNOSTIC**	**Original Date: July 2007**
CPT Codes: 74261, 74262	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_033-1	**Implementation Date: January 2024**

GENERAL INFORMATION

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INDICATIONS FOR DIAGNOSTIC CT COLONOGRAPHY (VIRTUAL COLONOSCOPY)

For diagnostic (symptomatic patient) evaluation when conventional colonoscopy is contraindicated or could not be completed[1-3]

- Patient had failed or incomplete colonoscopy
- Patient has an obstructive colorectal cancer
- When colonoscopy is medically contraindicated or not possible (e.g., patient is unable to undergo sedation or has medical conditions such as a recent myocardial infarction, recent colonic surgery, a bleeding disorder, or severe lung and/or heart disease)
- For a 3-year follow-up when at least one polyp of 6 mm in diameter detected at CTC if patient does not undergo polypectomy (or is unwilling or unable to undergo colonoscopy)

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification

- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BACKGROUND

Computed tomographic (CT) colonography, also referred to as virtual colonoscopy, is used to examine the colon and rectum to detect abnormalities such as polyps and cancer. Polyps may be adenomatous (which have the potential to become malignant) or completely benign.

Colorectal cancer (CRC) is the third most common cancer and the second most common cause of cancer death in the United States. Symptoms include blood in the stool, change in bowel habit, abdominal pain, and unexplained weight loss.

Relative contraindications to CTC include symptomatic acute colitis, acute diarrhea, recent acute diverticulitis, recent colorectal surgery, symptomatic colon-containing abdominal wall hernia, and small bowel obstruction. It is not indicated in routine follow-up of inflammatory bowel disease, hereditary polyposis or non-polyposis cancer syndromes, evaluation of anal disease, or the pregnant or potentially pregnant patient. For all high-risk individuals, colonoscopy is preferred.

In addition to its use as a diagnostic test in symptomatic patients, CT colonography may be used in asymptomatic patients with a high risk of developing colorectal cancer. Conventional colonoscopy is the main method currently used for examining the colon.

OVERVIEW

Request for a follow-up study - A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

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POLICY HISTORY

Date	Summary
April 2023	• General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
April 2022	• Updated references

Reviewed / Approved by NIA Clinical Guideline Committee

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HMSA

Specific policy administered by National Imaging Associates, Inc. (NIA)

Clinical guidelines Heart MRI	
CPT Codes: 75557, 75559, 75561, 75563, +75565, +0698T	**Original Date:** March 26, 2008
Guideline Number: HMSA_CG_028	**Last Revised Date (by HMSA):** February 2024
	Last Reviewed Date (by NIA Committee): February 2024
	Implementation Date: April 2024

GENERAL INFORMATION

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INDICATIONS FOR CARDIAC MAGNETIC RESONANCE (CMR)

Cardiomyopathy & Heart Failure[1, 2,3]

- To assess systolic and diastolic function in the evaluation of a newly diagnosed cardiomyopathy
- Suspected infiltrative disease such as amyloidosis, sarcoidosis[4], hemochromatosis, or endomyocardial fibrosis if PET has not been performed
- Suspected inherited or acquired cardiomyopathy
- Diagnosis of acute myocarditis, with suspicion based upon new, unexplained findings such as:

    - Rise in troponin not clearly due to acute myocardial infarction
    - Change in ECG suggesting acute myocardial injury or pericarditis, without evident myocardial infarction
- Assessment of hypertrophic cardiomyopathy[5]
    - When TTE is inadequate for diagnosis, management or operative planning, or when tissue characterization (degree of fibrosis) will impact indications for ICD
    - For patients with LVH when there is a suspicion of alternative diagnoses, including infiltrative or storage disease as well as athlete's heart
    - For patients who are not otherwise as high risk for SCD, in whom the decision to proceed with an ICD is uncertain after assessment (which includes personal/family history, echocardiography), and CMR imaging is beneficial to assess for maximum LV wall thickness, ejection fraction (EF), LV apical aneurysm, and extent of myocardial fibrosis with LGE
    - For patients with obstructive HCM in whom the autonomic mechanism of obstruction is inconclusive on echocardiography, CMR is indicated for selection and planning of SRT (septal reduction therapy)
    - For patients with HCM, repeat imaging on a periodic basis (every 3-5 years) for the purpose of SCD risk stratification to evaluate changes in LGE, EF, development of apical aneurysm or LV wall thickness
- Arrhythmogenic right ventricular cardiomyopathy to aid in identification and diagnosis (assessment of myocardial fat, fibrosis, and RV tissue characteristics), based upon reason for suspicion, such as:
    - Nonsustained ventricular tachycardia (VT)
    - Unexplained syncope
    - ECG abnormalities
    - First-degree relatives with positive genotype for ARVD
- Noncompaction cardiomyopathy to aid in the diagnosis (measurement of compacted to noncompacted myocardium) when TTE is suggestive
- Clinical symptoms and signs consistent with a cardiac diagnosis known to cause presyncope/syncope (including, but not limited to, hypertrophic cardiomyopathy)
- Pulmonary hypertension in the absence of severe valvular disease

Valvular Heart Disease

- Evaluation of valvular stenosis, regurgitation, or valvular masses when transthoracic echocardiography (TTE) is inadequate[6]
- Pre-TAVR assessment if the patient has not undergone cardiac CT[7]
- Prior to transcatheter mitral valve intervention, when TTE and TEE result in uncertain assessment of the severity of mitral regurgitation[8, 9]
- Suspected clinically significant bioprosthetic valvular dysfunction and inadequate images from TTE and TEE[6]

Evaluation of Intra- and Extra-Cardiac Structures

- Initial evaluation of cardiac mass, suspected tumor or thrombus, or potential cardiac source of emboli
- Re-evaluation of intracardiac mass when findings would change therapy
- Evaluation of pericardial disease to provide structural and functional assessment and differentiate constrictive vs restrictive physiology
- Assessment of left ventricular pseudoaneurysm, when TTE was inadequate
- Identification and characteristics of coronary aneurysms or anomalous coronary arteries

Pre-procedure Evaluation for Closure of ASD or PFO

- For assessment of atrial septal anatomy and atrial septal aneurysm
- For assessment of suitability for percutaneous device closure

Assessment Following LAA Occlusion

- For surveillance at 45 days or FDA guidance, if TEE or Heart CT was not done, to assess:
    - Device stability
    - Device leaks
    - To exclude device migration

Pre-Ablation Planning

- Evaluation of left atrium and pulmonary veins prior to radiofrequency ablation for atrial fibrillation

Aortic Pathology

- CT, MR, or echocardiogram can be used for screening and follow-up, with CT and MR preferred for imaging beyond the proximal ascending thoracic aorta
- Screening of first-degree relatives with a history of thoracic aortic aneurysm or dissection
- Six-month follow-up after initial diagnosis of thoracic aortic aneurysm to measure rate of change
- Annual follow-up for an enlarged thoracic aortic aneurysm (usually defined as > 4.4.cm)
- Biannual (2x/year) follow-up of enlarged aortic root or showing growth rate ≥ 0.5 cm/year
- Screening of first-degree relative with a bicuspid aortic valve
- Re-evaluation (<1 y) of the size and morphology of the aortic sinuses and ascending aorta in patients with a bicuspid AV and an ascending aortic diameter >4 cm with 1 of the following:
    - Aortic diameter >4.5 cm
    - Rapid rate of change in aortic diameter
    - Family history (first-degree relative) of aortic dissection

- Patients with Turner's syndrome annually if an abnormality exists; if initial study normal, can have imaging every 5 - 10 years[10]
- Evaluation in patients with known or suspected connective tissue disease or genetic condition that predispose to aortic aneurysm or dissection, such as Marfan syndrome, Ehlers-Danlos or Loeys-Dietz syndrome (at the time of diagnosis and 6 months thereafter), followed by annual imaging (can be done more frequently if > 4.5 cm or rate of growth > 0.5 cm/year- up to twice per year)

Congenital Heart Disease (CHD)[11]

- For all indications below, either CT or CMR can be done
- All lesions: evaluation prior to planned repair and evaluation for change in clinical status and/or new concerning signs or symptoms
- Patent Ductus Arteriosus: routine surveillance (1-2 years) in a patient with postprocedural aortic obstruction
- Eisenmenger Syndrome and Pulmonary Hypertension associated with CHD:
    - Evaluation due to change in pulmonary arterial hypertension-targeted therapy
    - Initial evaluation with suspicion of pulmonary hypertension following CHD surgery
- Aortic Stenosis or Regurgitation:
    - Routine surveillance (6-12 months) in a child with aortic sinus and/or ascending aortic dilation with increasing size
    - Routine surveillance (2–3 years) in a child with aortic sinus and/or ascending aortic dilation with stable size (CMR only)
- Aortic Coarctation and Interrupted Aortic Arch:
    - Routine surveillance (3–5 years) in a child or adult with mild aortic coarctation
    - Post procedure (surgical or catheter-based) routine surveillance (3–5 years) in an asymptomatic patient to evaluate for aortic arch aneurysms, in-stent stenosis, stent fracture, or endoleak
- Coronary anomalies
- Tetralogy of Fallot:
    - Postoperative routine surveillance (2–3 years) in a patient with pulmonary regurgitation and preserved ventricular function (CMR only)
    - Routine surveillance (2–3 years) in an asymptomatic patient with no or mild sequelae (CMR only)
    - Routine surveillance (2–3 years) in a patient with valvular or ventricular dysfunction, right ventricular outflow tract obstruction, branch pulmonary artery stenosis, arrhythmias, or presence of an RV-to-PA conduit
- Double Outlet Right Ventricle: Routine surveillance (3–5 years) in an asymptomatic patient with no or mild sequelae (CMR only)
- D-Loop Transposition of the Great Arteries (postoperative):
    - Routine surveillance (3–5 years) in an asymptomatic patient

    - Routine surveillance (1–2 years) in a patient with dilated aortic root with increasing size, or aortic regurgitation
    - Routine surveillance (3–12 months) in a patient with ≥moderate systemic AV valve regurgitation, systemic RV dysfunction, LVOT obstruction, or arrhythmias
- Congenitally Corrected Transposition of the Great Arteries:
    - Unrepaired: routine surveillance (3–5 years) in an asymptomatic patient
    - Postoperative: routine surveillance (3–5 years) in an asymptomatic patient
    - Postoperative anatomic repair: routine surveillance (6–12 months) in a patient with valvular or ventricular dysfunction, right or left ventricular outflow tract obstruction, or presence of an RV-to-PA conduit
    - Postoperative physiological repair with VSD closure and/or LV-to-PA conduit: routine surveillance (3–12 months) in a patient with ≥moderate systemic AV valve regurgitation, systemic RV dysfunction, and/or LV-to-PA conduit dysfunction
- Truncus Arteriosus: routine surveillance (1–2 years) in an asymptomatic child or adult with ≥ moderate truncal stenosis and/or regurgitation
- Single-Ventricle Heart Disease:
    - Postoperative routine surveillance (1–2 years) in an asymptomatic patient
    - Routine surveillance (1–2 years) in an asymptomatic adult postoperative Stage 2 palliation (CMR only)
- Ebstein's anomaly and Tricuspid Valve dysplasia (only CMR indicated):
    - Evaluation prior to planned repair and evaluation for change in clinical status and/or new concerning signs or symptoms
- Pulmonary Stenosis (only CMR indicated)
    - Unrepaired: routine surveillance (3–5 years) in an asymptomatic adult with PS and pulmonary artery dilation
    - Postprocedural (surgical or catheter-based): routine surveillance (1–3 years) in an asymptomatic adult with moderate or severe sequelae
- Pulmonary Atresia (postprocedural complete repair): routine surveillance (1–3 years) in an asymptomatic adult with ≥ moderate sequelae

Coronary Artery Disease Evaluation (CMR as an alternative to pharmacologic MPI)

- CMR, which is done pharmacologically, is used for the assessment of coronary artery disease, and can be performed if the patient would otherwise be a candidate for a pharmacologic MPI.
- Assessment of LV wall motion to identify patients with akinetic segments that would benefit from coronary revascularization
- To identify the extent and location of myocardial necrosis in patients with chronic or acute ischemic heart disease
- Follow-up of known CAD
    - Coronary stenosis of unclear significance on previous coronary angiography [3, 12]

- To diagnose microvascular dysfunction in patients with persistent stable anginal chest pain with suspected ischemia and nonobstructive coronary artery disease (INOCA) as documented in provider notes (no MPI diversion required). [13]

BACKGROUND[15]

- CMR is an imaging modality used to assess cardiac or vascular anatomy, function, perfusion, and tissue characteristics in a single examination. In lesions affecting the right heart, CMR provides excellent visualization and volume determination regardless of RV shape. This is particularly useful in patients with congenital heart disease
- **CMR Safety[16-19]**
  Since many cardiac patients have cardiac implanted electrical devices, the risk of CMR to the patient and the device must be weighed against the benefit to the patient in terms of clinical value in optimal management.

Cardiac magnetic imaging (CMR) is often required when transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) provide inadequate imaging data.

Stress CMR for assessment of coronary artery disease (CAD) is performed pharmacologically either as:

- Vasodilator perfusion imaging with gadolinium contrast; **OR**
- Dobutamine inotropic wall motion (ventriculography)

With respect to CAD evaluation, since CMR is only pharmacologic (non-exercise stress), and stress echocardiography (SE) or myocardial perfusion imaging (MPI) provide similar information about CAD:

- Requests for stress CMR require **diversion** to exercise SE first, and to exercise MPI second.
- **Exemptions** for the diversion to SE or exercise MPI:
  - If body habitus or marked obesity (e.g., BMI ≥ 40) would interfere significantly with imaging with SE and MPI[20]
  - Evaluation of young (< 55 years old) patients with documented complex CAD, who are likely to need frequent non-invasive coronary ischemia evaluation and/or frequent radiation exposure from other testing[21]

OVERVIEW

CMR in CORONARY ARTERY DISEASE (CAD)[12, 22, 23]

Stable patients without known CAD fall into 2 categories[12, 22, 23]:

- **Asymptomatic**, for whom global risk of CAD events can be determined from coronary risk factors, using calculators available online

- **Symptomatic,** for whom we estimate the pretest probability that their chest-related symptoms are due to clinically significant (≥ 50%) CAD (below):

The 3 Types of Chest Pain or Discomfort

- **Typical Angina (Definite)** is defined as including all **3** characteristics:
  - Substernal chest pain or discomfort with characteristic quality and duration
  - Provoked by exertion or emotional stress
  - Relieved by rest and/or nitroglycerine
- **Atypical Angina (Probable)** has only **2** of the above characteristics
- **Nonanginal Chest Pain/Discomfort** has only **0 - 1** of the above characteristics

The medical record should provide enough detail to establish the type of chest pain. From those details, The Pretest Probability of obstructive CAD is estimated from the **Diamond Forrester Table** below, recognizing that in some cases multiple additional coronary risk factors could increase pretest probability[12]:

Diamond Forrester Table

Age (Years)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain
≤ 39	Men	Intermediate	Intermediate	Low
	Women	Intermediate	Very low	Very low
40 – 49	Men	High	Intermediate	Intermediate
	Women	Intermediate	Low	Very low
50 – 59	Men	High	Intermediate	Intermediate
	Women	Intermediate	Intermediate	Low
≥ 60	Men	High	Intermediate	Intermediate
	Women	High	Intermediate	Intermediate

- **Very low:** < 5% pretest probability of CAD, usually not requiring stress evaluation[22]
- **Low:** 5 - 10% pretest probability of CAD
- **Intermediate:** 10% - 90% pretest probability of CAD
- **High:** > 90% pretest probability of CA

For additional information on stress imaging, please refer to NIA guideline CG 024 Myocardial Perfusion Imaging (aka Nuclear Cardiac Imaging Study).

Abbreviations

ARVD/C	Arrhythmogenic right ventricular dysplasia/cardiomyopathy
ASD	Atrial septal defect
CABG	Coronary artery bypass grafting surgery
CAD	Coronary artery disease
CMR	Cardiac magnetic resonance (imaging)
CT	Computed tomography
ECG	Electrocardiogram
EF	Ejection fraction
HCM	Hypertrophic cardiomyopathy
ICD	Implantable cardioverter-defibrillator
LAA	Left atrial appendage
LBBB	Left bundle-branch block
LGE	Late gadolinium enhancement
LV	Left ventricle
LVH	Left ventricular hypertrophy
LVOT	Left ventricular outflow
MPI	Myocardial perfusion imaging
MR	Mitral regurgitation
MR(I)	Magnetic resonance (imaging)
PA	Pulmonary artery
PET	Positron emission tomography
PFO	Patent foramen ovale
PS	Pulmonary stenosis
RV	Right ventricle
SCD	Sudden cardiac death
SE	Stress echocardiography
SRT	Septal reduction therapy
TAVR	Transcatheter Aortic Valve Replacement
TTE	Transthoracic Echo
TEE	Transesophageal Echo
VT	Ventricular tachycardia

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POLICY HISTORY

Date	Summary
February 2024	• Removed under Coronary Artery Disease evaluation "If the patient can walk and is having an MPI for another reason (LBBB, CABG, ect.), MPI is chosen over CMR"
September 2024	• Added follow up for known CAD • Added CAD evaluation for microvascular dysfunction
April 2023	• Added statement on clinical indications not addressed in this guideline • Added Washington State Legislative Language
February 2022	• Deleted the statement of deferral toward a stress echo, leaving the equivalency statement toward MPI • Clarified the requirement for description of chest pain by adding sentence "The medical record should provide enough detail to establish the type of chest pain." • Changed postoperative routine surveillance for single-ventricle heart disease to 1 – 2 years in an asymptomatic patient

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical Guidelines for Coronary Artery Calcium Scoring by: Electron-Beam Tomography (EBCT) OR Non-Contrast Coronary Computed Tomography (Non-contrast CCT)	**Original Date: January 2008**
CPT Codes: 75571, S8092	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_029	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CORONARY ARTERY CALCIUM (CAC) TESTING[1-10]

See Legislative Requirements for specific mandates in: State of New Mexico and State of Texas

CAC testing is for cardiovascular risk assessment in individuals aged 40-75 years who have an intermediate (5-19.9%) 10-year ASCVD risk based upon the ACC/AHA pooled cohort risk calculator. Documentation is required that the results of the study will affect decision making for preventative actions (i.e., statin therapy).

- Patients regardless of age can be considered for CAC testing when there is well-documented evidence of one of the following:
    - Patients with estimated 10-year risk of less than 5%, but are suspected to be at elevated atherosclerotic cardiovascular disease (ASCVD) risk because of a major

risk factor not accounted for in the global risk equations below and consider CAC score as an adjudicator to upgrade risk: [4, 5, 11, 12]
    - Family history of premature ASCVD
    - Persistently elevated LDL-C > 160mg/dl or non-HDL-C > 190mg/dl
    - Chronic kidney disease
    - Metabolic syndrome
    - Conditions specific to women (e.g., pre-eclampsia, premature menopause)
    - Inflammatory diseases (HIV, psoriasis, RA)
    - Ethnicity (e.g., South Asian ancestry)
    - Persistently elevated triglycerides (> 175mg/dl)
    - hsCRP > 2mg/L
    - Lp(a) levels > 50mg/dl
    - apoB > 130mg/dl
    - ABI < 0.9
  - Patients in whom statin therapy is indicated, but have intolerable adverse effects from, or are reluctant to take statin medication, in order to guide the need for alternative lipid-lowering strategies[2, 8, 13]
- CAC scoring should be performed in asymptomatic patients. It should not be used as a diagnostic test in patients with symptoms suggestive of ischemia.
- Patients with known CAD should not be considered for calcium scoring as the results are unlikely to affect treatment.[5, 13-15]
- CAC testing may be repeated for risk re-assessment after a minimum of 5 years, if documentation indicates it will alter management.[4, 5, 13] It should not be repeated if the patient already has two CAC scores of zero 5 years apart or has a score ≥ 400[4].

LEGISLATIVE REQUIREMENTS

- **State of New Mexico**
  - **§ 59A-23-7.16. Heart artery calcium scan coverage**
    - Coronary calcium scan can be **approved** every 5 years with the following:
      - Individual between ages 45 and 65 years of age **AND**
      - Individual has an intermediate risk of developing CHD as determined by a HCP based upon a score calculated from an evidence-based algorithm widely used in the medical community to assess a person's ten-year CVD risk
    - **EBCT is approvable** once every 5 years *even if individual has previously received a heart artery calcium score of ZERO*
    - EBCT is not required for future scores/testing if individual receives a heart artery calcium score greater than ZERO

        - At its discretion or as required by law, an insurer may offer or refuse coverage for further cardiac testing or procedures for eligible insureds based upon the results of a heart artery calcium scan
        - **Heart artery calcium scan** means a computed tomography scan measuring coronary artery calcium for atherosclerosis and abnormal artery structure and function

    Source: N.M.S.A. 1978, § 59A-23-7.16 New Mexico Legislature House Bill 126 [16]

- **State of Texas**
    - **HB 1290 Texas Heart Attack Prevention Screening Law Sec. 1376.003**
        - Indications for EBCT for the detection of coronary artery calcification:
            - Male between the ages of 45 – 76, **AND**
                - Patient is a diabetic **OR**
                - Has **intermediate** or **higher** risk factors (based on the Framingham risk criteria)
            - Female between the ages of 55 – 76, **AND**
                - Patient is a diabetic **OR**
                - Has **intermediate** or **higher** risk factors (based on the Framingham risk criteria)

    Source: Texas House Bill 1290 Sec. 1376.003[17]

BACKGROUND[2, 4, 5]

Coronary artery calcium (CAC) testing is a cardiovascular risk assessment tool, applicable only to the patient without known cardiovascular disease, for the purpose of primary prevention. It is not for the patient with suspected or known cardiovascular disease, coronary or otherwise, who already requires aggressive risk factor modification.

CAC testing, by either EBCT or non-contrast CCT, provides a quantitative assessment of coronary artery calcium content in Agatston units, as an adjunct to the estimation of global risk for coronary or cardiovascular events over the next 10 years.[7] A CAC Score > 0 is a highly specific feature of coronary atherosclerosis.

CAC score > 100 can also provide support for aspirin therapy[5, 18] and statin therapy.[19]

Patients who have already manifested cardiovascular disease are already at high global risk and the Global Cardiovascular Risk Calculators are not applicable.

Links to Global Cardiovascular Risk Calculators[1, 3, 7, 20, 21]

Risk Calculator	Website for Online Calculator
Framingham Cardiovascular Risk	https://reference.medscape.com/calculator/framingham-cardiovascular-disease-risk

Reynolds Risk Score Can use if no diabetes Unique for use of family history	http://www.reynoldsriskscore.org/
Pooled Cohort Equation	http://clincalc.com/Cardiology/ASCVD/PooledCohort.aspx?example
ACC/AHA Risk Calculator	http://tools.acc.org/ASCVD-Risk-Estimator/

Abbreviations

ASCVD	Atherosclerotic cardiovascular disease
CAC	Coronary artery calcium
CAD	Coronary artery disease
CCT	Cardiac computed tomography
EBCT	Electron beam computed tomography

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POLICY HISTORY

Date	Summary
April 2023	• Removed age limitations for CAC testing • Added new references • Added statement on clinical indications not addressed in this guideline
June 2022	• Updated state legislative requirements
February 2022	• Modified indication statements to include additional examples of CAD risk factors • EBCT not to be used as test for symptoms of ischemia • EBCT not to be used in patients with known CAD

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guideline **CT HEART** **CT HEART Congenital** **(Not including coronary arteries)**	**Original Date: September 1997**
CPT Codes: 75572, 75573	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_025	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR HEART COMPUTED TOMOGRAPHY (CT)[1, 2]

Congenital Heart Disease[3]

For all indications below, either CT or CMR can be performed:

- All congenital lesions: prior to planned repair and for change in clinical status and/or new concerning signs or symptoms
- Patent Ductus Arteriosus: routine surveillance (1-2 years) in a patient with postprocedural aortic obstruction
- Aortic Stenosis or Regurgitation: routine surveillance (6-12 months) in a child with aortic sinus and/or ascending aortic dilation with increasing size
- Aortic Coarctation and Interrupted Aortic Arch:
    - Routine surveillance (3–5 years) in a child or adult with mild aortic coarctation
    - Post procedure (surgical or catheter-based) routine surveillance (3–5 years) in an asymptomatic patient to evaluate for aortic arch aneurysms, in-stent stenosis, stent fracture, or endoleak
- Tetralogy of Fallot:

    - Routine surveillance (2–3 years) in a patient with valvular or ventricular dysfunction, right ventricular outflow tract obstruction, branch pulmonary artery stenosis, arrhythmias, or presence of an RV-to-PA conduit
- D-Loop Transposition of the Great Arteries (postoperative):
    - Routine surveillance (3–5 years) in an asymptomatic patient
    - Routine surveillance (1–2 years) in a patient with dilated aortic root with increasing size, or aortic regurgitation
    - Routine surveillance (3–12 months) in a patient with ≥moderate systemic AV valve regurgitation, systemic RV dysfunction, LVOT obstruction, or arrhythmias
- Congenitally Corrected Transposition of the Great Arteries:
    - Unrepaired: routine surveillance (3–5 years) in an asymptomatic patient
    - Postoperative: routine surveillance (3–5 years) in an asymptomatic patient
    - Postoperative anatomic repair: routine surveillance (6–12 months) in a patient with valvular or ventricular dysfunction, right or left ventricular outflow tract obstruction, or presence of an RV-to-PA conduit
    - Postoperative physiological repair with VSD closure and/or LV-to-PA conduit: routine surveillance (3–12 months) in a patient with ≥moderate systemic AV valve regurgitation, systemic RV dysfunction, and/or LV-to-PA conduit dysfunction
- Truncus Arteriosus: routine surveillance (1–2 years) in an asymptomatic child or adult with ≥ moderate truncal stenosis and/or regurgitation
- Single-Ventricle Heart Disease (includes hypoplastic left heart syndrome, double-inlet LV, double-inlet RV, mitral atresia, tricuspid atresia, unbalanced A-V septal defect): postoperative routine surveillance (3-5 years) in an asymptomatic patient

Cardiomyopathy

- Quantification of myocardial (muscle) mass (CMR or CT)
- Assessment of right ventricular morphology in suspected arrhythmogenic right ventricular cardiomyopathy, based upon other findings such as:
    - Nonsustained VT
    - Unexplained syncope
    - ECG abnormalities
    - First-degree relative with positive genotype of ARVC (either, but CMR is superior to CT)[4, 5]

Valvular Heart Disease

- Characterization of native or prosthetic valves with clinical signs or symptoms suggesting valve dysfunction, when TTE, TEE, and/or fluoroscopy have been inadequate[6]
- Evaluation of RV function in severe TR, including systolic and diastolic volumes, when TTE images are inadequate and CMR is not readily available
- Pulmonary hypertension in the absence of severe valvular disease

- Evaluation of suspected infective endocarditis with moderate to high pretest probability (i.e., staph bacteremia, fungemia, prosthetic heart valve, or intracardiac device), when TTE and TEE have been inadequate
- Evaluation of suspected paravalvular infections when the anatomy cannot be clearly delineated by TTE and TEE[7]

Evaluation of Intra- and Extra-cardiac Structures

- Evaluation of cardiac mass, suspected tumor or thrombus, or cardiac source of emboli, when imaging with TTE and TEE have been inadequate
- Re-evaluation of prior findings for interval change (i.e., reduction or resolution of atrial thrombus after anticoagulation), when a change in therapy is anticipated[6-8]
- Evaluation of pericardial anatomy, when TTE and/or TEE are inadequate or for better tissue characterization of a mass and detection of metastasis [CMR superior for physiologic assessment (constrictive versus restrictive) and tissue characterization, CT superior for calcium assessment][9, 10]

Electrophysiologic Procedure Planning[2]

- Evaluation of pulmonary venous anatomy prior to radiofrequency ablation of atrial fibrillation and for follow-up when needed for evaluation of pulmonary vein stenosis
- Non-invasive coronary vein mapping prior to placement of biventricular pacing leads

Transcatheter Structural Intervention Planning

- Evaluation for transcatheter aortic valve replacement (TAVR)[6, 11, 12]
- When TTE and TEE cannot provide adequate imaging, CT imaging can be used for planning: robotic mitral valve repair, atrial septal defect closure, left atrial appendage closure, ventricular septal defect closure, endovascular grafts, and percutaneous pulmonic valve implantation[12, 13]
- Evaluation for suitability of transcatheter mitral valve procedures, alone or in addition to TEE[14]

Aortic Pathology[6-8, 15-20, 21]

- CT, MR, or echo can be used for screening and follow-up, with CT and MR preferred for imaging beyond the proximal ascending thoracic aorta in the following scenarios:
    - Evaluation of dilated aortic sinuses or ascending aorta identified by TTE
    - Suspected acute aortic pathology, such as dissection
    - Re-evaluation of known aortic dilation or aortic dissection with a change in clinical status or cardiac examination or when findings would alter management
    - Screening first-degree relatives of individuals with a history of thoracic aortic aneurysm or dissection, or an associated high-risk mutation for thoracic aneurysm in common

    - Screening second-degree relative of a patient with thoracic aortic aneurysm, when the first-degree relative has aortic dilation, aneurysm, or dissection
    - Six-month follow-up after initial finding of a dilated thoracic aorta, for assessment of rate of change
    - Annual follow-up of enlarged thoracic aorta with size up to 4.4 cm
    - Biannual (twice/yr) follow-up of enlarged aortic root ≥ 4.5 cm or showing growth rate ≥ 0.5 cm/year
- Patients with Marfan syndrome may undergo annual imaging with CT, MRI or TTE, with increase to biannual (twice-yearly) when diameter ≥ 4.5 cm or when expansions is > 0.5 cm/yr
- Patient with Turner syndrome should undergo initial imaging with CT, MRI, or TTE for evidence of dilatation of the ascending thoracic aorta. If imaging is normal and there are no risk factors for aortic dissection, repeat imaging should be performed every 5 - 10 years, or if otherwise indicated. If the aorta is enlarged, appropriate follow-up imaging should be done according to size, as above
- Evaluation of the aorta in the setting of a known or suspected connective tissue disease or genetic condition that predisposes to aortic aneurysm or dissection (i.e., Loeys-Dietz, Ehlers-Danlos), with re-evaluation at 6 months for rate of expansion. Complete evaluation with CMR from the cerebrovascular circulation to the pelvis is recommended with Loeys-Dietz syndrome.

BACKGROUND

- Cardiac computed tomography (Heart CT) images the cardiac chambers, great vessels, valves, myocardium, and pericardium to assess cardiac structure and function, particularly when echocardiography (transthoracic echocardiography and transesophageal echocardiography) cannot provide adequate information
- CT imaging can be used for assessment of:
    - Structures of the heart (e.g., chambers, valves, great vessels, masses), as in this guideline
    - Quantitative level of calcium in the walls of the coronary arteries, in the separate coronary artery calcium (CAC) scoring guideline

OVERVIEW[2]

Imaging in Congenital Heart Disease

Echocardiography is often utilized for initial assessment of congenital heart disease. However, if findings are unclear or need confirmation, CMR or CT can be useful.[3]

CT and Cardiac Masses

CT and CMR are used to evaluate cardiac masses, describing their size, density, tissue characteristics, and spatial relationship to adjacent structures.

CT and Pericardial Disease

While echocardiography is most often used in the initial examination of pericardial disease, CT and CMR can evaluate pericardial thickening and masses which are often detected initially with echocardiography. CT and CMR can accurately define the site and extent of masses, e.g., cysts, hematomas, and neoplasms.[9]

Abbreviations

ARVD/C	Arrhythmogenic right ventricular dysplasia/cardiomyopathy
CABG	Coronary artery bypass grafting surgery
CAD	Coronary artery disease
CCS	Coronary calcium score
CCT	Cardiac (heart) CT
CHD	Coronary heart disease
CMR	Cardiac magnetic resonance (imaging)
CT	Computed tomography
CTA	Computed tomography angiography
ECG	Electrocardiogram
EF	Ejection fraction
HF	Heart failure
LVOT	Left ventricular outflow tract
MI	Myocardial infarction
MPI	Myocardial perfusion Imaging or cardiac nuclear imaging
MR(I)	Magnetic resonance (imaging)
PA	Pulmonary artery
PCI	Percutaneous coronary intervention
PVML	Paravalvular mitral leak
RV	Right ventricle
SE	Stress echocardiogram
TAVR	Transcatheter aortic valve replacement
TMVR	Transcatheter mitral valve replacement
TR	Tricuspid regurgitation
TEE	Transesophageal echocardiography
TTE	Transthoracic echocardiography
VT	Ventricular tachycardia

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POLICY HISTORY

Date	Summary
April 2023	• Added statement on clinical indications not addressed in this guideline
February 2022	Listed clinical spectrum comprising single-ventricle heart disease to include: hypoplastic left heart syndrome, double-inlet LV, double-inlet RV, mitral atresia, tricuspid atresia, unbalanced A-V septal defect

Reviewed / Approved by NIA Clinical Guideline Committee

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HMSA

Specific policy administered by National Imaging Associates, Inc. (NIA)

Clinical Guidelines CT Coronary Angiography (CCTA)	
CPT Codes: 75574	**Original Date:** October 2009
Guideline Number: HMSA_CG_062	**Last Revised Date (by HMSA):** February 2024
	Last Reviewed Date (by NIA Committee): April 2023
	Implementation Date: April 2024

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CORONARY COMPUTED TOMOGRAPHIC ANGIOGRAPHY (CCTA)[1-4]

Evaluation in Suspected Coronary Artery Disease (CAD)[5-8]

- Intermediate and high pretest probability patients[9]
- Low pretest probability patients should be considered for exercise treadmill test (ETT) unless other criteria for CCTA are met
- Symptomatic patients with prior PCI (stents > 3mm) or CABG history
- Exercise ECG stress test with intermediate Duke Treadmill (- 10 to + 4)
- Equivocal, borderline, or discordant stress evaluation with continued symptoms concerning for CAD

- Repeat testing in patient with new or worsening symptoms since prior normal stress imaging[3, 4]
- Asymptomatic patients without known CAD
    - Previously unevaluated ECG evidence of possible myocardial ischemia including ischemic ST segment or T wave abnormalities (see overview section)
    - Previously unevaluated pathologic Q waves (see overview section)
    - Previously unevaluated left bundle branch block
- Newly diagnosed clinical systolic heart failure or diastolic heart failure, with reasonable suspicion of cardiac ischemia (prior events, risk factors), unless invasive coronary angiography is planned (SE diversion not required) [3, 4, 10-12]
- Before valve surgery or transcatheter intervention as an alternative to coronary angiography[13-15]
- To establish the etiology of mitral regurgitation[15]
- Evaluation of coronary anomaly or aneurysm [16-19]
    - Evaluation prior to planned repair
    - Evaluation due to change in clinical status and/or new concerning signs or symptoms
    - Kawasaki disease and MIS-C follow up – for medium sized or greater aneurysms[20] periodic surveillance can be considered every 2-5 years. Once aneurysmal size has reduced to small aneurysms, surveillance can be performed every 3-5 years. No further surveillance once normalized.
- Evaluation of coronary artery bypass grafts, to assess[3, 21]:
    - Patency and location when invasive coronary arteriography was either nondiagnostic or not performed
    - Location prior to cardiac or another chest surgery

Electrophysiologic Procedure Planning

- Evaluation of anatomy prior to radiofrequency ablation

BACKGROUND

Coronary computed tomographic angiography (CCTA) is a noninvasive imaging study that uses intravenously administered contrast material and high-resolution, rapid imaging computed tomography (CT) .[22, 23]

Stable patients without known CAD fall into 2 categories[1, 2, 4]:

- **Asymptomatic**, for whom global risk of CAD events can be determined from coronary risk factors, using calculators available online (see Risk Calculators in the Overview section).

- **Symptomatic,** for whom we estimate the pretest probability that their chest-related symptoms are due to clinically significant CAD.

Three Types of Chest Pain or Discomfort:

- **Typical Angina (Definite)** is defined as including **ALL 3** characteristics:
  - Substernal chest pain or discomfort with characteristic quality and duration
  - Provoked by exertion or emotional stress
  - Relieved by rest and/or nitroglycerin
- **Atypical Angina (Probable)** has only **2** of the above characteristics
- **Nonanginal Chest Pain/Discomfort** has only **0 - 1** of the above characteristics
- Once the type of chest pain has been established from the medical record, the Pretest Probability of significant CAD is estimated from the **Diamond Forrester Table** below, recognizing that additional coronary risk factors could increase pretest probability[4]:

Diamond Forrester Table

Age (Years)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain
≤ 39	Men	Intermediate	Intermediate	Low
	Women	Intermediate	Very low	Very low
40 – 49	Men	High	Intermediate	Intermediate
	Women	Intermediate	Low	Very low
50 – 59	Men	High	Intermediate	Intermediate
	Women	Intermediate	Intermediate	Low
≥ 60	Men	High	Intermediate	Intermediate
	Women	High	Intermediate	Intermediate

  - **Very Low:** < 5% pretest probability of CAD
  - **Low:** 5 - 10% pretest probability of CAD
  - **Intermediate:** 10% - 90% pretest probability of CAD
  - **High:** > 90% pretest probability of CAD

OVERVIEW

The *2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR Guideline for the Evaluation and Diagnosis of Chest Pain* ***has given*** a Class 1 recommendation with level of evidence of A for patients with stable and acute chest pain, who have no known coronary artery disease (CAD).[9]

Patient selection and contraindications to CCTA must be considered and may be inappropriate for the following:

- Known history of severe and/or anaphylactic contrast reaction
- Inability to cooperate with scan acquisition and/or breath-hold instructions

- Pregnancy
- Clinical instability (e.g., acute myocardial infarction, decompensated heart failure, severe hypotension)
- Renal impairment as defined by local protocols
- Image quality depends on keeping HR optimally < 60 bpm, a regular rhythm, limited coronary calcification, stents > 3.0 mm in diameter, ≥ 5 second breath hold, and vessels requiring imaging ≥ 1.5 mm diameter.[24]

Scenarios that can additionally support a CCTA over a regular exercise treadmill test in the low probability scenario[25]

Inability to Exercise

- Physical limitations precluding ability to exercise for at least 3 full minutes of Bruce protocol
- The patient has limited functional capacity (< 4 METS) such as **ONE** of the following:
    - Unable to take care of their activities of daily living (ADLs) or ambulate
    - Unable to walk 2 blocks on level ground
    - Unable to climb 1 flight of stairs
    - Unable to vacuum, dust, do dishes, sweep, or carry a small grocery bag

Other Comorbidities

- Prior cardiac surgery (coronary artery bypass graft or valvular)
- Left ventricular ejection fraction ≤ 50%
- Severe chronic obstructive pulmonary disease (COPD) with pulmonary function test (PFT) documentation, severe shortness of breath on minimal exertion, or requirement of home oxygen during the day
- Poorly controlled hypertension, with systolic blood pressure (BP) > 180 or Diastolic BP > 120

ECG and Echo-Related Baseline Findings

- Pacemaker or implantable cardioverter defibrillator (ICD)
- Resting wall motion abnormalities on echocardiography
- Complete LBBB

Risk-Related

- Intermediate or high global risk in patients requiring type IC antiarrhythmic drugs
- Arrhythmia risk with exercise

ECG Stress Test Alone versus Stress Testing with Imaging

Prominent scenarios suitable for an ECG stress test **WITHOUT** imaging (i.e., exercise treadmill ECG test) require that the patient can exercise for at least 3 minutes of Bruce protocol with achievement of near maximal heart rate **AND** has an interpretable ECG for ischemia during exercise[4]:

- The (symptomatic) low pretest probability patient who can exercise and has an interpretable ECG[4]
- The patient who is under evaluation for exercise-induced arrhythmia
- The patient who requires an entrance stress test ECG for a cardiac rehab program or for an exercise prescription
- For the evaluation of syncope or presyncope during exertion[26]

Duke Exercise ECG Treadmill Score[27]

Calculates risk from ECG treadmill alone**:**

- The equation for calculating the Duke treadmill score (DTS) is: DTS = exercise time in minutes - (5 x ST deviation in mm or 0.1 mV increments) - (4 x exercise angina score), with angina score being 0 = none, 1 = non-limiting, and 2 = exercise-limiting
- The score typically ranges from - 25 to + 15. These values correspond to low-risk (with a score of ≥ + 5), intermediate risk (with scores ranging from - 10 to + 4), and high-risk (with a score of ≤
  - 11) categories

An uninterpretable baseline ECG includes[1]:

- ST segment depression of 1 mm or more (not for non-specific ST - T wave changes)
- Ischemic looking T wave inversions of at least 2.5 mm
- LVH with repolarization abnormalities, WPW, a ventricular paced rhythm, or left bundle branch block
- Digitalis use with associated ST - T abnormalities
- Resting HR under 50 bpm on a beta blocker and an anticipated suboptimal workload
- Note: RBBB with less than 1 mm ST depression at rest may be suitable for ECG treadmill testing
- Previously unevaluated pathologic Q waves (in two contiguous leads) defined as the following:
  - > 40 ms (1 mm) wide
  - > 2 mm deep
  - > 25% of depth of QRS complex

Global Risk of Cardiovascular Disease

Global risk of CAD is defined as the probability of manifesting cardiovascular disease over the next 10 years and refers to **asymptomatic** patients without known cardiovascular disease. It

should be determined using one of the risk calculators below. A high risk is considered greater than a 20% risk of a cardiovascular event over the ensuing 10 years.

High global risk by itself generally lacks scientific support as an indication for stress imaging.[5] There are rare exemptions, such as patients requiring IC antiarrhythmic drugs, who might require coronary risk stratification prior to initiation of the drug, when global risk is moderate or high.

- **CAD Risk—Low**
  10 - year absolute coronary or cardiovascular risk less than 10%
- **CAD Risk—Moderate**
  10 - year absolute coronary or cardiovascular risk between 10% and 20%
- **CAD Risk—High**
  10 - year absolute coronary or cardiovascular risk of greater than 20%

Websites for Global Cardiovascular Risk Calculators*

Risk Calculator	Websites for Online Calculator
Framingham Cardiovascular Risk	https://reference.medscape.com/calculator/framingham-cardiovascular-disease-risk
Reynolds Risk Score Can use if no diabetes Unique for use of family history	http://www.reynoldsriskscore.org/
Pooled Cohort Equation	http://clincalc.com/Cardiology/ASCVD/PooledCohort.aspx?example
ACC/AHA Risk Calculator	http://tools.acc.org/ASCVD-Risk-Estimator/
MESA Risk Calculator With addition of Coronary Artery Calcium Score, for CAD-only risk	https://www.mesa-nhlbi.org/MESACHDRisk/MesaRiskScore/RiskScore.aspx

*Patients who have already manifested cardiovascular disease are already at high global risk and are not applicable to the calculators.[28-32]

Definitions of Coronary Artery Disease[1, 2, 33-35]

- Percentage stenosis refers to the reduction in diameter stenosis when angiography is the method and can be estimated or measured using angiography or more accurately measured with intravascular ultrasound (IVUS).
- Coronary artery calcification is a marker of risk, as measured by Agatston score on coronary artery calcium imaging. It is not a diagnostic tool so much as it is a **risk**

stratification tool. Its incorporation into global risk can be achieved by using the MESA risk calculator.

- Stenoses ≥ 70% are considered obstructive coronary artery disease (also referred to as clinically significant), while stenoses ≤ 70% are considered non-obstructive coronary artery disease.[33]
- Ischemia-producing disease (also called hemodynamically or functionally significant disease, for which revascularization might be appropriate) generally implies at least one of the following:
    - Suggested by percentage diameter stenosis ≥ 70% by angiography; intermediate lesions are 50 – 69%[36]
    - For a left main artery, suggested by a percentage stenosis ≥ 50% or minimum luminal cross-sectional area on IVUS ≤ 6 square mm[1, 35, 37]
    - FFR (fractional flow reserve) ≤ 0.80 for a major vessel[35, 37]
    - iFR (instantaneous wave-free ratio) ≤ 0.89 for a major vessel[35, 38-40]
    - Demonstrable ischemic findings on stress testing (ECG or stress imaging), that are at least mild in degree
- A major vessel would be a coronary vessel that would be amenable to revascularization, if indicated. This assessment is made based on the diameter of the vessel and/or the extent of myocardial territory served by the vessel.
- FFR is the distal to proximal pressure ratio across a coronary lesion during maximal hyperemia induced by either intravenous or intracoronary adenosine. Less than or equal to 0.80 is considered a significant reduction in coronary flow.
- Newer technology that estimates FFR from CCTA images is covered under the separate NIA Guideline for FFR-CT.

Anginal Equivalent[1, 26, 41]

Development of an anginal equivalent (e.g., shortness of breath, fatigue, or weakness) either with or without prior coronary revascularization should be based upon the documentation of reasons that symptoms other than chest discomfort are not due to other organ systems (e.g., dyspnea due to lung disease, fatigue due to anemia), by presentation of clinical data such as respiratory rate, oximetry, lung exam, etc. (as well as D-dimer, chest CT(A), and/or PFTs, when appropriate), and then incorporated into the evaluation of coronary artery disease as would chest discomfort. Syncope, per se, is not an anginal equivalent.

Abbreviations

ACS	Acute coronary syndrome
ADLs	Activities of daily living
CABG	Coronary artery bypass grafting surgery
CAD	Coronary artery disease
CCS	Coronary calcium score
CCTA	Coronary computed tomography angiography
CT(A)	Computed tomography (angiography)
COPD	Chronic obstructive pulmonary disease
DTS	Duke Treadmill Score
ECG	Electrocardiogram
EF	Ejection fraction
FFR	Fractional flow reserve
ICD	Implantable cardioverter-defibrillator
iFR	Instantaneous wave-free ratio or instant flow reserve
IVUS	Intravascular ultrasound
LBBB	Left bundle branch block
LVH	Left ventricular hypertrophy
MESA	Multi-Ethnic Study of Atherosclerosis
METS	Metabolic equivalents
MI	Myocardial infarction
MPI	Myocardial perfusion imaging
PCI	Percutaneous coronary intervention
PFT	Pulmonary function test
RBBB	Right bundle branch block
SE	Stress echocardiography
TTE	Transthoracic echocardiography
WPW	Wolff-Parkinson-White syndrome

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POLICY HISTORY

Date	Summary
February 2024	• Removed “imaging” in; Equivocal, borderline, or discordant stress evaluation with continued symptoms concerning for CAD
April 2023	• Added Electrophysiology testing prior to ablation • Added Kawasaki/MIS-C section on follow up • Added statement about low pretest probability • Added statement on clinical indications not addressed in this guideline
February 2022	• Clarified “intermediate lesions are 50-69%” for ischemia-producing disease
January 2022	[Off-cycle review] • Deleted the requirement for stress echocardiography. • Changed to Intermediate and High probability chest pain patients now allowable as first line testing • Intermediate DTS patients now allowable for CCTA • Removed EF < 40%, keeping the existing EF< 50% systolic dysfunction, and adding symptomatic diastolic heart failure with no prior workup • Added a paragraph explaining the changes, new guidelines of November 2021 with contraindications within the overview section • Added section on when CCTA is preferred over ETT in low-risk patients • Deleted the phrasing ‘scenarios that support MPI over SE’ as it would no longer apply here. Replaced with ‘Scenarios that can additionally support a CCTA over a regular exercise treadmill test in the low probability scenario’. • Deleted statement that MPI may be supported over CCTA in Poorly controlled atrial fibrillation/ectopy • Took out the word ‘intermediate’ in the phrase “The (symptomatic) low pretest probability patient who is able to exercise and has an interpretable ECG” • Removed section on Coronary Artery calcium scoring

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines: **CTA Aortogram with Runoff**	**Original Date: July 2008**
CPT Codes: 75635	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_035	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE

When vascular imaging of the aorta and both legs, i.e., CTA aortogram and runoff is desired (sometimes incorrectly requested as Abd/Pelvis CTA & Lower Extremity CTA Runoff), **only one authorization request is required, using CPT Code 75635 Abdominal Arteries CTA. This study provides for imaging of the abdomen, pelvis, and both legs.** The CPT code description is CTA aorto-iliofemoral runoff; abdominal aorta and bilateral ilio-femoral lower extremity runoff**.**

When separate requests for CTA abdomen and CTA Pelvis are encountered for processes involving both the abdomen and pelvis (but do NOT need to include legs/runoff), they need to be resubmitted as a single Abdomen/Pelvis CTA (to avoid unbundling). Otherwise, the exam should be limited to the appropriate area (i.e., Abdomen OR Pelvis) that includes the area of concern.

INDICATIONS FOR ABDOMINAL ARTERIES CTA (For evaluation of a vascular abnormality in the abdominal aorta and lower extremities)

For evaluation of known or suspected abdominal, pelvic, or peripheral vascular disease[1-4]

- For known or suspected peripheral arterial disease (such as claudication, or clinical concern for vascular causes of ulcers) when non-invasive studies (pulse volume recording, ankle-brachial index, toe brachial index, segmental pressures, or doppler ultrasound) are abnormal or equivocal
- For critical limb ischemia with **ANY** of the below clinical signs of peripheral artery disease. Ultrasound imaging is **not** needed. If done and negative, it should still be approved due to a high false negative rate[5, 6]
    - Ischemic rest pain
    - Tissue loss
    - Gangrene

Pre-operative evaluation

- Evaluation of interventional vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia

Post-operative or post-procedural evaluation

- Evaluation of post-operative complications, e.g., pseudoaneurysms related to surgical bypass grafts, vascular stents, and stent-grafts
- Follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.
- After stenting or surgery with signs of recurrent symptoms **OR** abnormal ankle/brachial index; abnormal or indeterminate arterial doppler; **OR** pulse volume recording[7]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Chest CTA and Abdominal Arteries CTA Combos

To evaluate for an embolic source of lower extremity vascular disease. Echocardiography is also often needed, since the heart is the most commonly reported source of lower extremity emboli, accounting for 55 to 87 percent of events.

BACKGROUND

High resolution computed tomography angiography (CTA) provides a cost-effective and accurate imaging assessment in the diagnosis and follow-up of patients with aortic dissections or peripheral arterial disease (PAD).

OVERVIEW

Suspected Peripheral Arterial Disease – CTA (or MRA) is an excellent tool to diagnose lower extremity peripheral arterial disease (PAD). Benefits include the fast-scanning time and accurate detection of occlusions and stenosis. According to the Society for Vascular Surgery guidelines, "Measurement of the ankle-brachial index (ABI) is the primary method for establishing the diagnosis of PAD. An ABI of ≤0.90 has been demonstrated to have high sensitivity and specificity for the identification of PAD compared with the gold standard of invasive arteriography."[2] The presence of a normal ABI at rest and following exercise almost excludes atherosclerotic disease as a cause for leg claudication.[1, 8]

When an ABI is >1.40 (suggesting noncompressible calcified vessels) and clinical suspicion is high, other tests such as toe-brachial index <8, a resting toe pressure <40 mm Hg, a systolic peak posterior tibial artery flow velocity < 10cm/s may be used. "In symptomatic patients in whom revascularization treatment is being considered, we recommend anatomic imaging studies, such as arterial duplex ultrasound, CTA, MRA, and contrast arteriography."[2] This later statement is accompanied by a "B" (moderate) rating for the accompanying evidence ("A" = high, "C" = low) "In patients with limited renal function or planned surgical intervention, noninvasive imaging tests (particularly MRA and CTA) may obviate the need for diagnostic catheter angiography to visualize the location and severity of peripheral vascular disease."[1]

Follow-up imaging post vascular surgery procedures have not been well researched without clear surveillance protocols in place. Clinical exam, ABI and EUS within the first month of endovascular therapy are generally recommended to assess for residual stenosis, and again at 6 and 12 months, then annually. More sophisticated imaging with CTA, MRA, or invasive catheter angiography is reserved for complex cases.[9]

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POLICY HISTORY

Date	Summary
May 2023	• General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
April 2022	No substantive changes

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **BRAIN (HEAD) MRS**	**Original Date: April 2007**
CPT Codes: 76390, +0698T	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_003	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR BRAIN MRS[1]

- For the evaluation of a recurrent or residual brain tumor from post-treatment changes, e.g., radiation necrosis[2]
- For further evaluation of a brain lesion to distinguish a brain tumor from other non-tumor diagnoses (e.g., abscess or other infectious or inflammatory process)[3, 4]

BACKGROUND[3, 5]

Magnetic resonance spectroscopy (MRS) is a noninvasive imaging technique that determines the concentration of brain metabolites, such as N-acetylaspartate, choline, creatine, and lactate, within the body tissue examined. Radiofrequency waves are translated into biochemical composition of the scanned tissue; the resulting metabolic profile is useful in identifying brain tumors, e.g., differentiating neoplastic and non-neoplastic brain lesions. In selected cases, MRS may be a valuable supplement to MRI. It is sensitive, but nonspecific. This modality should be considered as an adjunct to conventional imaging rather than replacement for histopathological evaluation.

In terms of brain tumor evaluation and classification, carefully designed multi-center trials complying with criteria of evidence-based medicine have not yet been completed.[6]

Tumor Recurrence vs. Radiation Necrosis – Differentiation between recurrent brain tumors and treatment related injury, e.g., radiation necrosis, is difficult using conventional MRI. The typical appearance of radiation necrosis is similar to that of recurrent brain tumors. MRS is a quantitative approach, measuring various brain metabolic markers, to help in the differentiation of recurrent tumors and radiation necrosis. This differentiation is important as additional radiation can benefit recurrent disease but can be detrimental to radiation necrosis. MRS may help in determining treatment options and in preventing unnecessary surgery. In addition, a tumor recurrence diagnosed by MRS allows the surgeon to begin treatment early instead of having to wait for symptoms of recurrence or biopsy confirmation.[2, 7, 8] However, no consensus exists regarding the value of this in clinical decision making, and no approach has yet been validated to be sufficiently accurate.[2, 9, 10]

Glioma – MRS has been proposed for pre-operative grading of gliomas and differentiating high-grade gliomas (HGGs) from low-grade gliomas. It has been found to have moderate diagnostic value and should be combined with other advanced imaging techniques to improve accuracy. Currently, the data is limited; more research is needed for a definite conclusion for the utility of MRS for this indication. Therefore, it remains experimental/investigational.[11, 12]

MRS in other diseases – A role for MRS has been suggested in the management of neurodegenerative disease, epilepsy, and stroke. MRS can also be applied in conjunction with MRI in the evaluation of pediatric neurodegenerative disease, traumatic brain injury and neonatal hypoxia-ischemia.[13-15] However, to better define these roles, it will be necessary to standardize the MRS methodology, as well as the collection, analysis, and interpretation of data so it can be consistently translated to the applicable clinical settings. Currently, these potential applications remain experimental/investigational.[14]

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POLICY HISTORY

Date	Summary
May 2023	• Updated references • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
May 2022	Updated references and background section

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines: **UNLISTED STUDY**	**Original Date: September 2013**
76497 - Unlisted CT **76498 – Unlisted MRI**	**Last Revised Date: March 2023**
Guideline Number: NIA_CG_063	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE

The CPT code that has been selected is considered to be an "unlisted code".

UNLISTED MRI

CPT Code 76498, Unlisted MRI, can be used in the context of:

- Radiation treatment planning
- Whole Body MRI requests related to Rare Genetic Disease Screening as determined by professional society recommendations (not an all-inclusive list - see background):
    - Li-Fraumeni Syndrome (LFS)
    - Constitutional Mismatch Repair Deficiency (CMMRD) syndrome
    - Hereditary retinoblastoma
    - Neurofibromatosis Type 1
    - Hereditary Paraganglioma-Pheochromocytoma (PGL/PCC) Syndrome
    - Rhabdoid Tumor Predisposition Syndrome (RTPS)

- Increased genetic risk related to other cancer-predisposing syndromes

For all other MRI studies, another CPT code should be selected that describes the specific service being requested; otherwise, this procedure cannot be approved.

***NOTE: If there is concern for bone marrow pathologies** (for example, diffuse or multifocal marrow disorders; chronic recurrent multifocal osteomyelitis; marrow involvement in storage diseases or progression of smoldering multiple myeloma (SMM) to multiple myeloma (MM) or high risk SMM patients) **a Bone Marrow MRI study may be more appropriate, please see NIA GL 059*.**

UNLISTED CT

CPT Code 76497, Unlisted CT, can be used in the context of:

- Low Dose Whole Body CT
  - Initial workup of plasma cell dyscrasia (to differentiate MGUS, smoldering, and active myeloma/plasmacytoma)
  - Initial staging of known or suspected of active or smoldering multiple myeloma/plasmacytoma
  - Restaging of known active or smoldering myeloma/plasmacytoma- annually if no change in patient status, or at shorter interval clinically indicated by signs/symptoms, laboratory, or radiographic concern for disease relapse or progression

For all other CT studies, another CPT code should be selected that describes the specific service being requested, otherwise this procedure cannot be approved.

BACKGROUND

Multiple myeloma is a clonal plasma cell proliferative disorder hallmark by primary infiltration of bone marrow and the production of abnormal immunoglobulins. Myeloma is the second most common hematologic malignancy after lymphoma. Osseous disease is the most prominent finding in patients with suspected multiple myeloma (including smoldering myeloma).

Given the increased sensitivity of cross-sectional imaging and low dose that the studies can be performed as this method is now preferred over skeletal radiographs. Whole body MRI without contrast, whole body low dose CT (WBLD CT) or PET/CT the initial study of choice to evaluate patients with known or suspected multiple myeloma and smoldering myeloma.[1, 2] Whole body imaging with MRI (or PET/CT if MRI is not available) is the initial study of choice for initial evaluation of solitary osseous plasmacytoma,[1, 2] which is ordered as Bone Marrow MRI. Whole body imaging with PET/CT is the first choice for initial imaging of solitary extraosseous plasmacytoma.[1, 2]

Summary of Key American Association of Cancer Research Recommendations for WB-MRI Screening in Cancer Predisposition Syndrome[3, 4]	
Li-Fraumeni syndrome	Every 12 mos. from diagnosis
Constitutional mismatch repair deficiency syndrome	Every 12 mos. beginning at 6-8 y old
Hereditary paraganglioma-pheochromocytoma syndrome	Every 24 mos. beginning at 6-8 y old
Hereditary retinoblastoma	Every 12 mos. beginning at 8 y old
Neurofibromatosis:	
Type 1	Baseline tumor burden assessment at 16–20 y old
Type 2	Considered based on symptoms and lesion location

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POLICY HISTORY

Date	Summary
March 2023	• Updated and background and references • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
April 2022	No changes

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **BREAST MRI**	**Original Date: September 1997**
CPT Codes: **Unilateral without contrast 77046** **Bilateral without contrast 77047** **Unilateral without and with contrast 77048** **Bilateral without and with contrast 77049** **+0698T**	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_023	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
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INDICATIONS FOR BREAST MRI

See Legislative Requirements for specific mandates in: Commonwealth of Pennsylvania; State of Connecticut; State of Illinois; State of North Carolina, State of Ohio

NO HISTORY OF KNOWN BREAST CANCER+

Dense breast tissue on mammography

- Inconclusive screening mammogram when category 0 has been specifically assigned due to breast characteristics limiting the sensitivity of mammography (e.g., extremely or heterogeneously dense breast, implants obscure breast tissue)

High risk screening breast MRI

- A Breast Cancer Risk Assessment (including the Breast Cancer Consortium Risk Model (BCSC) which incorporates breast density, the International Breast Cancer Intervention Study (IBIS)/

Tyrer-Cuzick model, the Breast and Ovarian Analysis of Disease Incidence and Carrier Estimation Algorithm model (BOADICEA), the modified Gail (also known as the Breast Cancer Risk assessment tool (BCRAT)) or other validated risk assessment models) that identifies the patient as having a lifetime risk of 20% or greater of developing breast cancer[1]
    - Approve annually beginning 10 years prior to youngest family member's age at diagnosis or at age 40, whichever comes first, but not before age 25[2-6]
- Patients with lifetime risk of 20% or greater of developing breast cancer based on history of lobular neoplasia (LCIS/ALH (Lobular Carcinoma in Situ /Atypical Lobular Hyperplasia)) or ADH (atypical ductal hyperplasia)
    - Approve annually beginning at age of diagnosis of LCIS/ALH or ADH but not prior to age 25[2]
- Patients with intermediate lifetime risk (15%-20%) of developing breast cancer based on a history lobular neoplasia (LCIS/ALH (Lobular Carcinoma in Situ /Atypical Lobular Hyperplasia)) or ADH (atypical ductal hyperplasia)) AND have dense breast tissue on mammography
    - Approve annually beginning at age of diagnosis of LCIS/ALH or ADH but not prior to age 25[2, 7, 8]
- Patients with history of extensive chest irradiation (usually as treatment for Hodgkin's or other lymphoma between ages ten and thirty)
    - Begin eight years after radiation, but not prior to age 25[2]
- Patients with known *BRCA 1/2* mutation
    - Approve annually starting at age 25[2, 3]
- Patients not yet tested for *BRCA* gene, but with known *BRCA* mutation in first-degree relative
    - Approve annually starting at age 25[2, 3]
- Personal history of germline mutations known to predispose to a high risk of breast cancer:[1]
    - Li-Fraumeni syndrome (*TP53* mutation)
        - Begin age 20-29 or age at earliest diagnosed breast cancer in family, if younger than age 20
    - Cowden syndrome (*PTEN*) or Bannayan-Riley-Ruvalcaba syndrome (BRRS)
        - Begin age 35 or 10 years before earliest breast cancer diagnosis in family, whichever comes first (NCCN 2022)
    - *ATM*
        - Begin age 30-35 years
    - *BARD1*
        - Begin age 40
    - *CDH1*
        - Begin age 30
    - *CHEK2*
        - Begin age 30-35 years
    - *NF1*
        - Begin age 30, end age 50[2]
    - *PALB2*
        - Begin age 30

- Peutz-Jeghers Syndrome (*STK11*)
  - Begin age 30
- RAD51C
  - Begin age 40
- RAD51D
  - Begin age 40

[+]For screening examination to detect breast cancer in any of the following situations. It is appropriate to perform screening breast MRI at routine intervals in patients at increased risk who are lactating.

Contrast-enhanced MRI is not recommended during pregnancy due to the trans-placental passage of gadolinium and potential concern for the exposure of the fetus to gadolinium.

For evaluation of identified lesion, mass, or abnormality in breast in any of the following situations

- Evaluation of suspected breast cancer when other imaging examinations, such as ultrasound and mammography, and physical examination are inconclusive for the presence of breast cancer, and biopsy could not be performed (e.g., seen only in single view mammogram without ultrasound correlation)
  - Includes skin changes of suspected inflammatory breast cancer if conventional imaging and skin biopsies are first performed and negative[3, 9, 10]
- For evaluation of suspicious mass, lesion, distortion, or abnormality of the breast in patient with history of breast cancer when other imaging is inconclusive
- For cases of new nipple inversion when mammographic and sonographic findings are inconclusive, and a biopsy cannot be performed[11-13]
- Patients diagnosed with biopsy-proven lobular neoplasia, i.e., LCIS/ALH (Lobular Carcinoma in Situ /Atypical Lobular Hyperplasia) or ADH (atypical ductal hyperplasia)[2, 3, 14, 15]
- Spontaneous unilateral serous or bloody nipple discharge when conventional imaging is interpreted as BI-RADS 1-3 and there is no palpable mass thought to be related to the discharge[2, 3, 16]
- Paget's disease of the nipple: to detect underlying ductal carcinoma when conventional imaging is interpreted as BI-RADS 1-3 and there is no palpable mass[3]
- For a phyllodes tumor diagnosed by biopsy, breast MRI may help determine extent of disease and resectability in selected cases. However routine use for surgical planning is controversial[17-19]
- Follow-up of a probably benign (BI-RADS 3) lesion seen only on prior MRI (when prior mammogram and ultrasound did not show the abnormality)[20-22]

HISTORY OF KNOWN BREAST CANCER

- Yearly surveillance for history of breast cancer and dense breast tissue on mammography[4]
- Yearly surveillance for individuals with personal history of breast cancer diagnosed before age 50[4]

- Yearly surveillance in patients with genetic or other risk factors placing them at high risk for a new cancer or recurrence[3, 23]
- Yearly surveillance for individuals with a mammographically occult primary breast cancer[24].

Staging, treatment, and surveillance of patients with a known history of Breast Cancer

- Approve for initial staging when conventional imaging is indeterminate in defining the extent of cancer, or presence of multifocal, multicentric, or contralateral cancer, or if there is a discrepancy in estimated tumor size between physical exam and imaging[2, 3, 14]
- For invasive lobular carcinoma that is poorly or inadequately defined by mammography, ultrasound, or physical exam[2, 14]
- To identify primary cancer in a patient with axillary nodal adenocarcinoma and unidentified primary tumor[2]
- Prior to treatment: To serve as a baseline for comparison prior to a patient starting planned neoadjuvant chemotherapy[25]
  During or after treatment: To identify candidates for breast conserving therapy or evaluate response to treatment, including preoperative neoadjuvant therapy [within three (3) months][3]

Silicone Implants

MRI is not indicated for evaluation of saline implant complications or for asymptomatic silicone implants.[4, 26]

- Confirmation of suspected silicone gel-filled breast implant ruptures in a*symptomatic* patients, after an abnormal or indeterminate finding on mammography or breast ultrasound
- MRI is considered the gold standard for evaluation of symptomatic silicone implant rupture.[3, 4] Prior imaging is not required in patients with silicone implants and symptoms of possible rupture.
- For postoperative evaluation of silicone breast implant complications when other imaging is inconclusive

Pre-operative

- For preoperative evaluation for known breast cancer when surgery planned within thirty (30) days to be determined on a case-by-case basis[3, 14, 27, 28]

Post-operative/procedural evaluation

A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested[4]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

LEGISLATIVE REQUIREMENTS

- **Commonwealth of Pennsylvania**
    - The General Assembly of the Commonwealth of Pennsylvania hereby enacts as follows: Section 632 - Coverage for Mammographic Examinations and [Diagnostic] Breast Imaging and of the act of May 17, 1921 (P.L.682, No.284), known as The Insurance Company Law of 1921.
    - A group or individual health or sickness or accident insurance policy providing hospital or medical/surgical coverage and a group or individual subscriber contract or certificate issued by any entity subject to 40 Pa.C.S. Ch. 61 or 63, this act, the "Health Maintenance Organization Act," the "Fraternal Benefit Society Code" or an employe welfare benefit plan as defined in section 3 of the Employee Retirement Income Security Act of 1974 providing hospital or medical/surgical coverage shall also provide coverage for breast imaging.
        - The minimum coverage required shall include
            - supplemental magnetic resonance imaging or, if such imaging is not possible, ultrasound if recommended by the treating physician
            - all costs associated with one supplemental breast screening every year because the woman is believed to be at an increased risk of breast cancer due to:
                - personal history of atypical breast histologies
                - personal history or family history of breast cancer
                - genetic predisposition for breast cancer
                - prior therapeutic thoracic radiation therapy
                - heterogeneously dense breast tissue based on breast composition categories of the Breast Imaging and Reporting Data System established by the American College of Radiology with any one of the following risk factors
                    - lifetime risk of breast cancer of greater than 20%, according to risk assessment tools based on family history;
                    - personal history of BRCA1 or BRCA2 gene mutations;

        - first-degree relative with a BRCA1 or BRCA2 gene mutation but not having had genetic testing herself;
        - prior therapeutic thoracic radiation therapy between 10 and 30 years of age; or
        - personal history of Li-Fraumeni syndrome, Cowden syndrome or Bannayan-Riley-Ruvalcaba syndrome or a first-degree relative with one of these syndromes; or
        - extremely dense breast tissue based on breast composition (categories of the Breast Imaging and Reporting Data System established by the American College of Radiology)
    - Nothing in this subsection shall be construed to require an insurer to cover the surgical procedure known as mastectomy or to prevent the application of deductible, copayment or coinsurance provisions contained in the policy or plan.
    - Nothing in this subsection shall be construed as to preclude utilization review as provided under Article XXI of this act or to prevent the application of deductible, copayment or coinsurance provisions contained in the policy or plan for breast imaging in excess of the minimum coverage required.
    - As used in this section: "Supplemental breast screening" means a medically necessary and clinically appropriate examination of the breast using either standard or abbreviated magnetic resonance imaging or, if such imaging is not possible, ultrasound if recommended by the treating physician to screen for breast cancer when there is no abnormality seen or suspected in the breast.

  Source: Pennsylvania General Assembly, Senate Bill 8, Amended May 01, 2023[29]

- **State of Connecticut**
    - CT ST § 38a-530. Effective: October 1, 2020
        - Coverage for breast MRI is mandated within the State of Connecticut without coinsurance, copay of more than $20 deductible, or other out of pocket expenses for women with dense breast tissue if the woman is believed to be at increased risk of breast cancer because of family or personal history of breast cancer, positive genetic testing. Coverage is also mandated for other indications determined by a woman's physician, or when screening is recommended by a physician and the woman is over age 40, has a family or prior history of breast cancer or has breast disease diagnosed through biopsy as benign. This applies to high deductible plans unless plans are used to establish an HRA or HSA to the extent permitted by federal law. Though not designated in the original intent of the bill, language includes the above provisions and criteria for breast MRI.
    - Source: Connecticut General Assembly[30]

- **State of North Carolina**
  - Medicaid and NCHC cover magnetic resonance imaging (MRI) for the detection of:
    - Breast cancer in beneficiaries who are at a high genetic risk for breast cancer:
      - known BRCA 1 or 2 mutation in beneficiary;
      - known BRCA 1 or 2 mutation in relatives; or
      - pattern of breast cancer history in multiple first-degree relatives, often at a young age and bilaterally.
    - Breast cancer in beneficiaries who have breast characteristics limiting the sensitivity of mammography (such as dense breasts, implants, scarring after treatment for breast cancer).
    - A suspected occult breast primary tumor in beneficiaries with axillary nodal adenocarcinoma with negative mammography and clinical breast exam.
    - Breast cancer in beneficiaries with a new diagnosis of breast cancer. It can be used to determine the extent of the known cancer and/or to detect disease in the contralateral breast.
    - To evaluate implant integrity in beneficiaries with breast implants.
  - Source: NC Medicaid[31]; amended September 15, 2020

- **State of Illinois**

  Commercial, Exchange, and Medicaid
  - MRI of the entire breast or breasts is approvable for individuals 35 years or older
    - if a mammogram demonstrates heterogenous or dense breast tissue **OR**
    - when determined medically necessary by a physician licensed to practice medicine in all of its branches
  - Screening breast MRI approvable when determined medically necessary by a physician licensed to practice medicine in all of its branches

  Source: Illinois General Assembly
  Illinois General Assembly - Full Text of SB0162 (ilga.gov)[32]

- **State of Ohio**

  Medicaid
  - Section 1 (A)(3): "Supplemental breast cancer screening" means any additional screening method deemed medically necessary by a treating health care provider for proper breast cancer screening in accordance with applicable American college of radiology guidelines, including magnetic resonance imaging, ultrasound, or molecular breast imaging.
  - Section 1 (C)(2) The benefits provided under division (B)(2) of this section shall cover expenses for supplemental breast cancer screening for an adult woman who meets either of the following conditions:

- (a) The woman's screening mammography demonstrates, based on the breast imaging reporting and data system established by the American college of radiology, that the woman has dense breast tissue;
- (b) The woman is at an increased risk of breast cancer due to family history, prior personal history of breast cancer, ancestry, genetic predisposition, or other reasons as determined by the woman's health care provider.

Source: Ohio General Assembly – HB 371[33]
AM_134_3269-1 (state.oh.us)

BACKGROUND

Magnetic resonance imaging (MRI) of the breast is a useful tool for the detection and characterization of breast disease, assessment of local extent of disease, evaluation of treatment response, and guidance for biopsy and localization.[34] Breast MRI should always be bilateral to allow for assessment of symmetry between the breasts. MRI findings should be correlated with clinical history, physical examination, and the results of mammography and any other prior breast imaging.

OVERVIEW

MRI and risk evaluation – The age of a family member's diagnosis is **only** relevant for patients under the age of 40. Anyone 40 or over should be getting annual mammograms and breast MRIs if their lifetime risk is 20% or greater.

Nipple discharge – Nipple discharge is a common complaint with at least 80% of women having at least 1 episode. Discharge that is considered pathologic is unilateral, spontaneous, from one duct orifice and serous or bloody. Physiologic discharge will be bilateral, from multiple ducts, and white, green, or yellow in color. "In general, MRI may be considered in cases in which mammography and US have failed to identify an underlying cause of pathologic nipple discharge. The sensitivities of breast MRI for detecting the cause of the pathologic nipple discharge are 86% to 100% for invasive cancer and 40% to 100% for noninvasive disease".[35] Ductography (galactography) has the ability to demonstrate small lesions in the specific duct that is secreting the pathologic nipple discharge. However, it is invasive and may cause discomfort and pain. It can be time-consuming and technically challenging and the rate of inadequate or incomplete ductography is as high as 15%. The discharge must be present on the day of the study so that a cannula can be placed in the appropriate duct. Failure to cannulate the discharging duct may occur and cannulation of the wrong duct may cause a false-negative ductogram.[35]

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POLICY HISTORY

Date	Summary
May 2023	• Updated background • Updated references • Added dense breast to indications for breast MRI • Change screening ages based on society recommendations for high-risk conditions • Added language regarding lactating and pregnant patients • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
September 2022	Added mandate language for State of Illinois
June 2022	• Added criteria for an intermediate lifetime risk of breast cancer • Reformatted mandates
April 2022	• Revised high-risk screening section for germline mutations • Updated background section on genetic syndromes • Updated citations

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **CT BONE DENSITY STUDY**	**Original Date: April 1999**
CPT Codes: 77078	**Last Revised Date: March 2023**
Guideline Number: NIA_CG_060-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CT BONE DENSITY STUDY

For first time baseline study[1-5]

Patient with <u>suspected</u> osteoporosis or osteopenia meeting any of the following criteria when DXA scanning is not available or for patients with advanced degenerative changes of the spine or who are severely obese (BMI > 35 kg/m) that may limit the efficacy of DXA scans

- Asymptomatic women 65 years of age or older
- For post-menopausal women age < 65 or during the menopause transition, and men < 70 having at least one of the following applicable risk factors for low bone mass or fractures:
    - Low body weight (< 127 lb. or 57.6 kg or BMI < 20 kg per m)
    - A history of fracture
    - History of maternal hip fracture that occurred after the age of 50 years
    - High risk medications (e.g., steroids or glucocorticosteroids, medroxyprogesterone acetate, anticonvulsants, heparin, lithium, estrogen receptor modulators, calcitonin, or bisphosphonates)
    - History of estrogen deficiency
    - History of amenorrhea for greater than 1 year before the age of 42

    - Conditions that cause or contribute to osteoporosis and fractures (e.g., malabsorption syndromes, inflammatory bowel disease and other gastrointestinal conditions, metabolic bone disease, hyperparathyroidism, hypogonadism, thyroid hormone therapy or hyperthyroidism, chemotherapy, long-term heparin therapy, rheumatologic and autoimmune diseases, renal failure, hematologic disorders, multiple myeloma, chronic alcoholism, cerebral palsy, etc.)
    - Current use of cigarettes
    - Loss of body height (> 4 cm (> 1.5 inches))[1]
- Men aged 70 or older
- Individuals with fragility fractures, including vertebral abnormalities that are indicative of osteoporosis, osteopenia, low bone mineral content, or vertebral fractures seen on other imaging studies/x-ray
- Individuals aged 50 years and older who develop a wrist, hip, spine, or proximal humerus fracture with minimal or no trauma, excluding pathologic fractures
- Eating disorders, including anorexia nervosa and bulimia
- Individuals who have had gastric bypass for obesity (accuracy of DXA may be affected by obesity)
- Males and females greater than or equal to 50 years of age with advanced degenerative changes of the spine (with or without scoliosis), or other conditions that may falsely elevate bone marrow density

Follow-up of individuals with <u>known</u> osteoporosis or osteopenia[6, 7]

- In women with low to moderate risk reassess fracture risk in 2-4 years
- In post-menopausal women with a low bone mineral density at high risk for fractures on treatment, monitor the spine and hip every 1-3 years
- For patients on bisphosphonates, reassess fracture risk every 3-5 years
- No previous bone density within past 23 months **AND** meets any one of the above risk factor criteria. (More frequent BMD testing may be warranted in certain clinical situations and should be determined on a case-by-case basis.)

Indications for QCT/pQCT in pediatric and adolescent include[8]:

- Individuals receiving (or expected to receive) glucocorticoid therapy for more than 3 months
- Individuals receiving radiation or chemotherapy for malignancies
- Individuals with an endocrine disorder known to adversely affect BMD (e.g., hyperparathyroidism, hyperthyroidism, growth hormone deficiency or Cushing's syndrome)
- Individuals with bone dysplasias known to have excessive fracture risk (osteogenesis imperfecta, osteopetrosis) or high BMD, such as prolonged exposure to fluoride

- Individuals with medical conditions that could alter bone marrow density, such as: (chronic renal failure, inflammatory arthritides, eating disorders, organ transplantation, prolonged immobilization, sprue, inflammatory bowel disease, malnutrition, cystic fibrosis, osteomalacia, acromegaly, cirrhosis, HIV infection, prolonged exposure to fluorides, and hematologic disorders (thalassemia, sickle cell disease))

BACKGROUND

Bone mineral density (BMD) measurement identifies patients with low bone density and increased fracture risk. Methods for measuring BMD are non-invasive, painless, and available on an outpatient basis. Dual energy x-ray absorptiometry (DXA), previously referred to as DEXA, is the most commonly used method of evaluating BMD and is the only BMD technology for which World Health Organization (WHO) criteria for the diagnosis of osteoporosis can be used. Patients who have a BMD that is 2.5 standard deviations below that of a "young normal" adult (T-score at or below -2.5) are deemed to have osteoporosis. Quantitative computed tomography (QCT) has not been validated for WHO criteria but can identify patients with low BMD compared to the QCT reference database, and it can be used to identify patients who are at risk of fracture.

OVERVIEW:

DXA – Dual energy x-ray absorptiometry (DXA) is most often used to measure bone mineral density due to its low radiation exposure, low precision error, and capacity to measure multiple skeletal sites (spine, hip, or total body).

Axial DXA – This provides the "gold standard". Axial DXA predicts fracture risk at the site being measured.

Peripheral DXA – This device measures BMD at peripheral sites, generally at the heel or wrist. It is relatively cheap and portable and is an option when there is limited access to axial DXA.

Quantitative computed tomography (QCT) – QCT measures volumetric integral, trabecular, and cortical bone density at the spine and hip and can be used to determine bone strength. Radiation dose is increased when compared with DXA. Indications are the same for QCT as DXA; however, DXA is recommended as the first-line test in most cases.[1, 2]

Fracture Risk Assessment - The fracture risk assessment (FRAX) tool estimates the 10-year risk of having a fracture based on factors such as age, sex, body mass index (BMI), previous fractures, parental fracture history, glucocorticoid use, rheumatoid arthritis, and conditions predisposing to secondary osteoporosis (insulin-dependent diabetes, osteogenesis imperfecta in adults, untreated long-standing hyperthyroidism, hypogonadism or premature menopause (<45 years), chronic malnutrition, or malabsorption and chronic liver disease) and tobacco and

alcohol use. Based on FRAX, a 65-year-old woman, without any additional conditions increasing fracture risk, has a 9.3% 10-year risk of developing a fracture. This value is therefore used as the risk level cut-off recommending screening in patients younger than 65.[9]

Ethnicity and Screening - Due to the potential negative consequences of fractures and the lack of an optimal age at which to screen populations of different ethnicity, the US Preventive Services Task Force (USPSTF) now recommends screening all women aged 65 and older regardless of race and ethnicity.

Follow-up Imaging – Follow-up imaging is performed on patients at risk of developing osteoporosis or to evaluate the outcome of osteoporosis treatment. Follow-up imaging is generally performed at 1-2 years after initiation of therapy for osteoporosis and subsequently every 2 years unless clinical circumstances prompt earlier imaging. In patients at increased risk for developing osteoporosis, imaging may be performed more frequently, particularly with patients with certain medical conditions and taking medications predisposing to fracture. The later population includes those undergoing long-term therapy with common medications such as heparin or glucocorticoids.

Pediatric and Adolescent patients - As QCT can assess both volume and density of bone in the axial and appendicular skeleton, it may be more useful than DXA scans in children. Bone mineral density measurement in children and adolescents is indicated whenever clinical management is likely to be impacted by the test results.

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POLICY HISTORY

Date	Summary
March 2023	• Updated references • Added section on DJD of spine and qCT • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Removed additional resources
April 2022	• Added new section regarding pediatric and adolescent patients

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **BONE MARROW MRI**	**Original Date: July 2008**
CPT Codes: 77084	**Last Revised Date: March 2023**
Guideline Number: NIA_CG_059	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR BONE MARROW MRI (images entire body)

- For the diagnosis, staging and follow-up of patients with multiple myeloma (MM), as well as leukemia and other related hematological malignancies[1-3]
- Suspected progression of smoldering multiple myeloma (SMM) to multiple myeloma (MM) or high risk SMM patients[3-5]
- Diagnosis and assessment of treatment response in diffuse or multifocal marrow disorders (e.g., chronic recurrent multifocal osteomyelitis; marrow involvement in storage diseases, such as Gaucher's, or hematologic malignancies/ processes (e.g., Waldenström macroglobulinemia) when the diagnosis is in doubt)[6-8]

NOTE: If the request is for whole body MRI screening for a rare genetic predisposition syndrome (such as Li-Fraumeni syndrome (LFS) constitutional mismatch repair deficiency (CMMRD) syndrome, neurofibromatosis type 1 etc.) an unlisted MRI study may be more appropriate, please see NIA GL 063*.

BACKGROUND

Magnetic Resonance Imaging (MRI) is currently used for the detection of metastatic disease to the bone marrow. Bone marrow MRI, using moving tables and special coils to survey the whole body, is used for screening to search for primary tumors and metastases. The unique soft tissue contrast of MRI enables precise assessment of bone marrow infiltration and adjacent soft tissues allowing detection of alterations within the bone marrow earlier than with other imaging modalities. MRI results in a high detection rate for both focal and diffuse disease, mainly due to its high sensitivity in directly assessing the bone marrow components: fat- and water-bound protons.

When bone marrow MRI is indicated, it is a single CPT code study with large field of view images covering the osseous structures, usually in two planes. The study covers from the vertex to the heels. Individual CPT codes corresponding to multiple separate studies of portions of the axial and appendicular skeleton are not necessary for bone marrow MRI.

Some conditions with diffuse marrow infiltration are not confined to the musculoskeletal system. Additional dedicated organ MRI exams may also be required for these patients.

OVERVIEW

MRI allows bone marrow components to be visualized and is the most sensitive technique for the detection of bone marrow pathologies. The soft tissue contrast of MRI enables detection of alterations within the bone marrow before osseous destruction becomes apparent on CT. Whole body bone marrow MRI has been applied for bone marrow screening of metastasis, as well as for systemic primary bone malignancies, such as multiple myeloma (MM). Sensitive detection is mandatory to estimate prognosis and to determine adequate therapy.

Multiple myeloma and related conditions include: “1. Multiple myeloma- monoclonal proliferation of plasma cells with myeloma-defining CRAB (Calcium level elevation, Renal failure, Anemia, or Bone lesions) findings; 2. MGUS (monoclonal gammopathy of undetermined significance) - monoclonal proliferation of plasma cells without myeloma-defining CRAB; 3. Solitary plasmacytoma – monoclonal plasma cells manifesting as a single tumor; and 4. Smoldering myeloma - monoclonal proliferation of plasma cells in bone marrow and/or serum/urine with abnormal levels of monoclonal protein.”[9]

MRI findings are included as one of the International Myeloma Working Group (IMWG) diagnostic criteria of active myeloma.[2] Although MRI is not the only imaging tool for diagnosis, when “more than one focal lesion on MRI that is at least 5 mm or greater in size” in addition to >10% clonal bone marrow plasma cells, the diagnosis of active myeloma can be made. For smoldering multiple myeloma (SMM), defined as asymptomatic patients with increased levels of M protein and increased bone marrow plasma cells, “The IMWG now recommends that one of following: PET-CT, Low dose whole body CT (LDWBCT), or MRI of the whole body or spine (Bone marrow MRI) be done in all patients with suspected smoldering myeloma, with the exact

imaging modality determined by availability and resources".[4, 10] The importance of imaging in the diagnosis of active myeloma is highlighted as "The IMWG consensus statement now recommends that SMM patients with more than one unequivocal focal lesion (diameter > 5 mm) should be considered to have symptomatic myeloma that requires treatment".[2] Recent advances have allowed the identification of a subset of SMM patients with a greater than 80% risk of progression to MM in 2 years based on biomarkers.[5]

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POLICY HISTORY

Date	Summary
March 2023	• Removed duplicate statement for treatment follow up • Updated references • Removed additional resources • Added statement on clinical indications not addressed in this guideline
April 2022	• Added statement for whole body MRI related to genetic predisposition syndromes

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **HEART (Cardiac) PET with CT for Attenuation**	**Original Date: July 1999**
CPT Codes: 78459, 78491, 78492, +78434, 78429, 78430, 78431, 78432, 78433	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_079	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

This guideline is for stress imaging, specifically Heart (Cardiac) PET imaging, with appropriate preference for suitable alternatives, such as stress echocardiography (SE) or myocardial perfusion imaging (MPI), when more suitable, unless otherwise stated (refer to Background section).

INDICATIONS FOR HEART PET WITH CT FOR ATTENUATION[1-4]

- **SUSPECTED CAD (When neither SE nor MPI have provided or are expected to provide optimal imaging)**
  Symptomatic patients without known CAD (use Diamond Forrester Table)
  - Low or intermediate pretest probability and unable to exercise *(SE diversion not required)*
  - High pretest probability *(SE diversion not required)*
  - Repeat testing in a patient with new or worsening symptoms and negative result at least one year ago **AND** meets one of the criteria above
- **Asymptomatic patients without known CAD** *(SE diversion not required)*

- Previously unevaluated ECG evidence of possible myocardial ischemia including substantial ischemic ST segment or T wave abnormalities (see section in Overview)
- Previously unevaluated pathologic Q waves (see section in Overview)
- Unevaluated complete left bundle branch block

ABNORMAL CALCIUM SCORES (CAC)[4-8] (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)

- ASYMPTOMATIC patient with a calcium score >400, not previously evaluated
- SYMPTOMATIC patient with prior CAC ≥ 100

INCONCLUSIVE CAD EVALUATION AND OBSTRUCTIVE CAD REMAINS A CONCERN (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)

- Exercise stress ECG with low-risk Duke treadmill score (≥5), (see section in Overview) but patient's current symptoms indicate an intermediate or high pretest probability *(SE diversion not required* for high pretest probability)
- Exercise stress ECG with an intermediate Duke treadmill score (*SE diversion not required for symptoms consistent with high pretest probability*)
- Inconclusive/borderline coronary computed tomography angiography (CCTA) (e.g., 40 - 70% lesions)
- Non-diagnostic exercise stress test with physical inability to achieve target heart rate (THR) *(SE diversion not required)*
- An intermediate evaluation by prior stress imaging () *(SE diversion not required)*
- Coronary stenosis of unclear significance on previous coronary angiography[4]

FOLLOW-UP OF PATIENT'S POST CORONARY REVASCULARIZATION (PCI or CABG) (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)[4]

- **Asymptomatic, follow-up stress imaging** at a minimum of 2 years post coronary artery bypass grafting (CABG), or percutaneous coronary intervention (PCI), (whichever is later), is appropriate only for patients with a history of silent ischemia or a history of a prior left main stent

  OR

- For patients with high occupational risk (e.g., associated with public safety, airline and boat pilots, bus and train drivers, bridge and tunnel workers/toll collectors, police officers, and firefighters)

New, recurrent, or worsening symptoms post coronary revascularization, is an indication for stress imaging, if it will alter management (SE diversion not required for typical anginal symptoms or symptoms documented to be similar to those prior to revascularization)

FOLLOW-UP OF KNOWN CAD (When neither SE nor MPI have provided or are expected to provide optimal imaging)

- **Follow-up of asymptomatic or stable symptoms** when last invasive or non-invasive assessment of coronary disease showed hemodynamically significant CAD (ischemia on stress test or FFR ≤ 0.80 or significant stenosis in a major vessel (≥ 50% left main coronary artery or ≥ 70% LAD, LCX, RCA)) over two years ago, without intervening coronary revascularization is an appropriate indication for stress imaging in patients if it will alter management

SPECIAL DIAGNOSTIC CONDITIONS REQUIRING CORONARY EVALUATION (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)

- Prior acute coronary syndrome (as documented in MD notes), without subsequent invasive or non-invasive coronary evaluation
- Newly diagnosed systolic heart failure or diastolic heart failure, *with reasonable suspicion of cardiac ischemia (prior events, risk factors*), unless invasive coronary angiography is immediately planned[2, 9, 10]
- Reduced LVEF ≤ 50% requiring myocardial viability assessment to assist with decisions regarding coronary revascularization. (Diversion from PET not required when LVEF less than or equal to 40%)[9-11]
- Ventricular arrhythmias
    - Sustained ventricular tachycardia (VT) > 100 bpm, ventricular fibrillation (VF), or exercise-induced VT, when invasive coronary arteriography is not the immediately planned test[12]
    - Nonsustained VT, multiple episodes, each ≥ 3 beats at ≥ 100 bpm, frequent PVC's (defined as greater than or equal to 30/hour on remote monitoring) without known cause or associated cardiac pathology, when an exercise ECG cannot be performed
- Prior to Class IC antiarrhythmic drug initiation (Propafenone or Flecainide), as well as annually in intermediate and high global risk patients (SE diversion not required)[13]
- Assessment of hemodynamic significance of one of the following documented conditions[14]:
    - Anomalous coronary arteries[15]
    - Muscle bridging of coronary artery [4, 16]
- Coronary aneurysms in Kawasaki's disease[17] or due to atherosclerosis
- Following radiation therapy to the anterior or left chest, at 5 years post initiation and every 5 years thereafter[18]
- To diagnose microvascular dysfunction in patients with persistent stable anginal chest pain with suspected ischemia and nonobstructive coronary artery disease (INOCA), as documented in provider notes (*no MPI diversion required*).[19]

- **Cardiac Sarcoidosis[20-22]** (may be approved as a combination study with MPI for the evaluation and treatment of sarcoidosis)[23]
    - Evaluation and therapy monitoring in patients with sarcoidosis, after documentation of suspected cardiac involvement by echo or ECG, when CMR has not been performed
    - Evaluation of suspected cardiac sarcoid, after CMR has shown equivocal or negative findings in the setting of a high clinical suspicion[22]
    - Evaluation of CMR findings showing highly probable cardiac sarcoidosis, when PET could serve to identify inflammation and the consequent potential role for immunosuppressive therapy[22]
    - Initial and follow-up PET in monitoring therapy for cardiac sarcoid with immunosuppressive therapy, typically about 4 times over 2 years
- **Infective Endocarditis**
    - In suspected infective endocarditis with moderate to high probability (i.e., staph bacteremia, fungemia, prosthetic heart valve, or intracardiac device), when TTE and TEE have been inconclusive with respect to diagnosis of infective endocarditis or characterization of paravalvular invasive complications[24-26]
- **Aortitis**
    - For diagnosis and surveillance of Aortitis, PET/CT or PET/MRI‡ hybrid imaging[27]
      ‡**NOTE:** If PET/MR study is requested, there is no specific CPT Code for this imaging study and a Health Plan review will be required.

PRIOR TO ELECTIVE NON-CARDIAC SURGERY (When neither SE nor MPI have provided or are expected to provide optimal imaging)

- An intermediate or high risk surgery with of one or more risk factors (see below), AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year[28-30]*
    - **Risk factors:** history of ischemic heart disease, history of congestive heart failure, history of cerebrovascular disease, preoperative treatment with insulin, and preoperative serum creatinine >2.0 mg/dL.
    - **Surgical Risk:**
        - **High risk surgery:** Aortic and other major vascular surgery, peripheral vascular surgery, anticipated prolonged surgical procedures associated with large fluid shifts and/or blood loss
        - **Intermediate risk surgery:** Carotid endarterectomy, head and neck surgery, intraperitoneal and intrathoracic surgery, orthopedic surgery, prostate surgery
        - **Low risk surgery**: Endoscopic procedures, superficial procedure, cataract surgery, breast surgery

- Planning for any organ or stem cell transplantation is an indication for preoperative stress imaging, if there has not been a conclusive stress evaluation, CTA, or heart catheterization within the past year, at the discretion of the transplant service[31]

POST CARDIAC TRANSPLANT (SE diversion not required)[32]

- Annually, for the first five years post cardiac transplantation, in a patient not undergoing invasive coronary arteriography
- After the first five years post cardiac transplantation, patients with documented transplant coronary vasculopathy can be screened annually if invasive coronary arteriography is not planned

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BACKGROUND[33, 34]

Cardiac PET scanning, when used in conjunction with CT attenuation, includes evaluation of perfusion, function, viability, inflammation, anatomy, and risk stratification for cardiac-related events such as myocardial infarction and death. Maximum diagnostic accuracy of cardiac PET/CT is achieved when images are interpreted in conjunction with other relevant imaging, clinical information, and laboratory data.

PET Scan

- Indicated when all the criteria for MPI are met **AND** there is likely to be equivocal imaging results because of BMI, large breasts or implants, mastectomy, chest wall deformity, pleural or pericardial effusion or prior thoracic surgery or results of a prior MPI
- Can identify regions of myocardial viability with hibernating myocardium (viable, with poor flow and contractility) by imaging with fluorine18 (F-18) fluorodeoxyglucose (FDG or 18-FDG) for this purpose
- Useful in the evaluation of inflammation: e.g., evaluation and therapy monitoring in patients with sarcoidosis, after documentation of cardiac involvement by echo or electrocardiography (ECG), in place of, or subsequent to CMR if needed to help with an uncertain diagnosis

Coronary application of PET includes evaluation of **stable patients without known CAD**, who fall into two categories[2-4]

- **Asymptomatic**, for whom global risk of CAD events can be determined from coronary risk factors, using calculators available online (see websites for Global Cardiovascular Risk Calculators section).
- **Symptomatic,** for whom we estimate the pretest probability that their chest-related symptoms are due to clinically significant (≥ 50%) CAD (below):

The 3 Types of Chest Pain or Discomfort

- **Typical Angina (Definite)** is defined as including all **3** characteristics:
    - Substernal chest pain or discomfort with characteristic quality and duration
    - Provoked by exertion or emotional stress
    - Relieved by rest and/or nitroglycerine
- **Atypical Angina (Probable)** has only **2** of the above characteristics
- **Nonanginal Chest Pain/Discomfort** has only **0 - 1** of the above characteristics

The medical record should provide enough detail to establish the type of chest pain. From those details, The Pretest Probability of obstructive CAD is estimated from the **Diamond Forrester Table** below, recognizing that in some cases multiple additional coronary risk factors could increase pretest probability[2, 4]:

Diamond Forrester Table

Age (Years)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain
≤ 39	Men	Intermediate	Intermediate	Low
	Women	Intermediate	Very low	Very low
40 – 49	Men	High	Intermediate	Intermediate
	Women	Intermediate	Low	Very low
50 – 59	Men	High	Intermediate	Intermediate
	Women	Intermediate	Intermediate	Low
≥ 60	Men	High	Intermediate	Intermediate
	Women	High	Intermediate	Intermediate

- **Very Low:** < 5% pretest probability, usually not requiring stress evaluation
- **Low:** 5 - 10% pretest probability of CAD
- **Intermediate:** 10% - 90% pretest probability of CAD
- **High: > 90% pretest probability of CAD**

OVERVIEW

ECG Stress Test Alone versus Stress Testing with Imaging

Prominent scenarios suitable for an ECG stress test WITHOUT imaging (i.e., exercise treadmill ECG test) require that the patient can exercise for at least 3 minutes of Bruce protocol with achievement of near maximal heart rate AND has an interpretable ECG for ischemia during exercise[4]:

- The (symptomatic) low or intermediate pretest probability patient who can exercise and has an interpretable ECG[4]
- The patient who is under evaluation for exercise-induced arrhythmia

- The patient who requires an entrance stress test ECG for a cardiac rehab program or for an exercise prescription
- For the evaluation of syncope or presyncope during exertion[35]

Duke Exercise ECG Treadmill Score

Calculates risk from ECG treadmill alone[36]:

- The equation for calculating the Duke treadmill score (DTS) is: DTS = exercise time in minutes - (5 x ST deviation in mm or 0.1 mV increments) - (4 x exercise angina score), with angina score being 0 = none, 1 = non-limiting, and 2 = exercise-limiting.
- The score typically ranges from - 25 to + 15. These values correspond to low-risk (with a score of ≥ + 5), intermediate risk (with scores ranging from - 10 to + 4), and high-risk (with a score of ≤ - 11) categories.

An uninterpretable baseline ECG includes[2]:

- ST segment depression 1 mm or more (not for non-specific ST- T wave changes)
- Ischemic looking T waves; at least 2.5 mm inversions (excluding V1 and V2)
- LVH with repolarization abnormalities, pre-excitation pattern such as WPW, ventricular paced rhythm, or left bundle branch block
- Digitalis use with associated ST segment abnormalities

Previously unevaluated pathologic Q waves (in two contiguous leads) defined as the following:

- > 40 ms (1 mm) wide
- > 2 mm deep
- > 25% of depth of QRS complex

Global Risk of Cardiovascular Disease

Global risk of CAD is defined as the probability of manifesting cardiovascular disease over the next 10 years and refers to **asymptomatic** patients without known cardiovascular disease. It should be determined using one of the risk calculators below. A high risk is considered greater than a 20% risk of a cardiovascular event over the ensuing 10 years. **High global risk by itself generally lacks scientific support as an indication for stress imaging.** There are rare exemptions, such as patients requiring I-C antiarrhythmic drugs who might require coronary risk stratification prior to initiation of the drug.

- **CAD Risk—Low**
  10-year absolute coronary or cardiovascular risk less than 10%
- **CAD Risk—Moderate**
  10-year absolute coronary or cardiovascular risk between 10% and 20%
- **CAD Risk—High**
  10-year absolute coronary or cardiovascular risk of greater than 20%

Websites for Global Cardiovascular Risk Calculators*

Risk Calculator	Websites for Online Calculator
Framingham Cardiovascular Risk	https://reference.medscape.com/calculator/framingham-cardiovascular-disease-risk
Reynolds Risk Score Can use if no diabetes Unique for use of family history	http://www.reynoldsriskscore.org/
Pooled Cohort Equation	http://clincalc.com/Cardiology/ASCVD/PooledCohort.aspx?example
ACC/AHA Risk Calculator	http://tools.acc.org/ASCVD-Risk-Estimator/
MESA Risk Calculator With addition of Coronary Artery Calcium Score, for CAD-only risk	https://www.mesa-nhlbi.org/MESACHDRisk/MesaRiskScore/RiskScore.aspx

*Patients who have already manifested cardiovascular disease are already at high global risk and are not applicable to the calculators.[37-40]

Definitions of Coronary Artery Disease[2, 3, 6]

Percentage stenosis refers to the reduction in diameter stenosis when angiography is the method and can be estimated or measured using angiography or more accurately measured with intravascular ultrasound (IVUS).

- Coronary artery calcification is a marker of risk, as measured by Agatston score on coronary artery calcium imaging. Its incorporation into global risk can be achieved by using the MESA risk calculator.
- Ischemia-producing disease (also called hemodynamically or functionally significant disease, for which revascularization might be appropriate) generally implies at least one of the following:
    - Suggested by percentage diameter stenosis ≥ 70% by angiography; intermediate lesions are 50 – 69%[41]
    - For a left main artery, suggested by a percentage stenosis ≥ 50% or minimum lumen cross-sectional area on IVUS ≤ 6 square mm[2, 42]
    - FFR (fractional flow reserve) ≤ 0.80 for a major vessel[42]
    - Demonstrable ischemic findings on stress testing (ECG or stress imaging), that are at least mild in degree
- A major vessel would be a coronary vessel that would be amenable to revascularization if indicated. This assessment is made based on the diameter of the vessel and/or the extent of myocardial territory served by the vessel.

- FFR (fractional flow reserve) is the distal to proximal pressure ratio across a coronary lesion during maximal hyperemia induced by either intravenous or intracoronary adenosine. Less than or equal to 0.80 is considered a significant reduction in coronary flow.
- Newer technology that estimates FFR from CCTA image is covered under the separate NIA Guideline for FFR-CT.

Anginal Equivalent[2, 35]

Development of an anginal equivalent (e.g., shortness of breath, fatigue, or weakness) either with or without prior coronary revascularization should be based upon the documentation of reasons to suspect that symptoms other than chest discomfort are not due to other organ systems (e.g., dyspnea due to lung disease, fatigue due to anemia), by presentation of clinical data, such as respiratory rate, oximetry, lung exam, etc. (as well as d-dimer, chest CT(A), and/or PFTs, when appropriate), and then incorporated into the evaluation of coronary artery disease as would chest discomfort. Most syncope per se is not an anginal equivalent.

Abbreviations

ADLs	Activities of daily living
BMI	Body mass index
CABG	Coronary artery bypass grafting
CAC	Coronary artery calcium
CAD	Coronary artery disease
CCTA	Coronary computed tomography angiography
CMR	Cardiac magnetic resonance imaging
CT(A)	Computed tomography (angiography)
DTS	Duke Treadmill Score
ECG	Electrocardiogram
FFR	Fractional flow reserve
IVUS	Intravascular ultrasound
LBBB	Left bundle-branch block
LVEF	Left ventricular ejection fraction
LVH	Left ventricular hypertrophy
MESA	Multi-Ethnic Study of Atherosclerosis
MET	Estimated metabolic equivalent of exercise
MI	Myocardial infarction
MPI	Myocardial perfusion imaging
MR(I)	Magnetic resonance (imaging)
PCI	Percutaneous coronary intervention
PET	Positron emission tomography
PFT	Pulmonary function test
PVCs	Premature ventricular contractions
SE	Stress echocardiography
TEE	Transesophageal echocardiography
THR	Target heart rate
TTE	Transthoracic echocardiography
VF	Ventricular fibrillation
VT	Ventricular tachycardia
WPW	Wolff-Parkinson-White

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Policy History

Date	Summary
May 2023	• Removed time limitation "within past two years" for further evaluation inconclusive prior CAD evaluation • Added coronary stenosis of unclear significance on previous coronary angiography • Added indication for evaluation of ischemia and nonobstructive coronary artery disease (INOCA) • Clarified indication for PET/MPI combination study for evaluation of cardiac sarcoidosis • Added statement on clinical indications not addressed in this guideline
February 2022	• Moved the sentence regarding utilization of suitable alternatives to the General Information section • Clarified evaluation of possible ischemia in newly diagnosed heart failure by stating *"with reasonable suspicion of cardiac ischemia (prior events, risk factors, or symptoms and signs)"* • Clarified "intermediate lesions are 50-69%" for ischemia-producing disease • Placed Link to Overview Section in General Information • Added stress imaging approval for calcium score > 100 with low to intermediate probability symptoms • Deleted the requirement for diabetes when calcium score > 400 for stress imaging • Added Calcium score section: o Added stress imaging approval for calcium score > 100 with symptoms consistent with low to intermediate pretest probability • Added reminder *(SE diversion not required for CABG)* • Changed preoperative guideline to include intermediate risk surgery with one or more risk factors AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year • Changed solid organ transplant guideline to include stem cell transplant and "any" organ transplant • Added definition of surgical risk to preop guidelines • In Background section clarified the requirement for description of chest pain by adding sentence "The medical record should provide enough detail to establish the type of chest pain." • Added definition of Q waves

	• Deleted sentence regarding calcium scoring within the Global Risk Section • Deleted sentence regarding using calcium score solely for risk stratification • Deleted redundant statement on viability • Deleted IFR references

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **MYOCARDIAL PERFUSION IMAGING** **(aka NUCLEAR CARDIAC IMAGING STUDY)**	**Original Date: October 2009**
CPT Codes: 78451, 78452, 78453, 78454, 78466, 78468, 78469, 78481, 78483, 78499, +0742T	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_024	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

This guideline is for stress imaging, specifically myocardial perfusion imaging (MPI), with appropriate preference for suitable alternatives, such as stress echocardiography (SE), when more suitable, unless otherwise stated (refer to Overview).

INDICATIONS for MPI[1-4]

SUSPECTED CORONARY ARTERY DISEASE (CAD)

- **Symptomatic patients without known CAD (use Diamond Forrester Table)**
  - Low or intermediate pretest probability and unable to exercise *(SE diversion not required)*
  - High pretest probability *(SE diversion not required)*
  - Repeat testing in a patient with new or worsening symptoms and negative result at least one year prior AND meets one of the criteria above
- **Asymptomatic patients without known CAD** *(SE diversion not required)*
  - Previously unevaluated ECG evidence of possible myocardial ischemia including ischemic ST segment or T wave abnormalities (see Overview section)
  - Previously unevaluated pathologic Q waves (see Overview section)

- Previously unevaluated complete left bundle branch block

ABNORMAL CALCIUM SCORES (CAC)[4-8]

- ASYMPTOMATIC patient with a calcium score > 400, not previously evaluated
- SYMPTOMATIC patient with prior CAC ≥ 100

INCONCLUSIVE CAD EVALUATION AND OBSTRUCTIVE CAD REMAINS A CONCERN

- Exercise stress ECG with low-risk Duke treadmill score (≥5), (see section in Overview) but patient's current symptoms indicate an intermediate or high pretest probability *(SE diversion not required* for high pretest probability)
- Exercise stress ECG with an intermediate Duke treadmill score *(SE diversion not required* for symptoms consistent with high pretest probability)
- Intermediate coronary computed tomography angiography (CCTA) (e.g., 40 - 70% lesions)
- Non-diagnostic exercise stress test with inability to achieve target heart rate (THR) *(SE diversion not required)*
- An indeterminate (equivocal, borderline, or discordant) evaluation by prior stress imaging (SE or CMR) *(SE diversion not required)*
- Coronary stenosis of unclear significance on previous coronary angiography[4]

FOLLOW-UP OF PATIENT'S POST CORONARY REVASCULARIZATION (PCI or CABG)[4]

- **Asymptomatic follow-up stress imaging** at a minimum of 2 years post coronary artery bypass grafting (CABG) or percutaneous coronary intervention (PCI) (whichever is later) is appropriate for patients with a history of silent ischemia or a history of a prior left main stent.[4] *(SE diversion not required for CABG)*

  OR

  For patients with high occupational risk, associated with public safety, airline and boat pilots, bus and train drivers, bridge and tunnel workers/toll collectors, police officers and firefighters *(SE diversion not required)*
- **New, recurrent, or worsening symptoms post coronary revascularization** is an indication for stress imaging, if it will alter management (SE diversion not required for typical anginal symptoms or symptoms documented to be similar to those prior to revascularization).

FOLLOW-UP OF KNOWN CAD

- **Follow-up of asymptomatic or stable symptoms** when last invasive or non-invasive assessment of coronary disease showed hemodynamically significant CAD (ischemia on stress test or FFR ≤ 0.80 or significant stenosis in a major vessel (≥ 50% left main coronary artery or ≥ 70 % LAD, LCX, RCA)), over two years ago, without intervening coronary revascularization is an appropriate indication for stress imaging in patients if it will alter management

SPECIAL DIAGNOSTIC CONDITIONS REQUIRING CORONARY EVALUATION

- Prior acute coronary syndrome (with documentation in MD notes), without invasive or non-invasive coronary evaluation *(SE diversion not required)*
- Newly diagnosed systolic heart failure or diastolic heart failure, *with reasonable suspicion of cardiac ischemia (prior events, risk factors*), unless invasive coronary angiography is immediately planned *(SE diversion not required)*[1, 9-11]
- LVEF requiring myocardial viability assessment to assist with decisions regarding coronary revascularization[9, 12]
- Ventricular arrhythmias
    - Sustained ventricular tachycardia (VT) > 100 bpm, ventricular fibrillation (VF), or exercise-induced VT, when invasive coronary arteriography is not immediately planned[13] *(SE diversion not required)*
    - Nonsustained VT, multiple episodes, each ≥ 3 beats at ≥ 100 bpm, or frequent PVCs (defined as greater than or equal to 30/hour on remote monitoring) without known cause or associated cardiac pathology, when an exercise ECG cannot be performed[14]
- Prior to initiation of Class IC antiarrhythmic drug initiation (Propafenone or Flecainide), as well as annually in intermediate and high global risk patients *(SE diversion not required)* [15]
- Assessment of hemodynamic significance of one of the following documented conditions:
    - Anomalous coronary arteries[16]
    - Myocardial bridging of coronary artery
- Coronary aneurysms in Kawasaki's disease[17] or due to atherosclerosis
- Following radiation therapy to the anterior or left chest, at 5 years post initiation and every 5 years thereafter[18]
- Cardiac sarcoidosis: as a combination study with Heart PET for the evaluation and treatment of cardiac sarcoidosis.[19]
- Cardiac amyloidosis: for the diagnosis of cardiac transthyretin amyloidosis (ATTR). **Not** to be used for the diagnosis of cardiac light chain amyloidosis (AL)[20]

PRIOR TO ELECTIVE NON-CARDIAC SURGERY IN ASYMPTOMATIC PATIENT

- An intermediate or high risk surgery with of one or more risk factors (see below), AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year[21-23]
    - **Risk factors:** history of ischemic heart disease, history of congestive heart failure, history of cerebrovascular disease, preoperative treatment with insulin, and preoperative serum creatinine >2.0 mg/dL.
    - **Surgical Risk:**
        - **High risk surgery:** Aortic and other major vascular surgery, peripheral vascular surgery, anticipated prolonged surgical procedures associated with large fluid shifts and/or blood loss
        - **Intermediate risk surgery:** Carotid endarterectomy, head and neck surgery, intraperitoneal and intrathoracic surgery, orthopedic surgery, prostate surgery

        - **Low risk surgery**: Endoscopic procedures, superficial procedure, cataract surgery, breast surgery
- Planning for any organ or stem cell transplantation is an indication for preoperative MPI, if there has not been a conclusive stress evaluation, CTA, or heart catheterization within the past year, at the discretion of the transplant service. [3, 24]

POST CARDIAC TRANSPLANT *(SE diversion not required)*

- Annually, for the first five years post cardiac transplantation, in a patient not undergoing invasive coronary arteriography
- After the first five years post cardiac transplantation, patients with documented transplant coronary vasculopathy can be screened annually unless invasive coronary arteriography is planned

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BACKGROUND

This guideline is for stress imaging, specifically myocardial perfusion imaging (MPI), with appropriate preference for alternatives, such as stress echocardiography (SE) or stress ECG alone when more suitable (see section below).

Radionuclide myocardial perfusion imaging (MPI) allows for evaluation of cardiac perfusion at rest and at exercise, as well as using pharmacologic agents for the diagnosis and management of coronary artery disease. With radionuclide MPI, pharmacologic stress may be performed with an inotropic agent or vasodilator. These agents are indicated for patients who cannot reach an adequate endpoint with physical exercise stress testing.[25]

Stable patients without known CAD fall into 2 categories[1, 3, 4]:

- **Asymptomatic**, for whom global risk of CAD events can be determined from coronary risk factors, using calculators available online (see Websites for Global Cardiovascular Risk Calculators section).
- **Symptomatic,** for whom we estimate the pretest probability that their chest-related symptoms are due to clinically significant CAD (below):

The 3 Types of Chest Pain or Discomfort

- **Typical Angina (Definite)** is defined as including all **3** characteristics:
    - Substernal chest pain or discomfort with characteristic quality and duration
    - Provoked by exertion or emotional stress
    - Relieved by rest and/or nitroglycerine
- **Atypical Angina (Probable)** has only **2** of the above characteristics
- **Nonanginal Chest Pain/Discomfort** has only **0 - 1** of the above characteristics

The medical record should provide enough detail to establish the type of chest pain. From those details, The Pretest Probability of obstructive CAD is estimated from the Diamond Forrester Table below, recognizing that in some cases multiple additional coronary risk factors could increase pretest probability[1, 4]:

Diamond Forrester Table

Age (Years)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain
≤ 39	Men	Intermediate	Intermediate	Low
	Women	Intermediate	Very low	Very low
40-49	Men	High	Intermediate	Intermediate
	Women	Intermediate	Low	Very low
50-59	Men	High	Intermediate	Intermediate
	Women	Intermediate	Intermediate	Low
≥ 60	Men	High	Intermediate	Intermediate
	Women	High	Intermediate	Intermediate

- **Very low:** < 5%pretest probability of CAD, usually not requiring stress evaluation
- **Low:** 5 - 10% pretest probability of CAD
- **Intermediate:** 10% - 90% pretest probability of CAD
- **High:** > 90% pretest probability of CAD

OVERVIEW

MPI may be performed without diversion to a SE in any of the following[4, 26]:

- Inability to Exercise
    - Physical limitations precluding ability to exercise for at least 3 full minutes of Bruce protocol
    - Limited functional capacity (< 4 METS) **such as one** of the following:
        - Unable to take care of their ADLs or ambulate
        - Unable to walk 2 blocks on level ground
        - Unable to climb 1 flight of stairs
- Other Comorbidities
    - Severe chronic obstructive pulmonary disease (COPD) with pulmonary function test (PFT) documentation, severe shortness of breath on minimal exertion, or requirement of home oxygen during the day
    - Poorly controlled hypertension, with systolic BP > 180 or diastolic BP > 120 (and clinical urgency not to delay MPI)
- ECG and Echo-Related Baseline Findings

    - Prior cardiac surgery (coronary artery bypass graft or valvular)
    - Documented poor acoustic imaging window
    - Left ventricular ejection fraction ≤ 40%
    - Pacemaker or ICD
    - Persistent atrial fibrillation
    - Resting wall motion abnormalities that would make SE interpretation difficult
    - Complete left bundle branch block (LBBB)
- Risk-Related scenarios
    - High pretest probability in suspected CAD
    - Intermediate or high global risk in patients requiring type IC antiarrhythmic drugs (prior to initiation of therapy and annually)
    - Arrhythmia risk with exercise
- Previously unevaluated pathologic Q waves (in two contiguous leads) defined as the following:
    - > 40 ms (1 mm) wide
    - > 2 mm deep
    - > 25% of depth of QRS complex

ECG Stress Test Alone versus Stress Testing with Imaging

Prominent scenarios suitable for an ECG stress test WITHOUT imaging (i.e., exercise treadmill ECG test) require that the patient can exercise for at least 3 minutes of Bruce protocol with achievement of near maximal heart rate **AND** has an interpretable ECG for ischemia during exercise[4]:

- The (symptomatic) low or intermediate pretest probability patient who can exercise and has an interpretable ECG[4]
- The patient who is under evaluation for exercise-induced arrhythmia
- The patient who requires an entrance stress test ECG for a cardiac rehab program or for an exercise prescription
- For the evaluation of syncope or presyncope during exertion[27]

Duke Exercise ECG Treadmill Score[28]

Calculates risk from ECG treadmill alone**:**

- The equation for calculating the Duke treadmill score (DTS) is: DTS = exercise time in minutes - (5 x ST deviation in mm or 0.1 mV increments) - (4 x exercise angina score), with angina score being 0 = none, 1 = non-limiting, and 2 = exercise-limiting
- The score typically ranges from - 25 to + 15. These values correspond to low-risk (with a score of ≥ + 5), intermediate risk (with scores ranging from - 10 to + 4), and high-risk (with a score of ≤ - 11) categories

An uninterpretable baseline ECG includes[1]:

- ST segment depression 1 mm or more; (not for non-specific ST- T wave changes)
- Ischemic looking T waves; at least 2.5 mm inversions (excluding V1 and V2)

- LVH with repolarization abnormalities, pre-excitation pattern such as WPW, ventricular paced rhythm, or LBBB
- Digitalis use with associated ST segment abnormalities
- Resting HR under 50 bpm on a medication, such as beta-blockers or calcium channel blockers, that is required for patient's treatment and cannot be stopped, with an anticipated suboptimal workload

Global Risk of Cardiovascular Disease

Global risk of CAD is defined as the probability of manifesting cardiovascular disease over the next 10 years and refers to **asymptomatic** patients without known cardiovascular disease. It should be determined using one of the risk calculators below. A high risk is considered greater than a 20% risk of a cardiovascular event over the ensuing 10 years. **High global risk by itself generally lacks scientific support as an indication for stress imaging.** There are rare exceptions, such as patients requiring IC antiarrhythmic drugs who might require coronary risk stratification prior to initiation of the drug.

- **CAD Risk—Low**
  10-year absolute coronary or cardiovascular risk less than 10%.
- **CAD Risk—Moderate**
  10-year absolute coronary or cardiovascular risk between 10% and 20%.
- **CAD Risk—High**
  10-year absolute coronary or cardiovascular risk of greater than 20%.

Websites for Global Cardiovascular Risk Calculators*[29-33]

Risk Calculator	Websites for Online Calculator
Framingham Cardiovascular Risk	https://reference.medscape.com/calculator/framingham-cardiovascular-disease-risk
Reynolds Risk Score Can use if no diabetes Unique for use of family history	http://www.reynoldsriskscore.org/
Pooled Cohort Equation	http://clincalc.com/Cardiology/ASCVD/PooledCohort.aspx?example
ACC/AHA Risk Calculator	http://tools.acc.org/ASCVD-Risk-Estimator/
MESA Risk Calculator With addition of Coronary Artery Calcium Score, for CAD-only risk	https://www.mesa-nhlbi.org/MESACHDRisk/MesaRiskScore/RiskScore.aspx

*Patients who have already manifested cardiovascular disease are already at high global risk and are not applicable to the calculators.

Definitions of Coronary Artery Disease[1, 3, 6, 34]

Percentage stenosis refers to the reduction in diameter stenosis when angiography is the method and can be estimated or measured using angiography or more accurately measured with intravascular ultrasound (IVUS).

- Coronary artery calcification is a marker of risk, as measured by Agatston score on coronary artery calcium imaging. Its incorporation into global risk can be achieved by using the MESA risk calculator.
- Ischemia-producing disease (also called hemodynamically or functionally significant disease, for which revascularization might be appropriate) generally implies at least one of the following:
    - Suggested by percentage diameter stenosis ≥ 70% by angiography; intermediate lesions are 50 – 69%[35]
    - For a left main artery, suggested by a percentage stenosis ≥ 50% [1, 36, 37]
    - FFR (fractional flow reserve) ≤ 0.80 for a major vessel[36, 37]
    - Demonstrable ischemic findings on stress testing (ECG or stress imaging), that are at least mild in degree
- FFR (fractional flow reserve) is the distal to proximal pressure ratio across a coronary lesion. Less than or equal to 0.80 is considered a significant reduction in coronary flow.

Anginal Equivalent[1, 27]

Development of an anginal equivalent (e.g., shortness of breath, fatigue, or weakness) either with or without prior coronary revascularization should be based upon the documentation of reasons to suspect that symptoms other than chest discomfort are not due to other organ systems (e.g., dyspnea due to lung disease, fatigue due to anemia). This may include respiratory rate, oximetry, lung exam, etc. (as well as d-dimer, chest CT(A), and/or PFTs, when appropriate), and then incorporated into the evaluation of coronary artery disease as would chest discomfort. Syncope per se is not an anginal equivalent.

Abbreviations

ADLs	Activities of daily living
BSA	Body surface area in square meters
CABG	Coronary artery bypass grafting
CAD	Coronary artery disease
CMR	Cardiac magnetic resonance imaging
CTA	Computed tomography angiography
ECG	Electrocardiogram
FFR	Fractional flow reserve
IVUS	Intravascular ultrasound
LBBB	Left bundle-branch block
LVEF	Left ventricular ejection fraction
LVH	Left ventricular hypertrophy
MI	Myocardial infarction
MET	Estimated metabolic equivalent of exercise
MPI	Myocardial perfusion imaging
PCI	Percutaneous coronary intervention
PFT	Pulmonary function test
PVCs	Premature ventricular contractions
SE	Stress echocardiography
THR	Target heart rate
VT	Ventricular tachycardia
VF	Ventricular fibrillation
WPW	Wolf Parkinson White

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POLICY HISTORY

Date	Summary
May 2023	• Removed time limitation "within past two years" for further evaluation inconclusive prior CAD evaluation • Added coronary stenosis of unclear significance on coronary angiography • Clarified indication for combination PET/MPI in evaluation of cardiac sarcoidosis • Added indication for diagnosis of ATTR amyloidosis • Added statement on clinical indications not addressed in this guideline
February 2022	• Moved the sentence regarding utilization of suitable alternatives such as Stress Echocardiography to the General Information section • Placed Link to Overview Section in General Information • Clarified evaluation of possible ischemia in newly diagnosed heart failure by stating "with reasonable suspicion of cardiac ischemia (prior events, risk factors, or symptoms and signs)" • Clarified "intermediate lesions are 50-69%" for ischemia-producing disease • Added stress imaging approval for calcium score > 100 with low to intermediate probability symptoms • Deleted the requirement for diabetes when calcium score > 400 for stress imaging • Deleted "≤50%" from "LVEF ≤50% requiring myocardial viability assessment to assist with decisions regarding coronary revascularization" • Added Calcium score section: o Added stress imaging approval for calcium score > 100 with symptoms consistent with low to intermediate pretest probability • Added reminder *(SE diversion not required for CABG)* • Changed preoperative guideline to include intermediate risk surgery with one or more risk factors AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year • Changed solid organ transplant guideline to include stem cell transplant and "any" organ transplant • Added definition of surgical risk to preop guidelines • In Background section clarified the requirement for description of chest pain by adding sentence "The medical record should provide enough detail to establish the type of chest pain." • Added definition of Q waves

	• Deleted sentence regarding calcium scoring within the Global Risk Section • Deleted sentence regarding using calcium score solely for risk stratification • Deleted IFR references

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **HEART (Cardiac) PET**	**Original Date: July 1999**
CPT Codes: 78459, 78491, 78492, +78434	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_072	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

This guideline is for stress imaging, specifically Heart (Cardiac) PET imaging, with appropriate preference for suitable alternatives, such as stress echocardiography (SE) or myocardial perfusion imaging (MPI), when more suitable, unless otherwise stated (refer to Background section).

INDICATIONS FOR HEART PET[1-4]

SUSPECTED CAD (When neither SE nor MPI have provided or are expected to provide optimal imaging)

- **Symptomatic patients without known CAD (use Diamond Forrester Table)**
  - Low or intermediate pretest probability and unable to exercise *(SE diversion not required)*
  - High pretest probability *(SE diversion not required)*
  - Repeat testing in a patient with new or worsening symptoms and negative result at least one year ago **AND** meets one of the criteria above
- **Asymptomatic patients without known CAD** *(SE diversion not required)*
  - Previously unevaluated ECG evidence of possible myocardial ischemia including substantial ischemic ST segment or T wave abnormalities (see section in Background)

- Previously unevaluated pathologic Q waves (see section in Background)
- Unevaluated complete left bundle branch block

ABNORMAL CALCIUM SCORES (CAC)[3, 5-8] (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)

- ASYMPTOMATIC patient with a calcium score >400, not previously evaluated
- SYMPTOMATIC patient with prior CAC ≥ 100

INCONCLUSIVE CAD EVALUATION AND OBSTRUCTIVE CAD REMAINS A CONCERN (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)

- Exercise stress ECG with low-risk Duke treadmill score (≥5) (see section in Background) but patient's current symptoms indicate an intermediate or high pretest probability *(SE diversion not required for high pretest probability)*
- Exercise stress ECG with an intermediate Duke treadmill score (*SE diversion not required for symptoms consistent with high pretest probability*)
- Inconclusive/borderline coronary computed tomography angiography (CCTA) (e.g., 40 - 70% lesions)
- Non-diagnostic exercise stress test with physical inability to achieve target heart rate (THR) *(SE diversion not required)*
- An intermediate evaluation by prior stress imaging () *(SE diversion not required)*
- Coronary stenosis of unclear significance on previous coronary angiography[3]

FOLLOW-UP OF PATIENT'S POST CORONARY REVASCULARIZATION (PCI or CABG) (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)[3]

- **Asymptomatic, follow-up stress imaging** at a minimum of 2 years post coronary artery bypass grafting (CABG), or percutaneous coronary intervention (PCI), (whichever is later), is appropriate only for patients with a history of silent ischemia or a history of a prior left main stent

  OR

- For patients with high occupational risk (e.g., associated with public safety, airline and boat pilots, bus and train drivers, bridge and tunnel workers/toll collectors, police officers, and firefighters)

New, recurrent, or worsening symptoms post coronary revascularization are an indication for stress imaging, if it will alter management (SE diversion not required for typical anginal symptoms or symptoms documented to be similar to those prior to revascularization)

FOLLOW-UP OF KNOWN[3] CAD (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)

- **Follow-up of asymptomatic or stable symptoms** when last invasive or non-invasive assessment of coronary disease showed hemodynamically significant CAD (ischemia on stress test or FFR ≤ 0.80 or significant stenosis in a major vessel (≥ 50% left main coronary artery or ≥ 70% LAD, LCX or RCA)), over two years ago, without intervening coronary revascularization is an appropriate indication for stress imaging in patients if it will alter management

SPECIAL DIAGNOSTIC CONDITIONS REQUIRING CORONARY EVALUATION (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)

- Prior acute coronary syndrome (as documented in MD notes), without subsequent invasive or non-invasive coronary evaluation
- Newly diagnosed systolic heart failure or diastolic heart failure, *with reasonable suspicion of cardiac ischemia (prior events, risk factors*), unless invasive coronary angiography is immediately planned[2, 9, 10]
- Reduced LVEF ≤ 50% requiring myocardial viability assessment to assist with decisions regarding coronary revascularization. (Diversion from PET not required when LVEF less than or equal to 40%)[9-11]
- Ventricular arrhythmias
    - Sustained ventricular tachycardia (VT) > 100 bpm, ventricular fibrillation (VF), or exercise-induced VT, when invasive coronary arteriography is not the immediately planned test[12]
    - Nonsustained VT, multiple episodes, each ≥ 3 beats at ≥ 100 bpm, frequent PVC's (defined as greater than or equal to 30/hour on remote monitoring) without known cause or associated cardiac pathology, when an exercise ECG cannot be performed
- Prior to Class IC antiarrhythmic drug initiation (Propafenone or Flecainide), as well as annually in intermediate and high global risk patients (SE diversion not required)[13]
- Assessment of hemodynamic significance of one of the following documented conditions[14]:
    - Anomalous coronary arteries[15]
    - Muscle bridging of coronary artery [3, 16]
- Coronary aneurysms in Kawasaki's disease[17] or due to atherosclerosis
- Following radiation therapy to the anterior or left chest, at 5 years post initiation and every 5 years thereafter[18]
- To diagnose microvascular dysfunction in patients with persistent stable anginal chest pain with suspected ischemia and nonobstructive coronary artery disease (INOCA), as documented in provider notes (*no MPI diversion required*).
- **Cardiac Sarcoidosis[19-21]** (may be approved as a combination study with MPI for the evaluation and treatment of sarcoidosis)[22]

    - Evaluation and therapy monitoring in patients with sarcoidosis, after documentation of suspected cardiac involvement by echo or ECG, when CMR has not been performed
    - Evaluation of suspected cardiac sarcoid, after CMR has shown equivocal or negative findings in the setting of a high clinical suspicion[21]
    - Evaluation of CMR findings showing highly probable cardiac sarcoidosis, when PET could serve to identify inflammation and the consequent potential role for immunosuppressive therapy[21]
    - Initial and follow-up PET in monitoring therapy for cardiac sarcoid with immunosuppressive therapy, typically about 4 times over 2 years
- **Infective Endocarditis**
    - In suspected infective endocarditis with moderate to high probability (i.e., staph bacteremia, fungemia, prosthetic heart valve, or intracardiac device), when TTE and TEE have been inconclusive with respect to diagnosis of infective endocarditis or characterization of paravalvular invasive complications[23, 24]
- **Aortitis**
    - For diagnosis and surveillance of Aortitis, PET/CT or PET/MRI‡ hybrid imaging[25]
      ‡**NOTE:** If PET/MR study is requested, there is no specific CPT Code for this imaging study and a Health Plan review will be required.

PRIOR TO ELECTIVE NON-CARDIAC SURGERY (When neither SE nor MPI have provided or are expected to provide optimal imaging)

- An intermediate or high risk surgery with of one or more risk factors (see below), AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year[26-28]
    - **Risk factors:** history of ischemic heart disease, history of congestive heart failure, history of cerebrovascular disease, preoperative treatment with insulin, and preoperative serum creatinine >2.0 mg/dL.
    - **Surgical Risk:**
        - **High risk surgery:** Aortic and other major vascular surgery, peripheral vascular surgery, anticipated prolonged surgical procedures associated with large fluid shifts and/or blood loss
        - **Intermediate risk surgery:** Carotid endarterectomy, head and neck surgery, intraperitoneal and intrathoracic surgery, orthopedic surgery, prostate surgery
        - **Low risk surgery**: Endoscopic procedures, superficial procedure, cataract surgery, breast surgery
- Planning for any organ or stem cell transplantation is an indication for preoperative stress imaging, if there has not been a conclusive stress evaluation, CTA, or heart catheterization within the past year, at the discretion of the transplant service[29]

POST CARDIAC TRANSPLANT (SE diversion not required)[30]

- Annually, for the first five years post cardiac transplantation, in a patient not undergoing invasive coronary arteriography
- After the first five years post cardiac transplantation, patients with documented transplant coronary vasculopathy can be screened annually if invasive coronary arteriography is not planned

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BACKGROUND[31, 32]

PET Scan

- Indicated when all the criteria for MPI are met **AND** there is likely to be equivocal imaging results because of BMI, large breasts or implants, mastectomy, chest wall deformity, pleural or pericardial effusion, or prior thoracic surgery or results of a prior MPI
- Can identify regions of myocardial viability with hibernating myocardium (viable, with poor flow and contractility) by imaging with fluorine18 (F-18) fluorodeoxyglucose (FDG or 18-FDG) for this purpose.
- Useful in the evaluation of inflammation: e.g., evaluation and therapy monitoring in patients with sarcoidosis, after documentation of cardiac involvement by echo or electrocardiography (ECG), in place of, or subsequent to CMR if needed to help with an uncertain diagnosis

Coronary application of PET includes evaluation of **stable patients without known CAD**, who fall into two categories[2-4]

- **Asymptomatic**, for whom global risk of CAD events can be determined from coronary risk factors, using calculators available online (see Websites for Global Cardiovascular Risk Calculators section).
- **Symptomatic,** for whom we estimate the pretest probability that their chest-related symptoms are due to clinically significant (≧ 50%) CAD (below):

The 3 Types of Chest Pain or Discomfort

- **Typical Angina (Definite)** is defined as including **all 3** characteristics:
  - Substernal chest pain or discomfort with characteristic quality and duration
  - Provoked by exertion or emotional stress
  - Relieved by rest and/or nitroglycerine
- **Atypical Angina (Probable)** has only **2** of the above characteristics
- **Nonanginal Chest Pain/Discomfort** has only **0 - 1** of the above characteristics

The medical record should provide enough detail to establish the type of chest pain. From those details, The Pretest Probability of obstructive CAD is estimated from the Diamond

Forrester Table below, recognizing that in some cases multiple additional coronary risk factors could increase pretest probability[2, 3]:

Diamond Forrester Table

Age (Years)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain
≤ 39	Men	Intermediate	Intermediate	Low
	Women	Intermediate	Very low	Very low
40 – 49	Men	High	Intermediate	Intermediate
	Women	Intermediate	Low	Very low
50 – 59	Men	High	Intermediate	Intermediate
	Women	Intermediate	Intermediate	Low
≥ 60	Men	High	Intermediate	Intermediate
	Women	High	Intermediate	Intermediate

- **Very Low:** < 5% pretest probability, usually not requiring stress evaluation
- **Low:** 5 - 10% pretest probability of CAD
- **Intermediate:** 10% - 90% pretest probability of CAD
- **High:** > 90% pretest probability of CAD

OVERVIEW

ECG Stress Test Alone versus Stress Testing with Imaging

Prominent scenarios suitable for an ECG stress test WITHOUT imaging (i.e., exercise treadmill ECG test) require that the patient can exercise for at least 3 minutes of Bruce protocol with achievement of near maximal heart rate AND has an interpretable ECG for ischemia during exercise[3]:

- The (symptomatic) low or intermediate pretest probability patient who is able to exercise and has an interpretable ECG[3]
- The patient who is under evaluation for exercise-induced arrhythmia
- The patient who requires an entrance stress test ECG for a cardiac rehab program or for an exercise prescription
- For the evaluation of syncope or presyncope during exertion[33]

Duke Exercise ECG Treadmill Score[34]

Calculates risk from ECG treadmill alone**:**

- The equation for calculating the Duke treadmill score (DTS) is: DTS = exercise time in minutes - (5 x ST deviation in mm or 0.1 mV increments) - (4 x exercise angina score), with angina score being 0 = none, 1 = non-limiting, and 2 = exercise-limiting.

- The score typically ranges from - 25 to + 15. These values correspond to low-risk (with a score of ≥ + 5), intermediate risk (with scores ranging from - 10 to + 4), and high-risk (with a score of ≤ - 11) categories.

An uninterpretable baseline ECG includes[2]:

- ST segment depression 1 mm or more (not for non-specific ST- T wave changes)
- Ischemic looking T waves; at least 2.5 mm inversions (excluding V1 and V2)
- LVH with repolarization abnormalities, pre-excitation pattern such as WPW, ventricular paced rhythm, or left bundle branch block
- Digitalis use with associated ST segment abnormalities

Previously unevaluated pathologic Q waves (in two contiguous leads) defined as the following:

- > 40 ms (1 mm) wide
- > 2 mm deep
- > 25% of depth of QRS complex

Global Risk of Cardiovascular Disease

Global risk of CAD is defined as the probability of manifesting cardiovascular disease over the next 10 years and refers to **asymptomatic** patients without known cardiovascular disease. It should be determined using one of the risk calculators below. A high risk is considered greater than a 20% risk of a cardiovascular event over the ensuing 10 years. **High global risk by itself generally lacks scientific support as an indication for stress imaging.** There are rare exceptions, such as patients requiring IC antiarrhythmic drugs who might require coronary risk stratification prior to initiation of the drug.

- **CAD Risk—Low**
  10-year absolute coronary or cardiovascular risk less than 10%
- **CAD Risk—Moderate**
  10-year absolute coronary or cardiovascular risk between 10% and 20%
- **CAD Risk—High**
  10-year absolute coronary or cardiovascular risk of greater than 20%

Websites for Global Cardiovascular Risk Calculators*[35-39]

Risk Calculator	Websites for Online Calculator
Framingham Cardiovascular Risk	https://reference.medscape.com/calculator/framingham-cardiovascular-disease-risk
Reynolds Risk Score Can use if no diabetes Unique for use of family history	http://www.reynoldsriskscore.org/

Pooled Cohort Equation	http://clincalc.com/Cardiology/ASCVD/PooledCohort.aspx?example
ACC/AHA Risk Calculator	http://tools.acc.org/ASCVD-Risk-Estimator/
MESA Risk Calculator With addition of Coronary Artery Calcium Score, for CAD-only risk	https://www.mesa-nhlbi.org/MESACHDRisk/MesaRiskScore/RiskScore.aspx

*Patients who have already manifested cardiovascular disease are already at high global risk and are not applicable to the calculators.

Definitions of Coronary Artery Disease[2, 4, 6]

Percentage stenosis refers to the reduction in diameter stenosis when angiography is the method and can be estimated or measured using angiography or more accurately measured with intravascular ultrasound (IVUS).

- Coronary artery calcification is a marker of risk, as measured by Agatston score on coronary artery calcium imaging. Its incorporation into global risk can be achieved by using the MESA risk calculator.
- Ischemia-producing disease (also called hemodynamically or functionally significant disease, for which revascularization might be appropriate) generally implies at least one of the following:
    - Suggested by percentage diameter stenosis ≥ 70% by angiography; intermediate lesions are 50 – 69%[40]
    - For a left main artery, suggested by a percentage stenosis ≥ 50% or minimum lumen cross-sectional area on IVUS ≤ 6 square mm[2, 41]
    - FFR (fractional flow reserve) ≤ 0.80 for a major vessel[41]
    - Demonstrable ischemic findings on stress testing (ECG or stress imaging), that are at least mild in degree
- A major vessel would be a coronary vessel that would be amenable to revascularization if indicated. This assessment is made based on the diameter of the vessel and/or the extent of myocardial territory served by the vessel.
- FFR (fractional flow reserve) is the distal to proximal pressure ratio across a coronary lesion during maximal hyperemia induced by either intravenous or intracoronary adenosine. Less than or equal to 0.80 is considered a significant reduction in coronary flow.
- Newer technology that estimates FFR from CCTA image is covered under the separate NIA Guideline for FFR-CT.

Anginal Equivalent[2, 33]

Development of an anginal equivalent (e.g., shortness of breath, fatigue, or weakness) either with or without prior coronary revascularization should be based upon the documentation of reasons to suspect that symptoms other than chest discomfort are not due to other organ systems (e.g., dyspnea due to lung disease, fatigue due to anemia), by presentation of clinical data, such as respiratory rate, oximetry, lung exam, etc. (as well as d-dimer, chest CT(A), and/or PFTs, when appropriate), and then incorporated into the evaluation of coronary artery disease as would chest discomfort. Most syncope per se is not an anginal equivalent.

Abbreviations

ADLs	Activities of daily living
BMI	Body mass index
CABG	Coronary artery bypass grafting
CAC	Coronary artery calcium
CAD	Coronary artery disease
CCTA	Coronary computed tomography angiography
CMR	Cardiac magnetic resonance imaging
CT(A)	Computed tomography (angiography)
DTS	Duke Treadmill Score
ECG	Electrocardiogram
FFR	Fractional flow reserve
IVUS	Intravascular ultrasound
LBBB	Left bundle-branch block
LVEF	Left ventricular ejection fraction
LVH	Left ventricular hypertrophy
MESA	Multi-Ethnic Study of Atherosclerosis
MET	Estimated metabolic equivalent of exercise
MI	Myocardial infarction
MPI	Myocardial perfusion imaging
MR(I)	Magnetic resonance (imaging)
PCI	Percutaneous coronary intervention
PET	Positron emission tomography
PFT	Pulmonary function test
PVCs	Premature ventricular contractions
SE	Stress echocardiography
TEE	Transesophageal echocardiography
THR	Target heart rate
TTE	Transthoracic echocardiography
VF	Ventricular fibrillation
VT	Ventricular tachycardia
WPW	Wolff-Parkinson-White

Policy History

Date	Summary
May 2023	• Removed time limitation "within past two years" for further evaluation inconclusive prior CAD evaluation • Added coronary stenosis of unclear significance on previous coronary angiography. • Added indication for evaluation of ischemia and nonobstructive coronary artery disease (INOCA) • Clarified indication for PET/MPI combination study for evaluation of cardiac sarcoidosis • Added statement on clinical indications not addressed in this guideline
February 2022	• Moved the sentence regarding utilization of suitable alternatives such as Stress Echocardiography to the General Information section • Clarified "intermediate lesions are 50-69%" for ischemia-producing disease • Clarified evaluation of possible ischemia in newly diagnosed heart failure by stating *"with reasonable suspicion of cardiac ischemia (prior events, risk factors, or symptoms and signs)"* • Placed Link to Overview Section in General Information • Added stress imaging approval for calcium score > 100 with low to intermediate probability symptoms • Deleted the requirement for diabetes when calcium score > 400 for stress imaging • Added Calcium score section: o Added stress imaging approval for calcium score > 100 with symptoms consistent with low to intermediate pretest probability • Added reminder *(SE diversion not required for CABG)* • Changed preoperative guideline to include intermediate risk surgery with one or more risk factors AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year • Changed solid organ transplant guideline to include stem cell transplant and "any" organ transplant • Added definition of surgical risk to preop guidelines • In Background section clarified the requirement for description of chest pain by adding sentence "The medical record should provide enough detail to establish the type of chest pain. " • Added definition of Q waves

	• Deleted sentence regarding calcium scoring within the Global Risk Section • Deleted sentence regarding using calcium score solely for risk stratification • Deleted redundant statement on viability • Deleted IFR references

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*National Imaging Associates, Inc.	
Clinical guidelines **MUGA (Multiple Gated Acquisition) Scan**	**Original Date: September 1997**
CPT Codes: 78472, 78473, 78494, +78496	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_027	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

Indications for Multiple Gated Acquisition (MUGA) Scan[1]

- To evaluate left ventricular function in a patient with coronary artery disease, valvular heart disease, myocardial disease, or congenital heart disease, in any of the following scenarios:
    - When ventricular function is required for management, and transthoracic echocardiography (TTE) or other imaging has proven inadequate[2, 3]
    - When there are conflicting results between other testing (i.e., Myocardial Perfusion Imaging and TTE) in the measurement of ejection fraction (EF), and the results of the MUGA will help in the management of the patient
    - Prior TTE has demonstrated systolic dysfunction (EF < 50%) and management will change based on the results of the MUGA scan
- In the course of treatment with cardiotoxic medication when TTE images are inadequate to evaluate left ventricular systolic function[2-6]:
    - Baseline assessment prior to initiation of therapy
    - Monitoring during therapy. The frequency of testing should be left to the discretion of the ordering provider but in the absence of new abnormal findings, generally no more often than every 6 weeks while on active therapy

- Long term surveillance after completion of therapy may be required, especially for those who have been exposed to anthracycline medication. The frequency of testing is generally every 6-12 months, or at the discretion of the provider

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BACKGROUND[2, 7-9]

Multiple-gated acquisition (MUGA) scanning uses radiolabeled red blood cells to scan right and left ventricular images in a cine loop format that is synchronized with the electrocardiogram.

A prior MUGA scan is not an indication for repeat MUGA (if another modality would be suitable, i.e., TTE).

Abbreviations

EF	Ejection Fraction
MUGA	Multiple Gated Acquisition (nuclear scan of ventricular function)
TTE	Transthoracic echocardiography

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POLICY HISTORY

Date	Summary
April 2023	• Added statement on clinical indications not addressed in this guideline
February 2022	No significant changes

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*National Imaging Associates, Inc.	
Clinical guidelines **BRAIN PET SCAN**	**Original Date: July 1999**
CPT Codes: 78608, 78609	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_071	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR BRAIN PET SCAN

Known brain tumor or cancer[1, 2] when brain MRI is indeterminant or insufficient to:

- Differentiate radiation necrosis or post-treatment change from residual/recurrent tumor
- Differentiate low from high grade glioma
- Evaluation of primary brain lymphoma
- Evaluation of meningiomas (FDG or SSTR analogs (such as GA-68 Dotatate))
- To guide intervention/biopsy

To determine operability of refractory seizures[3-5]

Post-treatment/procedural evaluation

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed.

Mild Cognitive Impairment or Dementia[6]

- For the detection of early Alzheimer's disease†;
- For the differentiation between Alzheimer's disease, dementia with Lewy body disease (DLB)

and frontotemporal lobar degeneration (FTD)†; or

- To assess for the presence of beta amyloid plaque in Alzheimer's disease when being considered for treatments that target beta-amyloid plaque (such as Aduhelm)†

†Note: **AFTER** an initial insufficient evaluation with a Brain MRI‡ and the following 2 criteria have been met[7, 8]:

- Objective cognitive impairment[9, 10] has been demonstrated by:
  - Either by Mini Mental Status Evaluation (MMSE) or Montreal Cognitive Assessment (MoCA) less than 26[11]
  - **OR** by Neuropsychological testing showing at least mild cognitive impairment[12, 13]
- Potential treatable causes have been assessed and addressed,[9] such as:
  - Metabolic causes, such as thyroid or vitamin deficiency, anemia, or toxic metabolic encephalopathy
  - Medication side effects[14]
  - Medical causes, such as vascular or traumatic or inflammatory

‡**Note:** Brain CT is acceptable if brain MRI is contraindicated. However, Brain CT cannot be substituted for MRI when Brain PET is requested for evaluation of amyloid plaque because MRI is a prerequisite to beta-amyloid targeted treatment.

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BACKGROUND

Positron Emission Tomography (PET) scanning can be used to assesses brain metabolism and perfusion. Uses include identifying epileptic foci prior to surgery, differentiation of residual tumor versus scar, helping differentiate inconclusive findings on Brain MRI and identifying causes of cognitive decline.[15]

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POLICY HISTORY

Date	Summary
May 2023	• Added that Dotatate is now FDA approved for meningioma imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Additional resources removed
May 2022	• Updated references and background • Removed FDG from Indications title • Added meningioma when MR is inconclusive

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines: **Single Photon Emission Computed Tomography (SPECT), including** • **Bone/Joint** • **Non-Bone Infection/Inflammation** • **Tumor** • **Cardiac** • **Neck** • **Lung** • **Brain** • **Radionuclide Cisternography (CSF)** • **Renal** • **Abdomen/Pelvis**	**Original Date: July 2008**
CPT Codes: **78803 (SPECT), Single Area, single day** **78830 – SPECT/CT, single area, single day** **78831 – SPECT, multiple areas** **78832 – SPECT/CT, multiple areas** **78835 – Radiopharmaceutical quantification measurement**	**Last Revised Date: May 2023**
Guideline Numbers: NIA_CG_078	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

SPECT: Single-Photon Emission Computed Tomography (SPECT) is a nuclear medicine imaging technique used to localize data from gamma ray emitting injected radiopharmaceuticals to specific anatomical locations within the patient. The resulting 3D images can be reconstructed in multiple planes much like a CT scan uses XR, SPECT utilizes nuclear scintigraphy. The ability to manipulate the imaging data into distinct multiplanar slices improves the diagnostic capability and spatial resolution while using the same pharmaceutical as with traditional planar bone scan. Radiopharmaceuticals used vary based on the clinical indication. The technique is applied in brain, cardiac, pulmonary, abdominal, endocrine, and musculoskeletal imaging.

SPECT can be used localize a tumor, inflammatory process, or radioactive tracer distribution. Vascular flow and blood pool imaging are included if performed. The 78803 code represents single–day imaging of a single area, such as the head, neck, chest, or pelvis, or a single acquisition on one day.

SPECT/CT: (Single-photon emission computed tomography combined with Computed Tomography) is now available in many places. The CT portion helps correct the attenuation (decrease) of photons from the target as they get absorbed/reflected by the soft tissues before reaching the detector. CT helps with anatomic localization much like the CT of PET/CT.

When SPECT/CT is requested, additional CT approvals are NOT needed/provided (unless approvable for other separate indications per guidelines for that body part). The CT portion of a SPECT/CT is included in the specific CPT (i.e., 78830 – SPECT/CT, single area, single day and 78832 – SPECT/CT, multiple areas).

This guideline includes both to SPECT and SPECT/CT when routine dynamic and planar imaging is, or is projected to be, insufficient for the following indications (select 'ctrl' then 'left click' to jump to section)[1-6]:

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BONE/JOINT

MALIGNANCY

Note: For known bone metastases, whole body planar bone scan for staging and restaging is typically sufficient

- Screening evaluation of patients with malignancy presenting with elevated alkaline phosphatase, bone pain, or new pathological fracture
- Staging or Restaging evaluation when recent overlapping whole-body imaging (CT or PET/CT of the neck, chest, abdomen and pelvis) has not been performed, cannot be performed, or is inconclusive in evaluation of bone metastases
- Staging and restaging for radionuclide bone therapy for predominant bone metastases

INFECTION

- Osteomyelitis: a plain x-ray **AND** an MRI of the area have been performed, unless MRI is contraindicated, technically limited or inconclusive[5, 6]
- Discitis: MRI is contraindicated, technically limited or inconclusive

BONE VIABILITY

- Detection of early avascular necrosis, bone infarct, or bone graft viability when patient has had a plain x-ray; and MRI is contraindicated or inconclusive[7]

TRAUMA

- Extremities: Detection of stress fractures and other occult skeletal trauma when there is persistent pain in the suspected area after negative or inconclusive x-ray and MRI[8]
- Spine:
    - For indications such as spondylolysis or determination of age of fracture after CT/MRI is inconclusive[9]
    - Spondylolysis evaluation in a child, with persistent pain after MRI and conservative treatment, in determining further treatment plan[10, 11]

INCONCLUSIVE

- Inconclusive MRI/CT

- Identification of a primary etiology (via most reactive/ inflammatory changes) when multiple etiologies are identified by MRI/CT, **AND** intervention planning is needed (includes primary facet joint target localization)[9, 12-16]

POSTOPERATIVE

- Evaluation of persistent symptoms in postoperative spine/joints/bones, after X-ray and CT are negative/inconclusive[9, 17-22]

EXTREMITIES

- For evaluation of unexplained extremity pain when clinical criteria and other imaging (x-ray, **AND** MRI/ Ultrasound/ CT) evaluation is inconclusive (e.g., differentiating complex regional pain syndrome from other causes of pain)[23-26]

FOLLOW-UP

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

NOTE: Inconclusive includes the scenario when imaging findings do not explain patient clinical symptoms or lack of treatment efficacy.

BONE SPECT: Due to advances in cross-sectional imaging, the technique currently has limited indications for detecting bone pathology. It is most used in patients who have been found to have an unexpected single area abnormality on a planar (screening) bone scan. It is also used in those who cannot undergo MRI or CT imaging or to clarify the findings on MRI or CT. Although vast majority of bone scan indications have been replaced by MRI or CT over the decades, the recent advent of SPECT has shown comparable or complementary performance versus MRI for some indications as those listed above.[23, 24, 27, 28] For patients with impaired renal function who cannot receive iodinated or gadolinium-based contrast agents or undergo MRI for other reasons, SPECT imaging can improve the performance of conventional planar nuclear bone imaging.

TRACERS: Nuclear medicine bone imaging is commonly performed with Technetium-99m-MDP (methylene diphosphonate). For indications such as infection or inflammation, Indium-111/ Technetium-99m-HMPAO (hexamethylpropyleneamine oxime) labelled white blood cells, or Gallium-67 (for spine/sternum) can be used. Gallium is typically used for discitis evaluation, and imaging can be carried out to 2-3 days post tracer injection for better target-to-background ratio. Technetium-99m sulfur colloid scan is typically used concordantly for marrow mapping, to distinguish bone marrow from infection site.

Although 18F-labelled sodium fluoride (NaF) PET scanning is highly sensitive for detecting bone lesions, its routine use has not replaced conventional bone scanning due to the latter's "effectiveness, widespread availability, low cost and favorable dosimetry".[4] If a bone SPECT is not sufficient, specific PET tracers that detect both soft tissue and bone metastases (e.g., F18-FDG, F18- Fluciclovine, Ga68-Dotatate) have replaced largely the need for a separate NaF PET.

CRPS: In the evaluation of complex regional pain syndrome (CRPS), formerly reflex sympathetic dystrophy, three phase bone scintigraphy (flow, blood pool, and delayed images) and MRI imaging sensitivities reported in the medical literature, ranges widely.[26] In general, scintigraphy is more specific than MRI. SPECT imaging, however, is not routinely used for this indication.

NON-BONE INFECTION / INFLAMMATION

When primary standard modality of CT / CTA / MRI / Ultrasound are inconclusive, limited, or cannot be done,[29] including:

- Fever of Unknown Origin when CT/MR are negative/inconclusive/limited
- Non-bone infection/inflammation when primary standard imaging is negative/ inconclusive, including infections related to
    - Transplant and vascular grafts when ultrasound / CTA are negative/inconclusive/limited[30, 31]
    - Prosthetic valves when echocardiography AND Coronary CTA are inconclusive[32]
    - Cardiac implantable devices when echocardiography is inconclusive[32]

BACKGROUND

Infection-seeking tracers labelled with single-photon-emitting radionuclides include autologous leukocytes [white blood cells (WBC)] labelled with 99mTc-hexamethylpropyleneamine oxime (HMPAO) or 111In-diethylenetriaminepentaaceticacid (DTPA). Imaging is typically completed the same day (for Technetium-Tc labelled agents) or the 2nd day (for Indium-labelled agents). SPECT localizes the infection agent accumulation to the anatomic site more precisely than does planar imaging. The tracer activity is not affected by artifact from implants and devices. They are typically used when other modalities such as CT or MRI have not yielded conclusive results or have not explained clinical status.

For infections related to vascular grafts, nuclear medicine modalities are particularly useful to mapping the extent of the infection (focal uptake) for surgical planning. Primary imaging is first done with ultrasound for extracavitary graft and CTA for intracavitary graft.[30]

TUMOR

- Iodine imaging for subsequent post thyroidectomy staging of differentiated thyroid cancers, in the setting of[33]:

- Post thyroidectomy neck CT/MR showing residual unresectable thyroid tissue/ disease in the neck
- Distant metastases as seen on CT/MR
- Post thyroidectomy unstimulated thyroglobulin > 5-10ng/ml
- Radioactive iodine therapy is being considered for high risk or recurrent tumor
- Post radioiodine treatment (post therapy scan)
- During surveillance, with rising thyroglobulin or stable / rising antithyroglobulin antibodies or abnormal ultrasound neck

Note: Refer to neck for thyroid nodules

- For initial or restaging of Neuroendocrine tumors (typically In111-octreotide and Iodine-123 MIBG), for any part of the body,[34]
  - When CT/MRI OR PET imaging is not available, cannot be done, has contraindications, or is inconclusive
  - I-131 MIBG: when I131 MIBG therapy is being considered
  - In111- octreotide: Somatostatin analog therapy is being considered and Ga68 Dotatate PET is not available
- Imaging during / post therapy with therapeutic agents such as 131 Iodine, 177Lu-Dotatate, 111In Zevalin, when it can change management
- Lymphoscintigraphy with sentinel node localizations, for preoperative planning in melanoma, breast, head and neck, and gynecological cancers

BACKGROUND

Thyroid cancers are imaged by Iodine-123 or Iodine-131 tracers. Prior to treatment, sometimes a whole body I-123 imaging may be done if it is an aggressive cancer or if there is a suspicion of metastases. Whole body imaging with I-131 is acquired up to 10 days post therapeutic dosage with I-131 for thyroid cancers. Subsequent surveillance is done by monitoring thyroglobulin, thyroglobulin antibodies, and ultrasound neck. If there is concern for recurrence, typically whole body I-123 or I-131 imaging is done. SPECT is then done of the neck and of any other areas that need clarification on planar imaging.

Indium octreotide and Iodine MIBG (meta-iodobenzylguanidine) imaging are used to assess neuroendocrine tumors for somatostatin (SSTR) receptors to enable treatment with somatostatin analogs, such as octreotide acetate (Sandostatin).

177Lu-Dotatate is a treatment for neuroendocrine cancers that have SSTR expression as seen on Gallium-68 PET or Indium-111 pentetreotide/Octreotide imaging. 90Y-ibritumomab tiuxetan (or Zevalin®) is used as treatment for refractory non-Hodgkin's lymphoma and may need initial biodistribution assessment with Indium-111 ibritumomab tiuxetan. Therapeutic agents have gamma or bremsstrahlung radiation that can be harnessed to image and evaluate the biodistribution of the therapeutic tracer.

Lymphoscintigraphy with sentinel node mapping is often used in early-stage breast, melanoma, and gynecological cancers immediately prior to surgical resection of primary lesion. This evaluates initial lymph nodes draining the target region. These lymph nodes are resected during surgery to evaluate for possible involvement, in which case the cancer is upstaged.

CARDIAC

See MPI and MUGA guidelines.

NECK (NON-CANCER)

- Parathyroid adenoma: Clinically or laboratory proven hyperparathyroidism AND ultrasound of the neck has been completed. If CT is already done, it should be inconclusive.[35]
- Thyroid: Abnormal thyroid function tests and planar imaging is inconclusive for the location of a focal thyroid lesion.

BACKGROUND

Parathyroid adenomas are evaluated typically initially by cervical ultrasound. Parathyroid SPECT with Tc99m sestamibi or Iodine and sestamibi tracer combo has similar diagnostic performance to 4D-CT with less radiation dose.

Thyroid disorders that are diffuse typically do not need SPECT imaging. However, it may be needed in cases of differentiation of a single cold nodule in the background of multinodular goiter to direct biopsy. Iodine-123 tracer is typically used for these.

LUNG

- Quantification of lung function prior to lung resection/radiation
- Evaluation of congenital cardiac, thoracic, or pulmonary disease, or lung transplants or bronchopleural fistulae[36]
- Chronic thromboembolic pulmonary hypertension
- Suspected acute pulmonary embolism with comorbidities (such as COPD, left heart failure, pneumonia, tumor) AND chest x-ray has been performed, AND chest CTA cannot be performed or limited
- Calculation of lung shunt fraction prior to hepatic radioembolization

BACKGROUND

Ventilation perfusion scans are typically done for pulmonary embolism (PE) assessment when chest CTA cannot be performed, for young patients, or in pregnancy when they have a normal

chest x-ray (due to lower radiation exposure). SPECT of the ventilation images is markedly limited in the US as the two ventilation tracers used in the US (Tc99m DTPA, Xenon) are not highly amenable to SPECT imaging. This and the overdiagnosis of small insignificant PE on SPECT, like CTA, have enabled planar images to be the preferred method of evaluation of acute PE. However, for the purposes of lung surgery evaluation, congenital heart disease, and chronic pulmonary hypertension, the lung perfusion images have more significance, and these are amenable to SPECT with further increases in sensitivity and specificity.

BRAIN [37]

- For preoperative localization of epileptic foci after EEG, Brain MRI and PET are done and insufficient[38, 39]
- DAT scan[40-42]
    - To differentiate essential tremor and drug-induced parkinsonism from parkinsonian syndromes
    - For early/inconclusive parkinsonian features
    - For dementia: differentiating Dementia with Lewy Bodies (DLB) from other dementia types. If FDG PET was completed for this indication, and was inconclusive.
- To evaluate cerebrovascular reserve in planning appropriate endovascular/vascular intervention or neurovascular surgical approach[43, 44] - can include:
    - Evaluation for vascular diseases such as Moyamoya
    - Carotid balloon occlusion
    - Hyperperfusion syndromes
    - Shunting for idiopathic normal pressure hydrocephalus[45]
- Brain perfusion study for evaluation of brain death when CT or MRI already done and planar images are inconclusive[46]
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

BACKGROUND

Injected brain tracers used include 99mTc-bicisate (ECD; ethyl cysteinate dimer), 99mTc-exametazime (HMPAO; hexamethylpropylene amine oxime), and 99mTc-pentetate (DTPA; diethylenetriaminepentaacetic acid). I123 Ioflupane is used for DAT scan (Dopamine Transporter Scan). Brain imaging is routinely performed and included with brain SPECT imaging unless it is a done for brain death.. These tracers cross the blood brain barrier where they emit gamma rays that are detected by the imaging system. A 3D image of the brain is created using computerized techniques with the degree of radionuclide activity corresponding to neuronal activity or cerebral blood flow.

Epilepsy: 15–30% of patients with refractory focal epilepsy do not have distinct lesions on MRI. The next investigation for a possible surgically resectable epileptogenic focus includes PET. If this is negative or inconclusive, ictal (during seizure) brain SPECT can be obtained, which can reveal increased uptake at the epileptogenic area.

Stroke/ Trauma/ Presurgical planning: These situations are usually evaluated with brain MRI (or brain CT if there is a contraindication to brain MRI). However, if these results are inconclusive or limited, could not be performed, do not explain the clinical picture, or if additional information is needed for surgeries, Brain SPECT images are obtained, often to evaluate vascular reserve. Brain images are obtained at rest and after vasodilatory acetazolamide injection challenge. These may clarify inconclusive clinical or imaging abnormalities or assess vascular reserve for surgeries. This can also be done with other challenges as well, such as carotid balloon occlusion. In the assessment of transient ischemic disease, reduced perfusion can be seen earlier than changes on conventional imaging and may help plan appropriate therapeutic intervention. In traumatic brain injury (including whiplash, post-concussion syndromes), SPECT studies have shown areas of hypoperfusion without corresponding MRI or CT findings.[47]

Brain Death: This is typically used in the ICU setting, when clinical assessment and electroencephalography are less reliable in diagnosing brain death because of conditions such as severe hypothermia, coma caused by barbiturates, electrolyte or acid–base imbalance, endocrine disturbances, drug intoxication, poisoning, and neuromuscular blockade. Brain death scintigraphy may also be helpful in patients who are being considered as possible organ donors or when family members require documentation of lack of blood flow.

Dementia: Brain SPECT imaging has been largely replaced by brain PET due to better resolution.

DAT scan (Dopamine transporter Imaging): I123 Ioflupane tracer demonstrates the location and concentration of dopamine transporters (DATs) in the synapses of striatal dopaminergic neurons. This is decreased in presynaptic parkinsonian syndromes (Parkinson's disease, multiple system atrophy, and progressive supranuclear palsy) but is not affected in mimicking conditions such as essential tremor, drug-induced parkinsonism or psychogenic parkinsonism. It is also useful in the differentiation of Alzheimer dementia from Dementia with Lewy Bodies. The latter is in the spectrum of parkinsonism but may or may not have clinical symptoms of parkinsonism, such as bradykinesia, rigidity, or tremor at rest.

RADIONUCLIDE CISTERNOGRAPHY (CSF)

- CSF imaging (for evaluation of hydrocephalus, leak, shunt, normal pressure hydrocephalus, spontaneous intracranial hypotension) when[45]
    - Brain/spine or respective site imaging already performed with appropriate CT/ MRI / CT myelography, and deemed to be insufficient; AND
    - Planar images projected to be insufficient for localization of abnormality

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

BACKGROUND

Cerebrospinal fluid (CSF) flow studies for the evaluation of obstructive or non-obstructive hydrocephalus of various etiologies or CSF leaks (CSF cisternography) are performed after the intrathecal administration of radionuclide. The radionuclides used for CSF flow studies are Indium-111 DTPA for cisternography and leaks.[48] Persistence of activity in the lateral ventricles after 24 hours of imaging is diagnostic of normal pressure hydrocephalus. Cine phase contrast MRI is the preferred technique for evaluating CSF flow dynamics and helps determines which patients with NPH will benefit from treatment.[49, 50]

To evaluate ventriculoperitoneal shunt patency, Tc-99m DTPA radionuclide is injected into the shunt reservoir. Normal shunt patency is confirmed by showing activity along the entire course of the shunt, ultimately spilling into the abdominal cavity.

CSF leaks are more commonly acquired either iatrogenic or post-traumatic[51] than congenital or spontaneous and can occur anywhere along the cranial spinal axis. Scintigraphy for detecting CSF leaks has been superseded by CT and MRI myelographic techniques or thin section skull base CT due to their better spatial resolution.[51, 52] Diagnosis using scintigraphy requires intrathecal administration of radionuclide followed by imaging typically at 3,6, 24, and 48 hours. Pledgets can be placed in the nasal cavity or auditory canal in the setting of CSF rhinorrhea and otorrhea, respectively. CSF leak path is traced. Initial diagnostic imaging is typically done with high resolution CT, CT/MR cisternography.[53-55]

Spontaneous idiopathic hypotension (SIH), also known as craniospinal hypotension, poses a diagnostic challenge due to its protean clinical symptoms, inconsistently demonstrated imaging findings on conventional MRI scanning, and lack of awareness of the diagnosis among clinicians. SIH often presents a variable mix of symptoms, including orthostatic headaches, visual defects or blurred vision, limb paresthesia, transient 3rd cranial nerve palsy, numbness in the face or limbs, cognitive deficits, behavioral changes, neck pain and stiffness, taste alteration, or parkinsonism. In this condition a CSF leak anywhere along the neuraxis is not detected in nearly one-third of patients thought to be due to the slow or intermittent nature of these leaks.[56] Radionuclide cisternography was found to be more sensitive than CT myelography in a few limited case series.[57-59] Imaging at multiple time points up to 48 hours, as well as direct and indirect signs, aid in the detection of intermittent or slow leaks, with lower radiation exposure than CT myelography.[60] SPECT-CT allows improved anatomical localization and characterization.[61, 62]

RENAL [63, 64]

Complex clinical scenarios involving the following indications wherein cross-sectional imaging and routine dynamic planar imaging alone is, or projected to be, insufficient:

- Evaluation of renal collecting system for trauma, surgery, obstruction in ADULTS, or with signs, symptoms, and laboratory findings supporting the need for such an evaluation in adults; **AND**
    - CT has been performed and is inconclusive or contraindicated
- For evaluation of renal collecting system for obstruction or vesicoureteral reflux in children and young females:
    - After ultrasound and VCUG (voiding cystourethrography) / VUS (voiding urosonography) are inconclusive or discordant with clinical picture[63, 65]
- For diagnosis of reno-vascular hypertension with signs, symptoms, laboratory findings, or other imaging supporting the need for such a diagnosis when
    - Duplex ultrasound is inconclusive; **AND**
    - MRA or CTA cannot be performed or is contraindicated; **AND**
    - The patient has adequate renal function (GFR >30) mL/min/1.73 m^2) to undergo the study[63]
- Further evaluation of renal perfusion and split function after completion of ultrasound, including in the setting of surgery, trauma, infection, congenital and mass abnormalities[63]
- Diagnosis of renal transplant complications after ultrasound has been performed[31, 63]
- Evaluation of renal infections and discrimination of pyelonephritis from cortical scarring[63]
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

BACKGROUND

Renal scintigraphy remains an important technique for evaluation of the renal circulation, parenchyma, and collecting system. Through the acquisition of serial images over time and graphic depiction of radionuclide activity, information about renal blood flow and function not typically afforded by cross-sectional imaging can be achieved through qualitative and quantitative means. Tailored studies utilizing the administration of diuretic or angiotensin-converting enzyme inhibitors, in conjunction with the radionuclide imaging agent, allow for evaluation of suspected hydronephrosis or renovascular hypertension, respectively. The ability to create 3D multiplanar images with the SPECT technique improves the diagnostic capability over traditional planar imaging.

Tubular secretion agents, such as ^{99m}Tc-MAG3, are used for diuretic renography because tubular tracers are much more efficiently extracted by the kidney than ^{99m}Tc-DTPA (diethylene triamine pentaacetic acid), and washout is therefore easier to evaluate. 99mTc-DTPA is filtered purely by the glomerulus and thus can be used both to image the kidney and to measure

glomerular filtration rate. T- 99m DMSA (Dimercaptosuccinic acid) is especially useful for pyelonephritis and scar evaluations.

OVERVIEW

Diuresis renography can evaluate severity of urinary tract obstruction and can differentiate an obstructed collecting system from a dilated, but non-obstructing, system. It can also provide the differential function in each kidney. Multiple follow-up exams may be needed to detect gradual improvement or worsening.

Captopril Renography is done by imaging before and after administration of acetylcholine esterase inhibitor in patients with high index of suspicion of renovascular hypertension. It is used to identify subgroup in whom hypertension caused by renal artery stenosis could potentially respond to revascularization.[63]

Renal scintigraphy can be used to screen for postoperative complications in renal allograft dysfunction. These can include infarcts, acute tubular necrosis (ATN), collecting system obstruction, urine leaks, drug-induced nephrotoxicity, and rejection. ATN is differentiated from acute rejection as it usually occurs within the first few days after transplantation whereas acute rejection occurs from one week to months after transplantation. Baseline study may be for future comparison.

Renal scintigraphy can also be used to assess differential function in each kidney and in each segment of the kidney for further treatment implications in cases of surgery, trauma, infection, and congenital and mass abnormalities.

ABDOMEN/PELVIS

- Hepatic radioembolization[66]
    - For evaluation of pulmonary and gastrointestinal shunts or dosimetry calculations prior to procedure (typically utilizing Tc MAA) (78835 – Radiopharmaceutical quantification measurement)
    - Post-procedure imaging in lieu of PET to determine dose effect/dose toxicity (using the Y90 radiation itself)[67](78835 – Radiopharmaceutical quantification measurement)
- For evaluation of the following:
    - Intermittent/occult gastrointestinal bleeding after initial workup is indeterminate/contraindicated (scopes, CTA)[68]
    - Indeterminate or vascular hepatic lesions or bleed, when CT/MRI are contraindicated/inconclusive[69, 70]
    - Indeterminate accessory splenic tissue/asplenia when CT/MRI are contraindicated/inconclusive[71]

- Liver transplant (and other hepatic surgery/radiation) preoperative and postoperative function and complications when ultrasound/CT/MR are indeterminate or contraindicated[69]
- Localization of:
    - Suspected ectopic/residual gastric tissue (e.g., Meckel's diverticulum)[68]
    - Abnormalities in hepatobiliary scintigraphy (e.g., biliary abnormalities/leaks) when ultrasound (in infants) or CT is inconclusive/contraindicated[69]
- Peritoneal imaging for evaluation of complications of shunts, dialysis, or peritoneal integrity, when CT is inconclusive/contraindicated[68]
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

BACKGROUND

Most indications utilize a series of standard planar images over time to determine the progression of the radionuclide through the respective system. However, SPECT improves anatomic localization, increases diagnostic certainty and accuracy, and decreases the need for delayed imaging.

99mTc-labeled autologous red blood cells (99mTc-RBCs) are injected in intermittent gastrointestinal bleeds and imaged intermittently up to 24 hours to localize bleeds. It can detect bleeding rates as low as 0.1 cc/min to 0.5 cc/min (vs CTA-0.3-1ml/min and angiography 0.5-1ml/min). SPECT increases the sensitivity and specificity of bleeding-site localization. It has lower radiation exposure than CTA, particularly relevant in children (e.g., Meckel diverticulum studies).[72]

Tc99m sulfur colloid (and sometimes Tc99m RBC) ARE used to identify indeterminate vascular hepatic lesions, such as hemangiomas and hemangioendotheliomas. Denatured Tc99m RBC is useful for identifying indeterminate accessory splenic tissue.

Hepatic radioembolization is used for liver-dominant malignancy or metastases that are unresectable. It involves intraarterial injection of yttrium-90 (Y90)-labeled glass or resin microspheres. **A Tc99m MAA nuclear scan (typically requiring SPECT)** is performed before the actual treatment with Y90. MAA, which is similar in size to the Y90 microspheres, mimics the distribution of the Y90 particles and should embolize within the tumor's hepatic arterioles, thus outlining the expected localization of the radiation. The scan is compared to a CTA/MRA to evaluate for any possible shunting of the treatment agent to the lungs or the GI tract. Coils can be placed as needed to minimize any shunting of Y90 to areas other than the desired target.

Post-procedure imaging (within 24 hours) with either SPECT or PET (at the discretion of the treating physicians) is then performed to confirm the final distribution of the Y90 and to calculate the actual radiation dose delivered to the tumor. Utilizing the Bremsstrahlung radiation of the Y90 embolization agent, SPECT can be completed with routine nuclear medicine collimators. However, due to their higher energy level (as compared to routine

nuclear medicine agents), the Y90 photons scatter and/or pass through the collimator septa and degrade the image quality. Alternatively, PET scanning can be done, again using the Y90 treatment agent itself; but for PET via a minor decay pattern that emits a positron (32 in every one million decays) that is detectable with PET scanners. FDG PET may be needed later (ideally performed >12 weeks after treatment) to access tumor response to this radiation, in accordance with the tumor-specific guidelines for FDG PET restaging so may still require inconclusive conventional imaging, if necessary for the type of cancer being treated.

Peritoneal imaging includes evaluation of patency of peritoneovenous shunts, diaphragmatic perforations, or peritoneal loculations, especially prior to intraperitoneal chemotherapy. This is accomplished by injection of Tc99m MAA into the peritoneal cavity.

SPECT in **hepatobiliary imaging** can help localize abnormalities by distinguishing superimposed bowel activity and clarifying biliary abnormalities and bile leaks. It may obviate the need for delayed imaging and increase diagnostic certainty. Imaging is achieved utilizing the IV administration of Tc99m-labeled iminodiacetic acid, which is excreted by hepatocytes like bile.

Liver transplant complications are best evaluated by ultrasound, CT, and MR; however, limited applications in pediatric patients may exist when radiation doses or sedation considerations exist.

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POLICY HISTORY

BONE/JOINT SPECT/SPECT CT SCAN

Date	Summary
May 2023	• Updated and explained CPT code and removed most mentions of SPECT/CT since CPT codes for SPECT/CT are not managed
April 2022	• Reorganized indications for clarity • Within MALIGNANCY o Simplified staging or restaging evaluation by removing "for the following" and the sub-bullets for breast cancer, prostate cancer, primary bone cancers, and monitoring of cancers with predominantly bone metastases o Clarified staging or restaging evaluation to be performed if other imaging has not been performed, is contraindicated, or is inconclusive in evaluation of bone metastases

NON-BONE INFECTION/ INFLAMMATION SPECT/SPECT CT

Date	Summary
May 2023	• Wording adjustment
April 2022	• No significant changes

TUMOR SPECT/SPECT CT

Date	Summary
May 2023	• Wording adjustment
April 2022	• Renamed GL as Single Photon Emission Computed Tomography (SPECT)

CARDIAC SPECT/SPECT CT – As addressed in MPI and MUGA guidelines

NECK SPECT/SPECT CT (NON-CANCER)

Date	Summary
May 2023	• Wording adjustment
April 2022	• No significant changes

LUNG SPECT/SPECT CT

Date	Summary
May 2023	• Wording Adjustment
April 2022	• No significant changes

BRAIN SPECT/SPECT CT

Date	Summary
May 2023	• Wording adjustment
April 2022	• Removed For patient with history of stroke or trauma with recent Bract CT or MRI based on updated ACR Appropriateness Criteria

RADIONUCLIDE CISTERNOGRAPHY (CSF) SPECT/SPECT CT SCAN

Date	Summary
May 2023	• Wording adjustment
April 2022	• No significant changes

RENAL SPECT/SPECT CT

Date	Summary
May 2023	• Wording adjustment
April 2022	• No significant changes

ABDOMEN/PELVIS SPECT/ SPECTCT SCAN

Date	Summary
May 2023	• Wording adjustment
April 2022	• For Hepatic radioembolization o Clarified Tc MAA for evaluation of pulmonary and GI shunts or dosimetry calculations o Clarified Y90 for post-procedure imaging in lieu of PET for dose effect/dose toxicity • In Background, added further details on Y90 and imaging

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **PET SCANS** **includes** • **PET** • **PET with CT Attenuation** • **PET/CT**	**Original Date: September 1997**
78811 - Limited area e.g. Chest, head/neck **78812 - Skull base to mid thigh** **78813 - Whole Body** **78814 - With CT attenuation (Limited area e.g. Chest, head/neck)** **78815 - With CT attenuation (Skull base to mid thigh)** **78816 - With CT attenuation (Whole Body)**	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_070-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

GENERAL NOTES:

ADULT AND PEDIATRIC MALIGNANCIES[1]: ONCOLOGICAL PET IS INDICATED FOR BIOPSY-PROVEN CANCER **OR** STRONGLY SUSPECTED CANCER BASED ON OTHER DIAGNOSTIC TESTING. The appropriateness of an ordered PET/CT study is dependent on which radiopharmaceutical will be used for the PET/CT.

INDICATIONS FOR FDG PET:

See Legislative Requirements for specific mandates for the State of Washington

The following list applies to biopsy-proven cancers **AND** lung nodules with no known history of malignancy**. This is NOT a comprehensive list. Additional indications for PET are found in the tables following this list.** The definitions regarding initial staging and restaging (**including time interval following treatment****) apply.

- Solid lung nodule > 8 mm and no prior PET – Indicated
- Mixed lung nodule* with solid component > 6 mm and no prior PET – Indicated
- Basal cell carcinoma of the skin – **Not indicated** for initial staging or restaging
- Castleman's Disease – Indicated for initial staging and restaging
- Cervical Cancer (stage IB1 or higher) – Indicated for initial staging and restaging**
- Chondrosarcoma – **Not indicated** for initial staging or restaging
- Ewing's Sarcoma* – Indicated for staging (all ages) and restaging age < 30
- Head and Neck Cancer – Indicated for initial staging and restaging**
- Non-Small Cell Lung Cancer – Indicated for initial staging and restaging
- Lymphoma (Hodgkin's and non-Hodgkins) – Indicated for initial staging and restaging
- Melanoma* – cutaneous – (stage III, IV) – indicated for initial staging and restaging
- Merkel Cell – Indicated for initial staging and restaging
- Osteosarcoma* – Indicated for initial staging (all ages) and restaging age < 30
- Peritoneal Mesothelioma – Indicated for initial staging and restaging
- Post Transplant Lymphoproliferative Disorder (PTLD) – indicated for initial staging and restaging
- Renal – **Not indicated** for initial staging or restaging
- Rhabdomyosarcoma (RMS) – Indicated for initial staging and restaging
- Small bowel carcinoma* – **Not indicated** for initial staging
- Soft Tissue Sarcoma* (other than RMS) – Indicated for initial staging (age < 30) and restaging (age < 30)
- Testicular Cancer – Seminoma* – **Not indicated** for initial staging
- Testicular Cancer – Non-Seminoma – **Not indicated** for initial staging or restaging
- Thymoma/Thymic Cancer – Indicated for initial staging and restaging

*See additional indications in table below

**If radiation or chemoradiation were given, 12 weeks must have elapsed since last radiation treatment. See table below for additional indications if < 12 weeks.

INDICATIONS FOR SPECIAL TRACER PET:

The following list applies to for biopsy-proven cancers for which a non-FDG tracer (special tracer) is indicated in the specific clinical scenarios described. **This is NOT a comprehensive list. Additional indications for non-FDG PET are found in the tables following this list.** The definitions regarding initial staging and restaging (including time interval following

treatment**) apply. Diagnosis needs to be confirmed by biopsy and tracer planned clearly indicated.

- Prostate Cancer* – **PSMA** PET Indicated for initial staging **ONLY** of non-metastatic[2] Gleason 8, 9, 10 disease (or grade group 3, 4 or 5 disease)
- Carcinoid, Well-differentiated Neuroendocrine tumors, pheochromocytoma and paraganglioma* – **SSTR** PET (such as Ga68-Dotatate, Ga68-Dotattoc and Cu64-Dotatate) Indicated for initial staging ONLY

FDG-PET/CT (fluorodeoxyglucose-positron emission tomography)

LUNG NODULE[3] seen on LDCT or CT+ contrast (without known malignancy)

- Solid Component of Dominant Nodule (either solitary or clearly dominant) ≥ 8mm **OR**
- Part solid/mixed nodules with the solid component 6 mm or larger **OR**
- Mixed nodule (i.e., ground glass and solid nodule) with solid component of the nodule ≥ 4mm on LDCT when there has been
  - Interval growth of the solid component of at least 1.5mm on subsequent LDCT scans
    OR
  - Interval development of a new mixed nodule on subsequent LDCT with the solid nodule component ≥ 4mm

FDG PET

ONCOLOGICAL INDICATIONS FOR FDG PET

(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
ADRENAL[4] (other than pheochromocytoma/ paraganglioma)	Indicated when conventional imaging (see Background) and biochemical evaluation are highly suggestive of adrenocortical carcinoma	with prior indeterminate imaging
AIDS-related KAPOSI SARCOMA[5]	If concerns for coexisting KSHV associated inflammatory cytokine syndrome (KICS), MCD, or KSHV+ lymphoma	**Not Indicated**
ACUTE LYMPHOBLASTIC LEUKEMIA (ALL)[6]	lymphomatous extramedullary disease	lymphomatous extramedullary disease

ONCOLOGICAL INDICATIONS FOR FDG PET
(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
ACUTE MYELOGENOUS LEUKEMIA (AML)[7, 8]	If suspected extramedullary involvement	If suspected/known extramedullary involvement
ANAL[9]	with prior indeterminate imaging (see Background). (can consider PET/MR‡‡)	with prior indeterminate imaging
BASAL CELL[10] (BCC of the skin)	**Not Indicated**	**Not Indicated**
BILIARY TRACT CANCER[11] (Cholangiocarcinoma, Gall Bladder Cancer)	With prior indeterminate imaging	With prior indeterminate imaging
BLADDER[12]	With indeterminate imaging and muscle invasive disease only when the indeterminate finding is outside of the urinary tract	With indeterminate imaging and suspected metastatic disease or recurrence outside of the urinary tract
BONE CANCER[13]		
• **Chondrosarcoma**	**Not indicated**	**Not indicated**
• **Chordoma**	With prior indeterminate imaging	With prior indeterminate imaging
• **Ewing Sarcoma and Osteosarcoma**	Indicated (all ages)[13]; PET can be approved in conjunction with MR of primary site	Age < 30: Indicated Age > 30: Indicated for known or suspected metastatic disease based clinical or imaging findings or when PET was used for initial staging PET can be approved in conjunction with MR of primary site (all ages)

ONCOLOGICAL INDICATIONS FOR FDG PET
(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
BREAST[14] *See special tracer section below for FES PET*	with prior indeterminate imaging	with prior indeterminate imaging
CERVICAL[15]	Indicated for stage IB1 and above (can consider PET/MR‡‡)	Indicated
COLORECTAL[16, 17]	with prior indeterminate imaging **OR** potentially surgically curable metastatic disease **OR** when considered for image-guided liver-directed therapies	with prior indeterminate imaging (including discordance between tumor markers (CEA) and imaging) **OR** potentially surgically curable metastatic disease **OR** when considered for image-guided liver-directed therapies
ENDOMETRIAL[18]	with prior indeterminate imaging	with prior indeterminate imaging
ESOPHOGEAL and ESOPHAGOGASTRIC JUNCTION (EGJ)[19] (includes EGJ tumors with epicenter < 2 cm into stomach)	Indicated if no evidence of metastatic disease	Indicated following preoperative chemoradiation or definitive chemoradiation; **OR** with prior indeterminate imaging
FALLOPIAN TUBE CANCER	with prior indeterminate imaging	with prior indeterminate imaging
GASTRIC[20] (includes EGJ tumors with epicenter >2 cm into stomach)	with prior indeterminate imaging AND no evidence of metastatic disease	with prior indeterminate imaging

ONCOLOGICAL INDICATIONS FOR FDG PET
(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
GESTATIONAL TROPHOBLASTIC CANCER[21]	with prior indeterminate imaging	with prior indeterminate imaging or at completion of chemotherapy when hCG is not a reliable marker
GIST[22]	with prior indeterminate imaging	with prior indeterminate imaging
HEAD and NECK[23] (including mucosal melanoma of the head and neck)	Indicated Additionally, Face/Neck MRI (or CT) may be indicated concurrently with PET if needed for surgical planning	Indicated Additionally, Face/Neck MRI (or CT) may be indicated concurrently with PET 3-4 months after end of treatment in patients with locoregionally advanced disease or with altered anatomy If final PET/CT is equivocal or borderline for residual disease, a repeat PET/CT at $\geq$ 6 weeks may help identify those that can be safely observed without additional surgery
HEPATOCELLULAR[24]	with prior indeterminate imaging	with prior indeterminate imaging
LEUKEMIA (refer to specific types listed in table when possible)	If there is lymph node involvement (lymphomatous features), soft tissue and/or extramedullary involvement (myeloid sarcoma) and/or if	If there is lymph node involvement (lymphomatous features), soft tissue and/or extramedullary involvement (myeloid sarcoma) and/or if

ONCOLOGICAL INDICATIONS FOR FDG PET
(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
	forms “chloromas” (leukemia tumor balls)	forms “chloromas” (leukemia tumor balls)
LUNG		
• **Non-Small Cell**[25]	Indicated	Indicated
• **Limited stage small cell**[25]	Indicated	Indicated prior to radiation or with indeterminate imaging
• **Extensive stage small cell**	**Not indicated** unless conventional imaging is unable to conclusively classify the stage as extensive (see Background)	**Not indicated** unless consolidative thoracic radiation is planned (see Background)
LYMPHOCYTIC LEUKEMIA		
• **Chronic (CLL) and Small (SLL)**[26]	For suspected high-grade transformation or to guide biopsy with prior indeterminate imaging	with accelerated CLL or to guide biopsy with prior indeterminate imaging (includes negative CT with rising tumor markers or if conventional imaging documents mets, IF clearly considering resection)
LYMPHOMA (Non-Hodgkins and Hodgkins)[27-32]	Indicated (can consider PET/MR‡‡)	Indicated (can consider PET/MR‡‡)
MELANOMA		
• **Cutaneous**[33]	stage III, IV indicated; indicated for dermal melanomas that lack epidermal involvement	Indicated for stage III, IV disease **OR** for workup of local satellite/in-transit and/or nodal recurrences (see Background)
• **Uveal**[34]	**Not indicated**	With prior indeterminate imaging

ONCOLOGICAL INDICATIONS FOR FDG PET
(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
MERKEL CELL[35]	Indicated	Indicated
MESOTHELIOMA (malignant)		
• **Pleural**[36]	Indicated for stage I-IIIA when the patient is a potential surgical candidate (see Background)	Indicated only prior to surgery for stage I-IIIA
• **Peritoneal**[37]	Indicated	Indicated
MULTIPLE MYELOMA[38]		
• **Smoldering myeloma** (asymptomatic)	Indicated	Indicated annually or possibly more frequently as clinically indicated (labs and/or symptoms to suggest progression)
• **Active myeloma**	Indicated	Indicated
• **Plasmacytoma**	Indicated	Indicated
NEUROBLASTOMA	Indicated when MIBG is negative, indeterminate, or there are discordant findings between MIBG and pathology	Indicated when FDG PET was used for initial staging or if MIBG has become indeterminate or discordant
NEUROENDOCRINE TUMORS:[39]		
• **Poorly differentiated**	with prior indeterminate imaging (see Background)	with prior indeterminate imaging (see Background)
• **Well-differentiated grade 3 with high Ki-67 (≥ 55%)**	Indicated after prior negative or indeterminate SSTR (dotatate) PET (see Background)	Indicated after prior negative or indeterminate SSTR (dotatate) PET (see Background)

ONCOLOGICAL INDICATIONS FOR FDG PET
(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
OVARIAN[40]	with prior indeterminate imaging	with prior indeterminate imaging (including discordance between tumor markers (CA-125) and imaging)
OCCULT PRIMARY[41]	with prior indeterminate imaging (see Background)	with prior indeterminate imaging (see Background)
PANCREATIC	With prior indeterminate imaging OR with any of the following high-risk features: • borderline resectable disease • markedly elevated CA19-9 >180 U/ml • large primary tumor/lymph nodes • very symptomatic (jaundice, symptomatic gastric outlet obstruction, venous thromboembolism, extreme pain and excessive weight loss)	When PET was used for initial staging and need to assess response to treatment in order to determine if now a surgical candidate
PENILE[42]	with prior indeterminate imaging	with prior indeterminate imaging
PERITONEAL CANCER[40] **(PRIMARY)**	with prior indeterminate imaging	with prior indeterminate imaging
POST TRANSPLANT LYMPHOPROLIFERATIVE DISORDER (PTLD)	Indicated when the diagnosis is made OR if suspected based on abnormal PE, abnormal imaging	Indicated

ONCOLOGICAL INDICATIONS FOR FDG PET
(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
	or abnormal labs (i.e., significantly elevated or rising viral titers)	
PROSTATE (FDG PET only) (see Prostate Special Tracer section)	**Not Indicated**	**Not Indicated**
RENAL[43]	**Not indicated**	**Not indicated**
SKIN SQUAMOUS CELL[44]	Indicated for biopsy proven ≥N1 or ≥M1 disease (lymph node or metastatic site has been biopsied and shows disease spread)	Indicated for biopsy proven ≥N1 or ≥M1 disease (lymph node or metastatic site has been biopsied and shows disease spread)
SMALL BOWEL CARCINOMA[45]	**Not indicated**	with prior indeterminate imaging
SOFT TISSUE SARCOMA[46]		
• **Rhabdomyosarcoma**	Indicated	Indicated
• **All other soft tissue sarcomas**	For patients <30 years old: Indicated For patients >30 years old: with prior indeterminate imaging	For patients < 30 yrs old: Indicated For patients <30 yrs old: with prior indeterminate imaging
TESTICULAR[47]		
• **Seminoma**	**Not Indicated**	with prior indeterminate imaging OR residual mass >3cm with normal AFP and beta-hcG and 6 weeks post chemotherapy

ONCOLOGICAL INDICATIONS FOR FDG PET
(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING (If this final PET/CT is equivocal or borderline for residual disease, an additional repeat PET/CT > 6 weeks later may help identify those that can be safely observed without additional surgery)
• **Non-Seminoma**	**Not Indicated**	**Not Indicated**
THYMOMA/THYMIC CANCER[48]	Indicated	Indicated
THYROID[49]		
• **Papillary, Follicular, Oncocytic (formerly Hurthle Cell)**	**Not Indicated**	with prior indeterminate imaging (including discordance between tumor markers (Tg, anti-Tg Ab) and imaging; see Background)
• **Anaplastic**	Indicated	Indicated
• **Medullary**	**Not Indicated** (see SSTR indications below)	With prior indeterminate imaging (including discordance between tumor markers (calcitonin, CEA) and imaging; see Background)
UTERINE (Endometrial Carcinoma and Uterine Sarcoma)[50]	with prior indeterminate imaging	with prior indeterminate imaging
VULVAR[51]	Indicated if ≥ T2 (extension beyond vulva/perineum) OR	Indicated

ONCOLOGICAL INDICATIONS FOR FDG PET

(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
	with prior indeterminate imaging	

MISCELLANEOUS INDICATIONS FOR FDG PET

(excluding brain and cardiac PET which have separate Guidelines)

TYPE	INITIAL STAGING	RESTAGING
CASTLEMAN'S DISEASE	Indicated	Indicated
HISTIOCYTIC NEOPLASMS[52]:		
• **Langerhan's**	Indicated	Indicated if on active treatment for multiple bone disease, high risk bone disease or multisystem involvement
• **Erdheim Chester**	Indicated	Indicated if on active treatment
• **Rosai-Dorfman**	Indicated	Indicated if on active treatment

ǂ SARCOIDOSIS

- **ONLY** if conventional testing (CXR, CT and inflammatory serology) remain indeterminate for known sarcoid to determine:
  - if treatment might be helpful
  - extent of disease, if it will potentially change management
  - response to treatment
- **OR** if strongly supected sarcoid to determine most suitable site to biopsy

ǂ VASCULITIS

- In limited circumstances, with known vasculitis, AFTER conventional imaging (MRA/CTA/MR/CT) has clearly been shown to be insufficient to determine treatment

ǂ NEUROFIBROMATOSIS TYPE 1[53-56]

- When there is a concern for transformation of a neurofibroma to a Malignant Peripheral Nerve Sheath Tumor (MPNST) based on a change in imaging (such as rapid growth or change in texture on exam or imaging) and/or symptoms (new or worsening pain in the location of a known neurofibroma), then a single FDG-PET is indicated (see Background).
- Restaging of a known MPNST with PET requires indeterminate imaging prior to PET approval.

ǂ Adjudications should occur on a case-by-case basis

YTTRIUM-90 (Y90)

Y90 PET SCAN: Indicated when performed immediately after treatment of liver malignancy (primary or metastatic). The Y90 treatment is also the tracer for this and PET is performed within 24 hours of treatment (while Y90 is still detectible) to confirm the final distribution of the Y90. PET.

NON FDG PET TRACERS

Somatostatin Receptor (SSTR) PET FOR NET (Neuroendocrine Tumors) (GA68-DOTATATE, GA68-DOTATOC and CU64-DOTATATE)

CANCER TYPE	INITIAL STAGING	RESTAGING
CARCINOID,NEUROENDOCRINE TUMORS (NET)[57] OF THE GI TRACT, PANCREAS, LUNG, THYMUS AND UNKNOWN PRIMARY, PHEOCHROMOCYTOMA, PARAGANGLIOMA	Indicated (PET/MR‡‡ can be considered)	Indicated when there is progression or recurrence is known or suspected (based on labs and/or conventional imaging) and SSTR directed therapy is being considered (see Background) (PET/MR‡‡ can be considered)
MEDULLARY THYROID	with prior indeterminate imaging	with prior indeterminate imaging (including discordance between tumor markers (calcitonin, CEA) and imaging; see Background)

FES (fluoroestradiol F 18 (Cerianna®)) PET

CANCER TYPE	INITIAL STAGING	RESTAGING
BREAST CANCER	**Not Indicated**	Indicated for biopsy proven recurrent or metastatic **Estrogen Receptor Positive (ER-positive)** disease when receptor status of sites of disease will

Somatostatin Receptor (SSTR) PET FOR NET (Neuroendocrine Tumors) (GA68-DOTATATE, GA68-DOTATOC and CU64-DOTATATE)

CANCER TYPE	INITIAL STAGING	RESTAGING
		result in a change treatment (see Background)

PSMA TRACERS (such as F18 piflufolastat (Pylarify®), GA 68 PSMA-11, GA 68 gozetotide (Locametz®), and GA 68 gozetotide (Illuccix®)) For PROSTATE CANCER[2, 58]

CANCER	INITIAL STAGING	RESTAGING
PROSTATE CANCER **TRACERS:** **Initial staging**: **PSMA** is the ONLY tracer potentially approvable for initial staging **Restaging**: PSMA is the preferred tracer, see Background for other tracers such as Axumin® and 11-Choline[58].	**PSMA** PET is indicated for initial staging of non-metastatic[2] very high risk, high risk and unfavorable intermediate risk prostate cancer (see Background) (can consider PET/MR‡‡) Pelvic MRI may be indicated concurrently if needed for surgical planning	**PSMA** PET is indicated in the following situations (see Background): **Post-radical prostatatectomy:** • For PSA persistence: detectable PSA (0.1 ng/mL or greater) at 3 months post-operatively (only one level required) • For rising PSA on two or more occasions OR a rise to > 0.1 ng/mL if was previously undetectable For **known metastatic disease** with progression **on treatment** and either: • Rising PSA (on two consecutive levels) • Disease progression on imaging (i.e. bone scan) A single restaging PSMA PET 12 weeks after treatment with radioligand therapy (Lu-177/Pluvicto) is indicated

LEGISLATIVE REQUIREMENTS

- Washington
    - Washington State Health Care Authority Health Technology Assessment 20181116B Positron Emission Tomography (PET) scans for lymphoma[59]
        - PET scans (i.e., PET with computed tomography or PET/CT) for lymphoma is a covered benefit with conditions.
        - An initial staging scan is covered followed by up to three (3) scans per active occurrence of lymphoma:
            - When used to assess a response to chemotherapy, scans should not be done any sooner than three (3) weeks after completion of any chemotherapy cycle, except for advanced stage Hodgkin's lymphoma, after four (4) cycles of ABVD chemotherapy.
            - When used to assess response to radiation therapy, scans should not be done any sooner than eight (8) weeks after completion of radiation or combined chemotherapy and radiation therapy.
        - Relapse: Covered when relapse is suspected in the presence of clinical symptoms or other imaging findings suggestive of recurrence
        - Surveillance: Not covered

Washington State Health Care Authority oversees the Apple Health (Medicaid) program and the Public Employees Benefits Board (PEBB) Program[60]

BACKGROUND

USEFUL DEFINITIONS: The **cancer specific details for adjudication still apply.**

- **INITIAL STAGING** refers to imaging that is performed AFTER the diagnosis of cancer is made, and generally before any treatment**.**
- **RESTAGING** includes scans that are either needed **during active treatment (subsequent treatment strategy)** to determine response to treatment/monitor treatment, a single **end of treatment** study done within 6 months of completion of treatment, or when there is clinical **concern for recurrence** (i.e., new imaging, new signs, rising labs/tumor markers or symptoms relative to type of cancer and entire clinical picture) (recurrence is not required to be biopsy proven)
- **ACTIVE TREATMENT** includes chemotherapy, immunotherapy, radiation, as well as patients on "maintenance therapy" who have known, or existing, metastatic disease being held in check by this treatment. Allogenic bone marrow transplant and CART T-cell therapy should be considered 'active' treatment for at least 6 months after infusion/transplant and as such can be approved at 30 days, 100 days, and 6 months after the most recent infusion.
- **SUBSEQUENT TREATMENT STRATEGY:**

- For restaging or monitoring response during active treatment (including immunotherapy), and/or a single evaluation after completion/cessation of therapy. The interval should **ideally**‡ be 6-12 weeks after surgery, and 12 weeks after radiation (to avoid false positive findings that can be caused by treatment changes or healing).
  - ‡NOTE: a valid clinical reason explaining why the interval needs to be shorter than ideal must be present
- PET/CT can be performed 1 - 3 weeks after neoadjuvant chemotherapy or neoadjuvant chemoradiation if done for presurgical planning to evaluate for distant metastatic disease or to evaluate known metastatic disease located in areas separate from the site(s) being radiated.
- When an end of treatment PET scan performed at an appropriate post-treatment interval (see above) shows indeterminate findings, one additional repeat PET in 3 months is indicated.

- **INDETERMINATE IMAGING:** When indeterminate imaging is required prior to PET, this typically means conventional imaging (CT, MRI, OR Nuclear Medicine Scan (i.e. bone scan)) shows a finding that is indeterminate **AND** clarification of that finding with PET will potentially change management. When PET is not indicated for a cancer type in the guideline (i.e. literature does not support the use of PET), PET is **not indicated** even if indeterminate imaging is provided. The information provided should clearly explain why conventional imaging is insufficient to determine treatment or management and includes situations such as the following:
  - **New or residual masses** described as **indeterminate** on conventional imaging
  - **Biopsy guidance:** To determine the best location to biopsy either within a tumor that has necrosis on imaging **OR** to determine the best location to biopsy when there are findings on standard imaging that would require a significantly invasive procedure (such as laparoscopic or open surgical procedures) **AND** malignancy is highly suspected based on imaging.
- When **previous conventional imaging has been shown to be negative**, yet a **concurrent PET scan was positive** (i.e. conventional imaging was falsely negative/ missed lesions seen on PET), we do not require repeat conventional imaging prior to every subsequent PET (because conventional imaging was already shown to be insufficient). Appropriate interval criteria should still be met.
- **SURVEILLANCE PET** is generally **not approvable**. Surveillance means no active treatment, no current suspicion of recurrence and occurs 6 months or more after completion of treatment. Generally, this would be accepted only when ordered by the treating oncologist or clearly at their recommendation (not as routine follow-up ordered by PCP). **Possible exceptions for the following indications only:**

- Ewing's Sarcoma and Osteosarcoma in patients specified as high risk: every 3 months for 2 years, then every 4 months up to year 3 post completion of treatment.
- Small Cell Neuroendocrine Cervical every 3-6 months for the first 2 years post completion of treatment
- Diffuse Large B Cell Lymphoma when disease was only seen previously on PET: every 6 months for 2 years, then one at 12 months up to year 3 post completion of treatment.
- Gestational trophoblastic disease when hCG is not a reliable marker every 6-12 months for up to 3 years post completion of treatment
- Histiocytic neoplasms every 3-6 months for the first 2 years post completion of treatment
- Melanoma (stage 2b-4) specified as high risk every 3-12 months for 2 years, then every 6-12 months, up to 5 years after initial diagnosis[33, 61]
- Solitary plasmacytoma (up to 3 yrs after the diagnosis of plasmacytoma)[62, 63]

PET with CONTRAINDICATIONS to contrasted CT AND MRI:

When PET is requested for restaging due to the inability to image with contrasted conventional imaging, indeterminate non-contrasted studies must be provided prior to consideration of PET. The inability to image with contrasted conventional imaging includes contraindications to both CT (such as chronic renal failure with GFR < 30 **OR** significant iodinated contrast allergy) **AND** to MRI (such as gadolinium allergy, implanted device that is not MRI compatible, or GFR <40). When requested for surveillance due to the above reasons, PET can be considered during the time that the highest risk of recurrence for that cancer (typically the first two years after completion of treatment).

‡‡**PET/MR**: When PET/MR can be considered per the guideline, if the criteria are met for PET for that cancer and the plan is to do a PET/MR rather than a PET/CT, the PET scan can be approved. In the same way a separate approval for total body CT is not needed when a PET/CT is requested, a separate approval for the total body MR is not typically needed. However, until a PET/MR CPT code is implemented, unlisted MR in addition to PET can be considered on a case-to-case basis.

PET IN COMBINATION WITH DEDICATED SITE SPECIFIC MR (OR CT): Distinct from PET/MR, when PET is needed in addition to a dedicated site specific MRI (or CT), two authorizations may be issued: one for the PET scan and one for the site specific MRI (or CT). Clear indications for both must be provided.

STAGING: Staging for cancer is cancer-specific and is typically based on the TNM system of staging. T stage refers to the extent of the main (primary) tumor. N stage refers to the extent of

spread to lymph nodes. M stage refers to whether or not the cancer has metastasized to other parts of the body. Clinical stage (such as cT2b) is determined by physical exam, imaging and possibly biopsy. Pathologic stage (such as pT2b) is determined after the tumor has been resected. Certain cancers have additional information that is needed to stage the patient (such as PSA level in prostate cancer).

CANCER SPECIFIC BACKGROUND:

Adrenal Tumors: Features of an adrenal mass on conventional imaging that are suspicious for adrenocortical carcinoma (ACC) include: size > 4 cm, inhomogenous mass with irregular margins and/or has local invasion. If there is no history of another primary malignancy and these features are present on imaging, then PET is reasonable. If there is a history of another primary tumor and a metastasis is suspected, biopsy should be done first to determine tissue type. A biochemical evaluation is also done to evaluate for other tumor types (such as pheochromocytoma) for which a different tracer (such as dotatate) may be more appropriate.

Anal Cancer: Normal pelvic lymph nodes are often not seen on imaging. When pelvic lymph nodes are visualized on imaging, even if normal in size, that finding raises concern for disease spread and can be considered indeterminate.

Brain Tumors: When an oncologic PET is requested for a primary brain malignancy, it typically should be reordered as a Brain PET (CPT 78608 and 78609). This includes requests for recurrent meningioma when dotatate PET is requested.

Breast Cancer: Fluoroestradiol F 18 (Cerianna® or FES) is a new tracer that is specific for estrogen receptor positive (ER-positive) breast cancer. It is used in recurrent or metastatic breast cancer that was known to be ER-positive at initial diagnosis to determine how much of the current disease has functional estrogen receptors. This can help determine whether endocrine therapy is appropriate. This tracer is **NOT** indicated for ER-negative disease. An FES PET is NOT done to monitor response to treatment but instead is done ONLY when the receptor status of the recurrent or metastatic sites is in question. FES PET is **NOT** used for assessing the primary site of disease.

Langerhans Cell Histiocytosis is the most common type of histiocytosis, with variable presentations and sites involvement. Some studies suggest PET/CT may be more effective in detecting bone lesions compared with MRI and bone scans in assessing disease response as healing/treatment changes of bone lesions on conventional imaging may be delayed. However, PET/CT is not the modality of choice in assessing disease response of lung or brain lesions.

Lung Cancer – Small Cell: Initial Staging is classified as Limited Stage (LS) and Extensive Stage (ES). In limited stage disease, the disease burden is localized to the chest (Any T, Any N, M0) AND able to be encompassed in a tolerable radiation plan. Patients with disease OUTSIDE of the chest (M1) or T3-4 due to multiple lung nodules that are too extensive or have tumor/nodal volume that is too large to be encompassed in a tolerable radiation plan are classified as extensive stage. When a patient cannot clearly be classified as ES but there are findings on

imaging suggestive of disease (typically extra-thoracic findings such as a liver lesion), then PET may be used to help classify the extent of disease as ES or LS. If conventional imaging clearly shows ES disease, then PET is not indicated. **Restaging:** When radiation is planned (either for LS disease OR for ES disease that has responded to treatment), PET is indicated to determine radiation fields. Otherwise, disease reassessment/response to therapy is with conventional imaging[64].

Melanoma: Local satellite/in-transit recurrences are in the deep dermis or subcutaneous fat within or adjacent to the melanoma scar. They are recurrences that occur after an initial adequate wide excision, likely represent dermal lymphatic disease and do need imaging at diagnosis. Persistent disease, by contrast, is disease remaining in the melanoma scar after an initial resection (likely due to inadequate resection) and imaging would only be indicated if stage III or IV disease is present[33].

Mesothelioma[36, 65]: The evaluation of recurrent pleural effusion and/or pleural thickening includes CT chest, thoracentesis and pleural biopsy. The diagnostic sensitivity of this investigation is 70-75%. If the first biopsy is non-diagnostic, there is a higher chance that subsequent biopsies will be non-diagnostic, thus a PET to guide subsequent biopsy is reasonable in this situation.

Multiple Myeloma: Making the diagnosis of myeloma is complex and may include bone marrow biopsy, cytometry, imaging etc. However, once the diagnosis of myeloma (multiple myeloma or plasmacytoma) is confirmed, PET may be considered.

Neuroendocrine Tumors (NET)[57]: a Somatostatin Receptor (SSTR) analog PET (commonly dotatate) is indicated at initial diagnosis to evaluate for metastatic disease. If a moderately invasive procedure is needed to confirm the diagnosis (i.e. open surgery), PET prior to this open biopsy may be reasonable when the clinical picture, labs and imaging are consistent with a NET. Restaging can be done with conventional imaging (CT/MRI). However, if progression is seen and/or SSTR directed therapy is being considered, then SSTR-PET is indicated. Because liver lesions are often not well imaged on SSTR-PET, a dedicated liver MRI at the time of SSTR-PET may be indicated if there are known or suspected liver metastases.

FDG PET may be more useful when a NET is metabolically active, such as in poorly differentiated NET and well differentiated grade 3 NET with a high Ki67 (≥ 55%). For poorly differentiated NET, indeterminate conventional imaging is needed prior to FDG PET. For well-differentiated grade 3 NET with a high Ki-67 (≥55%), a negative dotatate PET is required before an FDG PET can be considered.

Neurofibromatosis type 1 (NF1): Surveillance of lesions is completed with MRI (often whole body MRI.) Approximately 5% of patients with neurofibromatosis are thought to develop soft tissue sarcomas, most commonly malignant peripheral nerve sheath tumors (MPNSTs), a type of sarcoma. Risk factors for MPNST transformation include: whole *NF1* gene deletion, family history of MPNST, prior radiation therapy, large plexiform neurofibroma burden or multiple distinct nodular lesions on magnetic resonance imagining (MRI), neurofibromatous neuropathy,

and atypical neurofibroma(s). Once a PET has been done and was negative, rapid growth on conventional imaging and plan for biopsy need to be provided prior to consideration of another PET.

Occult Primary: The typical evaluation for a suspected metastatic malignancy includes a thorough physical exam, laboratory evaluation, CT of the Chest, Abdomen and Pelvis AND a biopsy of the site of disease. The biopsy results then indicate either a clear primary for which the relevant guideline is applied or an epithelial cancer (not site specific). Epithelial cancers are further classified as adenocarcinoma, carcinoma not specified, squamous cell carcinoma (SCC) or neuroendocrine carcinoma (see NET in guideline). If the primary is still not identified, further guidance is often complex and based on the site of disease identified.

Pheochromocytoma and Paraganglioma: Hypertension, tachycardia, sweating and syncope are typical symptoms. Biochemical workup includes catecholamines (such as metanephrines, normetanephrine, and/or dopamine). Elevations in catecholamines that are greater than two times above the upper limit of normal are usually present. Biopsy of a pheochromocytoma and paraganglioma that is biochemically active is contraindicated. Thus, when the clinical picture **AND** labs is consistent with pheochromocytoma/paraganglioma, the SSTR-PET can be approved without biopsy confirmation. However, if the catecholamines are not elevated (as above), in the setting of clinical concern and a mass, biopsy is required.

Prostate Cancer Initial Staging: PSMA is the only approvable tracer for initial staging. Risk groups are determined by the Gleason Score (on pathology report), PSA, clinical stage (by exam (digital rectal exam (DRE) and/or imaging such as pelvis MRI). This information may also be expressed as a grade group. The three risk groups for which PSMA PET is indicated are: very high risk, high risk and unfavorable intermediate risk. Any of the following criteria place the patient into one of these risk groups and PSMA PET may be approved for initial staging:

- Gleason score 8, 9 or 10
- Primary pattern 4 (Gleason 4+3=7)
- PSA > 20 AND Gleason score 3+3=6 or higher
- PSA > 10 AND Gleason score 3+4=7
- PSA > 10 AND Gleason score 3+3=6 AND clinical stage ≥ T2b
- Clinical stage ≥ T3a AND Gleason score 3+3=6 or higher
- Clinical stage ≥ T2b AND Gleason score 3+4=7 or higher
- ≥ 50% of cores positive for cancer in a random, non-targeted prostate biopsy
- Grade group 3, 4 or 5 disease

When **active surveillance** was selected as the initial plan of care, PSMA PET is indicated when the disease progresses to very high risk, high risk or unfavorable intermediate risk using the most recent Gleason score/biopsy result, clinical stage and PSA level.

A biopsy typically needs to be done confirming the diagnosis of prostate cancer prior to PSMA PET. If the PSA is > 50, when there is no clinical concern for infection nor has there been recent instrumentation **AND** there is an intent to treat the patient for prostate cancer without biopsy confirmation, PSMA PET can be considered. Situations where this may be reasonable are when the biopsy poses significant risk (i.e., anticoagulation or significant comorbidity) **OR** if treatment is urgently needed (such as spinal cord compromise from metastases)[66].

Patients who are **metastatic at diagnosis** (no prior treatment) are staged with conventional imaging[2]. PSMA PET can be considered if there are indeterminate findings on conventional imaging and specific details regarding how clarification of these findings with PSMA PET would change treatment are provided.

Prostate Cancer Restaging: PSMA is the preferred tracer for restaging of prostate cancer due to the increased sensitivity and specificity for detection of disease. There may be situations where Axumin or Choline are approvable tracers such as for detection of inconclusive findings on bone scan, when prior PET scans have used that tracer and direct comparison is needed or if PSMA is not available. For both Axumin and Choline, inconclusive conventional imaging is required and the reason that tracer is being requested instead of PSMA needs to be provided. When a PSMA PET has failed to detect a site of recurrence (i.e. PSMA PET was negative previously yet PSA continues to rise), a repeat PSMA PET may be approved as early as 6 months if the PSA doubling time is < 12 months.

Thyroid Cancer: Thyroid cancer can be grouped into three main histologic subtypes: Differentiated (including papillary, follicular, and oncocytic), Anaplastic and Medullary.

Differentiated thyroid cancer: As iodine is taken up by differentiated thyroid cancers, an iodine scan (I-123 and/or I-131) is often the first line imaging modality (in addition to ultrasound). When there is a discordance between the tumor marker (thyroglobulin or thyroglobulin antibody) and imaging (I-123 or I-131 scan) **AND** the thyroid tissue has been removed (total or completion thyroidectomy) or ablated, this indicates that the tumor may have de-differentiated and FDG PET is indicated. After therapy with I-131 it can take several months for Tg to disappear from the circulation, so an early elevated level does not necessarily indicate a recurrence/persistence of the cancer. For **papillary**, **follicular and oncocytic** thyroid cancer, FDG PET can be approved for the following:

- A total (or completion) thyroidectomy **OR** radioiodine iodine has been completed; **AND**
- Serum thyroglobulin (Tg) is >2 ng/ml (unstimulated or stimulated) **OR** there is a high anti-thyroglobulin antibody (anti-Tg Ab) >1 year after treatment **AND**
- A Negative current I-123 (or I-131) scan **OR** a Negative prior stimulated whole body I-123 (or I-131) scan done at Tg level similar to the current Tg level (a current scan is needed if on radioiodine sensitizing medications)

Anaplastic thyroid cancers are aggressive and imaging with FDG PET is appropriate.

Medullary thyroid cancers arise from the neuroendocrine parafollicular C cells of the thyroid and are not iodine-avid. Staging with SSTR PET is indicated for initial staging when indeterminate imaging is provided. For restaging, when calcitonin level is ≥ 150 pg/ml or CEA levels >5 ng/ml post-surgery **AND** indeterminate imaging (including negative CT/MRI with elevated calcitonin and/or CEA) is provided, PET is indicated. Typically the tracer for restaging is SSTR (dotatate), however, there may be situations where an FDG PET is reasonable.

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POLICY HISTORY

Date	Summary

May 2023	• Reorganized:
	  ○ Cancers where the guidance is straightforward into a list for ICRs and non-PET PCRs can approve/deny
	  ○ Definitions to background
	• Revised indeterminate imaging and contraindications to conventional imaging sections
	• Updated:
	  ○ Surveillance PET section with additional guidance
	  ○ Following Cancers to be consistent with updated version of NCCN
	  ▪ Adrenal: added indications in limited circumstances
	  ▪ Breast: changed to requiring inconclusive imaging and added a restaging indication for FES PET in special tracer section
	  ▪ Colorectal: added liver directed therapy and potentially curable M1 disease to restaging
	  ▪ Esophageal: initial staging clarified as indicated for non-metastatic, restaging changed from indicated to following chemoradiation or with indeterminate imaging
	  ▪ Small cell lung cancer: clarified staging in background section, limited stage: changed restaging to prior to radiation or with indeterminate imaging; for extensive stage: added indication for indeterminate imaging in initial staging, added indication when radiation is planned for restaging
	  ▪ Melanoma: added indication for satellite/in-transit and dermal melanomas that lack epidermal involvement
	  ▪ Neuroendocrine: separated types of NET, changed wording for poorly differentiated and well differentiated high grade in FDG section; added detail re what is needed for restaging in SSTR section
	  ▪ Renal: changed to not indicated
	  ▪ Skin squamous cell: added indication for biopsy proven lymph node positive and metastatic disease
	  ▪ Sarcoma: separated rhabdomyosarcoma as indicated (remainder require inconclusive imaging if > 30 yo)
	  ▪ Thyroid: moved most of detail into background section, made indications consistent with current NCCN guidance
	  ▪ MPNST: Added indication in section for NF1

	▪ Prostate cancer: Moved detail for initial staging and non-PSMA tracers into background; updated restaging indications • Regrouped the following Cancers in the table to coincide with grouping in NCCN: o Biliary Tract o Bone Cancers o Uterine Cancers • Added TNM explanation and cancer-specific background sections when needed for additional • General information moved to the beginning of the guideline with added statement on clinical indications not addressed in this guideline
May 2022	• Updated changes based on NCCN including updates most notably for prostate cancer, Hurthle, NETs • Clarified when PET may be approved prior to biopsy for lung nodules and when PET is unnecessary (e.g., disease clearly present in both sides of chest and/or outside the chest) • Added indications for rare specific histiocytic syndromes and for sarcoid and vasculitis for non-oncological indications • Added restaging for RCC and pancreatic cancer in specific situations • Added indications for Y90 PET scan (liver malignancy) • Updated definitions of clinical guidelines (PET, PET/CT, and PET with CT Attenuation) • Minor wording clarifications, table adjustments

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical Guidelines **STRESS ECHOCARDIOGRAPHY**	**Original Date: February 2010**
CPT Codes: 93350, 93351, +93320, +93321, +93325, +93352, +93356	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_026	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

This guideline is for stress imaging, specifically Stress Echocardiography (SE) with appropriate preference for suitable alternatives, such as an exercise treadmill exam without imaging, when more suitable, unless otherwise stated (refer to Overview section).

INDICATIONS for STRES ECHO [1-3]

SUSPECTED CORONARY ARTERY DISEASE (CAD)

Symptomatic patients without known CAD (use Diamond Forrester Table)

- Low or intermediate pretest probability, and electrocardiogram (ECG) is uninterpretable
- High pretest probability
- Repeat testing in patient with new or worsening symptoms and negative result at least one year ago AND meets one of the criteria above

Asymptomatic patients without known CAD

- Previously unevaluated ECG evidence of possible myocardial ischemia including ischemic ST segment or T wave abnormalities (see Overview section)
- Previously unevaluated pathologic Q waves (see Overview section)
- Previously unevaluated complete left bundle branch block

ABNORMAL CALCIUM SCORES (CAC)[1, 4-7]

- ASYMPTOMATIC patient with a calcium score >400, not previously evaluated
- SYMPTOMATIC patient with prior CAC ≥ 100

INCONCLUSIVE CAD EVALUATION AND OBSTRUCTIVE CAD REMAINS A CONCERN

- Exercise stress ECG with low-risk Duke treadmill score ≥5, but patient's current symptoms indicate an intermediate or high pretest probability
- Exercise stress ECG with an intermediate Duke treadmill score
- Intermediate coronary computed tomography angiography (CCTA) defined as:
    - 40 -70% lesion
- Coronary stenosis of unclear significance on previous coronary angiography[1]

FOLLOW-UP OF PATIENTS POST CORONARY REVASCULARIZATION (PCI or CABG)[8]

- **Asymptomatic, follow-up stress imaging** (MPI or SE), at a minimum of 2 years post coronary artery bypass grafting (CABG), or percutaneous coronary intervention (PCI), whichever is later, is appropriate for patients with a history of silent ischemia or a history of a prior left main stent[1]

  OR

- For patients with high occupational risk including any of the following:
    - Associated with public safety
    - Airline and boat pilots
    - Bus and train drivers
    - Bridge and tunnel workers/toll collectors
    - Police officers and firefighters
- **New, recurrent, or worsening symptoms post coronary revascularization** is an indication for stress imaging

FOLLOW-UP OF KNOWN CAD

- **Routine follow-up of asymptomatic or stable symptoms** when last invasive or non-invasive assessment of coronary disease showed hemodynamically significant CAD (ischemia on stress test or FFR ≤ 0.80 or significant stenosis in a major vessel (≥ 50% left main coronary artery or ≥ 70% LAD, LCX, RCA)), over two years ago without intervening coronary revascularization, is an appropriate indication for stress imaging (MPI or SE)

SPECIAL DIAGNOSTIC CONDITIONS REQUIRING CORONARY EVALUATION

- Prior acute coronary syndrome (with documentation in MD notes), within last three months, without a prior stress test or coronary angiography performed since that time

- Newly diagnosed systolic heart failure or diastolic heart failure, ***with reasonable suspicion of cardiac ischemia (prior events, risk factors*)**, unless invasive coronary angiography is immediately planned[4, 8]
- Ventricular arrhythmias:
    - Sustained ventricular tachycardia (VT) > 100 bpm, ventricular fibrillation (VF), or exercise-induced VT, when invasive coronary arteriography has not been performed[9]
    - Nonsustained VT, multiple episodes, each ≥ 3 beats at ≥ 100 bpm, frequent PVCs (defined as greater than or equal to 30/hour on remote monitoring), when an exercise ECG cannot be performed[9]
- For intermediate and high-risk global patients who require initiation of Class IC antiarrhythmic drugs. It can be performed annually thereafter until discontinuation of drug use[10]
- Hemodynamic assessment of ischemia in one of the following documented conditions:
    - Anomalous coronary arteries in an asymptomatic individual without prior stress echocardiography[11];
    - Myocardial bridging of a coronary artery[12]
- Coronary aneurysms in Kawasaki's disease[13]
- Following radiation therapy to the anterior or left chest, at 5 years post initiation and every 5 years thereafter[14]

CHRONIC VALVULAR DISEASE

Evaluation with Inclusion of Doppler[15-18]

- For the evaluation of aortic stenosis and flow (contractile) reserve in symptomatic patients with severe aortic stenosis by calculated valve area, low flow / low gradient, and ejection fraction < 50%
- For evaluation of asymptomatic moderate or severe aortic stenosis (AS) for measurement of changes in valve hemodynamics
- Non-severe aortic regurgitation (AR) with symptoms: Assessment of functional capacity and to assess for other causes of symptoms[8, 19]
- For evaluation of mitral stenosis (MS) if there is:
    - Exertional shortness of breath which suggests the amount of MS is worse than is seen on the resting echocardiogram
- For evaluation for mitral regurgitation (MR) if there is:
    - Exertional shortness of breath which suggests the amount of MR is worse than is seen on the resting echocardiogram; **OR**
    - The echocardiogram is not able to distinguish whether the MR is moderate or severe in a patient that is asymptomatic

- For symptomatic patients with HCM, who do not have resting or provocable outflow tract gradient ≥50 mm Hg on TTE, for detection and quantification of dynamic LVOT obstruction[20]
- For asymptomatic patients with HCM who do not have a resting or provocable outflow tract gradient ≥ 50 mm Hg on TTE (Class 2A)

DIASTOLIC FUNCTION

- For unexplained dyspnea and suspected heart failure with preserved LVEF[19] (HFpEF) with normal or equivocal diastolic function on resting images

PRIOR TO ELECTIVE NON-CARDIAC SURGERY[2, 21-23]

- An intermediate or high risk surgery with of one or more risk factors (see below), AND documentation of an inability to walk (or <4 METs) **AND** there has not been an imaging stress test within 1 year[21, 23, 24]
    - **Risk factors:** history of ischemic heart disease, history of congestive heart failure, history of cerebrovascular disease, preoperative treatment with insulin, and preoperative serum creatinine >2.0 mg/dL.
    - **Surgical Risks:**
        - **High risk surgery:** Aortic and other major vascular surgery, peripheral vascular surgery, anticipated prolonged surgical procedures associated with large fluid shifts and/or blood loss
        - **Intermediate risk surgery:** Carotid endarterectomy, head and neck surgery, intraperitoneal and intrathoracic surgery, orthopedic surgery, prostate surgery
        - **Low risk surgery**: Endoscopic procedures, superficial procedure, cataract surgery, breast surgery
- Planning for any organ or stem cell transplantation is an indication for preoperative stress imaging, if there has not been a conclusive stress evaluation, CTA, or heart catheterization within the past year, at the discretion of the transplant service. [2, 25]

POST CARDIAC TRANSPLANTATION

- Annually, for the first five years post cardiac transplantation, in a patient not undergoing invasive coronary arteriography
- After the first five years post cardiac transplantation, patients with documented transplant coronary vasculopathy can be screened annually unless invasive coronary arteriography is planned

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BACKGROUND

Stress echocardiography (SE) refers to ultrasound imaging of the heart during exercise electrocardiography (ECG) testing, during which visualized wall motion abnormalities can provide evidence of potential significant coronary artery disease (CAD).

While drug-induced stress with dobutamine can be an alternative to exercise stress testing in patients who are unable to exercise, this guideline does not require use of this modality. Hence, reference in this document to SE predominantly refers to exercise stress echocardiography.

Although SE provides comparable accuracy without radiation risk, relative to myocardial perfusion imaging (MPI), scenarios which do not permit effective use of SE might be better suited for stress imaging with MPI, cardiovascular magnetic resonance imaging (CMR) or positron emission tomography (PET), or coronary computed tomography angiography (CCTA).

Stable patients without known CAD fall into 2 categories[1-3]:

- **Asymptomatic patients**, for whom Global Risk of CAD events can be determined from coronary risk factors using calculators available online (see Websites for Global Cardiovascular Risk Calculators section)
- **Symptomatic patients,** for whom we estimate the Pretest Probability that their chest-related symptoms are due to clinically significant CAD (see below):

The 3 Types of Chest Pain or Discomfort:

- **Typical Angina (Definite)** is defined as including **all 3** of these characteristics:
    - Substernal chest pain or discomfort with characteristic quality and duration, such as:
        - Pressure-like
        - Radiating
        - Dull or aching
    - Provoked by exertion or emotional stress
    - Relieved by rest and/or nitroglycerine
- **Atypical Angina (Probable)** has only **2** of the above characteristics
- **Nonanginal Chest Pain/Discomfort** has only **0-1** of the above characteristics

The medical record should provide enough detail to establish the type of chest pain. From those details, the Pretest Probability of obstructive CAD is estimated from the Diamond Forrester Table below, recognizing that in some cases multiple additional coronary risk factors could increase pretest probability[1, 3]:

Diamond Forrester Table

Age (Years)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain
≤ 39	Men	Intermediate	Intermediate	Low
	Women	Intermediate	Very low	Very low
40 – 49	Men	High	Intermediate	Intermediate
	Women	Intermediate	Low	Very low
50 – 59	Men	High	Intermediate	Intermediate
	Women	Intermediate	Intermediate	Low
≥ 60	Men	High	Intermediate	Intermediate
	Women	High	Intermediate	Intermediate

- **Very low:** < 5% pretest probability of CAD, usually not requiring stress evaluation[3]
- **Low:** 5 - 10% pretest probability of CAD
- **Intermediate:** 10% - 90% pretest probability of CAD
- **High:** > 90% pretest probability of CAD

OVERVIEW

MPI may be performed without diversion to SE in any of the following[1, 26]:

- Inability to exercise
    - Physical limitations precluding ability to exercise for at least 3 full minutes of Bruce protocol
    - Limited functional capacity (< 4 metabolic equivalents) **such as one** of the following:
        - Cannot take care of their activities of daily living (ADLs) or ambulate
        - Cannot walk 2 blocks on level ground
        - Cannot climb 1 flight of stairs
        - Cannot vacuum, dust, do dishes, sweep, or carry a small grocery bag
- Other Comorbidities
    - Severe chronic obstructive pulmonary disease with pulmonary function test (PFT) documentation, severe shortness of breath on minimal exertion, or requirement of home oxygen during the day
    - Poorly controlled hypertension, with systolic BP > 180 or Diastolic BP > 120 (and clinical urgency not to delay MPI)
- ECG and Echo-Related Baseline Findings
    - Prior cardiac surgery (coronary artery bypass graft or valvular)
    - Documented poor acoustic imaging window
    - Left ventricular ejection fraction ≤ 40%
    - Pacemaker or ICD
    - Persistent atrial fibrillation
    - Resting wall motion abnormalities that would make SE interpretation difficult

    - Complete LBBB
- Risk-related scenarios
    - High pretest probability in suspected CAD
    - Intermediate or high global risk in patients requiring type IC antiarrhythmic drugs (prior to initiation of therapy and annually)
    - Arrhythmia risk with exercise
- Previously unevaluated pathologic Q waves (in two contiguous leads) defined as the following:
    - > 40 ms (1 mm) wide
    - > 2 mm deep
    - > 25% of depth of QRS complex

ECG Stress Test Alone versus Stress Testing with Imaging

Prominent scenarios suitable for an ECG stress test **WITHOUT** imaging (i.e., exercise treadmill ECG test) are inferred from the guidelines presented above, often requiring that the patient can exercise for at least 3 minutes of Bruce protocol with achievement of near maximal heart rate **AND** has an interpretable ECG for ischemia during exercise[1]:

- The (symptomatic) low or intermediate pretest probability patient who is able to exercise and has an interpretable ECG
- The patient who is under evaluation for exercise-induced arrhythmia[9]
- For the evaluation of syncope or presyncope during exertion[27]
- The patient who requires an entrance stress test ECG for a cardiac rehab program or for an exercise prescription.

Duke Exercise ECG Treadmill Score[28]

Calculates risk from ECG treadmill alone**:**

- The equation for calculating the Duke treadmill score (DTS) is: DTS = exercise time in minutes - (5 x ST deviation in mm or 0.1 mV increments) - (4 x exercise angina score), with angina score being 0 = none, 1 = non-limiting, and 2 = exercise-limiting.
- The score typically ranges from - 25 to + 15. These values correspond to low-risk (with a score of ≥ + 5), intermediate risk (with scores ranging from - 10 to + 4), and high-risk (with a score of ≤ -11) categories.

An uninterpretable baseline ECG includes[3]:

- ST segment depression 1 mm or more; (not for non-specific ST- T wave changes)
- Ischemic looking T wave -- at least 2.5 mm inversions (excluding V1 and V2)
- LVH, pre-excitation pattern such as WPW, a ventricular paced rhythm, or left bundle branch block
- Digitalis use

- Resting HR under 50 bpm on a medication, such as beta-blockers or calcium channel blockers, that is required for patient's treatment and cannot be stopped, with an anticipated suboptimal workload

Global Risk of Cardiovascular Disease

Global risk of CAD is defined as the probability of manifesting cardiovascular disease over the next 10 years and refers to **asymptomatic** patients without known cardiovascular disease. It should be determined using one of the risk calculators below. A high risk is considered greater than a 20% risk of a cardiovascular event over the ensuing 10 years. High global risk by itself generally lacks scientific support as an indication for stress imaging. There are rare exemptions, such as patients requiring IC antiarrhythmic drugs, who might require coronary risk stratification prior to initiation of the drug.

- **CAD Risk—Low**
  10-year absolute coronary or cardiovascular risk less than 10%.
- **CAD Risk—Moderate**
  10-year absolute coronary or cardiovascular risk between 10% and 20%.
- **CAD Risk—High**
  10-year absolute coronary or cardiovascular risk of greater than 20%.

Websites for Global Cardiovascular Risk Calculators*

Risk Calculator	Link to Online Calculator
Framingham Cardiovascular Risk	https://reference.medscape.com/calculator/framingham-cardiovascular-disease-risk
Reynolds Risk Score Can use if no diabetes Unique for use of family history	http://www.reynoldsriskscore.org/
Pooled Cohort Equation	http://clincalc.com/Cardiology/ASCVD/PooledCohort.aspx?example
ACC/AHA Risk Calculator	http://tools.acc.org/ASCVD-Risk-Estimator/
MESA Risk Calculator With addition of Coronary Artery Calcium Score, for CAD-only risk	https://www.mesa-nhlbi.org/MESACHDRisk/MesaRiskScore/RiskScore.aspx

*Patients who have known CAD are already at high global risk and are not applicable to the calculators.[29-33]

Definitions of Coronary Artery Disease[2, 3, 5, 34, 35]

- Percentage stenosis refers to the reduction in diameter stenosis when angiography is the method and refers to cross-sectional narrowing when IVUS (intravascular ultrasound) is the method of determination
- Coronary artery calcification is a marker of risk, as measured by Agatston score on coronary artery calcium imaging. Its incorporation into Global Risk can be achieved by using the MESA risk calculator.
- Ischemia-producing disease (also called hemodynamically or functionally significant disease, for which revascularization might be appropriate), generally implies at least one of the following:
    - Suggested by percentage diameter stenosis $\geq$ 70% by angiography; intermediate lesions are 50 – 69%[36]
    - For a left main artery, suggested by a percentage stenosis ≥ 50% or minimum lumen cross-sectional area on IVUS ≤ 6 square mm[3, 35, 37]
    - FFR (fractional flow reserve) ≤ 0.80 for a major vessel[35, 37]
- FFR (fractional flow reserve) is the distal to proximal pressure ratio across a coronary lesion during maximal hyperemia induced by either intravenous or intracoronary adenosine. Less than or equal to 0.80 is considered a significant reduction in coronary flow

Anginal Equivalent[3, 27, 38]

Development of an anginal equivalent (e.g., shortness of breath, fatigue, or weakness) either with or without prior coronary revascularization should be based upon the documentation of reasons to suspect that symptoms other than chest discomfort are not due to other organ systems (e.g., dyspnea due to lung disease, fatigue due to anemia). This may include respiratory rate, oximetry, lung exam, etc. (as well as d-dimer, chest CT(A), and/or PFTs, when appropriate), and then incorporated into the evaluation of coronary artery disease as would chest discomfort. Syncope per se is not an anginal equivalent.

Abbreviations

AAD	Antiarrhythmic drug
ADLs	Activities of daily living
BSA	Body surface area in square meters
CABG	Coronary artery bypass grafting surgery
CAC	Coronary artery calcium
CAD	Coronary artery disease
CCTA	Coronary computed tomography angiography
CMR	Cardiovascular magnetic resonance imaging
CT(A)	Computed tomography (angiography)
DTS	Duke Treadmill Score
ECG	Electrocardiogram
FFR	Fractional flow reserve
HCM	Hypertrophic cardiomyopathy
IVUS	Intravascular ultrasound
LBBB	Left bundle-branch block
LVEF	Left ventricular ejection fraction
LVH	Left ventricular hypertrophy
LVOT	Left ventricular outflow tract
MESA	Multi-Ethnic Study of Atherosclerosis
MET	Estimated metabolic equivalent of exercise
MI	Myocardial infarction
MPI	Myocardial perfusion imaging
MR	Mitral regurgitation
MS	Mitral stenosis
PCI	Percutaneous coronary intervention
PET	Positron emission tomography
PFT	Pulmonary function test
PVCs	Premature ventricular contractions
SE	Stress echocardiography
TTE	Transthoracic echocardiography
VT	Ventricular tachycardia
VF	Ventricular fibrillation
WPW	Wolff-Parkinson-White

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POLICY HISTORY

Date	Summary
May 2023	• Removed time limitation "within past two years" for further evaluation inconclusive prior CAD evaluation • Added coronary stenosis of unclear significance on coronary angiography • Added evaluation of asymptomatic moderate or severe aortic stenosis (AS) and aortic regurgitation (AR) for measurement of changes in valve hemodynamics • Added evaluation symptomatic patients with suspected diastolic dysfunction • Added statement on clinical indications not addressed in this guideline
February 2022	• Moved the sentence regarding utilization of suitable alternatives such as Stress Echocardiography and MPI to the General Information section • Clarified "intermediate lesions are 50-69%" for ischemia-producing disease • Placed Link to Overview Section in General Information • Deleted the requirement for diabetes when calcium score > 400 for stress imaging • Added Calcium score section: ○ Added stress imaging approval for calcium score > 100 with symptoms consistent with low to intermediate pretest probability • Changed preoperative guideline to include intermediate risk surgery with one or more risk factors AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year • Changed solid organ transplant guideline to include stem cell transplant and "any" organ transplant • Added definition of surgical risk to preop guidelines • In Background section clarified the requirement for description of chest pain by adding sentence "The medical record should provide enough detail to establish the type of chest pain. " • Added definition of Q waves • Deleted sentence regarding calcium scoring within the Global Risk Section • Deleted sentence regarding using calcium score solely for risk stratification • Deleted IFR references

Reviewed / Approved by NIA Clinical Guideline Committee

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Clinical guidelines **HEART CATHETERIZATION**	**Original Date: February 2010**
CPT Codes: 93452, 93453, 93454, 93455, 93456, 93457, 93458, 93459, 93460, 93461, +93462, +93463, +93464, +93565, +93566, +93567, +93568	**Last Revised Date: April 2023**
Guideline Number: NIA_CG_065	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR INVASIVE CORONARY ARTERIOGRAPHY[1-5]

General

- Typical angina with new onset or evolving ischemic EKG changes
- New onset or worsening of the patient's previously known anginal symptoms in a patient with a history of CABG or PCI
- Symptomatic patients with a high pretest probability
- Unheralded syncope (not near syncope), where the etiology is unclear

Stable Ischemic Heart Disease

- Exercise electrocardiogram (ECG) stress test with high-risk findings, such as Duke Score ≤ -11, ST segment elevation, hypotension, exercise-induced ventricular tachycardia (VT), or several minutes of ST segment depression post exercise[3]
- Stress imaging with high-risk findings (see Background section)
- Stress imaging with intermediate risk findings (see Background section) in a patient with one of the following:

    - Symptoms consistent with ischemia[3]
    - Unsatisfactory quality of life due to angina[2]
    - Ejection fraction (EF) < 50%[2]
- Non-invasive test with low-risk findings with new, worsening, or limiting symptoms with reasonable suspicion of cardiac origin despite optimal medical therapy (OMT) or inability to tolerate OMT[1-3]
- New, worsening, or limiting symptoms, with known unrevascularized obstructive coronary artery disease (CAD), in a patient eligible for revascularization[1, 2]
- Post STEMI with "culprit only" revascularization and plan for further PCI of non-culprit lesion[6]
- Discordant, equivocal, or inconclusive non-invasive evaluation in patients with suspected symptomatic stable ischemic heart disease, including the following[3, 5, 7]:
    - Low risk stress imaging with high-risk stress ECG response or stress induced typical angina[3]
    - Equivocal, uninterpretable, or inconclusive stress imaging due to issues of attenuation or other problems with interpretability[2, 3]

CCTA Abnormalities

- Symptomatic patient with one of the following[2-4]:
    - One vessel with ≥ 50% stenosis
    - A stenosis of 40-90% and FFR-CT ≤0.8[8]
    - ≥ 50% left main stenosis, **even if asymptomatic**

Heart Failure with Left Ventricular Dysfunction

- New heart failure, cardiomyopathy, or wall motion abnormality in patients who are candidates for coronary revascularization; including one of the following[2, 3, 5, 9, 10]:
    - Newly recognized heart failure in patients with known or suspected CAD
    - Symptomatic heart failure or ischemia with new, unexplained wall motion abnormality[2, 3]
    - Structural abnormality (severe mitral regurgitation or ventricular septal defect) with reason to suspect ischemic origin
    - Deterioration in clinical status of heart failure or cardiomyopathy requiring invasive evaluation for guidance or alteration in therapy
    - Clarification of the diagnosis of myocarditis versus acute coronary syndrome[11]

Ventricular Arrhythmias

- Ventricular arrhythmias, without identified non-cardiac cause:
    - Following recovery from unexplained sudden cardiac arrest[12]
    - Sustained VT or VF[3]
    - Exercise-induced VT[3]

Prior to Non-Coronary Intervention and Cardiac Surgery

- Evaluation of coronary anatomy, with consideration of coronary revascularization, prior to cardiac surgery in patients with any of the following[13-17]:
    - Symptoms of angina
    - Stress imaging with evidence of ischemia
    - Decreased LV systolic function (EF < 50%)
    - History of CAD
    - Coronary risk factors, including men > 40 and postmenopausal women
    - Non-invasive data that is inconclusive
    - Chronic severe secondary mitral regurgitation
    - Requirement for detailed assessment of coronary artery anatomy prior to aortic valve homograft surgery, pulmonary autograft (Ross procedure), or aortic root procedure
    - Patients undergoing transcatheter aortic valve replacement (TAVR) or other transcatheter valve procedures
    - Can be done pre-organ transplant when required by transplant center protocol in place of, but not in addition to an imaging study

Hypertrophic Cardiomyopathy

- Patients with HCM, who are candidates for SRT, and for whom there is uncertainty of LVOT obstruction on noninvasive imaging studies, invasive hemodynamic assessment with cardiac catheterization is recommended[18]
- In patients with symptoms or evidence of myocardial ischemia (CCTA also allowed)
- Prior to surgical myectomy in HCM patients who are at risk for coronary atherosclerosis (CCTA also allowed)

Post Cardiac Transplantation[19]

- Assessment for allograft vasculopathy annually for the first 5 years, followed by annual assessment in those with documented allograft vasculopathy, if stress imaging has not been performed
- Assessment of change in clinical status, including any of the following, if stress imaging has not been performed:
    - New left ventricular dysfunction
    - Symptoms of ischemia
    - Non-invasive findings of ischemia

Hemodynamic Assessment

- Indications for angiographic and/or hemodynamic assessment of valvular function or shunt physiology[3, 13, 20]

    - Assessment of bioprosthetic valve when transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) were inadequate, and cardiac magnetic resonance (CMR) or cardiac computed tomography (CCT) are not available
    - Assessment of mechanical valve prostheses when TTE and TEE are inadequate and CCTA is not available
    - Discordance between non-invasive data and clinical impression of severity of valvular disease
    - Evaluation of indeterminate shunt anatomy or shunt flows/ratio
- Indications for hemodynamic assessment only[3, 20]
    - Assessment of constrictive and restrictive physiology
    - Assessment of pulmonary hypertension when non-invasive data provides inadequate information for management, or to evaluate response to intravenous drug therapy
    - Assessment of hemodynamics in heart failure, cardiomyopathy, or adult congenital heart disease, when
        - Non-invasive data is discordant or conflicts with the clinical presentation
        - Non-invasive data is inadequate for clinical management

These guidelines only cover procedures that include left heart catheterization. NIA does not manage right heart catheterization as a stand-alone procedure.

BACKGROUND

Heart catheterization is an invasive angiographic procedure used to evaluate the presence and extent of coronary artery disease (CAD).

In addition to angiography, it can also include ventriculography, aortography, acquisition of hemodynamic data, measurement of cardiac output, detection and quantification of shunts and flows, intravascular ultrasound (IVUS), and fractional flow reserve (FFR)/instantaneous wave free ratio (iFR) for determination of a lesion's hemodynamic severity. CAD stenosis ≥70% (≥50% in the left main coronary artery) is considered clinically significant or obstructive CAD.[2, 5, 7, 21]

This guideline applies to patients with a stable clinical presentation, not to those with acute coronary syndromes or acute valvular abnormalities.

In stable patients, preliminary evaluation with non-invasive cardiac testing is usually indicated prior to a recommendation for cardiac catheterization.

Stable Patients without Known CAD fall into 2 categories[2, 5, 7]:

- **Asymptomatic**, for whom global risk of CAD events can be determined from coronary risk factors, using calculators available online (see Global Cardiovascular Risk Calculators section).

- **Symptomatic,** for whom the pretest probability that chest-related symptoms are due to clinically significant CAD is estimated.

The Three Types of Chest Pain or Discomfort and Pretest Probability of CAD

- **Typical Angina (Definite)** is defined as including all **3** characteristics:
  - Substernal chest pain or discomfort with characteristic quality and duration
  - Provoked by exertion or emotional stress
  - Relieved by rest and/or nitroglycerine
- **Atypical Angina (Probable)** has only **2** of the above characteristics
- **Non-anginal Chest Pain/Discomfort** has only **0 - 1** of the above characteristics

Once the type of chest pain has been established from the medical record, the pretest probability of obstructive CAD is estimated from the **Diamond Forrester Table** below, recognizing that in some cases multiple additional coronary risk factors could increase pretest probability.[2, 5]

Diamond Forrester Table

Age (Years)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Non-anginal Chest Pain
≤ 39	Men	Intermediate	Intermediate	Low
	Women	Intermediate	Very low	Very low
40 – 49	Men	High	Intermediate	Intermediate
	Women	Intermediate	Low	Very low
50 – 59	Men	High	Intermediate	Intermediate
	Women	Intermediate	Intermediate	Low
≥ 60	Men	High	Intermediate	Intermediate
	Women	High	Intermediate	Intermediate

- **Low:** 5 - 10% pretest probability of CAD
- **Intermediate:** 10% - 90% pretest probability of CAD
- **High:** > 90% pretest probability of CAD

Coronary Risk Categories Derived from Non-invasive Testing[2, 4]

- **High risk (> 3% annual death or MI)**
  - Severe resting left ventricular (LV) dysfunction (LVEF < 35%) not readily explained by non-coronary causes
  - Resting perfusion abnormalities ≥ 10% of the myocardium in patients without prior history or evidence of myocardial infarction (MI)

- Stress ECG findings including ≥ 2 mm of ST-segment depression at low workload or persisting into recovery, exercise-induced ST-segment elevation, or exercise-induced ventricular tachycardia (VT)/ventricular fibrillation (VF)
- Severe stress-induced left ventricular (LV) dysfunction (peak exercise EF < 45% or drop in EF with stress ≥ 10%)
- Stress-induced perfusion abnormalities involving ≥ 10% myocardium or stress segmental scores indicating multiple abnormal vascular territories
- Stress-induced LV dilation. Transient ischemic dilation (TID) is the ratio of left ventricular area immediately post-exercise divided by the area of the 4-hour redistribution image, with an abnormal ratio defined as > 1.12[22]
- Inducible wall motion abnormality (involving ≥ 2 segments or ≥2 vascular territories)
- Wall motion abnormality developing at low dose of dobutamine (≤ 10 mg/kg/min) or at a low heart rate (< 120 beats/min)
- Multivessel obstructive CAD (≥ 70% stenosis) or left main stenosis (≥ 50% stenosis) on CCTA

- **Intermediate risk (1% to 3% annual death or MI)**
  - Mild or moderate resting LV dysfunction (EF 35% to 49%) not readily explained by non-coronary causes
  - Resting perfusion abnormalities in 5% to 9.9% of the myocardium in patients without a history or prior evidence of MI
  - ≥1 mm of ST-segment depression occurring with exertional symptoms
  - Stress-induced perfusion abnormalities involving 5% to 9.9% of the myocardium or stress segmental scores (in multiple segments) indicating 1 vascular territory with abnormalities but without LV dilation
  - Inducible wall motion abnormality involving 1 segment or 1 vascular territory
  - CAC score 100 to 399 Agatston units (only for use in primary prevention, not for heart catheterization decision making)[2, 3, 7, 23]
  - One vessel CAD with ≥ 70% stenosis or moderate CAD stenosis (50% to 69% stenosis) in ≥ 2 arteries on CCTA
- **Low risk (< 1% annual death or MI)**
  - Low-risk treadmill score (score ≥ 5) or no new ST segment changes or exercise-induced chest pain symptoms, when achieving maximal levels of exercise
  - Normal or small myocardial perfusion defect at rest or with stress involving < 5% of the myocardium
  - Normal stress or no change of baseline wall motion abnormalities during stress
  - CAC score < 100 Agatston units (only for use in primary prevention, not for heart catheterization decision making)[2, 3, 7, 23]
  - No coronary stenosis > 50% on CCTA

Global Risk of Cardiovascular Disease

Global risk of CAD is defined as the probability of manifesting cardiovascular disease over the next 10 years and refers to **asymptomatic** patients without known cardiovascular disease. It should be determined using one of the risk calculators below. A high risk is considered greater than a 20% risk of a cardiovascular event over the ensuing 10 years. **High global risk by itself generally lacks scientific support as an indication for stress imaging**.[24] There are rare exemptions, such as patients requiring I-C antiarrhythmic drugs, who might require coronary risk stratification prior to initiation of the drug, when global risk is moderate or high.

- **CAD Risk—Low**
  10-year absolute coronary or cardiovascular risk less than 10%
- **CAD Risk—Moderate**
  10-year absolute coronary or cardiovascular risk between 10% and 20%
- **CAD Risk—High**
  10-year absolute coronary or cardiovascular risk of greater than 20%

Websites for Global Cardiovascular Risk Calculators*

Risk Calculator	Websites for Online Calculator
Framingham Cardiovascular Risk	https://reference.medscape.com/calculator/framingham-cardiovascular-disease-risk
Reynolds Risk Score Can use if no diabetes Unique for use of family history	http://www.reynoldsriskscore.org/
Pooled Cohort Equation	http://clincalc.com/Cardiology/ASCVD/PooledCohort.aspx?example
ACC/AHA Risk Calculator	http://tools.acc.org/ASCVD-Risk-Estimator/
MESA Risk Calculator With addition of Coronary Artery Calcium Score, for CAD-only risk	https://www.mesa-nhlbi.org/MESACHDRisk/MesaRiskScore/RiskScore.aspx

*Patients who have already manifested cardiovascular disease are already at high global risk and are not applicable to the calculators.[23, 25-28]

Definitions of Coronary Artery Disease[2, 4, 7, 29]

- Percentage stenosis refers to the reduction in diameter stenosis when angiography is the method and can be estimated or measured using angiography or more accurately measured with intravascular ultrasound (IVUS).

- Coronary artery calcification is a marker of risk, as measured by Agatston score on coronary artery calcium imaging. It is not a diagnostic tool so much as it is a **risk stratification** tool. Its incorporation into global risk can be achieved by using the MESA risk calculator.
- Ischemia-producing disease (also called hemodynamically or functionally significant disease, or obstructive coronary disease for which revascularization might be appropriate) implies at least one of the following:
    - Suggested by percentage diameter stenosis ≥ 70% by angiography; intermediate lesions are 50 – 69%[30]
    - For a left main artery, suggested by a percentage stenosis ≥ 50% or minimum luminal cross-sectional area on IVUS ≤ 6 square mm[2, 21, 29]
    - FFR (fractional flow reserve) ≤ 0.80 for a major vessel[21, 29]
    - iFR (instantaneous wave-free ratio) ≤ 0.89 for a major vessel[21, 31-33]
- A major vessel would be a coronary vessel that would be amenable to revascularization, if indicated. This assessment is made based on the diameter of the vessel and/or the extent of myocardial territory served by the vessel.
- FFR is the distal to proximal pressure ratio across a coronary lesion during maximal hyperemia induced by either intravenous or intracoronary adenosine. Less than or equal to 0.80 is considered a significant reduction in coronary flow.
- Instantaneous wave-free ratio (iFR) measures the ratio of distal coronary to aortic pressure during the wave free period of diastole, with a value ≤ 0.89 considered hemodynamically significant.[31-33]

Anginal Equivalent[2, 34, 35]

Development of an anginal equivalent (e.g., shortness of breath, fatigue, or weakness) either with or without prior coronary revascularization should be based upon the documentation of reasons that symptoms other than chest discomfort are not due to other organ systems (e.g., dyspnea due to lung disease, fatigue due to anemia), by presentation of clinical data such as respiratory rate, oximetry, lung exam, etc. (as well as D-dimer, chest CT(A), and/or PFTs, when appropriate), and then incorporated into the evaluation of coronary artery disease as would chest discomfort. Syncope per se is not an anginal equivalent.

Optimal Medical Therapy (OMT)

In general, a trial of OMT includes

- Anti-platelet therapy
- Lipid-lowering therapy
- Beta blocker
- Angiotensin converting enzyme (ACE) inhibitor

Abbreviations

CABG	Coronary artery bypass grafting surgery
CAC	Coronary artery calcium
CAD	Coronary artery disease
CCT	Cardiac computed tomography
CCTA	Coronary computed tomographic angiography
CMR	Cardiac magnetic resonance
CT(A)	Computed tomography (angiography)
ECG	Electrocardiogram
EF	Ejection fraction
FFR	Fractional flow reserve
FFR-CT	Fractional flow reserve – computed tomography
HCM	Hypertrophic cardiomyopathy
iFR	Instantaneous wave-free ratio
IVUS	Intravascular ultrasound
LV	Left ventricular
LVEF	Left ventricular ejection fraction
LVOT	Left ventricular outflow tract
MESA	Multi-Ethnic Study of Atherosclerosis
MI	Myocardial infarction
MR	Mitral regurgitation
OMT	Optimal medical therapy
PCI	Percutaneous coronary intervention
PFT	Pulmonary function test
SRT	Septal reduction therapy
TAVR	Transcatheter aortic valve replacement
TID	Transient ischemic dilation
TTE	Transthoracic echocardiography
TEE	Transesophageal echocardiography
VT	Ventricular tachycardia
VF	Ventricular fibrillation

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POLICY HISTORY

Date	Summary
April 2023	• Added definition of unstable angina to include ischemic EKG changes • Added definition in background section on OMT (optimal medical therapy) • Added indication for revascularization of non-culprit lesion post STEMI • Added statement on clinical indications not addressed in this guideline
February 2022	• Added indications to CCTA section regarding left main disease, single vessel disease >50% stenosis • Modified indication for exercise-induced VT removing statement "requiring signs and symptoms of ischemia" • Clarified definition of intermediate findings, non-invasive testing • FFR-CT statement updated • Modified indication for newly diagnosed HF removing statement "requiring signs and symptoms of ischemia"

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **TUMOR IMAGING PET - ANY SITE** **(UNLISTED PET)**	**Original Date: June 2007**
CPT Codes: G0235	**Last Revised Date: May 2023**
Guideline Number: NIA_CG_070-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations*

IMPORTANT NOTE:

PET imaging, any site, not otherwise specified, is a non-covered CPT code.

POLICY HISTORY

Date	Summary
May 2023	• General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
April 2022	No changes

Reviewed / Approved by NIA Clinical Guideline Committee

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IMPORTANT NOTE:

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POLICY HISTORY

Date	Summary
May 2023	• General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
April 2022	No changes

Reviewed / Approved by NIA Clinical Guideline Committee

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*National Imaging Associates, Inc.	
Clinical guidelines **LOW FIELD MRI**	**Original Date: July 2009**
CPT Codes: S8042	**Last Revised Date: March 2023**
Guideline Number: NIA_CG_064	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE

Low Field MRI services are not considered to be medically necessary, are not approvable for payment, and cannot be approved.

BACKGROUND

MRI scanners with a field strength of greater than 1.0 Tesla (T) are considered high field. The typical high field MRI units in clinical practice range between 1.0 – 3.0 Tesla. In October 2017 the FDA cleared the first 7 T MRI units.[1] The definition of mid and low field MRI is more variable with mid field units having a lower field strength range of 0.3 to 0.5 and an upper limit under 1.0 T. Low field units have field strengths below 0.3 to 0.2 T. The major disadvantage of low field strength MRI relative to higher field scanners is lower signal to noise ratios, less homogeneity in the magnetic field, lower detection of calcification, hemorrhage, or gadolinium enhancement. Lee et al showed that low field (<0.5 T) units were effective in evaluating medial meniscal, anterior cruciate ligament, and rotator cuff tears but not effective for evaluating lateral meniscal tears, osteochondral defects, or shoulder superior labrum-anterior posterior (SLAP) ligament complex pathology.[2, 3]

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POLICY HISTORY

Date	Summary
March 2023	• General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Removed Additional Resources
April 2022	No changes

Reviewed / Approved by NIA Clinical Guideline Committee

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*Evolent	
Clinical guidelines **PACEMAKER**	**Original Date: February 2013**
CPT Codes: **33206, 33207, 33208, 33212, 33213, 33214, 33227, 33228**	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_322	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR PACEMAKERS – ADULT (Excludes conditions that are expected to resolve)[1, 2]

Sinus Node Dysfunction (SND)

- Documented symptomatic sinus bradycardia, including frequent sinus pauses
- Symptomatic chronotropic incompetence (broadly defined as an inability to increase heart rate commensurate with activity or demand), documented by stress test or cardiac monitoring data (Holter/MCOT/Electrocardiography (ECG)) recording data
- Symptomatic sinus bradycardia that results from required guideline-directed medical therapy (GDMT) for which there is no alternative treatment
- Heart rate less than 40 while awake, even without definite association with significant symptoms consistent with bradycardia
- Tachycardia-bradycardia syndrome and symptoms attributable to bradycardia[2]
- Syncope of unexplained origin with clinically significant SND, either documented or provoked in electrophysiologic study (EPS)

Acquired Atrioventricular (AV) Block

First-Degree AV Block

- Marked first-degree Mobitz Type 1 AV block with symptoms clearly attributable to the AV block
- First-degree AV block with "pacemaker syndrome" symptoms (chronic fatigue, dyspnea on exertion, symptomatic hypotension) or hemodynamic compromise

Second-Degree AV Block (Mobitz Types I and II)

- Marked second-degree Mobitz Type 1 AV block with symptoms clearly attributable to the AV block
- Second-degree AV block with "pacemaker syndrome" symptoms (chronic fatigue, dyspnea on exertion, symptomatic hypotension) or hemodynamic compromise
- Second-degree Mobitz Type II AV block regardless of symptoms
- Advanced second-degree AV block
- Second-degree AV block associated with a wide QRS, or EPS-documented intra- or infra-His conduction
- Symptomatic bradycardia associated with second-degree AV block, either Mobitz I or II

Third-Degree/Complete AV Block

- Third-degree (complete) AV block, intermittent or persistent, regardless of symptoms
- High-grade AV block, regardless of symptoms

AF/Other

- Atrial fibrillation while awake, with pauses ≥ 5 seconds, or symptomatic bradycardia
- In sinus rhythm (with AV block) while awake, pauses ≥ 3 seconds or heart rates less than 40 beats per minute or an escape rhythm below the AV node
- Following catheter ablation of the AV junction
- Symptomatic AV block that results from required medical therapy for which there is no alternative treatment
- Exercise-induced second- or third-degree AV block without myocardial ischemia

Neuromuscular Disorders

- Marked first-degree or higher AV block, or an H-V interval ≥ 70 ms, associated with neuromuscular diseases, such as myotonic muscular dystrophy, Erb's dystrophy, Kearns-Sayre syndrome, and peroneal muscular atrophy, regardless of symptoms

Chronic Fascicular (Including any of RBBB, LBBB, LAHB, LPHB) Block

- Alternating bundle-branch block
- Syncope of unexplained origin when other likely causes have been excluded, specifically ventricular tachycardia[3]

- Syncope and bundle branch block with an HV interval ≥ 70 ms, or evidence of infranodal block at EPS[2]
- Incidental findings at EPS study of an H-V interval ≥ 100 milliseconds, or non-physiological, pacing-induced infra-His block in asymptomatic patients

Hypersensitive Carotid Sinus Syndrome and Neurocardiogenic Syncope

- Recurrent syncope due to spontaneously occurring carotid sinus stimulation AND carotid sinus pressure induced ventricular asystole ≥ 3 seconds, or AV block, or ≥ 50 mmHg drop in systolic BP[1, 3]
- Syncope without clear, provocative events and with a hypersensitive cardioinhibitory response (asystole) ≥ 3 seconds
- Recurrent syncope and asystole ≥ 3 seconds with syncope or ≥ 6 seconds without symptoms or with presyncope, documented by ECG recording data[4, 5]

Pacing to Terminate or Prevent Tachycardia

- Symptomatic recurrent supraventricular tachycardia documented to be terminated by pacing in the setting of failed catheter ablation and/or drug treatment
- Prevention of pause-dependent ventricular tachycardia (VT)

INDICATIONS FOR PEDIATRIC AND ADULT CONGENITAL HEART DISEASE PACING[1, 4, 6]

Children, Adolescents (< 19 years), and ADULT Patients with Congenital Heart Disease (CHD)

Sinus Node Dysfunction (SND)

- SND with symptomatic age- and activity-inappropriate bradycardia
- Sinus bradycardia with complex CHD AND a resting heart rate < 40 bpm **OR** pauses in ventricular rate > 3 seconds
- CHD and impaired hemodynamics due to sinus bradycardia or loss of AV synchrony
- Asymptomatic sinus bradycardia following repair of CHD with an awake resting heart rate < 40 bpm or pauses in ventricular rate > 3 seconds
- CHD and SND or junctional bradycardia, for the prevention of recurrent episodes of intra-atrial reentrant tachycardia[4, 6, 7]

AV Block

- Second- or third-degree AV block with symptomatic bradycardia, ventricular dysfunction, or low cardiac output
- Congenital third-degree AV block with a wide QRS escape rhythm, complex ventricular ectopy, or ventricular dysfunction
- Congenital third-degree AV block in the infant with a ventricular rate < 55 bpm or with congenital heart disease and a ventricular rate < 70 bpm

- Congenital third-degree AV block after 1 year of age with an average heart rate < 50 bpm, abrupt pauses in ventricular rate that are 2 or 3 times the basic cycle length, or associated with symptoms due to chronotropic incompetence
- Adults with congenital complete AV block with symptomatic bradycardia, wide QRS escape rhythm, mean daytime heart rate < 50 bpm, complex ventricular ectopy, or ventricular dysfunction[2]
- Adults with congenital complete AV block, regardless of symptoms[2]
- Unexplained syncope after prior congenital heart surgery complicated by transient complete heart block, with residual fascicular block after excluding other causes of syncope
- Congenital third-degree AV block in asymptomatic children or adolescents with an acceptable rate, a narrow QRS, and normal ventricular function

Scenarios in which Pacemakers are Not Indicated

- SND in patients that are asymptomatic, or symptoms occur without documented bradycardia
- Asymptomatic first-degree AV block or Mobitz I second-degree AV block with a narrow QRS
- Asymptomatic fascicular block (Including any of RBBB, LBBB, LAHB, LPHB)
- Asymptomatic bifascicular block (RBBB/LAHB or RBBB/LPHB) with or without first-degree AVB where a higher degree of heart block has not been demonstrated
- Hypersensitive cardioinhibitory response to carotid sinus stimulation without symptoms or with vague symptoms
- Asymptomatic bifascicular block (RBBB/LAHB or RBBB/LPHB) with or without first-degree AVB after surgery for CHD without prior transient complete AV block

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BACKGROUND[1]

Pacemaker implantation generally serves to address bradycardia, with the intention of ameliorating related symptoms, preventing complications of syncope, and/or reducing mortality risk.

This guideline is not intended to cover the type of bradycardia pacing device. CRT (cardiac resynchronization therapy or biventricular pacing) and ICD (implantable cardioverter defibrillator) implantation are covered in separate guidelines.

OVERVIEW

General

A pacemaker system is composed of a pulse generator and one or more leads. The pulse generator is implanted under the skin, usually below one of the collarbones (clavicles). It contains a battery, a microprocessor that governs timing and function, and a radio antenna to allow for noninvasive interrogation and reprogramming. The leads are insulated cables that conduct electricity from the pulse generator to the heart. Leads are most commonly inserted into a vein and then advanced under fluoroscopy (x-ray guidance) to within one or more heart chambers. The leads are fastened within the chambers to the heart muscle using either hooks or retractable/extendable screws, which are built into their tips. Timed electrical impulses are delivered from the pulse generator via the leads to the heart, where stimulation results in heart muscle contraction.

Leadless pacemakers are sometimes used as an alternative to transvenous pacemakers when no upper extremity venous access exists or when risk of device pocket infection is particularly high, such as previous infection and patients on hemodialysis.[8] Leadless pacemakers currently only have the capacity to pace the ventricle. The prevalence of leadless device infections is low as the principal source of infection.

Heart Block Definitions[1]

- First-Degree: All sinus or atrial beats are conducted to the ventricles, but with a delay (PR interval of > 200 ms)
- Second-Degree: Intermittent failure of conduction of single beats from atrium to ventricles
    - (Mobitz) Type I: Conducted beats have variable conduction times from atrium to ventricles
    - (Mobitz) Type II: Conducted beats have uniform conduction times from atrium to ventricles
    - Advanced or high degree: Two or more consecutive non-conducted sinus or (non-premature) atrial beats with some conducted beats
- Third-Degree: No atrial beats are conducted from atrium to ventricle

Abbreviations

AV	Atrioventricular
CHF	Congestive heart failure
CRT	Cardiac resynchronization therapy (same as biventricular pacing)
ECG	Electrocardiogram
EPS	Electrophysiologic Study
GDMT	Guideline-Directed Medical Therapy
HV	His-ventricular
ICD	Implantable cardioverter-defibrillator
LAHB	Left Anterior Hemiblock
LBBB	Left bundle-branch block
LPHB	Left Posterior Hemiblock
LV	Left ventricular/left ventricle
LVEF	Left ventricular ejection fraction
MI	Myocardial infarction
ms	Milliseconds
RBBB	Right Bundle Branch Block
s	Seconds
STEMI	ST-elevation Myocardial Infarction
SND	Sinus node dysfunction
VT	Ventricular tachycardia

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POLICY HISTORY

Date	Summary
April 2023	• Additional statement on leadless pacemaker • Added statement on clinical indications not addressed in this guideline
February 2022	• Added section on leadless pacemakers

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **TEMPOROMANDIBULAR JOINT (TMJ) MRI**	**Original Date: May 2003**
CPT Code: 70336	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_007	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
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INDICATIONS FOR TEMPOROMANDIBULAR JOINT (TMJ) MRI

For evaluation of temporomandibular joint dysfunction (TMD) with suspected internal joint derangement with[1-3]:

- Persistent symptoms of facial or jaw pain, restricted range of motion, pain and/or noise with TMJ function (i.e., chewing) **AND**
- Conservative therapy with a trial of anti-inflammatory **AND** behavioral modification* has been unsuccessful for at least four (4) weeks

* Behavioral modification includes patient education, self-care, cognitive behavior therapy, physical therapy, and occlusal devices. Muscle relaxants can be used for spasm.

Note: X-ray should be the initial study if there is recent trauma, dislocation, malocclusion, or dental infection

For evaluation of juvenile idiopathic arthritis (JIA)[3, 4]

Abnormal initial x-ray or ultrasound needing additional imaging[1]

Pre-operative evaluation in candidates for orthognathic surgery

Post-operative evaluation[5]

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BACKGROUND

Temporomandibular joint (TMJ) dysfunction causes pain and dysfunction in the jaw joint and muscles controlling jaw movement. Symptoms may include jaw pain, masticator muscle stiffness, limited movement or locking of the jaw, clicking or popping in jaw joint when opening or closing the mouth, and a change in how the upper and lower teeth fit together. The cause of the condition is not always clear but may include acute or chronic trauma to the jaw or temporomandibular joint, e.g., grinding of teeth, clenching of jaw, or impact in an accident. Osteoarthritis or rheumatoid arthritis may also contribute to the condition.

Etiologies of TMJ dysfunction (TMD) include intra-articular (intracapsular) and extra-articular (extracapsular pathology). Intra-articular (intracapsular pathology), such as disc displacement and coexisting osteoarthritis or degenerative joint disease, is considered the most common cause of serious TMJ pain and dysfunction and the most likely to be treated surgically. Extra-articular (extracapsular pathology) includes musculoskeletal (bone, masticatory muscles and tendons) and central nervous system/peripheral nervous system.[6]

Imaging can assist in the diagnosis of TMD when history and physical examination findings are equivocal. The initial study should be plain radiography (transcranial and transmaxillary views) or panoramic radiography when there is recent trauma, dislocation, malocclusion, or dental infection.[2] Ultrasound is an inexpensive and easily performed imaging modality that can also be used to evaluate the TMJ.[7] CT is useful to evaluate the bony structures of the TMJ when there is suspicion of bony involvement (i.e., fractures, erosions, infection, invasion by tumor, as well as congenital anomalies).[1] Magnetic resonance imaging (MRI) has the highest sensitivity, specificity, and accuracy in the evaluation of temporomandibular joint dysfunction and provides tissue contrast for visualizing the soft tissue and periarticular structures of the TMJ.

Conservative care for TMD includes patient education, self-care, behavioral modification, cognitive behavioral therapy/biofeedback, medication, physical therapy, and occlusive devices. Medications include NSAIDS and muscle relaxants and in chronic cases, benzodiazepines, or antidepressants. There is lack of high-quality evidence and uncertainty about the effectiveness of manual therapy and therapeutic physical therapy in treating TMJ dysfunction.[8] The use of occlusive splints is thought to alleviate some of the degenerative forces on the TMJ which may be helpful in patients with bruxism or nocturnal teeth clenching. Preferred devices are unclear from the literature and dental consultation is required.[2] In systematic reviews, there has been short-term benefit observed from splinting but no clear role in the overall long-term treatment of TMD patients.[9, 10]

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POLICY HISTORY

Date	Summary
April 2023	• Updated references • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
May 2022	Updated background and references

Reviewed / Approved by Clinical Guideline Committee

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Clinical guidelines **BRAIN (HEAD) CT**	**Original Date: September 1997**
CPT Codes: 70450 70460 70470	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_002	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

REDUCING RADIATION EXPOSURE

Brain CT/CTA are not approvable simultaneously unless they meet the criteria described below in the Indications for Brain CT/Brain CTA combination studies section. If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- Inconclusive or show a need for additional or follow up imaging evaluation OR
- The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.

(*Unless approvable in the combination section as noted in the guidelines)

Important Note: Brain MRI is preferred to Brain CT in most circumstances where the patient can tolerate MRI and sufficient time is available to schedule the MRI examination. Assessment of subarachnoid hemorrhage, acute trauma, or bone abnormalities of the calvarium (fracture, etc.) may be better imaged with CT. CT is also appropriate in an urgent situation where MRI is not readily available (stroke, increased ICP, CNS infection).

‡‡ — *Designates CT is indicated only when MRI is contraindicated or cannot be performed*

INDICATIONS FOR BRAIN CT

For evaluation of headache[1-5]

- Chronic headache with a change in character/pattern (e.g., more frequent, increased severity or duration) ‡‡
- Cluster headaches or other trigeminal-autonomic cephalgias, i.e., paroxysmal hemicrania, hemicrania continua, short-lasting unilateral neuralgiform headache attacks (SUNCT/SUNA) imaging is indicated once to eliminate secondary causes[6] ‡‡
- Acute headache, sudden onset:
    - With a personal or family history (brother, sister, parent, or child) of brain aneurysm or AVM (arteriovenous malformation)
    - < 48 hours of "worst headache in my life" or "thunderclap" headache
        - Note: The duration of a thunderclap type headache lasts more than 5 minutes. Sudden onset new headache reaching maximum intensity within 2-3 minutes.
    - Prior history of stroke or intracranial bleed
    - Known coagulopathy or on anticoagulation
- New onset of headache with any of the following[1, 7, 8]:
    - Acute, new, or fluctuating neurologic deficits, such as sensory deficits, limb weakness, abnormal reflexes (pathological, asymmetric, hyperreflexia), speech difficulties, visual loss, lack of coordination, or mental status changes or with signs of increased intracranial pressure (papilledema). See background ‡‡
    - History of cancer or significantly immunocompromised ‡‡
    - Fever
    - Subacute head trauma
    - Age ≥ 50 ‡‡
    - New severe unilateral headache with radiation to or from the neck, associated with suspicion of carotid or vertebral artery dissection ‡‡
    - Related to activity or event (sexual activity, exertion, Valsalva, position) and (new or progressively worsening ‡‡
    - Persistent or worsening during a course of physician-directed treatment[1, 9, 10] ‡‡

Note: Neuroimaging warranted for atypical/complex migraine aura, but not for a typical migraine aura (see background)

- Special considerations in the pediatric population with persistent headache[11]
    - Occipital location ‡‡
    - Age < 6 years ‡‡
    - Symptoms indicative of increased intracranial pressure, such as recurring headaches after waking with or without associated nausea/vomiting ‡‡
    - Documented absence of family history of headache ‡‡

- Severe headache in a child with an underlying disease that predisposes to intracranial pathology (e.g., immune deficiency, sickle cell disease, neurofibromatosis, history of neoplasm, coagulopathy, hypertension, congenital heart disease)

For evaluation of neurologic symptoms or deficits[12]

- Acute, new, or fluctuating neurologic symptoms or deficits, such as sensory deficits, limb weakness, abnormal reflexes (pathological, asymmetric, hyperreflexia), speech difficulties, visual loss, lack of coordination, or mental status changes (see background)

For evaluation of known or suspected stroke or vascular disease[13-15]

- Known or suspected stroke with any acute, new, or fluctuating symptoms or deficits such as sensory deficits, limb weakness, speech difficulties, visual loss, lack of coordination, or mental status changes (see background)
- Suspected stroke with first-degree family history of aneurysm (brother, sister, parent, or child) or known coagulopathy or on anticoagulation
- Symptoms of transient ischemic attack (TIA) (episodic neurologic symptoms such as sensory deficits, limb weakness, speech difficulties, visual loss, lack of coordination, or mental status changes) ‡‡
- Suspected acute subarachnoid hemorrhage (SAH)
- Follow-up for known hemorrhage, hematoma, or vascular abnormalities
- Suspected central venous thrombosis - see background[14, 16] ‡‡
- Evaluation of neurological signs or symptoms in sickle cell disease[17-19] ‡‡
- High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity >200 ‡‡[19]

For evaluation of known or suspected trauma[20-24]

- Known or suspected trauma or injury to the head with documentation of one or more of the following acute, new, or fluctuating:
  - Focal neurologic findings
  - Motor changes
  - Mental status changes
  - Amnesia
  - Vomiting
  - Seizures
  - Headache
  - Signs of increased intracranial pressure
- Known coagulopathy or on anticoagulation
- Known or suspected skull fracture by physical exam and/or prior imaging
- Repeat scan 24 hours post head trauma for anticoagulated patients with suspected diagnosis of delayed subdural hematoma

- Post concussive syndrome if persistent or disabling symptoms and imaging has not been performed
- Subacute or chronic traumatic brain injury with new cognitive and/or neurologic deficit ‡‡

For evaluation of suspected brain tumor, mass, or metastasis[25-27]

- Suspected brain tumor with any acute, new, or fluctuating neurologic symptoms or deficits such as sensory deficits, abnormal reflexes (pathological, asymmetric, hyperreflexia), limb weakness, speech difficulties, visual loss, lack of coordination or mental status changes ‡‡ (see background)
- Suspected brain metastasis or intracranial involvement in patients with a history of cancer based on symptoms or examination findings (may include new or changing lymph nodes) ‡‡
- Lesion with atypical features for further evaluation or follow up
- Suspected Pituitary Tumors (Brain MRI is the study of choice if indicated) or Sella CT if MRI is contraindicated or cannot be performed
- Histiocytic Neoplasms for screening and/or with neurological signs or symptoms[28,29]
    - Erdheim-Chester Disease
    - Langerhans Cell Histiocytosis
    - Rosai-Dorfman Disease
- Screening for known non-CNS Cancer and for screening of hereditary cancers syndromes (Brain MRI is the study of choice if indicated)

For evaluation of known brain tumor, mass, or metastasis

- Follow-up of known CNS cancer (either primary malignant brain tumor or secondary brain metastasis) undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer[27] ‡‡
- Suspected recurrence with prior history of CNS cancer (either primary or secondary) based on neurological symptoms or examination findings ‡‡
- Follow-up of known low grade tumor (WHO I-II) (i.e., meningioma, glioma, astrocytoma, oligodendroglioma) ‡‡
    - For surveillance as per as per professional society recommendations[27]
    - If symptomatic, new/changing signs or symptoms or complicating factors
- Known pituitary tumors (Brain MRI is the study of choice if indicated) or Sella CT if MRI is contraindicated or cannot be performed
- Tumor monitoring in neurocutaneous syndromes as per tumor type ‡‡
- Bone tumor or abnormality of the skull[28]
- Histiocytic Neoplasms to assess treatment response and surveillance of known brain/skull lesions[29, 30]
    - Erdheim-Chester Disease
    - Langerhans Cell Histiocytosis
    - Rosai-Dorfman Disease [31]

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated, OR evaluation of suspected metastases[27] ‡‡

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine, or Lumbar Spine

For evaluation of known or suspected seizure disorder[32-36]

- New onset of seizures or newly identified change in seizure activity/pattern **‡‡** (Brain MRI is the study of choice if indicated)

For evaluation of known or suspected inflammatory disease or infection (e.g., meningitis or abscess)[37, 38] **‡‡**

- Suspected intracranial abscess or brain infection with acute altered mental status OR positive lab findings (such as elevated WBCs) OR follow-up assessment during or after treatment completed **‡‡**
- Meningitis with positive signs and symptoms (such as fever, headache, mental status changes, stiff neck) OR positive lab findings (such as elevated white blood cells or abnormal lumbar puncture fluid exam) **‡‡**
- Suspected encephalitis with headache and altered mental status OR follow-up as clinically warranted **‡‡**
- Endocarditis with suspected septic emboli **‡‡**
- Central Nervous System (CNS) involvement in patients with known or suspected vasculitis or autoimmune disease with abnormal inflammatory markers or autoimmune antibodies **‡‡**
- Suspected primary CNS vasculitis based on neurological signs and symptoms with completed infectious/inflammatory lab work-up **‡‡** [39, 40]
- Immunocompromised patient (e.g., transplant recipients, HIV with CD4 < 200, primary immunodeficiency syndromes, hematologic malignancies) with focal neurologic symptoms, headaches, behavioral, cognitive, or personality changes **‡‡** [41]

For evaluation of clinical assessment documenting cognitive impairment of unclear cause[42-44]

- Change in mental status with a mental status score of either MMSE or MoCA of less than 26 or other similar mental status instruments */formal neuropsychological testing showing at least mild cognitive impairment AND a completed basic metabolic workup (such as thyroid function testing, liver function testing, complete blood count, electrolytes, and B12) **‡‡**

* Other examples include Mini-Cog, Memory Impairment Screen, Saint Louis University Mental Status Examination (SLUMS), Brief Alzheimer's Screen (BAS), Blessed Dementia Scale (BDS), Clinical Dementia Rating (CDR)[45, 46]

For evaluation of movement disorders[47, 48]

- Acute onset of a movement disorder with concern for stroke or hemorrhage ‡‡
- For evaluation of Parkinson's disease with atypical feature or other movement disorder (i.e., suspected Huntington disease, chorea, parkinsonian syndromes, hemiballismus, atypical dystonia) to exclude an underlying structural lesion ‡‡

Note: CT has limited utility in the chronic phases of disease. Brain MRI is the study of choice if indicated. Imaging is not indicated in essential tremor, Tourette' syndrome or isolated focal dystonia (e.g., blepharospasm, cervical dystonia, laryngeal dystonia, oromandibular dystonia, writer's dystonia).[49-51]

For evaluation of cranial nerve and visual abnormalities (Brain MRI is the study of choice if indicated)

- Abnormal eye findings on physical or neurologic examination (papilledema, nystagmus, ocular nerve palsies, new onset anisocoria, visual field deficit, etc.)[52] ‡‡
  Note: See background
- Binocular diplopia with concern for intracranial pathology[53] after comprehensive eye evaluation ‡‡
- Childhood strabismus with development delay or abnormal fundoscopic exam to rule out intracranial abnormalities[54, 55] ‡‡
- Horner's syndrome with symptoms localizing the lesion to the central nervous system[56] ‡‡
- Evaluation of cranial nerve palsy/neuropathy/neuralgia when thought to be due to tumor, stroke, or bony abnormalities of the skull base or when MRI is contraindicated or cannot be performed[57]
- Bulbar symptoms, i.e., difficulty in chewing, weakness of the facial muscles, dysarthria, palatal weakness, dysphagia, and dysphonia and/or signs, i.e., atrophy and fasciculations of the tongue and absent gag reflex[58]‡‡
- Pseudobulbar symptoms, i.e., dysphagia, dysarthria, facial weakness, sudden, stereotyped emotional outbursts that are not reflective of mood and/or signs, i.e., spastic tongue and exaggerated gag/jaw jerk[59]‡‡

For evaluation of known or suspected congenital abnormality (such as craniosynostosis, neural tube defects)[60-62]

- Known or suspected congenital abnormality with any acute, new, or fluctuating neurologic, motor, or mental status changes
- Evaluation of macrocephaly in an infant/child <18 with previously abnormal US, abnormal neurodevelopmental examination,[63] signs of increased ICP or closed anterior fontanelle ‡‡
- Microcephaly in an infant/child < 18 ‡‡
- Craniosynostosis and other head deformities
- Evaluation of the corticomedullary junction in Achondroplasia[64, 65] ‡‡

- Cerebral palsy if etiology has not been established in the neonatal period, there is change in the expected clinical or developmental profile or concern for progressive neurological disorder[66, 67]
- Prior treatment or planned treatment for congenital abnormality
  Note: For evaluation of known or suspected hydrocephalus please see section on CSF abnormalities.

Cerebral Spinal Fluid (CSF) Abnormalities

- Evaluation of suspected hydrocephalus with any acute, new, or fluctuating neurologic, motor, or mental status changes
- Known hydrocephalus**†**
- For initial evaluation of a suspected Arnold Chiari malformation **‡‡**
- Follow-up imaging of a known type II or type III Arnold Chiari malformation **‡‡**. For Arnold Chiari type I, follow-up imaging only if new or changing signs/symptoms[68, 69]
- Initial evaluation for a known syrinx or syringomyelia**‡‡**
- Known or suspected normal pressure hydrocephalus (NPH)[70]
  - With symptoms of gait difficulty, cognitive disturbance, and urinary incontinence
- Follow-up shunt evaluation[71-73]
  - Post operativity if indicated based on underlying disease and pre-operative radiographic findings and/or
  - 6-12 months after placement and/or
  - With neurologic symptoms that suggest shunt malfunction
- Evaluation of known or suspected cerebrospinal fluid (CSF) leakage[74]
- Cisternography for intermittent and complex CSF rhinorrhea/otorrhea. CSF fluid should always be confirmed with laboratory testing (Beta-2 transferrin assay)[75, 76]
- Suspected spontaneous intra-cranial hypotension with distinct postural headache other symptoms include: nausea, vomiting, dizziness, tinnitus, diplopia neck pain or imbalance[77] **‡‡**
  †Often congenital, but can present later in life; or less commonly acquired secondary to tumor, stroke, trauma, infection, etc.[78]

Further evaluation of indeterminate or questionable findings on prior imaging:

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Pre-operative/procedural evaluation for brain/skull surgery

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Other Indications[19, 79-81]

- Vertigo associated with any of the following: ‡‡
    - Signs or symptoms suggestive of a CNS lesion (ataxia, visual loss, double vision, weakness or a change in sensation)[82, 83]
    - Progressive unilateral hearing loss
    - Risk factors for cerebrovascular disease with concern for stroke
    - After full neurologic examination and vestibular testing with concern for central vertigo (i.e., skew deviation, vertical nystagmus, head thrust test, videonystagmography (VNG)/ electronystagmography (ENG))
- Diagnosis of central sleep apnea on polysomnogram ‡‡
    - Children > 1 year[84]
    - Adults in the absence of heart failure, chronic opioid use, high altitude, or treatment emergent central sleep apnea AND concern for a central neurological cause (Chiari malformation, tumor, infectious/inflammatory disease) OR with an abnormal neurological exam[85]
- Syncope with clinical concern for seizure or associated neurological signs or symptoms[86-88] ‡‡
- Cyclical vomiting syndrome or abdominal migraine with any localizing neurological symptoms[89-91] ‡‡
- Soft tissue mass of the head with nondiagnostic initial evaluation (ultrasound and/or radiograph)[92-94]‡‡
- Psychological changes with neurological deficits on exam or after completion of a full neurological assessment that suggests a possible neurologic cause[95] ‡‡
- Global developmental delay or developmental delay with abnormal neurological examination in a child < 18 years[96, 97] ‡‡
- Unexplained event (BRUE) formerly apparent life-threatening event (ALTE) in infants < 1 year with concern for neurological cause based on history and exam[98] ‡‡
  Note: Imaging is not indicated in low-risk patients
- Prior to lumbar puncture in patients with suspected increased intracranial pressure or at risk for herniation

Indications for Combination Studies[13, 14]

Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the neuroaxis), patient history, and other available information, including prior imaging.

Exception: Approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology[99]

- **Brain CT/Neck CTA**
    - Recent ischemic stroke or transient ischemic attack
    - Suspected carotid or vertebral artery dissection with focal or lateralizing neurological deficits
- **Brain CT/Brain CTA**
    - Recent ischemic stroke or transient ischemic attack
    - Acute, sudden onset of headache with personal history of a vascular abnormality or first-degree family history of aneurysm
    - Headache associated with exercise, exertion, Valsalva or sexual activity[6] ‡‡
    - Suspected venous thrombosis (dural sinus thrombosis) – Brain CTV (see background) ‡‡
    - Neurological signs or symptoms in sickle cell patients ‡‡
    - High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200 ‡‡ [19]
- **Brain CT/Brain CTA/Neck CTA**
    - Recent stroke or transient ischemic attack (TIA)
    - Suspected carotid or vertebral artery dissection with focal or lateralizing neurological deficits

*Note: MRA and CTA are generally comparable noninvasive imaging alternatives each with their own advantages and disadvantages. Brain MRI can alternatively be combined with Brain CTA/Neck CTA.

- **Brain CT/Orbit CT**
    - Optic neuropathy or unilateral optic disk swelling of unclear etiology to distinguish between a compressive lesion of the optic nerve, optic neuritis, ischemic optic neuropathy (arteritic or non-arteritic), central retinal vein occlusion, or optic nerve infiltrative disorders[100] ‡‡
    - Bilateral optic disk swelling (papilledema) with visual loss[101] ‡‡
- **Brain CT/Cervical CT/Thoracic CT/Lumbar CT (any combination) ‡‡**
    - For initial evaluation of a suspected Arnold Chiari malformation
    - Follow-up imaging of a known type II or type III Arnold Chiari malformation. For Arnold Chiari type I, follow-up imaging only if new or changing signs/symptoms[68, 69]
    - Oncological Applications (e.g., primary nervous system, metastatic)
        - Drop metastasis from brain or spine (CT spine imaging in this scenario is usually CT myelogram) see background
        - Suspected leptomeningeal carcinomatosis (see background)[102]
        - Tumor evaluation and monitoring in neurocutaneous syndromes

- CSF leak highly suspected and supported by patient history and/or physical exam findings (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula - CT spine imaging in this scenario is usually CT myelogram)[103]

BACKGROUND

Computed tomography (CT) is an imaging technique used to view the structures of the brain and is useful in evaluating pathologies in the brain. It provides more detailed information on head trauma, brain tumors, stroke, and other pathologies in the brain than regular radiographs.

CT scan for Headache – Generally, magnetic resonance imaging is the preferred imaging technique for evaluating the brain parenchyma, and CT is preferable for evaluating subarachnoid hemorrhage. CT is faster and more readily available than MRI and is often used in urgent clinical situations. Neurologic imaging is warranted in individuals with headache disorders along with abnormal neurologic examination results or predisposing factors for brain pathology.

Headache timeframes and other characteristics – Generally, acute headaches are present from hours to days, subacute from days to weeks, and chronic headaches for more than 3 months. Acute severe headaches are more likely to be pathological (e.g., SAH, cerebral venous thrombosis) than non-acute (e.g., migraine, tension-type). Headaches can also be categorized as new onset or chronic/recurrent. Non-acute, new onset headaches do not require imaging unless there is a red flag as delineated above. Incidental findings lead to additional medical procedures and expense that do not improve individual well-being. Primary headache syndromes, such as migraine and tension headaches, are often episodic with persistent or progressive headache not responding to treatment, requiring further investigation (e.g., new daily persistent headache). Imaging is indicated in chronic headaches if there is a change in the headache frequency (number of headaches episodes/month), duration of each episode, severity of the headaches or new characteristics, such as changing aura or associated symptoms.[1, 6, 104-106]

Migraine with Aura[6, 7, 107] – The headache phase of a migraine is preceded and/or accompanied by transient neurological symptoms, referred to as aura, in at least a third of migraine attacks. The most common aura consists of positive and/or negative visual phenomena, present in up to 99% of the individuals. Somatosensory is the secondary most common type of aura (mostly paresthesia in an upper limb and/or hemiface). Language/speech (mainly paraphasia and anomic aphasia) can also be affected. These neurological symptoms typically evolve over a period of minutes and may last up to 20 minutes or more. The gradual evolution of symptoms is thought to reflect spreading of a neurological event across the visual and somatosensory cortices. Characteristically, the aura usually precedes and terminates prior to headache, usually within 60 minutes. In others, it may persist or begin during the headache phase. ICHD-3 definition of the aura of migraine with typical aura consists of visual and/or sensory and/or speech/language symptoms, but no motor, brainstem, or retinal symptoms and is characterized by gradual development, duration of each symptom no longer than one hour, a mix of positive and negative features and complete reversibility. Atypical or complex aura includes motor,

brainstem, monocular visual disturbances, or ocular cranial nerve involvement (hemiplegic migraine, basilar migraine/brainstem aura, retinal migraine, ophthalmoplegic migraine) and secondary causes need to be excluded. Additional features of an aura that raise concern for an underlying vascular etiology include late age of onset, short duration, evolution of the focal symptoms, negative rather than positive visual phenomenon, and history of vascular risk factors.

Neurological Deficits – Examples of abnormal reflexes related to upper motor neuron lesion/central pathology include hyperreflexia, clonus, Hoffman sign and Babinski, snout, palmar grasp, and rooting reflexes.

Visual loss has many possible etiologies, and MRI or CT is only indicated in suspected neurological causes of visual loss based on history and exam. Visual field defects, such as bitemporal hemianopsia, homonymous hemianopsia, or quadranopsia, require imaging as well as does suspected optic nerve pathology. Subjective symptoms such as blurred vision or double vision with no clear correlate on neurological examination requires a comprehensive eye evaluation to exclude more common causes, such as cataracts, refractive errors, retinopathy, glaucoma, or macular degeneration. Transient visual loss with history consistent with TIA but normal exam at time of examination also should be imaged. Positive visual phenomena, such as photopsias or scintillations that march across the visual field, suggest migraine whereas negative phenomenon, such as shaded or blurred, is more characteristic of ischemia.

Imaging for Stroke – Individuals presenting with symptoms of acute stroke should receive prompt imaging to determine whether they are candidates for treatment with tissue plasminogen activator. Non-contrast CT can evaluate for hemorrhage that would exclude the individual from reperfusion therapy. Functional imaging can be used to select individuals for thrombolytic therapy by measuring the mismatch between "infarct core" and "ischemic penumbra" and may define ischemic areas of the brain with the potential to respond positively to reperfusion therapy. Contrast-enhanced CT angiography (CTA) may follow the non-contrast CT imaging to identify areas of large vessel stenosis or occlusion which may be a target for therapy.

Recent stroke or transient ischemic attack – A stroke or central nervous system infarction is defined as "brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury. … Ischemic stroke specifically refers to central nervous system infarction accompanied by overt symptoms, whereas silent infarction causes no known symptoms."[108] If imaging or pathology is not available, a clinical stroke is diagnosed by symptoms persisting for more than 24 hours. Ischemic stroke can be further classified by the type and location of ischemia and the presumed etiology of the brain injury. These include large-artery atherosclerotic occlusion (extracranial or intracranial), cardiac embolism, small-vessel disease and less commonly dissection, hypercoagulable states, sickle cell disease and undetermined causes.[109] TIAs in contrast, "are a brief episode of neurological dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction on imaging."[110] On average, the annual risk of future ischemic stroke after a TIA or initial ischemic stroke is 3–4%, with an incidence as high as 11% over the next 7 days and 24–29% over the following 5 years. This has significantly decreased in the last half century due to advances in secondary prevention.[111]

Therefore, when revascularization therapy is not indicated or available in individuals with an ischemic stroke or TIA, the focus of the work-up is on secondary prevention. This includes noninvasive vascular imaging to identify the underlying etiology and to assess immediate complications and risk of future stroke. The majority of stoke evaluations take place in the inpatient setting. Admitting TIA individuals is reasonable if they present within 72 hours and have an ABCD (2) score ≥3, indicating high risk of early recurrence, or the evaluation cannot be rapidly completed on an outpatient basis.[110] Minimally, both stroke and TIA should have an evaluation for high-risk modifiable factors, such as carotid stenosis atrial fibrillation, as the cause of ischemic symptoms.[109] Diagnostic recommendations include neuroimaging evaluation as soon as possible, preferably with MRI, including DWI; noninvasive imaging of the extracranial vessels should be performed; and noninvasive imaging of intracranial vessels is reasonable.[112]

Individuals with a history of stroke and recent workup with new signs or symptoms indicating progression or complications of the initial CVA should have repeat brain imaging as an initial study. Individuals with remote or silent strokes discovered on imaging should be evaluated for high-risk modifiable risk factors based on the location and type of the presumed etiology of the brain injury.

CT and Central Venous Thrombosis – A CTV or MRV is indicated for the definite evaluation of a central venous thrombosis/dural sinus thrombosis. The most frequent presentations are isolated headache, intracranial hypertension syndrome (headache, nausea/vomiting, transient visual obscurations, pulsatile tinnitus, CN VI palsy, papilledema),[113] seizures, focal neurological deficits, and encephalopathy. Risk factors are hypercoagulable states inducing genetic prothrombotic conditions, antiphospholipid syndrome and other acquired prothrombotic diseases (such as cancer), oral contraceptives, pregnancy, puerperium (6 weeks postpartum), infections, and trauma. Since venous thrombosis can cause SAH, infarctions, and hemorrhage, parenchymal imaging with MRI/CT is also appropriate.[16, 114, 115]

CT scan for Head Trauma – Most types of head injury are minor injuries; clinical signs and symptoms help predict the need for brain CT following injury. CT has advantages in evaluating head injury due to its sensitivity for demonstrating mass effect, ventricular size and configuration, bone injuries, and acute hemorrhage. An individual who presents with certain clinical risk factors may be more likely to benefit from CT imaging. Some of the clinical risk factors that may be used as a guide to predict the probability of abnormal CT following minor head injury are vomiting, skull fracture, and age greater than 60 years. Individuals with a Glasgow Coma Scale of 15 or less who also have been vomiting or have a suspected skull fracture are likely to show abnormal results on CT scan. CT is also useful in detecting delayed hematoma, hypoxic-ischemic lesions, or cerebral edema in the first 72 hours after head injury.

CT and tumors – MRI is the ideal modality to follow-up meningioma, pituitary tumors, low grade tumors, neurocutaneous syndromes, and staging/surveillance for non-CNS cancers. CT should only be used when MRI is contraindicated or is unable to be obtained. Surveillance timelines should follow NCCN guidelines. Imaging is also warranted if the individual is symptomatic or there are new/changing signs or symptoms or complicating factors.

MMSE – The Mini Mental State Examination (MMSE) is a tool that can systematically and thoroughly assess mental status. It is an 11-question measure that tests five areas of cognitive function: orientation, registration, attention and calculation, recall, and language. The MMSE has been the most commonly used measure of cognitive function in dementia research, but researchers have recognized that it is relatively insensitive and variable in mildly impaired individuals. The maximum score is 30. A score of 23 or lower is indicative of cognitive impairment. The MMSE takes only 5-10 minutes to administer and is, therefore, practical to use repeatedly and routinely.

MoCA – The Montreal Cognitive Assessment (MoCA) was designed as a rapid screening instrument for mild cognitive dysfunction. It assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation. MoCA differs from the MMSE mainly by including tests of executive function and abstraction, and by putting less weight on orientation to time and place. Ten of the MMSE's 30 points are scored solely on the time-place orientation test, whereas the MoCA assigns it a maximum of six points. The MoCA also puts more weight on recall and attention-calculation performance, while de-emphasizing language skill. Time to administer the MoCA is approximately 10 minutes. The total possible score is 30 points; a score of 26 or above is considered normal.

CT for evaluation of the cranial nerves – Magnetic resonance imaging (MRI) is considered the gold standard in the study and evaluation of the cranial nerves. Computed tomography (CT) allows, usually, an indirect view of the nerve and is useful to demonstrate the intraosseous segments of cranial nerves, the foramina through which they exit skull base, and their pathologic changes. In optic neuritis, CT has limited utility. Contrast-enhanced CT scanning of the orbits may help exclude other orbital pathology. CT scanning of the brain, regardless of whether intravenous contrast material is administered or not, does not yield prognostic and treatment-altering information. In Bell's Palsy temporal bone CT is useful in the evaluation of the caliber and the course of the IAC and bony facial nerve canal in the temporal bone. When using CT to evaluate the facial nerve, pathology often can only be inferred by visualization of erosion or destruction of the adjacent bony facial nerve canal. In contrast, MRI visualizes soft tissues well and so is better suited for evaluating soft tissue facial nerve abnormalities.

Anosmia – There is no relevant literature to support the use of CT head in the evaluation of the olfactory nerve.

CT scan for congenital abnormalities – While MRI is preferred to CT for evaluation of most congenital CNS abnormalities, in some clinical situations CT is preferred (craniosynostosis) or equivalent to MRI. CT is appropriate in the follow-up of hydrocephalus or VP shunt function where the etiology of hydrocephalus has been previously determined or in individuals for which MRI evaluation would require general anesthesia.

CT for Macrocephaly – Consider ultrasound in infants with macrocephaly and a normal neurological examination, no evidence of increased ICP, and an open anterior fontanelle. If head US is normal, the infant should be monitored closely.[116] The anterior fontanelle generally closes between 10 and 24 months of age, with 3% closing between 5-9 months and 11% after 24 months.[117]

CT and Normal Pressure Hydrocephalus (NPH) – Although diagnosis can be made based on CT findings alone, MRI is more accurate for disclosing associated pathologies (such as cerebrovascular disease), excluding other potential etiologies, and for detecting NPH typical signs of prognostic value. A CT scan can exclude NPH and is appropriate for screening purposes and in individuals who cannot undergo MRI.

CT and Vertigo – The most common causes of vertigo seen are benign paroxysmal positional vertigo (BPPV), vestibular neuronitis (VN) and Ménière's disease. These peripheral causes of vertigo are benign, and treatment involves reassurance and management of symptoms. Central causes of vertigo, such as cerebrovascular accidents (CVAs), tumors and multiple sclerosis (MS), need to be considered if the individual presents with associated neurological symptoms, such as weakness, diplopia, sensory changes, ataxia or confusion. Magnetic resonance imaging is appropriate in the evaluation of individuals with vertigo who have neurologic signs and symptoms, progressive unilateral hearing loss or risk factors for cerebrovascular disease. MRI is more appropriate than CT for diagnosing vertigo due to its superiority in visualizing the posterior portion of the brain, where most central nervous system disease that causes vertigo is found. A full neurologic and otologic evaluation including provocative maneuvers, vestibular function testing and audiogram can help evaluate vertigo of unclear etiology and differentiate between central and peripheral vertigo.

CT and developmental delay – Significant developmental delay is defined as significant delay (more than two standard deviations below the mean) in one or more developmental domains: gross/fine motor, speech/language, cognition, social/personal, and activities of daily living. Isolated delay in social/language development is characteristic of autism spectrum disorders or hearing loss. Isolated delay in motor development is characteristic of cerebral palsy (a static encephalopathy) or myopathy. Global developmental delay (GDD) is a subset of developmental delay defined as significant delay (by at least 2 SD's) in two or more developmental categories. Note that the term "GDD" is usually reserved for children < 5 years old, whereas in older children > 5 years, disability is quantifiable with IQ testing.

CT scan and Meningitis – In suspected bacterial meningitis, CT with contrast may be performed before lumbar puncture (LP) to show preliminary meningeal enhancement. It is important to evaluate for a mass lesion or cause of elevated ICP that would contraindicate an LP. CT may be used to define the pathology of the base of the skull and that may require therapeutic intervention and surgical consultation. Some causes of an intracranial infection include fractures of the paranasal sinus and inner ear infection.

Leptomeningeal Carcinomatosis[118-121] – Leptomeningeal metastasis is an uncommon and typically late complication of cancer with poor prognosis and limited treatment options. Diagnosis is often challenging with nonspecific presenting symptoms ranging from headache and confusion to focal neurologic deficits such as cranial nerve palsies. Standard diagnostic evaluation involves a neurologic examination, MRI of the brain and spine with gadolinium, and cytologic evaluation of the cerebral spinal fluid (CSF). Hematologic malignancies (leukemia and lymphoma), primary brain tumors as well as solid malignancies can spread to the leptomeninges. The most common solid tumors giving rise to LM are breast cancer (12 - 35 %), small and non-small cell lung cancer (10-26 %), melanoma (5 -25 %), gastrointestinal malignancies (4-14 %), and cancers of unknown primary (1-7 %).

Drop Metastases – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas and less commonly choroid plexus neoplasms and teratomas.[122]

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POLICY HISTORY

Date	Summary
May 2023	Updated and reformatted references Updated background section Reorganized indications General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline Added: • Indeterminate imaging section • Lesion with atypical features for further evaluation or follow up • Initial evaluation for a known syrinx or syringomyelia • Bulbar and Pseudobulbar symptoms to match Brain MRI Clarified: • Abnormal reflexes (pathological, asymmetric, hyperreflexia) • New onset headache - Related to activity or event (sexual activity, exertion, Valsalva, position), new or progressively worsening • Tumor surveillance as per professional society recommendations • Brain CT/Brain CTA - Headache associated with exercise, exertion, Valsalva or sexual activity Deleted: • Anosmia (loss of smell) or dysosmia documented by objective testing that is persistent and of unknown origin
May 2022	Updated and reformatted references Updated background section Combo statement added Reorganized indications Changed visual deficits section added to background Clarified: • Acute headache, sudden onset • New onset headache related to activity or event (sexual activity, exertion, position), new or progressively worsening • Visual loss in background/removed note • Histiocytic Neoplasms (Erdheim-Chester Disease, Langerhans Cell Histiocytosis, and Rosai-Dorfman Disease) for screening and/or with neurological signs or symptoms • Follow-up of known CNS cancer (either primary malignant brain tumor or secondary brain metastasis) as per NCCN • Tumor monitoring in neurocutaneous syndromes as per tumor type • Histiocytic Neoplasms (Erdheim-Chester Disease, Langerhans Cell Histiocytosis, and Rosai-Dorfman Disease) To assess treatment response and surveillance of known brain/skull lesions

	• Examples of mental status instruments to screen for cognitive impairment
	• Binocular diplopia with concern for intracranial pathology after comprehensive eye evaluation
	• Evaluation of cranial nerve palsy/neuropathy/neuralgia. Brain MRI is the study of choice if indicated
	Added:
	• Abnormal reflexes to neurologic deficit sections
	• High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200 when MRI is contraindicated or cannot be performed (Also in Combo Brain CT/CTA)
	• Suspected Pituitary Tumors Brain MRI is the study of choice if indicated or Sella CT if MRI is contraindicated or cannot be performed
	• For screening for known non-CNS Cancer and for screening of hereditary cancers syndromes Brain MRI is the study of choice if indicated
	• Follow-up of known low grade tumor (WHO I-II) (i.e., meningioma, glioma, astrocytoma, oligodendroglioma)
	  ○ For surveillance as per NCCN
	  ○ If symptomatic, new/changing signs or symptoms or complicating factors
	• Known pituitary tumors Brain MRI is the study of choice if indicated or Sella CT if MRI is contraindicated or cannot be performed
	• Seizure disorder, Movement disorders: Brain MRI is the study of choice if indicated
	• Tourette syndrome to list of movement disorders in which MRI is not indicated
	• Bulbar or pseudobulbar symptoms when MRI is contraindicated or cannot be performed
	• For initial evaluation of a suspected Arnold Chiari malformation
	• Follow-up imaging of a known type II or type III Arnold Chiari malformation. For Arnold Chiari type I, follow-up imaging only if new or changing signs/symptoms
	• **General Combo statement**
	Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the neuroaxis), patient history, and other available information, including prior imaging.

	• **Combo Brain CT/CTA**:
	  ○ Neurological signs or symptoms in sickle cell patients
	  ○ Note: MRA and CTA are generally comparable noninvasive imaging alternatives each with their own advantages and disadvantages.
	  ▪ Brain MRI can alternatively be combined with Brain CTA/Neck CTA.
	• **Combo Brain CT/ Cervical CT/Thoracic CT/Lumbar CT** (mirrors MRI)
	  ○ Arnold Chiari
	  ○ Oncological Applications
	  ○ CSF leak
	Deleted:
	• Patient with history of CNS cancer (either primary or secondary) and a recent course of chemotherapy, radiation therapy (to the brain), or surgical treatment within the last two (2) years
	• Follow-up of known meningioma section/background

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **TEMPORAL BONE, MASTOID, ORBITS, SELLA, INTERNAL AUDITORY CANAL CT**	**Original Date: September 1997**
CPT Codes: 70480, 70481, 70482	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_006 - 1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR ORBIT CT

Note: CT is preferred for visualizing bony detail and calcifications. MRI is superior for the evaluation of the visual pathways, globe, and soft tissues.[1, 2]

- Abnormal external or direct eye exam[1]:
  - Exophthalmos (proptosis) or enophthalmos
  - Ophthalmoplegia with concern for orbital pathology[3]
  - Unilateral optic disk swelling if MRI is contraindicated or cannot be performed[4-6]
  - Documented visual defect if MRI is contraindicated or cannot be performed[7-10]
    - Unilateral or with abnormal optic disc(s) (i.e., optic disc blurring, edema, or pallor); **AND**
    - Not explained by an underlying diagnosis, glaucoma, or macular degeneration
- Optic Neuritis if MRI is contraindicated or cannot be performed
  - If atypical presentation (bilateral, absence of pain, optic nerve hemorrhages, severe visual impairment, lack of response to steroids, poor recovery or recurrence)[11-14]

    - If needed to confirm optic neuritis and rule out compressive lesions
- Orbital trauma
    - Physical findings of direct eye injury
    - Suspected orbital trauma with indeterminate x-ray
    - For further evaluation of a fracture seen on x-ray for treatment or surgical planning
- Orbital or ocular mass/tumor, suspected, or known[1, 7]
- Clinical suspicion of orbital infection[15, 16]
- Clinical suspicion of osteomyelitis[17, 18]
    - Direct visualization of bony deformity **OR**
    - Abnormal x-rays
- Clinical suspicion of Orbital Inflammatory Disease (e.g., eye pain and restricted eye movement with suspected orbital pseudotumor) if MRI is contraindicated or cannot be performed[19]
- Congenital orbital anomalies[20]
- Complex strabismus (with ophthalmoplegia or ophthalmoparesis) to aid in diagnosis, treatment and/or surgical planning[21-23]

Combination Studies with Orbit CT

- Brain CT/Orbit CT if MRI is contraindicated or cannot be performed
    - Optic neuropathy or unilateral optic disk swelling of unclear etiology to distinguish between a compressive lesion of the optic nerve, optic neuritis, ischemic optic neuropathy (arteritic or non-arteritic), central retinal vein occlusion, or optic nerve infiltrative disorders[24]
    - Bilateral optic disk swelling (papilledema) with vision loss[5]
    - Approved indications as noted above and being performed in high-risk populations and will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology[25]

INDICATIONS FOR SELLA CT[26]

When MRI is contraindicated or cannot be performed[27, 28]

- For further evaluation of known sellar and parasellar masses
- Suspected pituitary gland disorder[29] based on any of the following:
    - Documented visual field defect suggesting compression of the optic chiasm; **OR**
    - Laboratory findings suggesting pituitary dysfunction[30]; **OR**
    - Pituitary apoplexy with sudden onset of neurological and hormonal symptoms; **OR**
    - Other imaging suggesting sella (pituitary) mass

INDICATIONS FOR TEMPORAL/MASTOID/INTERNAL AUDITORY CANAL CT

Hearing loss (documented on audiogram)[31, 32]

- Asymmetric sensorineural when MRI is contraindicated[33, 34]
- Conductive or mixed[35]
- Congenital[35]
- Cochlear implant evaluation[36-39]

Note: For congenital/childhood sensorineural hearing loss suspected to be due to a structural abnormality, CT is the preferred imaging modality for the osseous structures and malformations of the inner ear. MRI is used for evaluating CNVIII, the brain parenchyma, or the membranous labyrinth.

Tinnitus[40-42]

- Pulsatile tinnitus with concern for osseous pathology of the temporal bone
- Unilateral non-pulsatile tinnitus and MRI is contraindicated or cannot be performed

Ear Infection

- Clinical suspicion of acute mastoiditis as a complication of acute otitis media[43-46]
    - Systemic illness or toxic appearance
    - Signs of extracranial complications (e.g., postauricular swelling/erythema, auricular protrusion, retro-orbital pain, hearing loss, tinnitus, vertigo, nystagmus)
    - Not responding to treatment

Note: MRI is also indicated if there are signs of intracranial complications (e.g., meningeal signs, cranial nerve deficits, focal neurological findings, altered mental status). This is most common in the pediatric population

- Chronic Otitis Media (with or without cholesteatoma on exam)[45, 47]
    - Failed treatment for acute otitis media

Cholesteatoma[48, 49]

CSF Otorrhea[50, 51]

- When looking to characterize a bony defect (for intermittent leaks and complex cases consider CT/MR/Nuclear Cisternography). There should be a high suspicion or confirmatory CSF fluid laboratory testing (Beta-2 transferrin assay)

Temporal Bone Fracture[52-54]

- Suspected based on mechanism of injury **OR**
- Indeterminate findings on initial imaging **OR**
- For further evaluation of a known fracture for treatment or surgical planning

Vascular Indications[55, 56]

- Suspected or known with need for further evaluation
    - Dehiscence of the jugular bulb or carotid canal **OR**
    - Other vascular anomalies of the temporal bone (i.e., aberrant internal carotid artery, high jugular bulb, persistent stapedial artery, aberrant petrosal sinus)

Peripheral vertigo[32, 57, 58]

- Based on clinical exam (Head-Impulse with saccade, Spontaneous unidirectional horizontal nystagmus, Dix-Hallpike maneuver); **AND**
    - Persistent symptoms after a trial of medication and four weeks of vestibular therapy (e.g., Epley's maneuvers)

Bell's Palsy/hemifacial spasm if MRI is contraindicated or cannot be performed (for evaluation of the extracranial nerve course)

- If atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset[59]

OTHER INDICATIONS FOR TEMPORAL BONE, MASTOID, ORBIT, SELLA, INTERNAL AUDITORY CANAL CT

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post- operative/procedural evaluation

- When imaging, physical, or laboratory findings indicate surgical or procedural complications
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

BACKGROUND

Computed tomography's use of thin sections with multi-planar reconstruction (e.g., axial, coronal, and sagittal planes), along with its three-dimensional rendering, permits thorough diagnosis and management of ocular and orbital disorders. Brain CT is often ordered along with CT of the orbit for head injury with orbital trauma. MRI Orbits is preferred over CT Orbits except in the case of orbital trauma, infection, or bone abnormalities

Temporal bone, mastoid, and internal auditory canal computed tomography (CT) is a unique study performed for problems, such as conductive hearing loss, chronic otitis media, mastoiditis, cholesteatoma, congenital hearing loss and cochlear implants. It is a modality of choice because it provides 3D positional information and offers a high degree of anatomic detail. It is rarely used for evaluation of VIIth or VIIIth nerve tumors.

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ADDITIONAL RESOURCES

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POLICY HISTORY

Date	Summary
April 2023	Updated references Added: • Note on congenital hearing loss • Section on further evaluation of indeterminate or questionable findings on prior imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline Clarified: • There should be a high suspicion of CSF leak or confirmatory CSF fluid laboratory testing (Beta-2 transferrin assay)
March 2022	Updated References Re-ordered indications Clarified: • Optic neuritis If atypical presentation (bilateral, absence of pain, optic nerve hemorrhages, severe visual impairment, lack of response to steroids, poor recovery or recurrence • Clinical suspicion of Orbital Inflammatory Disease if MRI is contraindicated or cannot be performed • Pulsatile tinnitus with concern for osseous pathology of the temporal bone • Complex strabismus syndromes (with ophthalmoplegia or ophthalmoparesis)

Reviewed / Approved by Clinical Guideline Committee

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Clinical guidelines **SINUS & MAXILLOFACIAL CT** **LIMITED OR LOCALIZED FOLLOW UP SINUS CT**	**Original Date: September 1997**
CPT Codes: 70486, 70487, 70488, 76380	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_009	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

A single authorization for CPT codes 70486, 70487, 70488, or 76380 includes imaging of the entire maxillofacial area, including face and sinuses. Multiple authorizations are not required.

INDICATIONS FOR SINUS & MAXILLOFACIAL CT

Rhinosinusitis[1-5]

- Clinical suspicion of fungal infection[6, 7]
- Clinical suspicion of complications,[8] such as
  - Preseptal, orbital, or intracranial infection[9]
  - Osteomyelitis
  - Cavernous sinus thrombosis
- Acute (< 4 weeks) or subacute (4-12 weeks) sinusitis (presumed infectious)
  - Not responding to medical management including 2 or more courses of antibiotics in the past 3 months
- Recurrent acute rhinosinusitis with 4 or more annual episodes without persistent symptoms in-between
- Chronic recurrent sinusitis[3] (> 12 weeks)
  - Not responding to medical management*, and with at least two of the following:
    - mucopurulent discharge

        - nasal obstruction and congestion
        - facial pain, pressure, and fullness
        - decreased or absent sense of smell
    - With nasal polyps especially unilateral polyps, concern for polyps extending outside of the nasal cavity, or other atypical presentations[3]

*Note: Medical management for chronic sinusitis includes nasal saline irrigation and/or topical intranasal steroids. In chronic sinusitis, repeat imaging is not necessary unless clinical signs or symptoms have changed. Biologics such as dupilumab can be used to treat chronic sinusitis with nasal polyposis

- Allergic Rhinitis – sinus imaging usually not indicated unless there are signs of complicated infection, signs of neoplasm, or persistence of symptoms/chronic rhinosinusitis despite treatment (including antihistamines) and is a possible surgical candidate[10]
- If suspected as a cause of poorly controlled asthma (endoscopic sinus surgery improves outcomes)[11]
- To evaluate in the setting of unilateral nasal polyps or obstruction[3]

Note: Imaging may be indicated in those predisposed to complications, including diabetes, immune-compromised state, immotile cilia disorders, or a history of facial trauma or surgery.

Pediatrics Rhinosinusitis[12, 13]

- Persistent or recurrent sinusitis not responding to treatment (primarily antibiotics, treatment may require a change of antibiotics)
- Suspicion of orbital or central nervous system involvement (e.g., swollen eye, proptosis, altered consciousness, seizures, nerve deficit)
- Clinical suspicion of a fungal infection (more common in immunocompromised children)

Deviated nasal septum, polyp, or other structural abnormality seen on imaging or direct visualization

- Causing significant airway obstruction AND
- Imaging is needed to plan surgery or determine if surgery is appropriate[14, 15]

Suspected sinonasal mass based on exam, nasal endoscopy, or prior imaging [3, 16]

Refractory Asthma - these patients benefit from medical treatment and surgery together[11, 17, 18]

Anosmia or Dysosmia noted on objective testing, is persistent, of unknown origin for evaluation of peripheral sinonasal disease and/or bone-related pathology.[16,19-21]

Suspected infection

- Osteomyelitis (after x-rays and MRI cannot be performed)[22]
- Abscess based on clinical signs and symptoms of infection

Face mass[16, 23]

- Present on physical exam and remains non-diagnostic after x-ray or ultrasound is completed; **OR**
- Known or highly suspected head and neck cancer on examination; **OR**
- Failed 2 weeks of treatment for suspected infectious adenopathy[24]

Facial trauma[25-33]

- Serious facial injury with concern for fracture on exam (e.g., bony step off, ecchymosis, nasal deformity, depression, malocclusion)
  Note: x-rays should be performed for isolated dental/mandibular injury
- Suspected facial bone fracture with indeterminate x-ray
- For further evaluation of a known fracture for treatment or surgical planning

CSF (cerebrospinal fluid) rhinorrhea when looking to characterize a bony defect

Note: For intermittent leaks and complex cases, consider CT/MRI/Nuclear Cisternography. There should be a high suspicion or confirmatory CSF fluid laboratory testing (Beta-2 transferrin assay)

Salivary gland

- Sialadenitis (infection and inflammation of the salivary glands) with indeterminate ultrasound, bilateral symptoms or concern for abscess[34]
- Suspected or known salivary gland stones [35-37]

Granulomatosis with polyangiitis (Wegener's granulomatosis) disease[38]

Suspected Osteonecrosis of the Jaw[39]

- Possible etiologies: bisphosphonate treatment, dental procedures, Denosumab, radiation treatment

Trigeminal neuralgia/neuropathy if MRI is contraindicated or cannot be performed (for evaluation of the extracranial nerve course)

- If atypical features (i.e., bilateral, hearing loss, dizziness/vertigo, visual changes, sensory loss, numbness, pain > 2min, pain outside trigeminal nerve distribution, progression)[6, 40]

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- When imaging, physical, or laboratory findings indicate surgical or procedural complications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.[37]
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Cone Beam CT (CBCT)

- Can be used in the evaluation of rhinosinusitis for the above-mentioned indications and for surgical planning/pre-operative evaluation in non-neoplastic indications.

* Cone beam CT is not approvable in the evaluation of dentomaxillofacial imaging[16, 41-44]

COMBINATION OF STUDIES WITH SINUS & MAXILLOFACIAL CT

Sinus CT/Chest CT

- Granulomatosis with polyangiitis (Wegener's granulomatosis) disease (GPA)[45]

Sinus CT/Chest CT/Abdomen and Pelvis CT/Brain MRI[46, 47]

- For initial workup prior to Bone Marrow Transplant (BMT)

BACKGROUND

Computed tomography (CT) primarily provides information about bony structures but may also be useful in evaluating soft tissue masses. It can help document the extent of facial bone fractures, facial infections, and abscesses, and can aid in diagnosing salivary stones. Additionally, CT may be useful in characterizing and identifying tumor extent in the face and may be used in the assessment of chronic osteomyelitis.

CT scans can provide more detailed information about the anatomy and abnormalities of the paranasal sinuses than plain films. A CT scan provides greater definition of the sinuses and is more sensitive than plain radiography for detecting sinus pathology, especially within the sphenoid and ethmoid sinuses. CT scan findings can be nonspecific, however, and should not be used routinely in the diagnosis of acute sinusitis. The primary role of CT scans is to aid in the

diagnosis and management of recurrent and chronic sinusitis, or to define the anatomy of the sinuses prior to surgery.

CT vs MRI - MRI allows better differentiation of soft tissue structures within the sinuses. It is used occasionally in cases of suspected tumors or fungal sinusitis. Otherwise, MRI has no advantages over CT scanning in the evaluation of sinusitis. Disadvantages of MRI include high false-positive findings, poor bony imaging, and higher cost. MRI scans take considerably longer to accomplish than CT scans and may be difficult to obtain in patients who are claustrophobic.

Rhinosinusitis - Society consensus recommendation is not to order sinus computed tomography (CT) or indiscriminately prescribe antibiotics for uncomplicated acute rhinosinusitis.[42] Viral infections cause the majority of acute rhinosinusitis and only 0.5 percent to 2 percent progress to bacterial infections. Most acute rhinosinusitis resolves without treatment in two weeks. Uncomplicated acute rhinosinusitis is generally diagnosed clinically and does not require a sinus CT scan or other imaging. Antibiotics are not recommended for patients with uncomplicated acute rhinosinusitis who have mild illness and assurance of follow-up. If a decision is made to treat, amoxicillin with clavulanate should be first-line antibiotic treatment for most acute rhinosinusitis. If improvement is not demonstrated, it is recommended to change antibiotics to either high-dose amoxicillin plus clavulanate, doxycycline, a fluoroquinolone such as moxifloxacin or levofloxacin, or a dual treatment of clindamycin plus a third-generation oral cephalosporin.[5]

Anosmia - Nonstructural causes of anosmia include post viral symptoms, medications (Amitriptyline, Enalapril, Nifedipine, Propranolol, Penicillamine, Sumatriptan, Cisplatin, Trifluoperazine, Propylthiouracil). These should be considered prior to advanced imaging to look for a structural cause. Anosmia and dysgeusia have been reported as common early symptoms in patients with COVID-19, occurring in greater than 80 percent of patients. For isolated anosmia, imaging is typically not needed once the diagnosis of COVID has been made, given the high association. As such, COVID testing should be done prior to imaging.[48-50]
MRI Orbits, Face, and Neck MRI rather than MRI Brain is the mainstay for directly imaging the olfactory apparatus and sinonasal or anterior cranial fossa tumors that may impair or directly involve the olfactory apparatus.[6]

Suspected Osteonecrosis of the Jaw - CT scan characterize the extension of the lesions and in detecting cortical involvement. MRI should be reserved for those patients who have soft tissue extension of the disease.[51]

Trigeminal Neuralgia - According to the International Headache Society, TN is defined as “a disorder characterized by recurrent unilateral brief electric shock-like pain, abrupt in onset and termination, limited to the distribution of one or more divisions of the trigeminal nerve and triggered by innocuous stimuli.”[52]

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POLICY HISTORY

Date	Summary
May 2023	Updated references Updated background Added: • Nasal polyps as an indication for chronic recurrent sinusitis • Cone Beam CT (CBCT) • Can be used in the evaluation of rhinosinusitis for the above-mentioned indications and for surgical planning/pre-operative evaluation in non-neoplastic indications. * Cone beam CT is not approvable in the evaluation of dentomaxillofacial imaging • Section on further evaluation of indeterminate or questionable findings on prior imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Section on CSF rhinorrhea to characterize bony defect • Biologics such as dupilumab for chronic sinusitis with nasal polyposis Clarified: • Acute (<4weeks) or subacute (4-12 weeks) sinusitis (presumed infectious) - not responding to medical management including 2 or more courses of antibiotics in the past 3 months • When CT would be indicated for anosmia/dysosmia and removed when MRI is contraindicated • Serious facial injury with concern for fracture on exam (e.g. bony step off, ecchymosis, nasal deformity, depression, malocclusion) • Note: x-rays should be performed in isolated dental/mandibular injury • There should be a high suspicion of CSF leak or confirmatory CSF fluid laboratory testing (Beta-2 transferrin assay) Removed: • When MRI is contraindicated or if bony involvement suspected from suspected sinonasal mass • Lesion seen on x-ray or other study – covered in new indication
March 2022	Reformatted and update references Reformatted and updated background Reformatted-structural abnormality, salivary gland, and trauma sections Clarified:

	• Sialadenitis (infection and inflammation of the salivary glands) with indeterminate ultrasound, bilateral symptoms, or concern for abscess • acute vs subacute sinusitis • described medical management for acute (including 2 or more courses of antibiotics at least 5 days each course) and chronic sinusitis (includes nasal saline irrigation and/or topical intranasal steroids) • Abscess Added: • Note: Imaging may be indicated in those predisposed to complications, including diabetes, immune-compromised state, or a history of facial trauma or surgery (Acute sinusitis) • And is a surgical candidate- for chronic sinusitis and recurrent acute rhinosinusitis • In chronic sinusitis, repeat imaging is not necessary unless clinical signs or symptoms have changed. • Indications for allergic rhinitis Removed: • 4 weeks of medical management for acute and chronic sinusitis

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*Evolent	
Clinical guidelines **NECK CT (Soft Tissue)**	**Original Date: September 1997**
CPT Codes: 70490, 70491, 70492	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_008-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR NECK CT[1, 2]

Suspected tumor or cancer

- Suspicious lesions in mouth or throat[3]
- Suspicious mass/tumor found on another imaging study and needing clarification[1]
- Neck mass or lymphadenopathy (not parotid region and not thyroid region):
    - Present on physical exam and remains non-diagnostic after ultrasound is completed[3]
    - Mass or abnormality found on other imaging study and needing further evaluation
    - Increased risk for malignancy[4] with one or more of the following findings[5]:
        - Fixation to adjacent tissues
        - Firm consistency
        - Size > 1.5 cm
        - Ulceration of overlying skin
        - Mass present ≥ two weeks (or uncertain duration) without significant fluctuation and not considered of infectious cause
        - History of cancer
    - Failed 2 weeks of treatment for suspected infectious adenopathy[6]

- Pediatric (≤ 18 years old) considerations[7]
    - Ultrasound should be inconclusive or suspicious unless there is a history of malignancy[8]

Note: For discrete cystic lesions of the neck, an ultrasound should be performed as initial imaging unless there is a high suspicion of malignancy

- Neck Mass (parotid region)[1]
    - Parotid mass found on other imaging study and needing further evaluation

Note: US is the initial imaging study of a parotid region mass to determine if the location is inside or outside the gland[1, 9, 10]

- Neck Mass (thyroid region)[2]
    - Staging and monitoring for recurrence of known thyroid cancer[2]
    - To assess extent of thyroid tissue when other imaging suggests extension through the thoracic inlet into the mediastinum or concern for airway compression[11, 12]

Note: US is the initial imaging study of a thyroid region mass. Biopsy is usually the next step. In the evaluation of known thyroid malignancy, CT is preferred over MRI since there is less respiratory motion artifact. Chest CT may be included for preoperative assessment in some cases.

Known or suspected deep space infections or abscesses of the pharynx or neck with signs or symptoms of infection[13]

Known tumor or cancer of skull base, tongue, larynx, nasopharynx, pharynx, or salivary glands[14]

- Initial staging[3]
- Restaging during treatment
- Areas difficult to visualize on follow-up examination
- Suspected recurrence or metastases based on symptoms or examination findings[15]
    - New mass
    - Change in lymph nodes

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation (e.g., post neck dissection)

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Other indications for a Neck CT

- Sialadenitis (infection and inflammation of the salivary glands) with indeterminate ultrasound, bilateral symptoms or concern for abscess[16]
- Suspected or known salivary gland stones [10, 16-19]
- To assess for foreign body when radiograph is inconclusive or negative[20]
- Vocal cord lesions or vocal cord paralysis[21]
- For evaluation of tracheal stenosis[22, 23]
- Dysphagia after appropriate work up including endoscopy and fluoroscopic studies (modified barium swallow, or biphasic Esophogram)[24, 25]
- Unexplained throat pain for more than 2 weeks when ordered by a specialist with all of the following[26-28]
    - Complete otolaryngologic exam and laryngoscopy
    - No signs of infection
    - Evaluation for and failed treatment of laryngopharyngeal reflux
    - Risk factor for malignancy, i.e., tobacco use, alcohol use, dysphagia, weight loss OR age older than 50 years
- Unexplained ear pain when ordered by a specialist and MRI is contraindicated with all of the following[29]
    - Otoscopic exam, nasolaryngoscopy, lab evaluation (ESR, CBC) AND
    - Risk factor for malignancy, i.e., tobacco use, alcohol use, dysphagia, weight loss OR age older than 50 years
- Diagnosed primary hyperparathyroidism when surgery is planned[30]
    - Previous nondiagnostic ultrasound or nuclear medicine scan[31]
- Bell's palsy/hemifacial spasm, if MRI is contraindicated or cannot be performed (for evaluation of the extracranial nerve course)

    - If atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset[32]
- Objective cranial nerve palsy (CN IX-XII) if MRI is contraindicated or cannot be performed (for evaluation of the extracranial nerve course)[33, 34]

BACKGROUND

High resolution CT can visualize both normal and pathologic anatomy of the neck. It is used in the evaluation of neck soft tissue masses, abscesses, and lymphadenopathy. For neck tumors, it defines the extent of the primary tumor and identifies lymph node spread. CT provides details about the larynx and cervical trachea and its pathology. Additional information regarding airway pathology is provided by three-dimensional images created from the CT dataset. Neck CT can also accurately depict and characterize tracheal stenoses.

With the rise of human papillomavirus-related oral, pharyngeal, and laryngeal cancers in adults, contrast-enhanced neck CT has become more important for the evaluation of a neck mass, deemed at risk for malignancy, surpassing ultrasound for the initial evaluation in many cases. The American Academy of Otolaryngology-Head and Neck Surgery recently issued strong recommendations for neck CT or MRI, emphasizing the importance of a timely diagnosis.[5]

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POLICY HISTORY

Date	Summary
April 2023	Updated references Removed additional resources Added: • Section on further evaluation of indeterminate or questionable findings on prior imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
March 2022	Reformatted indications Clarified: • Thyroid imaging • Abscess • Suspected or known salivary gland stones Added: Sialadenitis (infection and inflammation of the salivary glands) with indeterminate ultrasound, bilateral symptoms, or concern for abscess

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*Evolent	
Clinical guidelines **BRAIN (HEAD) CTA**	**Original Date: September 1997**
CPT Codes: 70496	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_004-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR BRAIN CTA

Brain CT/CTA are not approvable simultaneously unless they meet the criteria described below in the Indications for Brain CT/Brain CTA combination studies section. If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- Inconclusive or show a need for additional or follow up imaging evaluation OR
- The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.

(*Unless approvable in the combination section as noted in the guidelines)

Patients with claustrophobia, limited ability to cooperate, an implanted device or in an urgent scenario may be better suited for CTA; whereas those with renal disease or iodine contrast allergy should have MRA.[1]

For evaluation of suspected intracranial vascular disease[2, 3]

Aneurysm screening

- Screening for intracranial aneurysm if two or more first-degree family members (parent, brother, sister, or child) of intracranial aneurysm

  Note: Repeat study is recommended every 5 years[4]

  - For one first degree relative with aneurysm, asymptomatic screening is not indicated - would require a neurological sign or symptom supporting clinical concern for aneurysm[5-7]
- Screening for aneurysm in polycystic kidney disease (in adults), Loeys-Dietz syndrome‡, fibromuscular dysplasia, spontaneous coronary arteries dissection (SCAD), or known aortic coarctation (after age 10)[8-14]

‡For Loeys-Dietz, imaging should be repeated at least every two years

Vascular abnormalities

- Suspected vascular malformation (arteriovenous malformation (AVM) or dural arteriovenous fistula) in patient with previous or indeterminate imaging study
- Thunderclap headache with continued concern for underlying vascular abnormality (i.e., aneurysm or reversible cerebral vasoconstriction syndrome) after initial negative brain imaging.[15-18]

Note: Negative brain CT < 6 hours after headache onset excludes subarachnoid hemorrhage in neurologically intact patients[15] MRI lacks sensitivity in excluding subarachnoid hemorrhage less than 24 hours after headache onset.[16, 19]

- Headache associated with exercise, exertion, Valsalva or sexual activity[16]
- Isolated third nerve palsy (oculomotor) with pupil involvement to evaluate for aneurysm[17]
- Pulsatile tinnitus to identify a suspected arterial vascular etiology[18, 20]

Note: MRI is the study of choice for detecting low flow malformations (see background)[21-23]

Cerebrovascular Disease

Ischemic

- Recent ischemic stroke or transient ischemic attack (See background section)[24, 25]
  Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management
- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[4, 26, 27]

Hemorrhagic

- Known subarachnoid hemorrhage (SAH)[28]

- Known cerebral intraparenchymal hemorrhage with concern for underlying vascular abnormality

Venous and MRV is contraindicated or cannot be performed[29]- CTV**

- Suspected venous thrombosis (dural sinus thrombosis)[30, 31]
- Distinguishing benign intracranial hypertension (pseudotumor cerebri) from dural sinus thrombosis[32, 33]

Sickle cells disease (ischemic and/or hemorrhagic) and MRA is contraindicated or cannot be performed[34]

- Neurological signs or symptoms in sickle cell disease
- Stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200

Vasculitis with initial laboratory workup (such as ESR, CRP, serology)[35]

- Suspected secondary CNS vasculitis based on neurological signs or symptoms in the setting of an underlying systemic disease with abnormal inflammatory markers or autoimmune antibodies
- Suspected primary CNS vasculitis based on neurological signs and symptoms with completed infectious/inflammatory lab work-up[36, 37]

Other intracranial vascular disease

- Suspected Moyamoya disease[38, 39]
- Suspected reversible cerebral vasoconstriction syndrome[40]
- Giant cell arteritis with suspected intracranial involvement[41]

For evaluation of known intracranial vascular disease[2, 3]

- Known intracranial aneurysm, treated aneurysm, or known vascular malformation (i.e., AVM or dural arteriovenous fistula)
- Known vertebrobasilar insufficiency with new or worsening signs or symptoms (VBI)[26, 27]
- Known vasculitis, reversible cerebral vasoconstriction syndrome or Moyamoya disease[36, 38-40]

Pre-operative/procedural evaluation for brain/skull surgery

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation[42, 43]

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Indications for Brain CTA/Neck CTA combination studies

- Recent ischemic stroke or transient ischemic attack[24] (see background)

Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management

- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[26, 27]
- Suspected carotid or vertebral artery dissection; secondary to trauma or spontaneous due to weakness of vessel wall[44, 45]
- Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment[46-48]
- Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 70%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[49-51]
- Symptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 50%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[49, 52]
- Pulsatile tinnitus to identify a suspected arterial vascular etiology[18, 20]

Indications for Brain CT/Brain CTA combination studies[2, 3]

- Recent ischemic stroke or transient ischemic attack (TIA) when MRI is contraindicated or cannot be performed
- Acute, sudden onset of headache with personal history of a vascular abnormality or first-degree family history of aneurysm

- Headache associated with exercise, exertion, Valsalva or sexual activity when MRI is contraindicated or cannot be performed[16]
- Suspected venous thrombosis (dural sinus thrombosis) and MRI is contraindicated or cannot be performed – CT/CTV**
- Neurological signs or symptoms in sickle cell patients when MRI is contraindicated or cannot be performed
- High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200 when MRI is contraindicated or cannot be performed

Indications for Brain CT/Brain CTA/Neck CTA combination studies

- Recent ischemic stroke or transient ischemic attack (TIA)[2, 3] when MRI is contraindicated or cannot be performed
- Approved indications as noted above and being performed in high-risk populations (in whom MRI is contraindicated or cannot be performed) and will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology

***Note**: CTA and MRA are generally comparable noninvasive imaging alternatives each with their own advantages and disadvantages. Brain MRI can be combined with Brain CTA/Neck CTA.

BACKGROUND

Computed tomography angiography (CTA) is recognized as a valuable diagnostic tool for the management of patients with cerebrovascular disease. With its three-dimensional reconstructions, CTA can simultaneously demonstrate the bony skull base and its related vasculature. CTA use of ionizing radiation and an iodine-based intravascular contrast medium is a disadvantage when compared to magnetic resonance angiography (MRA), but it is quicker and requires less patient cooperation than MRA. CTA is much less invasive than catheter angiography which involves injecting contrast material into an artery.

CTA for Evaluation of Aneurysm – CTA is useful in the detection of cerebral aneurysms. The sensitivity of CTA to detect cerebral aneurysms $\leq$ 5 mm is higher than that with digital subtraction angiography (DSA). Most aneurysms missed with CTA are $\leq$ 3mm. Aneurysms in the region of the anterior clinoid process may extend into the subarachnoid space where they carry the threat of hemorrhage. CTA can help delineate the borders of the aneurysm in relation to the subarachnoid space and may help detect acute ruptured aneurysms. It may be used in the selection of patients for surgical or endovascular treatment of ruptured intracranial aneurysms.

CTA for Screening of Patients with first-degree relative (parent, brother, sister or child) who have a history of aneurysm – Data has suggested that individuals with a parent, brother, sister, or child harboring an intracranial aneurysm are at increased risk of aneurysms. It is likely that multiple genetic and environmental risk factors contribute to the increased risk.

CTA and PCKD

Screening imaging every 5 years, and annual follow-up imaging in patients in with a known intracranial aneurysm is recommended. The current literature recommends initial screening by the age of 30 years and earlier if there is a strong family history of intracranial aneurysm. Screening is generally not recommended is the pediatric population (less than 18 years). No upper age limit for screening patients with ADPKD has been recommended.

CTA for evaluation of Arteriovenous Malformation (AVM) – A good correlation has been found between catheter angiography and CTA in the detection of arteriovenous malformations. CTA allows calculation of the volume of an AVM nidus and identifies and quantifies embolic material within it. CTA may be used for characterization and stereotactic localization before surgical resection or radiosurgical treatment of arteriovenous malformations.

CTA and non-aneurysmal vascular malformations – Non-aneurysmal vascular malformations can be divided in low flow vascular malformations and high flow vascular malformations. Low flow vascular malformations include dural venous anomalies (DVA), cavernomas, and capillary telangiectasias. High flow vascular malformations include AVM and dural arteriovenous fistulas (dAVF). For low flow malformations, MRI is the study of choice. There is limited medical literature to support vascular imagining (CTA or MRA). CTA plays a limited role in the assessment of cavernoma but may be used to demonstrate a DVA. MRA is not usually helpful in the assessment of cavernoma, capillary telangiectasia, and DVA. Vascular imaging is indicated in high flow vascular malformations.[2, 3, 23]

MRA vs CTA for CVA – Preferred vascular imaging of the head and neck includes non-contrast head MRA and contrast-enhanced neck MRA. MRA may not be able to be performed in patients with claustrophobia, morbid obesity, or implanted device, but it can be useful in patients with renal failure or contrast allergies. In patients with high radiation exposure, MRA as an alternative should be considered. For acute stroke, CTA is preferred after CT (to rule of hemorrhage) and to look for thrombus/possible intervention that is time-sensitive.[53]

CTA and recent stroke or transient ischemic attack – A stroke or central nervous system infarction is defined as “brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury. … Ischemic stroke specifically refers to central nervous system infarction accompanied by overt symptoms, whereas silent infarction causes no known symptoms”.[54] If imaging or pathology is not available, a clinical stroke is diagnosed by symptoms persisting for more than 24 hours. Ischemic stroke can be further classified by the type and location of ischemia and the presumed etiology of the brain injury. These include large-artery atherosclerotic occlusion (extracranial or intracranial), cardiac embolism, small-vessel disease and less commonly dissection, hypercoagulable states, sickle cell disease and undetermined causes.[55] TIAs in contrast, “are a brief episode of neurological dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction on

imaging".[56] On average, the annual risk of future ischemic stroke after a TIA or initial ischemic stroke is 3–4%, with an incidence as high as 11% over the next 7 days and 24–29% over the following 5 years. This has significantly decreased in the last half century due to advances in secondary prevention.[57]

When revascularization therapy is not indicated or available in patients with an ischemic stroke or TIA, the focus of the work-up is on secondary prevention. This includes noninvasive vascular imaging to identify the underlying etiology, assess immediate complications and risk of future stroke. The majority of stroke evaluations take place in the inpatient setting. Admitting TIA patients is reasonable if they present within 72 hours and have an ABCD (2) score ≥ 3, indicating high risk of early recurrence, or the evaluation cannot be rapidly completed on an outpatient basis.[56] Minimally, both stroke and TIA should have an evaluation for high-risk modifiable factors such as carotid stenosis atrial fibrillation as the cause of ischemic symptoms.[55] Diagnostic recommendations include neuroimaging evaluation as soon as possible, preferably with magnetic resonance imaging, including DWI; noninvasive imaging of the extracranial vessels should be performed, and noninvasive imaging of intracranial vessels is reasonable.[25]

Patients with a history of stroke and recent work-up with new signs or symptoms indicating progression or complications of the initial CVA should have repeat brain imaging as an initial study. Patients with remote or silent strokes discovered on imaging should be evaluated for high-risk modifiable risk factors based on the location and type of the presumed etiology of the brain injury.

CTA for Evaluation of Vertebrobasilar Insufficiency (VBI) – Multidetector CT angiography (MDCTA) may be used in the evaluation of vertebral artery pathologies. The correlation between MDCTA and color Doppler sonography is moderate. CTA is used for minimally invasive follow-up after intracranial stenting for VBI. It enables visualization of the patency of the stent lumen and provides additional information about all brain arteries and the brain parenchyma.

CTA and Intracerebral Hemorrhage – CTA is useful as a screening tool for an underlying vascular abnormality in the evaluation of spontaneous intracerebral hemorrhage (ICH). Etiologies of spontaneous ICH include tumor, vascular malformation, aneurysm, hypertensive arteriopathy, cerebral amyloid angiopathy, venous thrombosis, vasculitis, RCVS, drug-induced vasospasm, venous sinus thrombosis, Moyamoya disease, anticoagulant use and hemorrhagic transformation of an ischemic infarct. History can help point to a specific etiology. Possible risk factors for the presence of underlying vascular abnormalities include age younger than 65, female, lobar or intraventricular location, and the absence of hypertension or impaired coagulation.[58]

CTV and Central Venous Thrombosis** – a CT Venogram is indicated for the evaluation of a central venous thrombosis/dural sinus thrombosis. The most frequent presentations are isolated headache, intracranial hypertension syndrome, seizures, focal neurological deficits, and

encephalopathy. Risk factors are hypercoagulable states inducing genetic prothrombotic conditions, antiphospholipid syndrome and other acquired prothrombotic diseases, such as cancer, oral contraceptives, pregnancy, puerperium (6 weeks postpartum), infections, and trauma. Since venous thrombosis can cause SAH, infarctions, and hemorrhage, parenchymal imaging with MRI/CT is also appropriate.[29, 59-61]

CTA and dissection- Craniocervical dissections can be spontaneous or traumatic. Patients with blunt head or neck trauma who meet Denver Screening criteria should be assessed for cerebrovascular injury (although about 20% will not meet criteria). The criteria include: focal or lateralizing neurological deficits (not explained by head CT), infarct on head CT, face, basilar skull, or cervical spine fractures, cervical hematomas that are not expanding, Glasgow coma score less than 8 without CT findings, massive epistaxis, cervical bruit or thrill.[44, 62-64] Spontaneous dissection presents with headache, neck pain with neurological signs or symptoms. There is often minor trauma or precipitating factor (i.e., exercise, neck manipulation). Dissection is thought to occur due to weakness of the vessel wall, and there may be an underlying connective tissue disorder. Dissection of the extracranial vessels can extend intracranially and/or lead to thrombus which can migrate into the intracranial circulation causing ischemia. Therefore, vascular imaging of the head and neck is warranted.[45, 65]

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POLICY HISTORY

Date	Summary
May 2023	• Updated and reformatted references • Updated background section • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging Added: - Section on further evaluation of indeterminate or questionable findings on prior imaging - Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment - Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management (also in combo section) - Note on CTA VS MRA Clarified: - Screening for aneurysm in polycystic kidney disease (in *adults*) - Screening for intracranial aneurysm if *two or more* first-degree family members (parent brother, sister, or child) with history of intracranial aneurysm - *For one first degree relative with aneurysm, asymptomatic screening is not indicated - would require a neurological sign or symptom supporting clinical concern for aneurysm.* - Thunderclap headache with continued concern for underlying vascular abnormality (*i.e., aneurysm or reversible cerebral vasoconstriction syndrome) after initial negative brain imaging* - *Note: MRI lacks sensitivity in excluding subarachnoid hemorrhage less than 24 hours after headache onset* - Headache associated with exercise, *exertion, Valsalva* or sexual activity (Also in Combo Brain CT/CTA) Deleted: Vascular abnormality visualized on previous brain imaging that is equivocal or needs further evaluation
March 2022	Updated and reformatted references Added New combo statement Updated background Clarified:

	• Aneurysm screening in aortic coarctation after age 10
	• MRI is the study of choice for detecting low flow vascular malformations (see background)
	• Follow-up of known intracranial aneurysm, treated aneurysm, or known vascular malformation
	• Pulsatile tinnitus to identify a suspected arterial vascular etiology
	• Combo studies- CVA/TIA when MRI is contraindicated or cannot be performed
	Changed:
	• Thunderclap headache with continued concern for underlying vascular abnormality after initial negative brain imaging > 6 hours after onset
	Added:
	• Brain MRI/Brain MRA combination (when MRI contraindicated)
	  ○ Neurological signs or symptoms in sickle cell patients
	  ○ High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **NECK CTA**	**Original Date: September 1997**
CPT Codes: 70498	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_012-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR NECK CTA

If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- Inconclusive or show a need for additional or follow up imaging evaluation **OR**
- The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.

(*Unless approvable in the combination section as noted in the guidelines)

Patients with claustrophobia, limited ability to cooperate, an implanted device or in an urgent situation may be better suited for CTA, whereas those with extensive calcification, renal disease iodine contrast allergy should have MRA.[1]

For evaluation of known or suspected extracranial vascular disease

Cerebrovascular Disease

- Recent ischemic stroke or transient ischemic attack (see Background)[2-4]

Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management

- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[5-7]
- Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 70%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries)[8-10]
- Symptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 50%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries)[8, 11, 12]

Aneurysm screening

- Screening for aneurysm in Loeys-Dietz syndrome**, fibromuscular dysplasia or spontaneous coronary arteries dissection (SCAD)[13-16]

**For Loeys-Dietz imaging should be repeated at least every two years

Tumor/pulsatile mass

- Pulsatile mass on exam[17]
- Known or suspected carotid body tumors, or other masses such as a paraganglioma, arteriovenous fistula pseudoaneurysm, atypical lymphovascular malformation[18]

Note: Ultrasound (US) may be used to identify a mass overlying or next to an artery in initial work up of a pulsatile mass.

Other extracranial vascular disease[19]

- Large vessel vasculitis (Giant cell or Takayasu arteritis) with suspected extracranial involvement[20-23]
- Subclavian steal syndrome when ultrasound is positive or indeterminate **OR** for planning interventions[24]
- Suspected carotid or vertebral artery dissection; secondary to trauma or spontaneous due to weakness of vessel wall[25, 26]
- To identity an arterial source of bleeding in patients with hemorrhage of the head and neck[27]
- Horner's syndrome (miosis, ptosis, and anhidrosis)[28]
- For evaluation of pulsatile tinnitus (subjective or objective) for suspected arterial vascular etiology[29]
- For further evaluation of a congenital vascular malformation of the head and neck
- Known extracranial vascular disease that needs follow-up or further evaluation

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation (e.g., carotid endarterectomy)

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

INDICATIONS FOR COMBINATION STUDIES

Neck CTA/Brain CTA

- Recent ischemic stroke or transient ischemic attack (TIA)(see Background) [2, 3, 30]

Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management

- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[5, 7]
- Suspected carotid or vertebral artery dissection; due to trauma or spontaneous due to weakness of vessel wall[25, 26]
- Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment[31, 32]
- Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 70%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[8-10]
- Symptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 50%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[8, 11, 12]
- Pulsatile tinnitus (subjective or objective) for suspected arterial vascular etiology[29]

BACKGROUND

For vascular disease, MRA and CTA are generally comparable. No current literature compares the efficacy of contrast enhanced CT to CTA or MRI and MRA for evaluation of pulsatile neck mass, so any are approvable.[33] CTA may be complementary to CT in the following settings: evaluation of a pulsatile neck mass to assess vascular detail when needed; assessment of relevant vascular anatomy for pre-procedural evaluation; vascular supply to tumors and vessel encasement and narrowing by tumors; extent of disease in vasculitis; and to help determine the nature and extent of congenital or acquired vascular anomalies.

MRA vs CTA for Carotid Artery Evaluation[34, 35] - MRA and CTA are generally comparable noninvasive imaging alternatives, each with their own advantages and disadvantages. Advantages of CTA over MRA include superior spatial resolution, rapid image acquisition, decreased susceptibility to motion artifacts and artifacts from calcification as well as being better able to evaluate slow flow and tandem lesions. However, CTA can also overestimate high-grade stenosis. Limitations of CTA include radiation exposure to the patient, necessity of IV contrast, and risk of contrast allergy and contrast nephropathy. MRA is an excellent screening test since it does not utilize ionizing radiation. Duplex US and contrast-MRA is a common choice for carotid artery evaluation. Limitations of MRA include difficulty in patients with claustrophobia and the risk of nephrogenic systemic sclerosis with gadolinium contrast agents in specific patients. In patients with high radiation exposure, MRA as an alternative imaging modality should be considered.

CTA and dissection - Craniocervical dissections can be spontaneous or traumatic. Patients with blunt head or neck trauma who meet Denver Screening criteria should be assessed for cerebrovascular injury (although about 20% will not meet criteria). The criteria include: focal or lateralizing neurological deficits (not explained by head CT), infarct on head CT, face, basilar skull, or cervical spine fractures, cervical hematomas that are not expanding, Glasgow coma score less than 8 without CT findings, massive epistaxis, cervical bruit or thrill.[25, 36-38] Spontaneous dissection presents with headache, neck pain with neurological signs or symptoms. There is often minor trauma or precipitating factor (e.g., exercise, neck manipulation). Dissection is thought to occur due to weakness of the vessel wall, and there may be an underlying connective tissue disorder. Dissection of the extracranial vessels can extend intracranially and/or lead to thrombus, which can migrate into the intracranial circulation causing ischemia. Therefore, MRA of the head and neck is warranted.[26, 39]

CTA and recent stroke or transient ischemic attack (TIA) - A stroke or central nervous system infarction is defined as "brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury. … Ischemic stroke specifically refers to central nervous system infarction accompanied by overt symptoms, whereas silent infarction causes no known symptoms."[40] If imaging or pathology is not available, a clinical stroke is diagnosed by symptoms persisting for more than 24 hours. Ischemic stroke can be further classified by the type and location of ischemia and the presumed etiology of the brain injury. These include large-artery atherosclerotic occlusion (extracranial or

intracranial), cardiac embolism, small-vessel disease and less commonly dissection, hypercoagulable states, sickle cell disease and undetermined causes.[41] TIAs in contrast, "are a brief episode of neurological dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction on imaging."[42] On average, the annual risk of future ischemic stroke after a TIA or initial ischemic stroke is 3–4%, with an incidence as high as 11% over the next 7 days and 24–29% over the following 5 years. This has significantly decreased in the last half century due to advances in secondary prevention.[43]

When revascularization therapy is not indicated or available in patients with an ischemic stroke or TIA, the focus of the work-up is on secondary prevention. This includes noninvasive vascular imaging to identify the underlying etiology, assess immediate complications and risk of future stroke. The majority of stroke evaluations take place in the inpatient setting. Admitting TIA patients is reasonable if they present within 72 hours and have an ABCD(2) score ≥3, indicating high risk of early recurrence, or the evaluation cannot be rapidly completed on an outpatient basis.[42] Minimally, both stroke and TIA should have an evaluation for high-risk modifiable factors, such as carotid stenosis atrial fibrillation, as the cause of ischemic symptoms.[41] Diagnostic recommendations include neuroimaging evaluation as soon as possible, preferably with magnetic resonance imaging, including DWI; noninvasive imaging of the extracranial vessels should be performed, and noninvasive imaging of intracranial vessels is reasonable.[30]

Patients with a history of stroke and recent work up with new signs or symptoms indicating progression or complications of the initial CVA should have repeat brain imaging as an initial study. Patients with remote or silent strokes discovered on imaging should be evaluated for high-risk modifiable risk factors based on the location and type of the presumed etiology of the brain injury.[30, 40-43]

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POLICY HISTORY

Date	Summary
May 2023	Updated References Added • For further evaluation of a congenital vascular malformation of the head and neck • Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment (Combo Neck/Brain CTA) • Section on further evaluation of indeterminate or questionable findings on prior imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
March 2022	Updated and reformatted references Expanded background on CTA vs MRA Clarified • Pulsatile tinnitus to identify a suspected arterial vascular etiology • Large vessel vasculitis with suspected extracranial involvement Added: • To identity an arterial source of bleeding in patients with hemorrhage of the head and neck • New Combo statement

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **SINUS, FACE, ORBIT, NECK, and INTERNAL AUDITORY CANAL MRI**	**Original Date: November 2007**
CPT Codes: 70540, 70542, 70543	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_014	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR ORBIT MRI

If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- Inconclusive or show a need for additional or follow up imaging evaluation OR
- The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.

(*Unless approvable in the combination section as noted in the guidelines)

MRI is superior for the evaluation of the visual pathways, globe and soft tissues; CT is preferred for visualizing bony detail and calcifications[1, 2]

- **Abnormal external or direct eye exam**
    - Exophthalmos (proptosis) or enophthalmos
    - Ophthalmoplegia with concern for orbital pathology
    - Unilateral optic disk swelling[3-5]
    - Documented visual field defect[6-9]

        - Unilateral or with abnormal optic disc(s) (e.g., optic disc blurring, edema, or pallor); **AND**
        - Not explained by underlying diagnosis, glaucoma, or macular degeneration

- **Optic neuritis**[10-14]
    - If atypical presentation (bilateral, absence of pain, optic nerve hemorrhages, severe visual impairment, lack of response to steroids, poor recovery or recurrence)[15, 16]
    - If needed to confirm optic neuritis and rule out compressive lesions

- **Orbital trauma**[17, 18]
    - Physical findings of direct eye injury
    - Suspected orbital trauma with indeterminate x-ray or ultrasound

- **Orbital or ocular mass/tumor, suspected or known**[1, 7]

- **Clinical suspicion of orbital infection**[1, 2]

- **Clinical suspicion of osteomyelitis**[19, 20]
    - Direct visualization of bony deformity **OR**
    - Abnormal x-rays

- **Clinical suspicion of Orbital Inflammatory Disease** (e.g., eye pain and restricted eye movement with suspected orbital pseudotumor)[21]

- **Congenital orbital anomalies**

- **Complex strabismus syndromes** (with ophthalmoplegia or ophthalmoparesis) to aid in diagnosis, treatment and/or surgical planning[22-24]

NOTE: FOR ADDITIONAL ONCOLOGIC ORBIT MRI INDICATIONS, CLICK HERE

INDICATIONS FOR ORBIT AND BRAIN MRI COMBINATION STUDIES:

- Optic neuropathy or unilateral optic disk swelling of unclear etiology to distinguish between a compressive lesion of the optic nerve, optic neuritis, ischemic optic neuropathy (arteritic or non-arteritic), central retinal vein occlusion or optic nerve infiltrative disorders[25]
- Bilateral optic disk swelling (papilledema) with vision loss[3]
- Optic neuritis

    - If atypical presentation (bilateral, absence of pain, optic nerve hemorrhages, severe visual impairment, lack of response to steroids, poor recovery or recurrence)[11-16]
    - If needed to confirm optic neuritis and rule out compressive lesions
- Known or suspected neuromyelitis optica spectrum disorder with severe, recurrent, or bilateral optic neuritis[26]
- Suspected retinoblastoma[27, 28]
- For approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology[29]

INDICATIONS FOR FACE/SINUS MRI:

- **Rhinosinusitis[30]**
    - Clinical suspicion of fungal infection[31]
    - Clinical suspicion of orbital or intracranial complications,[19, 20] such as
        - Preseptal, orbital, or central nervous system infection
        - Osteomyelitis
        - Cavernous sinus thrombosis
- **Sinonasal obstruction, suspected mass,** based on exam, nasal endoscopy, or prior imaging[30, 32]
- **Anosmia or Dysosmia** based on objective testing that is persistent and of unknown origin[33-35]
- **Suspected infection**
    - Osteomyelitis (after x-rays)[36]
    - Abscess based on clinical signs and symptoms of infection
- **Face mass[30, 37, 38]**
    - Present on physical exam and remains non-diagnostic after x-ray or ultrasound is completed
    - Known or highly suspected head and neck cancer on examination[30]
    - Failed 2 weeks of treatment for suspected infectious adenopathy[39]
- **Facial trauma[17, 18, 40, 41]**
    - Concern for soft tissue injury to further evaluate for treatment or surgical planning[42]
- **Granulomatosis with polyangiitis (Wegener's granulomatosis) disease[31]**
- **Trigeminal neuralgia/neuropathy** (for evaluation of the extracranial nerve course)
    - If atypical features (e.g., bilateral, hearing loss, dizziness/vertigo, visual changes, sensory loss, numbness, pain > 2min, pain outside trigeminal nerve distribution, progression)[33, 43]

NOTE: FOR ADDITIONAL ONCOLOGIC FACE/SINUS MRI INDICATIONS, CLICK HERE

INDICATIONS FOR FACE/SINUS AND BRAIN MRI COMBINATION STUDIES:

- Granulomatosis with polyangiitis (Wegener's granulomatosis) disease[44]
- Trigeminal neuralgia that meets the above criteria[33, 43]
- For approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology[29]

INDICATIONS FOR NECK MRI:

Suspected tumor or cancer[45]:

- Suspicious lesions in mouth or throat[38]
- Suspicious mass/tumor found on another imaging study and needing clarification
- Neck mass or lymphadenopathy (non-parotid or non-thyroid)
    - Present on physical exam and remains non-diagnostic after ultrasound is completed[38]
    - Mass or abnormality found on other imaging study and needing further evaluation
    - Increased risk for malignancy with one or more of the following findings[46]:
        - Fixation to adjacent tissues
        - Firm consistency
        - Size >1.5 cm
        - Ulceration of overlying skin
        - Mass present ≥ two weeks (or uncertain duration) without significant fluctuation and not considered of infectious cause
        - History of cancer
    - Failed 2 weeks of treatment for suspected infectious adenopathy[39]
    - Pediatric (≤18 years old) considerations[10]
        - Ultrasound should be inconclusive or suspicious unless there is a history of malignancy[11]

Note: For discrete cystic lesions of the neck, an ultrasound should be performed as initial imaging unless there is a high suspicion of malignancy

- Neck Mass (parotid)[45]
    - Parotid mass found on other imaging study and needing further evaluation (US is the initial imaging study of a parotid region mass)
- Neck Mass (thyroid)[47]
    - Staging and monitoring for recurrence of known thyroid cancer[47]
        - To assess extent of thyroid tissue when other imaging suggests extension through the thoracic inlet into the mediastinum or concern for airway compression[48, 49]

Note: US is the initial imaging study of a thyroid region mass. Biopsy is usually the next step. In the evaluation of known thyroid malignancy, CT is preferred over MRI since there is less

respiratory motion artifact. Chest CT may be included for preoperative assessment in some cases

Known or suspected deep space infections or abscesses of the pharynx or neck with signs or symptoms of infection[50]

Other indications for a Neck MRI:

- MR Sialography to evaluate salivary ducts[51, 52]
- Vocal cord lesions or vocal cord paralysis[53]
- Unexplained ear pain when ordered by a specialist with all of the following[54]
    - Otoscopic exam, nasolaryngoscopy, lab evaluation (ESR, CBC) **AND**
    - Risk factor for malignancy i.e., tobacco use, alcohol use, dysphagia, weight loss **OR** age older than 50 years
- Diagnosed primary hyperparathyroidism when surgery is planned
    - Previous nondiagnostic ultrasound or nuclear medicine scan[55, 56]
- Bell's palsy/hemifacial spasm (for evaluation of the extracranial nerve course)
    - If atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset[57]
- Objective cranial nerve palsy (CN IX-XII) (for evaluation of the extracranial nerve course)[33, 58]
- Brachial plexopathy if mechanism of injury or EMG/NCV studies are suggestive[59, 60]

  Note: Chest MRI is preferred study, but neck and/or shoulder (upper extremity) MRI can be approved depending on the suspected location of injury

NOTE: FOR ADDITIONAL ONCOLOGIC NECK MRI INDICATIONS, CLICK HERE

INDICATIONS FOR NECK AND BRAIN MRI COMBINATION STUDIES:

- Objective cranial nerve palsy (CN IX-XII) (for evaluation of the extracranial nerve course)[33, 58]
- Bell's Palsy/hemifacial spasm that meets the above criteria[57]
- For approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology[29]

Indications for Internal Auditory Canal (IAC) MRI (Not including Brain)

- Unilateral non-pulsatile tinnitus
- Pulsatile tinnitus
- Suspected acoustic neuroma (Schwannoma) or cerebellar pontine angle tumor with any of the following signs and symptoms: unilateral hearing loss by audiometry, headache, disturbed balance or gait, unilateral tinnitus, facial weakness, or altered sense of taste

- Suspected cholesteatoma
- Suspected glomus tumor
- Asymmetric sensorineural hearing loss on audiogram
- Congenital/childhood sensorineural hearing loss suspected to be due to a structural abnormality[61-63] (CNVIII, the brain parenchyma, or the membranous labyrinth). CT is the preferred imaging modality for the osseous anatomy and malformations of the inner ear.
- CSF otorrhea (MRI/Nuclear Cisternography for intermittent leaks, CT for active leaks); there should be a high suspicion or confirmatory CSF fluid laboratory testing (Beta-2 transferrin assay)
- Bell's Palsy for evaluation of the extracranial nerve course -if atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset[57]

ADDITIONAL ONCOLOGIC INDICATIONS FOR ORBIT/FACE/SINUS/NECK MRI

Known tumor or cancer of skull base, orbits, sinuses, face, tongue, larynx, nasopharynx, pharynx, or salivary glands[64]

- Initial staging[38]
- Restaging during treatment
- Suspected recurrence or new metastases based on symptoms or examination findings
    - New mass
    - Change in lymph nodes[65]
- Surveillance appropriate for tumor type and stage

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- < 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post- operative/procedural evaluation

- When imaging, physical, or laboratory findings indicate surgical or procedural complications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.[37]
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

BACKGROUND:

Magnetic resonance imaging (MRI) is used in the evaluation of face and neck region masses, trauma, and infection. The soft tissue contrast between normal and abnormal tissues provided by MRI is sensitive for differentiating between inflammatory disease and malignant tumors and permits the precise delineation of tumor margins. MRI is used for therapy planning and follow-up of face and neck neoplasms. It is also used for the evaluation of neck lymphadenopathy and vocal cord lesions.

CT scanning remains the study of choice for the imaging evaluation of acute and chronic inflammatory diseases of the sinonasal cavities. MRI is not considered the first-line study for routine sinus imaging because of limitations in the definition of the bony anatomy and length of imaging time. MRI for confirmation of diagnosis of sinusitis is discouraged because of hypersensitivity (overdiagnosis) in comparison to CT without contrast. MRI, however, is superior to CT in differentiating inflammatory conditions from neoplastic processes. MRI may better depict intraorbital and intracranial complications in cases of aggressive sinus infection, as well as differentiating soft-tissue masses from inflammatory mucosal disease. MRI may also identify fungal invasive sinusitis or encephaloceles.

Anosmia – Nonstructural causes of anosmia include post viral symptoms, medications (Amitriptyline, Enalapril, Nifedipine, Propranolol, Penicillamine, Sumatriptan, Cisplatin, Trifluoperazine, Propylthiouracil). These should be considered prior to advanced imaging to look for a structural cause. Anosmia and dysgeusia have been reported as common early symptoms in patients with COVID-19, occurring in greater than 80 percent of patients. For isolated anosmia, imaging is typically not needed once the diagnosis of COVID has been made given the high association. As such, COVID testing should be done prior to imaging.[66-68]
MRI Orbits, Face, and Neck MRI rather than MRI Brain is the mainstay for directly imaging the olfactory apparatus and sinonasal or anterior cranial fossa tumors that may impair or directly involve the olfactory apparatus.[33]

CSF (cerebrospinal fluid) leaks – For CSF rhinorrhea, Sinus CT is indicated when looking to characterize a bony defect. For CSF otorrhea, Temporal Bone CT is indicated. For intermittent leaks and complex cases, consider CT/MRI/Nuclear Cisternography. There should be a high suspicion or confirmatory CSF fluid laboratory testing (Beta-2 transferrin assay).[69, 70]

Trigeminal Neuralgia – According to the International Headache Society, TN is defined as "a disorder characterized by recurrent unilateral brief electric shock-like pain, abrupt in onset and termination, limited to the distribution of one or more divisions of the trigeminal nerve and triggered by innocuous stimuli."[71]

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POLICY HISTORY

Date	Summary
May 2023	Updated references Updated background Added: • Combo Orbit/Brain MRI -Suspected retinoblastoma • Combo Neck/Brain MRI -Bell's Palsy/hemifacial spasm that meets the above criteria • Section on further evaluation of indeterminate or questionable findings on prior imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline Removed additional resources

March 2022	Updated references
	Added New Combo statement
	<u>Orbit</u>
	• Clarified:
	  ○ Optic neuritis
	  ▪ If atypical presentation (bilateral, absence of pain, optic nerve hemorrhages, severe visual impairment, lack of response to steroids, poor recovery or recurrence)
	  ▪ If needed to confirm optic neuritis and rule out compressive lesions (combo section)
	  ○ Complex strabismus syndromes (with ophthalmoplegia or ophthalmoparesis)
	<u>Sinus</u>
	• Re-ordered indications
	• Reformatted and updated backgrounds
	• Clarified:
	  ○ Abscess
	  ○ Facial trauma - Concern for soft tissue injury to further evaluate for treatment or surgical planning
	• Deleted:
	  ○ Physical findings of direct facial bone injury
	<u>Neck</u>
	• Reformatted indications
	• Added:
	  ○ Mass or abnormality found on other imaging study and needing further evaluation
	• Clarified

	○ Non thyroid masses ○ Thyroid imaging ○ Abscess

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **BRAIN (HEAD) MRA/MRV**	**Original Date: September 1997**
CPT Codes: 70544, 70545, 70546	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_004-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR BRAIN (HEAD) MR Angiography/MR Venography

Brain MRI/MRA are not approvable simultaneously unless they meet the criteria described below in the Indications for Brain MRI/Brain MRA combination studies section. If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- Inconclusive or show a need for additional or follow up imaging evaluation OR
- The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of suspected intracranial vascular disease[1, 2]

- **Aneurysm screening**
  - Screening for intracranial aneurysm if two or more first-degree family members (parent brother, sister, or child) with history of intracranial aneurysm
    - Repeat study is recommended every 5 years[3]

- For one first degree relative with aneurysm, asymptomatic screening is not indicated - would require a neurological sign or symptom supporting clinical concern for aneurysm.[4-6]
- Screening for aneurysm in polycystic kidney disease (in adults), Loeys-Dietz syndrome*, fibromuscular dysplasia, spontaneous coronary arteries dissection (SCAD), or known aortic coarctation (after age 10)[7-15]

  *For Loeys-Dietz imaging should be repeated at least every two years

- **Vascular abnormalities**
  - Suspected vascular malformation (arteriovenous malformation (AVM) or dural arteriovenous fistula) in patient with previous or indeterminate imaging study
  - Thunderclap headache with continued concern for underlying vascular abnormality (i.e. aneurysm or reversible cerebral vasoconstriction syndrome) after initial negative brain imaging [16]

    Note: Negative brain CT < 6 hours after headache onset excludes subarachnoid hemorrhage in neurologically intact patients. MRI lacks sensitivity in excluding subarachnoid hemorrhage less than 24 hours after headache onset.[17, 18]

  - Headache associated with exercise, exertion, Valsalva, or sexual activity[18]
  - Isolated third nerve palsy (oculomotor) with pupil involvement to evaluate for aneurysm[19]
  - Pulsatile tinnitus to identify a suspected arterial vascular etiology[20, 21]

    Note: MRI is the study of choice for detecting cavernomas, developmental venous anomalies and capillary telangiectasia (see background)[22]

- **Cerebrovascular Disease**
  - Ischemic
    - Recent ischemic stroke or transient ischemic attack (See background)[23, 24]

      Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management

    - Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[19, 25-27]
  - Hemorrhagic
    - Known subarachnoid hemorrhage (SAH) – CTA is favored over MRA
    - Known cerebral intraparenchymal hemorrhage with concern for underlying vascular abnormality
  - Venous-MRV†
    - Suspected central venous thrombosis (dural sinus thrombosis)[28, 29]
    - Distinguishing benign intracranial hypertension (pseudotumor cerebri) from dural sinus thrombosis[30, 31]

- Sickle cells disease (ischemic and/or hemorrhagic)[32, 33]
    - Neurological signs or symptoms in sickle cell patients
    - High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200

- **Vasculitis with initial laboratory workup (such as ESR, CRP, serology)[34]**
    - Suspected secondary CNS vasculitis based on neurological sign or symptoms in the setting of an underlying systemic disease with abnormal inflammatory markers or autoimmune antibodies
    - Suspected primary CNS vasculitis based on neurological signs and symptoms with completed infectious/inflammatory lab work-up[35, 36]
    - Giant cell arteritis with suspected intracranial involvement[37-40]

- **Other intracranial vascular disease**
    - Suspected Moyomoya disease[41, 42]
    - Suspected reversible cerebral vasoconstriction syndrome[43]

For evaluation of known intracranial vascular disease[1, 2]

- Known intracranial aneurysm, treated aneurysm, or known vascular malformation (i.e., AVM or dural arteriovenous fistula)
- Known vertebrobasilar insufficiency with new or worsening signs or symptoms[25, 27]
- Known vasculitis, reversible cerebral vasoconstriction syndrome or Moyomoya disease[35, 41-44]

Pre-operative/procedural evaluation for brain/skull surgery

- Pre-operative evaluation for a planned surgery or procedure
- Refractory trigeminal neuralgia when done for surgical planning[45]

Post-operative/procedural evaluation[46, 47]

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested

Further evaluation of indeterminate or questionable findings on prior imaging:

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Indications for Brain MRA/Neck MRA combination studies[1, 2]

- Recent ischemic stroke or transient ischemic attack (TIA)[24] (also in combo section)
- Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management
- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[25-27]
- Suspected carotid or vertebral artery dissection; secondary to trauma or spontaneous due to weakness of vessel wall[48, 49]
- Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment[50-52]
- Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 70%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[53-55]
- Symptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 50%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[53, 56]
- Pulsatile tinnitus to identify a suspected arterial vascular etiology[20, 21]

Indications for Brain MRI/Brain MRA combination studies[1, 2]

- Recent ischemic stroke or transient ischemic attack (TIA)
- Thunderclap headache with continued concern for underlying vascular abnormality (i.e., aneurysm or reversible cerebral vasoconstriction syndrome) after initial negative brain imaging[16]

  Note: Negative brain CT < 6 hours after headache onset excludes subarachnoid hemorrhage in neurologically intact patients. MRI lacks sensitivity in excluding subarachnoid hemorrhage less than 24 hours after headache onset.[17, 18]

- Acute, sudden onset of headache with personal history of a vascular abnormality or first-degree family history of aneurysm
- Headache associated with exercise, exertion, Valsalva or sexual activity[18]
- Suspected venous thrombosis (dural sinus thrombosis) – MRI/MRV†
- Neurological signs or symptoms in sickle cell patients
- High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200

Indications for Brain MRI/Brain MRA/Neck MRA combination studies

- Recent ischemic stroke or transient ischemic attack (TIA)[1, 2, 57]
- Approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology[58]

Any Combination of Brain MRA/Neck MRA/Brain MRI with IAC

- Pulsatile tinnitus with concern for a suspected arterial vascular and/or intracranial etiology[20, 57]

***Note:** CTA and MRA are generally comparable noninvasive imaging alternatives each with their own advantages and disadvantages. Brain MRI can be combined with Brain CTA/Neck CTA.

BACKGROUND

Magnetic resonance angiography (MRA) or magnetic resonance venography (MRV) can be used as a first-line investigation of intracranial vascular disease. It is an alternative to invasive intra-catheter angiography that was once the mainstay for the investigation of intracranial vascular disease. MRA/MRV may use a contrast agent, gadolinium, which is non-iodine-based, for better visualization. It can be used in patients who have history of contrast allergy and who are at high risk of kidney failure. A single authorization covers both MRA and MRV.

The three different techniques of MRA/MRV include time of flight (both 2D and 3D TOF), phase contrast (PC), and contrast-enhanced angiography. Time of flight MRA takes advantage of the phenomena of flow-related enhancement and is the preferred MRA technique due to the speed at which the exam can be acquired.

MRA and Cerebral Aneurysms – Studies that compared MRA with catheter angiography in detecting aneurysms found that MRA could find 77% - 94% of the aneurysms previously diagnosed by catheter angiography that were larger than 5 mm. For aneurysms smaller than 5 mm, MRI detected only 10% - 60% of those detected with catheter angiography. On the other hand, aneurysms that were missed by catheter angiography in patients with acute subarachnoid hemorrhage were detected with MRA due to the much larger number of projections available with MRA.[59] The decrease in specificity, when compared with CTA, is reported to have false-positive cases related to normal vascular variants of infundibular origin of vessels and vessel loops. Limitations of MRA head include required safety screening and relatively long acquisition time in urgent clinical scenario.

MRA and PCKD[13-15, 60]

Screening imaging every 5 years, and annual follow-up imaging in patients in with a known intracranial aneurysm is recommended. The current literature recommends initial screening by the age of 30 years and earlier if there is a strong family history of intracranial aneurysm. Screening is generally not recommended is the pediatric population (less than 18 years). No upper age limit for screening patients with ADPKD has been recommended.

MRA and Cerebral Arteriovenous Malformations (AVM) – Brain arteriovenous malformation (AVM) may cause intracranial hemorrhage and is usually treated by surgery. 3D TOF-MRA is commonly used during the planning of radiosurgery to delineate the AVM nidus, but it is not highly specific for the

detection of a small residual AVM aft er radiosurgery. There is no evidence to support screening of first-degree relatives for AVMs[61]. The risk of having an AVM may be higher than in the general population, but absolute risk is low.

MRA and non-aneurysmal vascular malformations – Non-aneurysmal vascular malformations can be divided in low flow vascular malformations and high flow vascular malformations. Low flow vascular malformations include dural venous anomalies (DVA), cavernomas, and capillary telangiectasias. High flow vascular malformations include AVM and dural arteriovenous fistulas (dAVF). For low flow malformations, MRI is the study of choice. There is limited medical literature to support vascular imagining (CTA or MRA). CTA plays a limited role in the assessment of cavernoma but may be used to demonstrate a DVA. MRA is not usually helpful in the assessment of cavernoma, capillary telangiectasia, and DVA. Vascular imaging is indicated in high flow vascular malformations.[1, 2, 22]

MRA vs CTA for CVA – Preferred vascular imaging of the head and neck includes non-contrast head MRA and contrast-enhanced neck MRA. MRA may not be able to be performed in patients with claustrophobia, morbid obesity, or implanted device, but it can be useful in patients with renal failure or contrast allergies. For acute stroke, CTA is preferred after CT (to rule out hemorrhage) and to look for thrombus/possible intervention that is time sensitive.[62]

MRA and recent stroke or transient ischemic attack – A stroke or central nervous system infarction is defined as "brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury. … Ischemic stroke specifically refers to central nervous system infarction accompanied by overt symptoms, whereas silent infarction causes no known symptoms."[63] If imaging or pathology is not available, a clinical stroke is diagnosed by symptoms persisting for more than 24 hours. Ischemic stroke can be further classified by the type and location of ischemia and the presumed etiology of the brain injury. These include large-artery atherosclerotic occlusion (extracranial or intracranial), cardiac embolism, small-vessel disease and less commonly dissection, hypercoagulable states, sickle cell disease and undetermined causes.[64] TIAs in contrast, "are a brief episode of neurological dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction on imaging."[65] On average, the annual risk of future ischemic stroke after a TIA or initial ischemic stroke is 3–4%, with an incidence as high as 11% over the next 7 days and 24–29% over the following 5 years. This has significantly decreased in the last half century due to advances in secondary prevention.[66]

Therefore, when revascularization therapy is not indicated or available in patients with an ischemic stroke or TIA, the focus of the work-up is on secondary prevention. This includes noninvasive vascular imaging to identify the underlying etiology, assess immediate complications and risk of future stroke. The majority of stroke evaluations take place in the inpatient setting. Admitting TIA patients is reasonable if they present within 72 hours and have an ABCD(2) score ≥ 3, indicating high risk of early recurrence, or the evaluation cannot be rapidly completed on an outpatient basis (Easton, 2009). Minimally, both stroke and TIA should have an evaluation for high-risk modifiable factors, such as

carotid stenosis atrial fibrillation, as the cause of ischemic symptoms.[64] Diagnostic recommendations include neuroimaging evaluation as soon as possible, preferably with magnetic resonance imaging, including DWI; noninvasive imaging of the extracranial vessels should be performed, and noninvasive imaging of intracranial vessels is reasonable.[23]

Patients with a history of stroke and recent workup with new signs or symptoms indicating progression or complications of the initial CVA should have repeat brain imaging as an initial study. Patients with remote or silent strokes discovered on imaging should be evaluated for high-risk modifiable risk factors based on the location and type of the presumed etiology of the brain injury.

MRA and Intracerebral Hemorrhage – MRA is useful as a screening tool for an underlying vascular abnormality[67] in the evaluation of spontaneous intracerebral hemorrhage (ICH). Etiologies of spontaneous ICH include tumor, vascular malformation, aneurysm, hypertensive arteriopathy, cerebral amyloid angiopathy, venous thrombosis, vasculitis, RCVS, drug-induced vasospasm, venous sinus thrombosis, Moyomoya disease, anticoagulant use and hemorrhagic transformation of an ischemic infarct. History can help point to a specific etiology. Possible risk factors for the presence of underlying vascular abnormalities include age younger than 65, female, lobar or intraventricular location, and the absence of hypertension or impaired coagulation.

MRV – A pitfall of the TOF technique, particularly 3D TOF, is that in areas of slowly flowing blood, turbulence, or blood which flows in the imaging plane there can be regions of absent or diminished signal. The signal loss can be confused with vascular occlusion or thrombi. To avoid this pitfall, MRA performed after the intravenous administration of gadolinium-based contrast agents is utilized at many facilities.

Intracranial magnetic resonance venography (MRV) is used primarily to evaluate the patency of the venous sinuses. The study can be performed with TOF, Phase contrast and IV contrast-enhanced techniques. Delayed images to allow for enhancement of the venous system are required to obtain images when intravenous gadolinium-enhanced studies are undertaken.

Saturation pulses are utilized in studies not undertaken with intravenous contrast to help eliminate flow-related signal in a specified direction and thus display the desired arterial or venous structures on their own. In cranial applications, saturation pulses applied at the inferior margin of the imaging field eliminate signal from arterial flow in order to visualize the veins. Conversely, superior saturation pulses are used to eliminate venous flow-related enhancement when evaluation of the arterial structures is desired.[68]

†MRV and Central Venous Thrombosis – a MR Venogram is indicated for the evaluation of a central venous thrombosis/dural sinus thrombosis. The most frequent presentations are isolated headache, intracranial hypertension syndrome (headache, nausea/vomiting, transient visual obscurations, pulsatile tinnitus, CN VI palsy, papilledema),[69] seizures, focal neurological deficits, and encephalopathy. Risk factors are hypercoagulable states inducing genetic prothrombotic conditions, antiphospholipid

syndrome and other acquired prothrombotic diseases (such as cancer), oral contraceptives, pregnancy, puerperium (6 weeks postpartum), infections, and trauma. COVID-19 infection is associated with hypercoagulability, a thromboinflammatory response, and an increased incidence of venous thromboembolic events (VTE).[70, 71] Since venous thrombosis can cause SAH, infarctions, and hemorrhage, parenchymal imaging with MRI/CT is also appropriate.[72-74]

Combination MRI/MRA of the Brain – This is one of the most misused combination studies and other than what is indicated above these examinations should be ordered in sequence, not together. Vascular abnormalities can be visualized on the brain MRI.

Patients presenting with a new migraine with aura (especially an atypical or complex aura) can mimic a transient ischemic attack or an acute stroke. If there is a new neurologic deficit, imaging should be guided by concern for cerebrovascular disease, not that the patient has a headache.[16]

MRA and dissection- Craniocervical dissections can be spontaneous or traumatic. Patients with blunt head or neck trauma who meet Denver Screening criteria should be assessed for cerebrovascular injury (although about 20% will not meet criteria). The criteria include focal or lateralizing neurological deficits (not explained by head CT); infarct on head CT; face, basilar skull, or cervical spine fractures; cervical hematomas that are not expanding; Glasgow coma score less than 8 without CT findings; massive epistaxis; cervical bruit or thrill.[48, 75-77] Spontaneous dissection presents with headache, neck pain with neurological signs or symptoms. There is often minor trauma or precipitating factor (i.e., exercise, neck manipulation). Dissection is thought to occur due to weakness of the vessel wall, and there may be an underlying connective tissue disorder. Dissection of the extracranial vessels can extend intracranially and/or lead to thrombus which can migrate into the intracranial circulation, causing ischemia. Therefore, MRA of the head and neck is warranted.[49, 78]

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POLICY HISTORY

Date	Summary
May 2023	Updated and reformatted references Updated background section Added: - Section on further evaluation of indeterminate or questionable findings on prior imaging - Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment (Combo Brain/Neck MRA) - Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management (also in combo section) - Note on CTA VS MRA Clarified: - Screening for aneurysm in polycystic kidney disease (in *adults*) - Screening for intracranial aneurysm if *two or more* first-degree family members (parent brother, sister, or child) with history of intracranial aneurysm - *For one first degree relative with aneurysm, asymptomatic screening is not indicated - would require a neurological sign or symptom supporting clinical concern for aneurysm***.** - Thunderclap headache with continued concern for underlying vascular abnormality (*i.e. aneurysm or reversible cerebral vasoconstriction syndrome) after initial negative brain imaging* - *Note: MRI lacks sensitivity in excluding subarachnoid hemorrhage less than 24 hours after headache onset (also in Combo Brain MRI/MRA section)* - Headache associated with exercise, *exertion, Valsalva* or sexual activity (Also in Combo Brain MRI/MRA) - Known subarachnoid hemorrhage (SAH) – CTA is favored over MRA Deleted: - Vascular abnormality visualized on previous brain imaging that is equivocal or needs further evaluation
March 2022	Updated and reformatted references Updated background section Added New Combo statement Clarified: • Aneurysm screening in aortic coarctation after age 10

	• MRI is the study of choice for detecting cavernomas, developmental venous anomalies and capillary telangiectasia (see background)
	• Follow up of known intracranial aneurysm, *treated aneurysm*, or known vascular malformation
	• Pulsatile tinnitus to identify *a suspected arterial* vascular etiology
	• **MRI/MRA combo** - Thunderclap headache with continued concern for underlying vascular abnormality after initial negative work-up *Unless there is clear documentation of a contraindication to LP or that LP is unable to be performed due to extenuating circumstances
	Added:
	• Pulsatile tinnitus in new combo section (MRI Brain with IAC/MRA Head/MRA Neck)
	• Brain MRI/Brain MRA combination:
	  ○ Neurological signs or symptoms in sickle cell patients
	  ○ High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200
	Changed:
	• Thunderclap headache with continued concern for underlying vascular abnormality after initial negative brain imaging > 6 hours after onset as well as in combo section

Reviewed / Approved by Clinical Guideline Committee

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Clinical guidelines **NECK MRA/MRV**	**Original Date: September 1997**
CPT Codes: 70547, 70548, 70549	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_012-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR NECK MRA

If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- Inconclusive or show a need for additional or follow up imaging evaluation OR
- The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of known or suspected extracranial vascular disease

Cerebrovascular Disease

- Recent ischemic stroke or transient ischemic attack (see Background)[1-3]

  Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management

- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[4-6]
- Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 70%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries)[7-9]
- Symptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 50%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries)[7, 10, 11]

Aneurysm screening

- Screening for aneurysm in Loeys-Dietz syndrome**, fibromuscular dysplasia or spontaneous coronary arteries dissection (SCAD)[12-15]

  ** For Loeys-Dietz imaging should be repeated at least every two years

Tumor/pulsatile mass

- Pulsatile mass on exam[16]
- Known carotid body tumors, or other masses such as a paraganglioma, arteriovenous fistula, pseudoaneurysm, atypical lymphovascular malformation[17, 18]

  Note: Ultrasound (US) may be used to identify a mass overlying or next to an artery in initial work up of a pulsatile mass.

Other extracranial vascular disease

- Large vessel vasculitis (Giant cell or Takayasu arteritis) with suspected extracranial involvement[19-23]
- Subclavian steal syndrome when ultrasound is positive or indeterminate OR for planning an intervention[24]
- Suspected carotid or vertebral artery dissection; secondary to trauma or spontaneous due to weakness of vessel wall[25, 26]
- Horner's syndrome (miosis, ptosis, and anhidrosis)[27]
- For evaluation of pulsatile tinnitus (subjective or objective) for suspected arterial vascular etiology[28]
- For further evaluation of a congenital vascular malformation of the head and neck
- Known extracranial vascular disease that needs follow-up or further evaluation[29-31]

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation (e.g., carotid endarterectomy)

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

INDICATIONS FOR COMBINATION STUDIES

Neck MRA/Brain MRA

- Recent ischemic stroke or transient ischemic attack (TIA) (see Background)[1, 2, 32]

  Note: For remote strokes with no prior vascular imaging, imaging can be considered based on location/type of stroke and documented potential to change management

- Known or suspected vertebrobasilar insufficiency (VBI) in patients with symptoms such as dizziness, vertigo, headaches, diplopia, blindness, vomiting, ataxia, weakness in both sides of the body, or abnormal speech[4, 5]
- Suspected carotid or vertebral artery dissection secondary to trauma or spontaneous due to weakness of vessel wall[25, 26]
- Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment[33, 34]
- Asymptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., internal carotid stenosis > 70%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[7-9]
- Symptomatic patients with an abnormal ultrasound of the neck or carotid duplex imaging (e.g., carotid stenosis ≥ 50%, technically limited study, aberrant direction of flow in the carotid or vertebral arteries) and patient is surgery or angioplasty candidate[7, 8, 10]
- For evaluation of pulsatile tinnitus (subjective or objective) for suspected arterial vascular etiology[28]

Neck MRA/Brain MRA/Brain MRI

- Recent ischemic stroke or transient ischemic attack (See Background)
- Suspected carotid or vertebral artery dissection with focal or lateralizing neurological deficits

- Approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent vascular and intracranial pathology[35]

Any Combination of Neck MRA/Brain MRA/Brain MRI with IAC

- Pulsatile tinnitus with concern for a suspected arterial vascular and/or intracranial etiology[28, 36]

BACKGROUND

For vascular disease, in general, MRA and CTA are comparable. No current literature compares the efficacy of contrast enhanced CT to CTA or MRI and MRA for evaluation of pulsatile neck mass, so any are approvable. MRA may be complementary to MRI in the following settings: evaluation of a pulsatile neck mass to assess vascular detail when needed; assessment of relevant vascular anatomy for pre-procedural evaluation; vascular supply to tumors and vessel encasement and narrowing by tumors; extent of disease in vasculitis; and to help determine the nature and extent of congenital or acquired vascular anomalies.[37]

MRA vs CTA for Carotid Artery Evaluation[38, 39] – MRA and CTA are generally comparable noninvasive imaging alternatives, each with their own advantages and disadvantages. MRA is an excellent screening test since it does not utilize ionizing radiation. Duplex US and contrast-MRA is a common choice for carotid artery evaluation. Limitations of MRA include difficulty in patients with claustrophobia and the risk of nephrogenic systemic sclerosis with gadolinium contrast agents in specific patients. Advantages of CTA over MRA include superior spatial resolution, rapid image acquisition, decreased susceptibility to motion artifacts and artifacts from calcification as well as being better able to evaluate slow flow and tandem lesions. However, it can also overestimate high-grade stenosis. Limitations of CTA include radiation exposure to the patient, necessity of IV contrast, and risk of contrast allergy and contrast nephropathy.

MRA and Carotid Body Tumor – Carotid body tumors are found in the upper neck at the branching of the carotid artery. Although most of them are benign, they may be locally aggressive with a small malignant potential. MRA may be used to identify a carotid body tumor due to its ability to define the extension of the tumor in relation to the carotid arteries, involvement of the base of the skull and bilateral tumors.

MRA and dissection – Craniocervical dissections can be spontaneous or traumatic. Patients with blunt head or neck trauma who meet Denver Screening criteria should be assessed for cerebrovascular injury (although about 20% will not meet criteria). The criteria include: focal or lateralizing neurological deficits (not explained by head CT), infarct on head CT, face, basilar skull, or cervical spine fractures, cervical hematomas that are not expanding, glasgow coma

score less than 8 without CT findings, massive epistaxis, cervical bruit or thrill.[25, 40-42] Spontaneous dissection presents with headache, neck pain with neurological signs or symptoms.

There is often minor trauma or precipitating factor (e.g., exercise, neck manipulation). Dissection is thought to occur due to weakness of the vessel wall, and there may be an underlying connective tissue disorder. Dissection of the extracranial vessels can extend intracranially and/or lead to thrombus, which can migrate into the intracranial circulation causing ischemia. Therefore, MRA of the head and neck is warranted.[26, 43]

Post-operative evaluation of carotid endarterectomy – Carotid endarterectomy is a vascular surgical procedure that removes plaque from the carotid artery. MRA with multiprojection volume reconstruction is a non-invasive imaging modality that is an alternative to postoperative angiography following carotid endarterectomy. It allows the surgeon to get informative and comparative data.

MRA and recent stroke or transient ischemic attack (TIA) – A stroke or central nervous system infarction is defined as "brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury. … Ischemic stroke specifically refers to central nervous system infarction accompanied by overt symptoms, whereas silent infarction causes no known symptoms."[44] If imaging or pathology is not available, a clinical stroke is diagnosed by symptoms persisting for more than 24 hours. Ischemic stroke can be further classified by the type and location of ischemia and the presumed etiology of the brain injury. These include large-artery atherosclerotic occlusion (extracranial or intracranial), cardiac embolism, small-vessel disease and less commonly dissection, hypercoagulable states, sickle cell disease and undetermined causes.[45] TIAs in contrast, "are a brief episode of neurological dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction on imaging."[46] On average, the annual risk of future ischemic stroke after a TIA or initial ischemic stroke is 3–4%, with an incidence as high as 11% over the next 7 days and 24–29% over the following 5 years. This has significantly decreased in the last half century due to advances in secondary prevention.[47]

When revascularization therapy is not indicated or available in patients with an ischemic stroke or TIA, the focus of the work-up is on secondary prevention. This includes noninvasive vascular imaging to identify the underlying etiology, assess immediate complications and risk of future stroke. The majority of stroke evaluations take place in the inpatient setting. Admitting TIA patients is reasonable if they present within 72 hours and have an ABCD(2) score >or=3, indicating high risk of early recurrence, or the evaluation cannot be rapidly completed on an outpatient basis.[46] Minimally, both stroke and TIA should have an evaluation for high-risk modifiable factors, such as carotid stenosis atrial fibrillation, as the cause of ischemic symptoms.[45] Diagnostic recommendations include neuroimaging evaluation as soon as possible, preferably with magnetic resonance imaging, including DWI; noninvasive imaging of the

extracranial vessels should be performed, and noninvasive imaging of intracranial vessels is reasonable.[32]

Patients with a history of stroke and recent work-up with new signs or symptoms indicating progression or complications of the initial CVA should have repeat brain imaging as an initial study. Patients with remote or silent strokes discovered on imaging should be evaluated for high-risk modifiable risk factors based on the location and type of the presumed etiology of the brain injury.

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POLICY HISTORY

Date	Summary
May 2023	• Updated references • Follow-up of known carotid or vertebral artery dissection within 3-6 months for evaluation of recanalization and/or to guide anticoagulation treatment (Combo Neck/Brain MRA) • Section on further evaluation of indeterminate or questionable findings on prior imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
March 2022	Updated background on MRA Vs CTA Clarified • Pulsatile tinnitus to identify *a suspected arterial* vascular etiology • Large vessel vasculitis with suspected extracranial involvement Added: • For further evaluation of a congenital vascular malformation of the head and neck • Pulsatile tinnitus in new combo section (MRI Brain with IAC/MRA Head/MRA Neck) • New Combo statement

Reviewed / Approved by Clinical Guideline Committee

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Clinical guidelines **BRAIN (HEAD) MRI** **BRAIN (HEAD) MRI with IAC (Internal Auditory Canal)**	**Original Date: September 1997**
CPT Codes: **70551, 70552, 70553, +0698T – Brain MRI**	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_001	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations*

INDICATIONS FOR BRAIN MRI

Brain MR/MRA are not approvable simultaneously unless they meet the criteria described below in the Indications for Brain MR/Brain MRA combination studies section. If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- Inconclusive or show a need for additional or follow up imaging evaluation **OR**
- The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of headache[1-5]

- Chronic headache with a change in character/pattern (e.g., more frequent, increased severity, or duration)
- Cluster headaches or other trigeminal-autonomic cephalgias, i.e., paroxysmal hemicrania, hemicrania continua, short-lasting unilateral neuralgiform headache attacks (SUNCT/SUNA) imaging is indicated once to eliminate secondary causes[6]
- Acute headache, sudden onset:

    - With a personal or family history (brother, sister, parent, or child) of brain aneurysm or AVM (arteriovenous malformation) **OR**
    - < 48 hours of "worst headache in my life" or "thunderclap" headache.
        - Note: The duration of a thunderclap type headache lasts more than 5 minutes. Sudden onset new headache reaching maximum intensity within 2-3 minutes.
    - Prior history of stroke or intracranial bleed
    - Known coagulopathy or on anticoagulation
- New onset of headache with any of the following[1, 7, 8]:
    - Acute, new, or fluctuating neurologic deficits, such as sensory deficits, limb weakness, abnormal reflexes (pathological, asymmetric, hyperreflexia), speech difficulties, visual loss, lack of coordination, or mental status changes or with signs of increased intracranial pressure (papilledema). (See background)
    - History of cancer or significantly immunocompromised
    - Fever
    - Subacute head trauma
    - Pregnancy or puerperium[9, 10]
    - Age ≥ 50[1, 7, 11-13]
    - Severe unilateral headache with radiation to or from the neck, associated with suspicion of carotid or vertebral artery dissection
    - Related to activity or event (sexual activity, exertion, Valsalva, position), new or progressively worsening[14]
    - Persistent or progressively worsening during a course of physician-directed treatment[1, 15, 16]

  Note: Neuroimaging warranted for atypical/complex migraine aura, but not for a typical migraine aura (see background)

- Special considerations in the pediatric population with persistent headache[17-19]:
    - Occipital location
    - Age < 6 years
    - Symptoms indicative of increased intracranial pressure, such as recurring headaches after waking with or without associated nausea/vomiting
    - Documented absence of family history of headache
    - Severe headache in a child with an underlying disease that predisposes to intracranial pathology (e.g., immune deficiency, sickle cell disease, neurofibromatosis, history of neoplasm, coagulopathy, hypertension, congenital heart disease)

For evaluation of neurologic symptoms or deficits[20]

- Acute, new, or fluctuating neurologic symptoms or deficits such as, sensory deficits, limb weakness, abnormal reflexes (pathological, asymmetric, hyperreflexia), speech difficulties, visual loss, lack of coordination, or mental status changes (see background)

For evaluation of known or suspected stroke or vascular disease[21-23]

- Known or suspected stroke with any acute, new, or fluctuating symptoms or deficits such as sensory deficits, limb weakness, speech difficulties, visual loss, lack of coordination, or mental status changes (see background)
- Suspected stroke with a personal or first-degree family history (brother, sister, parent, or child) of aneurysm or known coagulopathy or on anticoagulation
- Symptoms of transient ischemic attack (TIA) (episodic neurologic symptoms such as sensory deficits, limb weakness, speech difficulties, visual loss, lack of coordination, or mental status changes)
- Evaluation of suspected acute subarachnoid hemorrhage (SAH)
- Follow-up for known hemorrhage, hematoma, or vascular abnormalities

  Note: MRI is the study of choice for detecting cavernous malformations (CCM) and other low flow vascular malformations (see background). Follow-up imaging of known CCM should be done only to guide treatment decisions or to investigate new symptoms. First-degree relatives of patients with more than one family member with a CCM should have a screening MRI as well as genetic counseling[24-26]

- Suspected central venous thrombosis - see background[21, 27]
- Screening for silent cerebral infarcts in early school age children and adults with HbSS sickle cell disease or HbSβ0 thalassemia[28]
- Evaluation of neurological signs or symptoms in sickle cell disease[29, 30]
- High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity >200[31, 32]

For evaluation of known or suspected trauma[33-35]

- Known or suspected trauma or injury to the head with documentation of one or more of the following acute, new, or fluctuating:
  - Focal neurologic findings
  - Motor changes
  - Mental status changes
  - Amnesia
  - Vomiting
  - Seizures
  - Headache
  - Signs of increased intracranial pressure
- Known coagulopathy or on anticoagulation
- Known or suspected skull fracture by physical exam and/or prior imaging
- Post concussive syndrome if persistent or disabling symptoms and MRI has not been performed[36]
- Subacute or chronic traumatic brain injury with new cognitive and/or neurologic deficit

For evaluation of suspected brain tumor, mass, or metastasis[37, 38]

- Suspected brain tumor with any acute, new, or fluctuating neurologic symptoms or deficits such as sensory deficits, limb weakness, abnormal reflexes (pathological, asymmetric, hyperreflexia), speech difficulties, visual loss, lack of coordination, or mental status changes (see background)
- Suspected brain metastasis or intracranial involvement in patients with a history of cancer based on neurological symptoms or examination findings (may include new or changing lymph nodes)
- Lesion with atypical features for further evaluation or follow up
- Suspected Pituitary Tumors[39-42]
    - Neurologic findings (e.g., visual field deficit suggesting compression of the optic chiasm, diplopia, gaze palsy)
    - Suspected hypofunctioning pituitary gland based on hormonal testing
        - Hypopituitarism
        - Growth hormone deficiency
        - Hypogonadotropic hypogonadism [low sex hormones and gonadotropins (FSH/LH)][43]
            - Total testosterone persistently < 150 with low or normal LH/FSH i.e., severe secondary hypogonadism **OR**
            - Total testosterone levels persistently borderline around the lower limits of normal range (200-400 ng/dL) with low or normal LH/FSH; **AND**
                - Neurological signs or symptoms; **OR**
                - Other pituitary hormonal abnormalities; **OR**
                - Low free testosterone and consideration and addressment of reversible functional causes of gonadotropin suppression (e.g., obesity, opioid use, diabetes, steroid use, or comorbid illness)
    - Suspected hyperfunctioning pituitary gland based on hormonal testing
        - Central hyperthyroidism (high TSH)
        - Cushing syndrome suspected (high ACTH (>5) with cortisol suppression on low or high dose dexamethasone suppression test)[44-47]
        - Acromegaly/gigantism (high GH/IGF-1)
        - Elevated prolactin[48-50]
            - ≥ 250 ng/mL **OR**
            - After evaluation for another cause (e.g., pregnancy, hypothyroidism, renal insufficiency, medication- see background)
                - ≥ 100 ng/mL **OR**
                - Persistently elevated **OR**
                - Neuroendocrine signs or symptoms (i.e., headache, galactorrhea, abnormal menses, infertility, or bitemporal hemianopsia) **OR**
                - Abnormal pituitary hormones (low testosterone/estrogen/ progesterone **AND** low or normal LH/FSH)
    - Central Diabetes Insipidus (low ADH)

    - Precocious puberty in a child (male < 9; female < 8), with hormonal studies suggesting a central cause [51]
    - Pituitary apoplexy with sudden onset of neurological and hormonal symptoms
- For screening for known non-CNS Cancer[52-61] - see background
    - Default screening for
        - Kidney cancer
        - Lung cancer
        - Merkel cell carcinoma
        - Mucosal melanoma of the head and neck, especially of the oral cavity
        - Poorly differential neuroendocrine cancer (Large or Small cell/Unknown primary of neuroendocrine origin)
    - Screening with preconditions
        - AML……. Suspicion of leukemic meningitis
        - Cutaneous melanoma……. Stage IIIC or higher
        - Testicular cancer-Seminoma……. High risk
        - Gestational Trophoblastic Neoplasia……. Pulmonary metastasis
        - Bladder cancer…… High risk, i.e., small cell
    - All other cancer if CNS symptoms present
- Histiocytic Neoplasms for screening and/or with neurological signs or symptoms[62, 63]
    - Erdheim-Chester Disease
    - Langerhans Cell Histiocytosis
    - Rosai-Dorfman Disease
- For screening of Hereditary Cancer Syndromes - see background
    - Li Fraumeni syndrome- Annually[64]
    - Von Hippel Lindau – Every 2 years, starting at age of 8 years[65]
    - Tuberous Sclerosis – Every 1-3 years, until the age of 25 years[66]
    - MEN1 – Every 3-5 years, starting at the age of 5 years[67]
    - NF-2- Brain IAC: Annually starting at the age of 10 years[68]
    - Sturge Weber Syndrome: Once, after age 1 to rule out intracranial involvement; in patients <1 year, only if symptomatic[69]

For evaluation of known brain tumor, mass, or metastasis

- Follow-up of known CNS cancer (either primary malignant brain tumor or secondary brain metastasis) undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer[38]
- Suspected recurrence with prior history of CNS cancer based on neurological symptoms or examination findings
- Follow-up of known low grade tumor (WHO I-II) (i.e., meningioma, glioma, astrocytoma, oligodendroglioma)
    - For surveillance as per professional society recommendations[38]
    - If symptomatic, new/changing signs or symptoms or complicating factors
- Follow-up of known pituitary adenoma

    - New neuroendocrine signs or symptoms
    - Functioning adenoma - to assess response to treatment and 1-year follow-up after drug holiday[70-73]
    - Asymptomatic Macroadenoma (≥ 10mm) follow-up every 6-18 months, post-surgical follow-up every 1-2 years after surgery[74]
    - Asymptomatic, non-functioning Microadenoma < 10mm repeat in one year; if stable, repeat every 2-3 years[75]
- Follow-up of known pineal cyst (≥ 5mm) if there are atypical features or symptoms (e.g., headaches, gaze paresis, ataxia, papilledema, nausea/vomiting)[76, 77]
- Follow up of known Rathke cleft cyst[78, 79]
    - If no symptoms, MRI at 1/3/5 years to stability
    - With new neurological symptoms or atypical imaging features
    - Post treatment, yearly for 5 years
- Follow-up of known arachnoid cyst[80-83]
    - In patients < 4 years old, serial imaging is warranted
    - In patients > 4 years old, repeat imaging only if newly symptomatic, i.e., headaches, increased intracranial pressure, hydrocephalus, local mass effect, seizures, visual/endocrine dysfunction
- Midline dermoid cysts/sinuses with concern for intracranial extension[41-43, 48]
- Tumor monitoring in neurocutaneous syndromes as per tumor type
- Histiocytic Neoplasms to assess treatment response and surveillance of known brain lesions[62, 63, 84]
    - Erdheim-Chester Disease
    - Langerhans Cell Histiocytosis
    - Rosai-Dorfman Disease

Indications for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated, OR evaluation of suspected metastases[38]

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of known or suspected seizure disorder[85-90]

- New onset of an unprovoked seizure
- Newly identified change in seizure activity/pattern
- Known seizure disorder without previous imaging
- Medically refractory epilepsy

Note: In the pediatric population, **imaging is not indicated in simple febrile seizures** or in idiopathic focal or generalized epilepsy with typical features [BECTS, childhood absence epilepsy (CAE), juvenile absence epilepsy (JAE), and juvenile myoclonic epilepsy (JME)][87, 91-93]

For evaluation of suspected multiple sclerosis (MS)[94-97]

- For evaluation of patient with neurologic symptoms or deficits suspicious for MS with
    - A clinically isolated syndrome (optic neuritis, transverse myelitis, or brain stem syndrome); **OR**
    - Recurrent episodes of variable neurological signs or symptoms not attributable to another cause
- To demonstrate dissemination in time for diagnosis (every 6-12 months)

For evaluation of known multiple sclerosis (MS)[94, 97, 98]

- To establish a new baseline (no recent imaging, postpartum, or 3-6 months after switching disease modifying therapy)
- Prior to starting or switching disease-modifying therapy
- 6-month repeat scan in patients with MRI disease activity that is not associated with new clinical symptoms on a routine follow-up scan (i.e., Radiographically isolated syndrome)[99]
- Every 1-2 years while on disease-modifying therapy to assess for subclinical disease activity, less frequently when stable for 2-3 years
- New signs or symptoms suggested of an exacerbation or unexpected clinical worsening
- Progressive Multifocal Leukoencephalopathy (PML) surveillance for patients on natalizumab (Tysabri)[100]
    - 12 months after the start of treatment in all patients
    - Further surveillance MRI scanning timing is based on risk
        - Annually, if anti-JCV antibody negative,
        - Every 3-4 months, if high risk of PML occurrence:
            - seropositive for JC virus and have been treated with natalizumab for ≥18 months **OR**
            - high anti-JC virus antibody index values (>0.9) **OR**
            - previously treated with immunosuppressive therapies
    - Brain MRI every 3–4 months for up to 12 months, in high-risk patients who switch from natalizumab to other therapeutics

Note: In the pediatric population, use a similar scan frequency for disease and therapeutic monitoring. Increase frequency of imaging (e.g., every 6 months) in children with highly active disease or in situations where imaging will change management.

For evaluation of known or suspected infectious or inflammatory disease (e.g., meningitis or abscess)[101, 102]

- Suspected intracranial abscess or brain infection with acute altered mental status or with positive lab findings (such as elevated WBCs) OR follow-up assessment during or after treatment completed

- Meningitis with positive signs and symptoms (such as fever, headache, mental status changes, stiff neck) **OR** with positive lab findings (such as elevated white blood cells or abnormal lumbar puncture fluid exam)
- Suspected encephalitis with headache and altered mental status or follow-up as clinically warranted
- Endocarditis with suspected septic emboli
- Suspected temporal arteritis in a patient ≥ 50 with temporal headache, abrupt visual changes, jaw claudication, temporal artery tenderness, constitutional symptoms or elevated ESR;[103-107] **AND**
    - Negative initial work-up (color Doppler ultrasonography or biopsy); **OR**
    - Atypical features, failure to response to treatment or concern for intracranial involvement

Note: Protocol should include high-resolution contrast-enhanced imaging the temporal artery

- Central Nervous System (CNS) involvement in patients with known or suspected vasculitis or autoimmune disease with abnormal inflammatory markers or autoimmune antibodies
- Suspected primary CNS vasculitis based on neurological signs and symptoms with completed infectious/inflammatory lab work-up[108, 109]
- Immunocompromised patient (e.g., transplant recipients, HIV with CD4<200, primary immunodeficiency syndromes, hematologic malignancies) with focal neurologic symptoms, headaches, behavioral, cognitive or personality changes
- Neurosarcoidosis[110-112]
    - Initial Evaluation:
        - Suspected based on neurological sign/symptoms and lab work (ACE, CSF analysis) **OR**
        - Known history of sarcoidosis with neurological signs or symptoms
    - Follow-up of known neurosarcoidosis:
        - To assess treatment response
        - Worsening signs or symptoms

For evaluation of clinical assessment documenting cognitive impairment of unclear cause[113-115]

- Mental status score of either MMSE or MoCA of less than 26 or other similar mental status instruments*/formal neuropsychological testing showing at least mild cognitive impairment **AND** a completed basic metabolic workup (such as thyroid function testing, liver function testing, complete blood count, electrolytes, and B12)

*Other examples include Mini-Cog, Memory Impairment Screen, Saint Louis University Mental Status Examination (SLUMS), Brief Alzheimer's Screen (BAS), Blessed Dementia Scale (BDS), Clinical Dementia Rating (CDR)[116, 117]

FDA labeling for the drug Aduhelm (for Alzheimer's disease) requires baseline imaging and monitoring with Brain MRI.[118, 119] Criteria for coverage includes the following:

- Baseline study within 1 year of initiating treatment unless the patient has a more recent exacerbation, traumatic event [e.g., falls, etc.], or co-morbidity necessitating an evaluation within one-month preceding initiation
- Prior to the 7th and 12th infusions
- Monitoring if radiographic severe Amyloid Related Imaging Abnormalities (ARIA) is suspected or observed

NOTE: Enhanced clinical vigilance for ARIA is recommended during the first 8 doses of treatment with Aduhelm, particularly during titration. If a patient experiences symptoms which could be suggestive of ARIA, clinical evaluation should be performed, including MRI testing if indicated.

For evaluation of movement disorders[120-125]

- For evaluation of suspected Parkinson's with atypical feature or unresponsive to levodopa
- For evaluation of new non-Parkinson neurological symptoms in known Parkinson's disease complicating the evaluation of the current condition
- For the evaluation of other movement disorder to exclude a structural lesion (i.e., suspected Huntington disease, chorea, atypical parkinsonian syndromes, hemiballismus, atypical dystonia)
  Note: MRI not indicated in essential tremor, Tourette' syndrome, or isolated focal dystonia (e.g., blepharospasm, cervical dystonia, laryngeal dystonia, oromandibular dystonia, writer's dystonia)[121, 125, 126]

For evaluation of cranial nerve and visual abnormalities

- Optic neuritis
- Abnormal eye findings on physical or neurologic examination (papilledema, pathologic nystagmus, optic atrophy, ocular nerve palsies, new onset anisocoria, visual field deficit, etc.)[127]

  Note: See background
- Binocular diplopia with concern for intracranial pathology[128] after comprehensive eye evaluation[129]
- Childhood strabismus with development delay or abnormal fundoscopic exam to rule out intracranial abnormalities[130, 131]
- Horner's syndrome with symptoms localizing the lesion to the central nervous system[132]
- Trigeminal neuralgia or neuropathy[5, 133, 134]
- Occipital Neuralgia to exclude a structural lesion, notably in atypical cases[135-137]
- Bell's Palsy- if atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset[138]
- Hemifacial spasm[139]
- Other objective cranial nerve palsy (CN IX-XII)[140, 141]
- Bulbar symptoms, i.e., difficulty in chewing, weakness of the facial muscles, dysarthria, palatal weakness, dysphagia, and dysphonia and/or signs, i.e., atrophy and fasciculations of the tongue and absent gag reflex[142]

- Pseudobulbar symptoms, i.e., dysphagia, dysarthria, facial weakness, sudden, stereotyped emotional outbursts that are not reflective of mood and/or signs, i.e., spastic tongue and exaggerated gag/jaw jerk[143]

For evaluation of known or suspected congenital abnormality (such as craniosynostosis, neural tube defects)[144, 145]

- Known or suspected congenital abnormality with any acute, new, or fluctuating neurologic, motor, or mental status changes
- Evaluation of macrocephaly in an infant/child <18 with previously abnormal US, abnormal neurodevelopmental examination, signs of increased ICP or closed anterior fontanelle[146]
- Evaluation of microcephaly in an infant/child < 18
- Evaluation of craniosynostosis and other skull deformities. CT is preferred imaging to assess bony structures; MRI imaging is preferred to assess intracranial soft tissue
- Evaluation of the corticomedullary junction in Achondroplasia[147, 148]
- Cerebral palsy if etiology has not been established in the neonatal period, there is change in the expected clinical or developmental profile or concern for progressive neurological disorder[149, 150]
- X-linked Adrenoleukodystrophy[151]
    - Baseline MRI between 12 and 18 months old
    - Second MRI 1 year after baseline
    - MRI every 6 months between 3 and 12 years old
    - Annual MRI after 12 years old
- Prior treatment **OR** treatment planned for congenital abnormality

Note: For evaluation of known or suspected hydrocephalus please see section on CSF abnormalities.

Cerebral Spinal Fluid (CSF) Abnormalities

- Evaluation of suspected hydrocephalus with any acute, new, or fluctuating neurologic, motor, or mental status changes
- Known hydrocephalus†
- For initial evaluation of a suspected Arnold Chiari malformation†
- Follow-up imaging of a known type II or type III Arnold Chiari malformation. For Arnold Chiari type I, follow-up imaging only if new or changing signs/symptoms[152]
- Initial evaluation for a known syrinx or syringomyelia†
- Known or suspected normal pressure hydrocephalus (NPH)[153]
    - With symptoms of gait difficulty, cognitive disturbance, and urinary incontinence
- Follow-up shunt evaluation[154-157]
    - Post operativity if indicated based on underlying disease or pre-operative radiographic findings and/or
    - 6-12 months after placement and/or
    - With neurologic symptoms that suggest shunt malfunction

- Evaluation of known or suspected cerebrospinal fluid (CSF) leakage[158]
- Cisternography for intermittent and complex CSF rhinorrhea/otorrhea. CSF fluid should always be confirmed with laboratory testing (Beta-2 transferrin assay)[159, 160]
- Suspected spontaneous intra-cranial hypotension with distinct postural headache (other symptoms include nausea, vomiting, dizziness, tinnitus, diplopia neck pain or imbalance)[161, 162]
- CSF flow study for evaluation and management of CSF flow disorders[163, 164]
  †Often congenital, but can present later in life; or less commonly acquired secondary to tumor, stroke, trauma, infection, etc.[165]

Pre-operative/procedural evaluation for brain/skull surgery

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Other Indications for a Brain MRI

- Vertigo associated with any of the following[166-168]
  - Signs or symptoms suggestive of a CNS lesion (ataxia, visual loss, double vision, weakness, or a change in sensation)
  - Progressive unilateral hearing loss
  - Risk factors for cerebrovascular disease with concern for stroke
  - After full neurologic examination and vestibular testing with concern for central vertigo (i.e., skew deviation, vertical nystagmus, head thrust test, videonystagmography (VNG)/ electronystagmography (ENG))
- Diagnosis of central sleep apnea on polysomnogram
  - Children > 1 year[169]
  - Adults in the absence of heart failure, chronic opioid use, high altitude, or treatment emergent central sleep apnea **AND** concern for a central neurological cause (Chiari malformation, tumor, infectious/inflammatory disease) **OR** with an abnormal neurological exam[170]

- Syncope with clinical concern for seizure or associated neurological signs or symptoms[171, 172]
- Cyclical vomiting syndrome or abdominal migraine with any localizing neurological symptoms[173-175]
- Soft tissue mass of the head with nondiagnostic initial evaluation (ultrasound and/or radiograph)[176-178]
- Psychological changes with neurological deficits on exam or after completion of a full neurological assessment that suggests a possible neurologic cause[179]
- Global developmental delay or developmental delay with abnormal neurological examination in a child < 18 years[180, 181]
- Unexplained event (BRUE) formerly apparent life-threatening event (ALTE) in infants < 1 year with concern for neurological cause based on history and exam[182]

  Note: Imaging is not indicated in low-risk patients

- Bone Marrow Transplant (BMT)
  - For initial workup of BMT (along with CT Chest[183], CT Sinus and CT Abdomen and Pelvis)[184]).

Indications for a Brain MRI with Internal Auditory Canal (IAC) (If only images of the IACs is needed w/o Brain imaging see Guideline Number: Evolent_CG_014)

- Unilateral non-pulsatile tinnitus
- Pulsatile tinnitus
- Suspected acoustic neuroma (Schwannoma) or cerebellar pontine angle tumor with any of the following signs and symptoms: unilateral hearing loss by audiometry, headache, disturbed balance or gait, unilateral tinnitus, facial weakness, or altered sense of taste
- Suspected cholesteatoma
- Suspected glomus tumor
- Asymmetric sensorineural hearing loss on audiogram
- Congenital/childhood sensorineural hearing loss suspected to be due to a structural abnormality[185-187] (CNVIII, the brain parenchyma, or the membranous labyrinth). CT is the preferred imaging modality for the osseous anatomy and malformations of the inner ear.
- CSF otorrhea (MRI/Nuclear Cisternography for intermittent leaks, CT for active leaks)[188]; there should be a high suspicion or confirmatory CSF fluid laboratory testing (Beta-2 transferrin assay)
- Clinical suspicion of acute mastoiditis as a complication of acute otitis media with intracranial complications (i.e., meningeal signs, cranial nerve deficits, focal neurological findings, altered mental status)[189, 190]
- Bell's Palsy for evaluation of the extracranial nerve course -if atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset[138]

Indications for MR Perfusion Imaging[191]

- Neurovascular disease
  - Assessment of ischemic penumbra in acute stroke

    - Assessment of cerebrovascular reserve
    - Further evaluation of known vascular abnormality (stenosis, malformation, vasospasm, vasculitis, Moya-Moya)
- Mass lesions
    - Differentiating tumor from tumor mimic
    - Differentiating glioblastoma from brain metastasis[192]
    - Discriminating low- from high-grade gliomas[193]
    - Differentiating recurrent brain tumors from radiation/chemo necrosis[194, 195]
    - Surgical planning

Indications for Combination Studies[21, 22]

Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the neuroaxis), patient history, and other available information, including prior imaging.

Exception: For approved indications as noted above and being performed in a child under 8 years of age who will need anesthesia for the procedure and there is a suspicion of concurrent intracranial pathology[196]

- **Brain MRI/Neck MRA***
    - Recent ischemic stroke or transient ischemic attack
    - Suspected carotid or vertebral artery dissection with focal or lateralizing neurological deficits
- **Brain MRI/Brain MRA***
    - Recent ischemic stroke or transient ischemic attack
    - Thunderclap headache with continued concern for underlying vascular abnormality after initial negative brain imaging > 6 hours after onset[197-199]

      Note: Negative brain CT < 6 hours after headache onset excludes subarachnoid hemorrhage in neurologically intact patients[200]

    - Acute, sudden onset of headache with personal history of a vascular abnormality or first-degree family history of aneurysm
    - Headache associated with exercise, exertion, Valsalva or sexual activity[6, 14]
    - Suspected venous thrombosis (dural sinus thrombosis) – Brain MRV see background
    - Neurological signs or symptoms in sickle cell patients
    - High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200 [30]
- **Brain MRI/Brain MRA/Neck MRA***
    - Recent stroke or transient ischemic attack (TIA)
    - Suspected carotid or vertebral artery dissection with focal or lateralizing neurological deficits
- **Brain MRI with IAC/ Brain MRA/Neck MRA (any combination)***

- Pulsatile tinnitus with concern for a suspected arterial vascular and/or intracranial etiology[201, 202]

***Note:** MRA and CTA are generally comparable noninvasive imaging alternatives each with their own advantages and disadvantages. Brain MRI can alternatively be combined with Brain CTA/Neck CTA.

- **Brain MRI/Cervical MRI/Thoracic MRI (any combination)**
  - Combination studies for MS: These body regions might be evaluated separately or in combination as guided by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history (e.g., symptom(s), time course, and where in the CNS the likely localization(s) is/are), and other available information, including prior imaging.
    - For evaluation of neuromyelitis optica spectrum disorders (recurrent or bilateral optic neuritis; recurrent transverse myelitis)[203]
    - For known MS, prior to the initiation or change of disease modification treatments and assess disease burden (to establish a new baseline)[204]
    - Follow-up scans, including brain and spine imaging, if patients have known spine disease:
      - 6-12 months after starting/changing treatment
      - Every 1-2 years while on disease-modifying therapy to assess for subclinical disease activity, less frequently when stable for 2-3 years
- **Brain MRI/Cervical MRI/Thoracic MRI/Lumbar MRI (any combination)**
  - For initial evaluation of a suspected Arnold Chiari malformation
  - Follow-up imaging of a known type II or type III Arnold Chiari malformation. For Arnold Chiari type I, follow-up imaging only if new or changing signs/symptoms[152, 205]
  - Oncological Applications (e.g., primary nervous system, metastatic)
    - Drop metastasis from brain or spine (see background)
    - Suspected leptomeningeal carcinomatosis (see background)[206]
    - Tumor evaluation and monitoring in neurocutaneous syndromes - See background
  - CSF leak highly suspected and supported by patient history and/or physical exam findings (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula)
- **Brain MRI/Orbit MRI**
  - Optic neuropathy or unilateral optic disk swelling of unclear etiology to distinguish between a compressive lesion of the optic nerve, optic neuritis, ischemic optic neuropathy (arteritic or non-arteritic), central retinal vein occlusion or optic nerve infiltrative disorders[207]
  - Bilateral optic disk swelling (papilledema) with visual loss[208]
  - Optic Neuritis

        - If atypical presentation (bilateral, absence of pain, optic nerve hemorrhages, severe visual impairment, lack of response to steroids, poor recovery or recurrence)[209, 210]
        - If needed to confirm optic neuritis and rule out compressive lesions
    - Known or suspected neuromyelitis optica spectrum disorder with severe, recurrent, or bilateral optic neuritis[203]
    - Suspected retinoblastoma[211, 212]
- **Brain MRI/FACE/SINUS/NECK MRI**
    - Granulomatosis with polyangiitis (Wegener's granulomatosis) disease[213]
    - Trigeminal neuralgia or neuropathy with an atypical presentation (for evaluation of the extracranial nerve course) [140, 214] See background
    - Bell's Palsy/hemifacial spasm for evaluation of the extracranial nerve course -if atypical signs, slow resolution beyond three weeks, no improvement at four months, or facial twitching/spasms prior to onset[138]
    - Objective cranial nerve palsy (CN IX-XII) (for evaluation of the extracranial nerve course)[140, 141]

BACKGROUND

Brain (head) MRI is the procedure of choice for most brain disorders. It provides clear images of the brainstem and posterior brain, which are difficult to view on a CT scan. It is also useful for the diagnosis of demyelinating disorders (such as multiple sclerosis (MS) that cause destruction of the myelin sheath of the nerve). The evaluation of blood flow and the flow of cerebrospinal fluid (CSF) is possible with this non-invasive procedure.

MRI for Headache – Generally, magnetic resonance imaging is the preferred imaging technique for evaluating the brain parenchyma, and CT is preferable for evaluating subarachnoid hemorrhage. CT is faster and more readily available than MRI and is often used in urgent clinical situations. Neurologic imaging is warranted in patients with headache disorders along with abnormal neurologic examination results or predisposing factors for brain pathology. Contrast-enhanced MRI is performed for evaluation of inflammatory, infectious, neoplastic, and demyelinating conditions.

Headache timeframes and other characteristics – Generally, acute headaches are present from hours to days, subacute from days to weeks and chronic headaches for more than 3 months. Acute severe headaches are more likely to be pathological (e.g., SAH, cerebral venous thrombosis) than non-acute (e.g., migraine, tension-type). Headaches can also be categorized as new onset or chronic/recurrent. Non-acute new onset headaches do not require imaging unless there is a red flag as delineated above. Incidental findings lead to additional medical procedures and expense that do not improve patient well-being. Primary headache syndromes, such as migraine and tension headaches, are often episodic with persistent or progressive headache not responding to treatment requiring further investigation (e.g., new daily persistent headache). Imaging is indicated in chronic headaches if there is a change in

the headache frequency (number of headaches episodes/month), duration of each episode, severity of the headaches or new characteristics, such as changing aura or associated symptoms.[1, 6, 215-217]

Migraine with aura[6, 7, 218] – The headache phase of a migraine is preceded and/or accompanied by transient neurological symptoms referred to as aura in at least a third of migraine attacks. The most common aura consists of positive and/or negative visual phenomena, present in up to 99% of the individuals. Somatosensory is the secondary most common type of aura (mostly paresthesia's in an upper limb and/or hemiface). Language/speech (mainly paraphasia and anomic aphasia) can also be affected. These neurological symptoms typically evolve over a period of minutes and may last up to 20 minutes or more. The gradual evolution of symptoms is thought to reflect spreading of a neurological event across the visual and somatosensory cortices. Characteristically, the aura usually precedes and terminates prior to headache, usually within 60 minutes. In others, it may persist or begin during the headache phase. ICHD-3 definition of the aura of migraine with typical aura consists of visual and/or sensory and/or speech/language symptoms, but no motor, brainstem or retinal symptoms and is characterized by gradual development, duration of each symptom no longer than one hour, a mix of positive and negative features and complete reversibility. Atypical or complex aura includes motor, brainstem, monocular visual disturbances, or ocular cranial nerve involvement (hemiplegic migraine, basilar migraine/brainstem aura, retinal migraine, ophthalmoplegic migraine) and secondary causes need to be excluded. Additional features of an aura that raise concern for an underlying vascular etiology include late age of onset, short duration, evolution of the focal symptoms, negative rather than positive visual phenomenon, and history of vascular risk factors.

Neurological Deficits – Examples of abnormal reflexes related to upper motor neuron lesion/central pathology include hyperreflexia, clonus, Hoffman sign and Babinski, snout, palmar grasp, and rooting reflexes.

Visual loss has many possible etiologies, and MRI is only indicated in suspected neurological causes of visual loss based on history and exam. Visual field defects, such as bitemporal hemianopsia, homonymous hemianopsia, or quadranopsia, require imaging as well as does suspected optic nerve pathology. Subjective symptoms such as blurred vision or double vision with no clear correlate on neurological examination requires a comprehensive eye evaluation to exclude more common causes, such as cataracts, refractive errors, retinopathy, glaucoma, or macular degeneration. Transient visual loss with history consistent with TIA but normal exam at time of examination also should be imaged. Positive visual phenomena, such as photopsias or scintillations that march across the visual field, suggest migraine whereas negative phenomenon, such as shaded or blurred, is more characteristic of ischemia.

Table 1: Gait and brain imaging[219-224]

Gait	Characteristic	Work up/Imaging
Hemiparetic	**Spastic unilateral, circumduction**	**Brain and/or, Cervical spine imaging based on associated symptoms**
Diplegic	**Spastic bilateral, circumduction**	**Brain, Cervical and Thoracic Spine imaging**
Myelopathic	**Wide based, stiff, unsteady**	**Cervical and/or Thoracic spine MRI based on associated symptoms**
Ataxic	**Broad based, clumsy, staggering, lack of coordination, usually also with limb ataxia**	**Brain imaging**
Apraxic	**Magnetic, shuffling, difficulty initiating**	**Brain imaging**
Parkinsonian	**Stooped, small steps, rigid, turning en bloc, decreased arm swing**	**Brain Imaging**
Choreiform	**Irregular, jerky, involuntary movements**	**Medication review, consider brain imaging as per movement disorder Brain MR guidelines**
Sensory ataxic	**Cautious, stomping, worsening without visual input (ie + Romberg)**	**EMG, blood work, consider spinal (cervical or thoracic cord imaging) imaging based on EMG**
Neurogenic	**Steppage, dragging of toes**	**EMG, if there is foot drop, Lumbar spine MRI Pelvis MR appropriate evidence of plexopathy**
Vestibular	**Insecure, veer to one side, worse when eyes closed, vertigo**	**Consider Brain/IAC MRI as per GL**

Non-neurological causes of gait dysfunction include pain (antalgic), side effects of drugs (analgesic, antihistamines, benzos, psych meds, antihypertensives), visual loss, hearing impairment, orthopedic disorders, rheumatologic disorders, psychogenic, and cardiorespiratory problems (orthostasis).[220, 222-224]

MRI and recent stroke or transient ischemic attack – A stroke or central nervous system infarction is defined as "brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury. … Ischemic stroke specifically refers to central nervous system infarction accompanied by overt symptoms, whereas silent infarction causes no known symptoms."[225] If imaging or pathology is not available, a clinical stroke is diagnosed by symptoms persisting for more than 24 hours. Ischemic stroke can be further classified by the type and location of ischemia and the presumed etiology of the brain injury. These include large-artery atherosclerotic occlusion (extracranial or intracranial), cardiac embolism, small-vessel disease

and less commonly dissection, hypercoagulable states, sickle cell disease and undetermined causes.[226] TIAs in contrast, "are a brief episode of neurological dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction on imaging."[227] On average, the annual risk of future ischemic stroke after a TIA or initial ischemic stroke is 3–4%, with an incidence as high as 11% over the next 7 days and 24–29% over the following 5 years. This has significantly decreased in the last half century due to advances in secondary prevention.[228]

Therefore, when revascularization therapy is not indicated or available in individuals with an ischemic stroke or TIA, the focus of the work-up is on secondary prevention. This includes noninvasive vascular imaging to identify the underlying etiology, assess immediate complications and risk of future stroke. The majority of stroke evaluations take place in the inpatient setting. Admitting TIA patients is reasonable if they present within 72 hours and have an ABCD(2) score ≥3, indicating high risk of early recurrence, or the evaluation cannot be rapidly completed on an outpatient basis.[227] Minimally, both stroke and TIA should have an evaluation for high-risk modifiable factors, such as carotid stenosis atrial fibrillation as the cause of ischemic symptoms.[226] Diagnostic recommendations include neuroimaging evaluation as soon as possible, preferably with magnetic resonance imaging, including DWI; noninvasive imaging of the extracranial vessels should be performed, and noninvasive imaging of intracranial vessels is reasonable.[229]
Individuals with a history of stroke and recent work-up with new signs or symptoms indicating progression or complications of the initial CVA should have repeat brain imaging as an initial study. Individuals with remote or silent strokes discovered on imaging should be evaluated for high-risk modifiable risk factors based on the location and type of the presumed etiology of the brain injury.

Non-aneurysmal vascular malformations – Non-aneurysmal vascular malformations can be divided in low flow vascular malformations and high flow vascular malformations. Low flow vascular malformations include dural venous anomalies (DVA), cavernomas, and capillary telangiectasias. High flow vascular malformations include AVM and dural arteriovenous fistulas (dAVF). For low flow malformations, MRI is the study of choice. Limited medical literature is available to support vascular imagining (CTA or MRA). CTA plays a limited role in the assessment of cavernoma but may be used to demonstrate a DVA. MRA is not usually helpful in the assessment of cavernoma, capillary telangiectasia, and DVA. Vascular imaging is indicated in high flow vascular malformations.[230-232]

MRI and Central Venous Thrombosis – a MR Venogram is indicated for the definite evaluation of a central venous thrombosis/dural sinus thrombosis. The most frequent presentations are isolated headache, intracranial hypertension syndrome (headache, nausea/vomiting, transient visual obscurations, pulsatile tinnitus, CN VI palsy, papilledema),[233] seizures, focal neurological deficits, and encephalopathy. Risk factors are hypercoagulable states inducing genetic prothrombotic conditions, antiphospholipid syndrome and other acquired prothrombotic diseases (such as cancer), oral contraceptives, pregnancy, puerperium (6-weeks postpartum), infections, and trauma. COVID-19 infection is associated with hypercoagulability, a thromboinflammatory response, and an increased incidence of venous thromboembolic events (VTE).[234, 235] Since venous thrombosis can cause SAH, infarctions, and hemorrhage, parenchymal imaging with MRI/CT is also appropriate.[27, 236, 237]

Galactorrhea and MRI – Isolated galactorrhea without elevated prolactin (normoprolactinemic) is usually due to breast pathology, i.e., breast feeding, trauma, ill-fitting undergarments. Consider mammogram, breast ultrasound, and serial dilution of the individual's prolactin sample to correct for possible hook effect.[238, 239]

Chart 1: Causes of Hyperprolactinemia[240]

Physiological	1) Coitus 2) Exercise 3) Lactation 4) Pregnancy 5) Sleep 6) Stress
Pathological	*1) Hypothalamic-pituitary stalk damage* a) Granulomas b) Infiltrations c) Irradiation d) Rathke's cyst e) Trauma: pituitary stalk section, suprasellar surgery f) Tumors: craniopharyngioma, germinoma, hypothalamic metastases, meningioma, suprasellar pituitary mass extension *2) Pituitary* a) Acromegaly b) Idiopathic c) Lymphocytic hypophysitis or parasellar mass d) Macroadenoma (compressive) e) Macroprolactinemia f) Plurihormonal adenoma g) Prolactinoma h) Surgery i) Trauma *3) Systematic Disorders* a) Chest – neurogenic chest wall trauma, surgery, herpes zoster b) Chronic renal failure c) Cirrhosis d) Cranial radiation e) Epileptic seizures f) Polycystic ovarian disease g) Pseudocyesis
Pharmacological	1) Anesthetics 2) Anticonvulsant 3) Antihistamines (H_2) 4) Antihypertensives 5) Cholinergic agonist 6) Drug-induced hypersecretion 7) Catecholamine depletory 8) Dopamine receptor blockers

	9) Dopamine synthesis inhibitor 10) Estrogens: oral contraceptives, oral contraceptive withdrawal 11) Neuroleptics/antipsychotics

Table 2: MRI and staging screening in Non-CNS Cancers[53, 54, 56, 58]

(NON-BRAIN/CNS) CANCER	PRECONDITION
Cutaneous melanoma	Stage IIIC or higher, default staging screening ≥ stage IIIC, surveillance with periodic brain MRI up to 3 years even if asymptomatic without prior brain mets; and if prior brain mets, surveillance every 3-6 months up to 3 years
Testicular cancer-Seminoma	If high risk, such as beta HCG >5000IU/L, or multiple lung or visceral mets, choriocarcinoma, neurological symptoms, or AFP>10,000ng/ml
Merkel cell carcinoma	Default staging screening, but especially for high risk (≥stage IIIb, immunosuppression)
Lung cancer	Default staging screening brain MRI also for surveillance in small cell every 3 months for 2 years if they have had no prophylactic cranial radiation

Surveillance for trilateral heritable retinoblastoma (Pineoblastoma surveillance)
Brain MRI at the time of retinoblastoma diagnosis; some centers recommend a brain MRI every 6 months until 5 years old[241, 242]

MRI and Neurocutaneous Syndromes

- In NF-1, clinical evaluation appears to be more useful to detect complications than is screening imaging in asymptomatic individuals. Imaging is indicated in evaluation of suspected tumors based on clinical evaluation and for follow-up of known intracranial tumors.[243]
- Conversely in NF-2, routine MR imaging screening is always indicated, given the high prevalence of CNS tumors, especially vestibular schwannomas. In individuals with NF-2, routine screening brain/IAC imaging is indicated annually starting from age 10 if asymptomatic or earlier with clinical signs/symptoms. Most individuals with NF2 eventually develop a spinal tumor, most commonly schwannomas, but meningioma and ependymomas are also seen. Spinal imaging at baseline and every 2 to 3 years is also advised with more frequent imaging, if warranted, based on sites of tumor involvement.[68]
- In individuals with Tuberous Sclerosis, Brain MRI should be obtained every 1-3 years up until age 25 for surveillance for CNS abnormalities.[66]
- In Von Hippel Lindau Syndrome, imaging of the brain and spinal cord for hemangioblastomas is recommended every 2 years.[65]
- In Sturge Weber Syndrome, Brain MRI can rule out intracranial involvement only after age 1 and is recommended in individuals <1 year only if symptomatic.[69]

Multiple Sclerosis[95, 244, 245] – The diagnosis of MS requires demonstration of lesions in the CNS disseminated in time and space and the absence of fever, infection, or other more likely etiologies. An expanding amount of available disease-modifying treatments are effective in slowing down disease progression, especially in the early stages. These treatments can have serious side effects and can be costly; therefore, the accurate and expeditious diagnosis of MS is critical.

The diagnosis of MS can be made on clinical presentation alone with 2 clinical attacks and objective clinical evidence of more than 2 lesions. Attacks may be individual-reported or objectively observed and must last for a minimum of 24 hours and be 30 days apart. However, corroborating magnetic resonance imaging (MRI) is the diagnostic standard and is used, as well, to rule out other disorders. Additionally, MRI findings can replace certain clinical criteria in a substantial number of individuals. In the revised McDonald Criteria, MRI findings can be used to establish dissemination in both time and space.

Table 3: Variable Symptoms and Signs of MS

Symptoms	***Signs***
Depressed mood	Ataxia
Memory loss/cognitive changes	Dysmetria
Dizziness or vertigo	Decreased sensation (pain, vibration, position)
Fatigue	Decreased strength
Hearing loss and tinnitus	Hyperreflexia, spasticity
Heat sensitivity (Uhthoff Phenomenon)	Nystagmus
Incoordination and gait disturbances	Lhermitte's sign
Sensory disturbances (dysesthesias, numbness, paresthesia's)	Visual defects (internuclear ophthalmoplegia, optic disc pallor, red color desaturation, reduced visual acuity)
Pain	
Urinary symptoms	
Visual disturbances (diplopia, oscillopsia)	
Weakness	

In the presence of a clear, clinically isolated syndrome such as optic neuritis, transverse myelitis, or brain stem syndrome, brain MRI is the next diagnostic step. MS can also have variable and often subjective symptoms that come and go (see Table 3). If there are recurrent episodes of variable neurological signs or symptoms not attributable to another cause with clinical concern for MS, imaging is warranted as well.

MRI and Neuromyelitis optica spectrum disorders (NMOSD)[203] – NMOSD are inflammatory disorders of the central nervous system characterized by severe, immune-mediated demyelination and axonal damage predominantly affecting the optic nerves and spinal cord, but also the brain and brainstem. NMOSD can be distinguished from multiple sclerosis and other inflammatory disorders by the presence of the aquaporin-4 (AQP4) antibody. Features of NMOSD include attacks of bilateral or sequential optic neuritis acute transverse myelitis and the area postrema syndrome (with intractable hiccups or nausea and vomiting). The evaluation of suspected NMOSD entails brain and spinal cord neuroimaging. In contrast to MS (in which spinal cord involvement tends to be incomplete and asymmetric), NMOSD have a longer extent of spinal cord demyelination generally involving three or more vertebral segments.

Temporal Arteritis – Giant cell arteritis (GCA) is an inflammatory disorder that should be considered in individuals over the age of 50 with the following signs or symptoms: new headaches, acute onset of visual disturbances (especially transient monocular visual loss), jaw claudication, constitutional symptoms, tenderness over the temporal artery, and elevated ESR and/or CRP. A diagnosis of polymyalgia rheumatica (PMR) is highly associated. Large vessel GCA denotes involvement of the aorta and its first-order branches, especially the subclavian arteries, and is common. Extra- and intracranial cerebral vasculitis can also be seen but is rarer, and strokes are related to vasculitis of extracranial cerebral arteries causing vertebral or internal carotid arteries stenosis. Gold standard for diagnosis of GCA is temporal artery biopsy. Color Doppler ultrasound (CDUS) can be used as a surrogate for temporal artery biopsy in some cases. High-resolution magnetic resonance imaging (MRI) can visualize the temporal arteries when used with contrast. The presence of clinical manifestations unusual in GCA should prompt consideration of alternative diagnoses. Examples of such include adenopathy, pulmonary infiltrates, digital cyanosis, ulceration or gangrene, mononeuritis multiplex, stroke in the distribution of the middle cerebral artery, glomerulitis, and/or rapidly rising creatinine.[103-107, 246]

MMSE – The Mini Mental State Examination (MMSE) is a tool that can be used to assess mental status systematically and thoroughly. It is an 11-question measure that tests five areas of cognitive function: orientation, registration, attention and calculation, recall, and language. The MMSE has been the most commonly used measure of cognitive function in dementia research, but researchers have recognized that it is relatively insensitive and variable in mildly impaired individuals. The maximum score is 30. A score of 23 or lower is indicative of cognitive impairment. The MMSE takes only 5-10 minutes to administer and is, therefore, practical to use repeatedly and routinely.

MoCA – The Montreal Cognitive Assessment (MoCA) was designed as a rapid screening instrument for mild cognitive dysfunction. It assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation. MoCA differs from the MMSE mainly by including tests of executive function and

abstraction, and by putting less weight on orientation to time and place. Ten of the MMSE's 30 points are scored solely on the time-place orientation test, whereas the MoCA assigns it a maximum of six points. The MoCA also puts more weight on recall and attention-calculation performance, while de-emphasizing language skill. Time to administer the MoCA is approximately 10 minutes. The total possible score is 30 points; a score of 26 or above is considered normal.

MRI and Movement disorders – Atypical parkinsonian syndromes include progressive supranuclear palsy (PSP), multiple system atrophy (MSA), corticobasal degeneration (CBD), and dementia with Lewy bodies.

Anosmia – Nonstructural causes of anosmia include post-viral symptoms, medications (Amitriptyline, Enalapril, Nifedipine, Propranolol, Penicillamine, Sumatriptan, Cisplatin, Trifluoperazine, Propylthiouracil). These should be considered prior to advanced imaging to look for a structural cause.

Anosmia and dysgeusia have been reported as common early symptoms in individuals with COVID-19, occurring in greater than 80 percent of individuals. For isolated anosmia, imaging is typically not needed once the diagnosis of COVID has been made given the high association. As such, COVID testing should be done prior to imaging.[247-249]

MRI Orbits, Face, and Neck MRI rather than MRI Brain is the mainstay for directly imaging the olfactory apparatus and sinonasal or anterior cranial fossa tumors that may impair or directly involve the olfactory apparatus.

Trigeminal Neuralgia (TN) – According to the International Headache Society, TN is defined as "a disorder characterized by recurrent unilateral brief electric shock-like pain, abrupt in onset and termination, limited to the distribution of one or more divisions of the trigeminal nerve and triggered by innocuous stimuli."[6] Atypical features include bilateral, hearing loss, dizziness/vertigo, visual changes, sensory loss, numbness, pain > 2min, pain outside trigeminal nerve distribution and progression.[140, 214]

Occipital Neuralgia – According to the International Headache Society, occipital neuralgia is defined "Unilateral or bilateral paroxysmal, shooting or stabbing pain in the posterior part of the scalp, in the distribution(s) of the greater, lesser and/or third occipital nerves, sometimes accompanied by diminished sensation or dysesthesia in the affected area and commonly associated with tenderness over the involved nerve(s). Pain is eased temporarily by local anesthetic block of the affected nerve(s). Occipital neuralgia must be distinguished from occipital referral of pain arising from the atlantoaxial or upper zygapophyseal joints or from tender trigger points in neck muscles or their insertions."[6]

MRI for Macrocephaly – Consider ultrasound in infants with macrocephaly and a normal neurological examination, no evidence of increased ICP and an open anterior fontanelle. If head US is normal, the infant should be monitored closely.[250] The anterior fontanelle generally closes between 10 and 24 months of age, with 3% closing between 5-9 months and 11% after 24 months.[251]

MRI and Normal Pressure Hydrocephalus (NPH) – Although diagnosis can be made based on CT findings alone, MRI is more accurate for disclosing associated pathologies (such as cerebrovascular disease), excluding other potential etiologies and for detecting NPH typical signs of prognostic value. A

CT scan can exclude NPH and is appropriate for screening purposes and in individuals who cannot undergo MRI.[153]

MRI and Vertigo – The most common causes of vertigo seen are benign paroxysmal positional vertigo (BPPV), vestibular neuronitis (VN) and Ménière's disease. These peripheral causes of vertigo are benign, and treatment involves reassurance and management of symptoms. Central causes of vertigo, such as cerebrovascular accidents (CVAs), tumors and multiple sclerosis (MS), need to be considered if the individual presents with associated neurological symptoms, such as weakness, diplopia, sensory changes, ataxia, or confusion. Magnetic resonance imaging is appropriate in the evaluation of individuals with vertigo who have neurologic signs and symptoms, progressive unilateral hearing loss or risk factors for cerebrovascular disease. MRI is more appropriate than CT for diagnosing vertigo due to its superiority in visualizing the posterior portion of the brain, where most central nervous system disease that causes vertigo is found. A full neurologic and otologic evaluation including provocative maneuvers, vestibular function testing and audiogram can help evaluate vertigo of unclear etiology and differentiate between central and peripheral vertigo.

MRI and developmental delay – Significant developmental delay is defined as significant delay (more than two standard deviations below the mean) in one or more developmental domains: gross/fine motor, speech/language, cognition, social/personal, and activities of daily living. Isolated delay in social/language development is characteristic of autism spectrum disorders or hearing loss. Isolated delay in motor development is characteristic of cerebral palsy (a static encephalopathy) or myopathy. Global developmental delay (GDD) is a subset of developmental delay defined as significant delay (by at least 2 SD's) in two or more developmental categories. Note that the term "GDD" is usually reserved for children <5 years old, whereas in older children >5 years, disability is quantifiable with IQ testing. The yield of magnetic resonance imaging is low in children with autism spectrum disorder and no other neurologic findings; therefore, MRI is not recommended as a part of routine evaluation.[252]

Low risk brief resolved unexplained event (BRUE) formerly apparent life-threatening event (ALTE) requires all the following:

- Age > 60 days
- Gestational age ≥ 32 weeks or older and corrected gestational age ≥ 45 weeks
- First brief event
- Event lasting < 1 minute
- No CPR required by the trained medical provider
- No concerning historical features or physical examination findings.

Combination MRI/MRA of the Brain – This is one of the most misused combination studies and other than what is indicated above these examinations should be ordered in sequence, not together. Vascular abnormalities can be visualized on the brain MRI.

Individuals presenting with a new migraine with aura (especially an atypical or complex aura) can mimic a transient ischemic attack or an acute stroke. If there is a new neurologic deficit, imaging should be guided by concern for cerebrovascular disease, not that the individual has a headache.[11, 197]

Leptomeningeal Carcinomatosis[253-256] – Leptomeningeal metastasis is an uncommon and typically late complication of cancer with poor prognosis and limited treatment options. Diagnosis is often challenging with nonspecific presenting symptoms ranging from headache and confusion to focal neurologic deficits such as cranial nerve palsies. Standard diagnostic evaluation involves a neurologic examination, MRI of the brain and spine with gadolinium, and cytologic evaluation of the cerebral spinal fluid (CSF). Hematologic malignancies (leukemia and lymphoma), primary brain tumors as well as solid malignancies can spread to the leptomeninges. The most common solid tumors giving rise to LM are breast cancer (12 - 35 %), small and non-small cell lung cancer (10-26 %), melanoma (5 -25 %), gastrointestinal malignancies (4-14 %), and cancers of unknown primary (1-7 %).

Drop Metastases – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas and less commonly choroid plexus neoplasms and teratomas.[257]

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ADDITIONAL RESOURCES

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POLICY HISTORY

Date	Summary

May 2023	Updated and reformatted references
	Updated background section
	Added:
	• Indeterminate imaging section
	• Follow up of known Rathke cleft cyst
	  ○ If no symptoms, MRI at 1/3/5 years to stability
	  ○ With new neurological symptoms or atypical imaging features
	  ○ Post treatment, yearly for 5 years
	• General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
	• Added statement regarding further evaluation of indeterminate findings on prior imaging
	Clarified:
	• Abnormal reflexes (*pathological, asymmetric, hyperreflexia)*
	• New onset headache - Related to activity or event (sexual activity, *exertion, Valsalva*, position), new or progressively worsening
	• Post concussive syndrome if persistent or disabling symptoms and *MRI* has not been performed
	• *Screening* for silent cerebral infarcts in early school age children and adults with *HbSS sickle cell disease or HbSβ0 thalassemia*
	• Cushing syndrome *suspected (high ACTH (>5) with cortisol suppression on low or high dose dexamethasone suppression test)*
	• Elevated prolactin after evaluation for another cause - neuroendocrine signs or symptoms (i.e., headache, galactorrhea, abnormal menses, infertility, or bitemporal hemianopsia) and/or *abnormal pituitary hormones (low testosterone /estrogen/ progesterone AND low or normal LH/FSH)*
	• Total testosterone levels persistently borderline around the lower limits of normal range (200-400 ng/dL) with low or normal LH/FSH; AND Low free testosterone and *consideration and addressment* of reversible functional causes of gonadotropin suppression (e.g., obesity, opioid use, diabetes, steroid use, or comorbid illness)
	• Tumor surveillance *as per professional society recommendations*
	• Note: In the pediatric population, imaging is not indicated in simple febrile seizures *or in idiopathic focal or generalized epilepsy with typical features [BECTS, childhood absence epilepsy (CAE), juvenile absence epilepsy (JAE), and juvenile myoclonic epilepsy (JME)]*

	• 6-month repeat scan in patients with MRI disease activity that is not associated with *new clinical symptoms on a routine follow-up scan (i.e., Radiographically isolated syndrome)* • Indications for MR Perfusion Imaging section • Brain MRI/Brain MRA - Headache associated with exercise, *exertion*, *Valsalva* or sexual activity Deleted: • Pediatric seizure indications and combined with adult • Anosmia (loss of smell) or dysosmia documented by objective testing that is persistent and of unknown origin (also in combo section)
May 2022	Updated and reformatted references Updated background section Combo statements added Reorganized indications Changed visual deficits section added to background Reorganized suspected tumor section Clarified: • Acute headache, sudden onset • New onset headache related to activity or event (sexual activity, exertion, position), new or progressively worsening • Visual loss in background/removed note • Low flow vascular malformations • Histiocytic Neoplasms (Erdheim-Chester Disease, Langerhans Cell Histiocytosis, and Rosai-Dorfman Disease) for screening and/or with neurological signs or symptoms • Total testosterone levels persistently borderline around the lower limits of normal range (200-400 ng/dL) with low or normal LH/FSH; ○ *Low free testosterone* and consideration of reversible functional causes of gonadotropin suppression (e.g., obesity, opioid use, diabetes, steroid use or comorbid illness) • Follow-up of known CNS cancer (either primary malignant brain tumor or secondary brain metastasis) as per NCCN • Tumor monitoring in neurocutaneous syndromes as per tumor type • Histiocytic Neoplasms (Erdheim-Chester Disease, Langerhans Cell Histiocytosis, and Rosai-Dorfman Disease) To assess treatment response and surveillance of known brain lesions • To demonstrate dissemination in time for diagnosis (every 6-12 months) • To establish a new baseline (3-6 months after switching disease modifying therapy)

	• PML surveillance - Every 3-4 months, if high risk of PML occurrence; Brain MRI every 3–4 months for up to 12 months, in high-risk patients who switch from natalizumab to other therapeutics • Examples of mental status instruments to screen for cognitive impairment • For evaluation of new non-Parkinson neurological symptoms • Binocular diplopia with concern for intracranial pathology after comprehensive eye evaluation • Trigeminal neuralgia or *neuropathy*, notably with an atypical presentation • **MRI Brain/MRI Orbit Combo** – Optic Neuritis if atypical presentation (bilateral, absence of pain, optic nerve hemorrhages, severe visual impairment, lack of response to steroids, poor recovery, or recurrence • **MRI Brain/MRI Face/Sinus/Neck Combo**- Trigeminal neuralgia or neuropathy with an atypical presentation (for evaluation of the extracranial nerve course) Added: • Abnormal reflexes to neurologic deficit sections • 1-time screening for silent cerebral infarcts in school age children and adults with sickle cell disease • High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200 • Midline dermoid cysts/sinuses with concern for intracranial extension • Elevated prolactin in the absence of other cause: ≥ 100, persistently elevated or neuroendocrine signs or symptoms • Follow-up of known low grade tumor (WHO I-II) (i.e., meningioma, glioma, astrocytoma, oligodendroglioma) ○ For surveillance as per NCCN ○ If symptomatic, new/changing signs or symptoms or complicating factors • 6-month repeat scan in patients with MRI disease activity that is not associated with clinical activity on a follow-up scan (MS) • Note about pediatric MS imaging – same as adults except Increase frequency of imaging (e.g., every 6 months) in children with highly active disease or in situations where imaging will change management • Neurosarcoidosis ○ Initial Evaluation: ▪ Suspected based on neurological sign/symptoms and lab work (ACE, CSF analysis) OR

	▪ Known history of sarcoidosis with neurological signs or symptoms o Follow up of known neurosarcoidosis: ▪ To assess treatment response ▪ Worsening signs or symptoms • Tourette syndrome to list of movement disorders in which MRI is not indicated • Occipital Neuralgia • X-linked Adrenoleukodystrophy o Baseline MRI between 12 and 18 months old o Second MRI 1 year after baseline o MRI every 6 months between 3 and 12 years old o Annual MRI after 12 years old • Congenital/childhood sensorineural hearing loss suspected to be due to a structural abnormality (CNVIII, the brain parenchyma, or the membranous labyrinth). CT is the preferred imaging modality for the osseous anatomy and malformations of the inner. • Pulsatile tinnitus to combo section (MRI Brain with IAC/MRA Head/MRA Neck) • **General Combo statement** Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the neuroaxis), patient history, and other available information, including prior imaging. • **Combo Brain MRI/MRA**: o Neurological signs or symptoms in sickle cell patients o High stroke risk in sickle cell patients (2 - 16 years of age) with a transcranial doppler velocity > 200 • **Brain MRI with IAC/ Brain MRA/Neck MRA (any combination**) o Pulsatile tinnitus with concern for a suspected arterial vascular and/or intracranial etiology o Note: MRA and CTA are generally comparable noninvasive imaging alternatives each with their own advantages and disadvantages. Brain MRI can alternatively be combined with Brain CTA/Neck CTA. • **MRI Brain/MRI Face/Sinus/Neck Combo-** o Bell's Palsy/hemifacial spams for evaluation of the extracranial nerve course -if atypical signs, slow resolution beyond three

	weeks, no improvement at four months, or facial twitching/spasms prior to onset • **MRI Brain/Spine Combo section** o Drop metastasis from brain or spine o Combination studies for MS: These body regions might be evaluated separately or in combination as guided by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history (e.g., symptom(s), time course, and where in the CNS the likely localization(s) is/are), and other available information, including prior imaging Changed: • Thunderclap headache with continued concern for underlying vascular abnormality after initial negative brain imaging > 6 hours after onset (as well as in combo Brain MRI/MRA) Deleted: • Precocious puberty: and evidence of an accelerated bone age on x-y • Patient with history of CNS cancer (either primary or secondary) and a recent course of chemotherapy, radiation therapy (to the brain), or surgical treatment within the last two (2) years • Follow-up of known meningioma section/background

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **FUNCTIONAL BRAIN MRI**	**Original Date: June 2007**
CPT Codes: 70554, 70555	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_013	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR FUNCTIONAL BRAIN MRI[1, 2]

Pre-operative/procedural Evaluation[1]

In the following where fMRI may have a significant role in the mapping of a lesion in relation to eloquent cortex (i.e., language, motor, sensory and visual centers) to determine the appropriateness of surgical intervention

- Focal brain lesion (i.e., tumor or vascular malformation) for presurgical planning[3-6]
- Pre-operative evaluation for epilepsy surgery[7, 8]
- Brain tumor for radiation treatment planning[9, 10]

Post-operative/procedural Evaluation

- Therapeutic follow-up. A documented medical reason must clearly explain the medical necessity for follow up (i.e., evaluation of post-treatment eloquent cortex).

BACKGROUND

Functional MRI (fMRI) of the brain is a non-invasive imaging technique, using radio waves and a strong magnetic field, to image the brain activity of a patient prior to undergoing brain surgery

for tumors or epilepsy. It is based on the increase in blood flow to the local vasculature when parts of the brain are activated and helps to determine the location of vital areas of brain function. fMRI images capture blood oxygen levels in parts of the brain that are responsible for perception, cognition, and movement allowing neurosurgeons to operate with less possibility of harming areas that are critical to the patient's quality of life. fMRI is primarily used for presurgical planning, operative risk assessment and therapeutic follow-up.

Task vs Resting-state fMRI

During resting-state fMRI (rs-fMRI), unlike task-based functional MRI, the individual is not required[11-13] to perform any specific task. This is beneficial for patients who have difficulty performing tasks, such as pediatric and certain neurologic or psychiatric patients. This technique has been well-utilized in research, and its clinical use is increasing considerably, especially in presurgical planning (e.g., mapping epileptic foci) and neuropsychiatric diseases. For the above indications, non-tasked based fMRI such as resting state fMRI can also be performed.

fMRI as an Alternative to the Invasive Wada test and Direct Electrical Stimulation – fMRI is considered an alternative to the Wada test and direct electrical stimulation as it is a non-invasive method for location of vital brain areas. The Wada test is used for the pre-operative evaluations of patients with brain tumors and seizures to determine which side of the brain is responsible for vital cognitive functions, e.g., speech and memory. It can assess the surgical risk of damaging the vital areas of the brain. The Wada test is invasive, involving an angiography procedure to guide a catheter to the internal carotid where a barbiturate is injected, putting one hemisphere of the brain to sleep. Direct electrical stimulation mapping is invasive requiring the placement of electrodes in the brain. The electrodes are used to stimulate multiple cortical sites in the planned area of resection to allow the surgeons to identify and mark which areas can be safely resected.[14, 15]

fMRI and Brain Tumors – fMRI may significantly affect therapeutic planning in patients who have potentially resectable brain tumors. Due to its non-invasiveness, its relatively high spatial resolution, and its pre-operative results, fMRI is used before surgery in the evaluation of patients with brain tumors. fMRI may have a significant role in mapping lesions that are located in close proximity to vital areas of brain function (language, sensory motor, and visual). It can determine the precise spatial relationship between the lesion and adjacent functionally essential parenchyma, allowing removal of as much pathological tissue as possible during resection of brain tumors without compromising essential brain functions. fMRI provides an alternative to other invasive tests, such as the Wada test and direct electrical stimulation.[16]

fMRI and Seizures – Brain fMRI can influence the diagnostic and therapeutic decisions of the seizure team, thereby affecting the surgical approach and outcomes. Brain surgery is often the treatment for patients with refractory epilepsy, especially patients with a single seizure focus. fMRI can be used to image and localize abnormal brain function in patients with seizures. fMRI

can help determine brain functions (language, sensory motor, and visual) of areas bordering the lesion, resulting in better outcomes with less neurologic deficit.[8]

fMRI is increasingly being used to evaluate candidates for surgical treatment of intractable epilepsy (Phase 1 evaluation) and can aid in surgical decision-making. It can 1) help to improve functional outcome by enabling surgery that spares functional cortex, 2) guide surgical intervention by revealing when reorganization of function has occurred, and 3) show when abnormal cortex is also functionally active, and hence that surgery may not be the best option[17, 18].

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POLICY HISTORY

Date	Summary
May 2023	• Updated background and references • Added - to determine the appropriateness of surgical intervention • Background section regarding non-task-based fMRI • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
May 2022	Updated background and references

Reviewed / Approved by Clinical Guideline Committee

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HMSA

Specific policy administered by Evolent

Clinical Guidelines Chest (Thorax) CT	
CPT Codes: 71250, 71260, 71270	**Original Date:** September 1997
Guideline Number: HMSA_CG_020	**Last Revised Date (by HMSA):** February 2024
	Last Reviewed Date (by Evolent): February 2024
	Implementation Date: April 2024

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

This Chest CT Guideline covers CPT codes 71250 (CT chest without contrast), CT chest with contrast (71260), CT chest without and with contrast (71270)

INDICATIONS FOR CHEST CT

Incidental Lung Nodules[1]

- Incidental pulmonary nodules detected on a non-screening (regular) Chest CT Age ≥ 35 years old – use Table 1: Fleischner table
    - **Excludes**
        - Lung cancer screening

- History of cancer (imaging follow-up for surveillance is 3 months to detect interval nodule growth)
- Immunosuppression (may require a shorter follow-up, such as 1 month, if suspicion of fulminant infection)

- **Incidental pulmonary nodules on non-chest CT** (such as a shoulder CT or abdomen CT)
  - If the nodule is non-calcified, a Chest CT is approvable immediately
  - If there is a history of malignancy, immunosuppression or <35 years old a chest CT is approvable immediately
  - If the nodule is irregular an immediate Chest CT is approvable
  - If the patient history notes a prior Chest CT was done, those results should be submitted prior to another CT chest approval
  - All other lung nodules should follow Fleischner society criteria chart below

Incidental pulmonary nodules on X-rays including portions of the chest (i.e., chest, ribs, shoulder, abdomen) that are indeterminate (not typical of granulomatous disease) as noted by the radiologist. No time delay between the x-ray and the subsequent Chest CT needed.

Table 1: 2017 Fleischner Society Guidelines for Management of Incidentally Detected Pulmonary Nodules[2]

A: Solid Nodules*

	Size			
Nodule Type	<6 mm (<100 mm³)	6–8 mm (100–250 mm³)	>8 mm (>250 mm³)	Comments
Single				
Low risk†	No routine follow-up	CT at 6–12 months, then consider CT at 18–24 months	Consider CT at 3 months, PET/CT, or tissue sampling	Nodules <6 mm do not require routine follow-up in low-risk patients (recommendation 1A).
High risk†	Optional CT at 12 months	CT at 6–12 months, then CT at 18–24 months	Consider CT at 3 months, PET/CT, or tissue sampling	Certain patients at high risk with suspicious nodule morphology, upper lobe location, or both may warrant 12-month follow-up (recommendation 1A).
Multiple				
Low risk†	No routine follow-up	CT at 3–6 months, then consider CT at 18–24 months	CT at 3–6 months, then consider CT at 18–24 months	Use most suspicious nodule as guide to management. Follow-up intervals may vary according to size and risk (recommendation 2A).
High risk†	Optional CT at 12 months	CT at 3–6 months, then at 18–24 months	CT at 3–6 months, then at 18–24 months	Use most suspicious nodule as guide to management. Follow-up intervals may vary according to size and risk (recommendation 2A).

B: Subsolid Nodules*

	Size		
Nodule Type	<6 mm (<100 mm³)	≥6 mm (>100 mm³)	Comments
Single			
Ground glass	No routine follow-up	CT at 6–12 months to confirm persistence, then CT every 2 years until 5 years	In certain suspicious nodules < 6 mm, consider follow-up at 2 and 4 years. If solid component(s) or growth develops, consider resection. (Recommendations 3A and 4A).
Part solid	No routine follow-up	CT at 3–6 months to confirm persistence. If unchanged and solid component remains <6 mm, annual CT should be performed for 5 years.	In practice, part-solid nodules cannot be defined as such until ≥6 mm, and nodules <6 mm do not usually require follow-up. Persistent part-solid nodules with solid components ≥6 mm should be considered highly suspicious (recommendations 4A-4C)
Multiple	CT at 3–6 months. If stable, consider CT at 2 and 4 years.	CT at 3–6 months. Subsequent management based on the most suspicious nodule(s).	Multiple <6 mm pure ground-glass nodules are usually benign, but consider follow-up in selected patients at high risk at 2 and 4 years (recommendation 5A).

Known Cancer[3-5]

- Cancer staging (includes unknown primary)
- Cancer restaging
- Suspicious signs or symptoms of recurrence
- Suspected cancer based on prior imaging[6]
- In a patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer

Chest Mass (non-lung parenchymal)[7]

- Mass or lesion, including lymphadenopathy, after inconclusive initial imaging; can allow one follow-up to ensure stability/benignity (additional follow up may be approved as needed if a bothersome change in the findings or symptoms persist post treatment)
- Thymoma screening in Myasthenia Gravis patients[8]

Known or Suspected Interstitial Lung Disease (often requested as high resolution CT) after initial chest x-ray excludes a more acute disease as the etiology for the concern, if clinically appropriate (if no concern for acute process recent CXR is not an absolute requirement)

- Based on restrictive pattern pulmonary function test
- In patients with known collagen vascular disease in whom ILD is suspected
- With signs or symptoms unresponsive to treatment such as:
    - Shortness of breath
    - Persistent dyspnea
    - Persistent cough
- Monitoring treatment response of known interstitial lung disease
- Guidance in selection of the most appropriate site for biopsy of diffuse lung disease[9]

Chronic Cough (> 8 weeks) and chest x-ray completed[10]

- After evaluation for other causes and failed treatment for those diagnosed with:
    - Asthma
    - Gastroesophageal Reflux Disease
    - Discontinuation of ACE inhibitors
    - Postnasal drip
- Clinical concern for bronchiectasis

Tuberculosis (TB)[11]

- Known or suspected tuberculosis and initial chest x-ray done

Infection Follow-up Imaging

- Abscess, empyema, or pleural effusions on chest x-ray[12]

- For evaluation of non-resolving pneumonia or inflammatory disease documented by **at least two** imaging studies:
    - Unimproved with 4 weeks of antibiotic treatment; **OR**
    - Unresolved at 8 weeks[13,14]

Pneumothorax on Chest X-ray[15]

Vocal Cord Paralysis on Endoscopic Exam[16]

- Neck and Chest CT is an approvable combo

Granulomatosis with Polyangiitis (Wegener's Granulomatosis)[17]

Vascular Disease

- CT chest is NOT the preferred study for vascular disease, CTA should be considered. See Chest CTA guideline.
- Chest CT can be used to detect and follow-up thoracic aortic aneurysms. See Background section.

Suspected Pulmonary Embolism (PE)[18]

- Chest CT NOT approvable for PE; should be CTA

Congenital Malformations

- Thoracic malformation on chest x-ray[19]
- Congenital Heart Disease with pulmonary hypertension[20]

Hemoptysis after x-ray completed[21,22]

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure
- Pre-operative evaluation for Electromagnetic Navigation Bronchoscopy[23] (this is a non-diagnostic CT)

Post-operative/procedural evaluation

- Post-surgical follow-up when records document medical reason requiring additional imaging

Lung Transplant imaging[24]

- All potential lung transplant recipients undergo pretransplant chest CT to delineate the extent of disease, assist in surgical planning, and possible contraindications
- CT is not routinely performed for donor evaluation

- Surveillance imaging varies in frequency and modality among various transplant centers, as there is no universal protocol. (A typical protocol may include surveillance CXR in the first year, spaced out monthly and then to every 3 months until 1 year after transplant. Surveillance Chest CT is then done annually.)
- Clinical concerns for complication at any time after transplant (while initial imaging typically begins with CXR, because many of the complications following transplant do not have classic XR findings, imaging can begin with CT)

Transplants

- Prior to solid organ transplantation
- For initial workup prior to Bone Marrow Transplant (BMT) (along with CT Abdomen and Pelvis[25], CT Sinus and Brain MRI)[26]).

Chest Wall

- Pain (after initial evaluation with chest x-ray and/or rib films)[27]
- History of known or suspected cancer
- Signs and symptoms of infection, such as: fever, elevated inflammatory markers, known infection at other sites
- Suspected chest wall injuries (including musculotendinous, costochondral cartilage, sternoclavicular joint, and manubriosternal joint injuries), when imaging will potentially alter management
- Malformations (such as pectus excavatum, pectus carinatum, scoliosis) in patients with cardiorespiratory symptoms for whom treatment is being considered
- Mass or lesion after inconclusive initial imaging ((MRI preferred over chest CT for chest wall mass)

Chest CT and COVID-19 (Coronavirus)

- Acute COVID
    - Imaging is indicated in a patient with COVID-19 and worsening respiratory status after chest X ray is shown to be insufficient for management or has indeterminant findings. (Imaging is NOT indicated in patients with Covid who have mild clinical features unless they are at risk for disease progression)
- Long (Chronic) COVID
    - Prior history of Covid with hypoxia or impaired lung function of follow-up[28]
        - Restricted diffusion on Pulmonary Function Test (would need a HRCT – High Resolution CT)
        - Low oxygen saturation and a Chest x-ray was done
    - Known fibrosis with continued symptoms

Pulmonary Hypertension[29]

Pulmonary artery diameter/ascending aortic diameter ≥ 1 measured on Chest CT can be used as a reliable method for early diagnosis of PH

Miscellaneous

- When clinical or laboratory findings remain unexplained after negative CXR and initial work up appropriate to the findings fail to determine their etiology, yet chest pathology remains as possible cause such as
    - Weight loss when initial workup and abdomen/pelvis CT/MR fail to identify the cause for weight loss can Chest CT be approved. If CXR suggests a malignancy and/or source of weight loss, then Chest CT would be approvable on the basis of abnormal CXR
    - For confirmed gestational trophoblastic disease when HCG fails to decline appropriately following surgery[30]
- Multiple Endocrine Neoplasia type 1 (MEN1) every 1-3 years (chest CT or MRI also approvable for this syndrome at same interval)[31]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Combination of studies with Chest CT

- **Abdomen CT/Pelvis CT/Chest CT/Neck MRI/Neck CT with MUGA** – known tumor/cancer for initial staging or evaluation before starting chemotherapy or radiation treatment
- **Neck and Chest CT -** Neck and Chest CT is an approvable combo with vocal cord paralysis and concern for recurrent laryngeal nerve lesion

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BACKGROUND

Computed tomography (CT) scans provide greater clarity than regular x-rays and are used to further examine abnormalities found on chest x-rays. They may be used for detection and evaluation of various disease and conditions in the chest, e.g., tumor, inflammatory disease, vascular disease, congenital abnormalities, trauma, and symptoms such as hemoptysis.

OVERVIEW

CT and Aneurysm

- Initial evaluation of aneurysm[32-34]
    - Echocardiogram shows aneurysm
    - Echocardiogram inconclusive of proximal aorta and first-degree relative with thoracic aneurysm
    - Chest x-ray shows possible aneurysm
- Follow-up after established Thoracic Aneurysm (above these sizes surgery is usually recommended)[32-34]
    - Aortic Root or Ascending Aorta
        - 3.5 to 4.5 - Annual
        - 4.5 to 5.4 - Every 6 months
    - Genetically mediated (Marfan syndrome, Aortic Root or Ascending Aorta)
        - 3.5 to 4.0 - Annual
        - 4.0 to 5.0 - Every 6 months
    - Descending Aorta
        - 4.0 to 5.0 - Annual
        - 5.0 to 6.0 - Every 6 months

CT and Interstitial Lung Disease[35] – Radiography of the chest is usually appropriate for the initial imaging of patients who undergo screening and surveillance for lung disease when occupational exposure is present.

Costochondritis[36] – If physical exam findings are suggestive of costochondritis but the pain is persistent despite conservative care, it should be kept in mind that costochondritis can be recurrent and persistent. It is associated with fibromyalgia. Chest CT should be considered if the findings are not consistent with typical costochondritis, such as fever or elevated inflammatory markers, suggestive of infection or a suspicion of cancer based on history or current findings.

CT for Management of Hemoptysis[21,22] – High-resolution CT (HRCT) is useful for estimating the severity of hemoptysis, localizing the bleeding site and determining the cause of the bleeding. Its results can be related to the severity of bleeding. The volume of expectorated blood and the amount of blood that may be retained within the lungs without being coughed up are important. HRCT is a way to evaluate the amount of bleeding and its severity. It may also help in the localization of bleeding sites and help in detecting the cause of bleeding.

CT and Solitary Pulmonary Nodules – Solitary Pulmonary nodules are abnormalities that are solid, semisolid and non-solid; another term to describe a nodule is focal opacity. CT makes it possible to find smaller nodules and contrast-enhanced CT is used to differentiate benign from malignant pulmonary modules. When a nodule is increasing in size or has spiculated margins or mixed solid and ground-glass attenuation, malignancy should be expected. Patients who have pulmonary nodules and who are immunocompromised may be subject to inflammatory processes.

CT and Empyema – Contrast-enhanced CT used in the evaluation of the chest wall may detect pleural effusion and differentiate a peripheral pulmonary abscess from a thoracic empyema. CT may also detect pleural space infections and help in the diagnosis and staging of thoracic empyema.

CT and Rib fractures[37] – Chest CT may be useful for characterizing a pathologic fracture, and some features may be helpful in differentiating a primary malignant tumor of bone from metastasis. CT may also be helpful to search for a primary malignancy in patients with a suspected pathologic fracture; however, there is no strong indication that CT serves a significant use as the initial imaging modality to detect pathologic rib fractures.

CT and Occupational Lung Disease[35] – The chest radiograph and CT are complementary in the initial workup of suspected occupational lung disease. When patients with occupational exposures present with respiratory symptoms, chest radiography serves as the primary function of excluding alternative diagnoses, such as infectious pneumonia or pulmonary edema, with HRCT findings offering the best characterization of lung disease.

CT and Tuberculosis – "The chest radiograph is usually the first study performed in patients suspected of having TB. Although frontal and lateral radiographs are often performed in this setting, it has been shown that the lateral radiograph does not improve the detection of findings related to TB. In those with signs or symptoms of disease, the radiographic pattern of upper-lobe or superior-segment lower-lobe fibrocavitary disease in the appropriate clinical setting is sufficient to warrant respiratory isolation and sputum culture for definitive diagnosis. Using radiographs in combination with clinical evaluation results in a high sensitivity for the diagnosis but a relatively low specificity for both latent and active TB. In addition, radiographs may reveal ancillary findings of TB such as pleural effusion or spondylitis. For immunocompromised hosts, particularly those with a low CD4 count, computed tomography (CT) should be considered."[38] CT may be of value in the severely immunocompromised patient with a normal or near-normal radiograph by revealing abnormal lymph nodes or subtle parenchymal disease. Finally, CT may also have a role in identifying patients with latent TB who will be at risk for reactivation disease.

CT and Superior Vena Cava (SVC) Syndrome – SVC is associated with cancer, e.g., lung, breast and mediastinal neoplasms. These malignant diseases cause invasion of the venous intima or an extrinsic mass effect. Adenocarcinoma of the lung is the most common cause of SVC. SVC is a clinical diagnosis with typical symptoms of shortness of breath along with facial and upper extremity edema. Computed tomography (CT), often the most readily available technology, may be used as confirmation and may provide information including possible causes.

CT and Family History of Lung Cancer[39] – Family history is equally important. Individuals with a family history of lung cancer among first-degree relatives have been consistently shown to have a two-fold higher risk of developing lung cancer themselves. Those with multiple affected family members diagnosed at younger age appear to be at greater risk.

CT and COVID-19 – Chest CT is **not** recommended as a screening test for COVID-19 or as a first-line test to diagnose COVID-19 due to its poor sensitivity and specificity.[40,41] It is only needed when expected to guide clinical management, such as for patients with moderate to severe disease who show lack of respiratory improvement, unexplained deterioration, or worsening gas exchange. In patients with associated co-morbidities (age >65 yr., diabetes, hypertension, obesity, cardiovascular disease, chronic respiratory disease, immune compromise, etc.), CT may be useful in these patients when they have mild symptoms and a normal or indeterminant CXR but have an oxygen saturation <93% at rest on room air or who de-saturate on a 6-minute walk test. In an acute setting, CT can assist in the determining the need for hospitalization. In subacute and chronic settings, it can help predict which patients are likely to have residual pulmonary involvement. CT can also help rule out lung fibrosis in patients recovered from COVID-19 infection that present with hypoxia/impaired lung function on follow up.[42,43]

Fever of Unknown Origin

Initial work up prior to CT would include a comprehensive history, repeated physical exam, complete blood count with differential, three sets of blood cultures, chest x-ray, complete metabolic panel, urinalysis, ESR, ANA, RA, CMV IgM antibodies, virus detection in blood, heterophile antibody test, tuberculin test, and HIV antibody test. Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for fever can Chest CT be approved. If CXR suggests a malignancy and/or source of fever, then Chest CT would be approved.

Suspected paraneoplastic syndromes with no established cancer diagnosis: laboratory evaluation and imaging

The laboratory evaluation for paraneoplastic syndrome is complex. If the appropriate lab test results are suspicious for malignancy, imaging is indicated.

For SIADH (hyponatremia + increased urine osmolality), there is a high association with small cell lung cancer, therefore imaging typically starts with chest CT. If other symptoms suggest a different diagnosis other than small cell lung cancer, different imaging studies may be reasonable.

For hypercalcemia (high serum calcium, low-normal PTH, high PTHrP) it is reasonable to start with bone imaging followed by a more directed evaluation such as mammogram, chest, abdomen and pelvis imaging as appropriate.

For Cushing syndrome (hypokalemia, normal-high midnight serum ACTH NOT suppressed with dexamethasone) abdominal and chest imaging is reasonable. If dexamethasone suppression test DOES suppress ACTH, pituitary MRI is reasonable.

For hypoglycemia, labs drawn during a period of hypoglycemia (glucose < 55, typically a 72 hour fast) (insulin level, C-peptide and IGF-2:IGF-1 ratio) should be done to evaluate for an insulinoma. An elevated insulin level, elevated C-peptide and/or normal IGF-2:IGF-1 ratio warrant CT or MRI abdomen to look for insulinoma. A low insulin, low C-peptide and/or elevated IGF-2:IGF-1 ratio warrant chest and abdominal imaging.

When a paraneoplastic neurologic syndrome is suspected, nuclear and cytoplasmic antibody panels are often ordered to further identify specific tumor types. Results are needed prior to imaging. Because these tests are highly specific, if an antibody highly associated with a specific cancer is positive, then further imaging for that cancer is reasonable. For example, anti-Hu has a high association with SCLC and chest CT would be reasonable. Anti-MA2 has a high association with testicular cancer and testicular ultrasound would be a reasonable next step.

Weight loss definitions and initial evaluation – Unintentional weight loss is considered clinically significant if the amount of weight lost over 12 months is ≥ 5%. Older age and higher percentage of weight loss correlate with higher likelihood of malignancy. A targeted evaluation is recommended when there are signs or symptoms suggestive of a specific source. For example, when there is clinically significant weight loss with abdominal pain that prompts an evaluation for an abdominal source of the weight loss; CXR and labs such as TSH would not be needed prior to abdominal imaging. Conversely a smoker with a cough and weight loss would not start with abdominal imaging, a chest x-ray (CXR) would be the first test to start with. When there is no suspected diagnosis, initial evaluation includes CXR, age-appropriate cancer screening (such as colonoscopy and mammography) and labs (including CBC, CMP, HbA1C, TSH, stool hemoccult, ESR/CRP, HIV, Hepatitis C). If this initial evaluation fails to identify a cause of weight loss, then the patient is monitored and if progressive weight loss is seen on subsequent visits/weights, then CT Abdomen/Pelvis is reasonable (MRI if there is a contraindication to CT such as contrast allergy or impaired renal function). Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for weight loss can Chest CT be approved. If CXR suggests a malignancy and/or source of weight loss, then Chest CT would be approved.

POLICY HISTORY

Date	Summary
February 2024	Removed LDCT language and CPT code 71271 from the guideline for HMSA Added incidental lung nodules discovered/not discovered on chest CT for HMSA HP to the July 1, 2024 NIA guideline
January 2024	Removed language about former smoker to align with the American Cancer Society recommendations
May 2023	• Added FUO, weight loss and paraneoplastic information to background • Updated Covid information in the background • Clarified details on nodules seen on other imaging such as non-chest CT or non CXR • Added transplant imaging • Clarified non cigarette smoking for LDCT • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
March 2022	• Clarified that no time delay required between chest x-ray and subsequent Chest CT for indeterminate incidental pulmonary nodules on chest x-ray (not typical of granulomatous disease) • Moved “Pre-operative evaluation for Electromagnetic Navigation Bronchoscopy” from Post-operative/procedural evaluation to Pre-operative/procedural evaluation • Added known fibrosis with continued symptoms to Long (Chronic) COVID

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Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **CHEST CTA**	**Original Date: September 1997**
CPT Codes: 71275	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_022-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CHEST CTA

Chest Computed Tomography Angiography (CTA) is ordered for evaluation of the intrathoracic blood vessels. Chest CT and Chest CTA should not be approved at the same time.

Suspected Pulmonary Embolism (PE)[1-5]

- High risk for PE based on shock or hypotension, OR a validated pre-test high probability score (such as Well's >6, Modified Geneva score >11 -see Background),(D dimer is NOT needed for hi risk; can approve hi risk even with normal D dimer)
- Intermediate and Low risk require elevated D dimer(see Background)[6] (**NOTE**: A normal D-dimer obviates the need for PE imaging in hemodynamically stable patients with a low or intermediate clinical likelihood of PE.)

Vascular Disease

- Superior vena cava (SVC) syndrome[7]
- Subclavian Steal Syndrome after positive or inconclusive ultrasound[8, 9]
- Thoracic Outlet Syndrome[10, 11]
- Takayasu's arteritis[12]
- Clinical concern for Acute Aortic dissection[13, 14]

- Sudden painful ripping sensation in the chest or back and may include
    - New diastolic murmur
    - Cardiac tamponade
    - Distant heart sounds
    - Hypotension or shock

Initial/Screening for Thoracic Aortic Disease[15-17]

- Echocardiogram or chest x-ray show aneurysm
- Initial study for a suspected aneurysm
- Screening of first-degree relatives of individuals with a known thoracic aortic aneurysm (defined as > 50% above normal) or known dissection
- Evaluation in patients with known or suspected connective tissue disease or genetic condition that predisposes to aortic aneurysm or dissection, such as Marfan's, Ehlers Danlos, get a one-time study or for Loeys-Dietz syndrome- allow imaging at diagnosis and then every two years, or more frequently if abnormalities are found (Imaging may include head, neck, chest, abdomen and pelvis)14, 20 (MRA preferred due to cumulative radiation risk)
- Screening of the thoracic aorta after a diagnosis of a bicuspid aortic valve (dilation of the ascending aorta may not be seen on echocardiogram)[18]
    - If normal, re-image every three to five years
- Screening of first-degree relatives of patients with a bicuspid aortic valve
- Turner's syndrome – Screen for coarctation or aneurysm of the thoracic aorta
    - If normal results, screen every 5-10 years
    - If abnormal, screen annually
- Suspected vascular cause of dysphagia or expiratory wheezing with other imaging is suggestive or inconclusive

Follow-up after established Thoracic Aortic Aneurysm (TAA)[15-17]

- Six months follow-up after initial finding of a dilated thoracic aorta, for assessment of rate of change
    - Aortic Root or Ascending Aorta (in cm)
        - 3.5 to 4.4 Annual
        - 4.5 to 5.5 or growth rate ≥ 0.5 cm/year - Every 6 months
    - Genetically mediated (Marfan syndrome, Aortic Root or Ascending Aorta) (in cm)
        - 3.5 to 4.4 Annual
        - 4.5 to 5.0 or growth rate ≥ 0.5 cm/year Every 6 months
        - Surgery generally recommended over 5.0 cm
    - Descending Aorta (in cm)[19]
        - 4.0 to 5.0 Annual
        - 5.0 to 6.0 Every 6 months
- Follow-up post medical treatment of aortic dissection:
    - Acute dissection: 1 month, 6 months, then annually

    - Chronic dissection: annually
- Follow-up TEVAR surveillance at 1 month, then I year post op and if stable, then annually
- Follow up open repair if no residual aortopathy within first post op year, then every 5 years (if have residual aortopathy or abnormal findings on surveillance, annual follow up in then needed)
- Re-evaluation of known ascending aortic dilation or history of aortic dissection with a change in clinical status or cardiac exam or when findings may alter management.

Congenital Malformations (Chest Magnetic Resonance Angiography preferred if pediatrics or repeat imaging)

- Thoracic malformation on other imaging (chest x-ray, echocardiogram, gastrointestinal study, or inconclusive CT)[20-23]
- Congenital heart disease with pulmonary hypertension[24] or vascular anomalies
- Pulmonary sequestration[25]

Pulmonary Hypertension based on other testing[26, 27]

- Echocardiogram
- Right heart catheterization

Atrial fibrillation with ablation planned[28]

Preoperative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure
- Pre-transplant CT or CTA/MRA chest approvable for surgical planning (to evaluate for vascular anatomy, mediastinal pathology, malignancy screening etc.)

Post-operative/procedural evaluation

- Post-operative complications[29, 30]
- See above indications for TAA follow up

Chest CTA and Abdomen CTA, Abdomen/Pelvis CTA or Abdominal Arteries CTA

- Transcatheter Aortic Valve Replacement (TAVR)[14, 31]
- Acute aortic dissection
- Takayasu's arteritis[12]
- Post-operative complications[29, 30]
- To evaluate for an embolic source of lower extremity vascular disease (may also approved as a combination chest CTA and Abdominal Arteries CTA when LE runoff disease needs to be evaluated as well). Echocardiography is also often needed, since the

heart is the most commonly reported source of lower extremity emboli, accounting for 55 to 87 percent of events.[32]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BACKGROUND

Computed tomography angiography is a non-invasive imaging modality that may be used in the evaluation of thoracic vascular problems. Chest CTA (non-coronary) may be used to evaluate vascular conditions, e.g., pulmonary embolism, thoracic aneurysm, thoracic aortic dissection, aortic coarctation, or pulmonary vascular stenosis. The vascular structures as well as the surrounding anatomical structures are depicted by CTA.

Pulmonary embolism (PE) Methods utilizing clinical assessment to determine probability for PE include:

Wells Score[33]

▪ Clinical symptoms of DVT (leg swelling, pain with palpation)	3.0
▪ Other diagnosis less likely than pulmonary embolism	3.0
▪ Heart rate >100	1.5
▪ Immobilization (≥3 days) or surgery in the previous four weeks	1.5
▪ Previous DVT/PE	1.5
▪ Hemoptysis	1.0
▪ Malignancy	1.0
Probability	**Score**
Traditional clinical probability assessment (Wells criteria)	
High	>6.0
Moderate	2.0 to 6.0
Low	<2.0

Modified Geneva Score[34]

Modified Geneva score

	Variables	Points
Risk factors	Age >65 years	1
	Previous deep venous thrombosis or pulmonary embolism	3
	Surgery under general anesthesia or fracture of the lower limbs within one month	2
	Active malignancy (solid or hematologic; currently active or cured within the last year)	2
Symptoms	Unilateral lower-limb pain	3
	Hemoptysis	2
Signs	Heart rate 75 to 94 beats per minute	3
	≥95 beats per minute	5
	Pain on lower limb deep venous palpation and unilateral edema	4
		Total points
Pre-test probability assessment	Low	0 to 3
	Intermediate	4 to 10
	High	≥11

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POLICY HISTORY

Date	Summary
April 2023	• Simplified PE indications to high risk, no need for d dimer, all else requires d dimer (added Pretest probability tables and removed other details from background) • Clarified and updated follow up after repair of TAA • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
March 2022	• For Suspected Pulmonary Embolism, clarified 'intermediate or high risk' as determined by parameters detailed in Overview section and included hyperlink to Overview section

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **CHEST (THORAX) MRI**	**Original Date: September 1997**
CPT Codes: 71550, 71551, 71552	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_021	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CHEST MRI

The combination of superior soft tissue contrast and lack of ionizing radiation may make Chest Magnetic Resonance Imaging (MRI) preferable for the pediatric population, during pregnancy and also when frequent serial imaging is needed. This must be weighed against a longer acquisition time, greater likelihood of patient motion artifact as well as the lack of experience in obtaining and interpreting non-vascular chest MR. Recent technological advancements have made non-vascular thoracic MRI increasingly utilized, however **Chest Computed Tomography (CT) is generally better for lung parenchymal evaluation at this time**. Chest Magnetic Resonance Angiography (MRA) is ordered for evaluation of the intrathoracic blood vessels. Chest MRI and Chest MRA should not be approved at the same time.

Chest Mass (non-lung parenchymal)[1-7]

- Mass or lesion, including lymphadenopathy, after non-diagnostic x-ray or ultrasound (Chest CT indicated for pulmonary nodule)
- Thymoma screening in Myasthenia Gravis patients[8]
- Congenital thoracic malformation on other imaging (chest x-ray, echocardiogram, gastrointestinal study, or inconclusive CT)[9-12]

Chest Wall (MRI preferred over CT):

- Pain (after initial evaluation with chest x-ray and/or rib films)
- History of known or suspected cancer involving the chest wall
- Signs and symptoms of infection with concern for chest wall involvement, such as: fever, elevated inflammatory markers, known infection at other sites
- Suspected chest wall injuries (including musculotendinous, costochondral cartilage, sternoclavicular joint, and manubriosternal joint injuries) when imaging will potentially alter management
- Malformations (such as pectus excavatum, pectus carinatum, scoliosis) in patients with cardiorespiratory symptoms for whom treatment is being considered
- Mass or lesion after inconclusive initial imaging (MRI preferred over chest CT for chest wall mass)

Brachial Plexopathy[13, 14]

- If mechanism of injury or Electromyography/Nerve Conduction Velocity (EMG/NCV) studies are suggestive
- Chest MRI is preferred study, but neck and/or shoulder (upper extremity) MRI can be ordered depending on the suspected location of injury

Cystic Fibrosis[15]

- Can be an alternative to Chest CT to evaluate perfusion abnormalities, bronchiectasis, and mucus plugging if needed for treatment planning

Vascular Diseases are better evaluated with Chest CTA or MRA[16]

- Superior vena cava (SVC) syndrome[17]
- Subclavian Steal Syndrome after positive or inconclusive ultrasound[18, 19]
- Thoracic Outlet Syndrome[16, 20, 21]
- Takayasu's arteritis[22]
- Acute or chronic aortic dissection[23, 24]
- Pulmonary hypertension - To evaluate for cause after echocardiogram or right heart catheterization[25, 26]

Congenital Malformations

- Congenital heart disease with pulmonary hypertension[27]
- Pulmonary sequestration[28]

Atrial fibrillation with ablation planned[29]

Preoperative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- Post-surgical follow-up when records document medical reason requiring additional imaging

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BACKGROUND

Magnetic Resonance Imaging (MRI) is a noninvasive imaging technique for detection and evaluation of various disease and conditions in the chest, e.g., congenital anomalies and aneurysms. MRI may be used instead of computed tomography (CT) in patients with allergies to radiographic contrast or with impaired renal function. Also, to decrease radiation exposure, Chest MRI may be used rather than CT when repeated imaging is expected (i.e., surveillance).

OVERVIEW

MRI for Non-Parenchymal Masses[30]

CT and MRI are similar in usefulness when imaging the chest wall and pleura. The main advantages of MRI are lack or radiation, superior contrast resolution for delineation of anatomy, evaluation of local invasion, greater ability to image in “unconventional planes” and real time imaging capabilities. CT is still the gold standard for evaluation parenchymal disease; however, MR is also now being considered in the assessment of endometriosis, lung nodules and lung cancer staging. The lack of standardized protocols and experience in interpretation still limits the usefulness of non-vascular chest MRI.

Due to the capability of MR to distinguish certain fat and fluid characteristics, MR can be superior to CT for evaluating mediastinal masses. The presence of microscopic fat allows MR to distinguish thymic hyperplasia from mass. Similarly, because of macroscopic fat, MR is useful in evaluating dermoid cysts teratomas, thymolipomas, lipomas and liposarcomas.
MRI can also differentiate simple from complex cystic lesions better than CT, and is thus useful for evaluating cystic mediastinal masses, such as thymic, foregut duplication or pericardial cysts and lymphatic malformations.

Finally, MRI can help differentiate types of neurogenic tumors (schwannomas, neurofibromas and ganglioneuromas) that may have similar CT features, to evaluate of intraspinal and neural extension of the tumor, as well as to assess adherence or invasion of a mediastinal mass to adjacent structures.

MRI and Myasthenia Gravis – Myasthenia Gravis is a chronic autoimmune disease characterized by weakness of the skeletal muscles causing fatigue and exhaustion that is aggravated by activity and relieved by rest. It most often affects the ocular and other cranial muscles and is thought to be caused by the presence of circulating antibodies. Symptoms include ptosis, diplopia, chewing difficulties, and dysphagia. Thymoma has a known association with myasthenia. Contrast-enhanced MRI may be used to identify the presence of a mediastinal mass suggestive of myasthenia gravis in patients with renal failure or allergy to contrast material.

MRI and Thoracic Outlet Syndrome – Thoracic outlet syndrome is a group of disorders involving compression at the superior thoracic outlet that affects the brachial plexus, the subclavian artery, and veins. It refers to neurovascular complaints due to compression of the brachial plexus or the subclavian vessels. Magnetic resonance multi-plane imaging shows bilateral images of the thorax and brachial plexus and can demonstrate the compression of the brachial plexus and venous obstruction.

MRI and Brachial Plexus - MRI is the only diagnostic tool that accurately provides high resolution imaging of the brachial plexus. The brachial plexus is formed by the cervical ventral rami of the lower cervical and upper thoracic nerves which arise from the cervical spinal cord, exit the bony confines of the cervical spine, and traverse along the soft tissues of the neck, upper chest, and course into the arms.

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POLICY HISTORY

Date	Summary
April 2023	• Updates on mass imaging and chest wall imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
March 2022	• Updated references

Reviewed / Approved by Clinical Guideline Committee

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Clinical guidelines **CHEST MRA/MRV**	**Original Date: September 1997**
CPT Codes: 71555	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_022-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CHEST MRA

Chest Magnetic Resonance Angiography (MRA) is ordered for evaluation of the intrathoracic blood vessels. Chest MRI and Chest MRA should not be approved at the same time.

Vascular Disease

- Superior vena cava (SVC) syndrome[1]
- Subclavian Steal Syndrome after positive or inconclusive ultrasound[2, 3]
- Thoracic Outlet Syndrome[4-6]
- Takayasu's arteritis[7]
- Clinical concern for acute aortic dissection[8, 9]
    - Sudden painful ripping sensation in the chest or back and may include
        - New diastolic murmur
        - Cardiac tamponade
        - Distant heart sounds
        - Hypotension or shock
- For MRPA (MR Pulmonary Angiography) in patients with intermediate pretest probability with a positive D-dimer or high pretest probability (but only at centers that

routinely perform it well and only for patients for whom standard tests are contraindicated)
    - Risk can be determined by the parameters detailed in Background section

Initial/Screening for Thoracic Aortic Disease[10-12]

- Echocardiogram or chest x-ray show aneurysm
- Screening of first-degree relatives of individuals with a thoracic aortic aneurysm (defined as ≥ 50% above normal) or dissection
- Evaluation in patients with known or suspected connective tissue disease or genetic condition that predisposes to aortic aneurysm or dissection, such as Marfan's, Ehlers-Danlos, get a one-time study or for Loeys-Dietz syndrome- allow imaging at diagnosis and then every two years, or more frequently if abnormalities are found (Imaging may include head, neck, chest, abdomen and pelvis)(MRA preferred due to cumulative radiation risk)
- Screening of the thoracic aorta after a diagnosis of a bicuspid aortic valve (dilation of the ascending aorta may not be seen on echocardiogram)[13, 14]
    - If normal, reimage every three to five years
- Screening of first-degree relatives of patients with a bicuspid aortic valve
- Turner's syndrome – Screen for coarctation or aneurysm of the thoracic aorta
    - If normal results, screen every 5-10 years
    - If abnormal, screen annually
- Suspected vascular cause of dysphagia or expiratory wheezing with other imaging is suggestive or inconclusive

Follow-up after established Thoracic Aneurysm[14-16]

- Six months follow-up after initial finding of a dilated thoracic aorta, for assessment of rate of change
    - Aortic Root or Ascending Aorta (in cm)
        - 3.5 to 4.4 – annual
        - 4.5 to 5.5 or growth rate ≥ 0.5cm/year – every 6 months
    - Genetically mediated (Marfan syndrome, Aortic Root or Ascending Aorta) (in cm)
        - 3.5 to 4.4 – annual
        - 4.5 to 5.5 or growth rate ≥ 0.5cm/year – every 6 months
        - Surgery generally recommended over 5.0cm
    - Descending Aorta (in cm)[17]
        - 4.0 to 5.0 – annual
        - 5.0 to 6.0 – every 6 months
- Follow-up post medical treatment of aortic dissection:
    - Acute dissection: 1 month, 6 months, then annually
    - Chronic dissection: annually
- Follow-up TEVAR surveillance at 1 month, then 1 year post op if stable, then annually

- Follow-up open repair if no residual aortopathy within first post op year, then every 5 years (if have residual aortopathy or abnormal findings on surveillance, annual follow-up if needed)
- Re-evaluation of known ascending aortic dilation or history of aortic dissection with a change in clinical status or cardiac exam or when findings may alter management

Congenital Malformations

- Thoracic malformation on other imaging (chest x-ray, echocardiogram, gastrointestinal study, or inconclusive CT)[15-18]
- Congenital heart disease with pulmonary hypertension[19] or vascular anomalies
- Pulmonary Sequestration[20]

Pulmonary Hypertension based on other testing[21, 22]

- Echocardiogram
- Right heart catheterization

Atrial fibrillation with ablation planned[23]

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure
- Pre-transplant CT or CTA/MRA chest approvable for surgical planning (to evaluate for vascular anatomy, mediastinal pathology, malignancy screening etc.)

Post-operative/procedural evaluation

- Post-operative complications[24, 25]
- See above indications for TAA follow up

Chest MRA and Abdomen MRA or Abdomen/Pelvis MRA

- Transcatheter Aortic Valve Replacement (TAVR)
- Acute aortic dissection
- Takayasu's arteritis
- Post-operative complications
- To evaluate for an embolic source of lower extremity vascular disease (may also approved as a combination chest MRA, Abdominal MRA and a single LE MRA when LE runoff disease needs to be evaluated as well). Echocardiography is also needed, since the heart is the most commonly reported source of lower extremity emboli i, accounting for 55 to 87 percent of events.

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BACKGROUND

Magnetic resonance angiography (MRA) is a noninvasive technique used to provide cross-sectional and projection images of the thoracic vasculature, including large- and medium-sized vessels, e.g., the thoracic aorta. MRA provides images of both normal and diseased blood vessels, and it quantifies blood flow through these vessels. Successful vascular depiction relies on the proper imaging pulse sequences. MRA may use a contrast agent, gadolinium, which is non-iodine-based, for better visualization. It can be used in patients who have history of contrast allergy and who are at high risk of kidney failure.

OVERVIEW

Coarctation of the Aorta – One of the most common congenital vascular anomalies is coarctation of the aorta, characterized by obstruction of the juxtaductal aorta. Clinical symptoms, e.g., murmur, systemic hypertension, difference in blood pressure in upper and lower extremities, absent femoral or pedal pulses, may be present. Gadolinium-enhanced 3D MRA may assist in preoperative planning as it provides angiographic viewing of the aorta, the arch vessels, and collateral vessels. It may also assist in the identification of postoperative complications.

Pulmonary Embolism (PE) –Studies show mixed results regarding the value of MRA versus CTA in detecting pulmonary embolism. A systematic review and meta-analysis found MRA to be inferior to CTA in detecting PE. Therefore, MRA should be used only if CTA is not available or contraindicated in a specific patient.[26]

Central Venous Thrombosis – CTA/MRA is useful in the identification of venous thrombi. Venous thrombosis can be evaluated by gadolinium-enhanced 3D MRA as an alternative to CTA, which may not be clinically feasible due to allergy to iodine contrast media or renal insufficiency.

MRI and Patent Ductus Arteriosus – Patent ductus arteriosus (PDA) is a congenital heart problem in which the ductus arteriosus does not close after birth. It remains patent allowing oxygen-rich blood from the aorta to mix with oxygen-poor blood from the pulmonary artery. MRI can depict the precise anatomy of a PDA to aid in clinical decisions. It allows imaging in

multiple planes without a need for contrast administration. Patients are not exposed to ionizing radiation.

Other MRA Indications – MRA is useful in the assessment for postoperative complications of pulmonary venous stenosis.

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POLICY HISTORY

Date	Summary
April 2023	• Simplified PE indications and removed other details from background) • Clarified and updated follow up after repair of TAA • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
March 2022	• No significant changes

Reviewed / Approved by Clinical Guideline Committee

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Clinical guideline **CERVICAL SPINE CT**	**Original Date: September 1997**
CPT Codes: 72125, 72126, 72127	**Last Revised Date: December 2023**
Guideline Number: Evolent_CG_041	**Implementation Date: July 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CERVICAL SPINE CT

[+]If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months), the results of the prior study should be:

- **Inconclusive or show a need for additional or follow-up imaging evaluation OR**
- **The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.**

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of neurologic deficits when Cervical Spine MRI is contraindicated or inappropriate[1-4]

- With any of the following new neurological deficits documented on physical exam
  - Extremity muscular weakness (and not likely caused by plexopathy or peripheral neuropathy)
  - Pathologic (e.g., Babinski, Lhermitte's sign, Chaddock Sign, Hoffman's and other upper motor neuron signs); OR abnormal deep tendon reflexes (and not likely caused by plexopathy, or peripheral neuropathy)

- Absent/decreased sensory changes along a particular cervical dermatome (nerve distribution): pin prick, touch, vibration, proprioception, or temperature (and not likely caused by plexopathy or peripheral neuropathy)
- Upper or lower extremity increase muscle tone/spasticity
- New onset bowel or bladder dysfunction (e.g., retention or incontinence)—not related to an inherent bowel or bladder process
- Gait abnormalities (see Table 1 below for more details)

- Suspected cord compression with any neurological deficits as listed above

For evaluation of neck pain with any of the following when Cervical Spine MRI is contraindicated[5]

- With new or worsening objective neurologic deficits on exam, as above
- Failure of conservative treatment* for a minimum of six (6) weeks within the last six (6) months;[6]

  NOTE - Failure of conservative treatment is defined as one of the following:
  - Lack of meaningful improvement after a full course of treatment; **OR**
  - Progression or worsening of symptoms during treatment; **OR**
  - Documentation of a medical reason the member is unable to participate in treatment

  Closure of medical or therapy offices, patient inconvenience, or noncompliance without explanation does not constitute "inability to complete" treatment.
- With progression or worsening of symptoms during the course of conservative treatment*
- With an abnormal electromyography (EMG) or nerve conduction study (if performed) indicating a cervical radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain)[7]
- Isolated back pain in pediatric population[8, 9] – conservative care not required if red flags present. Red flags that prompt imaging include any of the following:
  - Age 5 or younger, **OR**
  - Constant pain, **OR**
  - Pain lasting > 4 weeks, **OR**
  - Abnormal neurologic examination, **OR**
  - Early morning stiffness and/or gelling, **OR**
  - Night pain that prevents or disrupts sleep, **OR**
  - Radicular pain, **OR**
  - Fever or weight loss or malaise, **OR** [10, 11]
  - Postural changes (e.g., kyphosis or scoliosis), **OR**
  - Limp (or refusal to walk in a younger child)

As part of initial pre-operative/post-operative/procedural evaluation ("CT best examination to assess for hardware complication, extent of fusion and pseudarthrosis"[12, 13] and MRI for cord, nerve root compression, disc pathology, or post-op infection)

Note: If ordered by Neurosurgeon or orthopedic surgeon for purposes of surgical planning, a contraindication to MRI is not required.

- For preoperative evaluation/planning
- CT discogram
- Evaluation of post operative pseudoarthrosis after initial x-rays (CT should not be done before 6 months after surgery)
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula -preferred exam CT myelogram))[14]
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery in the last 6 months. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested (routine surveillance post-op not indicated without symptoms)
- Surgical infection as evidenced by signs/symptoms, laboratory, or prior imaging findings
- New or changing neurological deficits or symptoms post-operatively[12, 15] - see neurological deficit section above.
- When combo requests (see above statement[+]) are submitted (i.e., MRI and CT of the spine), the office notes should clearly document the need for both studies to be done simultaneously (e.g., the need for both soft tissue and bony anatomy is required)[16]
    - Combination requests where both cervical spine CT and MRI cervical spine are both approvable (not an all-inclusive list):
        - OPLL (Ossification of posterior longitudinal ligament)[17]
        - Pathologic or complex fractures
        - Malignant process of spine with both bony and soft tissue involvement
        - Unstable craniocervical junction
        - Clearly documented indication for bony and soft tissue abnormality where assessment will change management for the patient

For evaluation of suspected myelopathy when Cervical Spine MRI is contraindicated[18-22]

- Does **NOT** require conservative care
- Progressive symptoms including hand clumsiness, worsening handwriting, difficulty with grasping and holding objects, diffuse numbness in the hands, pins and needles sensation, increasing difficulty with balance and ambulation
- Any of the neurological deficits as noted above

For evaluation of trauma or acute injury[23]

- Presents with any of the following neurological deficits as above
- With progression or worsening of symptoms during the course of conservative treatment*
- History of underlying spinal abnormalities (i.e., ankylosing spondylitis) (Both MRI and CT are approvable)[24, 25]

- When the patient is clinically unevaluable or there are preliminary imaging findings (x-ray or CT) needing further evaluation
- When office notes specify the patient meets NEXUS (National Emergency X-Radiography Utilization Study) or CCR (Canadian Cervical Rules) criteria for imaging[23]:
    - CT for initial imaging
    - MRI when suspect spinal cord or nerve root injury or when patient is obtunded, and CT is negative
    - CT or MRI for treatment planning of unstable spine

("MRI and CT provide complementary information. When indicated it is appropriate to perform both examinations"[23])

For evaluation of known fracture or new compression fractures with worsening neck pain[23, 26]

- To assess union of a fracture when physical examination, plain radiographs, or prior imaging suggest delayed or non-healing
- To determine the position of fracture fragments
- With history of malignancy (if MRI is contraindicated or cannot be performed)
- With an associated new focal neurologic deficit as above[27]
- Prior to a planned surgery/intervention or if the results of the CT will change management

CT myelogram: When MRI cannot be performed/contraindicated/surgeon preference[14, 28-32]

- When signs and symptoms inconsistent or not explained by the MRI findings
- Demonstration of the site of a CSF leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula)
- Surgical planning, especially regarding to the nerve roots or evaluation of dural sac
- Evaluation of suspected brachial plexus or nerve root injury in the neonate

For evaluation of tumor, cancer, or metastasis with any of the following:

(MRI is usually the preferred study- CT may be needed to further characterize solitary indeterminate lesions seen on MRI)[9, 33, 34]

- **Primary tumor**
    - Initial staging primary spinal tumor[35]
    - Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
    - Known spinal tumor with new signs or symptoms (e.g., new or increasing nontraumatic pain, physical, laboratory, and/or imaging findings)
    - With an associated new focal neurologic deficit as above[27]
- **Metastatic tumor**
    - With evidence of metastasis on bone scan needing further clarification OR inconclusive findings on a prior imaging exam

- With an associated new focal neurologic deficit[27]
- Known malignancy with new signs or symptoms (e.g., new or increasing nontraumatic pain, radiculopathy or neck pain that occurs at night and wakes the patient from sleep with known active cancer, physical, laboratory, and/or imaging findings) in a tumor that tends to metastasize to the spine[9, 36]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification. When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding[9]
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam). When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding.[9] When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding[9]

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine, or Lumbar Spine

For evaluation of known or suspected infection (osteomyelitis)/abscess when Cervical Spine MRI is contraindicated[37]

- As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings[38]
- Follow-up imaging of infection
    - With worsening symptoms/laboratory values (i.e., white blood cell count, ESR/CRP) or radiographic findings[39]

For evaluation of known or suspected inflammatory disease or atlantoaxial instability when MRI is contraindicated or for surgical treatment planning:

- In rheumatoid arthritis with neurologic signs/symptoms, or evidence of subluxation on radiographs (lateral radiograph in flexion and neutral should be the initial study)[40, 41]
    - Patients with negative radiographs but symptoms suggestive of cervical instability or in patients with neurologic deficits
- High-risk disorders affecting the atlantoaxial articulation, such as Down syndrome, Marfan syndrome with neurological signs/symptoms, abnormal neurological exam, or evidence of abnormal or inconclusive radiographs of the cervical spine[42]
- Spondyloarthropathies, known or suspected

- Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and appropriate rheumatology workup

For evaluation of spine abnormalities related to immune system suppression, e.g., HIV, chemotherapy, leukemia, or lymphoma when Cervical Spine MRI is contraindicated[37, 43]

- As evidenced by signs/symptoms, laboratory, or prior imaging findings

Other Indications for a Cervical Spine CT when MRI is contraindicated or cannot be performed

(Note- See combination requests, below, for initial advanced imaging assessment and pre-operatively)

- Tethered cord or spinal dysraphism (known or suspected), based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata[44-46]
  - Known Arnold-Chiari syndrome (For initial imaging (one-time initial modality assessment) see combination below)
  - Known Chiari I malformation without syrinx or hydrocephalus, follow-up imaging after initial diagnosis with new or changing signs/symptoms or exam findings consistent with spinal cord pathology[47]
  - Known Chiari II (Arnold-Chiari syndrome), III, or IV malformation
  - Achondroplasia (one Cervical Spine MRI to assess the craniocervical junction, as early as possible (even in asymptomatic cases)[48, 49]
- Syrinx or syringomyelia (known or suspected)
  - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis)[50]
  - To further characterize a suspicious abnormality seen on prior imaging
  - Known syrinx with new/worsening symptoms
- Toe walking in a child with signs/symptoms of myelopathy localized to the Cervical Spine
- Suspected neuroinflammatory Conditions/Diseases (e.g., sarcoidosis, Behcet's)
  - After detailed neurological exam and appropriate initial work up

Initial evaluation of trigeminal neuralgia not explained on recent Brain imaging

COMBINATION STUDIES WITH CERVICAL SPINE CT WHEN MRI IS CONTRAINDICATED OR CANNOT BE PERFORMED OR SURGEON PREFERENCE

Brain CT/Cervical CT

- For evaluation of known Arnold-Chiari Malformation

Cervical and Thoracic CT

- Initial evaluation of known or suspected syrinx or syringomyelia
  - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis[50])
  - To further characterize a suspicious abnormality seen on prior imaging
  - Known syrinx with new/worsening symptom

Any combination of Cervical and/or Thoracic and/or Lumbar CTs:

Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history, and other available information, including prior imaging.

Exception- Indications for combination studies[51, 52]: Are approved indications as noted below and being performed in children who will need anesthesia for the procedure

- Any combination of these studies for:
    - Survey/complete initial assessment of infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10[53-55] (e.g., congenital scoliosis, idiopathic scoliosis, scoliosis with vertebral anomalies)
    - In the presence of neurological deficit, progressive spinal deformity, or for preoperative planning[56]
    - Back pain with known vertebral anomalies (hemivertebrae, hypoplasia, agenesis, butterfly, segmentation defect, bars, or congenital wedging) in a child on preliminary imaging
    - Scoliosis with any of the following[57]:
        - Progressive spinal deformity;
        - Neurologic deficit (new or unexplained);
        - Early onset;
        - Atypical curve (e.g., short segment, >30’ kyphosis, left thoracic curve, associated organ anomalies);
        - Pre-operative planning; OR
        - When office notes clearly document how imaging will change management
- Arnold-Chiari malformations[58, 59]
    - Arnold-Chiari I
        - For evaluation of spinal abnormalities associated with initial diagnosis of Arnold-Chiari Malformation. (C/T/L spine due to association with tethered cord and syringomyelia), and initial imaging has not been completed[44, 53]
    - Arnold-Chiari II-IV - For initial evaluation and follow-up as appropriate
        - Usually associated with open and closed spinal dysraphism, particularly meningomyelocele)
- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata,[44-46] when anesthesia required for imaging[60] (e.g., meningomyelocele, lipomeningomyelocele, diastematomyelia, fatty/thickened filum terminale, and other spinal cord malformations)
- Oncological Applications (e.g., primary nervous system, metastatic)
    - Drop metastasis from brain or spine (imaging also includes brain; CT spine imaging in this scenario is usually CT myelogram)- See Overview
    - Suspected leptomeningeal carcinomatosis (LC)[61]- See Overview

    - Any combination of these for spinal survey in patient with metastases
    - Tumor evaluation and monitoring in neurocutaneous syndromes
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula -preferred exam CT myelogram))[14]
- CT myelogram when meets above guidelines and MRI is contraindicated or for surgical planning
- Post-procedure (discogram) CT

BACKGROUND

Computed tomography (CT) is performed for the evaluation of the cervical spine. CT may be used as the primary imaging modality, or it may complement other modalities. Primary indications for CT include conditions, e.g., traumatic, neoplastic, and infectious. CT is often used to study the cervical spine for conditions such as degenerative disc disease when MRI is contraindicated. CT provides excellent depiction of bone detail and is used in the evaluation of known fractures of the cervical spine and for evaluation of postoperative patients.

OVERVIEW

***Conservative Treatment**
Non-operative conservative treatment should include a multimodality approach consisting of at least one (1) active and one (1) inactive component targeting the affected region.

Active Modalities

- Physical therapy
- Physician-supervised home exercise program**
- Chiropractic care

Inactive Modalities

- Medications (e.g., NSAIDs, steroids, analgesics)
- Injections (e.g., epidural injection, selective nerve root block)
- Medical Devices (e.g., TENS unit, bracing)

****Home Exercise Program (HEP)**
The following two elements are required to meet conservative therapy guidelines for HEP:[13, 62]

- Documentation of an exercise prescription/plan provided by a physician, physical therapist, or chiropractor; **AND**
- Follow-up documentation regarding completion of HEP after the required 6-week timeframe or inability to complete HEP due to a documented medical reason (e.g., increased pain or inability to physically perform exercises).

Cervical myelopathy – Symptom severity varies, and a high index of suspicion is essential for making the proper diagnosis in early cases. Symptoms of pain and radiculopathy may not be present. The natural history of myelopathy is characterized by neurological deterioration. The most frequently encountered symptom is gait abnormality (86%) followed by increased muscular reflexes (79.1%), pathological reflexes (65.1%), paresthesia of upper limb (69.8%) and pain (67.4%).[19]

Table 1: Gait and spine imaging[63-68]

Gait	Characteristic	Work up/Imaging
Hemiparetic	**Spastic unilateral, circumduction**	**Brain and/or, Cervical spine imaging based on associated symptoms**
Diplegic	**Spastic bilateral, circumduction**	**Brain, Cervical and Thoracic Spine imaging**
Myelopathic	**Wide based, stiff, unsteady**	**Cervical and/or Thoracic spine MRI based on associated symptoms**
Cerebellar Ataxic	**Broad based, clumsy, staggering, lack of coordination, usually also with limb ataxia**	**Brain imaging see Brain MRI Guideline**
Apraxic	**Magnetic, shuffling, difficulty initiating**	**Brain imaging see Brain MRI Guideline**
Parkinsonian	**Stooped, small steps, rigid, turning en bloc, decreased arm swing**	**Brain Imaging see Brain MRI Guideline**
Choreiform	**Irregular, jerky, involuntary movements**	**Medication review, consider brain imaging as per movement disorder Brain MR guidelines**
Sensory ataxic	**Cautious, stomping, worsening without visual input (ie + Romberg)**	**EMG, blood work, consider spinal (cervical or thoracic cord imaging) imaging based on EMG**
Neurogenic	**Steppage, dragging of toes**	• **EMG initial testing;** • **BUT if there is a foot drop, lumbar spine MRI is appropriate without EMG** • **Pelvis MR if there is evidence of plexopathy**
Vestibular	**Insecure, veer to one side, worse when eyes closed, vertigo**	**Consider Brain/IAC MRI see Brain MRI Guideline**

Ossification Posterior Longitudinal Ligament (OPLL)[17] – Most common in cervical spine (rare but more severe in thoracic spine).

Table 2: CT and Cutaneous Stigmata[69]

Risk Stratification for Various Cutaneous Markers		
High Risk	Intermediate Risk	Low Risk
• Hypertrichosis • Infantile hemangioma • Atretic meningocele • DST • Subcutaneous lipoma • Caudal appendage • Segmental hemangiomas in association with LUMBAR‡ syndrome	• Capillary malformations (also referred to as NFS or salmon patch when pink and poorly defined or PWS when darker red and well-defined)	• Coccygeal dimple • Light hair • Isolated café au lait spots • Mongolian spots • Hypo- and hypermelanotic macules or papules • Deviated or forked gluteal cleft • Nonmidline lesions
‡LUMBAR, lower body hemangioma and other cutaneous defects, urogenital abnormalities, ulcerations, myelopathy, bony defects, anorectal malformations, arterial anomalies, and renal anomalies.		

Neck and Back Pain with Cancer History – Bone is the third most common site of metastases after the liver and the lungs, and approximately two-thirds of all osseous metastases occur in the spine. Approximately 60–70% of patients with systemic cancer will have spinal metastasis. Radiographic (x-ray) examination should be performed in cases of back pain when a patient has a cancer history, but without known active cancer or a tumor that tends to metastasize to the spine. This can make a diagnosis in many cases. This may occasionally allow for selection of bone scan in lieu of MRI in some cases. When radiographs do not answer the clinical question, then MRI may be appropriate after a consideration of conservative care.

"Neoplasms causing VCF (vertebral compression fractures) include 1) primary bone neoplasms, such as hemangioma (aggressive type) or giant cell tumors, and tumor-like conditions causing bony and cellular remodeling, such as aneurysmal bone cysts, or Paget's disease (osteitis deformans); 2) primary malignant neoplasms including but not limited to multiple myeloma and lymphoma; and 3) metastatic neoplasms."[26]

Most common spine metastasis involving primary metastasis originate from the following tumors in descending order: breast (21%), lung (19%), prostate (7.5%), renal (5%), gastrointestinal (4.5%), and thyroid (2.5%). While all tumors can seed to the spine, the cancers mentioned above metastasize to the spinal column early in the disease process.[36]

CT Myelogram – Myelography is the instillation of intrathecal contrast media under fluoroscopy. Patients are then imaged with CT to evaluate for spinal canal pathology. Although this technique has diminished greatly due to the advent of MRI due to its non-invasiveness and

superior soft-tissue contrast, myelography is still a useful technique for conventional indications, such as spinal stenosis, when MRI is contraindicated or nondiagnostic or surgeon preference (see guidelines above), brachial plexus injury in neonates, radiation therapy treatment planning, and cerebrospinal fluid (CSF) leak.[70, 71]

Drop Metastases[72] – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas and less commonly choroid plexus neoplasms and teratomas.

Leptomeningeal Carcinomatosis[73] – Leptomeningeal carcinomatosis is a complication of cancer in which cancerous cells spread to the membranes (meninges) that covers the brain and spinal cord. The most common solid tumors that involve the leptomeninges are breast, lung, melanoma, gastrointestinal, and primary central nervous system tumors.

POLICY HISTORY

Date	Summary
Dec 2023	Conservative treatment language updated in body and background
May 2023	• Updated references • Updated background section • Clarified pathological reflexes • Added pseudoarthrosis to surgery section • Added "Further evaluation of indeterminate or questionable findings on prior imaging": • Clarified cerebellar ataxia in gait table • Added: "Initial evaluation of trigeminal neuralgia not explained on recent Brain imaging" • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Removed Additional Resources
March 2022	• Added o Combination request for overlapping body part statement o Clarified muscle weakness no related to plexopathy or peripheral neuropathy o Clarified bowel and bladder dysfunction – not related to an inherent bowel or bladder problem o Clarified isolated neck pain in pediatric patient o Clarified CT myelogram section o Added subsection for cervical and thoracic spine section for syrinx and syringomyelia o Descriptions for tethered cord o Background section of Drop Metastases o Background section of Leptomeningeal Carcinomatosis o Clarified toe walking in pediatric patient with myelopathy for cervical spine • Removed o Removed from combination section syrinx and syringomyelia and added subsection for cervical and thoracic spine section o Removed pediatric back pain from the total spine combination section

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Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **THORACIC SPINE CT**	**Original Date: September 1997**
CPT Codes: 72128, 72129, 72130	**Last Revised Date: December 2023**
Guideline Number: Evolent_CG_043	**Implementation Date: July 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR THORACIC SPINE CT

[+]If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- **Inconclusive or show a need for additional or follow up imaging evaluation OR**
- **The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient (the entire spinal cord and/or autonomic postganglionic chain must be assessed)**

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of neurologic deficits when Thoracic Spine MRI is contraindicated or inappropriate[1-3]

- With any of the following new neurological deficits documented on physical exam
  - Extremity muscular weakness (and not likely caused by plexopathy, or peripheral neuropathy)[4, 5]
  - Pathologic (e.g., Babinski, Chaddock Sign) reflexes

    - Pathologic (e.g., Babinski, Lhermitte's sign, Chaddock Sign, Hoffman's and other upper motor neuron signs); **OR** abnormal deep tendon reflexes (and not likely caused by plexopathy, or peripheral neuropathy)
    - Absent/decreased sensory changes along a particular thoracic dermatome (nerve distribution): pin prick, touch, vibration, proprioception, or temperature weakness (and not likely caused by plexopathy, or peripheral neuropathy)
    - Upper or lower extremity increase muscle tone/spasticity and likely localized to the thoracic spinal cord
    - New onset bowel or bladder dysfunction (e.g., retention or incontinence) - not related to an inherent bowel or bladder process
    - Gait abnormalities (see Table 1 for more details)
- Suspected cord compression with any neurological deficits as listed above

For evaluation of back pain with any of the following when Thoracic Spine MRI is contraindicated[6-9]

- With new or worsening objective neurologic deficits on exam, as above
- Failure of conservative treatment* for a minimum of six (6) weeks within the last six (6) months;[10]
  NOTE - Failure of conservative treatment is defined as one of the following:
    - Lack of meaningful improvement after a full course of treatment; **OR**
    - Progression or worsening of symptoms during treatment; **OR**
    - Documentation of a medical reason the member is unable to participate in treatment

  Closure of medical or therapy offices, patient inconvenience, or noncompliance without explanation does not constitute "inability to complete" treatment.
- With progression or worsening of symptoms during the course of conservative treatment*
- With an abnormal electromyography (EMG) or nerve conduction study (if performed) indicating a thoracic radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain)[11]
- Isolated back pain in pediatric population[12] – conservative care not required if red flags present. Red flags that prompt imaging include any of the following:
    - Age 5 or younger, **OR**
    - Constant pain, **OR**
    - Pain lasting > 4 weeks, **OR**
    - Abnormal neurologic examination, **OR**
    - Early morning stiffness and/or gelling, **OR**
    - Night pain that prevents or disrupts sleep, **OR**
    - Radicular pain, **OR**
    - Fever or weight loss or malaise, **OR**
    - Postural changes (e.g., kyphosis or scoliosis), **OR**

- Limp (or refusal to walk in a younger child < 5yo)

As part of initial pre-operative/post-operative/procedural evaluation ("CT best examination to assess for hardware complication, extent of fusion and pseudoarthrosis"[13, 14] and MRI for cord, nerve root compression, disc pathology, or post-op infection)

If ordered by Neurosurgeon or orthopedic surgeon for purposes of surgical planning. A contraindication to MRI is not required

- For preoperative evaluation/planning
- CT discogram
- Evaluation of post operative pseudoarthrosis after initial x-rays (CT should not be done before 6 months after surgery)
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula -preferred exam CT myelogram)[15]
- Prior to spinal cord stimulator to exclude canal stenosis if no prior imaging of the thoracic spine has been done recently and MRI is contraindicated
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery in the last 6 months. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested (routine surveillance post-op not indicated without symptoms)
- Surgical infection as evidenced by signs/symptoms, laboratory, or prior imaging findings
- New or changing neurological deficits or symptoms post-operatively [13, 16] - see neurological deficit section above
- When combo requests are submitted (i.e., MRI and CT of the spine), the office notes should clearly document the need for both studies to be done simultaneously, i.e., the need for both soft tissue and bony anatomy is required[17]
    - Combination requests where both thoracic spine CT and MRI thoracic spine are both approvable (not an all-inclusive list):
        - OPLL (Ossification of posterior longitudinal ligament)
            - Most common in cervical spine (rare but more severe in thoracic spine)[18]
        - Pathologic or complex fractures
        - Malignant process of spine with both bony and soft tissue involvement
        - Clearly documented indication for bony and soft tissue abnormality where assessment will change management for the patient

For evaluation of suspected myelopathy when Thoracic Spine MRI is contraindicated[19-23]

- Does NOT require conservative care

- Progressive symptoms including unsteadiness; broad-based gait; increased muscle tone; pins and needles sensation; weakness and wasting of the lower limbs; diminished sensation to light touch, temperature, proprioception, and vibration; limb hyperreflexia and pathologic reflexes; bowel and bladder dysfunction in more severe cases
- Any of the neurological deficits as noted above

For evaluation of trauma or acute injury[24]

- Presents with any of the following neurological deficits as above
- With progression or worsening of symptoms during the course of a trial of conservative treatment*
- History of underlying spinal abnormalities (i.e., ankylosing spondylitis, diffuse idiopathic skeletal hyperostosis) (Both MRI and CT would be approvable)[25-27]
- When the patient is clinically unevaluable or there are preliminary imaging findings (x-ray or CT) needing further evaluation

("MRI and CT provide complementary information. When indicated It is appropriate to perform both examinations")[24]

For evaluation of known fracture or known/new compression fractures with worsening back pain[24, 28]

- To assess union of a fracture when physical examination, plain radiographs, or prior imaging suggest delayed or non-healing
- To determine the position of fracture fragments
- With history of malignancy (if MRI is contraindicated or cannot be performed)
- With an associated new focal neurologic deficit as above[29]
- Prior to a planned surgery/intervention or if the results of the CT will change management

CT myelogram: When MRI cannot be performed/contraindicated/surgeon preference[30-34]

- When signs and symptoms are inconsistent or not explained by the MRI findings
- Demonstration of the site of a CSF leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula)
- Surgical planning, especially regarding to the nerve roots or evaluation of dural sac

For evaluation of tumor, cancer, or metastasis with any of the following:

(MRI is usually the preferred study- CT may be needed to further characterize solitary indeterminate lesions seen on MRI)[35]

- **Primary tumor**

    - Initial staging primary spinal tumor[36]
    - Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
    - Known spinal tumor with new signs or symptoms (e.g., new or increasing nontraumatic pain, physical, laboratory, and/or imaging findings)
    - With an associated new focal neurologic deficit as above[29]
- **Metastatic tumor**
    - With evidence of metastasis on bone scan needing further clarification OR inconclusive findings on a prior imaging exam
    - With an associated new focal neurologic deficit[29]
    - Known malignancy with new signs or symptoms (e.g., new or increasing nontraumatic pain, radiculopathy or neck pain that occurs at night and wakes the patient from sleep with known active cancer, physical, laboratory, and/or imaging findings) in a tumor that tends to metastasize to the spine[37, 38]

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification. When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.) (When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding.)

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated, OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine, or Lumbar Spine

For evaluation of known or suspected infection (osteomyelitis), abscess or inflammatory disease when Thoracic MRI is contraindicated or cannot be performed[39, 40]

- As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings[41]
- Follow-up imaging of infection
    - With worsening symptoms/laboratory values (i.e., white blood cell count, ESR/CRP) or radiographic findings[42]

Spondyloarthropathies

- Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and appropriate rheumatology workup

For evaluation of spine abnormalities related to immune system suppression, e.g., HIV, chemotherapy, leukemia, or lymphoma when Thoracic MRI is contraindicated[39]

- As evidenced by signs/symptoms, laboratory, or prior imaging findings

Other Indications for a Thoracic Spine CT when MRI is contraindicated or cannot be performed

(Note- See combination requests, below, for initial advanced imaging assessment and pre-operatively)

- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata[43-45]
- Known Arnold-Chiari syndrome (For initial imaging (one-time initial modality assessment) see combination below)
    - Known Chiari I malformation without syrinx or hydrocephalus, follow-up imaging after initial diagnosis with new or changing signs/symptoms or exam findings consistent with spinal cord pathology[46]
    - Known Chiari II (Arnold-Chiari syndrome), III, or IV malformation
- Syrinx or syringomyelia (known or suspected)
    - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis)[47]
    - To further characterize a suspicious abnormality seen on prior imaging
    - Known syrinx with new/worsening symptoms
- Toe walking in a child with signs/symptoms of myelopathy localized to the Thoracic Spine
- Suspected neuroinflammatory Conditions/Diseases (e.g., sarcoidosis, Behcet's)
    - After detailed neurological exam and appropriate initial work up

COMBINATION STUDIES WITH THORACIC SPINE CT WHEN MRI IS CONTRAINDICATED OR CANNOT BE PERFORMED OR SURGEON PREFERENCE

Cervical and Thoracic CT

- Initial evaluation of known or suspected syrinx or syringomyelia
    - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis[47])
    - To further characterize a suspicious abnormality seen on prior imaging
    - Known syrinx with new/worsening symptom

Any combination of Cervical and/or Thoracic and/or Lumbar CTs

Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history, and other available information, including prior imaging.

Exception- Indications for combination studies[48, 49]: Are approved indications as noted below and being performed in children who will need anesthesia for the procedure

- Any combination of these studies for:
    - Survey/complete initial assessment of infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10[50-52] (e.g., congenital scoliosis, idiopathic scoliosis, scoliosis with vertebral anomalies)
    - In the presence of neurological deficit, progressive spinal deformity, or for preoperative planning[53]
    - Back pain with known vertebral anomalies (hemivertebrae, hypoplasia, agenesis, butterfly, segmentation defect, bars, or congenital wedging) in a child on preliminary imaging
    - Scoliosis with any of the following[54]:
        - Progressive spinal deformity;
        - Neurologic deficit (new or unexplained);
        - Early onset;
        - Atypical curve (e.g., short segment, >30' kyphosis, left thoracic curve, associated organ anomalies);
        - Pre-operative planning; OR
        - When office notes clearly document how imaging will change management
- Arnold-Chiari malformations[55, 56]
    - Arnold-Chiari I
        - For evaluation of spinal abnormalities associated with initial diagnosis of Arnold-Chiari Malformation. (C/T/L spine due to association with tethered cord and syringomyelia), and initial imaging has not been completed[44, 50]
    - Arnold-Chiari II-IV - For initial evaluation and follow-up as appropriate
        - Usually associated with open and closed spinal dysraphism, particularly meningomyelocele)
- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata,[43-45] when anesthesia required for imaging[57] (e.g., meningomyelocele, lipomeningomyelocele, diastematomyelia, fatty/thickened filum terminale, and other spinal cord malformations)
- Oncological Applications (e.g., primary nervous system, metastatic)
    - Drop metastasis from brain or spine (imaging also includes brain; CT spine imaging in this scenario is usually CT myelogram)- See Overview
    - Suspected leptomeningeal carcinomatosis (LC)[58]- See Overview

    - Any combination of these for spinal survey in patient with metastases
    - Tumor evaluation and monitoring in neurocutaneous syndromes
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula -preferred exam CT myelogram))[15]
- CT myelogram when meets above guidelines and MRI is contraindicated or for surgical planning
- Post-procedure (discogram) CT

BACKGROUND

Computed tomography is used for the evaluation, assessment of severity, and follow-up of diseases of the spine. Its use in the thoracic spine is limited, however, due to the lack of epidural fat in this part of the body. CT myelography improves the contrast severity of CT, but it is also invasive. CT may be used for conditions, e.g., degenerative changes, infection, and immune suppression, when magnetic resonance imaging (MRI) is contraindicated. It may also be used in the evaluation of tumors, cancer, or metastasis in the thoracic spine, and it may be used for preoperative and post-surgical evaluations. CT obtains images from different angles and uses computer processing to show a cross-section of body tissues and organs. CT is fast and is often performed in acute settings. It provides good visualization of cortical bone.

OVERVIEW

***Conservative Treatment**
Non-operative conservative treatment should include a multimodality approach consisting of at least one (1) active and one (1) inactive component targeting the affected region.

Active Modalities

- Physical therapy
- Physician-supervised home exercise program**
- Chiropractic care

Inactive Modalities

- Medications (e.g., NSAIDs, steroids, analgesics)
- Injections (e.g., epidural injection, selective nerve root block)
- Medical Devices (e.g., TENS unit, bracing)

****Home Exercise Program (HEP)**
The following two elements are required to meet conservative therapy guidelines for HEP:[9, 14]

- Documentation of an exercise prescription/plan provided by a physician, physical therapist, or chiropractor; **AND**

- Follow-up documentation regarding completion of HEP after the required 6-week timeframe or inability to complete HEP due to a documented medical reason (e.g., increased pain or inability to physically perform exercises).

Table 1: Gait and spine imaging[59-64]

Gait	Characteristic	Work up/Imaging
Hemiparetic	**Spastic unilateral, circumduction**	**Brain and/or, Cervical spine imaging based on associated symptoms**
Diplegic	**Spastic bilateral, circumduction**	**Brain, Cervical and Thoracic Spine imaging**
Myelopathic	**Wide based, stiff, unsteady**	**Cervical and/or Thoracic spine MRI based on associated symptoms**
Cerebellar ataxic	**Broad based, clumsy, staggering, lack of coordination, usually also with limb ataxia**	**Brain imaging see Brain MRI Guideline**
Apraxic	**Magnetic, shuffling, difficulty initiating**	**Brain imaging see Brain MRI Guideline**
Parkinsonian	**Stooped, small steps, rigid, turning en bloc, decreased arm swing**	**Brain Imaging see Brain MRI Guideline**
Choreiform	**Irregular, jerky, involuntary movements**	**Medication review, consider brain imaging as per movement disorder Brain MR guidelines**
Sensory ataxic	**Cautious, stomping, worsening without visual input (ie + Romberg)**	**EMG, blood work, consider spinal (cervical or thoracic cord imaging) imaging based on EMG**
Neurogenic	**Steppage, dragging of toes**	• **EMG initial testing;** • **BUT if there is a foot drop, lumbar spine MRI is appropriate without EMG** • **Pelvis MR if there is evidence of plexopathy**
Vestibular	**Insecure, veer to one side, worse when eyes closed, vertigo**	**Consider Brain/IAC MRI see Brain MRI Guideline**

Myelopathy – Symptom severity varies, and a high index of suspicion is essential for making the proper diagnosis in early cases. Symptoms of pain and radiculopathy may not be present. The natural history of myelopathy is characterized by neurological deterioration. The most frequently encountered symptom is gait abnormality (86%), followed by increased muscular reflexes (79.1%), pathological reflexes (65.1%), paresthesia of upper limb (69.8%), and pain (67.4%).[65]

CT Myelogram – Myelography is the instillation of intrathecal contrast media under fluoroscopy. Patients are then imaged with CT to evaluate for spinal canal pathology. Although this technique has diminished greatly due to the advent of MRI and its non-invasiveness and superior soft-tissue contrast, myelography is still a useful technique for conventional indications, such as spinal stenosis, when MRI is contraindicated, nondiagnostic or surgeon preference (see guidelines above), brachial plexus injury in neonates, radiation therapy treatment planning, and cerebrospinal fluid (CSF) leak.[66]

Back Pain with Cancer History – Bone is the third most common site of metastases after the liver and the lungs, and approximately two-thirds of all osseous metastases occur in the spine. Approximately 60–70% of patients with systemic cancer will have spinal metastasis. Radiographic (x-ray) examination should be performed in cases of back pain when a patient has a cancer history, but without known active cancer or a tumor that tends to metastasize to the spine. This can make a diagnosis in many cases. This may occasionally allow for selection of bone scan in lieu of MRI in some cases. When radiographs do not answer the clinical question, then MRI may be appropriate after a consideration of conservative care.

"Neoplasms causing VCF (vertebral compression fractures) include1) primary bone neoplasms, such as hemangioma (aggressive type) or giant cell tumors, and tumor-like conditions causing bony and cellular remodeling, such as aneurysmal bone cysts, or Paget's disease (osteitis deformans); ; 2) primary malignant neoplasms including but not limited to multiple myeloma and lymphoma; and 3) metastatic neoplasms, including and not limited to, multiple myeloma and lymphoma, and metastatic neoplasms."[28]

Most common spine metastasis involving primary metastasis originate from the following tumors in descending order: breast (21%), lung (19%), prostate (7.5%), renal (5%), gastrointestinal (4.5%), and thyroid (2.5%). While all tumors can seed to the spine, the cancers mentioned above metastasize to the spinal column early in the disease process.[37]
Drop Metastases[67] – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas and less commonly choroid plexus neoplasms and teratomas.

Leptomeningeal Carcinomatosis[68] – Leptomeningeal carcinomatosis is a complication of cancer in which cancerous cells spread to the membranes (meninges) that covers the brain and spinal cord. The most common solid tumors that involve the leptomeninges are breast, lung, melanoma, gastrointestinal, and primary central nervous system tumors.

Table 2: CT and Cutaneous Stigmata[69]

Risk Stratification for Various Cutaneous Markers		
High Risk	Intermediate Risk	Low Risk
• Hypertrichosis • Infantile hemangioma • Atretic meningocele • DST • Subcutaneous lipoma • Caudal appendage • Segmental hemangiomas in association with LUMBAR‡ syndrome	• Capillary malformations (also referred to as NFS or salmon patch when pink and poorly defined or PWS when darker red and well-defined)	• Coccygeal dimple • Light hair • Isolated café au lait spots • Mongolian spots • Hypo- and hypermelanotic macules or papules • Deviated or forked gluteal cleft • Nonmidline lesions
‡LUMBAR, lower body hemangioma and other cutaneous defects, urogenital abnormalities, ulcerations, myelopathy, bony defects, anorectal malformations, arterial anomalies, and renal anomalies.		

POLICY HISTORY

Date	Summary
Dec 2023	Conservative treatment language updated in body and background
May 2023	• Updated references • Updated background section • Clarified pathological reflexes • Added pseudoarthrosis to surgery section • Added "Further evaluation of indeterminate or questionable findings on prior imaging": • Clarified cerebellar ataxia in gait table • Removed radicular pain and malaise from Isolated Back Pain in the Pediatric population: Red flags. • Removed Additional Resources • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
March 2022	Added • Combination request for overlapping body part statement • Clarified muscle weakness not related to plexopathy or peripheral neuropathy • Clarified bowel and bladder dysfunction – not related to an inherent bowel or bladder problem • Descriptions for tethered cord • Clarified CT myelogram section • Background section of Drop Metastases • Background section of Leptomeningeal Carcinomatosis • Clarified toe walking in pediatric patient with myelopathy for thoracic spine Removed • Removed from combination section syrinx and syringomyelia and added subsection for cervical and thoracic spine section • Removed pediatric back pain from the total spine combination section

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Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines: **LUMBAR SPINE CT**	**Original Date: September 1997**
CPT Codes: 72131, 72132, 72133	**Last Revised Date: December 2023**
Guideline Number: Evolent_CG_045	**Implementation Date: July 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR LUMBAR SPINE CT

[+]If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- **Inconclusive or show a need for additional or follow up imaging evaluation OR**
- **The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.**

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of neurologic deficits when Lumbar Spine MRI is contraindicated or inappropriate

- With any of the following new neurological deficits documented on physical exam
  - Extremity muscular weakness (and not likely caused by plexopathy, or peripheral neuropathy)[1, 2]
  - Pathologic or abnormal reflexes (and not likely caused by plexopathy, or peripheral neuropathy)

    - Absent/decreased sensory changes along a particular lumbar dermatome (nerve distribution): pin prick, touch, vibration, proprioception or temperature (and not likely caused by plexopathy, or peripheral neuropathy)
    - Lower extremity increased muscle tone
    - New onset bowel or bladder dysfunction (e.g., retention or incontinence)- not related to an inherent bowel or bladder process
    - Gait abnormalities (see Table 1 for more details)
    - New onset foot drop (Not related to a peripheral nerve injury, e.g., peroneal nerve)
- Cauda Equina Syndrome as evidence by severe back pain/sciatica along with one of the defined symptoms (see Overview section)

For evaluation of back pain with any of the following when Lumbar Spine MRI is contraindicated[3-11]

- With new or worsening objective neurologic deficits* on exam, as above
- Failure of conservative treatment* for a minimum of six (6) weeks within the last six (6) months;
  NOTE - Failure of conservative treatment is defined as one of the following:
    - Lack of meaningful improvement after a full course of treatment; **OR**
    - Progression or worsening of symptoms during treatment; **OR**
    - Documentation of a medical reason the member is unable to participate in treatment

  Closure of medical or therapy offices, patient inconvenience, or noncompliance without explanation does not constitute "inability to complete" treatment.
- With progression or worsening of symptoms during the course of conservative treatment*
- With an abnormal electromyography (EMG) or nerve conduction study (if performed) indicating a lumbar radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain[12])
- Isolated back pain in pediatric population[13] - conservative care not required if red flags present. Red flags that prompt imaging include any of the following:
    - Age 5 or younger, **OR**
    - Constant pain, **OR**
    - Pain lasting > 4 weeks, **OR**
    - Abnormal neurologic examination, **OR**
    - Early morning stiffness and/or gelling, **OR**
    - Night pain that prevents or disrupts sleep, **OR**
    - Radicular pain, **OR**
    - Fever or weight loss or malaise, **OR**
    - Postural changes (e.g., kyphosis or scoliosis), **OR**
    - Limp (or refusal to walk in a younger child)[14, 15]

As part of initial pre-operative/post-operative/procedural evaluation ("CT best examination to assess for hardware complication, extent of fusion and pseudoarthrosis"[11, 16] and MRI for cord, nerve root compression, disc pathology, or post-op infection)

[Note: If ordered by Neurosurgeon or orthopedic surgeon for purposes of surgical planning, a contraindication to MRI is not required.]

- For preoperative evaluation/planning
- CT discogram
- Evaluation of post operative pseudoarthrosis after initial x-rays (CT should not be done before 6 months after surgery)
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula -preferred exam CT myelogram))[17]
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery in the last 6 months. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested (routine surveillance post-op not indicated without symptoms)
- Surgical infection as evidenced by signs/symptoms, laboratory, or prior imaging findings
- New or changing neurological deficits or symptoms post-operatively[16, 18] - see neurological deficit section above
- When combo requests are submitted (see above statement[+]) (i.e., MRI and CT of the spine), the office notes should clearly document the need for both studies to be done simultaneously, i.e., the need for both soft tissue and bony anatomy is required[19]
    - Combination requests where both lumbar spine CT and MRI lumbar spine are both approvable (not an all-inclusive list):
        - Pathologic or complex fractures
        - Malignant process of spine with both bony and soft tissue involvement
        - Clearly documented indication for bony and soft tissue abnormality where assessment will change management for the patient

For evaluation of trauma or acute injury[20]

- Presents with any of the following neurological deficits as above
- With progression or worsening of symptoms during the course of conservative treatment*
- History of underlying spinal abnormalities (i.e., ankylosing spondylitis or diffuse idiopathic skeletal hyperostosis) (Both MRI and CT would be approvable)[21]
- When the patient is clinically unevaluable or there are preliminary imaging findings (x-ray or CT) needing further evaluation

("MRI and CT provide complementary information. When indicated it is appropriate to perform both examinations")[20]

For evaluation of known fracture or new compression fractures with worsening back pain[20, 22]

- To assess union of a fracture when physical examination, plain radiographs, or prior imaging suggest delayed or non-healing
- To determine the position of fracture fragments
- With history of malignancy (if MRI is contraindicated or cannot be performed)
- With an associated new focal neurologic deficit as above[23]
- Prior to a planned surgery/intervention or if the results of the CT will change management

CT myelogram: When MRI cannot be performed/contraindicated/surgeon preference

- When signs and symptoms are inconsistent or not explained by the MRI findings[24-28]
- Demonstration of the site of a CSF leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula)
- Surgical planning, especially regarding to the nerve roots or evaluation of dural sac

Pars defect (spondylolysis) or spondylolisthesis

- Pars defect (spondylolysis) or spondylolisthesis in adults when Flexion/Extension x-rays show instability
- Clinically suspected Pars defect (spondylolysis) which is not seen on plain films in pediatric population (<18 yr) (flexion extension instability not required) and imaging would change treatment[29-31] when MRI is contraindicated/cannot be performed or surgeon preference

NOTE: Initial imaging (x-ray, or planar bone scan without SPECT; Bone scan with SPECT is superior to MRI and CT in the detection of pars interarticularis pathology including spondylolysis)[32]

For evaluation of tumor, cancer, or metastasis with any of the following:

(MRI is usually the preferred study- CT may be needed to further characterize solitary indeterminate lesions seen on MRI)[33, 34]

- **Primary tumor**
    - Initial staging primary spinal tumor[35]
    - Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
    - Known spinal tumor with new signs or symptoms (e.g., new or increasing nontraumatic pain, physical, laboratory, and/or imaging findings)

    - With an associated new focal neurologic deficit as above[23]
- **Metastatic tumor**
    - With evidence of metastasis on bone scan needing further clarification OR inconclusive findings on a prior imaging exam
    - With an associated new focal neurologic deficit[23]
    - Known malignancy with new signs or symptoms (e.g., new or increasing nontraumatic pain, radiculopathy or back pain that occurs at night and wakes the patient from sleep with known active cancer, physical, laboratory, and/or imaging findings) in a tumor that tends to metastasize to the spine[36, 37]

Further evaluation of indeterminate or questionable findings on prior imaging.

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification. When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding [36]
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam (When MRI cannot be performed, is contraindicated, or CT is preferred to characterize the finding [36]

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of known or suspected infection (osteomyelitis), abscess or inflammatory disease when Lumbar Spine MRI is contraindicated[4, 38, 39,42]

- **Infection:**
    - As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings[40]
    - Follow-up imaging of infection
        - With worsening symptoms/laboratory values (i.e., white blood cell count, ESR/CRP) or radiographic findings[41]
- **Spondyloarthropathies**
    - Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and rheumatology workup

For evaluation of spine abnormalities related to immune system suppression, e.g., HIV, chemotherapy, leukemia, or lymphoma, and Lumbar Spine MRI is contraindicated[38]

- As evidenced by signs/symptoms, laboratory, or prior imaging findings

Other Indications for a Lumbar Spine CT when MRI is contraindicated or cannot be performed

(Note- See combination requests, below, for initial advanced imaging assessment and pre-operatively)

- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata[42-44]
- Known anorectal malformations[45, 46]
- Suspicious sacral dimple (those that are deep, larger than 0.5 cm, located within the superior portion of the gluteal crease or above the gluteal crease, multiple dimples, or associated with other cutaneous markers) (D'Alessandro, 2009) or duplicated or deviated gluteal cleft[47]
    - in patients ≤ 3 months should have ultrasound
- Toe walking in a child when associated with upper motor neuron signs, including hyperreflexia, spasticity; or orthopedic deformity with concern for spinal cord pathology/tethered cord (e.g., pes cavus, clawed toes, leg, or foot length deformity (excluding tight heel cords))
- Known Chiari II (Arnold-Chiari syndrome), III, or IV malformation
- For follow-up/repeat evaluation of Arnold-Chiari I with new signs or symptoms suggesting recurrent spinal cord tethering (For initial diagnosis see below)
- Suspected neuroinflammatory Conditions/Diseases (e.g., sarcoidosis, Behcet's)
    - After detailed neurological exam and appropriate initial work up completed

COMBINATION STUDIES WITH LUMBAR SPINE CT WHEN MRI IS CONTRAINDICATED OR CANNOT BE PERFORMED OR SURGEON PREFERENCE

Any combination of Cervical and/or Thoracic and/or Lumbar CTs

Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history, and other available information, including prior imaging.

Exception- Indications for combination studies[48, 49]: Are approved indications as noted below and being performed in children who will need anesthesia for the procedure

- Any combination of these studies for:
    - Survey/complete initial assessment of infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10[50-52] (e.g., congenital scoliosis, idiopathic scoliosis, scoliosis with vertebral anomalies)
    - In the presence of neurological deficit, progressive spinal deformity, or for preoperative planning[53]
    - Back pain with known vertebral anomalies (hemivertebrae, hypoplasia, agenesis, butterfly, segmentation defect, bars, or congenital wedging) in a child on preliminary imaging

    - Scoliosis with any of the following[54]:
        - Progressive spinal deformity;
        - Neurologic deficit (new or unexplained);
        - Early onset;
        - Atypical curve (e.g., short segment, >30' kyphosis, left thoracic curve, associated organ anomalies);
        - Pre-operative planning; OR
        - When office notes clearly document how imaging will change management
- Arnold-Chiari malformations[55, 56]
    - Arnold-Chiari I
        - For evaluation of spinal abnormalities associated with initial diagnosis of Arnold-Chiari Malformation. (C/T/L spine due to association with tethered cord and syringomyelia), and initial imaging has not been completed[44, 50]
    - Arnold-Chiari II-IV - For initial evaluation and follow-up as appropriate
        - Usually associated with open and closed spinal dysraphism, particularly meningomyelocele)
- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata,[42-44] when anesthesia required for imaging[57] (e.g., meningomyelocele, lipomeningomyelocele, diastematomyelia, fatty/thickened filum terminale, and other spinal cord malformations)
- Oncological Applications (e.g., primary nervous system, metastatic)
    - Drop metastasis from brain or spine (imaging also includes brain; CT spine imaging in this scenario is usually CT myelogram)- See Overview
    - Suspected leptomeningeal carcinomatosis (LC)[58]- See Overview
    - Any combination of these for spinal survey in patient with metastases
    - Tumor evaluation and monitoring in neurocutaneous syndromes
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula -preferred exam CT myelogram))[17]
- CT myelogram when meets above guidelines and MRI is contraindicated or for surgical planning
- Post-procedure (discogram) CT

BACKGROUND

Computed tomography is used for the evaluation, assessment of severity, and follow-up of diseases of the spine. Its use in the thoracic spine is limited, however, due to the lack of epidural fat in this part of the body. CT myelography improves the contrast severity of CT, but it is also invasive. CT may be used for conditions, e.g., degenerative changes, infection, and immune suppression, when magnetic resonance imaging (MRI) is contraindicated. It may also be used in the evaluation of tumors, cancer, or metastasis in the thoracic spine, and it may be used for preoperative and post-surgical evaluations. CT obtains images from different angles and uses computer processing to show a cross-section of body tissues and organs. CT is fast and is often performed in acute settings. It provides good visualization of cortical bone.

OVERVIEW

*Conservative Treatment

Non-operative conservative treatment should include a multimodality approach consisting of at least one (1) active and one (1) inactive component targeting the affected region.

Active Modalities

- Physical therapy
- Physician-supervised home exercise program**
- Chiropractic care

Inactive Modalities

- Medications (e.g., NSAIDs, steroids, analgesics)
- Injections (e.g., epidural injection, selective nerve root block)
- Medical Devices (e.g., TENS unit, bracing)

**Home Exercise Program (HEP)

The following two elements are required to meet conservative therapy guidelines for HEP:[4, 11]

- Documentation of an exercise prescription/plan provided by a physician, physical therapist, or chiropractor; **AND**
- Follow-up documentation regarding completion of HEP after the required 6-week timeframe or inability to complete HEP due to a documented medical reason (e.g., increased pain or inability to physically perform exercises).

Table 1: Gait and spine imaging[59-64]

Gait	Characteristic	Work up/Imaging
Hemiparetic	Spastic unilateral, circumduction	Brain and/or, Cervical spine imaging based on associated symptoms
Diplegic	Spastic bilateral, circumduction	Brain, Cervical and Thoracic Spine imaging
Myelopathic	Wide based, stiff, unsteady	Cervical and/or Thoracic spine MRI based on associated symptoms
Cerebellar ataxic	Broad based, clumsy, staggering, lack of coordination, usually also with limb ataxia	Brain imaging see Brain MRI Guideline
Apraxic	Magnetic, shuffling, difficulty initiating	Brain imaging see Brain MRI Guideline
Parkinsonian	Stooped, small steps, rigid, turning en bloc, decreased arm swing	Brain Imaging see Brain MRI Guideline
Choreiform	Irregular, jerky, involuntary movements	Medication review, consider brain imaging as per movement disorder Brain MR guidelines
Sensory ataxic	Cautious, stomping, worsening without visual input (ie + Romberg)	EMG, blood work, consider spinal (cervical or thoracic cord imaging) imaging based on EMG
Neurogenic	Steppage, dragging of toes	• EMG initial testing; • BUT if there is a foot drop, lumbar spine MRI is appropriate without EMG • Pelvis MR if there is evidence of plexopathy
Vestibular	Insecure, veer to one side, worse when eyes closed, vertigo	Consider Brain/IAC MRI see Brain MRI Guideline

Table 2: CT and Cutaneous Stigmata[65]

Risk Stratification for Various Cutaneous Markers		
High Risk	Intermediate Risk	Low Risk
• Hypertrichosis • Infantile hemangioma • Atretic meningocele • DST • Subcutaneous lipoma • Caudal appendage • Segmental hemangiomas in association with LUMBAR‡ syndrome	• Capillary malformations (also referred to as NFS or salmon patch when pink and poorly defined or PWS when darker red and well-defined)	• Coccygeal dimple • Light hair • Isolated café au lait spots • Mongolian spots • Hypo- and hypermelanotic macules or papules • Deviated or forked gluteal cleft • Nonmidline lesions
‡LUMBAR, lower body hemangioma and other cutaneous defects, urogenital abnormalities, ulcerations, myelopathy, bony defects, anorectal malformations, arterial anomalies, and renal anomalies.		

Tethered spinal cord syndrome – a neurological disorder caused by tissue attachments that limit the movement of the spinal cord within the spinal column. Although this condition is rare, it can continue undiagnosed into adulthood. The primary cause is myelomeningocele and lipomyelomeningocele; the following are other causes that vary in severity of symptoms and treatment.

- Dermal sinus tract (a rare congenital deformity)
- Diastematomyelia (split spinal cord)
- Lipoma
- Tumor
- Thickened/tight filum terminale
- History of spine trauma/surgery
- Arnold-Chiari Malformation

Sacral Dimples – Simple midline dimples are the most commonly encountered dorsal cutaneous stigmata in neonates and indicate low risk for spinal dysraphism. Only atypical dimples are associated with a high risk for spinal dysraphism, particularly those that are large (>5 mm), high on the back (>2.5 cm from the anus), or appear in combination with other lesions.[66] High-risk cutaneous stigmata in neonates include hemangiomas, upraised lesions (i.e., masses, tails, and hairy patches), and multiple cutaneous stigmata (**Table 2**).

Back Pain with Cancer History – Bone is the third most common site of metastases after the liver and the lungs, and approximately two-thirds of all osseous metastases occur in the spine.

Approximately 60–70% of patients with systemic cancer will have spinal metastasis. Radiographic (x-ray) examination should be performed in cases of back pain when a patient has a cancer history, but without known active cancer or a tumor that tends to metastasize to the spine. This can make a diagnosis in many cases. This may occasionally allow for selection of bone scan in lieu of MRI in some cases. When radiographs do not answer the clinical question, then MRI may be appropriate after a consideration of conservative care.

"Neoplasms causing VCF (vertebral compression fractures) include: 1) primary bone neoplasms, such as hemangioma (aggressive type) or giant cell tumors, and tumor-like conditions causing bony and cellular remodeling, such as aneurysmal bone cysts, or Paget's disease (osteitis deformans), 2) primary malignant neoplasms including but not limited to multiple myeloma and lymphoma and 3) metastatic neoplasms."[22]

Most common spine metastasis involving primary metastasis originate from the following tumors in descending order: breast (21%), lung (19%), prostate (7.5%), renal (5%), gastrointestinal (4.5%), and thyroid (2.5%). While all tumor can seed to the spine, the cancers mentioned above metastasize to the spinal column early in the disease process.[37]

CT Myelogram – Myelography is the instillation of intrathecal contrast media under fluoroscopy. Patients are then imaged with CT to evaluate for spinal canal pathology. Although this technique has diminished greatly due to the advent of MRI due to its non-invasiveness and superior soft-tissue contrast, myelography is still a useful technique for conventional indications, such as spinal stenosis, when MRI is contraindicated, nondiagnostic, or surgeon preference (see guidelines above) brachial plexus injury in neonates, radiation therapy treatment planning, and cerebrospinal fluid (CSF) leak.

Cauda Equina Syndrome

- Symptoms include severe back pain or sciatica along with one or more of the following:
    - Saddle anesthesia - loss of sensation restricted to the area of the buttocks, perineum and inner surfaces of the thighs (areas that would sit on a saddle).
    - Recent bladder/bowel dysfunction
    - Achilles reflex absent on both sides
    - Sexual dysfunction that can come on suddenly
    - Absent anal reflex and bulbocavernosus reflex
- This is a "Red Flag" situation and Lumbar Spine MRI is approvable.

Drop Metastases[67] – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas and less commonly choroid plexus neoplasms and teratomas.

Leptomeningeal Carcinomatosis[68] – Leptomeningeal carcinomatosis is a complication of cancer in which cancerous cells spread to the membranes (meninges) that covers the brain and spinal cord. The most common solid tumors that involve the leptomeninges are breast, lung, melanoma, gastrointestinal, and primary central nervous system tumors.

POLICY HISTORY

Date	Summary
Dec 2023	Conservative treatment language updated in body and background
May 2023	• Updated references • Updated background section • Clarified pathological reflexes • Added pseudoarthrosis to surgery section • Added "Further evaluation of indeterminate or questionable findings on prior imaging": • Clarified cerebellar ataxia in gait table • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Removed Additional Resources
March 2022	Added • Combination request for overlapping body part statement • Clarified muscle weakness no related to plexopathy or peripheral neuropathy • Clarified bowel and bladder dysfunction – not related to an inherent bowel or bladder problem • Descriptions for tethered cord • Clarified CT myelogram section • Background section of Drop Metastases • Background section of Leptomeningeal Carcinomatosis • Clarified toe walking in pediatric patient • Added section on neuroinflammatory conditions Removed • Removed from combination section syrinx and syringomyelia and added subsection for cervical and thoracic spine section Removed pediatric back pain from the total spine combination section

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*Evolent	
Clinical guideline **CERVICAL SPINE MRI**	**Original Date: September 1997**
CPT Codes: 72141, 72142, 72156, +0698T	**Last Revised Date: December 2023**
Guideline Number: Evolent_CG_040	**Implementation Date: July 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CERVICAL SPINE MRI

+ If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- **Inconclusive or show a need for additional or follow up imaging evaluation OR**
- **The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.**

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of neurologic deficits[1-6]

- With any of the following new neurological deficits documented on physical exam
  - Extremity muscular weakness (and not likely caused by plexopathy, or peripheral neuropathy)
  - Pathologic (e.g., Babinski, Lhermitte's sign, Chaddock Sign, Hoffman's and other upper motor neuron signs); **OR** abnormal deep tendon reflexes (and not likely caused by plexopathy, or peripheral neuropathy)
  - Absent/decreased sensory changes along a particular cervical dermatome (nerve distribution): pin prick, touch, vibration, proprioception, or temperature (and not likely caused by plexopathy, or peripheral neuropathy)

- Upper or lower extremity increase muscle tone/spasticity
- New onset bowel or bladder dysfunction (e.g., retention or incontinence)- not related to an inherent bowel or bladder process
- Gait abnormalities (see Table 1 for more details)

- Suspected cervical cord compression with any neurological deficits as listed above

For evaluation of neck pain with any of the following[7-9]

- With new or worsening objective neurologic deficits (as listed above) on exam
- Failure of conservative treatment* for a minimum of six (6) weeks within the last six (6) months;[10]

  NOTE - Failure of conservative treatment is defined as one of the following:
  - Lack of meaningful improvement after a full course of treatment; **OR**
  - Progression or worsening of symptoms during treatment; **OR**
  - Documentation of a medical reason the member is unable to participate in treatment

  Closure of medical or therapy offices, patient inconvenience, or noncompliance without explanation does not constitute "inability to complete" treatment.
- With progression or worsening of symptoms during the course of conservative treatment*
- With an abnormal electromyography (EMG) or nerve conduction study (if performed) indicating a cervical radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain.)[11]
- Isolated back pain in pediatric population[12, 13] – conservative care not required if red flags present.

  Red flags that prompt imaging include any of the following:
  - Age 5 or younger **OR**
  - Constant pain, **OR**
  - Pain lasting > 4 weeks, **OR**
  - Abnormal neurologic examination, **OR**
  - Early morning stiffness and/or gelling; **OR**
  - Night pain that prevents or disrupts sleep; **OR**
  - Radicular pain; **OR**
  - Fever or weight loss or malaise **OR**[14, 15]
  - Postural changes (e.g., kyphosis or scoliosis) **OR**
  - Limp (or refusal to walk in a younger child)

As part of initial pre-operative / post-operative / procedural evaluation ("CT best examination to assess for hardware complication, extent of fusion and pseudoarthrosis"[12, 16] and MRI for cord, nerve root compression, disc pathology or post-op infection)

- For preoperative evaluation/planning
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar

puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula))

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery in the last 6 months. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested (routine surveillance post-op not indicated without symptoms)
- Surgical infection as evidenced by signs/symptoms, laboratory, or prior imaging findings
- New or changing neurological deficits or symptoms post-operatively[16, 17] - see neurological deficit section above
- When combo requests (see above statement[+]) are submitted (e.g., MRI and CT of the spine), the office notes should clearly document the need for both studies to be done simultaneously (e.g., the need for both soft tissue and bony anatomy is required)[18]
    - Combination requests where both cervical spine CT and MRI cervical spine are both approvable (not an all-inclusive list):
        - OPLL (Ossification of posterior longitudinal ligament)[19]
        - Pathologic or complex fractures
        - Malignant process of spine with both bony and soft tissue involvement
        - Unstable craniocervical junction
        - Clearly documented indication for bony and soft tissue abnormality where assessment will change management (i.e., surgical approach) for the patient

For evaluation of suspected myelopathy[20-24]

- Does **NOT** require conservative care
- Progressive symptoms including hand clumsiness, worsening handwriting, difficulty with grasping and holding objects, diffuse numbness in the hands, pins and needles sensation, increasing difficulty with balance and ambulation
- Any of the neurological deficits as noted above

For evaluation of known or suspected multiple sclerosis (MS)[20, 25-27]

- Evidence of MS on recent baseline Brain MRI
- Suspected or known MS with new or changing symptoms consistent with cervical spinal cord disease (focal neurologic deficit or clinical sign, e.g., Lhermitte sign)
- Suspected or known pediatric demyelinating diseases (MS/ADEM)

Combination studies MS[28]

- **These body regions might be evaluated separately or in combination as guided by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history (e.g., symptom(s), time course, and where in the CNS the likely localization(s) is/are), and other available information, including prior imaging.**

- Cervical **and/or** Thoracic MRI for evaluation of highly suspected multiple sclerosis (MS) when Brain MRI has indeterminate findings and/or does not fulfill the McDonald criteria for the diagnosis of MS[26]
- Cervical **and/or** Thoracic MRI with suspected transverse myelitis - with appropriate clinical symptoms (e.g., bilateral weakness, sensory disturbance, and autonomic dysfunction which typically evolve over hours or days)
- Brain MRI with Cervical **and/or** Thoracic MRI for evaluation of neuromyelitis optica spectrum disorders (recurrent or bilateral optic neuritis; recurrent transverse myelitis)[29]
- Known MS, entire CNS axis (Brain, **and/or** Cervical **and/or** Thoracic spine) is approvable prior to the initiation or change of disease modification treatments and assess disease burden (to establish a new baseline)
- Known MS- Follow-up scans, including brain and spine imaging, if patients have known spine disease:
  - 6-12 months after starting/changing treatment
  - Every 1-2 years while on disease-modifying therapy to assess for subclinical disease activity, less frequently when stable for 2-3 years

For evaluation of trauma or acute injury[12, 30]

- Presents with any of the following neurological deficits noted above
- With progression or worsening of symptoms during the course of conservative treatment*
- History of underlying spinal abnormalities (i.e., ankylosing spondylitis, diffuse idiopathic skeletal hyperostosis) (Both MRI and CT would be approvable)[31-33]
- When the patient is clinically unevaluable or there are preliminary imaging findings (x-ray or CT) needing further evaluation
- When office notes specify the patient meets NEXUS (National Emergency X-Radiography Utilization Study) or CCR (Canadian Cervical Rules) criteria for imaging:
  - CT for initial imaging
  - MRI when suspect spinal cord or nerve root injury or when patient is obtunded, and CT is negative
  - CT or MRI for treatment planning of unstable spine

("MRI and CT provide complementary information. When indicated it is appropriate to perform both examinations")[31]

For evaluation of known or new compression fractures with worsening neck pain[12]

- With history of malignancy
  - To aid in differentiation of benign osteoporotic fractures from metastatic disease
    - A follow-up MRI in 6-8 weeks after initial MRI when initial imaging cannot decipher (indeterminate) benign osteoporotic fracture from metastatic disease (Kumar, 2016)
- With an associated new focal neurologic deficit as above[34]
- Prior to a planned surgery/intervention or if the results of the MRI will change management

For evaluation of tumor, cancer, or metastasis with any of the following:

(MRI is usually the preferred study, but CT may be needed to further characterize solitary indeterminate lesions seen on MRI)[12, 35-37]

- **Primary tumor**
  - Initial staging primary spinal tumor[38]
  - Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
  - Known spinal tumor with new signs or symptoms (e.g., new or increasing nontraumatic pain, physical, laboratory, and/or imaging findings)
  - With an associated new focal neurologic deficit as above[34]
- **Metastatic tumor**
  - With evidence of metastasis on bone scan needing further clarification OR inconclusive findings on a prior imaging exam
  - With an associated new focal neurologic deficit[34]
  - Known malignancy with new signs or symptoms (e.g., new or increasing nontraumatic pain, radiculopathy or neck pain that occurs at night and wakes the patient from sleep with known active cancer, physical, laboratory, and/or imaging findings) in a tumor that tends to metastasize to the spine[12, 39]

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated, OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of known or suspected infection (osteomyelitis)/abscess[12,40]

- Infection
  - As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings[41]
  - Follow-up imaging of infection
    - With worsening symptoms/laboratory values (i.e., white blood cell count, ESR/CRP) or radiographic findings[42]

For evaluation of known or suspected inflammatory disease or atlantoaxial instability

- In rheumatoid arthritis with neurologic signs/symptoms, or evidence of subluxation on radiographs (lateral radiograph in flexion and neutral should be the initial study)[43, 44]
    - Patients with negative radiographs but symptoms suggestive of cervical instability or in patients with neurologic deficits MRI is indicated[45]
- High-risk disorders affecting the atlantoaxial articulation, such as Down syndrome, Marfan syndrome with neurological signs/symptoms, abnormal neurological exam, or evidence of abnormal or inconclusive radiographs of the cervical spine[46]
- Spondyloarthropathies, known or suspected
    - Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and appropriate rheumatology workup

For evaluation of spine abnormalities related to immune system suppression, e.g., HIV, chemotherapy, leukemia, or lymphoma[47, 48]

- As evidenced by signs/symptoms, laboratory, or prior imaging findings

Other Indications for a Cervical Spine MRI

(Note- See combination requests, below, for initial advanced imaging assessment and pre-operatively)

- Tethered cord or spinal dysraphism (known or suspected), based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata[49-51]
    - Known Arnold-Chiari syndrome (For initial imaging (one-time initial MRI-modality assessment) see combination below)
    - Known Chiari I malformation without syrinx or hydrocephalus, follow-up imaging after initial diagnosis with new or changing signs/symptoms or exam findings consistent with spinal cord pathology[52]
    - Known Chiari II (Arnold-Chiari syndrome), III, or IV malformation
- Achondroplasia (one Cervical Spine MRI to assess the craniocervical junction, as early as possible, even in asymptomatic cases)[53, 54]
- Syrinx or syringomyelia (known or suspected)
    - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis[55])
    - To further characterize a suspicious abnormality seen on prior imaging
    - Known syrinx with new/worsening symptoms
- Toe walking in a child with signs/symptoms of myelopathy localized to the Cervical Spine
- Suspected neuroinflammatory Conditions/Diseases (e.g., sarcoidosis, Behcet's)
    - After detailed neurological exam and appropriate initial work up
- Initial evaluation of trigeminal neuralgia[56] not explained on recent Brain imaging

COMBINATION OF STUDIES WITH CERVICAL SPINE MR

Brain MRI/Cervical MRI

- For evaluation of known Arnold-Chiari Malformation

Cervical and Thoracic MRI

- Initial evaluation of known or suspected syrinx or syringomyelia
    - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis[55])
    - To further characterize a suspicious abnormality seen on prior imaging
    - Known syrinx with new/worsening symptom

Any combination of Cervical and/or Thoracic and/or Lumbar MRIs

Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history, and other available information, including prior imaging.

Exception- Indications for combination studies[57, 58]: Are approved indications as noted below and being performed in children who will need anesthesia for the procedure

- Any combination of these studies for:
    - Survey/complete initial assessment of infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10[59-61] (e.g., congenital scoliosis, idiopathic scoliosis, scoliosis with vertebral anomalies)
    - In the presence of neurological deficit, progressive spinal deformity, or for preoperative planning[62]
    - Back pain with known vertebral anomalies (hemivertebrae, hypoplasia, agenesis, butterfly, segmentation defect, bars, or congenital wedging) in a child on preliminary imaging
    - Scoliosis with any of the following[63]:
        - Progressive spinal deformity
        - Neurologic deficit (new or unexplained)
        - Early onset
        - Atypical curve (e.g., short segment, > 30’ kyphosis, left thoracic curve, associated organ anomalies)
        - Pre-operative planning; OR
        - When office notes clearly document how imaging will change management
- Arnold-Chiari malformations[64, 65]
    - Arnold-Chiari I
        - For evaluation of spinal abnormalities associated with initial diagnosis of Arnold-Chiari Malformation. (C/T/L spine due to association with tethered cord and syringomyelia), and initial imaging has not been completed[51, 59]
    - Arnold-Chiari II-IV - For initial evaluation and follow-up as appropriate

        - Usually associated with open and closed spinal dysraphism, particularly meningomyelocele
- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata,[49-51] when anesthesia required for imaging[66] (e.g., meningomyelocele, lipomeningomyelocele, diastematomyelia, fatty/thickened filum terminale, and other spinal cord malformations)
- Oncological applications (e.g., primary nervous system, metastatic)
    - Drop metastasis from brain or spine (imaging also includes brain)- see Overview section
    - Suspected leptomeningeal carcinomatosis (LC)[67] -see Overview section
    - Any combination of these for spinal survey in patient with metastases
    - Tumor evaluation and monitoring in neurocutaneous syndromes - See Overview section
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula))

BACKGROUND

Magnetic resonance imaging (MRI) produces high quality multiplanar images of organs and structures within the body without radiation. It is the preferred modality for evaluating the internal structure of the spinal cord, providing assessment of conditions such as degenerative disc pathology, osteomyelitis, and discitis.

OVERVIEW

***Conservative Treatment**
Non-operative conservative treatment should include a multimodality approach consisting of at least one (1) active and one (1) inactive component targeting the affected region.

Active Modalities

- Physical therapy
- Physician-supervised home exercise program**
- Chiropractic care

Inactive Modalities

- Medications (e.g., NSAIDs, steroids, analgesics)
- Injections (e.g., epidural injection, selective nerve root block)
- Medical Devices (e.g., TENS unit, bracing)

****Home Exercise Program (HEP)**
The following two elements are required to meet conservative therapy guidelines for HEP:[68, 69]

- Documentation of an exercise prescription/plan provided by a physician, physical therapist, or chiropractor; **AND**

- Follow-up documentation regarding completion of HEP after the required 6-week timeframe or inability to complete HEP due to a documented medical reason (e.g., increased pain or inability to physically perform exercises).

Cervical myelopathy – Symptom severity varies, and a high index of suspicion is essential for making the proper diagnosis in early cases. Symptoms of pain and radiculopathy may not be present. The natural history of myelopathy is characterized by neurological deterioration. The most frequently encountered symptom is gait abnormality (86%) followed by increased muscular reflexes (79.1%), pathological reflexes (65.1%), paresthesia of upper limb (69.8%), and pain (67.4%).[24]

Table 1: Gait and spine imaging[70-75]

Gait	Characteristic	Work up/Imaging
Hemiparetic	**Spastic unilateral, circumduction**	**Brain and/or, Cervical spine imaging based on associated symptoms**
Diplegic	**Spastic bilateral, circumduction**	**Brain, Cervical and Thoracic Spine imaging**
Myelopathic	**Wide based, stiff, unsteady**	**Cervical and/or Thoracic spine MRI based on associated symptoms**
Cerebellar Ataxic	**Broad based, clumsy, staggering, lack of coordination, usually also with limb ataxia**	**Brain imaging - see Brain MRI Guideline**
Apraxic	**Magnetic, shuffling, difficulty initiating**	**Brain imaging - see Brain MRI Guideline**
Parkinsonian	**Stooped, small steps, rigid, turning en bloc, decreased arm swing**	**Brain Imaging - see Brain MRI Guideline**
Choreiform	**Irregular, jerky, involuntary movements**	**Medication review, consider brain imaging as per movement disorder Brain MR guidelines**
Sensory ataxic	**Cautious, stomping, worsening without visual input (ie + Romberg)**	**EMG, blood work, consider spinal (cervical or thoracic cord imaging) imaging based on EMG**
Neurogenic	**Steppage, dragging of toes**	• **EMG initial testing;** • **BUT if there is a foot drop, lumbar spine MRI is appropriate without EMG** • **Pelvis MR if there is evidence of plexopathy**
Vestibular	**Insecure, veer to one side, worse when eyes closed, vertigo**	**Consider Brain/IAC MR- see Brain MRI Guideline**

Table 2: MRI and Cutaneous Stigmata[OBJ]

Risk Stratification for Various Cutaneous Markers		
High Risk	Intermediate Risk	Low Risk
• Hypertrichosis • Infantile hemangioma • Atretic meningocele • DST • Subcutaneous lipoma • Caudal appendage • Segmental hemangiomas in association with LUMBAR[‡] syndrome	• Capillary malformations (also referred to as NFS or salmon patch when pink and poorly defined or PWS when darker red and well-defined)	• Coccygeal dimple • Light hair • Isolated café au lait spots • Mongolian spots • Hypo- and hypermelanotic macules or papules • Deviated or forked gluteal cleft • Nonmidline lesions
[‡]LUMBAR, lower body hemangioma and other cutaneous defects, urogenital abnormalities, ulcerations, myelopathy, bony defects, anorectal malformations, arterial anomalies, and renal anomalies.		

Ossification Posterior Longitudinal Ligament (OPLL)[19] – Most common in cervical spine (rare but more severe in thoracic spine)

Neck and Back Pain with Cancer History – Bone is the third most common site of metastases after the liver and the lungs, and approximately two-thirds of all osseous metastases occur in the spine. Approximately 60–70% of patients with systemic cancer will have spinal metastasis. Radiographic (x-ray) examination should be performed in cases of back pain when a patient has a cancer history, but without known active cancer or a tumor that tends to metastasize to the spine. This can make a diagnosis in many cases. This may occasionally allow for selection of bone scan in lieu of MRI in some cases. When radiographs do not answer the clinical question, then MRI may be appropriate after a consideration of conservative care.

Most common spine metastasis involving primary metastasis originate from the following tumors in descending order: breast (21%), lung (19%), prostate (7.5%), renal (5%), gastrointestinal (4.5%), and thyroid (2.5%). While all tumors can seed to the spine, the cancers mentioned above metastasize to the spinal column early in the disease process. Spinal metastasis is more commonly found in the thoracic region, followed by the lumbar region, while the cervical region is the least likely site of metastasis.[39]

MRI and Neurocutaneous Syndromes

- In NF-1, clinical evaluation appears to be more useful to detect complications than is screening imaging in asymptomatic patients. Imaging is indicated in evaluation of suspected tumors based on clinical evaluation and for follow-up of known intracranial and intraspinal tumors.[76]

- Conversely in NF-2, routine MR imaging screening is always indicated, given the high prevalence of CNS tumors, especially vestibular schwannomas. In patients with NF-2, routine screening brain/IAC imaging is indicated annually starting from age 10, if asymptomatic, or earlier with clinical signs/symptoms. Most individuals with NF2 eventually develop a spinal tumor, mostly commonly schwannomas, but meningioma and ependymomas are also seen. Spinal imaging at baseline and every 2 to 3 years is also advised with more frequent imaging, if warranted, based on sites of tumor involvement.[77]
- In patients with Tuberous Sclerosis, Brain MRI should be obtained every 1-3 years up until age 25 for surveillance for CNS abnormalities.[78]
- In Von Hippel Lindau Syndrome, imaging of the brain and spinal cord for hemangioblastomas is recommended every 2 years.[79]
- In Sturge Weber Syndrome, Brain MRI can rule out intracranial involvement after only age 1 and is recommended in patients <1 year old only if symptomatic.[80]

Drop Metastases[81] – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas, and less commonly choroid plexus neoplasms and teratomas.

Leptomeningeal Carcinomatosis[82] – Leptomeningeal carcinomatosis is complication of cancer in which cancerous cells spread to the membranes (meninges) that covers the brain and spinal cord. The most common solid tumors that involve the leptomeninges are breast, lung, melanoma, gastrointestinal, and primary central nervous system tumors.

POLICY HISTORY

Date	Summary
Dec 2023	Conservative treatment language updated in body and background
May 2023	• Updated references • Updated background section • Clarified pathological reflexes • Added trigeminal neuralgia • Added "Further evaluation of indeterminate or questionable findings on prior imaging": • Clarified cerebellar ataxia in gait table • Removed Additional Resources • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding clinical indications not addressed in the guideline.
March 2022	Added • Combination request for overlapping body part statement • Clarified muscle weakness no related to plexopathy or peripheral neuropathy • Clarified bowel and bladder dysfunction – not related to an inherent bowel or bladder problem • Clarified isolated neck pain in pediatric patient • Clarified combination MS for cervical and/or thoracic spine combination requests • Added subsection for cervical and thoracic spine section for syrinx and syringomyelia • Descriptions for tethered cord • Background section of Drop Metastases • Background section of Leptomeningeal Carcinomatosis • Clarified toe walking in pediatric patient with myelopathy for cervical spine Removed • Removed from combination section syrinx and syringomyelia and added subsection for cervical and thoracic spine section • Removed pediatric back pain from the total spine combination section

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Clinical guidelines **THORACIC SPINE MRI**	**Original Date: September 1997**
CPT Codes: 72146, 72147, 72157, +0698T	**Last Revised Date: December 2023**
Guideline Number: Evolent_CG_042	**Implementation Date: July 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR THORACIC SPINE MRI

[+]If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- **Inconclusive or show a need for additional or follow-up imaging evaluation OR**
- **The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient (the entire spinal cord and/or autonomic postganglionic chain must be assessed)**

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of neurologic deficits[1-4]

- With any of the following new neurological deficits documented on physical exam
  - Extremity muscular weakness (and not likely caused by plexopathy or peripheral neuropathy)[5, 6]
  - Pathologic (e.g., Babinski, Lhermitte's sign, Chaddock Sign, Hoffman's and other upper motor neuron signs); **OR** abnormal deep tendon reflexes (and not likely caused by plexopathy, or peripheral neuropathy)

    - Absent/decreased sensory changes along a particular thoracic dermatome (nerve distribution): pin prick, touch, vibration, proprioception, or temperature (and not likely caused by plexopathy, or peripheral neuropathy)
    - Upper or lower extremity increase muscle tone/spasticity, and likely localized to the thoracic spinal cord
    - New onset bowel or bladder dysfunction (e.g., retention or incontinence)- not related to an inherent bowel or bladder process
    - Gait abnormalities, most likely cause by a suspected or known myelopathy (see Table 1 for more details)
- Suspected thoracic cord compression with any neurological deficits as listed above

For evaluation of back pain with any of the following[7-9]

- With new or worsening objective neurologic deficits (as listed above) on exam
- Failure of conservative treatment* for a minimum of six (6) weeks within the last six (6) months;
  NOTE - Failure of conservative treatment is defined as one of the following:
    - Lack of meaningful improvement after a full course of treatment; **OR**
    - Progression or worsening of symptoms during treatment; **OR**
    - Documentation of a medical reason the member is unable to participate in treatment

  Closure of medical or therapy offices, patient inconvenience, or noncompliance without explanation does not constitute "inability to complete" treatment.
- With progression or worsening of symptoms during the course of conservative treatment*
- With an abnormal electromyography (EMG) or nerve conduction study (if performed) indicating a thoracic radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain)[10]
- Isolated back pain in pediatric population[11] – conservative care not required if red flags present. Red flags that prompt imaging include any of the following:
    - Age 5 or younger, **OR**
    - Constant pain, **OR**
    - Pain lasting > 4 weeks, **OR**
    - Abnormal neurologic examination, **OR**
    - Early morning stiffness and/or gelling, **OR**
    - Night pain that prevents or disrupts sleep, **OR**
    - Radicular pain, **OR**
    - Fever or weight loss or malaise, **OR**
    - Postural changes (e.g., kyphosis or scoliosis), **OR**
    - Limp (or refusal to walk in a younger child)[12, 13]

As part of initial pre-operative / post-operative / procedural evaluation ("CT best examination to assess for hardware complication, extent of fusion and pseudoarthrosis"[14, 15] and MRI for cord, nerve root compression, disc pathology or post-op infection)

- For preoperative evaluation/planning
- Prior to spinal cord stimulator to exclude canal stenosis if no prior MRI imaging of the thoracic spine has been done recently[16, 17]
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula or dural fistula))
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery in the last 6 months. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested (routine surveillance post-op not indicated without symptoms)
- Surgical infection as evidenced by signs/symptoms, laboratory, or prior imaging findings
- New or changing neurological deficits or symptoms post-operatively[14, 18]- see neurological deficit section above
- When combo requests (see above statement[+]) are submitted (i.e., MRI and CT of the spine), the office notes should clearly document the need for both studies to be done simultaneously, i.e., the need for both soft tissue and bony anatomy is required[19]
    - Combination requests where both thoracic spine CT and MRI thoracic spine are both approvable (not an all-inclusive list):
        - OPLL (Ossification of posterior longitudinal ligament)-
            - Most common in cervical spine (rare but more severe in thoracic spine)[20]
        - Pathologic or complex fractures
        - Malignant process of spine with both bony and soft tissue involvement
        - Clearly documented indication for bony and soft tissue abnormality where assessment will change management for the patient

For evaluation of suspected myelopathy[21-25]

- Does **NOT** require conservative care
- Progressive symptoms including unsteadiness, broad-based gait, increased muscle tone, pins and needles sensation, weakness and wasting of the lower limbs, and diminished sensation to light touch, temperature, proprioception, and vibration; limb hyperreflexia and pathologic reflexes; bowel and bladder dysfunction in more severe cases
- Any of the neurological deficits as noted above

For evaluation of known or suspected multiple sclerosis (MS)[25-28]

- Suspected or known MS with new or changing symptoms suggesting underlying thoracic spinal cord disease (i.e., transverse myelitis, progressive myelopathy)
- Suspected or known pediatric demyelinating diseases (MS/ADEM)

Combination studies for MS

- **These body regions might be evaluated separately or in combination as guided by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history (e.g., symptom(s), time course, and where in the CNS the likely localization(s) is/are), and other available information, including prior imaging.**
    - Cervical **and/or** Thoracic MRI for evaluation of highly suspected multiple sclerosis (MS) when Brain MRI has indeterminate findings and/or does not fulfill the McDonald criteria for the diagnosis of MS[27]
    - Cervical **and/or** Thoracic MRI with suspected transverse myelitis-with appropriate clinical symptoms (e.g., bilateral weakness, sensory disturbance, and autonomic dysfunction which typically evolve over hours or days)
    - Brain MRI with Cervical **and/or** Thoracic MRI for evaluation of neuromyelitis optica spectrum disorders (recurrent or bilateral optic neuritis; recurrent transverse myelitis)[29]
    - Known MS- entire CNS axis (Brain, **and/or** Cervical **and/or** Thoracic spine) is approvable prior to the initiation or change of disease modification treatments and assess disease burden (to establish a new baseline)
    - Known MS- Follow-up scans, including brain and spine imaging, if patients have known spine disease:
        - 6-12 months after starting/changing treatment
        - Every 1-2 years while on disease-modifying therapy to assess for subclinical disease activity, less frequently when stable for 2-3 years

For evaluation of trauma or acute injury[30]

- Presents with any of the following neurological deficits as above
- With progression or worsening of symptoms during the course of a trial of conservative treatment*
- History of underlying spinal abnormalities (i.e., ankylosing spondylitis, diffuse idiopathic skeletal hyperostosis) (Both MRI and CT would be approvable)[31-33]
- When the patient is clinically unevaluable or there are preliminary imaging findings (x-ray or CT) needing further evaluation

("MRI and CT provide complementary information. When indicated it is appropriate to perform both examinations").[30]

For evaluation of known or new compression fractures with worsening back pain[30, 34]

- With history of malignancy

    - To aid in differentiation of benign osteoporotic fractures from metastatic disease
        - A follow-up MRI in 6-8 weeks after initial MRI when initial imaging cannot decipher (indeterminate) benign osteoporotic fracture from metastatic disease[35]
- With an associated new focal neurologic deficit as above
- Prior to a planned surgery/intervention or if the results of the MRI will change management

For evaluation of tumor, cancer, or metastasis with any of the following:
(MRI is usually the preferred study, but CT may be needed to further characterize solitary indeterminate lesions seen on MRI)[36-38]

- **Primary tumor**
    - Initial staging primary spinal tumor[39]
    - Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
    - Known primary tumor with new signs or symptoms (e.g., new or increasing nontraumatic pain, physical, laboratory, and/or imaging findings)
    - With an associated new focal neurologic deficit as above[40]
- **Metastatic tumor**
    - With evidence of metastasis on bone scan needing further clarification OR inconclusive findings on a prior imaging exam
    - With an associated new focal neurologic deficit[40]
    - Known malignancy with new signs or symptoms (e.g., new or increasing nontraumatic pain, radiculopathy or back pain that occurs at night and wakes the patient from sleep with known active cancer, physical, laboratory, and/or imaging findings) in a tumor that tends to metastasize to the spine [33-35]

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated, OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of known or suspected infection (osteomyelitis), abscess, or inflammatory disease[41, 42]

- **Infection**
  - As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings[43]
  - Follow-up imaging of infection
    - With worsening symptoms/laboratory values (i.e., white blood cell count, ESR/CRP) or radiographic findings[44]
- **Spondyloarthropathies**
  - Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and appropriate rheumatology workup

For evaluation of spine abnormalities related to immune system suppression, e.g., HIV, chemotherapy, leukemia, or lymphoma[42]

- As evidenced by signs/symptoms, laboratory, or prior imaging findings

Other Indications for a Thoracic Spine MRI

(Note- See combination requests, below, for initial advanced imaging assessment and pre-operatively)

- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata[45-47]
- Known Arnold-Chiari syndrome (For initial imaging (one-time initial MRI-modality assessment) see combination below)
  - Known Chiari I malformation without syrinx or hydrocephalus, follow-up imaging after initial diagnosis with new or changing signs/symptoms or exam findings consistent with spinal cord pathology[48]
  - Known Chiari II (Arnold-Chiari syndrome), III, or IV malformation
- Syrinx or syringomyelia (known or suspected)
  - With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis[49])
  - To further characterize a suspicious abnormality seen on prior imaging
  - Known syrinx with new/worsening symptoms
- Toe walking in a child with signs/symptoms of myelopathy localized to the Thoracic Spine
- Suspected neuroinflammatory Conditions/Diseases (e.g., sarcoidosis, Behcet's)
  - After detailed neurological exam and appropriate initial work up

COMBINATION STUDIES WITH THORACIC SPINE MRI

Cervical and Thoracic MRI

- Initial evaluation of known or suspected syrinx or syringomyelia

- With neurologic findings and/or predisposing conditions (e.g., Chiari malformation, prior trauma, neoplasm, arachnoiditis, severe spondylosis[49])
- To further characterize a suspicious abnormality seen on prior imaging
- Known syrinx with new/worsening symptom

Any combination of Cervical and/or Thoracic and/or Lumbar MRIs
Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history, and other available information, including prior imaging.

Exception- Indications for combination studies[50, 51]: Are approved indications as noted below and being performed in children who will need anesthesia for the procedure

- Any combination of these studies for:
  - Survey/complete initial assessment of infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10[52-54] (e.g., congenital scoliosis, idiopathic scoliosis, scoliosis with vertebral anomalies)
  - In the presence of neurological deficit, progressive spinal deformity, or for preoperative planning[55]
  - Back pain with known vertebral anomalies (hemivertebrae, hypoplasia, agenesis, butterfly, segmentation defect, bars, or congenital wedging) in a child on preliminary imaging
  - Scoliosis with any of the following[56]
    - Progressive spinal deformity
    - Neurologic deficit (new or unexplained)
    - Early onset
    - Atypical curve (e.g., short segment, > 30’ kyphosis, left thoracic curve, associated organ anomalies)
    - Pre-operative planning; OR
    - When office notes clearly document how imaging will change management
- Arnold-Chiari malformations[57, 58]
  - Arnold-Chiari I
    - For evaluation of spinal abnormalities associated with initial diagnosis of Arnold-Chiari Malformation. (C/T/L spine due to association with tethered cord and syringomyelia), and initial imaging has not been completed[46, 52]
  - Arnold-Chiari II-IV - For initial evaluation and follow-up as appropriate
    - Usually associated with open and closed spinal dysraphism, particularly meningomyelocele
- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata,[45-47] when anesthesia

required for imaging[59] (e.g., meningomyelocele, lipomeningomyelocele, diastematomyelia, fatty/thickened filum terminale, and other spinal cord malformations)

- Oncological Applications (e.g., primary nervous system, metastatic)
    - Drop metastasis from brain or spine (imaging also includes brain)- see Overview
    - Suspected leptomeningeal carcinomatosis (LC)[60] -see Overview
    - Any combination of these for spinal survey in patient with metastases
    - Tumor evaluation and monitoring in neurocutaneous syndromes
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula))

BACKGROUND

Magnetic resonance imaging (MRI) produces high quality multiplanar images of organs and structures within the body without using ionizing radiation. It is used for evaluation, assessment of severity, and follow-up of diseases of the spine and is the preferred modality for imaging intervertebral disc degeneration. High contrast resolution (soft tissue contrast) and multiplanar imaging (sagittal as well as axial planes) are helpful in the evaluation of possible disc herniation and detecting nerve root compression. MRI is one of the most useful techniques to evaluate spine infection and is also used to evaluate tumors, cancer, and immune system suppression.

OVERVIEW

***Conservative Treatment**

Non-operative conservative treatment should include a multimodality approach consisting of a at least one (1) active and one (1) inactive component targeting the affected region.

Active Modalities

- Physical therapy
- Physician-supervised home exercise program**
- Chiropractic care

Inactive Modalities

- Medications (e.g., NSAIDs, steroids, analgesics)
- Injections (e.g., epidural injection, selective nerve root block)
- Medical Devices (e.g., TENS unit, bracing)

****Home Exercise Program (HEP)**

The following two elements are required to meet conservative therapy guidelines for HEP:[15, 61]

- Documentation of an exercise prescription/plan provided by a physician, physical therapist, or chiropractor; **AND**

- Follow-up documentation regarding completion of HEP after the required 6-week timeframe or inability to complete HEP due to a documented medical reason (e.g., increased pain or inability to physically perform exercises).

Table 1: Gait and spine imaging[62-67]

Gait	Characteristic	Work up/Imaging
Hemiparetic	**Spastic unilateral, circumduction**	**Brain and/or, Cervical spine imaging based on associated symptoms**
Diplegic	**Spastic bilateral, circumduction**	**Brain, Cervical and Thoracic Spine imaging**
Myelopathic	**Wide based, stiff, unsteady**	**Cervical and/or Thoracic spine MRI based on associated symptoms**
Cerebellar Ataxic	**Broad based, clumsy, staggering, lack of coordination, usually also with limb ataxia**	**Brain imaging see Brain MRI Guideline**
Apraxic	**Magnetic, shuffling, difficulty initiating**	**Brain imaging see Brain MRI Guideline**
Parkinsonian	**Stooped, small steps, rigid, turning en bloc, decreased arm swing**	**Brain Imaging see Brain MRI Guideline**
Choreiform	**Irregular, jerky, involuntary movements**	**Medication review, consider brain imaging as per movement disorder Brain MR guidelines**
Sensory ataxic	**Cautious, stomping, worsening without visual input (ie + Romberg)**	**EMG, blood work, consider spinal (cervical or thoracic cord imaging) imaging based on EMG**
Neurogenic	**Steppage, dragging of toes**	• **EMG initial testing;** • **BUT if there is a foot drop, lumbar spine MRI is appropriate without EMG** • **Pelvis MR if there is evidence of plexopathy**
Vestibular	**Insecure, veer to one side, worse when eyes closed, vertigo**	**Consider Brain/IAC MRI see Brain MRI Guideline**

Table 2: MRI and Cutaneous StigmataRisk Stratification for Various Cutaneous Markers		
High Risk	Intermediate Risk	Low Risk
• Hypertrichosis • Infantile hemangioma • Atretic meningocele • DST • Subcutaneous lipoma • Caudal appendage • Segmental hemangiomas in association with LUMBAR‡ syndrome	• Capillary malformations (also referred to as NFS or salmon patch when pink and poorly defined or PWS when darker red and well-defined)	• Coccygeal dimple • Light hair • Isolated café au lait spots • Mongolian spots • Hypo- and hypermelanotic macules or papules • Deviated or forked gluteal cleft • Nonmidline lesions
‡LUMBAR, lower body hemangioma and other cutaneous defects, urogenital abnormalities, ulcerations, myelopathy, bony defects, anorectal malformations, arterial anomalies, and renal anomalies.		

Myelopathy – Symptom severity varies, and a high index of suspicion is essential for making the proper diagnosis in early cases. Symptoms of pain and radiculopathy may not be present. The natural history of myelopathy is characterized by neurological deterioration. The most frequently encountered symptom is gait abnormality (86%) followed by increased muscular reflexes (79.1%), pathological reflexes (65.1%), paresthesia of upper limb (69.8%), and pain (67.4%).[68]

Ossification Posterior Longitudinal Ligament (OPLL)[20] – Most common in cervical spine (rare but more severe in thoracic spine)

Neck and Back Pain with Cancer History – Bone is the third most common site of metastases after the liver and the lungs, and approximately two-thirds of all osseous metastases occur in the spine. Approximately 60–70% of patients with systemic cancer will have spinal metastasis. Radiographic (x-ray) examination should be performed in cases of back pain when a patient has a cancer history, but without known active cancer or a tumor that tends to metastasize to the spine. This can make a diagnosis in many cases. This may occasionally allow for selection of bone scan in lieu of MRI in some cases. When radiographs do not answer the clinical question, then MRI may be appropriate after a consideration of conservative care.

Most common spine metastasis involving primary metastasis originate from the following tumors in descending order: breast (21%), lung (19%), prostate (7.5%), renal (5%), gastrointestinal (4.5%), and thyroid (2.5%). While all tumors can seed to the spine, the cancers

mentioned above metastasize to the spinal column early in the disease process. Spinal metastasis is more commonly found in the thoracic region, followed by the lumbar region, while the cervical region is the least likely site of metastasis.[69]

MRI and Neurocutaneous Syndromes

- In NF-1, clinical evaluation appears to be more useful to detect complications than is screening imaging in asymptomatic patients. Imaging is indicated in evaluation of suspected tumors based on clinical evaluation and for follow-up of known intracranial and intraspinal tumors.[70]
- Conversely in NF-2, routine MR imaging screening is always indicated, given the high prevalence of CNS tumors, especially vestibular schwannomas. In patients with NF-2, routine screening brain/IAC imaging is indicated annually starting from age 10, if asymptomatic, or earlier with clinical signs/symptoms. Most individuals with NF2 eventually develop a spinal tumor, mostly commonly schwannomas, but meningioma and ependymomas are also seen. Spinal imaging at baseline and every 2 to 3 years is also advised with more frequent imaging, if warranted, based on sites of tumor involvement.[71]
- In patients with Tuberous Sclerosis, Brain MRI should be obtained every 1-3 years up until age 25 for surveillance for CNS abnormalities.[72]
- In Von Hippel Lindau Syndrome, imaging of the brain and spinal cord for hemangioblastomas is recommended every 2 years.[73]
- In Sturge Weber Syndrome, Brain MRI can rule out intracranial involvement after only age 1 and is recommended in patients < 1 year old only if symptomatic.[74]

Drop Metastases[75] – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas and less commonly choroid plexus neoplasms and teratomas.

Leptomeningeal Carcinomatosis[76] – Leptomeningeal carcinomatosis is complication of cancer in which cancerous cells spread to the membranes (meninges) that covers the brain and spinal cord. The most common solid tumors that involve the leptomeninges are breast, lung, and melanoma, gastrointestinal, and primary central nervous system tumors.

POLICY HISTORY

Date	Summary
Dec 2023	Conservative treatment language updated in body and background
May 2023	• Updated references • Updated background section • Clarified pathological reflexes • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Clarified cerebellar ataxia in gait table • Removed radicular pain and malaise from Isolated Back Pain in the Pediatric population: Red flags • Removed Additional Resources
March 2022	Added • Combination request for overlapping body part statement • Clarified muscle weakness not related to plexopathy or peripheral neuropathy • Clarified bowel and bladder dysfunction – not related to an inherent bowel or bladder problem • Clarified combination MS for cervical and/or thoracic spine combination requests • Descriptions for tethered cord • Background section of Drop Metastases • Background section of Leptomeningeal Carcinomatosis • Clarified toe walking in pediatric patient with myelopathy for thoracic spine Removed • Removed from combination section syrinx and syringomyelia and added subsection for cervical and thoracic spine section • Removed pediatric back pain from the total spine combination section

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Reviewed / Approved by Clinical Guideline Committee

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Clinical guidelines **LUMBAR SPINE MRI**	**Original Date: September 1997**
CPT Codes: 72148, 72149, 72158, +0698T	**Last Revised Date: December 2023**
Guideline Number: Evolent_CG_044	**Implementation Date: July 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR LUMBAR SPINE MRI

†If there is a combination request* for an overlapping body part, either requested at the same time or sequentially (within the past 3 months) the results of the prior study should be:

- **Inconclusive or show a need for additional or follow up imaging evaluation OR**
- **The office notes should clearly document an indication why overlapping imaging is needed and how it will change management for the patient.**

(*Unless approvable in the combination section as noted in the guidelines)

For evaluation of neurologic deficits[1-4]

- With any of the following new neurological deficits documented on physical exam
  - Extremity muscular weakness (and not likely caused by plexopathy, or peripheral neuropathy)[5, 6]
  - Pathologic or abnormal reflexes (and not likely caused by plexopathy, or peripheral neuropathy)
  - Absent/decreased sensory changes along a particular lumbar dermatome (nerve distribution): pin prick, touch, vibration, proprioception or temperature (and not likely caused by plexopathy, or peripheral neuropathy)

- Lower extremity increased muscle tone
- New onset bowel or bladder dysfunction (e.g., retention or incontinence)- not related to an inherent bowel or bladder process
- Gait abnormalities (see Table 1 for more details)
- New onset foot drop (Not related to a peripheral nerve injury, e.g., peroneal nerve)

- Cauda Equina Syndrome as evidence by severe back pain/sciatica along with one of the defined symptoms (see Overview section)

For evaluation of back pain with any of the following[7-16]

- With new or worsening objective neurologic deficits on exam, as above
- Failure of conservative treatment* for a minimum of six (6) weeks within the last six (6) months;[16]
  NOTE – Failure of conservative treatment is defined as one of the following:
  - Lack of meaningful improvement after a full course of treatment; **OR**
  - Progression or worsening of symptoms during treatment; **OR**
  - Documentation of a medical reason the member is unable to participate in treatment

  Closure of medical or therapy offices, patient inconvenience, or noncompliance without explanation does not constitute "inability to complete" treatment.
- With progression or worsening of symptoms during the course of conservative treatment
- With an abnormal electromyography (EMG) or nerve conduction study (if performed) indicating a lumbar radiculopathy. (EMG is not recommended to determine the cause of axial lumbar, thoracic, or cervical spine pain.)[15]
- Isolated back pain in pediatric population[17] – conservative care not required if red flags present. Red flags that prompt imaging should include the presence of:
  - Age 5 or younger, **OR**
  - Constant pain, **OR**
  - Pain lasting > 4 weeks, **OR**
  - Abnormal neurologic examination, **OR**
  - Early morning stiffness and/or gelling, **OR**
  - Night pain that prevents or disrupts sleep, **OR**
  - Radicular pain, **OR**
  - Fever or weight loss or malaise, **OR**
  - Postural changes (e.g., kyphosis or scoliosis), **OR**
  - Limp (or refusal to walk in a younger child < 5yo)[18, 19]

As part of initial pre-operative / post-operative / procedural evaluation ("CT best examination to assess for hardware complication, extent of fusion and pseudoarthrosis"[16, 20] and MRI for cord, nerve root compression, disc pathology or post-op infection)

- For preoperative evaluation/planning
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula))
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery in the last 6 months. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested (routine surveillance post-op not indicated without symptoms)
- Surgical infection as evidenced by signs/symptoms, laboratory, or prior imaging findings
- New or changing neurological deficits or symptoms post-operatively [20, 21] - see neurological deficit section above
- When combo requests (see above statement[+]) are submitted (i.e., MRI and CT of the spine), the office notes should clearly document the need for both studies to be done simultaneously, i.e., the need for both soft tissue and bony anatomy is required[22]
    - Combination requests where both lumbar spine CT and MRI lumbar spine are both approvable (not an all-inclusive list)
        - Pathologic or complex fractures
        - Malignant process of spine with both bony and soft tissue involvement
        - Clearly documented indication for bony and soft tissue abnormality where assessment will change management for the patient

For evaluation of trauma or acute injury[23]

- Presents with any of the neurological deficits as above
- With progression or worsening of symptoms during the course of conservative treatment*
- History of underlying spinal abnormalities (i.e., ankylosing spondylitis or diffuse idiopathic skeletal hyperostosis) (Both MRI and CT would be approvable) [24]
- When the patient is clinically unevaluable or there are preliminary imaging findings (x-ray or CT) needing further evaluation

("MRI and CT provide complementary information. When indicated it is appropriate to perform both examinations").[23]

Pars defect (spondylolysis) or spondylolisthesis

- Pars defect (spondylolysis) or spondylolisthesis in adults when Flexion/Extension x-rays show instability
- Clinically suspected Pars defect (spondylolysis) which is not seen on plain films in pediatric population (< 18 yr) (flexion extension instability not required) and imaging would change treatment[25-27]

NOTE: Initial imaging (x-ray, or planar bone scan without SPECT; Bone scan with SPECT is superior to MRI and CT in the detection of pars interarticularis pathology including spondylolysis).[28]

For evaluation of known or new compression fractures with worsening back pain[29]

- With history of malignancy
    - To aid in differentiation of benign osteoporotic fractures from metastatic disease
        - A follow up MRI in 6-8 weeks after initial MRI when initial imaging cannot decipher benign osteoporotic fracture from metastatic disease
- With an associated new focal neurologic deficit as above
- Prior to a planned surgery/intervention or if the results of the MRI will change management.

For evaluation of tumor, cancer, or metastasis with any of the following:

(MRI is usually the preferred study, but CT may be needed to further characterize solitary indeterminate lesions seen on MRI)[30-32]

- **Primary tumor**
    - Initial staging primary spinal tumor[33]
    - Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
    - Known primary tumor with new signs or symptoms (e.g., new or increasing nontraumatic pain, physical, laboratory, and/or imaging findings)
    - With an associated new focal neurologic deficit as above[34]
- **Metastatic tumor**
    - With evidence of metastasis on bone scan needing further clarification OR inconclusive findings on a prior imaging exam
    - With an associated new focal neurologic deficit[34]
    - Known malignancy with new signs or symptoms (e.g., new or increasing nontraumatic pain, radiculopathy or back pain that occurs at night and wakes the patient from sleep with known active cancer, physical, laboratory, and/or imaging findings) in a tumor that tends to metastasize to the spine[35, 36]

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred**.** (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of known or suspected infection (osteomyelitis), abscess, or inflammatory disease[37, 38]

- **Infection**
  - As evidenced by signs and/or symptoms, laboratory (i.e., abnormal white blood cell count, ESR and/or CRP) or prior imaging findings[39]
  - Follow-up imaging of infection
    - With worsening symptoms/laboratory values (i.e., white blood cell count, ESR/CRP) or radiographic findings[40]
- **Spondyloarthropathies**
  - Ankylosing Spondylitis/Spondyloarthropathies with non-diagnostic or indeterminate x-ray and rheumatology workup

For evaluation of spine abnormalities related to immune system suppression, e.g., HIV, chemotherapy, leukemia, or lymphoma[38]

- As evidenced by signs/symptoms, laboratory, or prior imaging findings

Other Indications for a Lumbar Spine MRI

(Note: See combination request, below, for initial advanced imaging assessment and pre-operatively)

- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata[41-43]
- Known anorectal malformations[44, 45]
- Suspicious sacral dimple (those that are deep, larger than 0.5 cm, located within the superior portion of the gluteal crease or above the gluteal crease, multiple dimples, or associated with other cutaneous markers)[46] or duplicated or deviated gluteal cleft[47]
  - in patients ≤3 months should have ultrasound
- Toe walking in a child when associated with upper motor neuron signs, including hyperreflexia, spasticity; or orthopedic deformity with concern for spinal cord pathology and/or tethered cord (e.g., pes cavus, clawed toes, leg or foot length deformity (excluding tight heel cords))
- Known Chiari II (Arnold-Chiari syndrome), III, or IV malformation.
- For follow-up/repeat evaluation of Arnold-Chiari I with new signs or symptoms suggesting recurrent spinal cord tethering (For initial diagnosis see below)
- Suspected neuroinflammatory Conditions/Diseases (e.g**.,** sarcoidosis, Behcet's)

- After detailed neurological exam and appropriate initial work up completed

COMBINATION OF STUDIES WITH LUMBAR SPINE MRI

Any combination of Cervical and/or Thoracic and/or Lumbar MRIs

Note: These body regions might be evaluated separately or in combination as documented in the clinical notes by physical examination findings (e.g., localization to a particular segment of the spinal cord), patient history, and other available information, including prior imaging.

Exception- Indications for combination studies[48, 49]: Are approved indications as noted below and being performed in children who will need anesthesia for the procedure

- Any combination of these studies for:
  - Survey/complete initial assessment of infant/child with congenital scoliosis or juvenile idiopathic scoliosis under the age of 10[50-52] (e.g., congenital scoliosis, idiopathic scoliosis, scoliosis with vertebral anomalies)
  - In the presence of neurological deficit, progressive spinal deformity, or for preoperative planning[53]
  - Back pain with known vertebral anomalies (hemivertebrae, hypoplasia, agenesis, butterfly, segmentation defect, bars, or congenital wedging) in a child on preliminary imaging
  - Scoliosis with any of the following[54]:
    - Progressive spinal deformity
    - Neurologic deficit (new or unexplained)
    - Early onset
    - Atypical curve (e.g., short segment, > 30’ kyphosis, left thoracic curve, associated organ anomalies)
    - Pre-operative planning; OR
    - When office notes clearly document how imaging will change management
- Arnold-Chiari malformations[55, 56]
  - Arnold-Chiari I
    - For evaluation of spinal abnormalities associated with initial diagnosis of Arnold-Chiari Malformation. (C/T/L spine due to association with tethered cord and syringomyelia), and initial imaging has not been completed[42, 50]
  - Arnold-Chiari II-IV - For initial evaluation and follow-up as appropriate
    - Usually associated with open and closed spinal dysraphism, particularly meningomyelocele)
- Tethered cord, or spinal dysraphism (known or suspected) based on preliminary imaging, neurological exam, and/or high-risk cutaneous stigmata,[41-43] when anesthesia required for imaging[57] (e.g., meningomyelocele, lipomeningomyelocele,

diastematomyelia, fatty/thickened filum terminale, and other spinal cord malformations)

- Oncological Applications (e.g., primary nervous system, metastatic)
    - Drop metastasis from brain or spine (imaging also includes brain)- see Overview
    - Suspected leptomeningeal carcinomatosis (LC)[58] -see Overview
    - Any combination of these for spinal survey in patient with metastases
    - Tumor evaluation and monitoring in neurocutaneous syndromes - See Overview
- CSF leak highly suspected and supported by patient history and/or physical exam findings (leak (known or suspected spontaneous (idiopathic) intracranial hypotension (SIH), post lumbar puncture headache, post spinal surgery headache, orthostatic headache, rhinorrhea or otorrhea, or cerebrospinal-venous fistula))

BACKGROUND

Magnetic resonance imaging (MRI) is used in the evaluation, diagnosis, and management of spine-related conditions, e.g., degenerative disc disease, cauda equine compression, radiculopathy, infections, or cancer in the lumbar spine. MRI provides high quality multiplanar images of organs and structures within the body without the use of x-rays or radiation. In the lumbar area where gonadal exposure may occur, MRI's lack of radiation is an advantage.

OVERVIEW

***Conservative Treatment**

Non-operative conservative treatment should include a multimodality approach consisting of at least one (1) active and one (1) inactive component targeting the affected region.

Active Modalities

- Physical therapy
- Physician-supervised home exercise program**
- Chiropractic care

Inactive Modalities

- Medications (e.g., NSAIDs, steroids, analgesics)
- Injections (e.g., epidural injection, selective nerve root block)
- Medical Devices (e.g., TENS unit, bracing)

****Home Exercise Program (HEP)**

The following two elements are required to meet conservative therapy guidelines for HEP:[10, 59]

- Documentation of an exercise prescription/plan provided by a physician, physical therapist, or chiropractor; **AND**

- Follow-up documentation regarding completion of HEP after the required 6-week timeframe or inability to complete HEP due to a documented medical reason (e.g., increased pain or inability to physically perform exercises).

Table 1: Gait and spine imaging[60-65]

Gait	Characteristic	Work up/Imaging
Hemiparetic	**Spastic unilateral, circumduction**	**Brain and/or, Cervical spine imaging based on associated symptoms**
Diplegic	**Spastic bilateral, circumduction**	**Brain, Cervical and Thoracic Spine imaging**
Myelopathic	**Wide based, stiff, unsteady**	**Cervical and/or Thoracic spine MRI based on associated symptoms**
Cerebellar taxic	**Broad based, clumsy, staggering, lack of coordination, usually also with limb ataxia**	**Brain imaging see Brain MRI Guideline**
Apraxic	**Magnetic, shuffling, difficulty initiating**	**Brain imaging see Brain MRI Guideline**
Parkinsonian	**Stooped, small steps, rigid, turning en bloc, decreased arm swing**	**Brain Imaging see Brain MRI Guideline**
Choreiform	**Irregular, jerky, involuntary movements**	**Medication review, consider brain imaging as per movement disorder Brain MR guidelines**
Sensory ataxic	**Cautious, stomping, worsening without visual input (ie + Romberg)**	**EMG, blood work, consider spinal (cervical or thoracic cord imaging) imaging based on EMG**
Neurogenic	**Steppage, dragging of toes**	• **EMG initial testing;** • **BUT if there is a foot drop, lumbar spine MRI is appropriate without EMG** • **Pelvis MR if there is evidence of plexopathy**
Vestibular	**Insecure, veer to one side, worse when eyes closed, vertigo**	**Consider Brain/IAC MRI see Brain MRI Guideline**

Table 2: MRI and Cutaneous Stigmata[66]

Risk Stratification for Various Cutaneous Markers		
High Risk	Intermediate Risk	Low Risk
• Hypertrichosis • Infantile hemangioma • Atretic meningocele • DST • Subcutaneous lipoma • Caudal appendage • Segmental hemangiomas in association with LUMBAR‡ syndrome	• Capillary malformations (also referred to as NFS or salmon patch when pink and poorly defined or PWS when darker red and well-defined)	• Coccygeal dimple Light hair • Isolated café au lait spots • Mongolian spots • Hypo- and hypermelanotic macules or papules • Deviated or forked gluteal cleft • Nonmidline lesions
‡LUMBAR, lower body hemangioma and other cutaneous defects, urogenital abnormalities, ulcerations, myelopathy, bony defects, anorectal malformations, arterial anomalies, and renal anomalies.		

Sacral Dimples – Simple midline dimples are the most commonly encountered dorsal cutaneous stigmata in neonates and indicate low risk for spinal dysraphism. Only atypical dimples are associated with a high risk for spinal dysraphism, particularly those that are large (>5 mm), high on the back (>2.5 cm from the anus) or appear in combination with other lesions.[46] High-risk cutaneous stigmata in neonates include hemangiomas, upraised lesions (i.e., masses, tails, and hairy patches), and multiple cutaneous stigmata (Table 2).

Tethered spinal cord syndrome – This is a neurological disorder caused by tissue attachments that limit the movement of the spinal cord within the spinal column. Although this condition is rare, it can continue undiagnosed into adulthood. The primary cause is myelomeningocele and lipomyelomeningocele; the following are other associations that vary in severity of symptoms and treatment.

- Dermal sinus tract (a rare congenital deformity)
- Diastematomyelia (split spinal cord)
- Lipoma
- Tumor
- Thickened/tight filum terminale
- History of spine trauma/surgery
- Arnold-Chiari malformation

Magnetic resonance imaging (MRI) can display the low level of the spinal cord and a thickened filum terminale, the thread-like extension of the spinal cord in the lower back. Treatment

depends upon the underlying cause of the tethering. If the only abnormality is a thickened, shortened filum, then limited surgical treatment may suffice.

Back Pain with Cancer History – Bone is the third most common site of metastases after the liver and the lungs, and approximately two-thirds of all osseous metastases occur in the spine. Approximately 60–70% of patients with systemic cancer will have spinal metastasis. Radiographic (x-ray) examination should be performed in cases of back pain when a patient has a cancer history, but without known active cancer or a tumor that tends to metastasize to the spine. This can make a diagnosis in many cases. This may occasionally allow for selection of bone scan in lieu of MRI in some cases. When radiographs do not answer the clinical question, then MRI may be appropriate after a consideration of conservative care.

"Neoplasms causing VCF (vertebral compression fractures) include 1) primary bone neoplasms, such as hemangioma or giant cell tumors, and tumor-like conditions causing bony and cellular remodeling, such as aneurysmal bone cysts, or Paget's disease (osteitis deformans); 2) primary malignant neoplasms including but not limited to multiple myeloma and lymphoma; and 3) metastatic neoplasms."[29]

Most common spine metastasis involving primary metastasis originate from the following tumors in descending order: breast (21%), lung (19%), prostate (7.5%), renal (5%), gastrointestinal (4.5%), and thyroid (2.5%). While all tumors can seed to the spine, the cancers mentioned above metastasize to the spinal column early in the disease process.[35]

Cauda Equina Syndrome

- Symptoms include severe back pain or sciatica along with one or more of the following:
    - Saddle anesthesia - loss of sensation restricted to the area of the buttocks, perineum, and inner surfaces of the thighs (areas that would sit on a saddle)
    - Recent bladder/bowel dysfunction
    - Achilles reflex absent on both sides
    - Sexual dysfunction that can come on suddenly
    - Absent anal reflex and bulbocavernosus reflex

MRI and Neurocutaneous Syndromes

- In NF-1, clinical evaluation appears to be more useful to detect complications than is screening imaging in asymptomatic patients. Imaging is indicated in evaluation of suspected tumors based on clinical evaluation and for follow-up of known intracranial and intraspinal l tumors.[67]
- Conversely in NF-2, routine MR imaging screening is always indicated, given the high prevalence of CNS tumors, especially vestibular schwannomas. In patients with NF-2, routine screening brain/IAC imaging is indicated annually starting from age 10, if asymptomatic, or earlier with clinical signs/symptoms. Most individuals with NF2

eventually develop a spinal tumor, mostly commonly schwannomas, but meningioma and ependymomas are also seen. Spinal imaging at baseline and every 2 to 3 years is also advised with more frequent imaging, if warranted, based on sites of tumor involvement.[68]

- In patients with tuberous sclerosis, brain MRI should be obtained every 1-3 years up until age 25 for surveillance for CNS abnormalities.[69]
- In Von Hippel Lindau syndrome, imaging of the brain and spinal cord for hemangioblastomas is recommended every 2 years.[70]
- In Sturge Weber Syndrome, brain MRI can rule out intracranial involvement only after age 1 and is recommended in patients < 1 year only if symptomatic.[71]

Drop Metastases[72] – Drop metastases are intradural extramedullary spinal metastases that arise from intracranial lesions. Common examples of intracranial neoplasms that result in drop metastases include pineal tumors, ependymomas, medulloblastomas, germinomas, primitive neuroectodermal tumors (PNET), glioblastomas multiform, anaplastic astrocytomas, oligodendrogliomas and less commonly choroid plexus neoplasms and teratomas.

Leptomeningeal Carcinomatosis[73] – Leptomeningeal carcinomatosis is a complication of cancer in which cancerous cells spread to the membranes (meninges) that covers the brain and spinal cord. The most common solid tumors that involve the leptomeninges are breast, lung, melanoma, gastrointestinal, and primary central nervous system tumors.

POLICY HISTORY

Date	Summary
Dec 2023	Conservative treatment language updated in body and background
May 2023	• Updated references • Updated background section • Clarified pathological reflexes • Added "Further evaluation of indeterminate or questionable findings on prior imaging": • Clarified cerebellar ataxia in gait table • Removed "radicular pain" and "malaise" from Isolated Back Pain in the Pediatric population: Red flags • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Removed Additional Resources
March 2022	Added • Combination request for overlapping body part statement • Clarified muscle weakness not related to plexopathy or peripheral neuropathy • Clarified bowel and bladder dysfunction – not related to an inherent bowel or bladder problem • Descriptions for tethered cord • Background section of Drop Metastases • Background section of Leptomeningeal Carcinomatosis • Clarified toe walking in pediatric patient • Added section on neuroinflammatory conditions Removed • Removed from combination section syrinx and syringomyelia and added subsection for cervical and thoracic spine section • Removed pediatric back pain from the total spine combination section

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Clinical guidelines **SPINAL CANAL MRA/MRV**	**Original Date: May 2008**
CPT Codes: 72159	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_046	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR SPINAL CANAL MAGNETIC RESONANCE ANGIOGRAPHY (MRA)

- For the evaluation of spinal arteriovenous malformation (AVM)[1-5]
- Myelopathy when the suspected etiology is a compromise of blood flow or drainage to the spinal cord[6, 7]
- For the evaluation of a known cervical spine fracture, disc herniation, infection, or venous thrombosis where there is concern for vascular pathology (compression or thrombosis) compromising spinal cord blood flow or venous drainage[6, 7]
- For the evaluation of known or suspected vertebral artery injury when there is also concern for vascular compromise to the spinal canal and its contents (otherwise neck MRA or CTA is sufficient to evaluate vertebral artery injury)[8, 9]
- Preoperative evaluation (e.g., localization of the spinal arteries prior to complex spinal surgery, aortic aneurysm repair, or characterization of suspected vascular lesion of the spinal canal and its contents)[10-12]
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.[2]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BACKGROUND

Application of spinal magnetic resonance angiography (MRA) allows for more effective and noninvasive screening for vascular lesions than magnetic resonance imaging (MRI) alone. It may improve characterization of normal and abnormal intradural vessels while maintaining good spatial resolution. Spinal MRA may be used for the evaluation of spinal arteriovenous malformations, as well as injuries to blood vessels supplying the spine and cord.

OVERVIEW

Spinal MR Angiography/MR Venography[13] - Typically, contrast-enhanced 3D time of flight techniques and contrast-enhanced CT angiography (CTA) are used for evaluation of the spinal arteries, veins, and related pathology as a non-invasive alternative to the gold standard catheter angiography. The detection rate of the Adamkiewicz artery (AKA) by MRA is in the range of 69-100%, but with modern equipment both MRA and CTA detection rates should approach 100%.[11] Magnetic resonance angiography is well suited to patients who cannot receive iodinated contrast and undergo CTA. CTA has the advantage over MRA of providing greater spatial resolution, can image the entire spine during one contrast bolus, and provides for a faster exam time that is less prone to motion artifact. MRA is limited by a finite field of view, typically ≤ 50 cm.[11] MRI has the advantage over CT of detecting areas of ischemia via diffusion weighted imaging. Mathur et al showed a 100% sensitivity in detecting recurrent spinal arteriovenous fistulas post-treatment.[2]

Spinal Arteriovenous Malformations (AVMs) – Spinal cord arteriovenous malformations are comprised of snarled tangles of arteries and veins that affect the spinal cord. They are fed by spinal cord arteries and drained by spinal cord veins. Spinal dural arteriovenous (AV) fistulas are the most encountered vascular malformation of the spinal cord and are a treatable cause of progressive paraparesis. Magnetic resonance angiography (MRA) can record the pattern and velocity of blood flow through vascular lesions as well as the flow of cerebrospinal fluid throughout the spinal cord. MRA can define the vascular malformation and may assist in determining treatment.[5]

Spinal Arteries/Veins - Vascular malformations, trauma, disc herniations, neoplasms, and coagulopathies or infection causing thrombosis can compromise the spinal cord blood supply

and drainage. The spinal cord arterial supply is derived from the anterior spinal artery, posterolateral spinal artery, and the arteria radicularis magna or artery of Adamkiewicz (AKA). The anterior spinal artery supplies the anterior two-thirds of the cord and arises from the vertebral arteries. It receives contributions from the ascending cervical artery, the inferior thyroid artery, the intercostal arteries, the lumbar artery, the iliolumbar artery, lateral sacral arteries, and the AKA. The AKA arises on the left side of the aorta between the T8 and L1 segments, to anastomose with the anterior spinal artery and supply the lower two-thirds of the spinal cord. Two posterolateral spinal arteries arise from the posteroinferior cerebellar arteries and supply the posterior third (posterior columns, posterior roots, and dorsal horns) of the spinal cord. The spinal venous system is divided into intrinsic and extrinsic veins differentiated by their location within the spinal canal or extrinsic to the canal, respectively. They drain into the radiculomedullary veins, subsequently to paravertebral and intervertebral plexuses, then to the segmental veins that eventually drain into the ascending lumbar veins, azygos system, and pelvic venous plexuses.[6]

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POLICY HISTORY

Date	Summary
May 2023	• Updated references • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
May 2022	Updated references

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **PELVIS CTA (Angiography)**	**Original Date: July 2008**
CPT Codes: 72191	**Last Revised Date: March 2023**
Guideline Number: Evolent_CG_038	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR PELVIS CT Angiography / CT Venography (CTA/CTV)

IMPORTANT NOTE

When vascular imaging of the aorta and both legs, i.e., CTA aortogram and runoff is desired (sometimes incorrectly requested as Abd/Pelvis CTA & Lower Extremity CTA Runoff)**, only one authorization request is required, using CPT Code 75635 Abdominal Arteries CTA.** This study provides for imaging of the abdomen, pelvis, and both legs. The CPT code description is CTA aorto-iliofemoral runoff; abdominal aorta and bilateral ilio-femoral lower extremity runoff**.**

When separate requests for CTA abdomen and CTA Pelvis are encountered for processes involving both the abdomen and pelvis (but do NOT need to include legs/runoff), they need to be resubmitted as a single Abdomen/Pelvis CTA, using CPT Code 74174 (to avoid unbundling). Otherwise, the exam should be limited to the appropriate area (i.e., Abdomen OR Pelvis) that includes the area of concern.

Evaluation of known or suspected pelvic vascular disease
Abdominal Aortic Aneurysm (AAA) (needs to be resubmitted as CTA Abdomen and Pelvis unless there is a specific finding limited to the pelvis)

Other vascular abnormalities seen on prior imaging studies limited to the pelvis:

- Initial evaluation of inconclusive vascular findings on prior imaging
- Follow-up of known visceral vascular conditions in the pelvis (such as aneurysm, dissection, compression syndromes, arteriovenous malformations (AVMs), fistulas, intramural hematoma, and vasculitis)
- Vascular invasion or displacement by tumor (conventional CT or MRI also appropriate)[1]
- For known iliac vascular disease, e.g., aneurysm, dissection, arteriovenous malformations (AVMs), and fistulas, intramural hematoma, and vasculitis[2-4] when ultrasound is inconclusive (See background for ultrasound screening intervals). CTA/MRA rather than CT/MRI is needed for non-aortic disease when ultrasound is inconclusive.[5]
- Suspected complications of known aneurysm as evidenced by clinical findings such as new onset of pelvic pain

Vascular ischemia or hemorrhage needs to be resubmitted as CTA Abdomen and Pelvis unless there is a specific finding limited to the pelvis)

For patients at increased risk for vascular abnormalities (CTA or MRA): (needs to be resubmitted as CTA Abdomen and Pelvis unless there is a specific finding limited to the pelvis)

Venous

- For evaluation of suspected pelvic vascular disease or pelvic congestive syndrome when findings on ultrasound are indeterminate (MR or CT venography (CTV) may be used as the initial study for pelvic thrombosis or thrombophlebitis)[6, 7]
- For unexplained lower extremity edema (typically unilateral or asymmetric) with negative or inconclusive ultrasound[8]
- For evaluation of venous thrombosis in the inferior vena cava[9]
- Venous thrombosis if previous studies have not resulted in a clear diagnosis[10]
- Vascular invasion or displacement by tumor (Conventional CT or MRI also appropriate)[1, 11]
- For suspected May-Thurner Syndrome (iliac vein compression syndrome) (can include abdomen CTA)[12, 13]

Other vascular indications

- For evaluation of erectile dysfunction when a vascular cause is suspected and Doppler ultrasound is inconclusive[14]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Pre-operative evaluation[15, 16]

- Evaluation of interventional vascular procedures prior to endovascular aneurysm repair (EVAR), or for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Imaging of the deep inferior epigastric arteries for surgical planning (breast reconstruction surgery), if abdomen CTA is also needed, resubmit as abdomen and pelvis CTA[16]
- Prior to uterine artery embolization for fibroids (MRA preferred)[17]
- Prior to solid organ transplantation when vascular anatomy is needed

Post-operative or post-procedural evaluation

- Evaluation of post-operative complications of renal transplant allograft[18]
- Evaluation of endovascular/interventional vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Evaluation of post-operative complications, e.g., pseudoaneurysms related to surgical bypass grafts, vascular stents, and stent-grafts in the pelvis
- Follow-up for post-endovascular repair (EVAR) or open repair of abdominal aortic aneurysm (AAA)[5] or abdominal extent of iliac artery aneurysms. **CT preferred** unless MRA/CTA is needed for procedural planning or to evaluate complex anatomy.(Needs to be resubmitted as CTA Abdomen and Pelvis unless there is a specific finding limited to the pelvis)

When Pelvis CTA is requested in combination with Chest CTA, the Pelvis CTA needs to be resubmitted as an Abdomen/Pelvis CTA (see Abdomen/Pelvis CTA Guidelines for approvable combo indications)

BACKGROUND

Computed tomographic angiography (CTA) is used in the evaluation of many conditions affecting the veins and arteries of the pelvis or lower extremities. It is not appropriate as a screening tool for asymptomatic patients without a previous diagnosis.

OVERVIEW

CT/MRI and acute hemorrhage: MRI is not indicated. MRA/MRV is rarely indicated for evaluation of intraperitoneal or retroperitoneal hemorrhage, particularly in the acute setting.

CT is the study of choice due to its availability, speed of the study and less susceptibility to artifact from patient motion. Advances in technology have allowed conventional CT to not just detect hematomas but to also identify the source of acute vascular extravasation. In special cases, finer vascular detail to assess the specific vessel responsible for hemorrhage may require the use of CTA. CTA in diagnosis of lower gastrointestinal bleeding is such an example.[19] MRA/MRV can be utilized in non-acute situations to assess vascular structure involved in atherosclerotic disease and its complications, such as vasculitis, venous thrombosis, vascular congestion, or tumor invasion. Although some of these conditions may be associated with hemorrhage, bleeding is usually not the primary reason why MRI/MRA/MRV is selected for the evaluation. A special condition where MRI may be superior to CT for evaluating hemorrhage is to detect an underlying neoplasm as the cause of bleeding.[20]

Follow-up of asymptomatic, incidentally detected iliac artery aneurysms: The definition of an iliac artery aneurysm (IAA) is dilatation to more than 1.5 times its normal diameter; in general, a common iliac artery ≥ 18 mm in men and ≥ 15 mm in women; an internal iliac artery (IIA) > 8 mm is considered aneurysmal.

Iliac aneurysm ultrasound screening intervals:

- Aneurysm size 2.0 -2.9 cm, every 3 years
- Aneurysm size 3.0-3.4 cm, annually
- Aneurysm size > 3.5 cm, every 6 months[5]

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POLICY HISTORY

Date	Summary
March 2023	• Redirected vascular requests for abdomen alone or pelvis imaging alone to resubmit as abdomen and pelvis CTA required unless condition limited to pelvis • Other vascular abnormalities: clarified indication for non-aortic vascular conditions • Transplant: added section • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Aligned sections across body imaging guidelines
April 2022	• Removed follow-up intervals for EVAR and AAA since Abdomen Pelvis CTA is usually appropriate study

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guideline **PELVIS CT**	**Original Date: September 1997**
CPT Codes: 72192, 72193, 72194	**Last Revised Date: March 2023**
Guideline Number: Evolent_CG_036	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

Note: For syndromes for which imaging starts in the pediatric age group, MRI preferred

Note: PELVIS CT **ALONE** SHOULD ONLY BE APPROVED WHEN DISEASE PROCESS IS SUSPECTED TO BE LIMITED TO THE PELVIS. CT Abdomen/Pelvis Combo (CPT Codes: 74176, 74177, 74178) is the correct study when the indication(s) include both the abdomen AND pelvis, such as CTU (CT Urography), CTE (CT Enterography), acute abdominal pain, widespread inflammatory disease or neoplasm.

When separate requests for CT abdomen and CT Pelvis are encountered for processes involving both the abdomen and pelvis, they need to be resubmitted as a single Abdomen/Pelvis CT (to avoid unbundling). Otherwise, the exam should be limited to the appropriate area (i.e., Abdomen OR Pelvis) which includes the specific organ, area of known disease/abnormality, or the area of concern.

INDICATIONS FOR PELVIS CT

Pelvic Pain for Unknown Etiology

- CT allowed after initial workup is inconclusive and must include results of the following:
  - Initial imaging, such as ultrasound (although ultrasound does have limitations, it is a common misconception that ultrasound is not a good tool in ALL obese patients, such that it is often useful even in obese patients and quite reasonable

to attempt as a first-line imaging modality particularly given the benefit of no radiation), scope study, or x-ray AND
    - Appropriate laboratory testing (chemistry profile, complete blood count, and urinalysis)
- For acute pelvic pain in a patient over the age of 65[1, 2]

Initial staging of prostate cancer (MRI Pelvis preferred)
(Abdomen CT can also be approved for staging if PSMA PET not requested)

- Unfavorable intermediate risk, high risk and very high-risk disease
    - Gleason 8, 9, 10 disease
    - Gleason 4+3=7 disease (primary pattern 4)
    - Gleason 3+4=7 disease AND PSA > 10 or clinical stage ≥ T2b
    - Gleason 3+3=6 disease AND PSA > 20 or clinical stage ≥ T3
    - >50% cores positive for cancer in a random (non-targeted) biopsy[4]

*Note: In patients who have been on a 5-alpha reductase inhibitor (such as Proscar) in the past 12 months, an "adjusted PSA" should be used. To adjust, multiply PSA by a factor of 2 (e.g., PSA 6 on finasteride adjusts to a PSA of 12)

Known prostate cancer for workup of recurrence and response to treatment when there is a contraindication for MRI and PSMA PET is not requested[5]

- Initial treatment by radical prostatectomy
    - Failure of PSA to fall to undetectable levels or PSA detectable and rising on at least 2 subsequent determinations
- Initial treatment radiation therapy
    - Post-radiation therapy (Post-RT) rising PSA on at least 2 subsequent determinations or positive digital exam and is candidate for local therapy
- Known metastatic disease with progression on therapy does not require CI to MRI if CT is requested

Evaluation of suspicious or known mass/tumors

- Initial evaluation of suspicious pelvic masses/tumors found only in the pelvis by physical exam and ultrasound has been performed
- Surveillance: One follow-up exam to ensure no suspicious change has occurred in a tumor in the pelvis. No further surveillance CT unless tumor(s) are specified as highly suspicious, or change was found on exam or last follow-up imaging
- Initial staging of known cancer
- Follow-up of known cancer[4, 5]
    - In a patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer.
        - Known cancer with suspected pelvis metastasis based on a sign, symptom (e.g., anorexia, early satiety, intestinal obstruction, night sweats, pelvic

pain, weight loss, vaginal bleeding), or an abnormal lab value (alpha-fetoprotein, CEA, CA 19-9, p53 mutation)

- For abnormal incidental pelvic lymph nodes when follow-up is recommended based on prior imaging (initial 3-month follow-up)[6]

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated, OR evaluation of suspected metastases

- < 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of suspected infection or inflammatory disease[7, 8]

- Suspected perianal fistula or occult anorectal abscess (MRI preferred)[9-11]
- Suspected infection in the pelvis (based on elevated WBC, fever, anorexia, or nausea and vomiting)
- CT cystourethrography (CTCUG) in the preoperative setting[12]
- For suspected urethral stricture or periurethral pathology only if MRI cannot be done[13, 14]
- Complications of diverticulitis limited to the pelvis (prior imaging study is not required for diverticulitis diagnosis) with severe abdominal pain or severe tenderness or mass, not responding to antibiotic treatment

For evaluation of known infection or inflammatory disease follow-up[15]

- Any known infection to have created an abscess in the pelvis that requires re-evaluation
- Any history of fistula limited to the pelvis that requires re-evaluation or is suspected to have recurred
- For patients with recurrent fistula in anal or perianal Crohn's disease (MRI preferred)[11]
- Abnormal fluid collection seen on prior imaging that needs follow-up evaluation and limited to the pelvis

For evaluation of Inflammatory Bowel Disease (IBD) such as Crohn's or Ulcerative Colitis (MRE should be considered for age < 35 to reduce radiation exposure). If only Pelvis CT is requested for IBD, requests should be resubmitted as CT Abdomen and Pelvis (see Guideline for criteria) unless it is known that the disease is limited to the pelvis.

For suspected or known hernia

- For pelvic pain due to a suspected occult, spigelian, or incisional hernia when physical exam and prior imaging are non-diagnostic or equivocal or if requested as a preoperative study
- For confirming the diagnosis of a recurrent hernia when ultrasound is negative or non-diagnostic

- Hernia with suspected complications (e.g., bowel obstruction or strangulation, or non-reducible) based on symptoms (e.g., diarrhea, hematochezia, vomiting, severe pain), physical exam (guarding, rebound) or prior imaging[16]
- Deep pelvic hernia is suspected (obturator, sciatic or perineal); does not require US first but this type of hernia needs to be specified in notes[17] (if CT Abdomen is also needed, resubmit as CT Abdomen and Pelvis)

For evaluation of known or suspected non-aortic vascular disease (e.g., aneurysms, hematomas)[18, 19], CTA/MRA is the preferred study when ultrasound is inconclusive

- If a contraindication to CTA/MRA has been provided, CT can be approved
- Follow-up for post-endovascular repair (EVAR) or open repair of iliac artery aneurysms (CT preferred unless MRA/CTA is needed for procedural planning or to evaluate complex anatomy)
    - Routine, baseline study (post-op/intervention) is warranted within the first month after EVAR:
        - Repeat in 6 months if type II endoleak is seen (continue every 6 months x 24 months, then annually)
        - Repeat in 12 months if no endoleak or sac enlargement is seen
        - If neither endoleak nor AAA enlargement is seen on imaging one year after EVAR, CT is needed only if US is not feasible for annual surveillance (until year 5 as below)
    - If symptomatic or imaging shows increasing, or new findings related to stent graft – more frequent imaging may be needed

Musculoskeletal Indications (all of the following require contraindication to MRI)

- Known or suspected aseptic/avascular necrosis of hip(s) after completion of initial x-ray[20] (CT or MRI can be approved for surgical planning)
- Sacroiliitis (infectious or inflammatory, such as Ankylosing Spondylitis/ Spondyloarthropathies) after completion of x-ray and rheumatology workup[21-23]
- Sacroiliac joint dysfunction (after initial x-ray) when there is:
    - Persistent back and/or sacral pain unresponsive to four (4) weeks of conservative treatment, received within the past six (6) months, including physical therapy or physician-supervised home exercise plan (HEP)
- Persistent Pain:
    - For evaluation of persistent pain unresponsive to four (4) weeks of conservative treatment received within the past six (6) months
    - For suspected piriformis syndrome after failure of 4 weeks conservative treatment[24]
- For evaluation of both hips when the patient meets hip CT guidelines (x-ray + persistent pain unresponsive to conservative treatment) for both the right and left hip, Pelvis CT is the preferred study.

    - If labral tear is suspected due to a positive anterior impingement sign or posterior impingement sign, then bilateral hip CTs are the preferred studies (not Pelvis CT)
    - If bilateral hip arthrograms are requested and otherwise meet guidelines, bilateral hip MRIs are the preferred studies (not Pelvis CT)
- When non-diagnostic imaging is requested for anatomic guidance for hip surgery, a CT Pelvis is approvable since measurements of both hips may be needed (only one non-diagnostic request can be approved and should include the surgical site)
- For further evaluation of congenital anomalies of the sacrum and pelvis and initial imaging has been performed

Transplants

- Prior to solid organ transplantation
- For initial workup prior to Bone Marrow Transplantation (BMT) (along with CT Chest[25], CT Abdomen, CT Sinus and Brain MRI)[26]). Alternatively, PET might be sufficient to evaluate the abdomen and pelvis if indicated based on that malignancy (see PET Guideline)

For evaluation of trauma[27]

- For evaluation of trauma with lab or physical findings of pelvic bleeding
- For evaluation of physical or radiological evidence of complex or occult pelvic fracture or for pre-operative planning of complex pelvic fractures

Other Indications for Pelvic CT:

- Persistent pelvic pain not explained by previous imaging
- For diffuse, unexplained lower extremity edema with negative or inconclusive ultrasound[28]
- For suspected May-Thurner syndrome (CTV/MRV preferred)[29, 30]
- For further evaluation of a new onset or non-reducible varicocele[31]
- For assessment of pelvic congestion syndrome when findings on ultrasound are indeterminate (CTA/MRA preferred)[32]
- To locate an intrauterine device after ultrasound and plain x-ray are equivocal or non-diagnostic (imaging of the abdomen may also be indicated)[33, 34]
- For diagnosis or to guide treatment of urachal anomalies when ultrasound is non-diagnostic[35, 36]

Other Indications for Pelvis CT when CI to MRI is provided:

- For follow-up of an indeterminate or inconclusive finding on ultrasound limited to the pelvis
- For location or evaluation of undescended testes in adults and in children, including determination of location of testes, if ordered by a specialist[37]

- For evaluation and characterization of uterine and adnexal masses, (e.g., fibroids, ovaries, tubes, and uterine ligaments) or congenital uterine or renal abnormality where ultrasound has been done previously[38]
- For evaluation of abnormal uterine bleeding when ultrasound findings are indeterminate[39]
    - Age ≤ 50 – Vascular stalk or focal doppler signal on US
    - Age > 50 – Thickened endometrium, vascular stalk or focal doppler signal on US
- For evaluation of uterus prior to and after embolization (CTA may be approved in addition to CT for preprocedural planning)[40]
- For evaluation of endometriosis when preliminary imaging has been completed or to follow up known endometriosis[41, 42]
- For further evaluation of suspected adenomyosis when ultrasound is inconclusive,[43] such as the following:
    - Uterine abnormality on US
        - Anechoic spaces/cysts in myometrium
        - Heterogeneous echotexture
        - Obscured endometrial/myometrial border
        - Sub-endometrial echogenic linear striations
        - Thickening of the transition zone
        - Uterine enlargement
        - Uterine wall thickening
- Prior to uterine surgery if there is abnormality suspected on prior ultrasound
- For suspected placenta accreta or percreta when ultrasound is indeterminate[44]
- For further assessment of a scrotal or penile mass when ultrasound is inconclusive[45, 46]
- For investigation of a malfunctioning penile prosthesis
- Suspected urethral diverticula and other imaging is inconclusive[47]
- For suspected patent urachus or other urachal abnormalities when ultrasound is non-diagnostic[35, 36]
- For transient or episodic hematospermia and age ≥ 40 with negative or inconclusive ultrasound
- For persistent hematospermia (duration > 1 month, any age) with negative or inconclusive ultrasound [48]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Pre-operative evaluation

- For diagnostic purposes prior to pelvic surgery or procedure

For post-operative/procedural evaluation

- Follow-up of known or suspected post-operative complication involving the hips or the pelvis[49, 50] within six months
- A follow-up study to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed

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BACKGROUND

CT provides direct visualization of anatomic structures in the abdomen and pelvis and is a fast-imaging tool used to detect and characterize disease involving the abdomen and pelvis. Pelvic imaging begins at the iliac crests through pubic symphysis. It has an ability to demonstrate abnormal calcifications or fluid/gas patterns in the viscera or peritoneal space.

In general, ionizing radiation from CT should be avoided during pregnancy. Ultrasound is clearly a safer imaging option and is the first imaging test of choice; although, CT after equivocal ultrasound has been validated for diagnosis. Clinicians should exercise increased caution with CT imaging in children, pregnant women, and young adults due to the risks of exposure to ionizing radiation. Screening for pregnancy as part of a work-up is suggested to minimize the number of unexpected radiation exposures for women of childbearing age.

OVERVIEW

***Conservative Therapy**: This should include a multimodality approach consisting of a **combination of active and inactive components**. Inactive components, such as rest, ice, heat, modified activities, medical devices, acupuncture and/or stimulators, medications, injections (epidural, facet, bursal, and/or joint, not including trigger point), and diathermy can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or chiropractic care.

****Home Exercise Program** - **(HEP)/Therapy:** the following elements are required to meet guidelines for completion of conservative therapy[51]:

- Information provided on exercise prescription/plan AND
- Follow-up with member with documentation provided regarding lack of improvement (failed) after completion of HEP (after suitable 4-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute "inability to complete" HEP).
- Dates and duration of failed PT, physician-supervised HEP, or chiropractic treatment should be documented in the original office notes or an addendum to the notes.

Ultrasound should be considered prior to a request for Pelvis CT for the following:

- Initial evaluation or follow-up of ovarian mass or abnormal physical finding

Combination request of Abdomen CT/Chest CT - A Chest CT will produce images to the level of L3. Documentation for combo is required.

Helical CT of Prostate Cancer – Conventional CT is not useful in detecting prostate cancer as it does not allow direct visualization. Contrast-enhanced MRI is more useful in detecting prostate cancer. MRI is recommended in patients with suspected cancer but prior negative biopsy because MRI alone can miss up to 26% of clinically significant cancers that would be detected on systemic biopsy.[52] Helical CT of the prostate may be a useful alternative to MRI in patients with an increasing PSA level and negative findings on biopsy but is not the imaging study of choice.

Pelvic Trauma and CT Imaging – Helical CT is useful in the evaluation of low- or high-flow vascular injuries in patient with blunt or penetrating pelvic trauma. It provides detailing of fractures and position of fracture fragments along with the extent of diastasis of the sacroiliac joints and pubic symphysis. CT helps determine whether pelvic bleeding is present and can identify the source of bleeding. With CT, high flow hemorrhage can be distinguished from low flow hemorrhage aiding the proper treatment.

Imaging of hernias – Most hernias are diagnosed clinically with imaging recommended for the diagnosis of occult hernias or in the evaluation of hernia complications, such as bowel obstruction or strangulation. Groin hernias are at increased risk for incarceration/strangulation in women, right femoral hernias, and when there is a hernia-related hospitalization in the year preceding hernia repair. Morbidity and mortality are increased for strangulated hernias in patients over 65, prolonged symptoms, incarceration of over 24 hours, symptoms of > 3 days, bowel obstruction, anticoagulant use.[53] To detect occult hernias, ultrasound is a first-line study with a sensitivity of 86% and specificity of 77% compared to 80% sensitivity and 65% specificity for CT.[54] According to Miller et al, "Magnetic resonance imaging is generally not considered a first- or even second-line evaluation modality for hernias…".[55] Based on this analysis MRI is recommended only when ultrasound and CT have been performed and fail to make a diagnosis.

Weight loss definitions and initial evaluation[56, 57] – Unintentional weight loss is considered clinically significant if the amount of weight lost over 12 months is ≥ 5%. Older age and higher percentage of weight loss correlates with higher likelihood of malignancy. A targeted evaluation is recommended when there are signs or symptoms suggestive of a specific source. For example, when there is clinically significant weight loss with abdominal pain that prompts an evaluation for an abdominal source of the weight loss; CXR and labs such as TSH would not be needed prior to abdominal imaging. Conversely a smoker with a cough and weight loss would not start with abdominal imaging, a chest x-ray would be the first test to start with. When there is no suspected diagnosis, initial evaluation includes CXR, age-appropriate cancer screening (such as colonoscopy and mammography) and labs (including CBC, CMP, HbA1C, TSH, stool

hemoccult, ESR/CRP, HIV, Hepatitis C). If this initial evaluation fails to identify a cause of weight loss, then the patient is monitored and if progressive weight loss is seen on subsequent visits/weights, then CT Chest/Abdomen/Pelvis is reasonable; MRI if there is a contraindication to CT such as contrast allergy or impaired renal function.[58]

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POLICY HISTORY

Date	Summary
March 2023	• Prostate cancer: updated guidance based on new NCCN criteria • IBD: eliminated indications for abdomen alone or pelvis imaging alone, resubmission as abdomen and pelvis CT required unless limited indication • Hernia: added indication for deep pelvic hernia • Aneurysm: eliminated indications for abdomen alone or pelvis imaging alone, resubmission as abdomen and pelvis CT required unless limited indication, updated guidance for imaging intervals post-repair • Musculoskeletal: additional guidance provided for hip imaging, non-diagnostic requests added, corrected statement requiring abnormal x-ray to requiring prior x-ray • Transplant: added section (added section from MRI if CI to MRI provided) • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Aligned sections across body imaging guidelines
April 2022	• Added abnormal incidental pelvic lymph nodes when follow-up is recommended based on prior imaging (initial 3-month follow-up) to "Evaluation of suspicious or known mass/tumors" • Within sacroiliitis, clarification of non-diagnostic or indeterminate findings

Reviewed / Approved by Clinical Guideline Committee

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Clinical guidelines **PELVIS MRI**	**Original Date: September 1997**
CPT Codes: 72195, 72196, 72197, +0698T	**Last Revised Date: March 2023**
Guideline Number: Evolent_CG_037	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

Note: There is no MRI Abdomen/Pelvis combo (comparable to a CT Abdomen/Pelvis) such that if imaging of both the abdomen and pelvis are indicated, two separate exams (and authorization) are required (i.e., MRI Abdomen and MRI Pelvis)

INDICATIONS FOR PELVIC MRI (Click here for Fetal MRI indications**)**

Initial pelvic imaging for staging of prostate cancer (if not recently performed for biopsy planning; Abdomen MRI can also be approved for staging if PSMA PET not requested)

- Unfavorable intermediate risk, high risk and very high-risk disease*
  - Gleason 8, 9 or 10 disease
  - Gleason 4+3=7 disease (primary pattern 4)
  - Gleason 3+4=7 disease AND PSA > 10 or clinical stage ≥ T2b
  - Gleason 3+3=6 disease AND PSA > 20 or clinical stage ≥ T3
  - > 50% cores positive for cancer in a random (non-targeted) biopsy[1,2]

Pelvis MRI can be approved in combination with PSMA PET (see PET GL) for initial staging if meets above criteria

* In patients who have been on a 5-alpha reductase inhibitor (such as Proscar) in the past 12 months, an "adjusted PSA" should be used. To adjust, multiply PSA by a factor of 2 (i.e., PSA 6 on finasteride adjusts to a PSA of 12)

Known prostate cancer for workup of recurrence and response to treatment[3]

- Initial treatment by active surveillance (asymptomatic very low, low, or intermediate risk with expected patient survival ≥ 10 years):
    - Initial multiparametric MRI (mpMRI) for patients who chose active surveillance
    - mpMRI to be repeated no more than every 12 months unless clinically indicated
- Initial treatment by radical prostatectomy:
    - Failure of PSA to fall to undetectable level or PSA detectable and rising on at least 2 subsequent determinations
- Initial treatment radiation therapy:
    - Post-radiation therapy (Post-RT) rising PSA on at least 2 subsequent determinations or positive digital exam and is candidate for local therapy

Indication for prostate MRI (suspected prostate cancer)[4-9]

- Prior to prostate biopsy when notes indicate that biopsy is planned[10]
- In individuals with previous negative biopsy and ongoing concerns of increased risk of prostate cancer (i.e., rising or persistently elevated PSA OR suspicious digital rectal exam (DRE))
- For evaluation of elevated PSA (on two separate levels) when PI-RADS classification needed to make decision on whether or not to perform a biopsy when ALL of the following has been provided[11]:
    - Digital rectal examination (DRE) findings
    - PSA elevation not attributed to benign disease
    - Biopsy has been discussed with the patient (Typically, this request would be from the person performing the biopsy (i.e., urologist) and imaging done at the facility where the fusion biopsy would be performed should a higher risk lesion be identified.)
- For evaluation of a very suspicious prostate nodule on exam when biopsy is under consideration[11]
- Follow up MRI can be approved at the following intervals[12, 13]:
    - PI-RADS 3-5 lesions: 12-month interval
    - PI-RADS 1-2 lesions: 24-month interval
        - Earlier for PI-RADS 1-2 if biopsy is clearly planned, progressive rise in PSA or other risk factors exist

Evaluation of masses seen on ultrasound or CT for further evaluation of indeterminate or questionable findings:

- Initial imaging (see organ specific guidance below)
- One follow-up exam to ensure no suspicious change has occurred in a tumor in the pelvis. No further surveillance MR unless tumor(s) is/are specified as highly suspicious, or change was found on exam or last follow-up imaging.
- For abnormal incidental pelvic lymph nodes when follow-up is recommended based on prior imaging (initial 3-month follow-up)[4]

Initial staging of known cancer

Follow-up of known cancer[3, 14]:

- In a patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
- With suspected pelvic metastasis based on a sign, symptom, (e.g., anorexia, early satiety, intestinal obstruction, night sweats, pelvic pain, weight loss, vaginal bleeding) or an abnormal lab value (alpha-fetoprotein, CEA, CA 19-9, p53 mutation)

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine

For evaluation of suspected infection or inflammatory disease after preliminary imaging (such as CT, US, or nuclear medicine) has been performed or is contraindicated (includes MR urography (MRU) which includes abdomen MRI when indicated)[15-18]

- Suspected perianal fistula
- Suspected infection (based on elevated WBC, fever, anorexia, or nausea and vomiting) in the pelvis
- For suspected urethral stricture or periurethral pathology[19]
- Suspected peritonitis (would typically need to include MRI Abdomen), abdominal pain and tenderness to palpation is present, and at LEAST one of the following:
    - Rebound, guarding or rigid abdomen, OR
    - Severe tenderness to palpation over the entire abdomen
- Complications of diverticulitis with severe abdominal pain or severe tenderness or mass, not responding to antibiotic treatment (prior imaging study is not required for diverticulitis diagnosis)

For evaluation of known infection or inflammatory disease follow-up[16, 20, 21]

- Any known infection that is clinically suspected to have created an abscess in the pelvis and preliminary imaging has been performed or is contraindicated
- Any history of fistula limited to the pelvis that requires re-evaluation or is suspected to have recurred
- For patients with recurrent fistula or perianal Crohn's disease
- Abnormal fluid collection seen on prior imaging that needs follow-up evaluation and is limited to the pelvis

For evaluation of Inflammatory Bowel Disease (IBD) such as Crohn's or Ulcerative Colitis (includes MR enterography and can also approve Abdomen MRI/MRE)

- For suspected inflammatory bowel disease after complete work up including physical exam, labs, and recent colonoscopy[22-24]
- Known inflammatory bowel disease with recurrence or worsening signs/symptoms requiring re-evaluation or for monitoring therapy[25]

For suspected or known hernia

- For pelvic pain due to a suspected occult, spigelian, or incisional hernia when physical exam and prior imaging (ultrasound AND CT) are non-diagnostic or equivocal[26-29] and limited to the pelvis
- Hernia with suspected complications, such as strangulation or incarceration, based on physical exam (guarding, rebound) or prior imaging[30] (CT preferred)
- Suspected athletic pubalgia (sports hernia) in a patient with persistent groin pain that occurs with exertion, who has not responded to conservative treatment for four weeks, when other imaging is inconclusive[31, 32]
- Deep pelvic hernia is suspected (obturator, sciatic or perineal) (does not require US first but this type of hernia needs to be specified in notes)[33]

Indications for Musculoskeletal Pelvic MRI

- Initial evaluation of suspicious mass/tumor of the bones, muscles or soft tissues of the pelvis found on an imaging study, and needing clarification, or found by physical exam and after x-ray or ultrasound is completed
- Evaluation of suspected fracture and/or injury when initial imaging is completed or for confirmed stress (fatigue) fracture for "return to play" evaluation[34]
- For evaluation of known or suspected aseptic/avascular necrosis of hip(s) after completion of initial x-ray[35]
- Known or suspected sacroiliitis (infectious or inflammatory) after completion of x-ray[36] and rheumatologic workup
- Sacroiliac Joint Dysfunction (after initial X-ray) when there is[36]:

    - Persistent back and/or sacral pain unresponsive to four (4) weeks of conservative treatment, received within the past six (6) months, including physical therapy or physician supervised home exercise plan (HEP)
- For evaluating the lumbosacral plexus[37, 38]:
    - To confirm involvement in symptomatic patients with known tumor
    - To assess extent of injuries in the setting of pelvic trauma
    - To exclude the presence of masses in patients with unilateral changes, or inconclusive or abnormal findings on EMG when there are persistent symptoms
    - For evaluation when lumbar spine MRI is suspicious or indeterminate
- For suspicion of pudendal neuralgia in the setting of chronic pelvic pain with genital numbness and erectile dysfunction when other causes have been ruled out (see Background regarding diagnosis)[39]
- For suspicion of meralgia paresthetica when prior testing is inconclusive (diagnostic nerve block; electrodiagnostic testing; AND somatosensory evoked potentials)[40, 41]
- Persistent Pain:
    - For evaluation of persistent pain unresponsive to four (4) weeks of conservative treatment received within the past six (6) months
    - For suspected piriformis syndrome after failure of 4 weeks conservative treatment[42]
- For evaluation of both hips when the patient meets hip MRI guidelines (x-ray + persistent pain unresponsive to conservative treatment) for both the right and left hip, Pelvis MRI is the preferred study.
    - If labral tear is suspected due to a positive anterior impingement sign or posterior impingement sign, then bilateral hip MRIs are the preferred studies (not Pelvis MRI)
    - If bilateral hip arthrograms are requested and otherwise meet guidelines, bilateral hip MRIs are the preferred studies (not Pelvis MRI)
- For further evaluation of congenital anomalies of the sacrum and pelvis and initial imaging has been performed

For evaluation of known or suspected non-aortic vascular disease (e.g., aneurysms, hematomas)[43, 44], CTA/MRA is the preferred study when ultrasound is inconclusive

- If a contraindication to CTA/MRA has been provided, MRI can be approved

Other Indications for a Pelvic MRI when CT is inconclusive or cannot be completed

- Persistent abdominal/pelvic pain not explained by previous imaging
- For any of the following B symptoms: fevers more than 101° F, drenching night sweats, or unexplained weight loss of more than 10% of body weight over 6 months with documented concern for lymphoma/malignancy when CT is inconclusive or cannot be completed (can approve abdomen MRI, too, when appropriate)

- Clinically significant unintentional weight loss i.e., ≥ 5% of body weight in less than 12 months (or ≥ 2% in one month), with signs or symptoms suggestive of an abdominal cause (see Background for weight loss definitions and initial evaluation) , Abdomen MRI should also be approved)
- Ongoing unexplained clinically significant weight loss i.e., ≥ 5% of body weight in less than 12 months (or ≥ 2% in one month)[45-47], after initial workup (see Background) has been completed, no cause identified, and second visit documenting further decline in weight
- For fever of unknown origin (temperature of ≥ 101° degrees for a minimum of 3 weeks) after standard diagnostic tests are negative[48]
- For suspected or known retroperitoneal fibrosis after complete workup and ultrasound to determine extent of disease[49]
- For suspected paraneoplastic syndrome (including dermatomyositis) with high suspicion of abdominal malignancy and appropriate workup has been done (see Background for details)
- For diffuse, unexplained lower extremity edema with negative or inconclusive ultrasound[50]
- For suspected May-Thurner syndrome (CTV/MRV preferred)[51, 52]
- For further evaluation of a new onset or non-reducible varicocele[53]
- Prior to liver transplantation (Abdomen CT preferred, MRCP also approvable), may repeat studies immediately prior to transplantation with known HCC, PSC or cholangiocarcinoma
- Prior to Bone Marrow Transplant (BMT) (along with CT Chest[54], CT (or MR) Abdomen, CT Sinus and Brain MRI)[55]). Alternatively, PET might be sufficient to evaluate the abdomen and pelvis if indicated based on that malignancy (see PET Guideline)
- Prior to solid organ transplantation
- Von Hippel Lindau (VHL) at least every other year starting at age 16; can also approve abdomen MRI (abdomen and pelvis ultrasound starting at age 8)[56]
- Hereditary Paraganglioma syndromes every 2-3 years IF whole body MRI (unlisted MRI CPT 76498) not available. (WB MRI is the preferred study; if unable to do whole body MRI may approve abdomen MRI, pelvis MRI, skull base and neck MRI and chest CT. SDHB mutation may start at age 6, all other SDHx start at age 10).
- Multiple Endocrine Neoplasia type 1 (MEN1) every 1-3 years (chest CT or MRI also approvable for this syndrome at same interval) [57]

Other indications for a Pelvic MRI (MRI preferred over CT)

- Pelvic pain not explained by previous imaging/pre-procedure[58]
    - Appropriate laboratory testing (chemistry profile, complete blood count, and urinalysis) and initial imaging, such as ultrasound
- For location or evaluation of undescended testes in adults and in children, including determination of location of testes, if ordered by a specialist[59]

- For evaluation and characterization of uterine and adnexal masses, (e.g., fibroids, ovaries, tubes, and uterine ligaments) or congenital uterine or renal abnormality where ultrasound has been done previously[58]
- For evaluation of abnormal uterine bleeding when ultrasound findings are indeterminate[60]
    - Age ≤ 50 – Vascular stalk or focal doppler signal on US
    - Age > 50 – Thickened endometrium, vascular stalk or focal doppler signal on US
- For evaluation of uterus prior to and after embolization (MRA may be approved in addition to MRI for preprocedural planning)[61]
- For evaluation of endometriosis when preliminary imaging has been completed or to follow up known endometriosis[62, 63]
- For further evaluation of suspected adenomyosis when ultrasound is inconclusive,[64] such as the following:
    - Uterine abnormality on US
        - Anechoic spaces/cysts in myometrium
        - Heterogeneous echotexture
        - Obscured endometrial/myometrial border
        - Sub-endometrial echogenic linear striations
        - Thickening of the transition zone
        - Uterine enlargement
        - Uterine wall thickening
- Prior to uterine surgery if there is abnormality suspected on prior ultrasound
- For suspected placenta accreta or percreta when ultrasound is indeterminate[65]
- For further assessment of a scrotal or penile mass when ultrasound is inconclusive[66, 67]
- For investigation of a malfunctioning penile prosthesis
- Suspected urethral diverticula and other imaging is inconclusive[68]
  (MRI may be indicated without prior ultrasound in limited situations as suggested, such as when there is compelling evidence suggestive of urethral diverticulum (i.e., ostia on cystoscopy or tender cystic lesion on anterior vaginal wall overlying the urethra) or for surgical planning.)
- For suspected pelvic congestion syndrome in women with chronic pelvic pain when other imaging is non-diagnostic[69]
- For suspected patent urachus or other urachal abnormalities when ultrasound is non-diagnostic[70, 71]
- MR defecography for suspected structural cause of defecatory outlet obstruction to confirm diagnosis if other testing is equivocal (anorectal manometry and balloon expulsion testing)[72]
- For evaluation of enlargement of organ abnormality seen on previous imaging - to provide an alternative to an indeterminate or inconclusive ultrasound
- For diffuse, unexplained lower extremity edema with negative or inconclusive ultrasound

- Surveillance MRI (include abdomen) every 2-3 years for patients with Hereditary Paraganglioma syndromes Type 1-5[73]
- For transient or episodic hematospermia and age ≥ 40 with negative or inconclusive ultrasound
- For persistent hematospermia (duration > 1 month, any age) with negative or inconclusive ultrasound [74]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Pre-operative evaluation

- For diagnostic purposes prior to pelvic surgery or procedure

Post-operative/procedural evaluation

- Follow-up of known or suspected post-operative complication involving the hips or the pelvis[75, 76] within six months
- A follow-up study to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed.

Note: If an Abdomen/Pelvis MRI is indicated and the Abdomen MRI has already been approved, then the Pelvis MRI may be approved.

Fetal MRI (CPT codes 74712-74713) - To better define or confirm a known for suspected abnormality of the fetus after ultrasound has been performed during the second trimester[77] or when fetal surgery is planned and/or to make a decision about therapy, delivery or to advise the family about prognosis.[78] Also includes evaluation of the maternal pelvis and placenta.

BACKGROUND

Magnetic resonance imaging of the pelvis is a noninvasive technique for the evaluation, assessment of severity, and follow-up of diseases of the male and female pelvic organs. MRI

provides excellent contrast of soft tissues and provides multiplanar and 3D depiction of pathology and anatomy. Patients undergoing MRI do not have exposure to ionizing radiation or iodinated contrast materials. MRI techniques utilize body coils to image the entire pelvis or endoluminal coils for evaluation of the rectum, prostate, and genitourinary system.

OVERVIEW

PI-RADS Assessment Categories for Prostate Cancer[79]:

The assignment of a PI-RADS category is based on mpMRI findings only and does not incorporate other factors, including PSA testing, DRE (digital rectal exam), or clinical history.

PI-RADS 1 – Very low (clinically significant cancer is highly unlikely to be present)
PI-RADS 2 – Low (clinically significant cancer is unlikely to be present)
PI-RADS 3 – Intermediate (the presence of clinically significant cancer is equivocal)
PI-RADS 4 – High (clinically significant cancer is likely to be present)
PI-RADS 5 – Very high (clinically significant cancer is highly likely to be present)

***Conservative Therapy** – Conservative therapy should include a multimodality approach consisting of a **combination of active and inactive components**. Inactive components, such as rest, ice, heat, modified activities, medical devices, acupuncture and/or stimulators, medications, injections (epidural, facet, bursal, and/or joint, not including trigger point), and diathermy can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or chiropractic care.

****Home Exercise Program - (HEP)/Therapy** – the following elements are required to meet guidelines for completion of conservative therapy[80, 81]:

- Information provided on exercise prescription/plan AND
- Follow up with member with documentation provided regarding lack of improvement (failed) after completion of HEP (after suitable 4-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute "inability to complete" HEP).
- Dates and duration of failed PT, physician-supervised HEP, or chiropractic treatment should be documented in the original office notes or an addendum to the notes.

MRI and Undescended Testes – The most common genital malformation in boys is undescended testis. In one series, 70% of undescended testes are palpable. Despite the advances in ultrasound technology, ultrasound cannot reliably identify intra-abdominal testes, which comprise 20% of all undescended testes.[82] The timely management of undescended testis is important to potentially minimize the risk of infertility and lessen the risk of malignancy. MRI is used as a diagnostic tool in the detection of undescended testes and can

reveal information for both anatomic and tissue characterization. It is noninvasive, non-ionizing, and can obtain multiplanar images.

MRI and Adnexal Masses – MRI is used in the evaluation of adnexal masses. It can identify and characterize different neoplastic and nonneoplastic abnormalities, e.g., exophytic leiomyoma, endometrioma, dermoid cyst, and ovarian edema. It is a useful adjunct when sonography is inconclusive in the evaluation of adnexal masses.

MRI and Endometriosis – MRI manifestations of endometriosis vary including endometrioma, peritoneal endometrial implant, adhesion, and other rare features. The data obtained from imaging must be combined with clinical data to perform preoperative assessment of endometriosis.

MRI and Lumbosacral Plexopathy – Complete lumbar (L1-L4) or sacral plexopathy (L5-S3) may present with weakness, sensory loss, and flaccid loss of tendon reflexes. Clinical diagnosis is confirmed by EMG. Acute and chronic plexopathies may be caused by nerve sheath tumors; infectious, autoimmune, hereditary, or idiopathic neuropathies; extrinsic compression; or trauma.[38] There is no CPT® code specifically for imaging of the LS plexus.
Pudendal neuralgia may be considered in chronic pain patients who meet the Nantes criteria: pain in the area innervated by the pudendal nerve, pain more severe with sitting, pain that does not awaken the patient from sleep, pain with no objective sensory impairment, and pain relieved by pudendal block. All five criteria must be met for diagnosis.[39]

MRI and Prostate Cancer – Although prostate cancer is the second leading cause of cancer in men, most cases do not lead to a prostate cancer-related death. Aggressive treatment of prostate cancer can have side effects, such as incontinence, rectal injury, and impotence. It is very important to do an evaluation that will assist in making decisions about therapy or treatment. MRI can non-invasively assess prostate tissue, functionally and morphologically. MRI evaluation may use a large array of techniques, e.g., T1-weighted images, T2-weighted images, and dynamic contrast enhanced T1-weighted images.

MRI and Rectal Cancer – MRI is used in the evaluation of rectal cancer to visualize not only the intestinal wall but also the surrounding pelvic anatomy. MRI is an excellent imaging technique due to its high soft-tissue contrast, powerful gradient system, and high resolution. It provides accurate evaluation of the topographic relationship between lateral tumor extent and the mesorectal fascia.

Imaging of hernias – Most hernias are diagnosed clinically with imaging recommended for the diagnosis of occult hernias or in the evaluation of hernia complications, such as bowel obstruction or strangulation. To detect occult hernias, ultrasound is a first-line study with a sensitivity of 86% and specificity of 77%, compared to 80% sensitivity and 65% specificity for CT.[29] According to Miller et al, “Magnetic resonance imaging is generally not considered a first-

or even second-line evaluation modality for hernias…."[28] Both MRI and US can be valuable for diagnosing pathology in athletes with groin pain when a sports hernia is suspected. Pain usually occurs with exertion with tenderness over the pubic symphysis or tubercle and exquisite tenderness on direct palpation of the superficial inguinal ring (positive direct stress test).This term initially denoted a posterior inguinal wall deficiency due to disruption of fascia and/or muscle but more recently given the label "core injury" to also include adductor tendon tears, injury to the aponeurosis of the rectus abdominus and adductor longus tendons, and osteitis pubis.[31]

Elevated CA-125 and pelvic imaging – There is no evidence that isolated levels of CA-125 with no other clinical or radiologic evidence of pathology is sensitive or specific and should not be performed as an isolated test as it can lead to unnecessary studies and anxiety. It is elevated in most cases of epithelial ovarian cancer and is used in monitoring response to treatment as an adjunct to pelvic US. CA-125 has been shown to be increased in many conditions such as fibroids, adenomyosis, pancreatic cancer, endometriosis, tuberculosis, and interstitial lung disease. MRI is not indicated as a first-line test.[83]

Fever of Unknown Origin

Initial work up prior to CT would include a comprehensive history, repeated physical exam, complete blood count with differential, three sets of blood cultures, chest x-ray, complete metabolic panel, urinalysis, ESR, ANA, RA, CMV IgM antibodies, virus detection in blood, heterophile antibody test, tuberculin test, and HIV antibody test.[48] Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for fever can Chest CT be approved. If CXR suggests a malignancy and/or source of fever, then Chest CT would be approved.

Suspected paraneoplastic syndromes with no established cancer diagnosis: laboratory evaluation and imaging

The laboratory evaluation for paraneoplastic syndrome is complex. If the appropriate lab test results are suspicious for malignancy, imaging is indicated.

For **SIADH** (hyponatremia + increased urine osmolality), there is a high association with small cell lung cancer, therefore imaging typically starts with chest CT. If other symptoms suggest a different diagnosis other than small cell lung cancer, different imaging studies may be reasonable.

For **hypercalcemia** (high serum calcium, low-normal PTH, high PTHrP) it is reasonable to start with bone imaging followed by a more directed evaluation such as mammogram, chest, abdomen and pelvis imaging as appropriate.

For **Cushing syndrome** (hypokalemia, normal-high midnight serum ACTH NOT suppressed with dexamethasone) abdominal and chest imaging is reasonable. If dexamethasone suppression test DOES suppress ACTH, pituitary MRI is reasonable.

For **hypoglycemia**, labs drawn during a period of hypoglycemia (glucose < 55, typically a 72 hour fast) (insulin level, C-peptide and IGF-2:IGF-1 ratio) should be done to evaluate for an insulinoma. An elevated insulin level, elevated C-peptide and/or normal IGF-2:IGF-1 ratio warrant CT or MRI abdomen to look for insulinoma. A low insulin, low C-peptide and/or elevated IGF-2:IGF-1 ratio warrant chest and abdominal imaging.

When a **paraneoplastic neurologic syndrome** is suspected, nuclear and cytoplasmic antibody panels are often ordered to further identify specific tumor types. Results are needed prior to imaging. Because these tests are highly specific, if an antibody highly associated with a specific cancer is positive, then further imaging for that cancer is reasonable. For example, anti-Hu has a high association with SCLC and chest CT would be reasonable. Anti-MA2 has a high association with testicular cancer and testicular ultrasound would be a reasonable next step.

Weight loss definitions and initial evaluation
Unintentional weight loss is considered clinically significant if the amount of weight lost over 12 months is ≥ 5%. Older age and higher percentage of weight loss correlates with higher likelihood of malignancy. A targeted evaluation is recommended when there are signs or symptoms suggestive of a specific source. For example, when there is clinically significant weight loss with abdominal pain that prompts an evaluation for an abdominal source of the weight loss; CXR and labs such as TSH would not be needed prior to abdominal imaging. Conversely a smoker with a cough and weight loss would not start with abdominal imaging, a chest x-ray (CXR) would be the first test to start with. When there is no suspected diagnosis, initial evaluation includes CXR, age-appropriate cancer screening (such as colonoscopy and mammography) and labs (including CBC, CMP, HbA1C, TSH, stool hemoccult, ESR/CRP, HIV, Hepatitis C). If this initial evaluation fails to identify a cause of weight loss, then the patient is monitored and if progressive weight loss is seen on subsequent visits/weights, then CT Abdomen/Pelvis is reasonable (MRI if there is a contraindication to CT such as contrast allergy or impaired renal function). Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for weight loss can Chest CT be approved. If CXR suggests a malignancy and/or source of weight loss, then Chest CT would be approved.

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POLICY HISTORY

Date	Summary
March 2023	• Prostate cancer: updated guidance based on new NCCN criteria • IBD: clarified indications • Hernia: added indication for deep pelvic hernia • Musculoskeletal: additional guidance provided for hip imaging, non-diagnostic requests added, corrected statement requiring abnormal x-ray to requiring prior x-ray • Other: specified guidance for weight loss, paraneoplastic syndrome, edema; added indications for thrombocytopenia, gestational trophoblastic disease, cancer predisposition syndromes • Aneurysm: added section about non-aortic vascular disease • Transplant: added section • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Aligned sections across body imaging guidelines
March 2022	• Added when MRI is requested to potentially avoid a prostate biopsy • Added abnormal incidental pelvic lymph nodes when follow-up is recommended based on prior imaging (initial 3-month follow-up) • Within section concerning evaluation of suspected infection or inflammatory disease, added: o Suspected peritonitis (typically needing to include MRI Abd) with abd pain, tenderness to palpation, and at least one of the following: ▪ Rebound, guarding or rigid abdomen, OR ▪ Severe tenderness to palpation over entire abdomen o Complications of diverticulitis with severe abdominal pain or severe tenderness or mass, not responding to antibiotic treatment (prior imaging study is not required for diverticulitis diagnosis) • Removed “For MR Enterography (MRE) if CT or MRI of the abdomen and pelvis are inconclusive” from the section on evaluation of suspected IBD • Clarified pelvic pain due to suspected occult, spigelian, or incisional hernia • Clarified hernia with suspected complications • Added “after initial x-ray” to Sacroiliac Joint Dysfunction

	• Removed “For evaluation of suspected pelvic floor weakness in women with functional disorders, such as urinary or fecal incontinence, obstructed defecation, and pelvic organ prolapse” from “Other Indications for a Pelvic MRI” • Added B symptoms to “Other Indications for a Pelvic MRI”

Reviewed / Approved by Clinical Guideline Committee

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Clinical guidelines **PELVIS MRA/MRV (Angiography/Venography)**	**Original Date: May 2008**
CPT Codes: 72198	**Last Revised Date: March 2023**
Guideline Number: Evolent_CG_039	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE: Abdomen/Pelvis Magnetic Resonance Angiography (MRA) with Lower Extremity MRA Runoff Requests: **Two authorization requests are required, one Abdomen MRA, CPT code 74185 and one for Lower Extremity MRA, CPT code 73725 (a separate Pelvic MRA request is not required). This will provide imaging of the abdomen, pelvis, and both legs.**

INDICATIONS FOR PELVIS MR ANGIOGRAPHY / MR VENOGRAPHY (MRA/MRV)

Arterial

Evaluation of known or suspected pelvic vascular disease

Abdominal Aortic Aneurysm (AAA) (also approve Abdomen MRA):

- For **asymptomatic** known or suspected abdominal aortic aneurysms, **ultrasound** should be done prior to advanced imaging. Only when the ultrasound is inconclusive, is advanced imaging with CT or MRI needed
- For **symptomatic** known or suspected AAA (such as recent-onset abdominal pain or back pain, particularly in the presence of a pulsatile or epigastric mass, suspected dissection, or significant risk factors for AAA) CTA/MRA is appropriate and generally preferred over CT/MRI. (If contrast is contraindicated or other clinical indications for

abdomen and/or pelvic imaging are present, then CT/MR may be approved rather than CTA/MRA)
- If there is known complex vascular anatomy, CTA/MRA may be needed.

Other vascular abnormalities seen on prior imaging studies:

- Initial evaluation of inconclusive vascular findings on prior imaging
- Follow-up of known visceral vascular conditions in the pelvis (such as aneurysm, dissection, compression syndromes, arteriovenous malformations (AVMs), fistulas, intramural hematoma, and vasculitis)
- For assessment in patients with spontaneous coronary artery dissection (SCAD), can be done at time of coronary angiography (also approve MRA abdomen)[1]
- Vascular invasion or displacement by tumor (conventional CT or MRI also appropriate)[2]
- For known large vessel diseases (inferior vena cava or iliac arteries/veins), e.g., aneurysm/dissection (non-aortic disease), arteriovenous malformations (AVMs), and fistulas, intramural hematoma, and vasculitis[3-5]
    - Surveillance is done with ultrasound at intervals similar to AAA, however, CTA/MRA rather than CT/MRI is needed for non-aortic disease when ultrasound is inconclusive[6]
- Follow-up of iliac artery aneurysm when ultrasound is inconclusive and CI to CTA is provided (see Background)
- Suspected complications of known aneurysm as evidenced by clinical findings such as new onset of pelvic pain

Vascular ischemia or hemorrhage:

- To determine the vascular source of retroperitoneal hematoma or hemorrhage when CT is insufficient to determine the source and CTA is contraindicated (may also approve Abdomen MRA; CT rather than MRA/CTA is the modality of choice for diagnosing hemorrhage)[7]
- For evaluation of known or suspected mesenteric ischemia/ischemic colitis when CTA is contraindicated (can approve MRA abdomen and pelvis)[8]

For patients at increased risk for vascular abnormalities (CTA or MRA):

- For patients with fibromuscular dysplasia (FMD), a one-time vascular study of the abdomen and pelvis[9]
- For patients with vascular Ehlers-Danlos syndrome or Marfan syndrome, a one-time vascular study of the abdomen and pelvis
- For Loeys-Dietz, imaging at diagnosis and then every two years, more frequently if abnormalities are found (Imaging may include head, neck, chest, abdomen and pelvis)[10, 11]

Venous

- For evaluation of suspected pelvic vascular disease or pelvic congestive syndrome when findings on ultrasound are indeterminate (MR or CT venography (CTV) may be used as the initial study for evaluating pelvic thrombosis or thrombophlebitis)[12, 13]
- For unexplained lower extremity edema (typically unilateral or asymmetric) with negative or inconclusive ultrasound[14]
- For evaluation of venous thrombus in the inferior vena cava[15]
- Venous thrombosis if previous studies have not resulted in a clear diagnosis[16]
- Vascular invasion or displacement by tumor (Conventional CT or MRI also appropriate)[2]
- For known/suspected May-Thurner Syndrome (iliac vein compression syndrome)[17, 18]

Pre-operative evaluation[19-21]

- Evaluation prior to interventional vascular for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Evaluation prior to endovascular aneurysm repair (EVAR)
- Imaging of the deep inferior epigastric arteries for surgical planning (breast reconstruction surgery) include CTA/MRA abdomen
- Prior to uterine artery embolization for fibroids[22]
- Prior to solid organ transplantation when vascular anatomy is needed

Post-operative or post-procedural evaluation

- Post-operative complications of renal transplant allograft[23]
- Endovascular/interventional vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Post-operative complications, e.g., pseudoaneurysms related to surgical bypass grafts, vascular stents, and stent-grafts in the pelvis
- Follow-up for post-endovascular repair (EVAR) or open repair of abdominal aortic aneurysm (AAA)[24] or abdominal extent of iliac artery aneurysms (**CT preferred** unless MRA/CTA is needed for procedural planning or to evaluate complex anatomy)
    - Routine, baseline study (post-op/intervention) is warranted within the first month after EVAR:
    - Repeat in 6 months if type II endoleak is seen (continue every 6 months x 24 months, then annually)
    - Repeat in 12 months if no endoleak or sac enlargement is seen
    - If neither endoleak nor AAA enlargement is seen on imaging one year after EVAR, CT is needed only if US is inconclusive for annual surveillance (until year 5 as below)
    - Non-contrast CT of entire aorta (abdomen and pelvis) is needed every 5 years after open repair of AAA or EVAR
    - If symptomatic or imaging shows increasing, or new findings related to stent graft – more frequent imaging may be needed

    - For suspected complication such as: new-onset lower extremity claudication, ischemia, or reduction in ABI after aneurysm repair
- Follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Chest MRA, Abdomen MRA, or Abdomen/Pelvis MRA combo

- Acute aortic dissection (CTA or CT preferred)
- Takayasu's arteritis
- Marfan syndrome
- Loeys-Dietz syndrome
- Spontaneous coronary artery dissection (SCAD)
- Vascular Ehlers-Danlos syndrome
- Post-operative complications
- Significant post-traumatic or post-procedural vascular complications reasonably expected to involve the chest and/or abdomen and/or pelvis

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BACKGROUND

Magnetic resonance angiography (MRA) generates images of the arteries that can be evaluated for evidence of stenosis, occlusion, or aneurysms. It is used to evaluate the arteries of the abdominal aorta and the renal arteries. Contrast-enhanced MRA requires the injection of a contrast agent which results in very high-quality images. It does not use ionizing radiation, allowing MRA to be used for follow-up evaluations.

OVERVIEW

Bruits: Blowing vascular sounds heard over partially occluded blood vessels. Abdominal bruits may indicate partial obstruction of the aorta or other major arteries such as the renal, iliac, or femoral arteries. Associated risks include but are not limited to; renal artery stenosis, aortic aneurysm, atherosclerosis, AVM, or coarctation of aorta.

MRA and Chronic Mesenteric Ischemia – Contrast-enhanced MRA is used for the evaluation of chronic mesenteric ischemia, including treatment follow-up. Chronic mesenteric ischemia is usually caused by severe atherosclerotic disease of the mesenteric arteries, e.g., celiac axis, superior mesenteric artery, inferior mesenteric artery. At least two of the arteries are usually affected before the occurrence of symptoms such as abdominal pain after meals and weight loss. MRA is the technique of choice for the evaluation of chronic mesenteric ischemia in patients with impaired renal function.

MRA and Abdominal Aortic Aneurysm Repair – MRA may be performed before endovascular repair of an abdominal aortic aneurysm. Endovascular repair of abdominal aortic aneurysm is a minimally invasive alternative to open surgical repair, and its success depends on precise measurement of the dimensions of the aneurysm and vessels. This helps to determine selection of an appropriate stent-graft diameter and length to minimize complications, such as endoleakage. MRA provides images of the aorta and branches in multiple 3D projections and may help to determine the dimensions needed for placement of an endovascular aortic stent graft. MRA is noninvasive and rapid and may be used in patients with renal impairment.

Iliac aneurysm ultrasound screening intervals:

- Aneurysm size 2.0-2.9 cm, every 3 years
- Aneurysm size 3.0-3.4 cm, annually
- Aneurysm size > 3.5 cm, every 6 months[6]

MRI/CT and acute hemorrhage: MRI is not indicated and MRA/MRV (MR Angiography/ Venography) is rarely indicated for evaluation of intraperitoneal or retroperitoneal hemorrhage, particularly in the acute setting. CT is the study of choice due to its availability, speed of the study, and less susceptibility to artifact from patient motion. Advances in technology have allowed conventional CT to not just detect hematomas but also the source of acute vascular extravasation. In special cases, finer vascular detail to assess the specific source vessel responsible for hemorrhage may require the use of CTA. CTA in the diagnosis of lower gastrointestinal bleeding is such an example.[25]

MRA/MRV is often utilized in non-acute situations to assess vascular structure involved in atherosclerotic disease and its complications, vasculitis, venous thrombosis, vascular congestion, or tumor invasion. Although some of these conditions may be associated with hemorrhage, it is usually not the primary reason why MRI/MRA/MRV is selected for the evaluation. A special condition where MRI may be superior to CT for evaluating hemorrhage is to detect an underlying neoplasm as the cause of bleeding.[7]

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POLICY HISTORY

Date	Summary
March 2023	• Aneurysm: specified guidance on initial imaging and screening intervals with emphasis on requiring ultrasound on initial imaging and indications for advanced imaging, specified guidance on post-repair imaging • Other vascular abnormalities: clarified indication for non-aortic vascular conditions • Transplant: added section • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
April 2022	• Added "(abdomen and pelvis MRA when CTA is inconclusive or cannot be performed)

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **UPPER EXTREMITY CT** **(Hand, Wrist, Elbow, Long bone, or Shoulder CT)**	**Original Date: September 1997**
CPT Codes: 73200, 73201, 73202	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_057-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR UPPER EXTREMITY CT (HAND, WRIST, ARM, ELBOW, OR SHOULDER) (Plain radiographs must precede CT evaluation)

Some indications are for MRI, CT, or MR or CT Arthrogram. More than one should not be approved at the same time.

If a CT Arthrogram fits approvable criteria below, approve as CT.

Joint or muscle pain without positive findings on an orthopedic exam as listed above, after x-ray completed[1,2] (does not apply to young children). If MRI contraindicated or cannot be performed or requested as a CT arthrogram.

- Persistent joint or musculotendinous pain unresponsive to conservative treatment*, within the last 6 months which includes active medical therapy (physical therapy, chiropractic treatments, and/or physician-supervised exercise**), of at least four (4) weeks, **OR**
- With progression or worsening of symptoms during the course of conservative treatment

Joint specific provocative orthopedic examination and MRI is contraindicated or cannot be performed or requested as a CT arthrogram

Note: With a positive orthopedic sign, an initial x-ray is always preferred. However, it is not required to approve advanced imaging. Any test that suggests joint instability requires further imaging (list is not all inconclusive)

Shoulder[3-6]

- Rotator cuff weakness on exam
- Subscapularis tendon tear
    - Belly press off test
    - Napoleon test
    - Bear Hug test
    - Internal rotation lag
    - Lift-off test
- Supraspinatus tendon tear
    - Drop Arm
    - Full Can test
    - Empty Can (aka Jobe or Supraspinatus test)
    - Hawkins or Neer test[7] (only when ordered by an orthopedic surgeon if there is clear documentation in the records that an actual rotator cuff tear is suspected, and NOT just for the evaluation of impingement)
- Infraspinatus / Teres Minor / Biceps tendon tear
    - External rotation lag sign at 0 and 90 degrees
    - Pain or weakness with resisted external rotation testing
    - Hornblower test
    - Popeye sign (if acute finding or for evaluation of surgical correction)
- Labral tear/ Instability
    - Grind test
    - Clunk test
    - Crank test, Compression-rotation test
    - O'Brien's test
    - Anterior load and shift
    - Apprehension test
    - Posterior load and shift test
    - Jerk Test
    - Sulcus sign

Elbow[8, 9]

- Biceps tendon
    - Bicipital aponeurosis (BA) flex test
    - Biceps squeeze test

    - Hook test
    - Passive forearm pronation test
    - Reverse Popeye sign (if acute finding or for evaluation of surgical correction)
- Instability
    - Posterolateral rotatory drawer test
    - Tabletop relocation test
        - Valgus stress
        - Varus stress
        - Milking maneuver
        - Push-up test

Wrist[10, 11]

- Lunotriquetral ligament
    - Derby Relocation test
    - Reagan test (lunotriquetral ballottement test)
- TFCC tear
    - Press test
    - Ulnar foveal sign/test
    - Ulnocarpal stress test
- Scaphoid ligament
    - Watson test (scaphoid shift test)
    - Scapholunate ballottement test

Tendon or Muscle Rupture after x-ray[12-14] **(not listed above)** If MRI contraindicated or cannot be performed.

- High clinical suspicion of a specific tendon rupture based on mechanism of injury and physical findings (i.e., triceps or pectorals tendon rupture)

Shoulder Dislocations[15, 16] If MRI contraindicated or cannot be performed unless requested as CT arthrogram or to evaluate glenoid bone stock or size of Hill- Sachs lesion.

- Recurrent
- First time in any of the situations below that increase the risk or repeated dislocation
    - Glenoid or humeral bone loss on x-ray
    - Bankart lesion on radiographs
    - 14 – 40-year-old
    - > 40 with exam findings concerning for rotator cuff tear (i.e., weakness on exam)

Bone Fracture (If MRI contraindicated or cannot be performed)

- Suspected occult scaphoid fracture with snuffbox pain after initial x-ray

- Non scaphoid suspected occult, stress or insufficiency fracture with a negative initial x-ray[17-19]
    - Repeat x-rays in 10-14 days if negative or non-diagnostic
- Pathologic fracture on x-ray or CT[20]
- Suspected ligamentous/tendon injury with known fractures on x-ray/CT that may require surgery

Fracture Nonunion

- Nonunion or delayed union as demonstrated by no healing between two sets of x-rays. If a fracture has not healed by 4-6 months, there is delayed union. Incomplete healing by 6-8 months is nonunion.[21]

Osteochondral Lesions (defects, fractures, osteochondritis dissecans) and x-ray completed[22-25]

- Clinical suspicion based on mechanism of injury and physical findings

Loose bodies or synovial chondromatosis and after x-ray or ultrasound completed

- In the setting of joint pain or mechanical symptoms [26]

Osteonecrosis (e.g., Avascular necrosis (AVN)[27-29] when MRI is contraindicated or cannot be preformed

- To further characterize a prior abnormal x-ray
- Normal x-rays but symptomatic and high-risk (e.g., glucocorticosteroid use, renal transplant recipient, glycogen storage disease, alcohol abuse,27 sickle cell anemia28)
- Known osteonecrosis to evaluate a contralateral joint after initial x-rays

Joint prosthesis/replacement

- Suspected joint prosthesis loosening or dysfunction, (i.e. pseudotumor formation) after initial x-rays [30, 31]

Extremity Mass[32]

- Mass or lesion after non-diagnostic x-ray or ultrasound[33] MRI preferred. CT is better than MRI to evaluate mass calcification or bone involvement and may complement or replace MRI[34]
    - If superficial mass, then ultrasound is the initial study
    - If deep mass, then x-ray is the initial study
- Vascular malformations
    - After initial evaluation with ultrasound and results will change management or for preoperative planning[35]
        - CTA is also approvable for initial evaluation

        - Follow up after treatment/embolization

Known Primary Cancer of the Extremity[36-40]

- Initial staging primary extremity tumor
- Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
- Signs or symptoms or imaging findings suspicious for recurrence
- Suspected metastatic disease with signs/symptoms and after initial imaging with radiographs

Further evaluation of indeterminate or questionable findings on prior imaging and MRI cannot be performed or CT is preferred (i.e., tumor matrix)

- For initial evaluation of an inconclusive finding on a prior imaging report (i.e., x-ray, ultrasound or MRI) that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam).

Infection of Bone, Joint or Soft tissue abscess[41, 42]

MRI and nuclear medicine studies are recommended for acute infection as they are more sensitive in detecting early changes of osteomyelitis.[43] CT is better at demonstrating findings of chronic osteomyelitis (sequestra, involucrum, cloaca, sinus tracts) as well as detecting soft tissue gas and foreign bodies.[44]

- Abnormal x-ray or ultrasound
- Negative x-ray but with a clinical suspicion of infection
    - Signs and symptoms of joint or bone infection include:
        - Pain and swelling
        - Decrease range of motion
        - Fever
    - Laboratory findings of infection include any of the following:
        - Elevated ESR or CRP
        - Elevated white blood cell count
        - Positive joint aspiration
- Ulcer (diabetic, pressure, ischemic, traumatic) with signs of infection (redness, warm, swelling, pain, discharge which may range from white to serosanguineous) that is not improving despite treatment and bone, or deep infection is suspected
    - Increased suspicion if size or temperature increases, bone is exposed/positive probe-to-bone test, new areas of breakdown, new smell[45]

Pre-operative/procedural evaluation:

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation:

- When imaging, physical, or laboratory findings indicate joint infection, delayed or non-healing, or other surgical/procedural complications

Inflammatory Arthropathy (e.g., rheumatoid arthritis) and MRI is contraindicated or cannot be performed[46, 47]

- Further evaluation of an abnormality or non-diagnostic findings on prior imaging
- Initial imaging of a single joint for diagnosis or response to therapy after plain films and appropriate lab tests (e.g., RF, ANA, CRP, ESR)
- To determine change in treatment or when diagnosis is uncertain prior to start of treatment
- Follow-up to determine treatment efficacy in the following:
    - Early rheumatoid arthritis
    - Advanced rheumatoid arthritis if x-ray and ultrasound are equivocal or noncontributory

Known or suspected inflammatory myopathies (If MRI contraindicated or cannot be performed): (Includes polymyositis, dermatomyositis, immune-mediated necrotizing myopathy, inclusion body myositis)[48, 49]

- For diagnosis
- For biopsy planning

Crystalline Arthropathy

- Dual-energy CT can be used to characterize crystal deposition disease (i.e. gout) after
    - Appropriate rheumatological work up and initial x-rays AND
    - After inconclusive joint aspiration or when joint aspiration cannot be performed OR[50]
    - In the setting of extra-articular crystal deposits (i.e., tendons or bursa)

Foreign Body[51]

- Indeterminate x-ray and ultrasound

Peripheral Nerve Entrapment (e.g., carpal tunnel) and MRI is contraindicated or cannot be performed, including any of the following[52-56]:

- Abnormal electromyogram or nerve conduction study
- Abnormal x-ray or ultrasound

- Clinical suspicion and failed 4 weeks conservative treatment including at least two of the following (active treatment with physical therapy is not required):
    - Activity modification
    - Rest, ice, or heat
    - Splinting or orthotics
    - Medication

Brachial Plexopathy and MRI is contraindicated or cannot be performed[57, 58]

- If mechanism of injury or EMG/NCV studies are suggestive
- Chest CT is preferred study, but neck and/or shoulder (upper extremity) CT can be approved depending on the suspected location of injury

Pediatrics

- Osteoid Osteoma after an x-ray is done[59]

BACKGROUND

Computed tomography (CT) may be used for the diagnosis, evaluation, and management of conditions of the hand, wrist, elbow, and shoulder. CT is not usually the initial imaging test, but it is performed after standard radiographs. CT is used for preoperative evaluation or to evaluate specific abnormalities of the bones, joints, and soft tissues of the upper extremities.

OVERVIEW

***Conservative Therapy** – (Musculoskeletal) should include a multimodality approach consisting of a combination of active and inactive components. Inactive components, such as rest, ice, heat, modified activities, medical devices, (including crutches, immobilizer, metal braces, orthotics, rigid stabilizer, or splints, etc. and not to include neoprene sleeves), medications, injections (bursal, and/or joint, not including trigger point), and diathermy, can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or chiropractic care.

****Home Exercise Program - (HEP)** – The following two elements are required to meet guidelines for completion of conservative therapy:

- Information provided on exercise prescription/plan AND
- Follow-up with member with information provided regarding completion of HEP (after suitable 4-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute “inability to complete” HEP).

Shoulder Dislocation – Glenoid bone loss occurs in anterior shoulder dislocation. Severe degrees of glenoid bone loss are shown on axial radiography, but it can be quantified more definitively using CT. This information is important as it helps to predict the likelihood of further dislocation and the need for bone augmentation surgery. The number of dislocations cannot reliably predict the degree of glenoid bone loss; it is important to quantify glenoid bone loss, initially by arthroscopy and later by CT.

American Academy of Pediatrics "Choosing Wisely" Guidelines advise against ordering advanced imaging studies (MRI or CT) for most musculoskeletal conditions in a child until all appropriate clinical, laboratory and plain radiographic examinations have been completed. **"**History, physical examination, and appropriate radiographs remain the primary diagnostic modalities in pediatric orthopedics, as they are both diagnostic and prognostic for the great majority of pediatric musculoskeletal conditions. Examples of such conditions would include, but not be limited to, the work up of injury or pain (spine, knees, and ankles), possible infection, and deformity. MRI examinations and other advanced imaging studies frequently require sedation in the young child (5 years old or less) and may not result in appropriate interpretation if clinical correlations cannot be made. Many conditions require specific MRI sequences or protocols best ordered by the specialist who will be treating the patient… if you believe findings warrant additional advanced imaging, discuss with the consulting orthopedic surgeon to make sure the optimal studies are ordered."[60]

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POLICY HISTORY

Date	Summary
May 2023	• Updated orthopedic signs • Modified background sections • Modified dual energy CT • Added known AVN to evaluate contralateral side • Added vascular malformations • Added indeterminate findings on prior imaging and follow up surveillance • Added Popeye sign and Reverse Popeye sign • Updated References • Removed Additional Resources • Added statement regarding clinical indications not addressed in the guideline. • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
March 2022	• Simplified orthopedic sign section to include only the most robust signs and removed Table 1 • Clarified the Supraspinatus Test • Moved the section on shoulder impingement, non-traumatic shoulder instability and glenoid labral tears to the background information section • Expanded Bone or Ligament Injury section to include triangular fibrocartilage injury and superior labral anterior to posterior complex lesions when MRI cannot be done • Removed occult wrist ganglion section • Added Snuff box pain after initial x-ray to wrist section and Popeye sign to elbow section

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **UPPER EXTREMITY CTA/CTV**	**Original Date: July 2008**
CPT Codes: 73206	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_061-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

When a separate CTA and CT exam is requested, documentation requires a medical reason that clearly indicates why additional CT imaging of the upper extremity is needed.

INDICATIONS FOR UPPER EXTREMITY CTA/CTV (Computed Tomography Angiogram/Computed Tomography Venogram)

Hand Ischemia[1, 2]

- Arterial Doppler not needed with any of these acute symptoms:
  - Ischemic ulceration without segmental temperature change
  - Ischemic ulceration with painful ischemia
  - Acute sustained loss of perfusion with or without acral ulceration
  - Imminent loss of digit
- Clinical symptoms without the above features; with abnormal arterial Doppler and will change management
  - Includes Raynaud's (can be associated with scleroderma), Buerger disease, and other vasculopathies[3]
- Clinical concern for vascular cause of ulcers with abnormal or indeterminate ultrasound[4]
- After stenting or surgery with signs of recurrence or indeterminate ultrasound[5]

Deep Venous Thrombosis or Embolism

- After abnormal ultrasound of arm veins if it will change management, or with negative or indeterminate ultrasound to rule out other causes
- For evaluation of central veins
- Clinical suspicion of upper arterial emboli[8, 9]

Clinical suspicion of vascular disease with abnormal or indeterminate ultrasound[8, 9]

- Tumor invasion[10, 11]
- Trauma[12]
- Vasculitis[1, 13]
- Aneurysm[14]
- Stenosis/occlusions[15, 16]

Hemodialysis Graft Dysfunction, after Doppler ultrasound not adequate for treatment decisions[17]

Vascular Malformation

- After initial evaluation with ultrasound and results will change management OR
- Inconclusive ultrasound OR
- If a known or suspected high flow lesion
- For preoperative planning (CT is also approvable for initial evaluation if MRI contraindicated)

(MRA preferred however CTA useful in delineating some high flow lesions such as an arteriovenous malformation)

Traumatic injuries with clinical findings suggestive of arterial injury[12]

Assessment/evaluation of known vascular disease/condition

Further evaluation of indeterminate findings on prior imaging (**unless follow up is otherwise specified within the guideline):**

- For initial evaluation of an inconclusive finding on a prior imaging report (i.e., x-ray, ultrasound or CT) that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure[20]

Post-operative/procedural evaluation

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.[21, 22]

Special Circumstances[23]

- High suspicion of an acute arterial obstruction - Arteriography preferred (the gold standard)
- Renal impairment
    - Not on dialysis
        - Mild to moderate, GFR 30-45 ml/min MRA with contrast can be performed
        - Severe, GFR < 30 ml/min MRA without contrast
    - On dialysis
        - CTA with contrast can be performed
- Doppler ultrasound can be useful in evaluating bypass grafts

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BACKGROUND

Computed tomography angiography (CTA) can visualize blood flow in arterial and venous structures throughout the upper extremity using a computerized analysis of x-ray images. It is enhanced by contrast material that is injected into a peripheral vein to promote visualization. CTA is much less invasive than catheter angiography which involves injecting contrast material into an artery. CTA is less expensive and carries lower risks than catheter angiography.

OVERVIEW

UPPER EXTREMITY DVT – "Secondary UEDVT is far more common. Indwelling venous devices, such as catheters, pacemakers, and defibrillators, put patients at the highest risk of thrombus. Other risk factors include advanced age, previous thrombophlebitis, postoperative state, hypercoagulability, heart failure, cancer, right-heart procedures, intensive care unit admissions, trauma, and extrinsic compression."[6]

CTA and Dialysis Graft – The management of the hemodialysis access is important for patients undergoing dialysis. With evaluation and interventions, the patency of hemodialysis fistulas may be prolonged. In selected cases, CTA is useful in the evaluation of hemodialysis graft dysfunction due to its speed and high resolution. Rapid data acquisition during the arterial phase, improved visualization of small vessels and lengthened anatomic coverage increase the usefulness of CTA.

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POLICY HISTORY

Date	Summary
April 2023	• Updated references • Modified background section • Added vascular malformations • Added indeterminate prior imaging findings • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
March 2022	• Added a background section for upper extremity DVT. • Clarified renal impairment, not on dialysis, mild to moderate, GFR 30-45 ml/min MRA with contrast can be performed

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **UPPER EXTREMITY MRI** **(Hand, Wrist, Arm, Elbow, Long bone, or Shoulder MRI)**	**Original Date: September 1997**
CPT Codes: 73218, 73219, 73220, 73221, 73222, 73223, +0698T	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_057-3	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR UPPER EXTREMITY MRI (HAND, WRIST, ARM, ELBOW or SHOULDER) (Plain radiographs must precede MRI evaluation)

Some indications are for MRI, CT, or MR or CT Arthrogram. More than one should not be approved at the same time.

If an MR Arthrogram fits approvable criteria below, approve as MRI.

Joint or muscle pain without positive findings on an orthopedic exam as listed above, after x-ray completed[1, 2] (does not apply to young children).

- Persistent joint or musculotendinous pain unresponsive to conservative treatment*, within the last 6 months which includes active medical therapy (physical therapy, chiropractic treatments, and/or physician-supervised exercise**), of at least four (4) weeks, **OR**
- With progression or worsening of symptoms during the course of conservative treatment

Joint specific approvable provocative orthopedic examination tests and suspected injuries

Note: With a positive orthopedic sign, an initial x-ray is always preferred. However, it is not required to approve advanced imaging. A positive sign is weakness or pain. Any test that suggests joint instability requires further imaging (list is not all inconclusive)

Shoulder[3-6]

- Rotator cuff weakness on exam
- Subscapularis tendon tear
    - Belly press off test
    - Napoleon test
    - Bear Hug test
    - Internal rotation lag
    - Lift-off test
- Supraspinatus tendon tear
    - Drop Arm
    - Full Can test
    - Empty Can (aka Jobe or Supraspinatus test)
    - Hawkins or Neer test[7] (only when ordered by an orthopedic surgeon if there is clear documentation in the records that an actual rotator cuff tear is suspected, and NOT just for the evaluation of impingement)
- Infraspinatus / Teres Minor / Biceps tendon tear
    - External rotation lag sign at 0 and 90 degrees
    - Pain or weakness with resisted external rotation testing
    - Hornblower test
    - Popeye sign (if acute finding or for evaluation of surgical correction)
- Labral tear/ Instability
    - Grind test
    - Clunk test
    - Crank test, Compression-rotation test
    - O'Brien's test
    - Anterior load and shift
    - Apprehension test
    - Posterior load and shift test
    - Jerk Test
    - Sulcus sign

Elbow[8, 9]

- Biceps tendon
    - Bicipital aponeurosis (BA) flex test
    - Biceps squeeze test
    - Hook test

    - Passive forearm pronation test
    - Reverse Popeye sign (if acute finding or for evaluation of surgical correction)
- Instability
    - Posterolateral rotatory drawer test
    - Tabletop relocation test
    - Valgus stress
    - Varus stress
    - Milking maneuver
    - Push-up test

Wrist[10, 11]

- Lunotriquetral ligament
    - Derby relocation test
    - Reagan test (lunotriquetral ballottement test)
- TFCC tear
    - Press test
    - Ulnar foveal sign/test
    - Ulnocarpal stress test
- Scaphoid ligament
    - Watson test (scaphoid shift test)
    - Scapholunate ballottement test

Tendon or Muscle Rupture after x-ray (not listed above)

- High clinical suspicion of a specific tendon rupture based on mechanism of injury and physical findings (i.e., triceps or pectorals tendon rupture)

Shoulder Dislocations[12, 13]

- Recurrent
- First time in any of the situations below that increase the risk or repeated dislocation
    - Glenoid or humeral bone loss on x-ray
    - Bankart lesion on radiographs[14]
    - 14-40 year-old[15]
    - > 40 with exam findings concerning for rotator cuff tear (i.e., weakness on exam)

Bone Fracture or Ligament Injury

- Suspected occult scaphoid fracture with snuffbox pain after initial x-ray
- Non scaphoid suspected occult, stress or insufficiency fracture with a negative initial x-ray[16-18]
    - Repeat x-rays in 10-14 days if negative or non-diagnostic
- Pathologic fracture on x-ray or CT[19]

- Suspected ligamentous/tendon injury with known fractures on x-ray/CT that may require surgery

Fracture Nonunion

- Nonunion or delayed union as demonstrated by no healing between two sets of x-rays. If a fracture has not healed by 4-6 months, there is delayed union. Incomplete healing by 6-8 months is nonunion. CT is the preferred study [20]

Osteochondral Lesions (defects, fractures, osteochondritis dissecans) and x-ray completed[21-24]

- Clinical suspicion based on mechanism of injury and physical findings

Loose bodies or synovial chondromatosis and after x-ray or ultrasound completed

- In the setting of joint pain or mechanical symptoms [25]

Osteonecrosis (e.g., Avascular necrosis (AVN))[26-28]

- To further characterize a prior abnormal x-ray or CT suggesting osteonecrosis
- Normal x-rays but symptomatic and high-risk (e.g., glucocorticosteroid use, renal transplant recipient, glycogen storage disease, alcohol abuse,[29] sickle cell anemia[30])
- Known osteonecrosis to evaluate a contralateral joint after initial x-rays

Joint prosthesis/replacement

- Suspected joint prosthesis loosening or dysfunction, (i.e., pseudotumor formation) after initial x-rays [31, 32]

Extremity Mass[33]

- Mass or lesion after non-diagnostic x-ray or ultrasound[14] CT is better than MRI to evaluate mass calcification or bone involvement and may complement or replace MRI[34]
    - If superficial mass, then ultrasound is the initial study
    - If deep mass, then x-ray is the initial study
- Vascular malformations
    - After initial evaluation with ultrasound and results will change management[35]
    - Inconclusive ultrasound
    - For preoperative planning
        - MRA is also approvable
    - Follow up after treatment/embolization

Known Primary Cancer of the Extremity[36-40]

- Initial staging primary extremity tumor

- Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
- Signs or symptoms or imaging findings suspicious for recurrence
- Suspected metastatic disease with signs/symptoms and after initial imaging with radiographs

Further evaluation of indeterminate or questionable findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report (i.e., x-ray, ultrasound or MRI) that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Infection of Bone, Joint or Soft tissue abscess[41-43]

- Abnormal x-ray or ultrasound
- Negative x-ray or ultrasound but with a clinical suspicion of infection based on either of the following:
    - Signs and symptoms of joint or bone infection include:
        - Pain and swelling
        - Decrease range of motion
        - Fever
    - Laboratory findings of infection include any of the following:
        - Elevated ESR or CRP
        - Elevated white blood cell count
        - Positive joint aspiration
- Ulcer (diabetic, pressure, ischemic, traumatic) with signs of infection (redness, warm, swelling, pain, discharge which may range from white to serosanguineous) that is not improving despite treatment and bone, or deep infection is suspected
    - Increased suspicion if size or temperature increases, bone is exposed/positive probe-to-bone test, new areas of breakdown, new smell[44]

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- When imaging, physical or laboratory findings indicate joint infection, delayed or non-healing or other surgical/procedural complications.

For evaluation of known or suspected autoimmune disease (e.g., rheumatoid arthritis)[45, 46]

- Further evaluation of an abnormality or non-diagnostic findings on prior imaging
- Initial imaging of a single joint for diagnosis or response to therapy after plain films and appropriate lab tests (e.g., RF, ANA, CRP, ESR)
- To determine change in treatment or when diagnosis is uncertain prior to start of treatment
- Follow-up to determine treatment efficacy in the following:
    - Early rheumatoid arthritis
    - Advanced rheumatoid arthritis if x-ray and ultrasound are equivocal or non-contributory

Foreign Body[47]

- Indeterminate x-ray and ultrasound

Peripheral Nerve Entrapment (e.g., carpal tunnel)[48-52]

- Abnormal electromyogram or nerve conduction study
- Abnormal x-ray or ultrasound
- Clinical suspicion and failed 4 weeks conservative treatment including at least two of the following (active treatment with physical therapy is not required):
    - Activity modification
    - Rest, ice, or heat
    - Splinting or orthotics
    - Medication

Brachial Plexopathy[53, 54]

- If mechanism of injury or EMG/NCV studies are suggestive
- Chest MRI is preferred study, but neck and/or shoulder (upper extremity) MRI may be approved depending on the suspected location of injury

Pediatrics

- Chronic Recurrent Multifocal Osteomyelitis after initial work-up (labs (i.e. CRP/ESR and x-ray).[55] (Whole body Bone Marrow MRI is more appropriate when multiple joints requested see **Evolent_CG_059**)

BACKGROUND

Magnetic resonance imaging shows the soft tissues and bones. With its multiplanar capabilities, high contrast, and high spatial resolution, it is an accurate diagnostic tool for conditions affecting the joint and adjacent structures. MRI can positively influence clinicians' diagnoses

and management plans for patients with conditions such as primary bone cancer, fractures, abnormalities in ligaments/tendons/cartilage, septic arthritis, and infection/inflammation.

OVERVIEW

***Conservative Therapy** – (musculoskeletal) should include a multimodality approach consisting of a combination of active and inactive components. Inactive components such as rest, ice, heat, modified activities, medical devices, (including crutches, immobilizer, metal braces, orthotics, rigid stabilizer, or splints, etc. and not to include neoprene sleeves), medications, injections (bursal, and/or joint, not including trigger point), and diathermy, can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or chiropractic care.

****Home Exercise Program - (HEP)** – the following two elements are required to meet guidelines for completion of conservative therapy:

- Information provided on exercise prescription/plan AND
- Follow up with member with information provided regarding completion of HEP (after suitable 4-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute "inability to complete" HEP).

MRI and Brachial Plexus – MRI is the only diagnostic tool that accurately provides high resolution imaging of the brachial plexus. The brachial plexus is formed by the cervical ventral rami of the lower cervical and upper thoracic nerves which arise from the cervical spinal cord, exit the bony confines of the cervical spine, and traverse along the soft tissues of the neck, upper chest, and course into the arms.

The American Academy of Pediatrics "Choosing Wisely" Guidelines advise against ordering advanced imaging studies (MRI or CT) for most musculoskeletal conditions in a child until all appropriate clinical, laboratory and plain radiographic examinations have been completed. **"**History, physical examination, and appropriate radiographs remain the primary diagnostic modalities in pediatric orthopedics, as they are both diagnostic and prognostic for the great majority of pediatric musculoskeletal conditions. Examples of such conditions would include, but not be limited to, the work up of injury or pain (spine, knees, and ankles), possible infection, and deformity. MRI examinations and other advanced imaging studies frequently require sedation in the young child (5 years old or less) and may not result in appropriate interpretation if clinical correlations cannot be made. Many conditions require specific MRI sequences or protocols best ordered by the specialist who will be treating the patient. If you believe findings warrant additional advanced imaging, discuss with the consulting orthopedic surgeon to make sure the optimal studies are ordered."[56]

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POLICY HISTORY

Date	Summary

May 2023	• Updated:
	  ○ Orthopedic signs
	  ○ References
	• Added:
	  ○ Indeterminate findings on prior imaging and follow up surveillance
	  ○ Vascular malformations
	  ○ Known AVN to evaluate contralateral side
	  ○ Statement regarding clinical indications not addressed in the guideline
	  ○ Popeye sign, reverse Popeye sign
	• Modified:
	  ○ Background sections
	  ○ CRMO
	• Removed:
	  ○ Additional Resources

March 2022	• Simplified orthopedic sign section to include only the most robust signs and removed Table 1 • Clarified the Supraspinatus Test • Moved the section recommending active conservative care for shoulder impingement, non-traumatic shoulder instability and glenoid labral tears to the background information section • Removed occult wrist ganglion section • Added Snuff box pain after initial x-ray to wrist section and Popeye sign to Elbow section

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **UPPER EXTREMITY MRA/MRV**	**Original Date: July 2008**
CPT Codes: 73225	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_058-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

When a separate MRA and MRI exam is requested, documentation requires a medical reason that clearly indicates why additional MRI imaging of the upper extremity is needed.

INDICATIONS FOR UPPER EXTREMITY MRA/MRV

Hand Ischemia[1-3]

- Arterial Doppler not needed with any of these acute symptoms:
  - Ischemic ulceration without segmental temperature change
  - Ischemic ulceration with painful ischemia
  - Acute sustained loss of perfusion with or without acral ulceration
  - Imminent loss of digit
- Clinical symptoms without the above features with abnormal arterial Doppler and will change management
  - Includes Raynaud's (can be associated with scleroderma), Buerger disease, and other vasculopathies[4]
- Clinical concern for vascular cause of ulcers with abnormal or indeterminate ultrasound[5]
- After stenting or surgery with signs of recurrence or indeterminate ultrasound[6]

Deep Venous Thrombosis or Embolism[7, 8]

- After abnormal ultrasound of arm veins if it will change management, or with negative or indeterminate ultrasound to rule out other causes
- For evaluation of central veins
- Clinical suspicion of upper arterial emboli[9, 10]

Clinical suspicion of vascular disease with abnormal or indeterminate ultrasound or other imaging[9, 10]

- Tumor invasion[11, 12]
- Trauma[13]
- Vasculitis[2, 14]
- Aneurysm[15]
- Stenosis/occlusions[16]

Hemodialysis Graft Dysfunction, after Doppler ultrasound not adequate[17] for treatment decisions[18]

Vascular Malformation[19, 20]

- After initial evaluation with ultrasound and results will change management **OR**
- Inconclusive ultrasound **OR**
- For preoperative planning
    - MRI is also approvable for initial evaluation

Traumatic injuries with clinical findings suggestive of arterial injury – CTA preferred emergently[13]

Assessment/evaluation of known vascular disease/condition

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report (i.e., x-ray, ultrasound or CT) that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure[21]

Post-operative/procedural evaluations

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

Special Circumstances[22]

- High suspicion of an acute arterial obstruction - Arteriography preferred (the gold standard)
- Renal impairment
    - Not on dialysis
        - Mild to moderate, GFR 30-45 ml/min MRA with contrast can be performed
        - Severe, GFR < 30 ml/min MRA without contrast
    - On dialysis
        - CTA with contrast can be performed
- Doppler ultrasound can be useful in evaluating bypass grafts

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BACKGROUND

Magnetic resonance angiography (MRA) is a noninvasive alternative to catheter angiography for evaluation of vascular structures in the upper extremity. Magnetic resonance venography (MRV) is used to image veins instead of arteries. MRA and MRV are less invasive than conventional x-ray digital subtraction angiography.

OVERVIEW

UPPER EXTREMITY DVT – "Secondary UEDVT is far more common. Indwelling venous devices, such as catheters, pacemakers, and defibrillators, put patients at the highest risk of thrombus. Other risk factors include advanced age, previous thrombophlebitis, postoperative state, hypercoagulability, heart failure, cancer, right-heart procedures, intensive care unit admissions, trauma, and extrinsic compression."[7]

MRA and Dialysis Graft – The management of the hemodialysis access is important for patients undergoing dialysis. With evaluation and interventions, the patency of hemodialysis fistulas may be prolonged. In selected cases, MRA is useful in the evaluation of hemodialysis graft dysfunction. MRA provides excellent image quality and accurately demonstrating significant stenosis with high sensitivity and specificity in the evaluation of hemodialysis graft[23] dysfunctions.

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POLICY HISTORY

Date	Summary
April 2023	• Updated references • Modified background section • Added vascular malformations • Added indeterminate prior imaging findings
March 2022	• Clarified renal impairment, not on dialysis, mild to moderate, GFR 30-45 ml/min MRA with contrast can be performed • Updated background section for upper extremity DVT

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **LOWER EXTREMITY CT** **(Foot, Ankle, Knee, Leg or Hip CT)**	**Original Date: September 1997**
CPT Codes: 73700, 73701, 73702	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_057-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR LOWER EXTREMITY CT (FOOT, ANKLE, KNEE, LEG or HIP)
(Plain radiographs must precede CT evaluation)

Some indications are for MRI, CT, or MR or CT Arthrogram. More than one should not be approved at the same time.

If a CT Arthrogram fits approvable criteria below, approve as CT.

Joint or muscle pain without positive findings on an orthopedic exam as listed below and , after x-ray completed[1-3] (does not apply to young children). If MRI contraindicated or cannot be performed or requested as a CT arthrogram

- Persistent joint or musculotendinous pain unresponsive to conservative treatment*, within the last 6 months which includes active medical therapy (physical therapy, chiropractic treatments, and/or physician supervised exercise**) of at least four (4) weeks, **OR**
- With progression or worsening of symptoms during the course of conservative treatment

Joint specific approvable provocative orthopedic examination tests and suspected injuries[4] (If MRI contraindicated or cannot be performed or requested as a CT arthrogram).

Note: With a positive orthopedic sign, an initial x-ray is always preferred, however, it is not required to approve advanced imaging **UNLESS** otherwise specified in **bold** below. Any test that suggests joint instability requires further imaging (list is not all inconclusive)

ANKLE[5-7]

- Syndesmotic injury (high ankle injury) with tenderness to palpation over the syndesmosis (AITFL – anterior inferior tibiofibular ligament) and any of the following:
    - Positive stress x-rays
    - Squeeze test
    - Cotton test
    - Dorsiflexion external rotation test.
- Unstable lateral injury to ATFL (anterior talofibular ligament) with suspicion of a possible associated fracture around the ankle or a possible osteochondral injury of the talus **AFTER non-diagnostic or inconclusive x-rays** and any ONE of the following:
    - Positive stress x-rays
    - Positive anterior drawer test
    - Positive posterior drawer test
- Achilles tendon tear
    - Thompson test

KNEE[1, 8-12]

- Anterior cruciate ligament (ACL) Injury
    - Positive testing:
        - Anterior drawer
        - Lachman's
        - Pivot shift test

    OR

- Suspected ACL Rupture - Acute knee injury with physical exam limited by pain and swelling **AFTER initial x-ray completed**[13, 14]
    - Based on mechanism of injury, i.e., twisting, blunt force
        - Normal x-ray:
    - Extreme pain, inability to stand, audible pop at time of injury, very swollen joint
    - Abnormal x-ray:
        - Large joint effusion on x-ray knee effusion
- Acute mechanical locking of the knee not due to guarding[15]
- Meniscal injury/tear (A positive test is denoted by pain or audible/palpable clunk)
    - McMurray's Compression
    - Apley's

    - Thessaly test
- Patellar dislocation (acute or recurrent)
    - Positive patellofemoral apprehension test
    - Radiographic findings compatible with a history of patellar dislocation (i.e., lipohemarthrosis or osteochondral fracture)
- Posterior cruciate ligament (PCL) injury
    - Posterior drawer
    - Posterior tibial sag (Godfrey or step-off test)
- Medial collateral ligament tear
    - Positive valgus stress testing/laxity
- Lateral Collateral ligament tear
    - Positive Varus stress testing/laxity

HIP

- Femoroacetabular impingement (FAI)/ Labral tear
    - Anterior Impingement sign (aka FADIR test)[16-18]
    - Posterior Impingement sign (Pain with hip extension and external rotation on exam)[19]
    - Persistent hip mechanical symptoms (**after initial radiographs completed)** including clicking, locking, catching, giving way or hip instability with a clinical suspicion of labral tear and/or **radiographic findings** suggestive of FAI (i.e cross over sign/pistol grip deformity) and suspected labral tear
    - To determine candidacy for hip preservation surgery for known FAI[20]

NOTE: For evaluation of both hips when the patient meets hip MRI guidelines (x-ray + persistent pain unresponsive to conservative treatment) for both the right and left hip, Pelvis MRI (**NIA_CG_037)** is the preferred study

    - If labral tear is suspected and fulfills above criteria, then bilateral hip MRIs are the preferred studies (not Pelvis MRI)
    - If bilateral hip arthrograms are requested and otherwise meet guidelines, bilateral hip MRIs are the preferred studies (not Pelvis MRI)

Tendon Rupture after x-ray[21-24] (not listed in above) - If MRI contraindicated or cannot be performed.

- High clinical suspicion of specific tendon rupture based on mechanism of injury and physical findings (i.e., palpable defect in quadriceps or patellar tendon rupture)

Trauma

Bone Fracture (If MRI contraindicated or cannot be performed)

- Hip and femur

    - Suspected occult, stress or insufficiency fracture with a negative or non-diagnostic initial x-ray[25]:
        - Approve an immediate CT if contraindication to MRI or MRI cannot be performed (no follow up radiographs required)
- Non-hip extremities: suspected occult, stress, or insufficiency fracture
    - If x-rays, taken 10-14 days after the injury or clinical assessment, are negative or nondiagnostic[26]
    - If at high risk for a complete fracture with conservative therapy (e.g., navicular bone), then immediate CT is warranted[27]
- Pathologic or concern for impending fracture on x-ray[28] - approve immediate CT
- Suspected ligamentous/tendon injury with known fractures on x-ray that may require surgery

Fracture Nonunion

- Nonunion or delayed union as demonstrated by no healing between two sets of x-rays. If a fracture has not healed by 4-6 months, there is delayed union. Incomplete healing by 6-8 months is nonunion

Osteochondral Lesions (defects, fractures, osteochondritis dissecans) and x-ray done [8, 29-32]

- Clinical suspicion based on mechanism of injury and physical findings

Joint prosthesis/replacement

- Suspected joint prosthesis loosening or dysfunction, (i.e. pseudotumor formation) after initial x-rays [33, 34]
- Suspected metallosis with painful metal on metal hip replacement after initial x-rays
    - After initial x-rays and Cobalt - chromium levels > 7ppb[35]
    - Abnormal joint aspiration

Extremity Mass

- Mass or lesion after non-diagnostic x-ray or ultrasound[36]. MRI preferred. CT is better than MRI to evaluate mass calcification or bone involvement and may complement or replace MRI[37]
    - Baker's cyst should be initially evaluated with ultrasound
    - If superficial, then ultrasound is the initial study
    - If deep, then x-ray is the initial study
- Vascular malformations
    - After initial evaluation with ultrasound and results will change management or for preoperative planning[38]
        - CTA is also approvable for initial evaluation
    - Follow up after treatment/embolization

Known Primary Cancer of the Extremity[39-43]

- Initial staging primary extremity tumor
- Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
- Signs or symptoms or imaging findings suspicious for recurrence
- Suspected metastatic disease with signs/symptoms and after initial imaging with radiographs

Further evaluation of indeterminate or questionable findings on prior imaging and MRI cannot be performed or CT is preferred (i.e., tumor matrix):

- For initial evaluation of an inconclusive finding on a prior imaging report (i.e., x-ray, ultrasound, MRI) that requires further clarification.
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam

Osteonecrosis (Avascular necrosis (AVN), Legg-Calve-Perthes Disease) when MRI is contraindicated or cannot be performed[44-46]

- To further characterize a prior abnormal x-ray
- Normal or indeterminate x-rays but symptomatic and high risk (e.g., glucocorticosteroid use, renal transplant recipient, glycogen storage disease, alcohol abuse,[47] sickle cell anemia[48])
- Known osteonecrosis to evaluate a contralateral joint after initial x-rays

Loose bodies or synovial chondromatosis and after x-ray or ultrasound completed (If MRI contraindicated or cannot be completed)

- In the setting of joint pain or mechanical symptoms[49]

Infection of Bone, Joint, or Soft tissue abscess[50, 51]

Note: MRI and nuclear medicine studies are recommended for acute infection as they are more sensitive in detecting early changes of osteomyelitis.[52, 53] CT is better at demonstrating findings of chronic osteomyelitis (sequestra, involucrum, cloaca, sinus tracts) as well as detecting soft tissue gas and foreign bodies.[54]

- Abnormal x-ray or ultrasound
- Negative x-ray but with a clinical suspicion of infection
    - Signs and symptoms of joint or bone infection include:
        - Pain and swelling
        - Decrease range of motion
        - Fevers

    - Laboratory findings of infection include any of the following:
        - Elevated ESR or CRP
        - Elevated white blood cell count
        - Positive joint aspiration
- Ulcer (diabetic, pressure, ischemic, traumatic) with signs of infection (redness, warm, swelling, pain, discharge which may range from white to serosanguineous) that is not improving despite treatment and bone or deep infection is suspected[55]
    - Increased suspicion if size or temperature increases, bone is exposed/positive probe-to-bone test, new areas of breakdown, new smell[56]
- Neuropathic foot with friable or discolored granulation tissue, foul odor, non-purulent discharge, and delayed wound healing[57]

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- When imaging, physical, or laboratory findings indicate joint infection, delayed or non-healing, or other surgical/procedural complications
- Trendelenburg sign or other indication of muscle or nerve damage after recent hip surgery

For evaluation of known or suspected autoimmune disease (e.g., rheumatoid arthritis) and MRI is contraindicated or cannot be performed[58]

- Further evaluation of an abnormality or non-diagnostic findings on prior imaging
- Initial imaging of a single joint for diagnosis or response to therapy after plain films and appropriate lab tests (e.g., RF, ANA, CRP, ESR)
- To determine change in treatment or when diagnosis is uncertain prior to start of treatment
- Follow-up to determine treatment efficacy of the following:
    - Early rheumatoid arthritis
    - Advanced rheumatoid arthritis if x-ray and ultrasound are equivocal or non-contributory

Known or suspected inflammatory myopathies (If MRI contraindicated or cannot be performed): (Includes polymyositis, dermatomyositis, immune-mediated necrotizing myopathy, inclusion body myositis)[59, 60]

- For diagnosis
- For biopsy planning

Crystalline Arthropathy

- Dual-energy CT can be used to characterize crystal deposition disease (i.e., gout) after
    - Appropriate rheumatological work up and initial x-rays AND
    - After inconclusive joint aspiration or when joint aspiration cannot be performed OR[61]
    - In the setting of extra-articular crystal deposits (i.e., tendons or bursa)

Peripheral Nerve Entrapment (e.g., tarsal tunnel, Morton's neuroma) and MRI is contraindicated or cannot be performed, including any of the following[62-65]

- Abnormal Electromyogram or Nerve conduction study
- Abnormal x-ray or ultrasound
- Clinical suspicion and failed 4 weeks conservative treatment including at least 2 of the following (active treatment with physical therapy is not required):
    - Activity modification
    - Rest, ice, or heat
    - Splinting or orthotics
    - Medication

Leg length discrepancy

- CT scanogram [66, 67]

Foreign Body[68]

- Indeterminate x-ray and ultrasound

Painful acquired or congenital flatfoot deformity in an adult, after x-ray completed and MRI is contraindicated or cannot be performed.

- After failure of active conservative therapy listed above[69, 70]

Pediatrics

- Osteoid Osteoma after an x-ray is done[71]
- Painful flatfoot (pes planus) deformity with suspected tarsal coalition, not responsive to active conservative care[72]
    - When MRI cannot be performed
    - Extra-articular coalition is suspected (bony bridges around the joints)
    - When needed for surgical planning[73]

BACKGROUND

Plain radiographs are typically used as the first-line modality for assessment of lower extremity conditions. Computed tomography (CT) is used for evaluation of tumors, metastatic lesions, infection, fractures, and other problems. Magnetic resonance imaging (MRI) is the first-line choice for imaging of many conditions, but CT may be used in these cases if MRI is contraindicated or unable to be performed.

OVERVIEW

***Conservative Therapy** – (musculoskeletal) should include a multimodality approach consisting of a combination of active and inactive components. Inactive components such as rest, ice, heat, modified activities, medical devices (such as crutches, immobilizer, metal braces, orthotics, rigid stabilizer, or splints, etc. and not to include neoprene sleeves), medications, injections (bursal, and/or joint, not including trigger point), and diathermy, can be utilized. Active modalities may consist of physical therapy, a physician-supervised home exercise program**, and/or chiropractic care.

****Home Exercise Program (HEP)** – the following two elements are required to meet guidelines for completion of conservative therapy:

- Information provided on exercise prescription/plan AND
- Follow up with member with information provided regarding completion of HEP (after suitable 4-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute “inability to complete” HEP).

Joint Implants and Hardware – Dual-energy CT may be useful for metal artifact reduction if available but is also imperfect as the correction is based on a projected approximation of x-ray absorption, and it does not correct for scatter.[74] Dual-energy CT can be used to characterize crystal deposition disease, such as gout versus CPPD (calcium pyrophosphate deposition).[61]

CT and Osteolysis – Since computed tomography scans show both the extent and the location of lytic lesions, they are useful to guide treatment decisions, as well as to assist in planning for surgical intervention when needed, in patients with suspected osteolysis after Total Hip Arthroplasty (THA).

American Academy of Pediatrics “Choosing Wisely” Guidelines advise against ordering advanced imaging studies (MRI or CT) for most musculoskeletal conditions in a child until all appropriate clinical, laboratory and plain radiographic examinations have been completed. **“**History, physical examination, and appropriate radiographs remain the primary diagnostic modalities in pediatric orthopedics, as they are both diagnostic and prognostic for the great majority of pediatric musculoskeletal conditions. Examples of such conditions would include, but not be limited to, the work up of injury or pain (spine, knees and ankles), possible infection, and deformity. MRI examinations and other advanced imaging studies frequently require

sedation in the young child (5 years old or less) and may not result in appropriate interpretation if clinical correlations cannot be made. Many conditions require specific MRI sequences or protocols best ordered by the specialist who will be treating the patient…if you believe findings warrant additional advanced imaging, discuss with the consulting orthopedic surgeon to make sure the optimal studies are ordered."[75]

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POLICY HISTORY

Date	Summary

May 2023	• Updated orthopedic signs
	• Added
	  ○ When contraindicated to MRI where appropriate
	  ○ Metallosis
	  ○ Evaluation of indeterminate findings on imaging reports
	  ○ Non-diagnostic imaging
	  ○ CPT code for leg length
	  ○ Statement regarding clinical indications not addressed in the guideline
	• Clarified hip versus pelvis imaging
	• Updated DECT
	• Modified
	  ○ References.
	  ○ Background section
	  ○ Cancer of the extremity section

March 2022	• Clarification of language for non-hip stress fractures • Deleted Thessaly sign based on updated literature

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **LOWER EXTREMITY CTA/CTV**	**Original Date: July 2008**
CPT Codes: 73706	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_061-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR LOWER EXTREMITY CTA/CTV (COMPUTED TOMOGRAPHY ANGIOGRAM / COMPUTED TOMOGRAPHY VENOGRAM)

Abdominal Arteries CTA (CT Angiography) (CPT Code 75635) includes run-off, so this is not approvable when done in conjunction with that exam.

When a separate CTA and CT exam is requested, documentation requires a medical reason that clearly indicates why additional CT imaging of the upper extremity is needed.

Peripheral Vascular Disease when Abdominal Arteries CTA (CT Angiography) (CPT Code 75635) has not been recently approved or when aortoiliac disease is not a concern or the state of the aorta and iliac arteries is already known.

- Critical Limb ischemia **ANY** of the below with clinical signs of peripheral artery disease. Ultrasound imaging is not needed. If done and negative, it should still be approved due to high false negative rate[1, 2]
  - Ischemic rest pain
  - Tissue loss
  - Gangrene
- Claudication with abnormal or indeterminate ankle/brachial index, pulse volume recording or arterial Doppler[3-5]

- Clinical concern for vascular cause of ulcers with abnormal or indeterminate ultrasound (ankle/brachial index, arterial Doppler)[6]
- After stenting or surgery with signs of recurrent symptoms OR abnormal ankle/brachial index; abnormal or indeterminate arterial Doppler, OR pulse volume recording)[5]

Popliteal Artery Entrapment Syndrome with abnormal arterial ultrasound[7]

Deep Venous Thrombosis with clinical suspicion of lower extremity DVT after abnormal or non-diagnostic ultrasound where a positive study would change management[8-10]

Clinical suspicion of vascular disease with abnormal or indeterminate ultrasound or other imaging

- Tumor invasion[11]
- Trauma[12]
- Vasculitis[13]
- Aneurysm[14]
- Stenosis/occlusions[15]

Hemodialysis Graft Dysfunction after Doppler ultrasound not adequate for treatment decisions[16]

Vascular Malformation[17, 18]

- After initial evaluation with ultrasound and results will change management **OR**
- Inconclusive ultrasound **OR**
- If a known or suspected high flow lesion
- For preoperative planning (CT is also approvable for initial evaluation if MRI contraindicated)

(MRA preferred however CTA useful in delineating some high flow lesions such as an arteriovenous malformation.)

Traumatic injuries with clinical findings suggestive of arterial injury[12]

Assessment/evaluation of known vascular disease/condition

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report (i.e., x-ray, ultrasound or CT) that requires further clarification.

- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure[3]

Post- operative/procedural evaluation

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested[19, 20]

Special Circumstances[2]

- High suspicion of an acute arterial obstruction - Arteriography preferred (the gold standard).
- Renal impairment
    - Not on dialysis
        - Mild to moderate, GFR 30-89 ml/min MRA can be done
        - Severe, GFR < 30 ml/min MRA without contrast
    - On dialysis
        - CTA with contrast can be done
- Doppler ultrasound can be useful in evaluating bypass grafts

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BACKGROUND

Lower extremity computed tomography angiography (CTA) is an effective, noninvasive and robust imaging modality that is used in the assessment of symptomatic lower extremity vascular disease. It has excellent spatial resolution and shows accurate details of peripheral vasculature. CTA is an effective alternative to catheter-based angiography and allows accurate planning of open surgical and endovascular interventions.

OVERVIEW

The ankle- brachial index (ABI) is the ratio of systolic blood pressure at the ankle divided by the systolic pressure of the upper arm. The normal range lies between 0.9-1.4. An ABI[21, 22] of less than 0.9 is a reliable indicator of the presence of lower extremity PAD, indicating athero-occlusive arterial disease. The upper limit of normal ABI should not exceed 1.40. An ABI >1.40 is suggestive of arterial stiffening (i.e., medial arterial calcification) and is also associated with a higher risk of cardiovascular events and is seen in elderly patients, typically in those with diabetes or chronic kidney disease (CKD).

CTA and screening for peripheral vascular disease: The USPSTF (U.S. Preventive Services Task Force) does not recommend routine screening for peripheral vascular disease in asymptomatic patients.[23] High risk patients (e.g., diabetics) may be screened with ABI (ankle brachial index) and duplex ultrasound.

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POLICY HISTORY

Date	Summary
April 2023	• Updated references • Modified background section • Added vascular malformations • Added indeterminate prior imaging findings • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
March 2022	No changes

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **LOWER EXTREMITY MRI** **(Foot, Ankle, Knee, Leg or Hip MRI)**	**Original Date: September 1997**
CPT Codes: 73718, 73719, 73720, 73721, 73722, 73723, +0698T	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_057-4	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR LOWER EXTREMITY MRI (FOOT, ANKLE, KNEE, LEG or HIP)
(Plain radiographs must precede MRI evaluation)

Some indications are for MRI, CT, or MR or CT Arthrogram. More than one should not be approved at the same time.

If an MR Arthrogram fits approvable criteria below, approve as MRI

Joint or muscle pain without positive findings on an orthopedic exam as listed below and , after x-ray completed[1-3] (does not apply to young children).

- Persistent joint or musculotendinous pain unresponsive to conservative treatment*, within the last 6 months which includes active medical therapy (physical therapy, chiropractic treatments, and/or physician supervised exercise**) of at least four (4) weeks
- With progression or worsening of symptoms during the course of conservative treatment

Joint specific approvable provocative orthopedic examination tests and suspected injuries[4]

Note: With a positive orthopedic sign, an initial x-ray is always preferred, however, it is not required to approve advanced imaging **UNLESS** otherwise specified in **bold** below. Any test that suggests joint instability requires further imaging (list is not all inconclusive)

ANKLE[5-7]

- Syndesmotic injury (high ankle injury) with tenderness to palpation over the syndesmosis (AITFL – anterior inferior tibiofibular ligament) and any of the following:
    - Positive stress X-rays
    - Squeeze test
    - Cotton test
    - Dorsiflexion external rotation test.
- Unstable lateral injury to ATFL (anterior talofibular ligament) with suspicion of a possible associated fracture around the ankle or a possible osteochondral injury of the talus **AFTER non-diagnostic or inconclusive X-rays** and any **ONE** of the following:
    - Positive stress x-rays
    - Positive anterior drawer test
    - Positive posterior drawer test
- Achilles tendon tear
    - Thompson test

KNEE[1, 8-12]

- Anterior cruciate ligament (ACL) Injury
    - Positive testing:
        - Anterior drawer
        - Lachman's
        - Pivot shift test
- Suspected ACL Rupture - acute knee injury with physical exam limited by pain and swelling **AFTER initial x-ray completed**[13, 14]
    - Based on mechanism of injury, i.e., twisting, blunt force
        - Normal x-ray:
    - Extreme pain, inability to stand, audible pop at time of injury, very swollen joint
    - Abnormal x-ray:
        - Large joint effusion on x-ray knee effusion
- Acute mechanical locking of the knee not due to guarding[15]
- Meniscal injury/tear (A positive test is denoted by pain or audible/palpable clunk)
    - McMurray's Compression
    - Apley's
    - Thessaly test
- Patellar dislocation (acute or recurrent)
    - Positive patellofemoral apprehension test
    - Radiographic findings compatible with a history of patellar dislocation

(i.e., lipohemarthrosis or osteochondral fracture)

- Posterior cruciate ligament (PCL) injury
  - Posterior drawer
  - Posterior tibial sag (Godfrey or step-off test)
- Medial collateral ligament tear
  - Positive valgus stress testing/laxity
- Lateral Collateral ligament tear
  - Positive Varus stress testing/laxity

HIP

- Femoroacetabular impingement (FAI) / Labral tear
  - Anterior Impingement sign (aka FADIR test)[16-18]
  - Posterior Impingement sign (Pain with hip extension and external rotation on exam)[19]
  - Persistent hip mechanical symptoms (**after initial radiographs completed)** including clicking, locking, catching, giving way or hip instability with a clinical suspicion of labral tear and/or **radiographic findings** suggestive of FAI (i.e., cross over sign/pistol grip deformity) and suspected labral tear
  - To determine candidacy for hip preservation surgery for known FAI[20]

NOTE: For evaluation of both hips when the patient meets hip MRI guidelines (x-ray + persistent pain unresponsive to conservative treatment) for both the right and left hip, Pelvis MRI (**Evolent_CG_037)** is the preferred study.

- If labral tear is suspected and fulfills above criteria, then bilateral hip MRIs are the preferred studies (not Pelvis MRI)
- If bilateral hip arthrograms are requested and otherwise meet guidelines, bilateral hip MRIs are the preferred studies (not Pelvis MRI)

Tendon Rupture after X-Ray[21-24] (not listed in above)

- High clinical suspicion of specific tendon rupture based on mechanism of injury and physical findings (i.e., palpable defect in quadriceps or patellar tendon rupture)

Trauma
Bone Fracture

- Hip and Femur
  - Suspected occult, stress or insufficiency fracture with a negative or non-diagnostic initial x-ray[25]:
    - Approve an immediate MRI (no follow up radiographs required)- MRI preferred test
  - Suspicion of a hip fracture in a pregnant patient does not require an initial x-ray

- Non-hip extremities: Suspected occult, stress, or insufficiency fracture
    - If x-rays, taken 10-14 days after the injury or clinical assessment, are negative or non-diagnostic[26]
    - If at high risk for a complete fracture with conservative therapy (e.g., navicular bone), then immediate MRI is warranted[27]
- Pathologic or concern for impending fracture on x-ray or CT[28] – approve immediate MRI
- Suspected ligamentous/tendon injury with known fractures on x-ray/CT that may require surgery
- Nonunion or delayed union as demonstrated by no healing between two sets of x-rays. If a fracture has not healed by 4-6 months, there is delayed union. Incomplete healing by 6-8 months is nonunion, CT is the preferred study[29]

Osteochondral lesions (defects, fractures, osteochondritis dissecans) and x-ray completed[8, 30-32]

- Clinical suspicion based on mechanism of injury and physical findings

Joint prosthesis/replacement

- Suspected joint prosthesis loosening or dysfunction, (i.e., pseudotumor formation) after initial x-rays [33, 34]
- Suspected Metallosis with painful metal on metal hip replacement after initial x-rays

Extremity Mass[35]

- Mass or lesion after non-diagnostic x-ray or ultrasound.[36] CT is better than MRI to evaluate mass calcification or bone involvement and may complement or replace MRI[37]
    - Baker's cyst should be initially evaluated with ultrasound
    - If superficial mass, then ultrasound is the initial study
    - If deep mass, then x-ray is the initial study
- Vascular malformations
    - After initial evaluation with ultrasound and results will change management
    - Inconclusive ultrasound
    - For preoperative planning
        - MRA is also approvable
    - Follow up after treatment/embolization

Known Primary Cancer of the Extremity[38-42]

- Initial staging primary extremity tumor
- Follow-up of known primary cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
- Signs or symptoms or imaging findings suspicious for recurrence

- Suspected metastatic disease with signs/symptoms and after initial imaging with radiographs

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report (i.e., x-ray, ultrasound or CT) that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Osteonecrosis (e.g., Avascular Necrosis (AVN), Legg-Calve-Perthes Disease)[43-45]

- To further characterize a prior abnormal x-ray or CT suggesting osteonecrosis
- Normal or Indeterminate X-rays, but symptomatic and high risk (such as glucocorticosteroid use, renal transplant, glycogen storage disease, alcohol abuse, sickle cell anemia)[46]
- Known osteonecrosis to evaluate a contralateral joint after initial x-rays

Loose bodies or synovial chondromatosis and after x-ray or ultrasound completed

- In the setting of joint pain or mechanical symptoms[47, 48]

Infection of Bone, Joint, or Soft tissue abscess[49-51]

- Abnormal x-ray or ultrasound
- Negative x-ray or ultrasound but with a clinical suspicion of infection based on either of the following:
    - Signs and symptoms of joint or bone infection include:
        - Pain and swelling
        - Decreased range of motion
        - Fevers
    - Laboratory findings of infection include any of the following:
        - Elevated ESR or CRP
        - Elevated white blood cell count
        - Positive joint aspiration
- Ulcer (diabetic, pressure, ischemic, traumatic) with signs of infection (redness, warm, swelling, pain, discharge which may range from white to serosanguineous) that is not improving despite treatment and bone, or deep infection is suspected
    - Increased suspicion if size or temperature increases, bone is exposed/positive probe-to-bone test, new areas of breakdown, new smell[52]
- Neuropathic foot with friable or discolored granulation tissue, foul odor, non-purulent discharge, and delayed wound healing[53]

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure

Post-operative/procedural evaluation

- When imaging, physical or laboratory findings indicate joint infection, delayed or non-healing or other surgical/procedural complications.
- Trendelenburg sign[54] or other indication of muscle or nerve damage after recent hip surgery

For evaluation of known or suspected autoimmune disease (e.g., rheumatoid arthritis)[55]

- Further evaluation of an abnormality or non-diagnostic findings on prior imaging
- Initial imaging of a single joint for diagnosis or response to therapy after plain films and appropriate lab tests (e.g., RF, ANA, CRP, ESR)
- To determine change in treatment or when diagnosis is uncertain prior to start of treatment
- Follow-up to determine treatment efficacy of the following:
    - Early rheumatoid arthritis
    - Advanced rheumatoid arthritis if x-ray and ultrasound are equivocal or noncontributory

Known or suspected inflammatory myopathies: (Includes polymyositis, dermatomyositis, immune-mediated necrotizing myopathy, inclusion body myositis)[56, 57]

- For diagnosis
- For biopsy planning

Peripheral Nerve Entrapment (e.g., tarsal tunnel, Morton's neuroma)[58-61]

- Abnormal electromyogram or nerve conduction study
- Abnormal x-ray or ultrasound
- Clinical suspicion and failed 4 weeks conservative treatment including at least two of the following (active treatment with physical therapy is not required):
    - Activity modification
    - Rest, ice, or heat
    - Splinting or orthotics
    - Medication

Foreign Body[62]

- Indeterminate x-ray and ultrasound

Painful acquired or congenital flatfoot deformity in an adult, after x-ray completed

- After failure of active conservative therapy listed above[63, 64]

Special pediatric considerations

- Painful flatfoot deformity with suspected tarsal coalition, not responsive to active conservative care[65]
- Slipped Capital Femoral Epiphysis with negative frog leg and AP x-rays of the hips but clinically suspected[66-68]
    - Drehmann sign
    - Limited internal rotation of the hip
    - Consider imaging the asymptomatic contralateral hip with a normal x-ray to detect early SCFE if prophylactic surgery is planned[69]
- Chronic Recurrent Multifocal Osteomyelitis after initial work-up (labs (i.e. CRP/ESR and x-ray)[70, 71] – (Whole body bone marrow MRI is more appropriate when multiple joints requested see Evolent_CG_059)
- Acute limp in a child 5 or less years old
    - Concern for infection not localized to the hip (initial imaging not required)[72]
    - Concern for infection localized to the hip after initial evaluation with ultrasound[72]
- Osteoid Osteoma – MRI not usually done because x-ray and CT more accurate for diagnosis[73]

BACKGROUND

Magnetic resonance imaging shows the soft tissues and bones. With its multiplanar capabilities, high contrast, and high spatial resolution, it is an accurate diagnostic tool for conditions affecting the joint and adjacent structures. MRI can positively influence clinicians' diagnoses and management plans for patients with conditions such as primary bone cancer, fractures, abnormalities in ligaments/tendons/cartilage, septic arthritis, and infection/inflammation.

OVERVIEW

***Conservative Therapy** – (Musculoskeletal) should include a multimodality approach consisting of a combination of active and inactive components. Inactive components such as rest, ice, heat, modified activities, medical devices, (including crutches, immobilizer, metal braces, orthotics, rigid stabilizer, or splints, etc. and not to include neoprene sleeves), medications, injections (bursal, and/or joint, not including trigger point), and diathermy, can be utilized. Active modalities may consist of physical therapy, a physician supervised home exercise program**, and/or chiropractic care.

****Home Exercise Program (HEP)** – the following two elements are required to meet guidelines for completion of conservative therapy:

- Information provided on exercise prescription/plan AND
- Follow-up with member with information provided regarding completion of HEP (after suitable 4-week period), or inability to complete HEP due to physical reason- i.e., increased pain, inability to physically perform exercises. (Patient inconvenience or noncompliance without explanation does not constitute "inability to complete" HEP).

American Academy of Pediatrics "Choosing Wisely" Guidelines advise against ordering advanced imaging studies (MRI or CT) for most musculoskeletal conditions in a child until all appropriate clinical, laboratory and plain radiographic examinations have been completed. **"**History, physical examination, and appropriate radiographs remain the primary diagnostic modalities in pediatric orthopedics, as they are both diagnostic and prognostic for the great majority of pediatric musculoskeletal conditions. Examples of such conditions would include, but not be limited to, the work up of injury or pain (spine, knees and ankles), possible infection, and deformity. MRI examinations and other advanced imaging studies frequently require sedation in the young child (5 years old or less) and may not result in appropriate interpretation if clinical correlations cannot be made. Many conditions require specific MRI sequences or protocols best ordered by the specialist who will be treating the patient…if you believe findings warrant additional advanced imaging, discuss with the consulting orthopedic surgeon to make sure the optimal studies are ordered."[74]

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POLICY HISTORY

Date	Summary

April 2023	• Updated orthopedic signs
	• Clarified hip versus pelvis imaging
	• Added:
	  ○ Evaluation of indeterminate findings on imaging reports
	  ○ Metallosis
	  ○ Statement regarding clinical indications not addressed in the guideline
	• Modified:
	  ○ References
	  ○ Background section
	  ○ CRMO
	• Removed Additional Resources

March 2022	• Clarification of language for non-hip stress fractures • Deleted Thessaly sign based on updated literature

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **LOWER EXTREMITY MRA/MRV**	**Original Date: September 1997**
CPT Code: 73725	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_058-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

When a separate MRA and MRI exam is requested, documentation requires a medical reason that clearly indicates why additional MRI imaging of the lower extremity is needed.

Lower Extremity MRA & Abdomen/Pelvis Magnetic Resonance Angiography (MRA) Runoff Requests: **Two authorization requests are required, one Abdomen MRA, CPT code 74185 and one for Lower Extremity MRA, CPT code 73725.** This will provide imaging of the abdomen, pelvis, and both legs.

INDICATIONS FOR LOWER EXTREMITY MRA/MRV

Peripheral Vascular Disease

- Critical Limb ischemia **ANY** of the below with clinical signs of peripheral artery disease. Ultrasound imaging is not needed. If done and negative, it should still be approved due to high false negative rate[1, 2]
  - Ischemic rest pain
  - Tissue loss
  - Gangrene
- Claudication with abnormal or indeterminate ankle/brachial index, pulse volume recording or arterial Doppler[3-5]

- Clinical concern for vascular cause of ulcers with abnormal or indeterminate ultrasound (ankle/brachial index, arterial Doppler)[6]
- After stenting or surgery with signs of recurrent symptoms OR abnormal ankle/brachial index; abnormal or indeterminate arterial Doppler, OR pulse volume recording)[4]

Popliteal Artery Entrapment Syndrome with abnormal arterial ultrasound[7]

Deep Venous Thrombosis with clinical suspicion of lower extremity DVT after abnormal or non-diagnostic ultrasound where a positive study would change management[8-10]

Clinical suspicion of vascular disease with abnormal or indeterminate ultrasound or other imaging

- Tumor invasion[11, 12]
- Trauma[13]
- Vasculitis[14]
- Aneurysm[15]
- Stenosis/occlusions[16]

Hemodialysis Graft Dysfunction, after Doppler ultrasound not adequate[17] for treatment decisions[18]

Vascular Malformation[18, 19]

- After initial evaluation with ultrasound and results will change management **OR**
- Inconclusive ultrasound **OR**
- For preoperative planning
    - MRI is also approvable for initial evaluation

Traumatic injuries with clinical findings suggestive of arterial injury – CTA preferred emergently[13]

Assessment/evaluation of suspected or known vascular disease/condition

Pre-operative/procedural evaluation

- Pre-operative evaluation for a planned surgery or procedure[3]

Post-operative/procedural evaluation

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.[20, 21]

Special Circumstances[2]

- High suspicion of an acute arterial obstruction - Arteriography preferred (the gold standard).
- Renal impairment
    - Not on dialysis
        - Mild to moderate, GFR 30-45 ml/min MRA with contrast can be performed
        - Severe, GFR < 30 ml/min MRA without contrast
    - On dialysis
        - CTA with contrast can be done
- Doppler ultrasound can be useful in evaluating bypass grafts

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BACKGROUND

Magnetic resonance angiography (MRA) is a noninvasive alternative to catheter angiography for evaluation of vascular structures in the lower extremity. Magnetic resonance venography (MRV) is used to image veins instead of arteries. MRA and MRV are less invasive than conventional x-ray digital subtraction angiography.

OVERVIEW

Noninvasive testing - **Noninvasive hemodynamic testing** – "Noninvasive testing (NIVT), both before and after intervention, has been used for decades as a first-line investigatory tool in the diagnosis and categorization of PAD. It is widely available and provides a large amount of information at low cost without the use of ionizing radiation. NIVT can consist of one or more of the following components: the ABI, segmental pressure measurements (SPMs), pulse-volume recordings (PVRs), photoplethysmography (PPG), and transcutaneous oxygen pressure measurement (TcPO2)."[21] The ankle- brachial index (ABI) is the ratio of systolic blood pressure at the ankle divided by the systolic pressure of the upper arm. The normal range lies between 0.9-1.4. An ABI of less than 0.9 is a reliable indicator of the presence of lower extremity PAD, indicating athero-occlusive arterial disease. The upper limit of normal ABI should not exceed 1.40. An ABI >1.40 is suggestive of arterial stiffening (i.e., medial arterial calcification) and is also associated with a higher risk of cardiovascular events and is seen in elderly patients, typically in those with diabetes or chronic kidney disease (CKD).

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POLICY HISTORY

Date	Summary
April 2023	• Updated references • Modified background section • Added vascular malformations • Added graft evaluation • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added indeterminate prior imaging findings
March 2022	Clarified renal impairment, not on dialysis, mild to moderate, GFR 30-45 ml/min MRA with contrast can be performed

Reviewed / Approved by Clinical Guideline Committee

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Clinical guidelines **ABDOMEN CT**	**Original Date: September 1997**
CPT Codes: 74150, 74160, 74170	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_030	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

Note: For syndromes for which imaging starts in the pediatric age group, MRI preferred

NOTE: ABDOMEN CT **ALONE** SHOULD ONLY BE APPROVED WHEN DISEASE PROCESS IS SUSPECTED TO BE LIMITED TO THE ABDOMEN. Abdomen/Pelvis CT (CPT Codes: 74176, 74177, 74178) is the correct study when the indication(s) include both the abdomen AND pelvis, such as CTU (CT Urography), CTE (CT Enterography), acute abdominal pain, widespread inflammatory disease, or neoplasm.
When separate requests for CT abdomen and CT Pelvis are encountered for processes involving both the abdomen and pelvis, they need to be resubmitted as a single Abdomen/Pelvis CT (to avoid unbundling; CPT codes 74176, 74177, 74178). Otherwise, the exam should be limited to the appropriate area (i.e., Abdomen **OR** Pelvis) which includes the specific organ, area of known disease/abnormality, or the area of concern.

INDICATIONS FOR ABDOMEN CT

Abdominal Pain for Unknown Etiology

- CT allowed after initial workup is inconclusive and must include results of the following:
  - Appropriate laboratory testing (chemistry profile, complete blood count, and/or urinalysis) for the patient's presentation (e.g., suspected pancreatitis – amylase/lipase etc.) **AND**

    - Initial imaging (such as ultrasound, barium study, nuclear medicine, or scope study) appropriate to the symptoms
    - Not all of the above tests need to be performed, but both labs and initial imaging need to be performed
        - E.g., for GI bleeding, CBC and a scope study would be appropriate initial testing (however, a UA and ultrasound would not be)
- For acute abdominal pain in a patient over the age of 65[1, 2]
- Initial evaluation of abnormal findings seen on other imaging, such as ultrasound (US) or x-ray and limited to the abdomen, and CT is the most reasonable next step for that diagnosis

Evaluation of suspicious known mass/tumors (unconfirmed diagnosis of cancer) for further evaluation of indeterminate or questionable findings

- Initial evaluation of suspicious masses/tumors found by physical exam or imaging study, such as ultrasound (US), and only the abdomen is affected[3, 4]
- One follow-up exam to ensure no suspicious change has occurred in a tumor. No further surveillance imaging unless tumor(s) is/are specified as highly suspicious, or change was found on exam or last follow-up imaging.
- For abnormal incidental abdominal lymph nodes when follow-up is recommended based on prior imaging (initial 3-month follow-up)[5]

Follow-up of known cancer[6, 7]

- In a patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
- Known cancer with suspected abdominal metastasis based on a sign, symptom (e.g., anorexia, early satiety, intestinal obstruction, night sweats, pelvic pain, weight loss, vaginal bleeding) or an abnormal lab value (alpha-fetoprotein, CEA, CA 19-9, p53 mutation)

For evaluation of suspected infection or inflammatory disease based on exam or discovered on previous imaging[8-10]

- Right upper quadrant pain for suspected biliary disease with negative or equivocal ultrasound
- For epigastric or left upper quadrant pain if labs or other imaging are inconclusive[11]

For evaluation of suspected infection or for follow-up known infection limited to the abdomen

- Any known infection that is clinically suspected to have created an abscess limited to the abdomen. (If location unclear or unknown, CT Abdomen/Pelvis)
- Any history of fistula limited to the abdomen that requires re-evaluation or is suspected to have recurred
- Abnormal fluid collection limited to the abdomen seen on prior imaging that needs follow-up evaluation

For evaluation of Inflammatory Bowel Disease (IBD) such as Crohn's or Ulcerative Colitis (MRE should be considered for age < 35 to reduce radiation exposure). If only Abdomen CT is requested for IBD, the request should be resubmitted as CT Abdomen and Pelvis (see Guideline for criteria) unless it is known that the disease is limited to the abdomen.

For evaluation of an organ or abnormality seen on previous imaging

ADRENAL

- Indeterminate adrenal lesion seen on prior imaging
- For further evaluation of suspected adrenal tumors and/or endocrine disorders when there is clinical and laboratory evidence to suggest an adrenal source; see Background for specific laboratory testing that is needed based on suspected diagnosis[12]
- Adrenal mass < 4 cm incidentally discovered with benign characteristics, one follow-up at 6 months then annually x 2 years (no further imaging if stable, see Background for details)
- If adrenal mass ≥ 4 cm and no diagnosis of cancer, can approve for either pre-operative planning **OR** if surgery is not done, can repeat imaging in 6-12 months

LIVER

- Indeterminate liver lesion seen on prior imaging [11]
- For evaluation of rising AFP (requires a ≥7 ng/mL increased in AFP per month) in patients at high risk for HCC (known cirrhosis and/or chronic hepatitis B, see Background for additional risk categories)[13]
- For screening in patients at high risk for HCC (see above) every 6 months when prior ultrasound is insufficient to evaluate the liver due to steatosis/fatty liver or nodular liver
    - The finding of steatosis/fatty liver and/or nodular liver alone on an ultrasound report is insufficient for approval; the report must specify that those findings prevent adequate visualization of the liver by ultrasound
- For jaundice or abnormal liver function tests after equivocal or abnormal ultrasound[14]
- For surveillance of HCC (MRI or CT) in patients who have received liver-directed therapy, surgical resection, medical treatment, or transplant at one-month post treatment and then every 3 months for up to two years, then every 6 months[14, 15]
- For follow-up of suspected adenoma every 6-12 months
- For surveillance of patients with primary sclerosing cholangitis (also CA 19-9), every 6-12 months after the age of 20 (MRI and MRCP preferred over CT) [16]
- For follow-up of focal nodular hyperplasia (FNH), repeat imaging in 6-12 months to ensure stability. Additional imaging beyond that is needed only if atypical features or diagnosis is still in question. [17]
- For annual elastography[18] in chronic liver disease to stage hepatic fibrosis when MRI is contraindicated and transient elastography with ultrasound is insufficient

- In patients with Beckwith-Wiedemann syndrome and abnormal ultrasound or rising AFP and MRI is contraindicated [19]
- Pre-procedure for transjugular intrahepatic portosystemic shunt (TIPS)[20, 21]
- For evaluation and monitoring of Gaucher Disease at initial diagnosis and every 12 to 24 months when MRI is contraindicated [22]

Evaluation of iron overload in the following settings when MRI is contraindicated

- Initial evaluation of liver iron in Hemochromatosis diagnosed in lieu of liver biopsy [23]
- Annual evaluation for high-risk patients: transfusion-dependent thalassemia major, sickle cell disease, and other congenital anemias [24]when ultrasound is insufficient

PANCREAS

- Pancreatic cystic lesion found on initial imaging, approve for initial characterization of lesion
- For follow-up for pancreatic cyst as below AND MRI is contraindicated [25]:
    - For incidental and asymptomatic cysts <1.5 mm, **AND**:
        - Age < 65, image annually x 5 years, then every 2 years if stable
        - Age 65-79, imaging every 2 years x 5, then stop if stable
    - For cysts 1.5-1.9 cm with main pancreatic duct communication (MPD), image annually x 5 years, then every 2 years x 2, stop if stable at year 9.
    - For cysts 2.0-2.5 cm with MPD communication, image every 6 months x 4, then annually x 2, then every 2 years x 3, stop if stable at year 10.
    - For cysts 1.5-2.5 cm with NO MPD communication (or cannot be determined), image every 6 mos. x 4, then annually x 2 then every 2 years x 3, stop if stable at year 10.
    - For cyst > 2.5 cm on surveillance (i.e., intervention has not been chosen), image every 6 mos. x 4, then annually x 2 years, then every 2 years x 3. Stop if stable at year 10.
    - Patients > 80 years of age at presentation are imaged less frequently: image every 2 years x 2, stop if stable at year 4 (intervals are the same regardless of size if surveillance chosen)
    - GROWTH or suspicious change on a surveillance imaging scan may warrant more frequent surveillance
- For localization of a functional pancreatic tumor, see Background (endocrine) once diagnosis is confirmed (or highly suspected)
- Annual surveillance for individuals determined to have an increased lifetime risk of developing pancreatic cancer (if MRI/MRCP and EUS contraindicated), based on genetic predisposition or family history as below:
    - SKT11 variant (including Peutz-Jeghers): starting at age 30 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier)
    - CDKN2A variant: starting at age 40 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier)

- Other variants and based on family history as detailed below: Starting at age 50 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier) for the following:
    - ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family as the identified variant AND known mutation in other pancreatic susceptibility genes (ATM, BRCA1, BRCA2, MLH1 (Lynch), MSH2, MSH6, EPCAM, PALB2, TP53)
    - ≥ 2 first-degree relatives with a history of pancreatic cancer from the same side of the family
    - ≥ 3 first- and/or second-degree relatives with a history of pancreatic cancer from the same side of the family
- Hereditary Pancreatitis (such as PRSS1 variant) starting 20 years after onset of pancreatitis, or at age 40 years, whichever is earlier[1, 26-28]
- Multiple Endocrine Neoplasia type 1 (MEN1) (to screen for PanNET (neuroendocrine tumor) every 1-3 years (chest CT or MRI also approvable for this syndrome at same interval)

- Initial imaging for suspected acute pancreatitis due to epigastric pain with elevated amylase and/or lipase:
    - For mild presentation when symptom improvement is not seen after 72 hours of treatment and either:
        - ultrasound has been performed and did not show an abnormality such as gallstones, dilated bile duct
        - ultrasound suggests complications (such as fluid collection)
    - For severe presentation (such as fever, elevated WBC)
    - For a decline in clinical status and/or suspected complication
- Pancreatitis by history, (including pancreatic pseudocyst) with abdominal pain suspicious for worsening, or re-exacerbation
- Known necrotizing pancreatitis requiring follow-up
- In patients > 40 years of age who have pancreatitis with no identifiable cause (see Background), CT is indicated to exclude neoplasm [29]

RENAL

- For an indeterminate renal mass on other imaging [30]

Active surveillance for indeterminate cystic renal mass, not a simple renal cyst (Bosniak IIF (6 mos., 12 mos. then annually), III and IV lesions - see Background)[31]

- Follow-up for solid renal masses under 3 cm at 6 and 12 months, then annually [32,33]
- Surveillance for known angiomyolipoma (AML): annually if known tuberous sclerosis (TSC) or AML size is > 4 cm; every 2 years if AML size is 3-4 cm[34-36] (if AML < 3 cm, CT or MRI not needed unless pt has TSC)

- For surveillance of patients with the following known genetic mutations at the following intervals (MRI preferred due to lifetime radiation risk, CT can be approved if needed for surgical planning or CI to MRI):
    - BAP1-TPDS (BAP-1 tumor predisposition syndrome) every 2 years starting at age 30
    - BHDS (Birt-Hogg-Dube) every 3 years starting at age 20
    - HLRCC (hereditary leiomyomatosis and renal cell cancer) annually starting at age 8
    - HPRC (hereditary papillary renal carcinoma) every 1-2 years starting at age 30
    - PGL/PCC (hereditary paraganglioma/pheochromocytoma) every 4-6 years starting at age 12
    - TSC (tuberous sclerosis complex) without known AML every 3-5 years starting at age 12
        - TSC + known AML annually
    - VHL (Von Hippel Lindau) every 2 years starting at age 15[37]
- For evaluation of total kidney volume in polycystic kidney disease when MRI is contraindicated[38]

SPLEEN

- Incidental findings of the spleen that are indeterminate on other imaging
- For evaluation and monitoring of Gaucher Disease at initial diagnosis and every 12 to 24 months when MRI is contraindicated [22]

For evaluation of a suspected or known hernia [39]

- Abdominal/pelvic pain suspected to be due to an occult, umbilical, Spigelian, or incisional hernia (including recurrent hernias) when physical exam and prior imaging (such as ultrasound) is non-diagnostic or equivocal or if requested as a preoperative study and limited to the abdomen
- Hernia with suspected complications (e.g., bowel obstruction or strangulation, or non-reducible) based on symptoms (e.g., diarrhea, hematochezia, vomiting, severe pain, or guarding), physical exam (guarding, rebound) or prior imaging[40]
- Lower esophageal hernias (such as hiatal, paraesophageal) for pre-operative planning (Abdomen CT preferred, only approve one study, chest CT can be approved instead of abdomen if specific reason given); CT is not a part of the typical workup for diagnosis [41]
- Deep intraabdominal hernia is suspected (post-Roux-en-Y, does not require US first; hernia type needs to be specified)

For evaluation of known or suspected non-aortic vascular disease (e.g., aneurysms, hematomas)[42, 43], CTA/MRA is the preferred study when ultrasound is inconclusive

- If a contraindication to CTA/MRA has been provided, CT can be approved

Transplants

- Prior to solid organ transplantation
- For initial workup prior to Bone Marrow Transplantation (BMT) (along with CT Chest[44], CT Pelvis, CT Sinus and Brain MRI)[45]). Alternatively, PET might be sufficient to evaluate the abdomen and pelvis if indicated based on that malignancy (see PET Guideline)

Pre-operative planning

- For abdominal surgery or procedure

Post-operative/procedural evaluation

- Follow-up of known or suspected post-operative complication involving only the abdomen
- A follow-up study to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Indication for combination studies for the initial pre-therapy staging of cancer, evaluation before starting treatment OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine or Lumbar Spine, and MUGA

BACKGROUND

Abdominal imaging begins at the diaphragm and extends to the umbilicus or iliac crests. CT uses x-rays and multiple detectors to create cross-sectional images of the normal anatomy, as well as demonstrate abnormal soft tissue densities, calcifications or fluid/gas patterns in the viscera or peritoneal space.

Ultrasound is clearly a safe imaging option and is the first imaging test of choice. CT or MRI can then be done as needed after equivocal ultrasound. Clinicians should exercise increased caution with CT

imaging in children, pregnant women, and young adults due to the risks of exposure to ionizing radiation. Screening for pregnancy as part of a work-up is suggested to minimize the number of unexpected radiation exposures for women of childbearing age.

OVERVIEW

Ultrasound should be considered prior to a request for Abdomen CT for the following evaluations:

- Possible gallstones or abnormal liver function tests
- Evaluation of cholecystitis
- Follow up for aortic aneurysm

Liver

Hepatocellular carcinoma (HCC) Screening for Hepatocellular carcinoma (HCC) **–** AASLD (American Association for the Study of Liver Diseases) recommends screening for HCC with ultrasound every 6 months for patients with hepatitis C and B.[46] Advanced imaging is recommended when the AFP is rising, regardless of ultrasound results. The main risk factors for HCC are cirrhosis and Hepatitis B. Additional populations for which there is a benefit to surveillance for HCC include: Asian males Hepatitis B carriers ≥ 40 y, Asian female Hepatitis B carriers ≥50 y, Hepatitis B carriers with + family history of HCC and African and/or North American blacks with hepatitis B [13, 47].

Surveillance for HCC is required for patients who have received liver-directed therapy, surgical resection, medical treatment, or a transplant for HCC. However, because of the higher risk of tumor recurrence, US is not typically used for surveillance for HCC in the first 2 years after treatment. The European Association for the Study of the Liver recommends multiphase CT or MRI to assess response 1 month after resection or locoregional or systemic therapies, followed by one imaging technique every 3 months to complete at least 2 years, and then regular US every 6 months. This schedule is more frequent than some of the other society recommendations and the most common practice among interventional radiologists (every 3 months).

Imaging for pancreatitis – When acute pancreatitis is suspected, ultrasound is typically the first line imaging modality. The purpose of US is to identify other causes such as gallstones and/or biliary dilatation as well as help identify potential complications such as fluid collections. MRCP is preferred over CT for further evaluation of bile duct dilation. When a diagnosis other than pancreatitis is likely (such as when amylase and lipase are equivocal), CT or MRI may be indicated but would generally fall under indications for acute abdominal pain. In general, CT is not indicated in patients with mild pancreatitis who show rapid improvement with appropriate medical management. When a patient has or is at risk for severe pancreatitis, CT may be used after 72 hours to best assess the full extent of disease. CT should be repeated when the clinical picture drastically changes, such as with sudden onset of fever, decrease in hematocrit or sepsis. For prolonged symptoms (>4 weeks) with known fluid collection, CT or MRI is indicated. Common causes for pancreatitis include gallstones, alcohol,

hypertriglyceridemia, post-ERCP, trauma. In patients over 40 years old, when no cause for pancreatitis can be identified, advanced imaging is indicated to exclude neoplasm.

Adrenal incidentaloma – Adrenal masses detected on imaging for another reason (i.e., incidental finding) are becoming increasingly common. If there is no prior personal history of malignancy and no features concerning for malignancy on imaging, these patients should undergo hormonal (functional) evaluation and periodic imaging. If the mass is < 4 cm on imaging and has benign characteristic (homogenous, regular borders, HU < 10) a hormonal evaluation should be done. If that evaluation is negative, adrenal protocol/follow-up imaging can be performed at 6 months then annually for 1-2 years[12]. Repeat functional studies are recommended annually (or sooner if symptoms) for 5 years. If the mass exhibits growth or becomes hormonally active, then surgery is recommended [12]. Additional imaging beyond 2 years is reasonable if there has been growth and the mass is not resected; if stable, no further imaging is warranted unless the annual hormonal evaluation is positive. Masses ≥ 4cm generally are resected after hormonal evaluation is completed, additional imaging can be approved when needed for further characterization for surgical planning. If the decision is made not to resect the mass, then FU imaging in 6-12 months is reasonable.

Biochemically active tumors (adrenal and neuroendocrine): Laboratory evaluation prior to imaging - When neuroendocrine and hormonally active tumors are suspected, the required laboratory evaluation prior to advanced imaging is dependent on the tumor type that is suspected. The following list describes suspected syndrome/tumor and typical laboratory evaluation in parenthesis:

GI Carcinoid (24-hour urine or plasma 5-HIAA), Lung/Thymus Carcinoid (24-hour urine or plasma 5-HIAA AND one of the following: overnight dexamethasone suppression test, 2-3 midnight salivary cortisols, 24-hour urinary free cortisol), PPoma (serum pancreatic polypeptide), Insulinoma (serum insulin, pro-insulin and C-peptide all drawn during a period of hypoglycemia (i.e. 72 hour fast)), VIPoma (serum VIP), glucagonoma (serum glucagon), gastrinoma (serum gastrin), somatostatinoma (serum somatostatin), pheochromocytoma/paraganglioma (plasma free or 24-hour urine fractionated metanephrines and normetanephrines +/- serum or urine catecholamines), pituitary tumor (serum IGF-1, prolactin, LH/FSH, alpha subunits, TSH and ONE of the following: overnight dexamethasone suppression test, 2-3 midnight salivary cortisols, 24-hour urinary free cortisol), primary hyperaldosteronism (suppressed renin/renin activity in association with elevated plasma aldosterone (>10 ng/dL) and confirmatory testing if positive), adrenocortical carcinoma (testosterone, DHEA-S AND complete evaluation for hypercortisolemia or primary aldosteronism)[48].

If Cushing's (hypercortisolemia) is suspected, typical labs include a plasma ACTH AND one or more of the following: overnight dexamethasone suppression test, 2-3 midnight salivary cortisols, OR 24-hour urinary free cortisol. The results of the suppression test then indicate whether brain imaging is needed (pituitary source) OR chest and abdominal imaging is needed (CXR + Adrenal CT/MRI). ACTH > 20 after suppression > 20 is suggestive of Cushing's Disease and Pituitary MRI is indicated. ACTH after suppression < 5 is suggestive of Cushing's Syndrome and CXR + Adrenal CT/MRI is indicated [49]. If

indeterminate, a CRH or desmopressin test is then done. If there is no ACTH suppression with CRH/desmopressin, then adrenal imaging is indicated.

Genetic syndromes and adrenal tumors – Adrenal cortical carcinoma (ACC) diagnosed during childhood is known to be commonly associated with hereditary syndromes, including Beckwith-Wiedemann (BWS) and Li-Fraumeni syndrome (LFS). In adults, ACC may be associated with Multiple Endocrine Neoplasia 1 (MEN1), familial adenomatous polyposis coli and neurofibromatosis type 1 (NF1); however, there are currently no surveillance imaging recommendations.[50]

High risk characteristics for mucinous pancreatic cysts include all of the following: Symptoms, Jaundice secondary to the cyst, acute pancreatitis secondary to the cyst, elevated serum CA 19-9 and no benign cause present, an enhancing mural nodule or solid component within the cyst or pancreas, main pancreatic duct of > 5mm, change in duct caliber with upstream atrophy, size over 3 cm, high grade dysplasia or cancer on cytology. These patients should undergo EUS + -FNA or be referred to a multidisciplinary group for further recommendations.[51]

Genetic syndromes and adrenal tumors - Adrenal cortical carcinoma (ACC) diagnosed during childhood is known to be commonly associated with hereditary syndromes including Beckwith-Wiedemann (BWS) and Li-Fraumeni syndrome (LFS). In adults, ACC may be associated with Multiple Endocrine Neoplasia 1 (MEN1), familial adenomatous polyposis coli and neurofibromatosis type 1 (NF1); however, there are currently no surveillance imaging recommendations.[50]

CT of the kidney - Recommendations for follow up of a complex cystic renal mass are made using Bosniak criteria[52]:

- Bosniak I (water density 0-20 HU); no further follow-up
- Bosniak II (one or a few thin septations, small or fine calcifications, hyperdense cysts up to 3 cm); no further follow-up
- Bosniak IIF felt to be benign but too complex to be diagnosed with certainty; image at 6 and 12 months, then annually for 5 years if no progression
- Bosniak III thick-walled cystic lesions with wall or septal enhancement; resection favored vs conservative management and RFA in select cases[31]
- Bosniak IV malignant cystic renal mass with enhancing soft tissue components; resection favored, malignant until proven otherwise

Insulinomas are rare pancreatic tumors. Localization of the tumor by ultrasound and CT are the preferred initial options once a diagnosis has been made, followed by endoscopic ultrasound or arterial stimulation with hepatic venous sampling. Whipple's triad includes symptoms of hypoglycemia, low blood glucose relieved by ingestion of glucose, and benign 90%. Work-up prior to imaging should include: a 72-hour fast with serial glucose and insulin levels over this period until the patient becomes symptomatic. An insulin/glucose ration of greater than 0.3 has been found in virtually all patients with insulinoma or other islet cell disease.[53]

High risk characteristics for mucinous pancreatic cysts include all of the following: Symptoms, Jaundice secondary to the cyst, acute pancreatitis secondary to the cyst, elevated serum CA 19-9 and no benign cause present, an enhancing mural nodule or solid component within the cyst or pancreas, main pancreatic duct of > 5mm, change in duct caliber with upstream atrophy, size over 3 cm, high grade dysplasia or cancer on cytology. These patients should undergo EUS + -FNA or be referred to a multidisciplinary group for further recommendations.[54]

CT and elevated Liver Function Tests - For elevated bilirubin, or serum transaminases with or without bilirubin elevation, US is the initial recommended test to assess for duct dilatation which might lead to ERCP or MRCP, vs other causes which might necessitate further lab testing or liver biopsy.[55]

Combination request of Abdomen CT/Chest CT - A chest CT will produce images to the level of L3. Documentation for combo is required.

Imaging of hernias - Most hernias are diagnosed clinically with imaging recommended for the diagnosis of occult hernias or in the evaluation of hernia complications, such as bowel obstruction or strangulation. To detect occult hernias, ultrasound is a first-line study with a sensitivity of 86% and specificity of 77%, compared to 80% sensitivity and 65% specificity for CT.[56] According to Miller, et al "Magnetic resonance imaging is generally not considered a first- or even second-line evaluation modality for hernias…."[57] Based on this analysis, MRI is recommended only when ultrasound and CT have been performed and fail to make a diagnosis.

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POLICY HISTORY

Date	Summary
May 2023	• IBD: eliminated indications for abdomen alone or pelvis imaging alone, resubmission as abdomen and pelvis CT required unless limited indication • Adrenal: additional guidance provided for imaging intervals and background given for functional tumors • Liver: clarified guidance for HCC surveillance imaging, follow up of specific conditions such as hepatic steatosis and focal nodular hyperplasia • Pancreas: updated pancreatic cystic lesion guidance, specified guidance for increased lifetime risk for pancreatic cancer and pancreatitis • Renal: specified guidance for increased lifetime risk of renal cancer • Hernia: Added indications for lower esophageal and deep intraabdominal hernias • Aneurysm: eliminated indications for abdomen alone or pelvis imaging alone, resubmission as abdomen and pelvis CT required unless limited indication • Transplant: added section • Background: deleted some sections, added information to assist with adjudication/application of guideline statement • Aligned sections across body imaging guidelines • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
March 2022	• In Follow-up of known cancer, added per surveillance imaging of NCCN recommendations • Clarified IPMN and MCN surveillance imaging • Added total kidney volume in polycystic kidney disease when MRI is contraindicated to Renal section • Clarified “and/or” prior imaging (such as US) in abdominal/pelvic pain due to suspected hernia

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guideline **ABDOMEN/PELVIS CTA (Angiography)**	**Original Date: September 1997**
CPT Codes: 74174	**Last Revised Date: March 2023**
Guideline Number: Evolent_CG_069	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE

When vascular imaging of the aorta and both legs, i.e., CTA aortogram and runoff is desired (sometimes incorrectly requested as Abd/Pelvis CTA & Lower Extremity CTA Runoff), only one authorization request is required, using CPT Code 75635 Abdominal Arteries CTA. **This study provides for imaging of the abdomen, pelvis, and both legs.** The CPT code description is CTA aorto-iliofemoral runoff; abdominal aorta and bilateral ilio-femoral lower extremity runoff**.**

When separate requests for CTA abdomen and CTA Pelvis are encountered for processes involving both the abdomen and pelvis (but do NOT need to include legs/runoff), they need to be resubmitted as a single Abdomen/Pelvis CTA (to avoid unbundling). Otherwise, the exam should be limited to the appropriate area (i.e., Abdomen OR Pelvis) that includes the area of concern. INDICATIONS FOR ABDOMEN/PELVIS CT ANGIOGRAPHY/CT VENOGRAPHY (CTA/CTV)

For evaluation of known or suspected abdominal/pelvis vascular disease

Arterial Disease

Abdominal Aortic Aneurysm (AAA):

- For **asymptomatic** known or suspected abdominal aortic aneurysms, ultrasound should be done prior to advanced imaging. Only when the ultrasound is inconclusive, is advanced imaging needed (see Background for ultrasound screening intervals)
- For **symptomatic** known or suspected AAA (such as recent-onset abdominal pain or back pain, particularly in the presence of a pulsatile or epigastric mass, suspected dissection or significant risk factors for AAA) CTA/MRA is appropriate and generally preferred over CT/MRI. (If contrast is contraindicated or other clinical indications for abdomen and/or pelvic imaging are present, then CT/MR may be approved rather than CTA/MRA)
- If there is known complex vascular anatomy, CTA/MRA may be needed.

Other vascular abnormalities seen on prior imaging studies:

- Initial evaluation of inconclusive vascular findings on prior imaging
- Follow-up of known visceral vascular conditions (such as aneurysm, dissection, compression syndromes, arteriovenous malformations (AVMs), fistulas, intramural hematoma, and vasculitis) (pelvis may also be approved if needed based on location of abnormality)
    - Hepatic vascular abnormalities after ultrasound has been performed to clarify or further evaluate findings
- For assessment in patients with spontaneous coronary artery dissection (SCAD), can be done at time of coronary angiography [5]
- Vascular invasion or displacement by tumor (conventional CT or MRI also appropriate)[6]
- For known large vessel diseases (inferior vena cava, superior/inferior mesenteric, celiac, splenic, renal or iliac arteries/veins), e.g., aneurysm/dissection (non-aortic disease), arteriovenous malformations (AVMs), and fistulas, intramural hematoma, and vasculitis[7-9]
    - Surveillance may be done with ultrasound at intervals similar to AAA, however, CTA/MRA rather than CT/MRI may be needed for non-aortic disease when ultrasound is inconclusive[10]

Vascular ischemia or hemorrhage:

- To determine the vascular source of retroperitoneal hematoma or hemorrhage when CT is insufficient to determine the source of hemorrhage [9, 12]
- For evaluation of suspected mesenteric ischemia/ischemic colitis [11]
- Lower gastrointestinal hemorrhage: Active bleeding in a hemodynamically stable patient or non-localized intermittent bleeding as an alternative to Tc-99m RBC scan when colonoscopy did not localize the bleeding, or is contraindicated or unavailable[5, 6, 14]
- For hemodynamically unstable patients[15, 16]

For patients at increased risk for vascular abnormalities (CTA or MRA):

- For patients with fibromuscular dysplasia (FMD), a one-time vascular study of the abdomen and pelvis [13]

- For patients with vascular Ehlers-Danlos syndrome or Marfan syndrome, a one-time study of the abdomen and pelvis
- For Loeys-Dietz, imaging at diagnosis and then every two years, more frequently if abnormalities are found (Imaging may include head, neck, chest, abdomen and pelvis)[14, 20] (MRA preferred due to cumulative radiation risk)

Venous disease

- Venous thrombosis if previous studies have not resulted in a clear diagnosis
- For suspected/known May-Thurner syndrome[24, 25]
- For evaluation of venous thrombosis in the inferior vena cava (IVC)[17]
- Vascular invasion or displacement by tumor (if involves both the abdomen and pelvis (otherwise limit to either abdomen or pelvis as appropriate)
- For evaluation of suspected pelvic vascular disease or pelvic congestive syndrome when findings on ultrasound are indeterminate (MR or CT venography may be used as the initial study for evaluating pelvic thrombosis or thrombophlebitis)
- For unexplained lower extremity edema (typically unilateral or asymmetric) with negative or inconclusive ultrasound[26]

Pre-operative evaluation

- Evaluation of interventional vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Prior to repair of abdominal aortic aneurysm (AAA)
- For imaging of the deep inferior epigastric arteries for surgical planning (breast reconstructive surgery)[27]
- Prior to solid organ transplantation when vascular anatomy is needed

Post-operative or post-procedural evaluation

- Evaluation of endovascular/interventional abdominal vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Evaluation of post-operative complications, e.g., pseudoaneurysms, related to surgical bypass grafts, vascular stents, and stent-grafts in the peritoneal cavity
- Suspected complications of inferior vena cava (IVC) filters
- Follow-up for post-endovascular repair (EVAR) or open repair of abdominal aortic aneurysm (AAA)[1] or abdominal extent of iliac artery aneurysms (**CT preferred** unless MRA/CTA is needed for procedural planning or to evaluate complex anatomy)
    - Routine, baseline study (post-op/intervention) is warranted within the first month after EVAR:
        - Repeat in 6 months if type II endoleak is seen (continue every 6 months x 24 months, then annually)

        - Repeat in 12 months if no endoleak or sac enlargement is seen
        - If neither endoleak nor AAA enlargement is seen on imaging one year after EVAR, CT is needed only if US is not feasible for annual surveillance (until year 5 as below)
    - Non-contrast CT of entire aorta (Abdomen and Pelvis) is needed every 5 years after open repair of AAA or EVAR
    - If symptomatic or imaging shows increasing or new findings related to stent graft – more frequent imaging may be needed
    - For suspected complication such as: new-onset lower extremity claudication, ischemia, or reduction in ABI after aneurysm repair,

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Chest CTA/Abdomen/Pelvis CTA combo

- For evaluation of extensive vascular disease involving the chest and abdominal cavities
- For pre-op or preprocedural evaluation for Transcatheter Aortic Valve Replacement (TAVR)[29, 31]
- Acute aortic dissection[32]
- Takayasu's arteritis[33]
- Marfan syndrome
- Loeys-Dietz syndrome
- Spontaneous coronary artery dissection (SCAD)
- Vascular Ehlers-Danlos syndrome
- Post-operative complications[34, 35]
- Significant post-traumatic or post-procedural vascular complications

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BACKGROUND

Body CTA is a method used to characterize vascular anatomy, diagnose vascular diseases, and plan treatment. Following contrast thin section CT acquisition is utilized and timed to coincide with peak arterial and venous enhancement. Both multiplanar and 3D reconstructions can be reformatted**.**

Bruits - blowing vascular sounds heard over partially occluded blood vessels. Abdominal bruits may indicate partial obstruction of the aorta or other major arteries such as the renal, iliac, or femoral

arteries. Associated risks include but are not limited to; renal artery stenosis, aortic aneurysm, atherosclerosis, AVM, or coarctation of aorta.

Peripheral Artery Disease (PAD) – Before the availability of computed tomography angiography (CTA), peripheral arterial disease was evaluated using CT and only a portion of the peripheral arterial tree could be imaged. Multi-detector row CT (MDCT) overcomes this limitation and provides an accurate alternative to CT and is a cost-effective diagnostic strategy in evaluating PAD. Abdominal Arteries CTA (including runoff to the lower extremities) is the preferred study when evaluation of arterial sufficiency to the legs is part of the evaluation.

Lower GI bleeding- Colonoscopy should be the initial diagnostic procedure for nearly all patients presenting with acute LGIB (strong recommendation, low-quality evidence). Hematochezia associated with hemodynamic instability should lead to consideration of a brisk UGIB source, especially in at-risk patients, such as those with a history of peptic ulcer disease or liver disease with portal hypertension and those using antiplatelet or anticoagulant medications, and an upper endoscopy should be performed. CTA is a reasonable first-line screening test if needed before angiography or emergent surgery.[5]

CTA and Abdominal Aortic Aneurysm – Endovascular repair is an alternative to open surgical repair of an abdominal aortic aneurysm. It has lower morbidity and mortality rates and is minimally invasive. In order to be successful, it depends on precise measurement of the aneurysm and involved vessels. CTA with 3D reconstruction is useful in obtaining exact morphologic information on abdominal aortic aneurysms. CTA is also used for the detection of postoperative complications of endovascular repair.

CTA and Abdominal Aortic Aneurysm – The normal diameter of the suprarenal abdominal aorta is 3.0 cm and that of the infrarenal is 2.0 cm. Aneurysmal dilatation of the infrarenal aorta is defined as diameter ≥ 3.0 cm or dilatation of the aorta ≥ 1.5x the normal diameter.[2] Evaluation of AAA can be accurately made by ultrasound. Ultrasound can detect and size AAA, with the advantage of being relatively inexpensive, noninvasive, and not requiring iodinated contrast. The limitations are that overlying bowel gas can obscure findings and the technique is operator dependent. Ultrasound is used to screen for and to monitor aneurysms*. CT is used when US is inconclusive or insufficient. When there are suspected complications, complex anatomy and/or surgery is planned, CTA/MRA is preferred. Risk factors for AAA include smoking history, age, male gender, family history of AAA (first degree relative) and personal history of vascular disease. Risk factors for rupture include female gender, large initial aneurysm diameter, low FEV, current smoking history, elevated mean blood pressure and patients on immunosuppression after major organ transplantation. The Society of Vascular Surgery recommends elective repair of AAA ≥ 5.5 cm in patients at low or acceptable surgical risk.[1]

Ultrasound screening intervals*:

- Aneurysm size 2.5–3 cm, every 10 years
- Aneurysm size 3.0–3.9 cm, every 3 years

- Aneurysm size 4.0-4.9 cm, annually[36]
- Aneurysm size 5.0-5.4 cm, every 6 months

Iliac Artery Aneurysms – Follow-up asymptomatic incidentally detected iliac artery aneurysms: The definition of an iliac artery aneurysm is dilatation to more than 1.5 times its normal diameter, in general ≥ 18 mm in men and ≥ 15 mm in women, an internal iliac artery > 8mm. Surveillance is extrapolated from AAA surveillance and can be done by Doppler ultrasound or CTA if hard to visualize by ultrasound.[4]

CTA and Thoracic Aorta Endovascular Stent-Grafts – CTA is an effective alternative to conventional angiography for postoperative follow-up of aortic stent grafts. It is used to review complications after thoracic endovascular aortic repair. CTA can detect luminal and extraluminal changes to the thoracic aortic after stent-grafting and can be performed efficiently with fast scanning speed and high spatial and temporal resolution.

MRI/CT and acute hemorrhage – MRI is not indicated and MRA/MRV (MR Angiography/Venography) is rarely indicated for evaluation of intraperitoneal or retroperitoneal hemorrhage, particularly in the acute setting. **CT is the study of choice** due to its availability, speed of the study and less susceptibility to artifact from patient motion. Advances in technology have allowed conventional CT to not just detect hematomas but also the source of acute vascular extravasation. In special cases finer vascular detail to assess the specific source vessel responsible for hemorrhage may require the use of CTA. CTA in diagnosis of lower gastrointestinal bleeding is such an example.[14] In this case, colonoscopy should be the initial diagnostic procedure.

MRA/MRV is often utilized in non-acute situations to assess vascular structure involved in atherosclerotic disease and its complications, such as vasculitis, venous thrombosis, vascular congestion or tumor invasion. Although some of these conditions may be associated with hemorrhage, it is usually not the primary reason why MRI/MRA/MRV is selected for the evaluation. A special condition where MRI may be superior to CT for evaluating hemorrhage is to detect an underlying neoplasm as the cause of bleeding.[37]

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POLICY HISTORY

Date	Summary
March 2023	• Aneurysm: specified guidance on initial imaging and screening intervals with emphasis on requiring ultrasound on initial imaging and indications for advanced imaging, specified guidance on post-repair imaging • Other vascular abnormalities: clarified indication for non-aortic vascular conditions • Transplant: added section • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Aligned sections across body imaging guidelines
April 2022	• Added "(abdomen and pelvis MRA when CTA is inconclusive or cannot be performed)" to follow-up for EVAR and AAA

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **ABDOMEN CTA (Angiography)**	**Original Date: September 1997**
CPT Codes: 74175	**Last Revised Date: March 2023**
Guideline Number: Evolent_CG_034-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE

When vascular imaging of the aorta and both legs, i.e., CTA aortogram and runoff is desired (sometimes incorrectly requested as Abd/Pelvis CTA & Lower Extremity CTA Runoff), only one authorization request is required, using CPT Code 75635 Abdominal Arteries CTA. This study provides for imaging of the abdomen, pelvis, and both legs. The CPT code description is CTA aorto-iliofemoral runoff; abdominal aorta and bilateral ilio-femoral lower extremity runoff.

When separate requests for CTA abdomen and CTA Pelvis are encountered for processes involving both the abdomen and pelvis (but do NOT need to include legs/runoff), they need to be resubmitted as a single Abdomen/Pelvis CTA, using CPT 74174 (to avoid unbundling). Otherwise, the exam should be limited to the appropriate area (i.e., Abdomen OR Pelvis) that includes the area of concern.

INDICATIONS FOR ABDOMEN CT ANGIOGRAPHY/CT VENOGRAPHY (CTA/CTV)

For evaluation of known or suspected abdominal vascular disease

Arterial Disease

Abdominal Aortic Aneurysm (AAA) (should be CTA Abdomen and Pelvis if known or suspected aneurysm extends to the pelvis):

- For **asymptomatic** known or suspected abdominal aortic aneurysms, ultrasound should be done prior to advanced imaging. Only when the ultrasound is inconclusive, is advanced imaging with CT or MRI needed
- For **symptomatic** known or suspected AAA (such as recent-onset abdominal pain or back pain, particularly in the presence of a pulsatile or epigastric mass, suspected dissection, or significant risk factors for AAA) CTA/MRA is appropriate and generally preferred over CT/MRI. (If contrast is contraindicated or other clinical indications for abdomen and/or pelvic imaging are present, then CT/MR may be approved rather than CTA/MRA)
- If there is known complex anatomy, CTA/MRA may be needed.

Other vascular abnormalities seen on prior imaging studies:

- Initial evaluation of inconclusive vascular findings on prior imaging
- Follow-up of known visceral vascular conditions (such as aneurysm, dissection, compression syndromes, arteriovenous malformations (AVMs), fistulas, intramural hematoma, and vasculitis) (if pelvis is also needed, resubmit as CTA Abdomen and Pelvis)
    - Hepatic vascular abnormalities after ultrasound has been performed to clarify or further evaluate findings
- For assessment in patients with spontaneous coronary artery dissection (SCAD), can be done at time of coronary angiography (resubmit as CTA Abdomen and Pelvis if pelvis is needed)[1]
- Vascular invasion or displacement by tumor (conventional CT or MRI also appropriate)[2]
- For known large vessel diseases (inferior vena cava, superior/inferior mesenteric, celiac, splenic or renal arteries/veins), e.g., aneurysm/dissection (non-aortic disease), arteriovenous malformations (AVMs), and fistulas, intramural hematoma, and vasculitis[3-5]
- Surveillance may be done with ultrasound at intervals similar to AAA, however, CTA/MRA rather than CT/MRI may be needed for non-aortic disease when ultrasound is inconclusive[6]

Vascular ischemia or hemorrhage (needs to be resubmitted as CTA Abdomen and Pelvis unless there is a specific finding limited to the abdomen)

For patients at increased risk for vascular abnormalities (CTA or MRA): (needs to be resubmitted as CTA Abdomen and Pelvis unless there is a specific finding limited to the abdomen)

For evaluation of known or suspected renal artery stenosis or resistant hypertension in the setting of normal renal function (with impaired renal function, eGFR <30, use US with Doppler) unrelated to recent medication demonstrated by any of the following[2, 7-13]:

- Unsuccessful control after treatment with 3 or more (>2) anti-hypertensive medication at optimal dosing and one should be a diuretic
- Acute elevation of creatinine after initiation of an angiotensin converting enzyme inhibitor (ACE inhibitor) or angiotensin receptor blocker (ARB)
- Asymmetric kidney size noted on ultrasound

- Onset of hypertension in a person younger than age 30 without any other risk factors or family history of hypertension
- Significant hypertension (diastolic blood pressure > 110 mm Hg) in a young adult (i.e., younger than 35 years) suggestive of fibromuscular dysplasia[14]
- Diagnosis of a syndrome with a higher risk of vascular disease, such as neurofibromatosis, tuberous sclerosis, and Williams' syndrome
- New onset of hypertension after age 50
- Acute rise in blood pressure in a person with previously stable blood pressures
- Flash pulmonary edema without identifiable causes
- Malignant or accelerated hypertension
- Bruit heard over renal artery and hypertension
- Abnormal/inconclusive renal doppler ultrasound

Venous Disease

- Suspected renal vein thrombosis in patient with known renal mass or from other causes[15]
- Venous thrombosis if previous studies have not resulted in a clear diagnosis and limited to the abdomen
- Vascular invasion or displacement by tumor in the abdomen
- For evaluation of portal venous system (hepatic portal system) after doppler ultrasound has been performed
- For unexplained lower extremity edema (typically unilateral or asymmetric) with negative or inconclusive ultrasound[16]

Pre-operative evaluation

- For evaluation of transjugular intrahepatic portosystemic shunt (TIPS) when Doppler ultrasound indicates suspected complications[17-20]
- Evaluation prior to interventional vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Prior to solid organ transplantation when vascular anatomy is needed
- For surgical planning for UPJ (ureteropelvic junction) obstruction to look for a lower pole crossing vessel
- Planning prior Y90 radiation treatment for liver cancer in order to evaluate anatomic variation/shunts/determine best catheter placement/see if coil(s) needed[21]

Post-operative or post-procedural evaluation

- Evaluation of endovascular/interventional abdominal vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Evaluation of post-operative complications, e.g., pseudoaneurysms related to surgical bypass grafts, vascular stents, and stent-grafts in the peritoneal cavity

- Follow-up for post-endovascular repair (EVAR) or open repair of abdominal aortic aneurysm (AAA) or abdominal extent of iliac artery aneurysms typically needs to include pelvic imaging, therefore Abdomen Pelvis CT/CTA/MRA would usually be the appropriate study.

Other Vascular indications

- For evaluation of hepatic blood vessel abnormalities (aneurysm, hepatic vein thrombosis, stenosis post-transplant) after doppler ultrasound has been performed; to clarify or further evaluate ultrasound findings

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Chest CTA/Abdomen CTA combo

- For evaluation of extensive vascular disease involving the chest and abdominal cavities and pelvic imaging is not needed
- For pre-op or preprocedural evaluation for Transcatheter Aortic Valve Replacement (TAVR)[22, 23]
- Post-op complications[24, 25] and pelvic imaging is not needed
- Significant post-traumatic or post-procedural vascular complications and pelvic imaging is not needed

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BACKGROUND

Computed tomography angiography (CTA) generates images of the arteries that can be evaluated for evidence of stenosis, occlusion, or aneurysms. It is used to evaluate the arteries of the abdominal aorta and the renal arteries. CTA uses ionizing radiation and requires the administration of iodinated contrast agent, which is a potential hazard in patients with impaired renal function. Abdominal CTA is not used as a screening tool, e.g., evaluation of asymptomatic patients without a previous diagnosis.

Cross-sectional imaging (liver ultrasound with Doppler, CT or MRI) should be completed no more than a month prior to the transjugular intrahepatic portosystemic shunt (TIPS) to assess for vascular patency and look for hepatic masses or other problems that could complicate the procedure.

Post-procedure, an ultrasound of the liver is conducted a day after to assess shunt patency. Hepatic encephalopathy (HE) is the most common complication and usually occurs 2-3 weeks after insertion of

TIPS. Unique complications may include intravascular hemolysis and infection of the shunt. Other complications can include capsule puncture, intraperitoneal bleed, hepatic infarction, fistula, hematobilia, thrombosis of stent, occlusion, or stent migration and may require cross-sectional imaging.

Follow-up and maintenance imaging if complications suspected include Doppler ultrasound to assess shunt velocity. If asymptomatic sonogram performed at 4 weeks post placement, then every 6 months to a year. The gold standard for shunt patency is portal venography, usually reserved if concern for shunt occlusion.

OVERVIEW

CTA and Renal Artery Stenosis: Renal artery stenosis is the major cause of secondary hypertension. It may also cause renal insufficiency and end-stage renal disease. Atherosclerosis is one of the common causes of this condition, especially in older patients with multiple cardiovascular risk factors and worsening hypertension or deterioration of renal function. CTA is used to evaluate the renal arteries and detect renal artery stenosis.

NF1 may present with hypertension due to renal artery stenosis in children. All young patients (<30 year) with hypertension should be clinically screened for secondary causes of hypertension, including NF1, so that renal revascularization can be offered before permanent end organ damage has occurred.[26]

Abdominal Aneurysms and general guidelines for follow-up: The normal diameter of the suprarenal abdominal aorta is 3.0 cm and that of the infrarenal is 2.0 cm. Aneurysmal dilatation of the infrarenal aorta is defined as diameter ≥ 3.0 cm or dilatation of the aorta ≥ 1.5x the normal diameter.[27] Evaluation of AAA can be accurately made by **ultrasound.** Ultrasound can detect and size AAA, with the advantage of being relatively inexpensive, noninvasive, and not requiring iodinate contrast. The limitations are that overlying bowel gas can obscure findings and the technique is operator dependent. CT is used when US is inconclusive or insufficient. When there are suspected complications, complex anatomy and/or surgery is planned, CTA/MRA is preferred.

MRI/CT and acute hemorrhage: MRI is not indicated and MRA/MRV (MR Angiography/Venography) is rarely indicated for evaluation of intraperitoneal or retroperitoneal hemorrhage, particularly in the acute setting. **CT is usually the study of choice** due to its availability, speed of the study, and less susceptibility to artifact from patient motion. Advances in technology have allowed conventional CT to not just detect hematomas but also the source of acute vascular extravasation. In special cases finer vascular detail to assess the specific source vessel responsible for hemorrhage may require the use of CTA. CTA in diagnosis of lower gastrointestinal bleeding is such an example.[28]

MRA/MRV is often utilized in non-acute situations to assess vascular structure involved in atherosclerotic disease and its complications, vasculitis, venous thrombosis, vascular congestion, or tumor invasion. Although some of these conditions may be associated with hemorrhage, it is usually

not the primary reason why MRI/MRA/MRV is selected for the evaluation. A special condition where MRI may be superior to CT for evaluating hemorrhage is to detect an underlying neoplasm as the cause of bleeding.[29]

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POLICY HISTORY

Date	Summary
March 2023	• Redirected vascular requests for abdomen alone or pelvis imaging alone to resubmit as abdomen and pelvis CTA required unless condition limited to abdomen • Other vascular abnormalities: clarified indication for non-aortic vascular conditions • Transplant: added section • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Aligned sections across body imaging guidelines
April 2022	• Added indication for UPJ surgery • Clarified note regarding vascular imaging of the aorta and both legs (i.e., CTA aortogram and runoff) • Clarified evaluation of known or suspected aortic aneurysm • Removed follow-up intervals for EVAR and AAA since Abdomen Pelvis CTA is usually appropriate study • Added Y90 indication

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guideline **ABDOMEN/PELVIS CT COMBO**	**Original Date: September 1997**
CPT Codes: 74176, 74177, 74178	**Last Revised Date: March 2023**
Guideline Number: Evolent_CG_068	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

Note: For syndromes for which imaging starts in the pediatric age group, MRI preferred

Note: CT Abdomen/Pelvis Combo (CPT Codes: 74176, 74177, 74178) is the better study when the indication(s) include both the abdomen AND pelvis, such as CTU (CT Urography), CTE (CT Enterography), acute abdominal pain, widespread inflammatory disease, or neoplasm**.**
When separate requests for CT Abdomen and CT Pelvis are encountered for processes involving both the abdomen and pelvis, they need to be resubmitted as a single Abdomen/Pelvis CT (to avoid unbundling). Otherwise, the exam should be limited to the appropriate area (i.e., Abdomen **OR** Pelvis) which includes the specific organ, area of known disease/abnormality, or the area of concern**.**

INDICATIONS FOR ABDOMEN/PELVIS COMPUTED TOMOGRAPHY (CT)

Evaluation of Abdominal and Pelvis Pain for Unknown Etiology

- CT allowed after initial workup is inconclusive and must include results of the following:
  - Appropriate laboratory testing (chemistry profile, complete blood count, and/or urinalysis) for the patient's presentation (e.g., suprapubic pain – UA, suspected pancreatitis – amylase/lipase etc.) **AND**
  - Initial imaging (such as ultrasound, barium study, nuclear medicine, or scope study) appropriate to the symptoms
  - Not all of the above tests need to be performed, but both labs and initial imaging need to be performed

        - E.g., for GI bleeding, CBC and a scope study would be appropriate initial testing (however, a UA and ultrasound would not be)
- For acute abdominal pain in a patient over the age of 65[1, 2]
- Initial evaluation of abnormal findings seen on other imaging, such as ultrasound (US) or x-ray, both the abdomen and pelvis are likely affected, and CT is the most reasonable next step for that diagnosis

Evaluation of suspicious or known mass/tumors (unconfirmed diagnosis of cancer) for further evaluation of indeterminate or questionable findings

- Initial evaluation of suspicious masses/tumors found by physical exam or imaging study, such as ultrasound (US), and both the abdomen and pelvis are likely affected[3, 4]
- One follow-up exam to ensure no suspicious change has occurred in a tumor. No further surveillance imaging unless tumor(s) is/are specified as highly suspicious, or change was found on exam or last follow-up imaging.
- For abnormal incidental abdominopelvic lymph nodes when follow-up is recommended based on prior imaging (initial 3-month FU)[5]
- For follow-up of mesenteric panniculitis[6-8] or lymphadenitis[9] when another diagnosis is suspected after initial imaging or there is a failure of symptom resolution

Evaluation of known cancer[10, 11] (see exception for prostate cancer*)

- Initial staging of known cancer
- Follow-up of known cancer
    - Follow-up of known cancer of patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
    - New evidence of an unknown primary[12]
    - Known cancer with suspected abdominal/pelvic metastasis based on a sign, symptom, (e.g., anorexia, early satiety, intestinal obstruction, night sweats, pelvic pain, weight loss, vaginal bleeding) or an abnormal lab value (alpha-fetoprotein, CEA, CA 19-9, p53 mutation)

***Initial staging of prostate cancer for the following risk groups:** (MRI Pelvis preferred for pelvic imaging; only consider CT Abdomen and Pelvis approval if PSMA PET not requested)

- Unfavorable intermediate risk, high risk and very high-risk disease:
    - Gleason 8, 9, 10 disease
    - Gleason 4+3=7 disease (primary pattern 4)
    - Gleason 3+4=7 disease **AND** PSA > 10 or clinical stage ≥T2b
    - Gleason 3+3=6 disease **AND** PSA > 20 or clinical stage ≥T3
    - >50% cores positive for cancer in a random (non-targeted) biopsy[1, 13]

Note: In patients who have been on a 5-alpha reductase inhibitor (such as Proscar) in the past 12 months, an "adjusted PSA" should be used. To adjust, multiply PSA by a factor of 2 (e.g., PSA 6 on finasteride adjusts to a PSA of 12)

***Known prostate cancer for workup of recurrence and response to treatment (**MRI Pelvis preferred for pelvic imaging; only consider CT Abdomen and Pelvis approval if PSMA PET not requested

- Initial treatment with radical prostatectomy
    - Failure of PSA to fall to undetectable levels or PSA detectable and rising on at least 2 subsequent determinations
- Initial treatment with radiation therapy
    - Post-RT rising PSA on at least 2 subsequent determinations or positive digital exam and is candidate for local therapy
    - Known metastatic disease with progression on therapy does not require CI to MRI or PET if CT is requested

Suspected or known recent peritonitis and at LEAST ONE of the following:

- Rebound, guarding (not voluntary) or rigid abdomen, **OR**
- Severe tenderness to palpation present over entire abdomen

For evaluation of suspected infection or inflammatory disease[14, 15]

- Suspected diverticulitis or acute appendicitis** for initial imaging with at least **ONE** of the following[16]:
    - WBC Elevated
    - Fever
    - Anorexia
    - Nausea and vomiting

  **Use ultrasound or MRI in pregnant women with suspected appendicitis[17]
- Suspected diverticulitis[18] when
    - Pain is present in the LLQ (<3 months duration), medical records note suspicion for diverticulitis, the patient has no prior history of diverticulitis, **AND** LLQ tenderness is present on exam; **OR**
    - Patient is immunocompromised; **OR**
    - Patient has a history of diverticulitis, symptoms are similar to prior episodes, **AND** patient has failed treatment currently (treatment could be liquid diet/anti-inflammatories or antibiotic)
- Suspected appendicitis in a child (< age 18)[19-23] when ultrasound is inconclusive or cannot be completed due to body habitus or inability to cooperate **OR** when peritoneal signs are present (guarding, rebound) or other red flags
- For acute non-localized abdominal pain and fever[24]
- For suspected retroperitoneal fibrosis after labs and ultrasound have been completed and other etiologies for symptoms have been excluded (is a diagnosis of exclusion)[25,26]

For follow-up evaluation of known infection or inflammatory disease involving the abdomen and pelvis[14, 27]

- Complications of diverticulitis (diagnosed either clinically or by imaging) with severe abdominal/pelvic pain or severe tenderness or mass not responding to antibiotic treatment[14, 15]
- Pancreatitis by history (including pancreatic pseudocyst) with continued abdominal pain, early satiety, nausea, vomiting, or signs of infection greater than 4 weeks from initial presentation[27] when there is reason to suspect extensive disease extending into the pelvis (otherwise CT abdomen)
- Any known infection that is clinically suspected to have created an abscess in the abdomen and pelvis
- Any history of fistula that requires re-evaluation or is suspected to have recurred in the abdomen and pelvis
- Abnormal fluid collection seen on prior imaging that needs follow-up evaluation
- For known retroperitoneal fibrosis to determine extent of disease

Suspected or known acute pancreatitis[27] when have reason to suspect extension beyond abdomen, into pelvis

- Initial imaging for suspected acute pancreatitis due to epigastric pain with elevated amylase and/or lipase:
    - For mild presentation when symptom improvement is not seen after 72 hours of treatment and either:
        - ultrasound has been performed and did not show an abnormality such as gallstones, dilated bile duct
        - ultrasound suggests complications (such as fluid collection)
    - For severe presentation (such as fever, elevated WBC)
    - For a decline in clinical status and/or suspected complication
- Pancreatitis by history, (including pancreatic pseudocyst) with abdominal pain suspicious for worsening, or re-exacerbation
- Known necrotizing pancreatitis requiring follow-up

For evaluation of Inflammatory Bowel Disease (IBD) such as Crohn's or Ulcerative Colitis, (includes CT enterography (CTE), however, MRE should be considered for age < 35 to reduce radiation exposure)[28-33]

- For suspected inflammatory bowel disease after complete work up including physical exam, labs, and recent colonoscopy
- Known inflammatory bowel disease with recurrence or worsening signs/symptoms requiring re-evaluation or for monitoring therapy

For evaluation of hematuria when stone is NOT suspected (includes CT urography (CTU))[34-36]

- Documented by 3 or more red blood cells (RBC) per high-power field on urinalysis and not based on a dipstick test[34] **AND ONE** or more of the following:
    - Age > 60; **OR**
    - 30+ pack year smoking history
- > 25 RBC/hpf and infection has been excluded
- If not high risk (based on age, smoking history or > 25 RBC/hpf as above) need equivocal or abnormal renal ultrasound prior to CT
- Gross hematuria
    - UA must be negative for infection
    - UA can be negative for blood if hematuria is witnessed by patient or provider

NOTE: If a previous "routine" CT abdomen/pelvis has been done (with or with/without contrast), and a CTU is later requested, the previous CT must show a clear reason that additional delayed post-contrast images of the collecting system are needed.

For evaluation of known or suspected kidney or ureteral stone in a patient with acute flank pain

- **CT is indicated if one or more of the following is present:**
    - Atypical presentation (i.e., fever or WBC >15,000)
    - Inadequate analgesia
    - Abnormal or indeterminate ultrasound (with findings needing further evaluation with CT)
    - KUB has been provided and is highly suggestive of kidney or ureteral stone (US is the preferred initial imaging test but if provided, information on KUB can be used to make decision)
- **Ultrasound should be performed PRIOR to CT in the following situations (CT is needed only if US is inconclusive or has findings that need further imaging):**
    - Pediatric and pregnant patients (MRU preferred if further imaging indicated)
    - Typical presentation without signs/symptoms of infection in a patient < 65
- **CT is allowed for acute abdominal pain, in general, for patients >65**

Preoperative urinary stone planning

- CT is indicated when no imaging has been done in the last 30 days, or if passage or movement of stones will change management[37]

Postoperative urinary stone follow-up CT

- Symptomatic patients following:
    - Ureteroscopic extraction of an intact stone[38]
    - Ureteroscopy with lithotripsy/fragmentation of a radiolucent stone[38]
- Further evaluation of hydronephrosis seen on post-operative ultrasound (following ureteroscopy or ESWL)[38]

For evaluation of pyelonephritis in the following situations[39]

- When other imaging such as ultrasound is abnormal
- For a patient who remains febrile after 72 hours of treatment[40] or has deterioration in clinical status[40]
- With the following co-morbid conditions: personal history of stone disease or renal obstruction, recurrent pyelonephritis, vesicoureteral reflux, immune compromise, prior renal transplant with native kidneys in place, advanced age[39] or lack of response to initial therapy (based on culture)

For evaluation of Complicated Urinary tract Infection: (see above section for pyelonephritis)

- **Women:** UTI is considered complicated (and therefore imaging (ultrasound and/or CT) is warranted) in any of the following situations (may be done after resolution of infection),
    - Immunocompromised host
    - Persistence of bacteria or symptoms after culture specific treatment,
    - Rapid recurrence with same bacteria after treatment,
    - Multidrug resistant bacteria
    - When there is suspicion of renal calculi or obstruction[40, 41]
- **Men:** Any UTI is considered complicated due to high likelihood of anatomic abnormalities,[42] therefore imaging (ultrasound and/or CT) is warranted

Suspected small bowel obstruction when there is a strong clinical suspicion

- Crampy pain, vomiting, distention, high pitched or absent bowel sounds, prior history of abdominal surgery, or based on initial x-ray[43, 44]

Suspected colonic or mesenteric ischemia[45] CTA also appropriate[46]

For suspected small bowel bleeding when endoscopy and capsule endoscopy are inconclusive or negative[47]

For known or suspected abdominal aneurysm

- For known or suspected, **asymptomatic** abdominal aortic aneurysms, ultrasound should be done prior to advanced imaging. Only when the ultrasound is inconclusive, is advanced imaging with CT or MRI needed
    - Aneurysm size 2.5–3 cm, every 10 years
    - Aneurysm size 3.0–3.9 cm, every 3 years
    - Aneurysm size 4.0-4.9 cm, annually
    - Aneurysm size 5.0-5.4 cm, every 6 months
- For **symptomatic** known or suspected AAA (such as recent-onset abdominal pain or back pain, particularly in the presence of a pulsatile or epigastric mass, suspected dissection, or significant risk factors for AAA) CTA/MRA is appropriate and generally preferred over CT/MRI. (If contrast

is contraindicated or other clinical indications for abdomen and/or pelvic imaging are present, then CT/MR may be approved rather than CTA/MRA)

- If there is known complex anatomy, CTA/MRA may be needed.
- Suspected complications of known aneurysm as evidenced by signs/symptoms such as new onset of abdominal or pelvic pain (MRA/CTA preferred)
- Follow-up for post-endovascular repair (EVAR) or open repair of abdominal aortic aneurysm (AAA)[48] or abdominal extent of iliac artery aneurysms (CT preferred unless MRA/CTA is needed for procedural planning or to evaluate complex anatomy)
    - Routine, baseline study (post-op/intervention) is warranted within the first month after EVAR:
        - Repeat in 6 months if type II endoleak is seen (continue every 6 months x 24 months, then annually)
        - Repeat in 12 months if no endoleak or sac enlargement is seen
        - If neither endoleak nor AAA enlargement is seen on imaging one year after EVAR, CT is needed only if US is not feasible for annual surveillance (until year 5 as below)
    - Non-contrast CT of entire aorta (Abdomen and Pelvis) is needed every 5 years after open repair of AAA or EVAR
    - If symptomatic or imaging shows increasing, or new findings related to stent graft – more frequent imaging may be needed
    - For suspected complication such as: new-onset lower extremity claudication, ischemia, or reduction in ABI after aneurysm repair
- Evaluation of endovascular/interventional abdominal vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Evaluation of post-operative complications, e.g., pseudoaneurysms, related to surgical bypass grafts, vascular stents, and stent-grafts in the peritoneal cavity
    - Symptomatic/complications related to stent graft – more frequent imaging may be needed
- Follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

For evaluation of trauma[49]

- Suspected retroperitoneal hematoma or hemorrhage based on lab or physical findings
- Blunt injury with suspicion of multisystem trauma and hematuria
- Penetrating abdominal injury with suspicion of multisystem trauma with or without hematuria[49]

For evaluation of a suspected or known hernia

- Abdominal/pelvic pain suspected to be due to an occult, umbilical, Spigelian, or incisional hernia when physical exam and prior imaging is non-diagnostic or equivocal or if requested as a preoperative study
    - If inguinal hernia, approve CT Pelvis only (needs reason to include abdomen)
    - If umbilical hernia, approve CT Abdomen (needs reason to include pelvis)
- Hernia with suspected complications (e.g., bowel obstruction or strangulation, or non-reducible) based on symptoms (e.g., diarrhea, hematochezia, vomiting, severe pain, or guarding), physical exam (guarding, rebound) or prior imaging[50]
- For confirming the diagnosis of a recurrent hernia when ultrasound is negative or non-diagnostic
- Complex ventral hernia that is ≥ 10 cm for pre-operative planning[50]
- Deep intraabdominal/pelvic hernia is suspected (post-Roux-en-Y, obturator, sciatic or perineal) (does not require US first but this type of hernia needs to be specified in notes)[51]

Transplants

- Prior to solid organ transplantation
- For initial workup prior to Bone Marrow Transplantation (BMT) (along with CT Chest[52], CT Sinus and Brain MRI)[53]). Alternatively, PET might be sufficient to evaluate the abdomen and pelvis if indicated based on that malignancy (see PET Guideline)

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Other Indications for Abdomen/Pelvic CT Combo

- To locate a pheochromocytoma once there is clear biochemical evidence
- For one or more of the following B symptoms: fevers more than 101° F, drenching night sweats, and/or unexplained weight loss of more than 10% of body weight over 6 months with documented concern for lymphoma/malignancy [54]
- Clinically significant unintentional weight loss i.e., ≥5% of body weight in less than 12 months, with signs or symptoms suggestive of an abdominal cause (see Background)
- Ongoing unexplained clinically significant weight loss i.e., ≥5% of body weight in less than 12 months,[55-57] after initial workup (see Background) has been completed, no cause identified, and second visit documenting further decline in weight [58]

- For suspected paraneoplastic syndrome (including dermatomyositis) with high suspicion of abdominal malignancy and appropriate workup has been done (see Background for details)
- For acute unilateral (or asymmetric) lower extremity edema with negative or inconclusive doppler US
- For chronic unilateral (or asymmetric) lower extremity edema and suspicion of malignant cause[59, 60]
- For evaluation of suspected May-Thurner syndrome (CTV/MRV preferred)[61, 62]
- For elevation of carcinoembryonic antigen (CEA) in a patient with no cancer history after completing clinical workup (including organ-specific investigations, such as colonoscopy, gastroscopy, mammography, cystoscopy, ultrasound) that fails to demonstrate a reason and CEA is >10 ng/ml, or fails to drop below 5 ng/ml after 3-6 months intervals (see Background section)
- For fever of unknown origin (temperature of ≥101 degrees for a minimum of 3 weeks) after standard diagnostic tests are negative (see Background section)[63]
- For evaluation of thrombocytosis or thrombocytopenia when one or more of the following are present:
    - Any additional cytopenia (i.e., leukopenia, anemia)
    - LDH elevation
    - Splenomegaly on exam or imaging
    - Palpable lymphadenopathy
    - Bone marrow biopsy has been completed and concern for myeloproliferative disorder persists
    - Genetic mutation increasing risk of myeloproliferative disorder (such as JAK-2 mutation) on peripheral smear or bone marrow[64-67] biopsy
- For further evaluation of a new onset or non-reducible varicocele[68, 69]
- For suspected gestational trophoblastic disease when chest x-ray suggests distant disease (may include Chest CT)[70]
- For confirmed gestational trophoblastic disease when hcg fails to decline appropriately following surgery (may include Chest CT)[70]
- For patients with MEN-1, surveillance of abdomen and pelvis every 1-3 years (MRI preferred)
- Multiple Endocrine Neoplasia type 1 (MEN1) every 1-3 years (chest CT or MRI also approvable for this syndrome at same interval) [8, 71]
- Hereditary Paraganglioma syndromes every 2-3 years IF whole body MRI (unlisted MRI CPT 76498) is not available and CI to MRI exists. (WB MRI is the preferred study; if unable to do whole body MRI may approve abdomen MRI, skull base and neck MRI and chest CT). SDHB mutation may start at age 6, all other SDHx start at age 10
- For patients with FAP (Familial Adenomatous Polyposis, annual screening of abdomen and pelvis with MRI or CT for one or more of the following: personal history of desmoid tumor, family history of desmoid tumor or abdominal symptoms suggestive of desmoid tumor [72]

Pre-operative evaluation

- For abdominal/pelvic surgery or procedure

Post-operative/procedural evaluation

- Follow-up of known or suspected post-operative complication
- A follow-up study to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed.

Indication for combination studies for the initial pre-therapy staging of cancer, evaluation before starting treatment OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine, or Lumbar Spine, and MUGA

BACKGROUND

CT provides direct visualization of anatomic structures in the abdomen and pelvis and is a fast-imaging tool used to detect and characterize disease. Abdomen/pelvis imaging begins at the diaphragmatic dome through pubic symphysis. CT uses x-rays and multiple detectors to create cross-sectional images of the normal anatomy as well as demonstrate abnormal soft tissue densities, calcifications or fluid/gas patterns in the viscera or peritoneal space.

In general, ionizing radiation from CT should be avoided during pregnancy. Ultrasound is clearly a safer imaging option and is the first imaging test of choice; although, CT or MRI after equivocal ultrasound has been validated for diagnosis. Clinicians should exercise increased caution with CT imaging in children, pregnant women, and young adults due to the risks of exposure to ionizing radiation. Screening for pregnancy as part of a work-up is suggested to minimize the number of unexpected radiation exposures for women of childbearing age.

OVERVIEW

CT Imaging for renal colic and hematuria

More than 2 million emergency visits in the US are for suspected renal colic, and CT is performed in over 90% of patients diagnosed with kidney stones.[73] Evidence now supports ultrasound or no further imaging in specific clinical scenarios as renal colic is often self-limited. CT can guide therapy in a subset of patients who require intervention or who have other conditions that mimic renal colic (i.e., appendicitis). CT protocols include: "stone protocol" for detecting urinary tract calculi, "renal mass protocol" for characterizing known renal masses, and CT urography for evaluating hematuria. Non-contrast CT can be used for detecting most ureteral and renal stones but sometimes an intravenous contrast agent is needed to determine the relationship of the calculus to the opacified ureter.

CT imaging for recurrent urinary tract infections

Imaging in patients without risk factors and less than two infections a year on average and who respond promptly to therapy, is of low yield. Risk factors include but are not limited to: Infection with urea-splitting organism, previous pyelonephritis, history of calculi or obstruction, obstructive symptoms, elevated creatinine, severe diabetes, childhood UTI, neurogenic bladder dysfunction, history of GU surgery, suspected bladder diverticula or urethral, urinary incontinence, pelvic floor dysfunction, post void residual.[74]

CT Imaging for abdominal aortic aneurysms

NOTE: For known or suspected abdominal aneurysm, CT/MRI should not be approvable without a contraindication to CTAngiography /MRAngiography, such as severe renal dysfunction, contrast allergy, or another specific reason CT/MRI (rather than CTA/MRA) is preferred.

If a pulsatile abdominal mass is found in an asymptomatic patient, **abdominal ultrasonography** is an inexpensive and noninvasive technique for **initial evaluation**. For further examination, CT may be performed to better define the shape and extent of the aneurysm and the local anatomic relationships of the visceral and renal vessels. CT has high level of accuracy in sizing aneurysms; however, CTA and MRA are the gold standards for imaging. The majority of evidence regarding AAA surveillance using CT is based on CTA data and is primarily related to contrast bolus timing. Contrast-enhanced CT is well established in the literature and is capable of identifying aortic aneurysms, with many papers discussing incidental AAA identification.[75, 76] Risk of rupture in 6 years for an AAA < 4 cm is 1%. For a 4-5 cm AAA, the risk of rupture increases to 1-3% per year and becomes 6-11% per year for AAA 5-7 cm in cross sectional diameter. For any AAA >7 cm, the risk of rupture goes to 7% per year.

Initial evaluation of abdominal aortic aneurysm (AAA)

Initial evaluation of AAA is accurately made by ultrasound.

****Abdominal aneurysms and general guidelines for follow-up**

The normal diameter of the suprarenal abdominal aorta is 3.0 cm and that of the infrarenal is 2.0 cm. Aneurysmal dilatation of the infrarenal aorta is defined as diameter ≥ 3.0 cm or dilatation of the aorta ≥ 1.5x the normal diameter. Ultrasound can detect and size AAA, with the advantage of being relatively inexpensive, noninvasive, and not require iodinate contrast. The limitations are that overlying bowel gas can obscure findings and the technique is operator dependent. Ultrasound is used to screen for and to monitor aneurysms*. CT is used when US is inconclusive or insufficient. When there are suspected complications, complex anatomy and/or surgery is planned, CTA/MRA is preferred. Risk factors for AAA include smoking history, age, male gender, family history of AAA (first degree relative) and personal history of vascular disease. Risk factors for rupture include female gender, large initial aneurysm diameter, low FEV, current smoking history, elevated mean blood pressure and patients on immunosuppression after major organ transplantation. The Society of Vascular Surgery recommends elective repair of AAA ≥ 5.5 cm in patients at low or acceptable surgical risk. [1]

Ultrasound screening intervals*:

- Aneurysm size 2.5–3 cm, every 10 years
- Aneurysm size 3.0–3.9 cm, every 3 years
- Aneurysm size 4.0-4.9 cm, annually[77]
- Aneurysm size 5.0-5.4 cm, every 6 months

CT for Mesenteric Ischemia

CT of the abdomen and pelvis with intravenous (IV) contrast performed during the venous phase has been less well-studied compared with CTA in diagnosing mesenteric ischemia. CT with IV contrast can assess nonvascular findings, major arterial lesions, and mesenteric veins; however, the lack of arterial phase may lead to suboptimal evaluation of the mesenteric arteries compared to CTA.[46]

CT for elevation of CEA with no history of a previous CEA-producing tumor

CEA is not normally elevated after birth, but elevated CEA levels increases the chance of finding colon cancer from 1.3% to 4.6%. It is also a predictor of other diseases, including other cancers (e.g., mucinous adenocarcinomas of the endocervix and ovary, as well as keratinising squamous cell carcinoma of the cervix), diabetes, chronic lung, and liver disease.

Evaluation should begin with a thorough history, including smoking history, and clinical exam. Investigation would include repeat CEA, full blood count, iron, liver function and renal function tests, CA 125 levels, and calcitonin. If CEA <10ng/ml and clinical review is negative, repeat the clinical evaluation in 3 months and CEA for changes. If level falls, repeat at 6-month intervals until normal or 2 consecutive decreases. If CEA level remains above 5 ng/ml after 3-6-month intervals or exceeds 10ng/ml at any stage, consider CT imaging.[78]

CT and Fever of Unknown Origin

Initial work up prior to CT would include a comprehensive history, repeated physical exam, complete blood count with differential, three sets of blood cultures, chest x-ray, complete metabolic panel, urinalysis, ESR, ANA, RA, CMV IgM antibodies, virus detection in blood, heterophile antibody test, tuberculin test, and HIV antibody test.[63] Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for fever can Chest CT be approved. If CXR suggests a malignancy and/or source of fever, then Chest CT would be approved.

Suspected paraneoplastic syndromes with no established cancer diagnosis: laboratory evaluation and imaging

The laboratory evaluation for paraneoplastic syndrome is complex. If the appropriate lab test results are suspicious for malignancy, imaging is indicated.

For SIADH (hyponatremia + increased urine osmolality), there is a high association with small cell lung cancer, therefore imaging typically starts with chest CT. If other symptoms suggest a different diagnosis other than small cell lung cancer, different imaging studies may be reasonable.

For hypercalcemia (high serum calcium, low-normal PTH, high PTHrP) it is reasonable to start with bone imaging followed by a more directed evaluation such as mammogram, chest, abdomen, and pelvis imaging as appropriate.

For Cushing syndrome (hypokalemia, normal-high midnight serum ACTH **NOT** suppressed with dexamethasone) abdominal and chest imaging is reasonable. If dexamethasone suppression test **DOES** suppress ACTH, pituitary MRI is reasonable.

For hypoglycemia, labs drawn during a period of hypoglycemia (glucose < 55, typically a 72 hour fast) (insulin level, C-peptide, and IGF-2:IGF-1 ratio) should be done to evaluate for an insulinoma. An elevated insulin level, elevated C-peptide and/or normal IGF-2:IGF-1 ratio warrant CT or MRI abdomen to look for insulinoma. A low insulin, low C-peptide and/or elevated IGF-2:IGF-1 ratio warrant chest and abdominal imaging.

When a paraneoplastic neurologic syndrome is suspected, nuclear and cytoplasmic antibody panels are often ordered to further identify specific tumor types. Results are needed prior to imaging. Because these tests are highly specific, if an antibody highly associated with a specific cancer is positive, then further imaging for that cancer is reasonable. For example, anti-Hu has a high association with SCLC and chest CT would be reasonable. Anti-MA2 has a high association with testicular cancer and testicular ultrasound would be a reasonable next step.

Weight loss definitions and initial evaluation

Unintentional weight loss is considered clinically significant[55, 79] if the amount of weight lost over 12 months is ≥ 5%. Older age and higher percentage of weight loss correlates with higher likelihood of malignancy. A targeted evaluation is recommended when there are signs or symptoms suggestive of a specific source. For example, when there is clinically significant weight loss with abdominal pain that prompts an evaluation for an abdominal source of the weight loss; CXR and labs such as TSH would not be needed prior to abdominal imaging. Conversely a smoker with a cough and weight loss would not start with abdominal imaging, a chest x-ray (CXR) would be the first test to start with. When there is no suspected diagnosis, initial evaluation includes CXR, age-appropriate cancer screening (such as colonoscopy and mammography) and labs (including CBC, CMP, HbA1C, TSH, stool hemoccult, ESR/CRP, HIV, Hepatitis C). If this initial evaluation fails to identify a cause of weight loss, then the patient is monitored and if progressive weight loss is seen on subsequent visits/weights, then CT Abdomen/Pelvis is reasonable (MRI if there is a contraindication to CT such as contrast allergy or impaired renal function)[80]. Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for weight loss can Chest CT be approved. If CXR suggests a malignancy and/or source of weight loss, then Chest CT would be approved.

Combination request of Abdomen CT/Chest CT

A Chest CT will produce images to the level of L3. Documentation for combo is required.

Evaluation for appendicitis following clinical and laboratory evaluation

Sonography of the right upper quadrant and pelvis followed by graded compression and color Doppler sonography of the right lower quadrant was used by Gaitini and colleagues as the initial imaging study in 420 consecutive patients referred for emergency evaluation of acute appendicitis. This method correctly diagnosed acute appendicitis in 66 of 75 patients (88%) and excluded it correctly in 312 of 326 patients (96%). It was inconclusive in 19 patients (<5%). Sensitivity, specificity, positive predictive value, negative predictive value and accuracy were 74.2%, 97%, 88%, 93%, and 92%, respectively and comparable to CT.[81]

Appropriate and timely diagnosis of acute appendicitis is needed. Negative laparotomy rates can range from 16% to 47% when based on clinical and laboratory data alone, while perforation rate can reach 35% when surgery is delayed. Appropriate initial imaging can lower the negative laparotomy rate to 6-10%. Ultrasound has a higher non-diagnostic rate (4%) vs. 0.8% for MDCT. In a prospective study operator experience and patient BMI did not affect diagnostic accuracy.[81, 82]

Consider alternatives to CT imaging in patients with Crohn disease

In facilities where the technical and clinical expertise exists, MR enterography is emerging as the study of choice (replacing CT) for patients requiring frequent follow-up examinations to determine disease extent or progression. The technique also allows evaluation of extramucosal and extraluminal disease.

Consider the role of capsule endoscopy

Small bowel capsule endoscopy allows for direct visualization of the mucosa of the small intestine and has been found to be superior to barium studies, CTE and ileocolonscopy. However, the specificity has been questioned. There is a high negative predictive value of 96%. Also, it may identify a site for selected biopsy to establish a diagnosis.

Lab tests used in diagnosing IBD

Anti-glycan antibodies are more prevalent in CD than UC, but this test has a low sensitivity. Fecal calprotectin is a helpful test that can help differentiate IBD from irritable bowel syndrome as well as in assessment of disease activity, including response to therapy. Data supports the use of fecal calprotectin to predict relapse in CD. Those who relapsed in one year had significantly higher levels at baseline. Fecal lactoferrin and fecal PMN-elastase are also used for monitoring disease activity in Crohn's.[83]

Imaging of hernias

Most hernias are diagnosed clinically with imaging recommended for the diagnosis of occult hernias or in the evaluation of hernia complications, such as bowel obstruction or strangulation. To detect occult hernias, ultrasound is a first-line study with a sensitivity of 86% and specificity of 77%, compared to 80% sensitivity and 65% specificity for CT.[84] According to Miller, et al "Magnetic resonance imaging is generally not considered a first- or even second-line evaluation modality for hernias…."[85] Based on this analysis, MRI is recommended only when ultrasound and CT have been performed and fail to make a diagnosis.

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POLICY HISTORY

Date	Summary
March 2023	• Prostate cancer: updated guidance based on new NCCN criteria • IBD: clarified indications • Pancreas: specified guidance on pancreatitis • Pyelonephritis: clarified risk factors and indications • Aneurysm: specified guidance on initial imaging and screening intervals with emphasis on requiring ultrasound on initial imaging and indications for advanced imaging, specified guidance on post-repair imaging • Hernia: clarified hernia types and indicated studies • Transplant: added section • Other: specified guidance for weight loss, paraneoplastic syndrome, edema; added indications for thrombocytopenia, gestational trophoblastic disease, cancer predisposition syndromes • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Aligned sections across body imaging guidelines
March 2022	• Moved “New evidence of an unknown primary” from Evaluation of suspicious or known mass section to Initial staging of known cancer. • Clarified suspected diverticulitis • Added immunocompromised patients to suspected diverticulitis • Added “OR when peritoneal signs are present (guarding, rebound) or other red flags” to suspected appendicitis in a child • Clarified note regarding MRE for patients under 35 years of age • Removed “For CT Enterography (CTE) if a CT scan is inconclusive” from section on Suspected IBD • Clarified evaluation of hematuria • Clarified concern for lymphoma/malignancy with B symptoms and removed if CXR, labs, and Abd/Pelvis US have been completed

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **ABDOMEN MRI** **MRCP (Magnetic Resonance Cholangiopancreatography)** **MRE (Magnetic Resonance Enterography)** **MRU (Magnetic Resonance Urography)**	**Original Date: September 1997**
CPT Codes: 74181, 74182, 74183, S8037, +0698T	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_031	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE: A single authorization for CPT codes 74181, 74182, 74183, S8037 covers imaging of the biliary tree and its attached organs, i.e., the liver, gallbladder (GB), and pancreas. These same codes also cover MRI abdomen, Magnetic Resonance Enterography (MRE), and Magnetic Resonance Urography (MRU). Multiple authorizations are not typically required. When both Magnetic Resonance Cholangiopancreatography (MRCP) and MRI abdomen are requested, documentation requires a medical reason clearly indicating why both are needed, i.e., that meets guidelines for imaging of bowel, kidneys, or areas other than liver, pancreas, GB, and biliary tree as well.

Note: There are no MRI Abdomen/Pelvis combo (comparable to a CT Abdomen/Pelvis) such that if imaging of both the abdomen and pelvis are indicated, two separate exams (and authorization) are required (i.e., MRI Abdomen and MRI Pelvis)

INDICATIONS FOR ABDOMEN MRI

Evaluation of masses seen on ultrasound or CT for further evaluation of indeterminate or questionable findings:

- Initial imaging (see organ specific guidance below)
- One follow-up exam to ensure no suspicious change has occurred in a tumor in the pelvis. No further surveillance MR unless tumor(s) is/are specified as highly suspicious, or change was found on exam or last follow-up imaging.[1]
- For abnormal incidental pelvic lymph nodes when follow-up is recommended based on prior imaging (initial 3-month follow-up)[2]

Initial staging of known cancer

Follow-up of known cancer[3, 4]:

- In a patient undergoing active treatment within the past year or as per surveillance imaging guidance for that cancer
- With suspected abdominal metastasis based on a sign, symptom, (e.g., anorexia, early satiety, intestinal obstruction, night sweats, pelvic pain, weight loss, vaginal bleeding) or an abnormal lab value (alpha-fetoprotein, CEA, CA 19-9, p53 mutation)

For evaluation of an organ or abnormality seen on previous imaging

ADRENAL

- Indeterminate adrenal lesion seen on prior imaging
- For further evaluation of suspected adrenal tumors and/or endocrine disorders when there is clinical and laboratory evidence to suggest an adrenal source; see Background for specific laboratory testing that is needed based on suspected diagnosis
- Adrenal mass < 4 cm incidentally discovered with benign characteristics, one follow-up at 6 months then annually x 2 years (no further imaging if stable, see Background for details)
- If adrenal mass ≥ 4 cm and no diagnosis of cancer, can approve for either pre-operative planning **OR** if surgery is not done, can repeat imaging in 6-12 months
- Multiple Endocrine Neoplasia type 1 (MEN1) every 1-3 years (chest CT or MRI also approvable for this syndrome at same interval) [5, 6]
- Von Hippel Lindau (VHL) at least every other year starting at age 16, can also approve pelvis MRI (abdomen and pelvis ultrasound starting at age 8)[7]
- Hereditary Paraganglioma syndromes every 2-3 years **IF** whole body MRI (unlisted MRI CPT 76498) not available (WB MRI is the preferred study; if unable to do whole body MRI may approve abdomen MRI, pelvis MRI, skull base and neck MRI and chest CT. SDHB mutation may start at age 6, all other SDHx start at age 10.

LIVER

- Indeterminate liver lesion seen on prior imaging[8, 9]

- For evaluation of rising AFP (requires a ≥7 ng/mL increased in AFP per month) in patients at high risk for HCC (known cirrhosis and/or chronic hepatitis B[10], see Background for additional risk categories)
- For screening in patients at high risk for HCC (see above) every 6 months when prior ultrasound is insufficient to evaluate the liver due to steatosis/fatty liver or nodular liver
    - The finding of steatosis/fatty liver and/or nodular liver alone on an ultrasound report is insufficient for approval; the report must specify that those findings prevent adequate visualization of the liver by ultrasound
- For jaundice or abnormal liver function tests after equivocal or abnormal ultrasound[11]
- For surveillance of HCC (MRI or CT) in patients who have received liver-directed therapy, surgical resection, medical treatment, or transplant at one-month post treatment and then every 3 months for up to two years, then every 6 months[11, 12]
- For follow-up of suspected adenoma every 6-12 months
- For surveillance of patients with primary sclerosing cholangitis (also CA 19-9), every 6-12 months after the age of 20 (MRI and MRCP preferred over CT)[13]
- For follow-up of focal nodular hyperplasia (FNH), repeat imaging in 6-12 months to ensure stability. Additional imaging beyond that is needed only if atypical features or diagnosis is still in question[14].
- For annual elastography in chronic liver disease to stage hepatic fibrosis when transient elastography with ultrasound is insufficient
- In patients with Beckwith-Wiedemann syndrome and abnormal ultrasound or rising AFP[15]
- For evaluation of known liver metastases (Dedicated liver MRI with Eovist is not considered overlapping to a PET if there are known metastases in the liver (see Background))
- For evaluation and monitoring of Gaucher Disease at initial diagnosis and every 12 to 24 months[16]

Evaluation of iron overload in the following settings

- Initial evaluation of liver iron in Hemochromatosis diagnosed in lieu of liver biopsy[17]
- Annual evaluation for high-risk patients: transfusion-dependent thalassemia major, sickle cell disease, Gaucher Disease, and other congenital anemias[18] when ultrasound is insufficient

PANCREAS

- Pancreatic cyst on initial imaging, approve for initial characterization of lesion
- Follow-up imaging for pancreatic cyst as below[19]
    - For incidental and asymptomatic cysts <1.5 mm, **AND**:
        - Age < 65, image annually x 5 years, then every 2 years if stable
        - Age 65-79, imaging every 2 years x 5, then stop if stable
    - For cysts 1.5-1.9 cm with main pancreatic duct communication (MPD), image annually x 5 years, then every 2 years x 2, stop if stable at year 9.

- For cysts 2.0-2.5 cm with MPD communication, image every 6 months x 4, then annually x 2, then every 2 years x 3, stop if stable at year 10.
- For cysts 1.5-2.5 cm with **NO MPD** communication (or cannot be determined), image every 6 mos. x 4, then annually x 2 then every 2 years x 3, stop if stable at year 10.
- For cysts > 2.5 cm on surveillance (i.e., intervention has not been chosen), image every 6 mos. x 4, then annually x 2 years, then every 2 years x 3. Stop if stable at year 10.
- Patients > 80 years of age at presentation are imaged less frequently: image every 2 years x 2, stop if stable at year 4 (intervals are the same regardless of size if surveillance chosen)
- GROWTH or suspicious change on follow-up imaging scan may warrant more frequent surveillance

- For localization of a functional pancreatic tumor, see Background (endocrine) once diagnosis is confirmed (or highly suspected)
- Annual surveillance for individuals determined to have an increased lifetime risk of developing pancreatic cancer based on the following:
  - SKT11 variant (including Peutz-Jeghers): starting at age 30 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier)
  - CDKN2A variant: starting at age 40 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier)
  - Other variants and based on family history as detailed below: Starting at age 50 (or 10 years younger than the earliest pancreatic cancer diagnosis in the family, whichever is earlier) for the following:
    - ≥ 1 first- or second-degree relative with history of pancreatic cancer from the same side of the family as the identified variant **AND** known mutation in other pancreatic susceptibility genes (ATM, BRCA1, BRCA2, MLH1 (Lynch), MSH2, MSH6, EPCAM, PALB2, TP53)
    - ≥ 2 first-degree relatives with a history of pancreatic cancer from the same side of the family
    - ≥ 3 first- and/or second-degree relatives with a history of pancreatic cancer from the same side of the family
  - Hereditary Pancreatitis (such as PRSS1 variant) starting 20 years after onset of pancreatitis, or at age 40 years, whichever is earlier[6, 20-22]
  - Multiple Endocrine Neoplasia type 1 (MEN1) (to screen for PanNET (neuroendocrine tumor) every 1-3 years (chest CT or MRI also approvable for this syndrome at same interval)

RENAL

- For an indeterminate renal mass on other imaging[23]
- Active surveillance for indeterminate cystic renal mass, not a simple renal cyst[24] (See Bosniak criteria in Background section).

- Follow-up for solid renal masses under 3 cm at 6 and 12 months, then annually[25, 26]
- Surveillance for known angiomyolipoma (AML): annually if known tuberous sclerosis (TSC) or AML size is > 4 cm; every 2 years if AML size is 3-4 cm[27-29] (if AML < 3 cm, CT or MRI not needed unless pt has TSC)
- For surveillance of patients with the following known genetic mutations at the following intervals (MRI preferred due to lifetime radiation risk, CT can be approved if needed for surgical planning or CI to MRI):
    - BAP1-TPDS (BAP-1 tumor predisposition syndrome) every 2 years starting at age 30
    - BHDS (Birt-Hogg-Dube) every 3 years starting at age 20
    - HLRCC (hereditary leiomyomatosis and renal cell cancer) annually starting at age 8
    - HPRC (hereditary papillary renal carcinoma) every 1-2 years starting at age 30
    - PGL/PCC (hereditary paraganglioma/pheochromocytoma) every 4-6 years starting at age 12
    - TSC (tuberous sclerosis complex) without known AML every 3-5 years starting at age 12
        - TSC + known AML annually
- VHL (Von Hippel Lindau) every 2 years starting at age 15[30]
- MRU (may also approve MR pelvis for MR urography) when ultrasound is inconclusive, and CT (CTU) cannot be done or is inconclusive and MRI is recommended
- Polycystic Kidney Disease
    - Total kidney volume (TKV) is an important measure for assessing disease progression as it can determine prognosis through its ability to predict decline in renal function
        - Abdomen MRI is approvable prior to treatment (an ultrasound is not required prior to MR)
        - If MR is contraindicated or cannot be performed, Abdomen CT is approvable

SPLEEN

- Incidental findings of the spleen on ultrasound or CT that are indeterminate[31]
- For evaluation and monitoring of Gaucher Disease at initial diagnosis and every 12 to 24 months[16]

Suspected Hernia

- Occult, spigelian, incisional or epigastric hernia when physical exam and prior imaging (ultrasound **AND** CT) is non-diagnostic or equivocal[32-35] and limited to the abdomen
- Suspected incarceration or strangulation based on physical exam (guarding, rebound) or prior imaging (CT preferred)[36]

For evaluation of suspected infection or inflammatory disease when a contraindication to CT has been provided (includes MR urography (MRU) which includes Pelvis MRI when indicated)[8, 37-39]

- Persistent abdominal pain not explained by previous imaging/procedure
- Any known infection that is clinically suspected to have created an abscess in the abdomen

- Abnormal fluid collection limited to the abdomen seen on prior imaging that needs follow-up evaluation
- Suspected peritonitis (would typically need to include MRI Pelvis) when abdominal pain and tenderness to palpation are present, and **at LEAST one** of the following:
    - Rebound, guarding or rigid abdomen, **OR**
    - Severe tenderness to palpation over the entire abdomen
- Complications of diverticulitis (diagnosed either clinically or by imaging) with severe abdominal pain or severe tenderness or mass, not responding to antibiotic treatment)[40]

For evaluation of Inflammatory Bowel Disease (IBD) such as Crohn's or Ulcerative Colitis (includes MR enterography and can also approve Pelvis MRI/MRE)[12, 41-45]

- For suspected inflammatory bowel disease after complete work up including physical exam, labs, and recent colonoscopy
- Known inflammatory bowel disease with recurrence or worsening signs/symptoms requiring re-evaluation or for monitoring therapy

Other indications for abdominal MRI (and pelvis where appropriate)

- For history of fistula in the abdomen that requires re-evaluation or is suspected to have recurred
- Prior to liver transplantation (MRCP also approvable), may repeat studies immediately prior to transplantation with known HCC, PSC, or cholangiocarcinoma
- Prior to solid organ transplantation

Other indications for abdominal MRI (and pelvis where appropriate) when CT is inconclusive or cannot be completed

- Persistent abdominal/pelvic pain not explained by previous imaging
- To locate a pheochromocytoma once there is clear biochemical evidence (See Background)
- For any B symptoms of fevers more than 101° F, drenching night sweats, or unexplained weight loss of more than 10% of body weight over 6 months with documented concern for lymphoma/malignancy when CT is inconclusive or cannot be completed (can also approve pelvis MRI, when appropriate)
- Clinically significant unintentional weight loss i.e., ≥5% of body weight in less than 12 months (or ≥2% in one month), with signs or symptoms suggestive of an abdominal cause (see Background)
- Ongoing unexplained clinically significant weight loss i.e., ≥5% of body weight in less than 12 months (or ≥ 2% in one month)[46-48] after initial workup (see Background) has been completed, no cause identified, and second visit documenting further decline in weight[49]
- For fever of unknown origin (temperature of ≥ 101 degrees for a minimum of 3 weeks) after standard diagnostic tests are negative (see Background)[50]

- For suspected or known retroperitoneal fibrosis after complete workup and ultrasound to determine extent of disease[51]
- For suspected paraneoplastic syndrome (including dermatomyositis) with high suspicion of abdominal malignancy and appropriate workup has been done (see Background for details)
- Prior to Bone Marrow Transplant (BMT) (along with CT Chest[52], CT Sinus and Brain MRI)[53]). Alternatively, PET might be sufficient to evaluate the abdomen and pelvis if indicated based on that malignancy (see PET Guideline)For diffuse, unexplained lower extremity edema with negative or inconclusive ultrasound[54]
- For suspected May-Thurner syndrome (CTV/MRV preferred)[55, 56]
- For further evaluation of a new onset or non-reducible varicocele[57]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Indication for combination studies for the initial pre-therapy staging of cancer, OR active monitoring for recurrence as clinically indicated OR evaluation of suspected metastases

- ≤ 5 concurrent studies to include CT or MRI of any of the following areas as appropriate depending on the cancer: Neck, Abdomen, Pelvis, Chest, Brain, Cervical Spine, Thoracic Spine, or Lumbar Spine

INDICATIONS FOR MRCP[58-60]

- To confirm choledocholithiasis in patients in the acute setting after ultrasound has been completed[60-62]
- Suspected acute pancreatitis with atypical signs and symptoms, including equivocal amylase and lipase and diagnosis other than pancreatitis may be possible. (MRCP and CT/MRI may be ordered simultaneously in this setting and may be approved)[60, 63]
- Pancreatitis by history (greater than 4 weeks), (including pancreatic pseudocyst) with continued abdominal pain suspicious for worsening, or re-exacerbation. (MRCP and CT/MRI may be ordered simultaneously in this setting and may be approved)[60, 63]
- Evaluation of suspected congenital anomaly of the pancreaticobiliary tract, e.g., aberrant ducts, pancreas divisum or related complications[64]
- For confirmation of choledochal cyst after ultrasound has been done[65]
- For long-term postoperative surveillance for patients with history of choledochal cyst

- For post-surgical biliary anatomy and complications when ERCP is not possible or contraindicated
- For the assessment of benign or malignant biliary strictures
- Evaluation of persistent symptoms when abnormalities are identified on other imaging (e.g., ultrasound, CT, or MRI)
- Evaluation of abnormality related to the pancreatic or biliary tree based on symptoms or laboratory findings and initial imaging has been performed or is contraindicated (e.g., renal failure prevents contrast CT or body habitus limits US)
- Evaluation of pancreatobiliary disease in pregnant patients after ultrasound has been done
- Prior to liver transplantation (Abdomen MRI or Abdomen CT also approvable), may repeat studies immediately prior to transplantation with known HCC, PSC, or cholangiocarcinoma

INDICATIONS RELEVANT TO ABDOMEN MRI OR MRCP

Pre-operative evaluation

- For abdominal surgery or procedure

Post-operative/procedural evaluation

- Follow-up of known or suspected post-operative complication involving only the abdomen
- A follow-up study to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed

If both Abdomen and Pelvis MRI are indicated and the Pelvis MRI has already been approved, then the Abdomen MRI may be approved.

BACKGROUND

Abdominal Magnetic Resonance Imaging (MRI) is a proven and useful tool for the diagnosis, evaluation, assessment of severity, and follow-up of diseases of the abdomen and avoids exposing the patient to ionizing radiation. MRI may be the best imaging procedure for patients with allergy to radiographic contrast material or renal failure. It may also be the procedure of choice for suspected lesions that require a technique to detect subtle soft tissue contrast and provide a three-dimensional depiction of a lesion. Abdominal MRI studies are usually targeted for further evaluation of indeterminate or questionable findings, identified on more standard imaging exams such as ultrasound (US) and CT.

Magnetic Resonance Enterography is an excellent study for assessing submucosal pathology in inflammatory bowel disease. It generates highly reproducible images of the large and small bowel with

excellent sensitivity and specificity. It can determine the presence and extent of transmural inflammation, fibrotic disease, and other intra-abdominal complications. It is also useful in assessment of bowel obstruction, abscess formation, tethering and fistula and is less dependent on bowel distention than CT enterography.[12] MRE is similar overall to CTE and useful (reduce radiation burden) when multiple studies are likely.[42]

Magnetic Resonance Cholangiopancreatography (MRCP) is a non-invasive radiologic technique for imaging the biliary and pancreatic ducts in the clinical setting of cholestatic liver function tests, right upper quadrant pain, recurrent pancreatitis, and assessing postoperative complications. MRCP is reliable for the diagnosis of pancreatic ductal abnormalities, e.g., pancreas divisum. It is also used to diagnose bile duct stones and assess the level of biliary obstruction. MRCP is especially useful as an alternative to ERCP (Endoscopic retrograde cholangiopancreatography), when a noninvasive exam is desired or when there is a very small likelihood that the patient will need therapeutic intervention afforded by ERCP. MRCP is unwarranted in patients with known pathology requiring ERCP-mediated intervention. Due to the variable accuracy of ultrasound in detecting choledocholithiasis, preoperative MRCP prior to cholecystectomy has been advocated particularly in the setting of acute cholecystitis, near normal common bile duct diameter (where ultrasound is less accurate) and elevated liver functions, especially alanine amino transaminase (ALT).[66] Secretin-enhanced MR Cholangiopancreatography has been recently developed to improve the diagnostic quality of MRCP images.[67]

In diagnosing acute pancreatitis, MRI and MRCP are not as practical as CT. The latter can be performed more quickly and provide better images due to less motion artifact (if patient cannot cooperate with instructions for MRI) in acutely ill patients.[60] In selected patients, however, such as those who cannot receive iodinated contrast for CT, MRI/MRCP may be considered or used in a complementary fashion to CT. Complications of chronic pancreatitis using MRCP are well-imaged in cooperative patients.

Cross-sectional imaging (liver ultrasound with Doppler, CT, or MRI) should be completed no more than a month prior to the transjugular intrahepatic portosystemic shunt (TIPS) to assess for vascular patency and look for hepatic masses or other problems that could complicate the procedure.

Post procedure, an ultrasound of the liver is performed a day after to assess shunt patency. Hepatic encephalopathy (HE) is the most common complication and usually occurs 2-3 weeks after insertion of TIPS. Unique complications may include intravascular hemolysis and infection of the shunt. Other complications, which may require cross-sectional imaging, can include capsule puncture, intraperitoneal bleed, hepatic infarction, fistula, hematobilia, thrombosis of stent, occlusion, or stent migration.

Follow-up and maintenance imaging, if complications are suspected, include Doppler ultrasound to assess shunt velocity. If asymptomatic, a sonogram is performed at 4 weeks post placement, then

every 6 months to a year. The gold standard for shunt patency is portal venography, usually reserved if concern for shunt occlusion.

OVERVIEW

MRI of the liver – The liver is a common site of metastatic spread. Patients with a history of known or suspected malignancy, especially tumors from the colon, lung, pancreas, and stomach, are at risk for developing hepatocellular carcinoma. Patients with chronic liver disease are also at risk for developing liver cancer and undergo periodic liver screening for focal liver lesion detection, usually with ultrasonography (US). Liver-specific contrast agents (gadobenate dimeglumine (Gd-BOPTA, MultiHance) and gadoxetate disodium (Eovist) are taken up by functionally intact hepatocytes, allowing increased visualization of both tumors and liver metastases. As metastatic liver lesions do not take up these contrast agents, a dedicated liver MRI can help identify tumors as it allows more contrast differentiation between the tumor and normal liver tissue. In patients undergoing PET scans for active malignancies and there are either known liver metastases in need of restaging **OR** indeterminate liver lesions on other imaging (such as PET or CT), a dedicated liver MRI is considered complimentary **NOT** overlapping and can be approved in addition to PET if the patient otherwise meets criteria for PET approval (see PET Guideline for further guidance).

Screening for Hepatocellular carcinoma (HCC) – AASLD (American Association for the Study of Liver Diseases) recommends screening for HCC with ultrasound every 6 months for patients with hepatitis C and B.[37] Advanced imaging is recommended when the AFP is rising, regardless of ultrasound results. The main risk factors for HCC are cirrhosis and Hepatitis B. Additional populations for which there is a benefit to surveillance for HCC include: Asian males Hepatitis B carriers ≥ 40 y, Asian female Hepatitis B carriers ≥50 y, Hepatitis B carriers with + family history of HCC and African and/or North American blacks with hepatitis B.[10, 68]

MRI or MRCP for surveillance of cholangiocarcinoma in patients with PSC, other risk factors – Cholangiocarcinoma, a cancer with an increase in incidence globally, is very aggressive with 95% of patients dying within 5 years. Because of the superior sensitivity of MRI compared with ultrasound to detect cholangiocarcinoma, it is preferred for imaging surveillance. In a large study of PSC patients, regular surveillance was associated with a higher 5-year survival.[13]

The strongest risk factors for both intrahepatic (iCCA) and extrahepatic (eCCA) cholangiocarcinoma are choledochal cysts; cirrhosis is a stronger risk factor for iCCA (i.e., iCCA>eCCA); and choledocholithiasis is a stronger risk factor for eCCA (i.e., eCCA>iCCA).[69]

Adrenal incidentaloma – Adrenal masses detected on imaging for another reason (i.e., incidental finding) are becoming increasingly common. If there is no prior personal history of malignancy and no features concerning for malignancy on imaging, these patients should undergo hormonal (functional) evaluation and periodic imaging. If the mass is < 4 cm on imaging and has benign characteristic (homogenous, regular borders, HU < 10) a hormonal evaluation should be done. If that evaluation is negative, adrenal protocol/follow-up imaging can be performed at 6 months then annually for 1-2

years.[70] Repeat functional studies are recommended annually (or sooner if symptoms) for 5 years. If the mass exhibits growth or becomes hormonally active, then surgery is recommended.[71, 72] Additional imaging beyond 2 years is reasonable if there has been growth and the mass is not resected; if stable, no further imaging is warranted unless the annual hormonal evaluation is positive. Masses ≥ 4cm generally are resected after hormonal evaluation is completed, additional imaging can be approved when needed for further characterization for surgical planning. If the decision is made not to resect the mass, then FU imaging in 6-12 months is reasonable.

Biochemically active tumors (adrenal and neuroendocrine): Laboratory evaluation prior to imaging - When neuroendocrine and hormonally active tumors are suspected, the required laboratory evaluation prior to advanced imaging is dependent on the tumor type that is suspected. The following list describes suspected syndrome/tumor and typical laboratory evaluation in parenthesis:

GI Carcinoid (24-hour urine or plasma 5-HIAA), Lung/Thymus Carcinoid (24-hour urine or plasma 5-HIAA **AND** one of the following: overnight dexamethasone suppression test, 2-3 midnight salivary cortisols, 24-hour urinary free cortisol), PPoma (serum pancreatic polypeptide), Insulinoma (serum insulin, pro-insulin and C-peptide all drawn during a period of hypoglycemia (i.e. 72 hour fast)), VIPoma (serum VIP), glucagonoma (serum glucagon), gastrinoma (serum gastrin), somatostatinoma (serum somatostatin), pheochromocytoma/paraganglioma (plasma free or 24-hour urine fractionated metanephrines and normetanephrines +/- serum or urine catecholamines), pituitary tumor (serum IGF-1, prolactin, LH/FSH, alpha subunits, TSH and **ONE** of the following: overnight dexamethasone suppression test, 2-3 midnight salivary cortisols, 24-hour urinary free cortisol), primary hyperaldosteronism (suppressed renin/renin activity in association with elevated plasma aldosterone (>10 ng/dL) and confirmatory testing if positive), adrenocortical carcinoma (testosterone, DHEA-S **AND** complete evaluation for hypercortisolemia or primary aldosteronism)[72]

If Cushing's (hypercortisolemia) is suspected, typical labs include a plasma ACTH **AND** one or more of the following: overnight dexamethasone suppression test, 2-3 midnight salivary cortisols, **OR** 24-hour urinary free cortisol. The results of the suppression test then indicate whether brain imaging is needed (pituitary source) **OR** chest and abdominal imaging is needed (CXR + Adrenal CT/MRI). ACTH > 20 after suppression > 20 is suggestive of Cushing's Disease and Pituitary MRI +/- CXR is indicated. ACTH after suppression < 5 is suggestive of Cushing's Syndrome and CXR + Adrenal CT/MRI is indicated[73]. If indeterminate, a CRH or desmopressin test is then done. If there is no ACTH suppression with CRH/desmopressin, then adrenal imaging is indicated.[74]

Genetic syndromes and adrenal tumors – Adrenal cortical carcinoma (ACC) diagnosed during childhood is known to be commonly associated with hereditary syndromes, including Beckwith-Wiedemann (BWS) and Li-Fraumeni syndrome (LFS). In adults, ACC may be associated with Multiple Endocrine Neoplasia 1 (MEN1), familial adenomatous polyposis coli and neurofibromatosis type 1 (NF1); however, there are currently no surveillance imaging recommendations.[75]

High risk characteristics for mucinous pancreatic cysts include all of the following: Symptoms, Jaundice secondary to the cyst, acute pancreatitis secondary to the cyst, elevated serum CA 19-9 and no benign cause present, an enhancing mural nodule or solid component within the cyst or pancreas, main pancreatic duct of > 5mm, change in duct caliber with upstream atrophy, size over 3 cm, high grade dysplasia or cancer on cytology. These patients should undergo EUS + -FNA or be referred to a multidisciplinary group for further recommendations.[76]

MRI and elevated Liver Function Tests – For elevated bilirubin or serum transaminases with or without bilirubin elevation, US is the initial recommended test to assess for duct dilatation which might lead to ERCP or MRCP, vs other causes which might necessitate further lab testing or liver biopsy.[77]

MRI of the kidney – MRI in renal imaging has been used to differentiate benign lesions versus malignant lesions in patients unable to undergo CT scanning with contrast media or in cases where the CT findings were questionable. Initial evaluation of renal lesions is often undertaken with ultrasound. MRI can have additional diagnostic value in the evaluation of lesions with minimal amounts of fat or with intracellular fat. MRI may have a higher accuracy than CT in the evaluation of early lymph node spread. Although MRI of the kidney has not yet found broad clinical application, it may have an increasing role in the management of patients with renal disease.

Recommendations for follow up of a complex cystic renal mass are made using Bosniak criteria[78]:

- Bosniak I (water density 0-20 HU); no further follow-up
- Bosniak II (one or a few thin septations, small or fine calcifications, hyperdense cysts up to 3 cm); no further follow-up
- Bosniak IIF felt to be benign but too complex to be diagnosed with certainty; image at 6 and 12 months, then annually for 5 years if no progression
- Bosniak III thick-walled cystic lesions with wall or septal enhancement; resection favored vs conservative management and RFA in select cases[24]
- Bosniak IV malignant cystic renal mass with enhancing soft tissue components; resection favored; malignant until proven otherwise

MRI of the spleen – Among some radiologists, the spleen is considered a 'forgotten organ' although it is included and demonstrated on every abdominal CT and MRI. Malignant tumors of the spleen are rare; malignant lymphomas are the most common and are usually a manifestation of generalized lymphoma. Splenic metastases are predominantly hypointense on T1-weighted images and hyperintense on T2-weighted images, and MRI is used for the detection of necrotic or hemorrhagic metastases.

MRI for the evaluation of vascular abnormalities such as renal artery stenosis and celiac/superior mesenteric artery stenosis (in chronic mesenteric ischemia) – Doppler Ultrasound, MRA, or CTA should be considered as the preferred imaging modalities.

Imaging of hernias – Most hernias are diagnosed clinically with imaging recommended for the diagnosis of occult hernias or in the evaluation of hernia complications, such as bowel obstruction or strangulation. To detect occult hernias, ultrasound is a first-line study with a sensitivity of 86% and specificity of 77%, compared to 80% sensitivity and 65% specificity for CT.[35] According to Miller, et al "Magnetic resonance imaging is generally not considered a first- or even second-line evaluation modality for hernias…."[34] Based on this analysis, MRI is recommended only when ultrasound and CT have been performed and fail to make a diagnosis.

Fever of Unknown Origin

Initial work up prior to CT would include a comprehensive history, repeated physical exam, complete blood count with differential, three sets of blood cultures, chest x-ray, complete metabolic panel, urinalysis, ESR, ANA, RA, CMV IgM antibodies, virus detection in blood, heterophile antibody test, tuberculin test, and HIV antibody test.[65] Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for fever can Chest CT be approved. If CXR suggests a malignancy and/or source of fever, then Chest CT would be approved.

Suspected paraneoplastic syndromes with no established cancer diagnosis: laboratory evaluation and imaging

The laboratory evaluation for paraneoplastic syndrome is complex. If the appropriate lab test results are suspicious for malignancy, imaging is indicated.
For SIADH (hyponatremia + increased urine osmolality), there is a high association with small cell lung cancer, therefore imaging typically starts with chest CT. If other symptoms suggest a different diagnosis other than small cell lung cancer, different imaging studies may be reasonable.

For hypercalcemia (high serum calcium, low-normal PTH, high PTHrP) it is reasonable to start with bone imaging followed by a more directed evaluation such as mammogram, chest, abdomen, and pelvis imaging as appropriate.

For Cushing syndrome (hypokalemia, normal-high midnight serum ACTH **NOT** suppressed with dexamethasone) abdominal and chest imaging is reasonable. If dexamethasone suppression test **DOES** suppress ACTH, pituitary MRI is reasonable.

For hypoglycemia, labs drawn during a period of hypoglycemia (glucose < 55, typically a 72 hour fast) (insulin level, C-peptide, and IGF-2:IGF-1 ratio) should be done to evaluate for an insulinoma. An elevated insulin level, elevated C-peptide and/or normal IGF-2:IGF-1 ratio warrant CT or MRI abdomen to look for insulinoma. A low insulin, low C-peptide and/or elevated IGF-2:IGF-1 ratio warrant chest and abdominal imaging.

When a paraneoplastic neurologic syndrome is suspected, nuclear and cytoplasmic antibody panels are often ordered to further identify specific tumor types. Results are needed prior to imaging. Because these tests are highly specific, if an antibody highly associated with a specific cancer is positive, then further imaging for that cancer is reasonable. For example, anti-Hu has a high association with SCLC

and chest CT would be reasonable. Anti-MA2 has a high association with testicular cancer and testicular ultrasound would be a reasonable next step.

Weight loss definitions and initial evaluation – Unintentional weight loss is considered clinically significant if the amount of weight lost over 12 months is ≥ 5%. Older age and higher percentage of weight loss correlates with higher likelihood of malignancy. A targeted evaluation is recommended when there are signs or symptoms suggestive of a specific source. For example, when there is clinically significant weight loss with abdominal pain that prompts an evaluation for an abdominal source of the weight loss; CXR and labs such as TSH would not be needed prior to abdominal imaging. Conversely a smoker with a cough and weight loss would not start with abdominal imaging, a chest x-ray (CXR) would be the first test to start with. When there is no suspected diagnosis, initial evaluation includes CXR, age-appropriate cancer screening (such as colonoscopy and mammography) and labs (including CBC, CMP, HbA1C, TSH, stool hemoccult, ESR/CRP, HIV, Hepatitis C). If this initial evaluation fails to identify a cause of weight loss, then the patient is monitored and if progressive weight loss is seen on subsequent visits/weights, then CT Abdomen/Pelvis is reasonable (MRI if there is a contraindication to CT such as contrast allergy or impaired renal function). Lastly, with a negative CXR, only when initial workup and abdomen/pelvis CT/MR fail to identify the cause for weight loss can Chest CT be approved. If CXR suggests a malignancy and/or source of weight loss, then Chest CT would be approved.

Ultrasound – Ultrasound is the initial imaging technique used for screening suspected biliary or pancreatic disease, but it has limited ability to characterize abnormalities in the biliary and pancreatic ducts.

Endoscopic retrograde cholangiopancreatography (ERCP) – ERCP can combine diagnosis with therapeutic intervention, e.g., removal of stones, but it is an invasive procedure that carries significant risk of complications, e.g., pancreatitis. ERCP is also technically challenging in patients with post-surgical biliary and/or surgical anastomoses.

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POLICY HISTORY

Date	Summary
May 2023	• Adrenal: additional guidance provided for imaging intervals and background given for functional tumors • Liver: clarified guidance for HCC surveillance imaging, follow up of specific conditions such as hepatic steatosis and focal nodular hyperplasia • IBD: clarified indications • Pancreas: updated pancreatic cystic lesion guidance, specified guidance for increased lifetime risk for pancreatic cancer and pancreatitis • Renal: specified guidance for increased lifetime risk of renal cancer • Aneurysm: specified guidance on initial imaging and screening intervals with emphasis on requiring ultrasound on initial imaging and indications for advanced imaging, specified guidance on post-repair imaging • Transplant: added section • Other: specified guidance for weight loss, paraneoplastic syndrome, edema; added indications for cancer predisposition syndromes • Aligned sections across body imaging guidelines • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging

March 2022	• Clarified coding note regarding MRE, MRU, MRCP, and MRI
	• Added Initial staging of known cancer
	• Under evaluation of suspicious known mass/tumor, added one follow-up surveillance MR to ensure to suspicious change occurring in tumor in pelvis with no further surveillance MR unless tumor(s) is/are highly suspicious or change was found on last exam or last follow-up imaging
	• Follow-up of known cancer
	  ○ Clarified surveillance imaging per NCCN recommendations
	  ○ Added For abnormal incidental abdominal lymph nodes with follow-up is recommended based on prior imaging (initial 3-month follow-up)
	• Clarified elastography in chronic liver disease to stage hepatic fibrosis
	• Added Gaucher disease to Liver and Spleen sections
	• Added Polycystic Kidney Disease to Renal section
	• Clarified suspected incarceration or strangulation based on physical exam in Suspected Hernia section
	• In Other indications for abdominal MRI, changed wording (replaced ‘and’ with ‘or’ and deleted “if CXR labs and an ultrasound of the abdomen and pelvis have been completed”) to state “For B symptoms of fevers more than

	101 F, drenching night sweats, or unexplained weight loss of more than 10% of body weight over 6 months”

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **ABDOMEN MRA/MRV (Angiography)**	**Original Date: September 1997**
CPT Codes: 74185	**Last Revised Date: March 2023**
Guideline Number: Evolent_CG_034-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE:

Abdomen/Pelvis Magnetic Resonance Angiography (MRA) with Lower Extremity MRA Runoff Requests: Two authorization requests are required, one Abdomen MRA, CPT code 74185 and one for Lower Extremity MRA, CPT code 73725 (a separate Pelvic MRA request is not required). This will provide imaging of the abdomen, pelvis, and both legs.

INDICATIONS FOR ABDOMEN MR ANGIOGRAPHY/MR VENOGRAPHY (MRA/MRV)

Arterial Disease

For evaluation of known or suspected abdominal vascular disease
Abdominal Aortic Aneurysm (AAA) (also approve MRA Pelvis):

- For **asymptomatic** known or suspected abdominal aortic aneurysms, **ultrasound** should be done prior to advanced imaging. Only when the ultrasound is inconclusive, is advanced imaging with CT or MRI needed
- For **symptomatic** known or suspected AAA (such as recent-onset abdominal pain or back pain, particularly in the presence of a pulsatile or epigastric mass, suspected dissection or significant risk factors for AAA) CTA/MRA is appropriate and generally preferred over CT/MRI. (If contrast

is contraindicated or other clinical indications for abdomen and/or pelvic imaging are present, then CT/MR may be approved rather than CTA/MRA)
- If there is known complex anatomy, CTA/MRA may be needed.

Other vascular abnormalities seen on prior imaging studies:

- Initial evaluation of inconclusive vascular findings on prior imaging
- Follow-up of known visceral vascular conditions (such as aneurysm, dissection, compression syndromes, arteriovenous malformations (AVMs), fistulas, intramural hematoma, and vasculitis) (pelvis may also be approved if needed based on location of abnormality)
    - Hepatic vascular abnormalities after ultrasound has been performed to clarify or further evaluate findings
- For assessment in patients with spontaneous coronary artery dissection (SCAD), can be done at time of coronary angiography (also approve CTA pelvis)[1]
- Vascular invasion or displacement by tumor (conventional CT or MRI also appropriate)[2]
- For known large vessel diseases (inferior vena cava, superior/inferior mesenteric, celiac, splenic or renal arteries/veins), e.g., aneurysm/dissection (non-aortic disease), arteriovenous malformations (AVMs), and fistulas, intramural hematoma, and vasculitis[3-5]
    - Surveillance may be done with ultrasound at intervals similar to AAA, however, CTA/MRA rather than CT/MRI may be needed for non-aortic disease when ultrasound is inconclusive[6]

Vascular ischemia or hemorrhage:

- To determine the vascular source of retroperitoneal hematoma or hemorrhage when CT is insufficient to determine the source and CTA is contraindicated (CT rather than MRA/CTA is the modality of choice for diagnosing hemorrhage)[5]
- For evaluation of known or suspected mesenteric ischemia/ischemic colitis when CTA is contraindicated (can approve MRA abdomen and pelvis)[7]

For patients at increased risk for vascular abnormalities (CTA or MRA):

- For patients with fibromuscular dysplasia (FMD), a one-time vascular study of the abdomen and pelvis[8]
- For patients with vascular Ehlers-Danlos syndrome or Marfan syndrome, a one-time study of the abdomen and pelvis
- For Loeys-Dietz, imaging at diagnosis and then every two years, more frequently if abnormalities are found (Imaging may include head, neck, chest, abdomen and pelvis)[9, 10]

For evaluation of known or suspected renal artery stenosis or resistant hypertension in the setting of normal renal function (with impaired renal function, eGFR <30, use US with Doppler) unrelated to recent medication[11] demonstrated by any of the following[12, 13]:

- Unsuccessful control after treatment with 3 or more (>2) anti-hypertensive medication at optimal dosing
- Acute elevation of creatinine after initiation of an angiotensin converting enzyme inhibitor (ACE inhibitor) or angiotensin receptor blocker (ARB)
- Asymmetric kidney size noted on ultrasound
- Onset of hypertension in a person younger than age 30 without any other risk factors or family history of hypertension
- Significant hypertension (diastolic blood pressure > 110 mm Hg) in a young adult (i.e., younger than 35 years) suggestive of fibromuscular dysplasia
- Diagnosis of a syndrome with a higher risk of vascular disease, such as neurofibromatosis, tuberous sclerosis, and Williams' syndrome
- New onset of hypertension after age 50
- Acute rise in blood pressure in a person with previously stable blood pressures
- Flash pulmonary edema without identifiable causes
- Malignant hypertension
- Bruit heard over renal artery and hypertension
- Abnormal/inconclusive renal doppler ultrasound

Venous Disease

- Suspected renal vein thrombosis in patient with known renal mass or from other causes[14]
- Venous thrombosis if previous studies have not resulted in a clear diagnosis (add pelvis MRA/MRV when appropriate)
- For known/suspected May-Thurner syndrome (iliac vein compression syndrome include pelvic MRV)[4, 15]
- Vascular invasion or displacement by tumor (conventional CT or MRI also appropriate)[2]
- For evaluation of portal venous system (hepatic portal system) after doppler ultrasound has been performed
- For evaluation of suspected pelvic vascular disease or pelvic congestive syndrome (ordered in addition to Pelvis MRA) when findings on ultrasound are indeterminate (MR or CT venography may be used as the initial study for evaluating pelvic thrombosis or thrombophlebitis)
- For unexplained lower extremity edema (typically unilateral or asymmetric) with negative or inconclusive ultrasound[16]
- In pregnant women with suspected deep venous thrombosis (DVT) (vs serial compression ultrasound) (include pelvis MRV for iliac veins)[17]

Pre-operative evaluation

- For evaluation of transjugular intrahepatic portosystemic shunt (TIPS) when Doppler ultrasound indicates suspected complications
- Evaluation prior to interventional vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia

- Evaluation prior to endovascular aneurysm repair (EVAR)
- Imaging of the deep inferior epigastric arteries for surgical planning (breast reconstruction surgery), include pelvic MRA [18]
- Prior to solid organ transplantation when vascular anatomy is needed
- For surgical planning for UPJ (ureteropelvic junction) obstruction to look for a lower pole crossing vessel
- Planning prior Y90 radiation treatment for liver cancer in order to evaluate anatomic variation/shunts/determine best catheter placement/see if coil(s) needed[19]

Post-operative or post-procedural evaluation

- Follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested
- Evaluation of endovascular/interventional abdominal vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia
- Evaluation of post-operative complications, e.g., pseudoaneurysms, related to surgical bypass grafts, vascular stents, and stent-grafts in the peritoneal cavity
- Follow-up for post-endovascular repair (EVAR) or open repair of abdominal aortic aneurysm (AAA)[20] or abdominal extent of iliac artery aneurysms (CT preferred unless MRA/CTA is needed for procedural planning or to evaluate complex anatomy)
    - Routine, baseline study (post-op/intervention) is warranted within the first month after EVAR:
        - Repeat in 6 months if type II endoleak is seen (continue every 6 months x 24 months, then annually)
        - Repeat in 12 months if no endoleak or sac enlargement is seen
        - If neither endoleak nor AAA enlargement is seen on imaging one year after EVAR, CT is needed only if US is not feasible for annual surveillance (until year 5 as below)
    - Non-contrast CT of entire aorta (Abdomen and Pelvis) is needed every 5 years after open repair of AAA or EVAR
    - If symptomatic or imaging shows increasing, or new findings related to stent graft – more frequent imaging may be needed
    - For suspected complication such as: new-onset lower extremity claudication, ischemia, or reduction in ABI after aneurysm repair.

Other Vascular indications

- For evaluation of hepatic blood vessel abnormalities (aneurysm, hepatic vein thrombosis, stenosis post-transplant) after doppler ultrasound has been performed; to clarify or further evaluate ultrasound findings

- Kidney failure or renal insufficiency if initial evaluation performed with ultrasound is inconclusive to evaluate for renal artery stenosis

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Chest MRA/Abdomen MRA/Pelvic MRA combo

- For evaluation of extensive vascular disease involving the chest and abdominal cavities
- For pre-op or preprocedural evaluation for Transcatheter Aortic Valve Replacement (TAVR)[21, 22]
- Acute aortic dissection (CTA or CT preferred)[23]
- Takayasu's arteritis[24]
- Marfan syndrome
- Loeys-Dietz
- Spontaneous coronary artery dissection (SCAD)
- Vascular Ehlers-Danlos syndrome
- Post-operative complications
- Significant post-traumatic or post-procedural vascular complications reasonably expected to involve the chest and/or abdomen and/or pelvis

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BACKGROUND

Magnetic resonance angiography (MRA) generates images of the arteries that can be evaluated for evidence of stenosis, occlusion, or aneurysms. It is used to evaluate the arteries of the abdominal aorta and the renal arteries. Contrast-enhanced MRA requires the injection of a contrast agent, resulting in very high-quality images. MRA does not use ionizing radiation, allowing MRA to be used for follow-up evaluations. Abdominal MRA is not used as a screening tool, e.g., evaluation of asymptomatic patients without a previous diagnosis.

OVERVIEW

MRI Follow-up for post-endovascular repair (EVAR) – Although studies have shown that MRA is as sensitive as CT in detecting endoleaks, CTA is generally the study of choice in this evaluation due to convenience, improved spatial resolution, and less artifact from components of the stent graft. MRA is most helpful in the postoperative evaluation of patients with impaired renal function, but not severe enough to have contraindication to gadolinium administration or when CTA is inconclusive.

MRA and Abdominal Aortic Aneurysm – Endovascular repair is an alternative to open surgical repair of an abdominal aortic aneurysm. It has lower morbidity and mortality rates and is minimally invasive. In order to be successful, it depends on precise measurement of the aneurysm and involved vessels. MRA with gadolinium allows visualization of the aorta and major branches and is effective and reliable for use in planning the placement of the endovascular aortic stent graft. MRA is also used for the detection of postoperative complications of endovascular repair.

Abdominal Aneurysms and general guidelines for follow-up – The normal diameter of the suprarenal abdominal aorta is 3.0 cm and that of the infrarenal is 2.0 cm. Aneurysmal dilatation of the infrarenal aorta is defined as diameter ≥ 3.0 cm or dilatation of the aorta ≥ 1.5x the normal diameter.[25] Evaluation of AAA can be accurately made by ultrasound. Ultrasound can detect and size AAA, with the advantage of being relatively inexpensive, noninvasive, and not requiring iodinated contrast. The limitations are that overlying bowel gas can obscure findings and the technique is operator dependent. Ultrasound is used to screen for and to monitor aneurysms*. CT is used when US is inconclusive or insufficient. When there are suspected complications, complex anatomy and/or surgery is planned, CTA/MRA is preferred. Risk factors for AAA include smoking history, age, male gender, family history of AAA (first degree relative) and personal history of vascular disease. Risk factors for rupture include female gender, large initial aneurysm diameter, low FEV, current smoking history, elevated mean blood pressure and patients on immunosuppression after major organ transplantation. The Society of Vascular Surgery recommends elective repair of AAA ≥ 5.5 cm in patients at low or acceptable surgical risk.[20]

Ultrasound screening intervals*:

- Aneurysm size 2.5–3 cm, every 10 years
- Aneurysm size 3.0–3.9 cm, every 3 years
- Aneurysm size 4.0-4.9 cm, annually[26]
- Aneurysm size 5.0-5.4 cm, every 6 months

MRA and Chronic Mesenteric Ischemia -"MRA has become increasingly accurate in depicting and grading stenosis of the mesenteric vessels, particularly for the celiac artery and SMA, with reported sensitivity and specificity in suspected chronic mesenteric ischemia up to 95% to 100%" and may be used for measuring flow in the SMA and superior mesenteric veins.[7]

MRA and Renal Artery Stenosis – Renal artery stenosis is the major cause of secondary hypertension. It may also cause renal insufficiency and end-stage renal disease. Atherosclerosis is one of the common causes of this condition, especially in older patients with multiple cardiovascular risk factors and worsening hypertension or deterioration of renal function. Navigator-gated MR angiography is used to evaluate the renal arteries and detect renal artery stenosis.

MRA and Renal Vein Thrombosis – Renal vein thrombosis is a common complication of nephrotic syndrome and often occurs with membranous glomerulonephritis. Gadolinium-enhanced MRA can

demonstrate both the venous and arterial anatomy and find filling defects within renal veins. The test can be used for follow-up purposes as it does not use ionizing radiation.

MRI/CT and acute hemorrhage – MRI is not indicated and MRA/MRV (MR Angiography/Venography) is rarely indicated for evaluation of intraperitoneal or retroperitoneal hemorrhage, particularly in the acute setting. **CT is usually the study of choice** due to its availability, speed of the study, and less susceptibility to artifact from patient motion. Advances in technology have allowed conventional CT to not just detect hematomas but also the source of acute vascular extravasation. In special cases, finer vascular detail to assess the specific source vessel responsible for hemorrhage may require the use of CTA. CTA in diagnosis of lower gastrointestinal bleeding is such an example.[27]

MRA/MRV is often utilized in non-acute situations to assess vascular structure involved in atherosclerotic disease and its complications, vasculitis, venous thrombosis, vascular congestion, or tumor invasion. Although some of these conditions may be associated with hemorrhage, it is usually not the primary reason why MRI/MRA/MRV is selected for the evaluation. A special condition where MRI may be superior to CT for evaluating hemorrhage is to detect an underlying neoplasm as the cause of bleeding.[5]

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POLICY HISTORY

Date	Summary
March 2023	• Aneurysm: specified guidance on initial imaging and screening intervals with emphasis on requiring ultrasound on initial imaging and indications for advanced imaging, specified guidance on post-repair imaging • Other vascular abnormalities: clarified indication for non-aortic vascular conditions • Transplant: added section • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Aligned sections across body imaging guidelines
April 2022	• Added indication for UPJ surgery • Added "(abdomen and pelvis MRA when CTA is inconclusive or cannot be performed)" to follow-up for EVAR and AAA • Added Y90 indication

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **CT (VIRTUAL) COLONOSCOPY DIAGNOSTIC**	**Original Date: July 2007**
CPT Codes: 74261, 74262	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_033-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR DIAGNOSTIC CT COLONOGRAPHY (VIRTUAL COLONOSCOPY)

For diagnostic (symptomatic patient) evaluation when conventional colonoscopy is contraindicated or could not be completed[1-3]

- Patient had failed or incomplete colonoscopy
- Patient has an obstructive colorectal cancer
- When colonoscopy is medically contraindicated or not possible (e.g., patient is unable to undergo sedation or has medical conditions such as a recent myocardial infarction, recent colonic surgery, a bleeding disorder, or severe lung and/or heart disease)
- For a 3-year follow-up when at least one polyp of 6 mm in diameter detected at CTC if patient does not undergo polypectomy (or is unwilling or unable to undergo colonoscopy)

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification

- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BACKGROUND

Computed tomographic (CT) colonography, also referred to as virtual colonoscopy, is used to examine the colon and rectum to detect abnormalities such as polyps and cancer. Polyps may be adenomatous (which have the potential to become malignant) or completely benign.

Colorectal cancer (CRC) is the third most common cancer and the second most common cause of cancer death in the United States. Symptoms include blood in the stool, change in bowel habit, abdominal pain, and unexplained weight loss.

Relative contraindications to CTC include symptomatic acute colitis, acute diarrhea, recent acute diverticulitis, recent colorectal surgery, symptomatic colon-containing abdominal wall hernia, and small bowel obstruction. It is not indicated in routine follow-up of inflammatory bowel disease, hereditary polyposis or non-polyposis cancer syndromes, evaluation of anal disease, or the pregnant or potentially pregnant patient. For all high-risk individuals, colonoscopy is preferred.

In addition to its use as a diagnostic test in symptomatic patients, CT colonography may be used in asymptomatic patients with a high risk of developing colorectal cancer. Conventional colonoscopy is the main method currently used for examining the colon.

OVERVIEW

Request for a follow-up study - A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

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POLICY HISTORY

Date	Summary
April 2023	• General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
April 2022	• Updated references

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **CT (VIRTUAL) COLONOSCOPY SCREENING**	**Original Date: July 2007**
CPT Codes: 74263 - Screening	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_033-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CT COLONOGRAPHY (VIRTUAL COLONOSCOPY) SCREENING

- CT (computer tomographic) colonography (CTC) is considered medically appropriate as an alternative to colonoscopy for screening asymptomatic individuals in the following settings:
    - For **average or moderate risk** individuals‡ as defined below:
        - Age 45-75 years, for initial screening and every 5 years after initial negative screen[1-3]
        - Screening to age 75 or ≥ 10 years of life expectancy
        - One time screening age 76- 85 if no prior study has been completed (depending on comorbidities and life expectancy)
        - When colonoscopy is medically contraindicated or not possible (e.g., due to a known colonic lesion, structural abnormality, or technical difficulty, patient is unable to undergo sedation or has medical conditions such as recent myocardial infarction, recent colonic surgery, a bleeding disorder, or severe lung and/or heart disease)
        - For a patient with a first-degree family member with history of colorectal cancer or adenoma

        - After a positive fecal occult blood test (FOBT) or positive fecal immunochemical test (FIT)
    - For a patient at above average risk with a documented reason for not having a traditional colonoscopy

‡For **Average or Moderate Risk Individuals:**

- 50-75 years of age, Asymptomatic **AND WITHOUT** any of the following:
    - A family history of known genetic disorders that predispose them to a high lifetime risk of colorectal cancer[1, 4-6]** (See Background section)
    - A personal history of inflammatory bowel disease[1, 4-6]**

**Patients with these indications should undergo colonoscopy.

NOTE: If a polyp 6mm or larger is detected at screening CTC, and no polypectomy is done, the follow-up CTC (done at 3 years) is then considered diagnostic (rather than screening).

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BACKGROUND

The goal of CTC, sometimes referred to as CT colonography or virtual colonoscopy screening, is to reduce colorectal cancer mortality through cancer prevention and early detection. Virtual colonoscopy is an American Cancer Society-recommended screening exam that has been shown in studies in the United States and abroad to increase screening rates where offered. Virtual colonoscopy has been proven comparably accurate to colonoscopy in most people of screening age. Mandatory insurance coverage of CT colonography and the other USPSTF-recognized exams is a major step forward in the battle against colorectal cancer.[7] CT colonography has replaced double-contrast barium enema for nearly all indications as it is more effective and better tolerated.

OVERVIEW

CTC is a minimally invasive structural examination of the colon and rectum to evaluate for colorectal polyps or neoplasms in the asymptomatic patient. These guidelines have been updated based on revised ACR Appropriateness Criteria® for Colorectal Cancer Screening for

average or moderate risk individuals, which references the American College of Radiology Imaging Network (ACRIN) National CTC Trial. ACRIN is the largest multicenter trial to date with 2,531 asymptomatic patients included. The per patient sensitivity for detecting adenomas >6 mm was 78%, ≥10 mm was 84%. Of the 105 references used for this revised 2018 ACR guideline, 98 are categorized as diagnostic references. The 2022 NCCN guidelines recommend CT colonography every 5 years with a sensitivity of 86%-100% for colorectal cancer (colonoscopy 94.7%), and specificity of 88% (polyps ≥ 6 mm) to 94% (polyps ≥ 10 mm) vs 89% (polyps ≥ 10 mm) to 94% (polyps ≥ for colonoscopy.[5]

Relative contraindications to CTC include symptomatic acute colitis, acute diarrhea, recent acute diverticulitis, recent colorectal surgery, symptomatic colon-containing abdominal wall hernia, small bowel obstruction, Lynch syndrome, Polyposis syndromes including classical familial adenomatous polyposis, attenuated familial adenomatous polyposis, MUTYH-associated polyposis, Peutz-Jeghers syndrome, Juvenile polyposis syndrome, Cowden syndrome/PTEN hamartoma tumor syndrome, and Li-Fraumeni syndrome.[5]

It is not indicated for routine follow up of inflammatory bowel disease, hereditary polyposis or non-polyposis cancer syndromes, evaluation of anal disease, or the pregnant or potentially pregnant patient. For all high-risk individuals, colonoscopy is preferred.

Other Recommendations

It is suggested that screening begin in African Americans at age 45 years. It should also be noted that the American Cancer Society now recommends that screening be initiated starting at age 45; and recommends 6 test options for CRC screening; annual FIT or HSgFOBT (high-sensitivity, guaiac-based fecal occult blood test), mt-sDNA every three years, colonoscopy every 10 years, CTC every 5 years, and flexible sigmoidoscopy (FS) every 5 years.[8]

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POLICY HISTORY

Date	Summary
April 2023	• Updated references • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
April 2022	• Updated references

Reviewed / Approved by Clinical Guideline Committee

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HMSA

Specific policy administered by Evolent

Clinical guidelines Heart MRI	
CPT Codes: 75557, 75559, 75561, 75563, +75565, +0698T	**Original Date:** March 26, 2008
Guideline Number: HMSA_CG_028	**Last Revised Date (by HMSA):** February 2024
	Last Reviewed Date (by Evolent): February 2024
	Implementation Date: April 2024

GENERAL INFORMATION

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- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CARDIAC MAGNETIC RESONANCE (CMR)

Cardiomyopathy & Heart Failure[1, 2,3]

- To assess systolic and diastolic function in the evaluation of a newly diagnosed cardiomyopathy
- Suspected infiltrative disease such as amyloidosis, sarcoidosis[4], hemochromatosis, or endomyocardial fibrosis if PET has not been performed
- Suspected inherited or acquired cardiomyopathy
- Diagnosis of acute myocarditis, with suspicion based upon new, unexplained findings such as:

    - Rise in troponin not clearly due to acute myocardial infarction
    - Change in ECG suggesting acute myocardial injury or pericarditis, without evident myocardial infarction
- Assessment of hypertrophic cardiomyopathy[5]
    - When TTE is inadequate for diagnosis, management or operative planning, or when tissue characterization (degree of fibrosis) will impact indications for ICD
    - For patients with LVH when there is a suspicion of alternative diagnoses, including infiltrative or storage disease as well as athlete's heart
    - For patients who are not otherwise as high risk for SCD, in whom the decision to proceed with an ICD is uncertain after assessment (which includes personal/family history, echocardiography), and CMR imaging is beneficial to assess for maximum LV wall thickness, ejection fraction (EF), LV apical aneurysm, and extent of myocardial fibrosis with LGE
    - For patients with obstructive HCM in whom the autonomic mechanism of obstruction is inconclusive on echocardiography, CMR is indicated for selection and planning of SRT (septal reduction therapy)
    - For patients with HCM, repeat imaging on a periodic basis (every 3-5 years) for the purpose of SCD risk stratification to evaluate changes in LGE, EF, development of apical aneurysm or LV wall thickness
- Arrhythmogenic right ventricular cardiomyopathy to aid in identification and diagnosis (assessment of myocardial fat, fibrosis, and RV tissue characteristics), based upon reason for suspicion, such as:
    - Nonsustained ventricular tachycardia (VT)
    - Unexplained syncope
    - ECG abnormalities
    - First-degree relatives with positive genotype for ARVD
- Noncompaction cardiomyopathy to aid in the diagnosis (measurement of compacted to noncompacted myocardium) when TTE is suggestive
- Clinical symptoms and signs consistent with a cardiac diagnosis known to cause presyncope/syncope (including, but not limited to, hypertrophic cardiomyopathy)
- Pulmonary hypertension in the absence of severe valvular disease

Valvular Heart Disease

- Evaluation of valvular stenosis, regurgitation, or valvular masses when transthoracic echocardiography (TTE) is inadequate[6]
- Pre-TAVR assessment if the patient has not undergone cardiac CT[7]
- Prior to transcatheter mitral valve intervention, when TTE and TEE result in uncertain assessment of the severity of mitral regurgitation[8, 9]
- Suspected clinically significant bioprosthetic valvular dysfunction and inadequate images from TTE and TEE[6]

Evaluation of Intra- and Extra-Cardiac Structures

- Initial evaluation of cardiac mass, suspected tumor or thrombus, or potential cardiac source of emboli
- Re-evaluation of intracardiac mass when findings would change therapy
- Evaluation of pericardial disease to provide structural and functional assessment and differentiate constrictive vs restrictive physiology
- Assessment of left ventricular pseudoaneurysm, when TTE was inadequate
- Identification and characteristics of coronary aneurysms or anomalous coronary arteries

Pre-procedure Evaluation for Closure of ASD or PFO

- For assessment of atrial septal anatomy and atrial septal aneurysm
- For assessment of suitability for percutaneous device closure

Assessment Following LAA Occlusion

- For surveillance at 45 days or FDA guidance, if TEE or Heart CT was not done, to assess:
    - Device stability
    - Device leaks
    - To exclude device migration

Pre-Ablation Planning

- Evaluation of left atrium and pulmonary veins prior to radiofrequency ablation for atrial fibrillation

Aortic Pathology

- CT, MR, or echocardiogram can be used for screening and follow-up, with CT and MR preferred for imaging beyond the proximal ascending thoracic aorta
- Screening of first-degree relatives with a history of thoracic aortic aneurysm or dissection
- Six-month follow-up after initial diagnosis of thoracic aortic aneurysm to measure rate of change
- Annual follow-up for an enlarged thoracic aortic aneurysm (usually defined as > 4.4.cm)
- Biannual (2x/year) follow-up of enlarged aortic root or showing growth rate ≥ 0.5 cm/year
- Screening of first-degree relative with a bicuspid aortic valve
- Re-evaluation (<1 y) of the size and morphology of the aortic sinuses and ascending aorta in patients with a bicuspid AV and an ascending aortic diameter >4 cm with 1 of the following:
    - Aortic diameter >4.5 cm
    - Rapid rate of change in aortic diameter
    - Family history (first-degree relative) of aortic dissection

- Patients with Turner's syndrome annually if an abnormality exists; if initial study normal, can have imaging every 5 - 10 years[10]
- Evaluation in patients with known or suspected connective tissue disease or genetic condition that predispose to aortic aneurysm or dissection, such as Marfan syndrome, Ehlers-Danlos or Loeys-Dietz syndrome (at the time of diagnosis and 6 months thereafter), followed by annual imaging (can be done more frequently if > 4.5 cm or rate of growth > 0.5 cm/year- up to twice per year)

Congenital Heart Disease (CHD)[11]

- For all indications below, either CT or CMR can be done
- All lesions: evaluation prior to planned repair and evaluation for change in clinical status and/or new concerning signs or symptoms
- Patent Ductus Arteriosus: routine surveillance (1-2 years) in a patient with postprocedural aortic obstruction
- Eisenmenger Syndrome and Pulmonary Hypertension associated with CHD:
    - Evaluation due to change in pulmonary arterial hypertension-targeted therapy
    - Initial evaluation with suspicion of pulmonary hypertension following CHD surgery
- Aortic Stenosis or Regurgitation:
    - Routine surveillance (6-12 months) in a child with aortic sinus and/or ascending aortic dilation with increasing size
    - Routine surveillance (2–3 years) in a child with aortic sinus and/or ascending aortic dilation with stable size (CMR only)
- Aortic Coarctation and Interrupted Aortic Arch:
    - Routine surveillance (3–5 years) in a child or adult with mild aortic coarctation
    - Post procedure (surgical or catheter-based) routine surveillance (3–5 years) in an asymptomatic patient to evaluate for aortic arch aneurysms, in-stent stenosis, stent fracture, or endoleak
- Coronary anomalies
- Tetralogy of Fallot:
    - Postoperative routine surveillance (2–3 years) in a patient with pulmonary regurgitation and preserved ventricular function (CMR only)
    - Routine surveillance (2–3 years) in an asymptomatic patient with no or mild sequelae (CMR only)
    - Routine surveillance (2–3 years) in a patient with valvular or ventricular dysfunction, right ventricular outflow tract obstruction, branch pulmonary artery stenosis, arrhythmias, or presence of an RV-to-PA conduit
- Double Outlet Right Ventricle: Routine surveillance (3–5 years) in an asymptomatic patient with no or mild sequelae (CMR only)
- D-Loop Transposition of the Great Arteries (postoperative):
    - Routine surveillance (3–5 years) in an asymptomatic patient

    - Routine surveillance (1–2 years) in a patient with dilated aortic root with increasing size, or aortic regurgitation
    - Routine surveillance (3–12 months) in a patient with ≥moderate systemic AV valve regurgitation, systemic RV dysfunction, LVOT obstruction, or arrhythmias
- Congenitally Corrected Transposition of the Great Arteries:
    - Unrepaired: routine surveillance (3–5 years) in an asymptomatic patient
    - Postoperative: routine surveillance (3–5 years) in an asymptomatic patient
    - Postoperative anatomic repair: routine surveillance (6–12 months) in a patient with valvular or ventricular dysfunction, right or left ventricular outflow tract obstruction, or presence of an RV-to-PA conduit
    - Postoperative physiological repair with VSD closure and/or LV-to-PA conduit: routine surveillance (3–12 months) in a patient with ≥moderate systemic AV valve regurgitation, systemic RV dysfunction, and/or LV-to-PA conduit dysfunction
- Truncus Arteriosus: routine surveillance (1–2 years) in an asymptomatic child or adult with ≥ moderate truncal stenosis and/or regurgitation
- Single-Ventricle Heart Disease:
    - Postoperative routine surveillance (1–2 years) in an asymptomatic patient
    - Routine surveillance (1–2 years) in an asymptomatic adult postoperative Stage 2 palliation (CMR only)
- Ebstein's anomaly and Tricuspid Valve dysplasia (only CMR indicated):
    - Evaluation prior to planned repair and evaluation for change in clinical status and/or new concerning signs or symptoms
- Pulmonary Stenosis (only CMR indicated)
    - Unrepaired: routine surveillance (3–5 years) in an asymptomatic adult with PS and pulmonary artery dilation
    - Postprocedural (surgical or catheter-based): routine surveillance (1–3 years) in an asymptomatic adult with moderate or severe sequelae
- Pulmonary Atresia (postprocedural complete repair): routine surveillance (1–3 years) in an asymptomatic adult with ≥ moderate sequelae

Coronary Artery Disease Evaluation (CMR as an alternative to pharmacologic MPI)

- CMR, which is done pharmacologically, is used for the assessment of coronary artery disease, and can be performed if the patient would otherwise be a candidate for a pharmacologic MPI.
- Assessment of LV wall motion to identify patients with akinetic segments that would benefit from coronary revascularization
- To identify the extent and location of myocardial necrosis in patients with chronic or acute ischemic heart disease
- Follow-up of known CAD
    - Coronary stenosis of unclear significance on previous coronary angiography [3, 12]

- To diagnose microvascular dysfunction in patients with persistent stable anginal chest pain with suspected ischemia and nonobstructive coronary artery disease (INOCA) as documented in provider notes (no MPI diversion required). [13]

BACKGROUND[15]

- CMR is an imaging modality used to assess cardiac or vascular anatomy, function, perfusion, and tissue characteristics in a single examination. In lesions affecting the right heart, CMR provides excellent visualization and volume determination regardless of RV shape. This is particularly useful in patients with congenital heart disease
- **CMR Safety[16-19]**
  Since many cardiac patients have cardiac implanted electrical devices, the risk of CMR to the patient and the device must be weighed against the benefit to the patient in terms of clinical value in optimal management.

Cardiac magnetic imaging (CMR) is often required when transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) provide inadequate imaging data.

Stress CMR for assessment of coronary artery disease (CAD) is performed pharmacologically either as:

- Vasodilator perfusion imaging with gadolinium contrast; **OR**
- Dobutamine inotropic wall motion (ventriculography)

With respect to CAD evaluation, since CMR is only pharmacologic (non-exercise stress), and stress echocardiography (SE) or myocardial perfusion imaging (MPI) provide similar information about CAD:

- Requests for stress CMR require **diversion** to exercise SE first, and to exercise MPI second.
- **Exemptions** for the diversion to SE or exercise MPI:
  - If body habitus or marked obesity (e.g., BMI ≥ 40) would interfere significantly with imaging with SE and MPI[20]
  - Evaluation of young (< 55 years old) patients with documented complex CAD, who are likely to need frequent non-invasive coronary ischemia evaluation and/or frequent radiation exposure from other testing[21]

OVERVIEW

CMR in CORONARY ARTERY DISEASE (CAD)[12, 22, 23]

Stable patients without known CAD fall into 2 categories[12, 22, 23]:

- **Asymptomatic**, for whom global risk of CAD events can be determined from coronary risk factors, using calculators available online

- **Symptomatic,** for whom we estimate the pretest probability that their chest-related symptoms are due to clinically significant (≥ 50%) CAD (below):

The 3 Types of Chest Pain or Discomfort

- **Typical Angina (Definite)** is defined as including all **3** characteristics:
  - Substernal chest pain or discomfort with characteristic quality and duration
  - Provoked by exertion or emotional stress
  - Relieved by rest and/or nitroglycerine
- **Atypical Angina (Probable)** has only **2** of the above characteristics
- **Nonanginal Chest Pain/Discomfort** has only **0 - 1** of the above characteristics

The medical record should provide enough detail to establish the type of chest pain. From those details, The Pretest Probability of obstructive CAD is estimated from the **Diamond Forrester Table** below, recognizing that in some cases multiple additional coronary risk factors could increase pretest probability[12]:

Diamond Forrester Table

Age (Years)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain
≤ 39	Men	Intermediate	Intermediate	Low
	Women	Intermediate	Very low	Very low
40 – 49	Men	High	Intermediate	Intermediate
	Women	Intermediate	Low	Very low
50 – 59	Men	High	Intermediate	Intermediate
	Women	Intermediate	Intermediate	Low
≥ 60	Men	High	Intermediate	Intermediate
	Women	High	Intermediate	Intermediate

- **Very low:** < 5% pretest probability of CAD, usually not requiring stress evaluation[22]
- **Low:** 5 - 10% pretest probability of CAD
- **Intermediate:** 10% - 90% pretest probability of CAD
- **High:** > 90% pretest probability of CA

For additional information on stress imaging, please refer to NIA guideline CG 024 Myocardial Perfusion Imaging (aka Nuclear Cardiac Imaging Study).

Abbreviations

ARVD/C	Arrhythmogenic right ventricular dysplasia/cardiomyopathy
ASD	Atrial septal defect
CABG	Coronary artery bypass grafting surgery
CAD	Coronary artery disease
CMR	Cardiac magnetic resonance (imaging)
CT	Computed tomography
ECG	Electrocardiogram
EF	Ejection fraction
HCM	Hypertrophic cardiomyopathy
ICD	Implantable cardioverter-defibrillator
LAA	Left atrial appendage
LBBB	Left bundle-branch block
LGE	Late gadolinium enhancement
LV	Left ventricle
LVH	Left ventricular hypertrophy
LVOT	Left ventricular outflow
MPI	Myocardial perfusion imaging
MR	Mitral regurgitation
MR(I)	Magnetic resonance (imaging)
PA	Pulmonary artery
PET	Positron emission tomography
PFO	Patent foramen ovale
PS	Pulmonary stenosis
RV	Right ventricle
SCD	Sudden cardiac death
SE	Stress echocardiography
SRT	Septal reduction therapy
TAVR	Transcatheter Aortic Valve Replacement
TTE	Transthoracic Echo
TEE	Transesophageal Echo
VT	Ventricular tachycardia

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POLICY HISTORY

Date	Summary
February 2024	• Removed under Coronary Artery Disease evaluation "If the patient can walk and is having an MPI for another reason (LBBB, CABG, ect.), MPI is chosen over CMR"
September 2024	• Added follow up for known CAD • Added CAD evaluation for microvascular dysfunction
April 2023	• Added statement on clinical indications not addressed in this guideline • Added Washington State Legislative Language
February 2022	• Deleted the statement of deferral toward a stress echo, leaving the equivalency statement toward MPI • Clarified the requirement for description of chest pain by adding sentence "The medical record should provide enough detail to establish the type of chest pain." • Changed postoperative routine surveillance for single-ventricle heart disease to 1 – 2 years in an asymptomatic patient

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical Guidelines for Coronary Artery Calcium Scoring by: Electron-Beam Tomography (EBCT) OR Non-Contrast Coronary Computed Tomography (Non-contrast CCT)	**Original Date: January 2008**
CPT Codes: 75571, S8092	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_029	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CORONARY ARTERY CALCIUM (CAC) TESTING[1-10]

See Legislative Requirements for specific mandates in: State of New Mexico and State of Texas

CAC testing is for cardiovascular risk assessment in individuals aged 40-75 years who have an intermediate (5-19.9%) 10-year ASCVD risk based upon the ACC/AHA pooled cohort risk calculator. Documentation is required that the results of the study will affect decision making for preventative actions (i.e., statin therapy).

- Patients regardless of age can be considered for CAC testing when there is well-documented evidence of one of the following:
    - Patients with estimated 10-year risk of less than 5%, but are suspected to be at elevated atherosclerotic cardiovascular disease (ASCVD) risk because of a major

risk factor not accounted for in the global risk equations below and consider CAC score as an adjudicator to upgrade risk: [4, 5, 11, 12]
        - Family history of premature ASCVD
        - Persistently elevated LDL-C > 160mg/dl or non-HDL-C > 190mg/dl
        - Chronic kidney disease
        - Metabolic syndrome
        - Conditions specific to women (e.g., pre-eclampsia, premature menopause)
        - Inflammatory diseases (HIV, psoriasis, RA)
        - Ethnicity (e.g., South Asian ancestry)
        - Persistently elevated triglycerides (> 175mg/dl)
        - hsCRP > 2mg/L
        - Lp(a) levels > 50mg/dl
        - apoB > 130mg/dl
        - ABI < 0.9
    - Patients in whom statin therapy is indicated, but have intolerable adverse effects from, or are reluctant to take statin medication, in order to guide the need for alternative lipid-lowering strategies[2, 8, 13]
- CAC scoring should be performed in asymptomatic patients. It should not be used as a diagnostic test in patients with symptoms suggestive of ischemia.
- Patients with known CAD should not be considered for calcium scoring as the results are unlikely to affect treatment.[5, 13-15]
- CAC testing may be repeated for risk re-assessment after a minimum of 5 years, if documentation indicates it will alter management.[4, 5, 13] It should not be repeated if the patient already has two CAC scores of zero 5 years apart or has a score ≥ 400[4].

LEGISLATIVE REQUIREMENTS

- **State of New Mexico**
    - **§ 59A-23-7.16. Heart artery calcium scan coverage**
        - Coronary calcium scan can be **approved** every 5 years with the following:
            - Individual between ages 45 and 65 years of age **AND**
            - Individual has an intermediate risk of developing CHD as determined by a HCP based upon a score calculated from an evidence-based algorithm widely used in the medical community to assess a person's ten-year CVD risk
        - **EBCT is approvable** once every 5 years *even if individual has previously received a heart artery calcium score of ZERO*
        - EBCT is not required for future scores/testing if individual receives a heart artery calcium score greater than ZERO

        - At its discretion or as required by law, an insurer may offer or refuse coverage for further cardiac testing or procedures for eligible insureds based upon the results of a heart artery calcium scan
        - **Heart artery calcium scan** means a computed tomography scan measuring coronary artery calcium for atherosclerosis and abnormal artery structure and function

    Source: N.M.S.A. 1978, § 59A-23-7.16 New Mexico Legislature House Bill 126 [16]

- **State of Texas**
    - **HB 1290 Texas Heart Attack Prevention Screening Law Sec. 1376.003**
        - Indications for EBCT for the detection of coronary artery calcification:
            - Male between the ages of 45 – 76, **AND**
                - Patient is a diabetic **OR**
                - Has **intermediate** or **higher** risk factors (based on the Framingham risk criteria)
            - Female between the ages of 55 – 76, **AND**
                - Patient is a diabetic **OR**
                - Has **intermediate** or **higher** risk factors (based on the Framingham risk criteria)

    Source: Texas House Bill 1290 Sec. 1376.003[17]

BACKGROUND[2, 4, 5]

Coronary artery calcium (CAC) testing is a cardiovascular risk assessment tool, applicable only to the patient without known cardiovascular disease, for the purpose of primary prevention. It is not for the patient with suspected or known cardiovascular disease, coronary or otherwise, who already requires aggressive risk factor modification.

CAC testing, by either EBCT or non-contrast CCT, provides a quantitative assessment of coronary artery calcium content in Agatston units, as an adjunct to the estimation of global risk for coronary or cardiovascular events over the next 10 years.[7] A CAC Score > 0 is a highly specific feature of coronary atherosclerosis.

CAC score > 100 can also provide support for aspirin therapy[5, 18] and statin therapy.[19]

Patients who have already manifested cardiovascular disease are already at high global risk and the Global Cardiovascular Risk Calculators are not applicable.

Links to Global Cardiovascular Risk Calculators[1, 3, 7, 20, 21]

Risk Calculator	Website for Online Calculator
Framingham Cardiovascular Risk	https://reference.medscape.com/calculator/framingham-cardiovascular-disease-risk

Reynolds Risk Score Can use if no diabetes Unique for use of family history	http://www.reynoldsriskscore.org/
Pooled Cohort Equation	http://clincalc.com/Cardiology/ASCVD/PooledCohort.aspx?example
ACC/AHA Risk Calculator	http://tools.acc.org/ASCVD-Risk-Estimator/

Abbreviations

ASCVD	Atherosclerotic cardiovascular disease
CAC	Coronary artery calcium
CAD	Coronary artery disease
CCT	Cardiac computed tomography
EBCT	Electron beam computed tomography

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POLICY HISTORY

Date	Summary
April 2023	• Removed age limitations for CAC testing • Added new references • Added statement on clinical indications not addressed in this guideline
June 2022	• Updated state legislative requirements
February 2022	• Modified indication statements to include additional examples of CAD risk factors • EBCT not to be used as test for symptoms of ischemia • EBCT not to be used in patients with known CAD

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guideline **CT HEART** **CT HEART Congenital** **(Not including coronary arteries)**	**Original Date: September 1997**
CPT Codes: 75572, 75573	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_025	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR HEART COMPUTED TOMOGRAPHY (CT)[1, 2]

Congenital Heart Disease[3]

For all indications below, either CT or CMR can be performed:

- All congenital lesions: prior to planned repair and for change in clinical status and/or new concerning signs or symptoms
- Patent Ductus Arteriosus: routine surveillance (1-2 years) in a patient with postprocedural aortic obstruction
- Aortic Stenosis or Regurgitation: routine surveillance (6-12 months) in a child with aortic sinus and/or ascending aortic dilation with increasing size
- Aortic Coarctation and Interrupted Aortic Arch:
    - Routine surveillance (3–5 years) in a child or adult with mild aortic coarctation
    - Post procedure (surgical or catheter-based) routine surveillance (3–5 years) in an asymptomatic patient to evaluate for aortic arch aneurysms, in-stent stenosis, stent fracture, or endoleak
- Tetralogy of Fallot:

    - Routine surveillance (2–3 years) in a patient with valvular or ventricular dysfunction, right ventricular outflow tract obstruction, branch pulmonary artery stenosis, arrhythmias, or presence of an RV-to-PA conduit
- D-Loop Transposition of the Great Arteries (postoperative):
    - Routine surveillance (3–5 years) in an asymptomatic patient
    - Routine surveillance (1–2 years) in a patient with dilated aortic root with increasing size, or aortic regurgitation
    - Routine surveillance (3–12 months) in a patient with ≥moderate systemic AV valve regurgitation, systemic RV dysfunction, LVOT obstruction, or arrhythmias
- Congenitally Corrected Transposition of the Great Arteries:
    - Unrepaired: routine surveillance (3–5 years) in an asymptomatic patient
    - Postoperative: routine surveillance (3–5 years) in an asymptomatic patient
    - Postoperative anatomic repair: routine surveillance (6–12 months) in a patient with valvular or ventricular dysfunction, right or left ventricular outflow tract obstruction, or presence of an RV-to-PA conduit
    - Postoperative physiological repair with VSD closure and/or LV-to-PA conduit: routine surveillance (3–12 months) in a patient with ≥moderate systemic AV valve regurgitation, systemic RV dysfunction, and/or LV-to-PA conduit dysfunction
- Truncus Arteriosus: routine surveillance (1–2 years) in an asymptomatic child or adult with ≥ moderate truncal stenosis and/or regurgitation
- Single-Ventricle Heart Disease (includes hypoplastic left heart syndrome, double-inlet LV, double-inlet RV, mitral atresia, tricuspid atresia, unbalanced A-V septal defect): postoperative routine surveillance (3-5 years) in an asymptomatic patient

Cardiomyopathy

- Quantification of myocardial (muscle) mass (CMR or CT)
- Assessment of right ventricular morphology in suspected arrhythmogenic right ventricular cardiomyopathy, based upon other findings such as:
    - Nonsustained VT
    - Unexplained syncope
    - ECG abnormalities
    - First-degree relative with positive genotype of ARVC (either, but CMR is superior to CT)[4, 5]

Valvular Heart Disease

- Characterization of native or prosthetic valves with clinical signs or symptoms suggesting valve dysfunction, when TTE, TEE, and/or fluoroscopy have been inadequate[6]
- Evaluation of RV function in severe TR, including systolic and diastolic volumes, when TTE images are inadequate and CMR is not readily available
- Pulmonary hypertension in the absence of severe valvular disease

- Evaluation of suspected infective endocarditis with moderate to high pretest probability (i.e., staph bacteremia, fungemia, prosthetic heart valve, or intracardiac device), when TTE and TEE have been inadequate
- Evaluation of suspected paravalvular infections when the anatomy cannot be clearly delineated by TTE and TEE[7]

Evaluation of Intra- and Extra-cardiac Structures

- Evaluation of cardiac mass, suspected tumor or thrombus, or cardiac source of emboli, when imaging with TTE and TEE have been inadequate
- Re-evaluation of prior findings for interval change (i.e., reduction or resolution of atrial thrombus after anticoagulation), when a change in therapy is anticipated[6-8]
- Evaluation of pericardial anatomy, when TTE and/or TEE are inadequate or for better tissue characterization of a mass and detection of metastasis [CMR superior for physiologic assessment (constrictive versus restrictive) and tissue characterization, CT superior for calcium assessment][9, 10]

Electrophysiologic Procedure Planning[2]

- Evaluation of pulmonary venous anatomy prior to radiofrequency ablation of atrial fibrillation and for follow-up when needed for evaluation of pulmonary vein stenosis
- Non-invasive coronary vein mapping prior to placement of biventricular pacing leads

Transcatheter Structural Intervention Planning

- Evaluation for transcatheter aortic valve replacement (TAVR)[6, 11, 12]
- When TTE and TEE cannot provide adequate imaging, CT imaging can be used for planning: robotic mitral valve repair, atrial septal defect closure, left atrial appendage closure, ventricular septal defect closure, endovascular grafts, and percutaneous pulmonic valve implantation[12, 13]
- Evaluation for suitability of transcatheter mitral valve procedures, alone or in addition to TEE[14]

Aortic Pathology[6-8, 15-20, 21]

- CT, MR, or echo can be used for screening and follow-up, with CT and MR preferred for imaging beyond the proximal ascending thoracic aorta in the following scenarios:
    - Evaluation of dilated aortic sinuses or ascending aorta identified by TTE
    - Suspected acute aortic pathology, such as dissection
    - Re-evaluation of known aortic dilation or aortic dissection with a change in clinical status or cardiac examination or when findings would alter management
    - Screening first-degree relatives of individuals with a history of thoracic aortic aneurysm or dissection, or an associated high-risk mutation for thoracic aneurysm in common

    - Screening second-degree relative of a patient with thoracic aortic aneurysm, when the first-degree relative has aortic dilation, aneurysm, or dissection
    - Six-month follow-up after initial finding of a dilated thoracic aorta, for assessment of rate of change
    - Annual follow-up of enlarged thoracic aorta with size up to 4.4 cm
    - Biannual (twice/yr) follow-up of enlarged aortic root ≥ 4.5 cm or showing growth rate ≥ 0.5 cm/year
- Patients with Marfan syndrome may undergo annual imaging with CT, MRI or TTE, with increase to biannual (twice-yearly) when diameter ≥ 4.5 cm or when expansions is > 0.5 cm/yr
- Patient with Turner syndrome should undergo initial imaging with CT, MRI, or TTE for evidence of dilatation of the ascending thoracic aorta. If imaging is normal and there are no risk factors for aortic dissection, repeat imaging should be performed every 5 - 10 years, or if otherwise indicated. If the aorta is enlarged, appropriate follow-up imaging should be done according to size, as above
- Evaluation of the aorta in the setting of a known or suspected connective tissue disease or genetic condition that predisposes to aortic aneurysm or dissection (i.e., Loeys-Dietz, Ehlers-Danlos), with re-evaluation at 6 months for rate of expansion. Complete evaluation with CMR from the cerebrovascular circulation to the pelvis is recommended with Loeys-Dietz syndrome.

BACKGROUND

- Cardiac computed tomography (Heart CT) images the cardiac chambers, great vessels, valves, myocardium, and pericardium to assess cardiac structure and function, particularly when echocardiography (transthoracic echocardiography and transesophageal echocardiography) cannot provide adequate information
- CT imaging can be used for assessment of:
    - Structures of the heart (e.g., chambers, valves, great vessels, masses), as in this guideline
    - Quantitative level of calcium in the walls of the coronary arteries, in the separate coronary artery calcium (CAC) scoring guideline

OVERVIEW[2]

Imaging in Congenital Heart Disease

Echocardiography is often utilized for initial assessment of congenital heart disease. However, if findings are unclear or need confirmation, CMR or CT can be useful.[3]

CT and Cardiac Masses

CT and CMR are used to evaluate cardiac masses, describing their size, density, tissue characteristics, and spatial relationship to adjacent structures.

CT and Pericardial Disease

While echocardiography is most often used in the initial examination of pericardial disease, CT and CMR can evaluate pericardial thickening and masses which are often detected initially with echocardiography. CT and CMR can accurately define the site and extent of masses, e.g., cysts, hematomas, and neoplasms.[9]

Abbreviations

ARVD/C	Arrhythmogenic right ventricular dysplasia/cardiomyopathy
CABG	Coronary artery bypass grafting surgery
CAD	Coronary artery disease
CCS	Coronary calcium score
CCT	Cardiac (heart) CT
CHD	Coronary heart disease
CMR	Cardiac magnetic resonance (imaging)
CT	Computed tomography
CTA	Computed tomography angiography
ECG	Electrocardiogram
EF	Ejection fraction
HF	Heart failure
LVOT	Left ventricular outflow tract
MI	Myocardial infarction
MPI	Myocardial perfusion Imaging or cardiac nuclear imaging
MR(I)	Magnetic resonance (imaging)
PA	Pulmonary artery
PCI	Percutaneous coronary intervention
PVML	Paravalvular mitral leak
RV	Right ventricle
SE	Stress echocardiogram
TAVR	Transcatheter aortic valve replacement
TMVR	Transcatheter mitral valve replacement
TR	Tricuspid regurgitation
TEE	Transesophageal echocardiography
TTE	Transthoracic echocardiography
VT	Ventricular tachycardia

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POLICY HISTORY

Date	Summary
April 2023	• Added statement on clinical indications not addressed in this guideline
February 2022	Listed clinical spectrum comprising single-ventricle heart disease to include: hypoplastic left heart syndrome, double-inlet LV, double-inlet RV, mitral atresia, tricuspid atresia, unbalanced A-V septal defect

Reviewed / Approved by Clinical Guideline Committee

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HMSA

Specific policy administered by Evolent

Clinical Guidelines CT Coronary Angiography (CCTA)	
CPT Codes: 75574	**Original Date:** October 2009
Guideline Number: HMSA_CG_062	**Last Revised Date (by HMSA):** February 2024
	Last Reviewed Date (by Evolent): April 2023
	Implementation Date: April 2024

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CORONARY COMPUTED TOMOGRAPHIC ANGIOGRAPHY (CCTA)[1-4]

Evaluation in Suspected Coronary Artery Disease (CAD)[5-8]

- Intermediate and high pretest probability patients[9]
- Low pretest probability patients should be considered for exercise treadmill test (ETT) unless other criteria for CCTA are met
- Symptomatic patients with prior PCI (stents > 3mm) or CABG history
- Exercise ECG stress test with intermediate Duke Treadmill (- 10 to + 4)
- Equivocal, borderline, or discordant stress evaluation with continued symptoms concerning for CAD

- Repeat testing in patient with new or worsening symptoms since prior normal stress imaging[3, 4]
- Asymptomatic patients without known CAD
    - Previously unevaluated ECG evidence of possible myocardial ischemia including ischemic ST segment or T wave abnormalities (see overview section)
    - Previously unevaluated pathologic Q waves (see overview section)
    - Previously unevaluated left bundle branch block
- Newly diagnosed clinical systolic heart failure or diastolic heart failure, with reasonable suspicion of cardiac ischemia (prior events, risk factors), unless invasive coronary angiography is planned (SE diversion not required) [3, 4, 10-12]
- Before valve surgery or transcatheter intervention as an alternative to coronary angiography[13-15]
- To establish the etiology of mitral regurgitation[15]
- Evaluation of coronary anomaly or aneurysm [16-19]
    - Evaluation prior to planned repair
    - Evaluation due to change in clinical status and/or new concerning signs or symptoms
    - Kawasaki disease and MIS-C follow up – for medium sized or greater aneurysms[20] periodic surveillance can be considered every 2-5 years. Once aneurysmal size has reduced to small aneurysms, surveillance can be performed every 3-5 years. No further surveillance once normalized.
- Evaluation of coronary artery bypass grafts, to assess[3, 21]:
    - Patency and location when invasive coronary arteriography was either nondiagnostic or not performed
    - Location prior to cardiac or another chest surgery

Electrophysiologic Procedure Planning

- Evaluation of anatomy prior to radiofrequency ablation

BACKGROUND

Coronary computed tomographic angiography (CCTA) is a noninvasive imaging study that uses intravenously administered contrast material and high-resolution, rapid imaging computed tomography (CT) .[22, 23]

Stable patients without known CAD fall into 2 categories[1, 2, 4]:

- **Asymptomatic**, for whom global risk of CAD events can be determined from coronary risk factors, using calculators available online (see Risk Calculators in the Overview section).

- **Symptomatic,** for whom we estimate the pretest probability that their chest-related symptoms are due to clinically significant CAD.

Three Types of Chest Pain or Discomfort:

- **Typical Angina (Definite)** is defined as including **ALL 3** characteristics:
  - Substernal chest pain or discomfort with characteristic quality and duration
  - Provoked by exertion or emotional stress
  - Relieved by rest and/or nitroglycerin
- **Atypical Angina (Probable)** has only **2** of the above characteristics
- **Nonanginal Chest Pain/Discomfort** has only **0 - 1** of the above characteristics
- Once the type of chest pain has been established from the medical record, the Pretest Probability of significant CAD is estimated from the **Diamond Forrester Table** below, recognizing that additional coronary risk factors could increase pretest probability[4]:

Diamond Forrester Table

Age (Years)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain
≤ 39	Men	Intermediate	Intermediate	Low
	Women	Intermediate	Very low	Very low
40 – 49	Men	High	Intermediate	Intermediate
	Women	Intermediate	Low	Very low
50 – 59	Men	High	Intermediate	Intermediate
	Women	Intermediate	Intermediate	Low
≥ 60	Men	High	Intermediate	Intermediate
	Women	High	Intermediate	Intermediate

  - **Very Low:** < 5% pretest probability of CAD
  - **Low:** 5 - 10% pretest probability of CAD
  - **Intermediate:** 10% - 90% pretest probability of CAD
  - **High:** > 90% pretest probability of CAD

OVERVIEW

The *2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR Guideline for the Evaluation and Diagnosis of Chest Pain* ***has given*** a Class 1 recommendation with level of evidence of A for patients with stable and acute chest pain, who have no known coronary artery disease (CAD).[9]

Patient selection and contraindications to CCTA must be considered and may be inappropriate for the following:

- Known history of severe and/or anaphylactic contrast reaction
- Inability to cooperate with scan acquisition and/or breath-hold instructions

- Pregnancy
- Clinical instability (e.g., acute myocardial infarction, decompensated heart failure, severe hypotension)
- Renal impairment as defined by local protocols
- Image quality depends on keeping HR optimally < 60 bpm, a regular rhythm, limited coronary calcification, stents > 3.0 mm in diameter, ≥ 5 second breath hold, and vessels requiring imaging ≥ 1.5 mm diameter.[24]

Scenarios that can additionally support a CCTA over a regular exercise treadmill test in the low probability scenario[25]

Inability to Exercise

- Physical limitations precluding ability to exercise for at least 3 full minutes of Bruce protocol
- The patient has limited functional capacity (< 4 METS) such as **ONE** of the following:
    - Unable to take care of their activities of daily living (ADLs) or ambulate
    - Unable to walk 2 blocks on level ground
    - Unable to climb 1 flight of stairs
    - Unable to vacuum, dust, do dishes, sweep, or carry a small grocery bag

Other Comorbidities

- Prior cardiac surgery (coronary artery bypass graft or valvular)
- Left ventricular ejection fraction ≤ 50%
- Severe chronic obstructive pulmonary disease (COPD) with pulmonary function test (PFT) documentation, severe shortness of breath on minimal exertion, or requirement of home oxygen during the day
- Poorly controlled hypertension, with systolic blood pressure (BP) > 180 or Diastolic BP > 120

ECG and Echo-Related Baseline Findings

- Pacemaker or implantable cardioverter defibrillator (ICD)
- Resting wall motion abnormalities on echocardiography
- Complete LBBB

Risk-Related

- Intermediate or high global risk in patients requiring type IC antiarrhythmic drugs
- Arrhythmia risk with exercise

ECG Stress Test Alone versus Stress Testing with Imaging

Prominent scenarios suitable for an ECG stress test **WITHOUT** imaging (i.e., exercise treadmill ECG test) require that the patient can exercise for at least 3 minutes of Bruce protocol with achievement of near maximal heart rate **AND** has an interpretable ECG for ischemia during exercise[4]:

- The (symptomatic) low pretest probability patient who can exercise and has an interpretable ECG[4]
- The patient who is under evaluation for exercise-induced arrhythmia
- The patient who requires an entrance stress test ECG for a cardiac rehab program or for an exercise prescription
- For the evaluation of syncope or presyncope during exertion[26]

Duke Exercise ECG Treadmill Score[27]

Calculates risk from ECG treadmill alone**:**

- The equation for calculating the Duke treadmill score (DTS) is: DTS = exercise time in minutes - (5 x ST deviation in mm or 0.1 mV increments) - (4 x exercise angina score), with angina score being 0 = none, 1 = non-limiting, and 2 = exercise-limiting
- The score typically ranges from - 25 to + 15. These values correspond to low-risk (with a score of ≥ + 5), intermediate risk (with scores ranging from - 10 to + 4), and high-risk (with a score of ≤
  - 11) categories

An uninterpretable baseline ECG includes[1]:

- ST segment depression of 1 mm or more (not for non-specific ST - T wave changes)
- Ischemic looking T wave inversions of at least 2.5 mm
- LVH with repolarization abnormalities, WPW, a ventricular paced rhythm, or left bundle branch block
- Digitalis use with associated ST - T abnormalities
- Resting HR under 50 bpm on a beta blocker and an anticipated suboptimal workload
- Note: RBBB with less than 1 mm ST depression at rest may be suitable for ECG treadmill testing
- Previously unevaluated pathologic Q waves (in two contiguous leads) defined as the following:
  - > 40 ms (1 mm) wide
  - > 2 mm deep
  - > 25% of depth of QRS complex

Global Risk of Cardiovascular Disease

Global risk of CAD is defined as the probability of manifesting cardiovascular disease over the next 10 years and refers to **asymptomatic** patients without known cardiovascular disease. It

should be determined using one of the risk calculators below. A high risk is considered greater than a 20% risk of a cardiovascular event over the ensuing 10 years.

High global risk by itself generally lacks scientific support as an indication for stress imaging.[5] There are rare exemptions, such as patients requiring IC antiarrhythmic drugs, who might require coronary risk stratification prior to initiation of the drug, when global risk is moderate or high.

- **CAD Risk—Low**
  10 - year absolute coronary or cardiovascular risk less than 10%
- **CAD Risk—Moderate**
  10 - year absolute coronary or cardiovascular risk between 10% and 20%
- **CAD Risk—High**
  10 - year absolute coronary or cardiovascular risk of greater than 20%

Websites for Global Cardiovascular Risk Calculators*

Risk Calculator	Websites for Online Calculator
Framingham Cardiovascular Risk	https://reference.medscape.com/calculator/framingham-cardiovascular-disease-risk
Reynolds Risk Score Can use if no diabetes Unique for use of family history	http://www.reynoldsriskscore.org/
Pooled Cohort Equation	http://clincalc.com/Cardiology/ASCVD/PooledCohort.aspx?example
ACC/AHA Risk Calculator	http://tools.acc.org/ASCVD-Risk-Estimator/
MESA Risk Calculator With addition of Coronary Artery Calcium Score, for CAD-only risk	https://www.mesa-nhlbi.org/MESACHDRisk/MesaRiskScore/RiskScore.aspx

*Patients who have already manifested cardiovascular disease are already at high global risk and are not applicable to the calculators.[28-32]

Definitions of Coronary Artery Disease[1, 2, 33-35]

- Percentage stenosis refers to the reduction in diameter stenosis when angiography is the method and can be estimated or measured using angiography or more accurately measured with intravascular ultrasound (IVUS).
- Coronary artery calcification is a marker of risk, as measured by Agatston score on coronary artery calcium imaging. It is not a diagnostic tool so much as it is a **risk**

stratification tool. Its incorporation into global risk can be achieved by using the MESA risk calculator.

- Stenoses ≥ 70% are considered obstructive coronary artery disease (also referred to as clinically significant), while stenoses ≤ 70% are considered non-obstructive coronary artery disease.[33]
- Ischemia-producing disease (also called hemodynamically or functionally significant disease, for which revascularization might be appropriate) generally implies at least one of the following:
    - Suggested by percentage diameter stenosis ≥ 70% by angiography; intermediate lesions are 50 – 69%[36]
    - For a left main artery, suggested by a percentage stenosis ≥ 50% or minimum luminal cross-sectional area on IVUS ≤ 6 square mm[1, 35, 37]
    - FFR (fractional flow reserve) ≤ 0.80 for a major vessel[35, 37]
    - iFR (instantaneous wave-free ratio) ≤ 0.89 for a major vessel[35, 38-40]
    - Demonstrable ischemic findings on stress testing (ECG or stress imaging), that are at least mild in degree
- A major vessel would be a coronary vessel that would be amenable to revascularization, if indicated. This assessment is made based on the diameter of the vessel and/or the extent of myocardial territory served by the vessel.
- FFR is the distal to proximal pressure ratio across a coronary lesion during maximal hyperemia induced by either intravenous or intracoronary adenosine. Less than or equal to 0.80 is considered a significant reduction in coronary flow.
- Newer technology that estimates FFR from CCTA images is covered under the separate NIA Guideline for FFR-CT.

Anginal Equivalent[1, 26, 41]

Development of an anginal equivalent (e.g., shortness of breath, fatigue, or weakness) either with or without prior coronary revascularization should be based upon the documentation of reasons that symptoms other than chest discomfort are not due to other organ systems (e.g., dyspnea due to lung disease, fatigue due to anemia), by presentation of clinical data such as respiratory rate, oximetry, lung exam, etc. (as well as D-dimer, chest CT(A), and/or PFTs, when appropriate), and then incorporated into the evaluation of coronary artery disease as would chest discomfort. Syncope, per se, is not an anginal equivalent.

Abbreviations

ACS	Acute coronary syndrome
ADLs	Activities of daily living
CABG	Coronary artery bypass grafting surgery
CAD	Coronary artery disease
CCS	Coronary calcium score
CCTA	Coronary computed tomography angiography
CT(A)	Computed tomography (angiography)
COPD	Chronic obstructive pulmonary disease
DTS	Duke Treadmill Score
ECG	Electrocardiogram
EF	Ejection fraction
FFR	Fractional flow reserve
ICD	Implantable cardioverter-defibrillator
iFR	Instantaneous wave-free ratio or instant flow reserve
IVUS	Intravascular ultrasound
LBBB	Left bundle branch block
LVH	Left ventricular hypertrophy
MESA	Multi-Ethnic Study of Atherosclerosis
METS	Metabolic equivalents
MI	Myocardial infarction
MPI	Myocardial perfusion imaging
PCI	Percutaneous coronary intervention
PFT	Pulmonary function test
RBBB	Right bundle branch block
SE	Stress echocardiography
TTE	Transthoracic echocardiography
WPW	Wolff-Parkinson-White syndrome

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POLICY HISTORY

Date	Summary
February 2024	• Removed "imaging" in; Equivocal, borderline, or discordant stress evaluation with continued symptoms concerning for CAD
April 2023	• Added Electrophysiology testing prior to ablation • Added Kawasaki/MIS-C section on follow up • Added statement about low pretest probability • Added statement on clinical indications not addressed in this guideline
February 2022	• Clarified "intermediate lesions are 50-69%" for ischemia-producing disease
January 2022	[Off-cycle review] • Deleted the requirement for stress echocardiography. • Changed to Intermediate and High probability chest pain patients now allowable as first line testing • Intermediate DTS patients now allowable for CCTA • Removed EF < 40%, keeping the existing EF< 50% systolic dysfunction, and adding symptomatic diastolic heart failure with no prior workup • Added a paragraph explaining the changes, new guidelines of November 2021 with contraindications within the overview section • Added section on when CCTA is preferred over ETT in low-risk patients • Deleted the phrasing 'scenarios that support MPI over SE' as it would no longer apply here. Replaced with 'Scenarios that can additionally support a CCTA over a regular exercise treadmill test in the low probability scenario'. • Deleted statement that MPI may be supported over CCTA in Poorly controlled atrial fibrillation/ectopy • Took out the word 'intermediate' in the phrase "The (symptomatic) low pretest probability patient who is able to exercise and has an interpretable ECG" • Removed section on Coronary Artery calcium scoring

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines: **CTA Aortogram with Runoff**	**Original Date: July 2008**
CPT Codes: 75635	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_035	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE

When vascular imaging of the aorta and both legs, i.e., CTA aortogram and runoff is desired (sometimes incorrectly requested as Abd/Pelvis CTA & Lower Extremity CTA Runoff), **only one authorization request is required, using CPT Code 75635 Abdominal Arteries CTA. This study provides for imaging of the abdomen, pelvis, and both legs.** The CPT code description is CTA aorto-iliofemoral runoff; abdominal aorta and bilateral ilio-femoral lower extremity runoff**.**

When separate requests for CTA abdomen and CTA Pelvis are encountered for processes involving both the abdomen and pelvis (but do NOT need to include legs/runoff), they need to be resubmitted as a single Abdomen/Pelvis CTA (to avoid unbundling). Otherwise, the exam should be limited to the appropriate area (i.e., Abdomen OR Pelvis) that includes the area of concern.

INDICATIONS FOR ABDOMINAL ARTERIES CTA (For evaluation of a vascular abnormality in the abdominal aorta and lower extremities)

For evaluation of known or suspected abdominal, pelvic, or peripheral vascular disease[1-4]

- For known or suspected peripheral arterial disease (such as claudication, or clinical concern for vascular causes of ulcers) when non-invasive studies (pulse volume recording, ankle-brachial index, toe brachial index, segmental pressures, or doppler ultrasound) are abnormal or equivocal
- For critical limb ischemia with **ANY** of the below clinical signs of peripheral artery disease. Ultrasound imaging is **not** needed. If done and negative, it should still be approved due to a high false negative rate[5, 6]
    - Ischemic rest pain
    - Tissue loss
    - Gangrene

Pre-operative evaluation

- Evaluation of interventional vascular procedures for luminal patency versus restenosis due to conditions such as atherosclerosis, thromboembolism, and intimal hyperplasia

Post-operative or post-procedural evaluation

- Evaluation of post-operative complications, e.g., pseudoaneurysms related to surgical bypass grafts, vascular stents, and stent-grafts
- Follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.
- After stenting or surgery with signs of recurrent symptoms **OR** abnormal ankle/brachial index; abnormal or indeterminate arterial doppler; **OR** pulse volume recording[7]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam)

Chest CTA and Abdominal Arteries CTA Combos

To evaluate for an embolic source of lower extremity vascular disease. Echocardiography is also often needed, since the heart is the most commonly reported source of lower extremity emboli, accounting for 55 to 87 percent of events.

BACKGROUND

High resolution computed tomography angiography (CTA) provides a cost-effective and accurate imaging assessment in the diagnosis and follow-up of patients with aortic dissections or peripheral arterial disease (PAD).

OVERVIEW

Suspected Peripheral Arterial Disease – CTA (or MRA) is an excellent tool to diagnose lower extremity peripheral arterial disease (PAD). Benefits include the fast-scanning time and accurate detection of occlusions and stenosis. According to the Society for Vascular Surgery guidelines, "Measurement of the ankle-brachial index (ABI) is the primary method for establishing the diagnosis of PAD. An ABI of ≤0.90 has been demonstrated to have high sensitivity and specificity for the identification of PAD compared with the gold standard of invasive arteriography."[2] The presence of a normal ABI at rest and following exercise almost excludes atherosclerotic disease as a cause for leg claudication.[1, 8]

When an ABI is >1.40 (suggesting noncompressible calcified vessels) and clinical suspicion is high, other tests such as toe-brachial index <8, a resting toe pressure <40 mm Hg, a systolic peak posterior tibial artery flow velocity < 10cm/s may be used. "In symptomatic patients in whom revascularization treatment is being considered, we recommend anatomic imaging studies, such as arterial duplex ultrasound, CTA, MRA, and contrast arteriography."[2] This later statement is accompanied by a "B" (moderate) rating for the accompanying evidence ("A" = high, "C" = low) "In patients with limited renal function or planned surgical intervention, noninvasive imaging tests (particularly MRA and CTA) may obviate the need for diagnostic catheter angiography to visualize the location and severity of peripheral vascular disease."[1]

Follow-up imaging post vascular surgery procedures have not been well researched without clear surveillance protocols in place. Clinical exam, ABI and EUS within the first month of endovascular therapy are generally recommended to assess for residual stenosis, and again at 6 and 12 months, then annually. More sophisticated imaging with CTA, MRA, or invasive catheter angiography is reserved for complex cases.[9]

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POLICY HISTORY

Date	Summary
May 2023	• General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
April 2022	No substantive changes

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **BRAIN (HEAD) MRS**	**Original Date: April 2007**
CPT Codes: 76390, +0698T	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_003	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR BRAIN MRS[1]

- For the evaluation of a recurrent or residual brain tumor from post-treatment changes, e.g., radiation necrosis[2]
- For further evaluation of a brain lesion to distinguish a brain tumor from other non-tumor diagnoses (e.g., abscess or other infectious or inflammatory process)[3, 4]

BACKGROUND[3, 5]

Magnetic resonance spectroscopy (MRS) is a noninvasive imaging technique that determines the concentration of brain metabolites, such as N-acetylaspartate, choline, creatine, and lactate, within the body tissue examined. Radiofrequency waves are translated into biochemical composition of the scanned tissue; the resulting metabolic profile is useful in identifying brain tumors, e.g., differentiating neoplastic and non-neoplastic brain lesions. In selected cases, MRS may be a valuable supplement to MRI. It is sensitive, but nonspecific. This modality should be considered as an adjunct to conventional imaging rather than replacement for histopathological evaluation.

In terms of brain tumor evaluation and classification, carefully designed multi-center trials complying with criteria of evidence-based medicine have not yet been completed.[6]

Tumor Recurrence vs. Radiation Necrosis – Differentiation between recurrent brain tumors and treatment related injury, e.g., radiation necrosis, is difficult using conventional MRI. The typical appearance of radiation necrosis is similar to that of recurrent brain tumors. MRS is a quantitative approach, measuring various brain metabolic markers, to help in the differentiation of recurrent tumors and radiation necrosis. This differentiation is important as additional radiation can benefit recurrent disease but can be detrimental to radiation necrosis. MRS may help in determining treatment options and in preventing unnecessary surgery. In addition, a tumor recurrence diagnosed by MRS allows the surgeon to begin treatment early instead of having to wait for symptoms of recurrence or biopsy confirmation.[2, 7, 8] However, no consensus exists regarding the value of this in clinical decision making, and no approach has yet been validated to be sufficiently accurate.[2, 9, 10]

Glioma – MRS has been proposed for pre-operative grading of gliomas and differentiating high-grade gliomas (HGGs) from low-grade gliomas. It has been found to have moderate diagnostic value and should be combined with other advanced imaging techniques to improve accuracy. Currently, the data is limited; more research is needed for a definite conclusion for the utility of MRS for this indication. Therefore, it remains experimental/investigational.[11, 12]

MRS in other diseases – A role for MRS has been suggested in the management of neurodegenerative disease, epilepsy, and stroke. MRS can also be applied in conjunction with MRI in the evaluation of pediatric neurodegenerative disease, traumatic brain injury and neonatal hypoxia-ischemia.[13-15] However, to better define these roles, it will be necessary to standardize the MRS methodology, as well as the collection, analysis, and interpretation of data so it can be consistently translated to the applicable clinical settings. Currently, these potential applications remain experimental/investigational.[14]

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POLICY HISTORY

Date	Summary
May 2023	• Updated references • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
May 2022	Updated references and background section

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines: **UNLISTED STUDY**	**Original Date: September 2013**
76497 - Unlisted CT **76498 – Unlisted MRI**	**Last Revised Date: March 2023**
Guideline Number: Evolent_CG_063	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE

The CPT code that has been selected is considered to be an "unlisted code".

UNLISTED MRI

CPT Code 76498, Unlisted MRI, can be used in the context of:

- Radiation treatment planning
- Whole Body MRI requests related to Rare Genetic Disease Screening as determined by professional society recommendations (not an all-inclusive list - see background):
    - Li-Fraumeni Syndrome (LFS)
    - Constitutional Mismatch Repair Deficiency (CMMRD) syndrome
    - Hereditary retinoblastoma
    - Neurofibromatosis Type 1
    - Hereditary Paraganglioma-Pheochromocytoma (PGL/PCC) Syndrome
    - Rhabdoid Tumor Predisposition Syndrome (RTPS)

- Increased genetic risk related to other cancer-predisposing syndromes

For all other MRI studies, another CPT code should be selected that describes the specific service being requested; otherwise, this procedure cannot be approved.

***NOTE: If there is concern for bone marrow pathologies** (for example, diffuse or multifocal marrow disorders; chronic recurrent multifocal osteomyelitis; marrow involvement in storage diseases or progression of smoldering multiple myeloma (SMM) to multiple myeloma (MM) or high risk SMM patients) **a Bone Marrow MRI study may be more appropriate, please see NIA GL 059*.**

UNLISTED CT

CPT Code 76497, Unlisted CT, can be used in the context of:

- Low Dose Whole Body CT
  - Initial workup of plasma cell dyscrasia (to differentiate MGUS, smoldering, and active myeloma/plasmacytoma)
  - Initial staging of known or suspected of active or smoldering multiple myeloma/plasmacytoma
  - Restaging of known active or smoldering myeloma/plasmacytoma- annually if no change in patient status, or at shorter interval clinically indicated by signs/symptoms, laboratory, or radiographic concern for disease relapse or progression

For all other CT studies, another CPT code should be selected that describes the specific service being requested, otherwise this procedure cannot be approved.

BACKGROUND

Multiple myeloma is a clonal plasma cell proliferative disorder hallmark by primary infiltration of bone marrow and the production of abnormal immunoglobulins. Myeloma is the second most common hematologic malignancy after lymphoma. Osseous disease is the most prominent finding in patients with suspected multiple myeloma (including smoldering myeloma).

Given the increased sensitivity of cross-sectional imaging and low dose that the studies can be performed as this method is now preferred over skeletal radiographs. Whole body MRI without contrast, whole body low dose CT (WBLD CT) or PET/CT the initial study of choice to evaluate patients with known or suspected multiple myeloma and smoldering myeloma.[1, 2] Whole body imaging with MRI (or PET/CT if MRI is not available) is the initial study of choice for initial evaluation of solitary osseous plasmacytoma,[1, 2] which is ordered as Bone Marrow MRI. Whole body imaging with PET/CT is the first choice for initial imaging of solitary extraosseous plasmacytoma.[1, 2]

Summary of Key American Association of Cancer Research Recommendations for WB-MRI Screening in Cancer Predisposition Syndrome[3, 4]	
Li-Fraumeni syndrome	Every 12 mos. from diagnosis
Constitutional mismatch repair deficiency syndrome	Every 12 mos. beginning at 6-8 y old
Hereditary paraganglioma-pheochromocytoma syndrome	Every 24 mos. beginning at 6-8 y old
Hereditary retinoblastoma	Every 12 mos. beginning at 8 y old
Neurofibromatosis:	
Type 1	Baseline tumor burden assessment at 16–20 y old
Type 2	Considered based on symptoms and lesion location

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POLICY HISTORY

Date	Summary
March 2023	• Updated and background and references • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
April 2022	No changes

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **BREAST MRI**	**Original Date: September 1997**
CPT Codes: **Unilateral without contrast 77046** **Bilateral without contrast 77047** **Unilateral without and with contrast 77048** **Bilateral without and with contrast 77049** **+0698T**	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_023	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
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INDICATIONS FOR BREAST MRI

See Legislative Requirements for specific mandates in: Commonwealth of Pennsylvania; State of Connecticut; State of Illinois; State of North Carolina, State of Ohio

NO HISTORY OF KNOWN BREAST CANCER+

Dense breast tissue on mammography

- Inconclusive screening mammogram when category 0 has been specifically assigned due to breast characteristics limiting the sensitivity of mammography (e.g., extremely or heterogeneously dense breast, implants obscure breast tissue)

High risk screening breast MRI

- A Breast Cancer Risk Assessment (including the Breast Cancer Consortium Risk Model (BCSC) which incorporates breast density, the International Breast Cancer Intervention Study (IBIS)/

Tyrer-Cuzick model, the Breast and Ovarian Analysis of Disease Incidence and Carrier Estimation Algorithm model (BOADICEA), the modified Gail (also known as the Breast Cancer Risk assessment tool (BCRAT)) or other validated risk assessment models) that identifies the patient as having a lifetime risk of 20% or greater of developing breast cancer[1]
    - Approve annually beginning 10 years prior to youngest family member's age at diagnosis or at age 40, whichever comes first, but not before age 25[2-6]
- Patients with lifetime risk of 20% or greater of developing breast cancer based on history of lobular neoplasia (LCIS/ALH (Lobular Carcinoma in Situ /Atypical Lobular Hyperplasia)) or ADH (atypical ductal hyperplasia)
    - Approve annually beginning at age of diagnosis of LCIS/ALH or ADH but not prior to age 25[2]
- Patients with intermediate lifetime risk (15%-20%) of developing breast cancer based on a history lobular neoplasia (LCIS/ALH (Lobular Carcinoma in Situ /Atypical Lobular Hyperplasia)) or ADH (atypical ductal hyperplasia)) AND have dense breast tissue on mammography
    - Approve annually beginning at age of diagnosis of LCIS/ALH or ADH but not prior to age 25[2, 7, 8]
- Patients with history of extensive chest irradiation (usually as treatment for Hodgkin's or other lymphoma between ages ten and thirty)
    - Begin eight years after radiation, but not prior to age 25[2]
- Patients with known *BRCA 1/2* mutation
    - Approve annually starting at age 25[2, 3]
- Patients not yet tested for *BRCA* gene, but with known *BRCA* mutation in first-degree relative
    - Approve annually starting at age 25[2, 3]
- Personal history of germline mutations known to predispose to a high risk of breast cancer:[1]
    - Li-Fraumeni syndrome (*TP53* mutation)
        - Begin age 20-29 or age at earliest diagnosed breast cancer in family, if younger than age 20
    - Cowden syndrome (*PTEN*) or Bannayan-Riley-Ruvalcaba syndrome (BRRS)
        - Begin age 35 or 10 years before earliest breast cancer diagnosis in family, whichever comes first (NCCN 2022)
    - *ATM*
        - Begin age 30-35 years
    - *BARD1*
        - Begin age 40
    - *CDH1*
        - Begin age 30
    - *CHEK2*
        - Begin age 30-35 years
    - *NF1*
        - Begin age 30, end age 50[2]
    - *PALB2*
        - Begin age 30

- Peutz-Jeghers Syndrome (*STK11*)
  - Begin age 30
- RAD51C
  - Begin age 40
- RAD51D
  - Begin age 40

[+]For screening examination to detect breast cancer in any of the following situations. It is appropriate to perform screening breast MRI at routine intervals in patients at increased risk who are lactating.

Contrast-enhanced MRI is not recommended during pregnancy due to the trans-placental passage of gadolinium and potential concern for the exposure of the fetus to gadolinium.

For evaluation of identified lesion, mass, or abnormality in breast in any of the following situations

- Evaluation of suspected breast cancer when other imaging examinations, such as ultrasound and mammography, and physical examination are inconclusive for the presence of breast cancer, and biopsy could not be performed (e.g., seen only in single view mammogram without ultrasound correlation)
  - Includes skin changes of suspected inflammatory breast cancer if conventional imaging and skin biopsies are first performed and negative[3, 9, 10]
- For evaluation of suspicious mass, lesion, distortion, or abnormality of the breast in patient with history of breast cancer when other imaging is inconclusive
- For cases of new nipple inversion when mammographic and sonographic findings are inconclusive, and a biopsy cannot be performed[11-13]
- Patients diagnosed with biopsy-proven lobular neoplasia, i.e., LCIS/ALH (Lobular Carcinoma in Situ /Atypical Lobular Hyperplasia) or ADH (atypical ductal hyperplasia)[2, 3, 14, 15]
- Spontaneous unilateral serous or bloody nipple discharge when conventional imaging is interpreted as BI-RADS 1-3 and there is no palpable mass thought to be related to the discharge[2, 3, 16]
- Paget's disease of the nipple: to detect underlying ductal carcinoma when conventional imaging is interpreted as BI-RADS 1-3 and there is no palpable mass[3]
- For a phyllodes tumor diagnosed by biopsy, breast MRI may help determine extent of disease and resectability in selected cases. However routine use for surgical planning is controversial[17-19]
- Follow-up of a probably benign (BI-RADS 3) lesion seen only on prior MRI (when prior mammogram and ultrasound did not show the abnormality)[20-22]

HISTORY OF KNOWN BREAST CANCER

- Yearly surveillance for history of breast cancer and dense breast tissue on mammography[4]
- Yearly surveillance for individuals with personal history of breast cancer diagnosed before age 50[4]

- Yearly surveillance in patients with genetic or other risk factors placing them at high risk for a new cancer or recurrence[3, 23]
- Yearly surveillance for individuals with a mammographically occult primary breast cancer[24].

Staging, treatment, and surveillance of patients with a known history of Breast Cancer

- Approve for initial staging when conventional imaging is indeterminate in defining the extent of cancer, or presence of multifocal, multicentric, or contralateral cancer, or if there is a discrepancy in estimated tumor size between physical exam and imaging[2, 3, 14]
- For invasive lobular carcinoma that is poorly or inadequately defined by mammography, ultrasound, or physical exam[2, 14]
- To identify primary cancer in a patient with axillary nodal adenocarcinoma and unidentified primary tumor[2]
- Prior to treatment: To serve as a baseline for comparison prior to a patient starting planned neoadjuvant chemotherapy[25]
  During or after treatment: To identify candidates for breast conserving therapy or evaluate response to treatment, including preoperative neoadjuvant therapy [within three (3) months][3]

Silicone Implants

MRI is not indicated for evaluation of saline implant complications or for asymptomatic silicone implants.[4, 26]

- Confirmation of suspected silicone gel-filled breast implant ruptures in a*symptomatic* patients, after an abnormal or indeterminate finding on mammography or breast ultrasound
- MRI is considered the gold standard for evaluation of symptomatic silicone implant rupture.[3, 4] Prior imaging is not required in patients with silicone implants and symptoms of possible rupture.
- For postoperative evaluation of silicone breast implant complications when other imaging is inconclusive

Pre-operative

- For preoperative evaluation for known breast cancer when surgery planned within thirty (30) days to be determined on a case-by-case basis[3, 14, 27, 28]

Post-operative/procedural evaluation

A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested[4]

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

LEGISLATIVE REQUIREMENTS

- **Commonwealth of Pennsylvania**
    - The General Assembly of the Commonwealth of Pennsylvania hereby enacts as follows: Section 632 - Coverage for Mammographic Examinations and [Diagnostic] Breast Imaging and of the act of May 17, 1921 (P.L.682, No.284), known as The Insurance Company Law of 1921.
    - A group or individual health or sickness or accident insurance policy providing hospital or medical/surgical coverage and a group or individual subscriber contract or certificate issued by any entity subject to 40 Pa.C.S. Ch. 61 or 63, this act, the "Health Maintenance Organization Act," the "Fraternal Benefit Society Code" or an employe welfare benefit plan as defined in section 3 of the Employee Retirement Income Security Act of 1974 providing hospital or medical/surgical coverage shall also provide coverage for breast imaging.
        - The minimum coverage required shall include
            - supplemental magnetic resonance imaging or, if such imaging is not possible, ultrasound if recommended by the treating physician
            - all costs associated with one supplemental breast screening every year because the woman is believed to be at an increased risk of breast cancer due to:
                - personal history of atypical breast histologies
                - personal history or family history of breast cancer
                - genetic predisposition for breast cancer
                - prior therapeutic thoracic radiation therapy
                - heterogeneously dense breast tissue based on breast composition categories of the Breast Imaging and Reporting Data System established by the American College of Radiology with any one of the following risk factors
                    - lifetime risk of breast cancer of greater than 20%, according to risk assessment tools based on family history;
                    - personal history of BRCA1 or BRCA2 gene mutations;

        - first-degree relative with a BRCA1 or BRCA2 gene mutation but not having had genetic testing herself;
        - prior therapeutic thoracic radiation therapy between 10 and 30 years of age; or
        - personal history of Li-Fraumeni syndrome, Cowden syndrome or Bannayan-Riley-Ruvalcaba syndrome or a first-degree relative with one of these syndromes; or
        - extremely dense breast tissue based on breast composition (categories of the Breast Imaging and Reporting Data System established by the American College of Radiology)
    - Nothing in this subsection shall be construed to require an insurer to cover the surgical procedure known as mastectomy or to prevent the application of deductible, copayment or coinsurance provisions contained in the policy or plan.
    - Nothing in this subsection shall be construed as to preclude utilization review as provided under Article XXI of this act or to prevent the application of deductible, copayment or coinsurance provisions contained in the policy or plan for breast imaging in excess of the minimum coverage required.
    - As used in this section: "Supplemental breast screening" means a medically necessary and clinically appropriate examination of the breast using either standard or abbreviated magnetic resonance imaging or, if such imaging is not possible, ultrasound if recommended by the treating physician to screen for breast cancer when there is no abnormality seen or suspected in the breast.

  Source: Pennsylvania General Assembly, Senate Bill 8, Amended May 01, 2023[29]

- **State of Connecticut**
    - CT ST § 38a-530. Effective: October 1, 2020
        - Coverage for breast MRI is mandated within the State of Connecticut without coinsurance, copay of more than $20 deductible, or other out of pocket expenses for women with dense breast tissue if the woman is believed to be at increased risk of breast cancer because of family or personal history of breast cancer, positive genetic testing. Coverage is also mandated for other indications determined by a woman's physician, or when screening is recommended by a physician and the woman is over age 40, has a family or prior history of breast cancer or has breast disease diagnosed through biopsy as benign. This applies to high deductible plans unless plans are used to establish an HRA or HSA to the extent permitted by federal law. Though not designated in the original intent of the bill, language includes the above provisions and criteria for breast MRI.
    - Source: Connecticut General Assembly[30]

- **State of North Carolina**
  - Medicaid and NCHC cover magnetic resonance imaging (MRI) for the detection of:
    - Breast cancer in beneficiaries who are at a high genetic risk for breast cancer:
      - known BRCA 1 or 2 mutation in beneficiary;
      - known BRCA 1 or 2 mutation in relatives; or
      - pattern of breast cancer history in multiple first-degree relatives, often at a young age and bilaterally.
    - Breast cancer in beneficiaries who have breast characteristics limiting the sensitivity of mammography (such as dense breasts, implants, scarring after treatment for breast cancer).
    - A suspected occult breast primary tumor in beneficiaries with axillary nodal adenocarcinoma with negative mammography and clinical breast exam.
    - Breast cancer in beneficiaries with a new diagnosis of breast cancer. It can be used to determine the extent of the known cancer and/or to detect disease in the contralateral breast.
    - To evaluate implant integrity in beneficiaries with breast implants.
  - Source: NC Medicaid[31]; amended September 15, 2020

- **State of Illinois**
  Commercial, Exchange, and Medicaid
  - MRI of the entire breast or breasts is approvable for individuals 35 years or older
    - if a mammogram demonstrates heterogenous or dense breast tissue **OR**
    - when determined medically necessary by a physician licensed to practice medicine in all of its branches
  - Screening breast MRI approvable when determined medically necessary by a physician licensed to practice medicine in all of its branches

  Source: Illinois General Assembly
  Illinois General Assembly - Full Text of SB0162 (ilga.gov)[32]

- **State of Ohio**
  Medicaid
  - Section 1 (A)(3): "Supplemental breast cancer screening" means any additional screening method deemed medically necessary by a treating health care provider for proper breast cancer screening in accordance with applicable American college of radiology guidelines, including magnetic resonance imaging, ultrasound, or molecular breast imaging.
  - Section 1 (C)(2) The benefits provided under division (B)(2) of this section shall cover expenses for supplemental breast cancer screening for an adult woman who meets either of the following conditions:

- (a) The woman's screening mammography demonstrates, based on the breast imaging reporting and data system established by the American college of radiology, that the woman has dense breast tissue;
- (b) The woman is at an increased risk of breast cancer due to family history, prior personal history of breast cancer, ancestry, genetic predisposition, or other reasons as determined by the woman's health care provider.

Source: Ohio General Assembly – HB 371[33]
AM_134_3269-1 (state.oh.us)

BACKGROUND

Magnetic resonance imaging (MRI) of the breast is a useful tool for the detection and characterization of breast disease, assessment of local extent of disease, evaluation of treatment response, and guidance for biopsy and localization.[34] Breast MRI should always be bilateral to allow for assessment of symmetry between the breasts. MRI findings should be correlated with clinical history, physical examination, and the results of mammography and any other prior breast imaging.

OVERVIEW

MRI and risk evaluation – The age of a family member's diagnosis is **only** relevant for patients under the age of 40. Anyone 40 or over should be getting annual mammograms and breast MRIs if their lifetime risk is 20% or greater.

Nipple discharge – Nipple discharge is a common complaint with at least 80% of women having at least 1 episode. Discharge that is considered pathologic is unilateral, spontaneous, from one duct orifice and serous or bloody. Physiologic discharge will be bilateral, from multiple ducts, and white, green, or yellow in color. "In general, MRI may be considered in cases in which mammography and US have failed to identify an underlying cause of pathologic nipple discharge. The sensitivities of breast MRI for detecting the cause of the pathologic nipple discharge are 86% to 100% for invasive cancer and 40% to 100% for noninvasive disease".[35] Ductography (galactography) has the ability to demonstrate small lesions in the specific duct that is secreting the pathologic nipple discharge. However, it is invasive and may cause discomfort and pain. It can be time-consuming and technically challenging and the rate of inadequate or incomplete ductography is as high as 15%. The discharge must be present on the day of the study so that a cannula can be placed in the appropriate duct. Failure to cannulate the discharging duct may occur and cannulation of the wrong duct may cause a false-negative ductogram.[35]

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POLICY HISTORY

Date	Summary
May 2023	• Updated background • Updated references • Added dense breast to indications for breast MRI • Change screening ages based on society recommendations for high-risk conditions • Added language regarding lactating and pregnant patients • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging
September 2022	Added mandate language for State of Illinois
June 2022	• Added criteria for an intermediate lifetime risk of breast cancer • Reformatted mandates
April 2022	• Revised high-risk screening section for germline mutations • Updated background section on genetic syndromes • Updated citations

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **CT BONE DENSITY STUDY**	**Original Date: April 1999**
CPT Codes: 77078	**Last Revised Date: March 2023**
Guideline Number: Evolent_CG_060-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR CT BONE DENSITY STUDY

For first time baseline study[1-5]

Patient with <u>suspected</u> osteoporosis or osteopenia meeting any of the following criteria when DXA scanning is not available or for patients with advanced degenerative changes of the spine or who are severely obese (BMI > 35 kg/m) that may limit the efficacy of DXA scans

- Asymptomatic women 65 years of age or older
- For post-menopausal women age < 65 or during the menopause transition, and men < 70 having at least one of the following applicable risk factors for low bone mass or fractures:
    - Low body weight (< 127 lb. or 57.6 kg or BMI < 20 kg per m)
    - A history of fracture
    - History of maternal hip fracture that occurred after the age of 50 years
    - High risk medications (e.g., steroids or glucocorticosteroids, medroxyprogesterone acetate, anticonvulsants, heparin, lithium, estrogen receptor modulators, calcitonin, or bisphosphonates)
    - History of estrogen deficiency
    - History of amenorrhea for greater than 1 year before the age of 42

    - Conditions that cause or contribute to osteoporosis and fractures (e.g., malabsorption syndromes, inflammatory bowel disease and other gastrointestinal conditions, metabolic bone disease, hyperparathyroidism, hypogonadism, thyroid hormone therapy or hyperthyroidism, chemotherapy, long-term heparin therapy, rheumatologic and autoimmune diseases, renal failure, hematologic disorders, multiple myeloma, chronic alcoholism, cerebral palsy, etc.)
    - Current use of cigarettes
    - Loss of body height (> 4 cm (> 1.5 inches))[1]
- Men aged 70 or older
- Individuals with fragility fractures, including vertebral abnormalities that are indicative of osteoporosis, osteopenia, low bone mineral content, or vertebral fractures seen on other imaging studies/x-ray
- Individuals aged 50 years and older who develop a wrist, hip, spine, or proximal humerus fracture with minimal or no trauma, excluding pathologic fractures
- Eating disorders, including anorexia nervosa and bulimia
- Individuals who have had gastric bypass for obesity (accuracy of DXA may be affected by obesity)
- Males and females greater than or equal to 50 years of age with advanced degenerative changes of the spine (with or without scoliosis), or other conditions that may falsely elevate bone marrow density

Follow-up of individuals with <u>known</u> osteoporosis or osteopenia[6, 7]

- In women with low to moderate risk reassess fracture risk in 2-4 years
- In post-menopausal women with a low bone mineral density at high risk for fractures on treatment, monitor the spine and hip every 1-3 years
- For patients on bisphosphonates, reassess fracture risk every 3-5 years
- No previous bone density within past 23 months **AND** meets any one of the above risk factor criteria. (More frequent BMD testing may be warranted in certain clinical situations and should be determined on a case-by-case basis.)

Indications for QCT/pQCT in pediatric and adolescent include[8]:

- Individuals receiving (or expected to receive) glucocorticoid therapy for more than 3 months
- Individuals receiving radiation or chemotherapy for malignancies
- Individuals with an endocrine disorder known to adversely affect BMD (e.g., hyperparathyroidism, hyperthyroidism, growth hormone deficiency or Cushing's syndrome)
- Individuals with bone dysplasias known to have excessive fracture risk (osteogenesis imperfecta, osteopetrosis) or high BMD, such as prolonged exposure to fluoride

- Individuals with medical conditions that could alter bone marrow density, such as: (chronic renal failure, inflammatory arthritides, eating disorders, organ transplantation, prolonged immobilization, sprue, inflammatory bowel disease, malnutrition, cystic fibrosis, osteomalacia, acromegaly, cirrhosis, HIV infection, prolonged exposure to fluorides, and hematologic disorders (thalassemia, sickle cell disease))

BACKGROUND

Bone mineral density (BMD) measurement identifies patients with low bone density and increased fracture risk. Methods for measuring BMD are non-invasive, painless, and available on an outpatient basis. Dual energy x-ray absorptiometry (DXA), previously referred to as DEXA, is the most commonly used method of evaluating BMD and is the only BMD technology for which World Health Organization (WHO) criteria for the diagnosis of osteoporosis can be used. Patients who have a BMD that is 2.5 standard deviations below that of a "young normal" adult (T-score at or below -2.5) are deemed to have osteoporosis. Quantitative computed tomography (QCT) has not been validated for WHO criteria but can identify patients with low BMD compared to the QCT reference database, and it can be used to identify patients who are at risk of fracture.

OVERVIEW:

DXA – Dual energy x-ray absorptiometry (DXA) is most often used to measure bone mineral density due to its low radiation exposure, low precision error, and capacity to measure multiple skeletal sites (spine, hip, or total body).

Axial DXA – This provides the "gold standard". Axial DXA predicts fracture risk at the site being measured.

Peripheral DXA – This device measures BMD at peripheral sites, generally at the heel or wrist. It is relatively cheap and portable and is an option when there is limited access to axial DXA.

Quantitative computed tomography (QCT) – QCT measures volumetric integral, trabecular, and cortical bone density at the spine and hip and can be used to determine bone strength. Radiation dose is increased when compared with DXA. Indications are the same for QCT as DXA; however, DXA is recommended as the first-line test in most cases.[1, 2]

Fracture Risk Assessment - The fracture risk assessment (FRAX) tool estimates the 10-year risk of having a fracture based on factors such as age, sex, body mass index (BMI), previous fractures, parental fracture history, glucocorticoid use, rheumatoid arthritis, and conditions predisposing to secondary osteoporosis (insulin-dependent diabetes, osteogenesis imperfecta in adults, untreated long-standing hyperthyroidism, hypogonadism or premature menopause (<45 years), chronic malnutrition, or malabsorption and chronic liver disease) and tobacco and

alcohol use. Based on FRAX, a 65-year-old woman, without any additional conditions increasing fracture risk, has a 9.3% 10-year risk of developing a fracture. This value is therefore used as the risk level cut-off recommending screening in patients younger than 65.[9]

Ethnicity and Screening - Due to the potential negative consequences of fractures and the lack of an optimal age at which to screen populations of different ethnicity, the US Preventive Services Task Force (USPSTF) now recommends screening all women aged 65 and older regardless of race and ethnicity.

Follow-up Imaging – Follow-up imaging is performed on patients at risk of developing osteoporosis or to evaluate the outcome of osteoporosis treatment. Follow-up imaging is generally performed at 1-2 years after initiation of therapy for osteoporosis and subsequently every 2 years unless clinical circumstances prompt earlier imaging. In patients at increased risk for developing osteoporosis, imaging may be performed more frequently, particularly with patients with certain medical conditions and taking medications predisposing to fracture. The later population includes those undergoing long-term therapy with common medications such as heparin or glucocorticoids.

Pediatric and Adolescent patients - As QCT can assess both volume and density of bone in the axial and appendicular skeleton, it may be more useful than DXA scans in children. Bone mineral density measurement in children and adolescents is indicated whenever clinical management is likely to be impacted by the test results.

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POLICY HISTORY

Date	Summary
March 2023	• Updated references • Added section on DJD of spine and qCT • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Removed additional resources
April 2022	• Added new section regarding pediatric and adolescent patients

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*Evolent	
Clinical guidelines **BONE MARROW MRI**	**Original Date: July 2008**
CPT Codes: 77084	**Last Revised Date: March 2023**
Guideline Number: Evolent_CG_059	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR BONE MARROW MRI (images entire body)

- For the diagnosis, staging and follow-up of patients with multiple myeloma (MM), as well as leukemia and other related hematological malignancies[1-3]
- Suspected progression of smoldering multiple myeloma (SMM) to multiple myeloma (MM) or high risk SMM patients[3-5]
- Diagnosis and assessment of treatment response in diffuse or multifocal marrow disorders (e.g., chronic recurrent multifocal osteomyelitis; marrow involvement in storage diseases, such as Gaucher's, or hematologic malignancies/ processes (e.g., Waldenström macroglobulinemia) when the diagnosis is in doubt)[6-8]

NOTE: If the request is for whole body MRI screening for a rare genetic predisposition syndrome (such as Li-Fraumeni syndrome (LFS) constitutional mismatch repair deficiency (CMMRD) syndrome, neurofibromatosis type 1 etc.) an unlisted MRI study may be more appropriate, please see NIA GL 063*.

BACKGROUND

Magnetic Resonance Imaging (MRI) is currently used for the detection of metastatic disease to the bone marrow. Bone marrow MRI, using moving tables and special coils to survey the whole body, is used for screening to search for primary tumors and metastases. The unique soft tissue contrast of MRI enables precise assessment of bone marrow infiltration and adjacent soft tissues allowing detection of alterations within the bone marrow earlier than with other imaging modalities. MRI results in a high detection rate for both focal and diffuse disease, mainly due to its high sensitivity in directly assessing the bone marrow components: fat- and water-bound protons.

When bone marrow MRI is indicated, it is a single CPT code study with large field of view images covering the osseous structures, usually in two planes. The study covers from the vertex to the heels. Individual CPT codes corresponding to multiple separate studies of portions of the axial and appendicular skeleton are not necessary for bone marrow MRI.

Some conditions with diffuse marrow infiltration are not confined to the musculoskeletal system. Additional dedicated organ MRI exams may also be required for these patients.

OVERVIEW

MRI allows bone marrow components to be visualized and is the most sensitive technique for the detection of bone marrow pathologies. The soft tissue contrast of MRI enables detection of alterations within the bone marrow before osseous destruction becomes apparent on CT. Whole body bone marrow MRI has been applied for bone marrow screening of metastasis, as well as for systemic primary bone malignancies, such as multiple myeloma (MM). Sensitive detection is mandatory to estimate prognosis and to determine adequate therapy.

Multiple myeloma and related conditions include: “1. Multiple myeloma- monoclonal proliferation of plasma cells with myeloma-defining CRAB (Calcium level elevation, Renal failure, Anemia, or Bone lesions) findings; 2. MGUS (monoclonal gammopathy of undetermined significance) - monoclonal proliferation of plasma cells without myeloma-defining CRAB; 3. Solitary plasmacytoma – monoclonal plasma cells manifesting as a single tumor; and 4. Smoldering myeloma - monoclonal proliferation of plasma cells in bone marrow and/or serum/urine with abnormal levels of monoclonal protein.”[9]

MRI findings are included as one of the International Myeloma Working Group (IMWG) diagnostic criteria of active myeloma.[2] Although MRI is not the only imaging tool for diagnosis, when “more than one focal lesion on MRI that is at least 5 mm or greater in size” in addition to >10% clonal bone marrow plasma cells, the diagnosis of active myeloma can be made. For smoldering multiple myeloma (SMM), defined as asymptomatic patients with increased levels of M protein and increased bone marrow plasma cells, “The IMWG now recommends that one of following: PET-CT, Low dose whole body CT (LDWBCT), or MRI of the whole body or spine (Bone marrow MRI) be done in all patients with suspected smoldering myeloma, with the exact

imaging modality determined by availability and resources".[4, 10] The importance of imaging in the diagnosis of active myeloma is highlighted as "The IMWG consensus statement now recommends that SMM patients with more than one unequivocal focal lesion (diameter > 5 mm) should be considered to have symptomatic myeloma that requires treatment".[2] Recent advances have allowed the identification of a subset of SMM patients with a greater than 80% risk of progression to MM in 2 years based on biomarkers.[5]

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POLICY HISTORY

Date	Summary
March 2023	• Removed duplicate statement for treatment follow up • Updated references • Removed additional resources • Added statement on clinical indications not addressed in this guideline
April 2022	• Added statement for whole body MRI related to genetic predisposition syndromes

Reviewed / Approved by Clinical Guideline Committee

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Clinical guidelines **HEART (Cardiac) PET with CT for Attenuation**	**Original Date: July 1999**
CPT Codes: 78459, 78491, 78492, +78434, 78429, 78430, 78431, 78432, 78433	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_079	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

This guideline is for stress imaging, specifically Heart (Cardiac) PET imaging, with appropriate preference for suitable alternatives, such as stress echocardiography (SE) or myocardial perfusion imaging (MPI), when more suitable, unless otherwise stated (refer to Background section).

INDICATIONS FOR HEART PET WITH CT FOR ATTENUATION[1-4]

- **SUSPECTED CAD (When neither SE nor MPI have provided or are expected to provide optimal imaging)**
  Symptomatic patients without known CAD (use Diamond Forrester Table)
  - Low or intermediate pretest probability and unable to exercise *(SE diversion not required)*
  - High pretest probability *(SE diversion not required)*
  - Repeat testing in a patient with new or worsening symptoms and negative result at least one year ago **AND** meets one of the criteria above
- **Asymptomatic patients without known CAD** *(SE diversion not required)*

- Previously unevaluated ECG evidence of possible myocardial ischemia including substantial ischemic ST segment or T wave abnormalities (see section in Overview)
- Previously unevaluated pathologic Q waves (see section in Overview)
- Unevaluated complete left bundle branch block

ABNORMAL CALCIUM SCORES (CAC)[4-8] (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)

- ASYMPTOMATIC patient with a calcium score >400, not previously evaluated
- SYMPTOMATIC patient with prior CAC ≥ 100

INCONCLUSIVE CAD EVALUATION AND OBSTRUCTIVE CAD REMAINS A CONCERN (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)

- Exercise stress ECG with low-risk Duke treadmill score (≥5), (see section in Overview) but patient's current symptoms indicate an intermediate or high pretest probability *(SE diversion not required* for high pretest probability)
- Exercise stress ECG with an intermediate Duke treadmill score (*SE diversion not required for symptoms consistent with high pretest probability*)
- Inconclusive/borderline coronary computed tomography angiography (CCTA) (e.g., 40 - 70% lesions)
- Non-diagnostic exercise stress test with physical inability to achieve target heart rate (THR) *(SE diversion not required)*
- An intermediate evaluation by prior stress imaging () *(SE diversion not required)*
- Coronary stenosis of unclear significance on previous coronary angiography[4]

FOLLOW-UP OF PATIENT'S POST CORONARY REVASCULARIZATION (PCI or CABG) (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)[4]

- **Asymptomatic, follow-up stress imaging** at a minimum of 2 years post coronary artery bypass grafting (CABG), or percutaneous coronary intervention (PCI), (whichever is later), is appropriate only for patients with a history of silent ischemia or a history of a prior left main stent

  OR

- For patients with high occupational risk (e.g., associated with public safety, airline and boat pilots, bus and train drivers, bridge and tunnel workers/toll collectors, police officers, and firefighters)

New, recurrent, or worsening symptoms post coronary revascularization, is an indication for stress imaging, if it will alter management (SE diversion not required for typical anginal symptoms or symptoms documented to be similar to those prior to revascularization)

FOLLOW-UP OF KNOWN CAD (When neither SE nor MPI have provided or are expected to provide optimal imaging)

- **Follow-up of asymptomatic or stable symptoms** when last invasive or non-invasive assessment of coronary disease showed hemodynamically significant CAD (ischemia on stress test or FFR ≤ 0.80 or significant stenosis in a major vessel (≥ 50% left main coronary artery or ≥ 70% LAD, LCX, RCA)) over two years ago, without intervening coronary revascularization is an appropriate indication for stress imaging in patients if it will alter management

SPECIAL DIAGNOSTIC CONDITIONS REQUIRING CORONARY EVALUATION (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)

- Prior acute coronary syndrome (as documented in MD notes), without subsequent invasive or non-invasive coronary evaluation
- Newly diagnosed systolic heart failure or diastolic heart failure, *with reasonable suspicion of cardiac ischemia (prior events, risk factors*), unless invasive coronary angiography is immediately planned[2, 9, 10]
- Reduced LVEF ≤ 50% requiring myocardial viability assessment to assist with decisions regarding coronary revascularization. (Diversion from PET not required when LVEF less than or equal to 40%)[9-11]
- Ventricular arrhythmias
    - Sustained ventricular tachycardia (VT) > 100 bpm, ventricular fibrillation (VF), or exercise-induced VT, when invasive coronary arteriography is not the immediately planned test[12]
    - Nonsustained VT, multiple episodes, each ≥ 3 beats at ≥ 100 bpm, frequent PVC's (defined as greater than or equal to 30/hour on remote monitoring) without known cause or associated cardiac pathology, when an exercise ECG cannot be performed
- Prior to Class IC antiarrhythmic drug initiation (Propafenone or Flecainide), as well as annually in intermediate and high global risk patients (SE diversion not required)[13]
- Assessment of hemodynamic significance of one of the following documented conditions[14]:
    - Anomalous coronary arteries[15]
    - Muscle bridging of coronary artery [4, 16]
- Coronary aneurysms in Kawasaki's disease[17] or due to atherosclerosis
- Following radiation therapy to the anterior or left chest, at 5 years post initiation and every 5 years thereafter[18]
- To diagnose microvascular dysfunction in patients with persistent stable anginal chest pain with suspected ischemia and nonobstructive coronary artery disease (INOCA), as documented in provider notes (*no MPI diversion required*).[19]

- **Cardiac Sarcoidosis[20-22]** (may be approved as a combination study with MPI for the evaluation and treatment of sarcoidosis)[23]
    - Evaluation and therapy monitoring in patients with sarcoidosis, after documentation of suspected cardiac involvement by echo or ECG, when CMR has not been performed
    - Evaluation of suspected cardiac sarcoid, after CMR has shown equivocal or negative findings in the setting of a high clinical suspicion[22]
    - Evaluation of CMR findings showing highly probable cardiac sarcoidosis, when PET could serve to identify inflammation and the consequent potential role for immunosuppressive therapy[22]
    - Initial and follow-up PET in monitoring therapy for cardiac sarcoid with immunosuppressive therapy, typically about 4 times over 2 years
- **Infective Endocarditis**
    - In suspected infective endocarditis with moderate to high probability (i.e., staph bacteremia, fungemia, prosthetic heart valve, or intracardiac device), when TTE and TEE have been inconclusive with respect to diagnosis of infective endocarditis or characterization of paravalvular invasive complications[24-26]
- **Aortitis**
    - For diagnosis and surveillance of Aortitis, PET/CT or PET/MRI‡ hybrid imaging[27]
      ‡**NOTE:** If PET/MR study is requested, there is no specific CPT Code for this imaging study and a Health Plan review will be required.

PRIOR TO ELECTIVE NON-CARDIAC SURGERY (When neither SE nor MPI have provided or are expected to provide optimal imaging)

- An intermediate or high risk surgery with of one or more risk factors (see below), AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year[28-30]*
    - **Risk factors:** history of ischemic heart disease, history of congestive heart failure, history of cerebrovascular disease, preoperative treatment with insulin, and preoperative serum creatinine >2.0 mg/dL.
    - **Surgical Risk:**
        - **High risk surgery:** Aortic and other major vascular surgery, peripheral vascular surgery, anticipated prolonged surgical procedures associated with large fluid shifts and/or blood loss
        - **Intermediate risk surgery:** Carotid endarterectomy, head and neck surgery, intraperitoneal and intrathoracic surgery, orthopedic surgery, prostate surgery
        - **Low risk surgery**: Endoscopic procedures, superficial procedure, cataract surgery, breast surgery

- Planning for any organ or stem cell transplantation is an indication for preoperative stress imaging, if there has not been a conclusive stress evaluation, CTA, or heart catheterization within the past year, at the discretion of the transplant service[31]

POST CARDIAC TRANSPLANT (SE diversion not required)[32]

- Annually, for the first five years post cardiac transplantation, in a patient not undergoing invasive coronary arteriography
- After the first five years post cardiac transplantation, patients with documented transplant coronary vasculopathy can be screened annually if invasive coronary arteriography is not planned

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BACKGROUND[33, 34]

Cardiac PET scanning, when used in conjunction with CT attenuation, includes evaluation of perfusion, function, viability, inflammation, anatomy, and risk stratification for cardiac-related events such as myocardial infarction and death. Maximum diagnostic accuracy of cardiac PET/CT is achieved when images are interpreted in conjunction with other relevant imaging, clinical information, and laboratory data.

PET Scan

- Indicated when all the criteria for MPI are met **AND** there is likely to be equivocal imaging results because of BMI, large breasts or implants, mastectomy, chest wall deformity, pleural or pericardial effusion or prior thoracic surgery or results of a prior MPI
- Can identify regions of myocardial viability with hibernating myocardium (viable, with poor flow and contractility) by imaging with fluorine18 (F-18) fluorodeoxyglucose (FDG or 18-FDG) for this purpose
- Useful in the evaluation of inflammation: e.g., evaluation and therapy monitoring in patients with sarcoidosis, after documentation of cardiac involvement by echo or electrocardiography (ECG), in place of, or subsequent to CMR if needed to help with an uncertain diagnosis

Coronary application of PET includes evaluation of **stable patients without known CAD**, who fall into two categories[2-4]

- **Asymptomatic**, for whom global risk of CAD events can be determined from coronary risk factors, using calculators available online (see websites for Global Cardiovascular Risk Calculators section).
- **Symptomatic,** for whom we estimate the pretest probability that their chest-related symptoms are due to clinically significant (≥ 50%) CAD (below):

The 3 Types of Chest Pain or Discomfort

- **Typical Angina (Definite)** is defined as including all **3** characteristics:
    - Substernal chest pain or discomfort with characteristic quality and duration
    - Provoked by exertion or emotional stress
    - Relieved by rest and/or nitroglycerine
- **Atypical Angina (Probable)** has only **2** of the above characteristics
- **Nonanginal Chest Pain/Discomfort** has only **0 - 1** of the above characteristics

The medical record should provide enough detail to establish the type of chest pain. From those details, The Pretest Probability of obstructive CAD is estimated from the **Diamond Forrester Table** below, recognizing that in some cases multiple additional coronary risk factors could increase pretest probability[2, 4]:

Diamond Forrester Table

Age (Years)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain
≤ 39	Men	Intermediate	Intermediate	Low
	Women	Intermediate	Very low	Very low
40 – 49	Men	High	Intermediate	Intermediate
	Women	Intermediate	Low	Very low
50 – 59	Men	High	Intermediate	Intermediate
	Women	Intermediate	Intermediate	Low
≥ 60	Men	High	Intermediate	Intermediate
	Women	High	Intermediate	Intermediate

- **Very Low:** < 5% pretest probability, usually not requiring stress evaluation
- **Low:** 5 - 10% pretest probability of CAD
- **Intermediate:** 10% - 90% pretest probability of CAD
- **High: > 90% pretest probability of CAD**

OVERVIEW

ECG Stress Test Alone versus Stress Testing with Imaging

Prominent scenarios suitable for an ECG stress test WITHOUT imaging (i.e., exercise treadmill ECG test) require that the patient can exercise for at least 3 minutes of Bruce protocol with achievement of near maximal heart rate AND has an interpretable ECG for ischemia during exercise[4]:

- The (symptomatic) low or intermediate pretest probability patient who can exercise and has an interpretable ECG[4]
- The patient who is under evaluation for exercise-induced arrhythmia

- The patient who requires an entrance stress test ECG for a cardiac rehab program or for an exercise prescription
- For the evaluation of syncope or presyncope during exertion[35]

Duke Exercise ECG Treadmill Score

Calculates risk from ECG treadmill alone[36]:

- The equation for calculating the Duke treadmill score (DTS) is: DTS = exercise time in minutes - (5 x ST deviation in mm or 0.1 mV increments) - (4 x exercise angina score), with angina score being 0 = none, 1 = non-limiting, and 2 = exercise-limiting.
- The score typically ranges from - 25 to + 15. These values correspond to low-risk (with a score of ≥ + 5), intermediate risk (with scores ranging from - 10 to + 4), and high-risk (with a score of ≤ - 11) categories.

An uninterpretable baseline ECG includes[2]:

- ST segment depression 1 mm or more (not for non-specific ST- T wave changes)
- Ischemic looking T waves; at least 2.5 mm inversions (excluding V1 and V2)
- LVH with repolarization abnormalities, pre-excitation pattern such as WPW, ventricular paced rhythm, or left bundle branch block
- Digitalis use with associated ST segment abnormalities

Previously unevaluated pathologic Q waves (in two contiguous leads) defined as the following:

- > 40 ms (1 mm) wide
- > 2 mm deep
- > 25% of depth of QRS complex

Global Risk of Cardiovascular Disease

Global risk of CAD is defined as the probability of manifesting cardiovascular disease over the next 10 years and refers to **asymptomatic** patients without known cardiovascular disease. It should be determined using one of the risk calculators below. A high risk is considered greater than a 20% risk of a cardiovascular event over the ensuing 10 years. **High global risk by itself generally lacks scientific support as an indication for stress imaging.** There are rare exemptions, such as patients requiring I-C antiarrhythmic drugs who might require coronary risk stratification prior to initiation of the drug.

- **CAD Risk—Low**
  10-year absolute coronary or cardiovascular risk less than 10%
- **CAD Risk—Moderate**
  10-year absolute coronary or cardiovascular risk between 10% and 20%
- **CAD Risk—High**
  10-year absolute coronary or cardiovascular risk of greater than 20%

Websites for Global Cardiovascular Risk Calculators*

Risk Calculator	Websites for Online Calculator
Framingham Cardiovascular Risk	https://reference.medscape.com/calculator/framingham-cardiovascular-disease-risk
Reynolds Risk Score Can use if no diabetes Unique for use of family history	http://www.reynoldsriskscore.org/
Pooled Cohort Equation	http://clincalc.com/Cardiology/ASCVD/PooledCohort.aspx?example
ACC/AHA Risk Calculator	http://tools.acc.org/ASCVD-Risk-Estimator/
MESA Risk Calculator With addition of Coronary Artery Calcium Score, for CAD-only risk	https://www.mesa-nhlbi.org/MESACHDRisk/MesaRiskScore/RiskScore.aspx

*Patients who have already manifested cardiovascular disease are already at high global risk and are not applicable to the calculators.[37-40]

Definitions of Coronary Artery Disease[2, 3, 6]

Percentage stenosis refers to the reduction in diameter stenosis when angiography is the method and can be estimated or measured using angiography or more accurately measured with intravascular ultrasound (IVUS).

- Coronary artery calcification is a marker of risk, as measured by Agatston score on coronary artery calcium imaging. Its incorporation into global risk can be achieved by using the MESA risk calculator.
- Ischemia-producing disease (also called hemodynamically or functionally significant disease, for which revascularization might be appropriate) generally implies at least one of the following:
    - Suggested by percentage diameter stenosis ≥ 70% by angiography; intermediate lesions are 50 – 69%[41]
    - For a left main artery, suggested by a percentage stenosis ≥ 50% or minimum lumen cross-sectional area on IVUS ≤ 6 square mm^2 [2, 42]
    - FFR (fractional flow reserve) ≤ 0.80 for a major vessel[42]
    - Demonstrable ischemic findings on stress testing (ECG or stress imaging), that are at least mild in degree
- A major vessel would be a coronary vessel that would be amenable to revascularization if indicated. This assessment is made based on the diameter of the vessel and/or the extent of myocardial territory served by the vessel.

- FFR (fractional flow reserve) is the distal to proximal pressure ratio across a coronary lesion during maximal hyperemia induced by either intravenous or intracoronary adenosine. Less than or equal to 0.80 is considered a significant reduction in coronary flow.
- Newer technology that estimates FFR from CCTA image is covered under the separate NIA Guideline for FFR-CT.

Anginal Equivalent[2, 35]

Development of an anginal equivalent (e.g., shortness of breath, fatigue, or weakness) either with or without prior coronary revascularization should be based upon the documentation of reasons to suspect that symptoms other than chest discomfort are not due to other organ systems (e.g., dyspnea due to lung disease, fatigue due to anemia), by presentation of clinical data, such as respiratory rate, oximetry, lung exam, etc. (as well as d-dimer, chest CT(A), and/or PFTs, when appropriate), and then incorporated into the evaluation of coronary artery disease as would chest discomfort. Most syncope per se is not an anginal equivalent.

Abbreviations

ADLs	Activities of daily living
BMI	Body mass index
CABG	Coronary artery bypass grafting
CAC	Coronary artery calcium
CAD	Coronary artery disease
CCTA	Coronary computed tomography angiography
CMR	Cardiac magnetic resonance imaging
CT(A)	Computed tomography (angiography)
DTS	Duke Treadmill Score
ECG	Electrocardiogram
FFR	Fractional flow reserve
IVUS	Intravascular ultrasound
LBBB	Left bundle-branch block
LVEF	Left ventricular ejection fraction
LVH	Left ventricular hypertrophy
MESA	Multi-Ethnic Study of Atherosclerosis
MET	Estimated metabolic equivalent of exercise
MI	Myocardial infarction
MPI	Myocardial perfusion imaging
MR(I)	Magnetic resonance (imaging)
PCI	Percutaneous coronary intervention
PET	Positron emission tomography
PFT	Pulmonary function test
PVCs	Premature ventricular contractions
SE	Stress echocardiography
TEE	Transesophageal echocardiography
THR	Target heart rate
TTE	Transthoracic echocardiography
VF	Ventricular fibrillation
VT	Ventricular tachycardia
WPW	Wolff-Parkinson-White

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Policy History

Date	Summary
May 2023	• Removed time limitation "within past two years" for further evaluation inconclusive prior CAD evaluation • Added coronary stenosis of unclear significance on previous coronary angiography • Added indication for evaluation of ischemia and nonobstructive coronary artery disease (INOCA) • Clarified indication for PET/MPI combination study for evaluation of cardiac sarcoidosis • Added statement on clinical indications not addressed in this guideline
February 2022	• Moved the sentence regarding utilization of suitable alternatives to the General Information section • Clarified evaluation of possible ischemia in newly diagnosed heart failure by stating *"with reasonable suspicion of cardiac ischemia (prior events, risk factors, or symptoms and signs)"* • Clarified "intermediate lesions are 50-69%" for ischemia-producing disease • Placed Link to Overview Section in General Information • Added stress imaging approval for calcium score > 100 with low to intermediate probability symptoms • Deleted the requirement for diabetes when calcium score > 400 for stress imaging • Added Calcium score section: ○ Added stress imaging approval for calcium score > 100 with symptoms consistent with low to intermediate pretest probability • Added reminder *(SE diversion not required for CABG)* • Changed preoperative guideline to include intermediate risk surgery with one or more risk factors AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year • Changed solid organ transplant guideline to include stem cell transplant and "any" organ transplant • Added definition of surgical risk to preop guidelines • In Background section clarified the requirement for description of chest pain by adding sentence "The medical record should provide enough detail to establish the type of chest pain." • Added definition of Q waves

	• Deleted sentence regarding calcium scoring within the Global Risk Section • Deleted sentence regarding using calcium score solely for risk stratification • Deleted redundant statement on viability • Deleted IFR references

Reviewed / Approved by Clinical Guideline Committee

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Clinical guidelines **MYOCARDIAL PERFUSION IMAGING** **(aka NUCLEAR CARDIAC IMAGING STUDY)**	**Original Date: October 2009**
CPT Codes: 78451, 78452, 78453, 78454, 78466, 78468, 78469, 78481, 78483, 78499, +0742T	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_024	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

This guideline is for stress imaging, specifically myocardial perfusion imaging (MPI), with appropriate preference for suitable alternatives, such as stress echocardiography (SE), when more suitable, unless otherwise stated (refer to Overview).

INDICATIONS for MPI[1-4]

SUSPECTED CORONARY ARTERY DISEASE (CAD)

- **Symptomatic patients without known CAD (use Diamond Forrester Table)**
  - Low or intermediate pretest probability and unable to exercise *(SE diversion not required)*
  - High pretest probability *(SE diversion not required)*
  - Repeat testing in a patient with new or worsening symptoms and negative result at least one year prior AND meets one of the criteria above
- **Asymptomatic patients without known CAD** *(SE diversion not required)*
  - Previously unevaluated ECG evidence of possible myocardial ischemia including ischemic ST segment or T wave abnormalities (see Overview section)
  - Previously unevaluated pathologic Q waves (see Overview section)

- Previously unevaluated complete left bundle branch block

ABNORMAL CALCIUM SCORES (CAC)[4-8]

- ASYMPTOMATIC patient with a calcium score > 400, not previously evaluated
- SYMPTOMATIC patient with prior CAC ≥ 100

INCONCLUSIVE CAD EVALUATION AND OBSTRUCTIVE CAD REMAINS A CONCERN

- Exercise stress ECG with low-risk Duke treadmill score (≥5), (see section in Overview) but patient's current symptoms indicate an intermediate or high pretest probability *(SE diversion not required* for high pretest probability)
- Exercise stress ECG with an intermediate Duke treadmill score *(SE diversion not required* for symptoms consistent with high pretest probability)
- Intermediate coronary computed tomography angiography (CCTA) (e.g., 40 - 70% lesions)
- Non-diagnostic exercise stress test with inability to achieve target heart rate (THR) *(SE diversion not required)*
- An indeterminate (equivocal, borderline, or discordant) evaluation by prior stress imaging (SE or CMR) *(SE diversion not required)*
- Coronary stenosis of unclear significance on previous coronary angiography[4]

FOLLOW-UP OF PATIENT'S POST CORONARY REVASCULARIZATION (PCI or CABG)[4]

- **Asymptomatic follow-up stress imaging** at a minimum of 2 years post coronary artery bypass grafting (CABG) or percutaneous coronary intervention (PCI) (whichever is later) is appropriate for patients with a history of silent ischemia or a history of a prior left main stent.[4] *(SE diversion not required for CABG)*

  OR

  For patients with high occupational risk, associated with public safety, airline and boat pilots, bus and train drivers, bridge and tunnel workers/toll collectors, police officers and firefighters *(SE diversion not required)*
- **New, recurrent, or worsening symptoms post coronary revascularization** is an indication for stress imaging, if it will alter management (SE diversion not required for typical anginal symptoms or symptoms documented to be similar to those prior to revascularization).

FOLLOW-UP OF KNOWN CAD

- **Follow-up of asymptomatic or stable symptoms** when last invasive or non-invasive assessment of coronary disease showed hemodynamically significant CAD (ischemia on stress test or FFR ≤ 0.80 or significant stenosis in a major vessel (≥ 50% left main coronary artery or ≥ 70 % LAD, LCX, RCA)), over two years ago, without intervening coronary revascularization is an appropriate indication for stress imaging in patients if it will alter management

SPECIAL DIAGNOSTIC CONDITIONS REQUIRING CORONARY EVALUATION

- Prior acute coronary syndrome (with documentation in MD notes), without invasive or non-invasive coronary evaluation *(SE diversion not required)*
- Newly diagnosed systolic heart failure or diastolic heart failure, *with reasonable suspicion of cardiac ischemia (prior events, risk factors*), unless invasive coronary angiography is immediately planned *(SE diversion not required)*[1, 9-11]
- LVEF requiring myocardial viability assessment to assist with decisions regarding coronary revascularization[9, 12]
- Ventricular arrhythmias
    - Sustained ventricular tachycardia (VT) > 100 bpm, ventricular fibrillation (VF), or exercise-induced VT, when invasive coronary arteriography is not immediately planned[13] *(SE diversion not required)*
    - Nonsustained VT, multiple episodes, each ≥ 3 beats at ≥ 100 bpm, or frequent PVCs (defined as greater than or equal to 30/hour on remote monitoring) without known cause or associated cardiac pathology, when an exercise ECG cannot be performed[14]
- Prior to initiation of Class IC antiarrhythmic drug initiation (Propafenone or Flecainide), as well as annually in intermediate and high global risk patients *(SE diversion not required)* [15]
- Assessment of hemodynamic significance of one of the following documented conditions:
    - Anomalous coronary arteries[16]
    - Myocardial bridging of coronary artery
- Coronary aneurysms in Kawasaki's disease[17] or due to atherosclerosis
- Following radiation therapy to the anterior or left chest, at 5 years post initiation and every 5 years thereafter[18]
- Cardiac sarcoidosis: as a combination study with Heart PET for the evaluation and treatment of cardiac sarcoidosis.[19]
- Cardiac amyloidosis: for the diagnosis of cardiac transthyretin amyloidosis (ATTR). **Not** to be used for the diagnosis of cardiac light chain amyloidosis (AL)[20]

PRIOR TO ELECTIVE NON-CARDIAC SURGERY IN ASYMPTOMATIC PATIENT

- An intermediate or high risk surgery with of one or more risk factors (see below), AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year[21-23]
    - **Risk factors:** history of ischemic heart disease, history of congestive heart failure, history of cerebrovascular disease, preoperative treatment with insulin, and preoperative serum creatinine >2.0 mg/dL.
    - **Surgical Risk:**
        - **High risk surgery:** Aortic and other major vascular surgery, peripheral vascular surgery, anticipated prolonged surgical procedures associated with large fluid shifts and/or blood loss
        - **Intermediate risk surgery:** Carotid endarterectomy, head and neck surgery, intraperitoneal and intrathoracic surgery, orthopedic surgery, prostate surgery

        - **Low risk surgery**: Endoscopic procedures, superficial procedure, cataract surgery, breast surgery
- Planning for any organ or stem cell transplantation is an indication for preoperative MPI, if there has not been a conclusive stress evaluation, CTA, or heart catheterization within the past year, at the discretion of the transplant service. [3, 24]

POST CARDIAC TRANSPLANT *(SE diversion not required)*

- Annually, for the first five years post cardiac transplantation, in a patient not undergoing invasive coronary arteriography
- After the first five years post cardiac transplantation, patients with documented transplant coronary vasculopathy can be screened annually unless invasive coronary arteriography is planned

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BACKGROUND

This guideline is for stress imaging, specifically myocardial perfusion imaging (MPI), with appropriate preference for alternatives, such as stress echocardiography (SE) or stress ECG alone when more suitable (see section below).

Radionuclide myocardial perfusion imaging (MPI) allows for evaluation of cardiac perfusion at rest and at exercise, as well as using pharmacologic agents for the diagnosis and management of coronary artery disease. With radionuclide MPI, pharmacologic stress may be performed with an inotropic agent or vasodilator. These agents are indicated for patients who cannot reach an adequate endpoint with physical exercise stress testing.[25]

Stable patients without known CAD fall into 2 categories[1, 3, 4]:

- **Asymptomatic**, for whom global risk of CAD events can be determined from coronary risk factors, using calculators available online (see Websites for Global Cardiovascular Risk Calculators section).
- **Symptomatic,** for whom we estimate the pretest probability that their chest-related symptoms are due to clinically significant CAD (below):

The 3 Types of Chest Pain or Discomfort

- **Typical Angina (Definite)** is defined as including all **3** characteristics:
    - Substernal chest pain or discomfort with characteristic quality and duration
    - Provoked by exertion or emotional stress
    - Relieved by rest and/or nitroglycerine
- **Atypical Angina (Probable)** has only **2** of the above characteristics
- **Nonanginal Chest Pain/Discomfort** has only **0 - 1** of the above characteristics

The medical record should provide enough detail to establish the type of chest pain. From those details, The Pretest Probability of obstructive CAD is estimated from the Diamond Forrester Table below, recognizing that in some cases multiple additional coronary risk factors could increase pretest probability[1, 4]:

Diamond Forrester Table

Age (Years)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain
≤ 39	Men	Intermediate	Intermediate	Low
	Women	Intermediate	Very low	Very low
40-49	Men	High	Intermediate	Intermediate
	Women	Intermediate	Low	Very low
50-59	Men	High	Intermediate	Intermediate
	Women	Intermediate	Intermediate	Low
≥ 60	Men	High	Intermediate	Intermediate
	Women	High	Intermediate	Intermediate

- **Very low:** < 5%pretest probability of CAD, usually not requiring stress evaluation
- **Low:** 5 - 10% pretest probability of CAD
- **Intermediate:** 10% - 90% pretest probability of CAD
- **High:** > 90% pretest probability of CAD

OVERVIEW

MPI may be performed without diversion to a SE in any of the following[4, 26]:

- Inability to Exercise
    - Physical limitations precluding ability to exercise for at least 3 full minutes of Bruce protocol
    - Limited functional capacity (< 4 METS) **such as one** of the following:
        - Unable to take care of their ADLs or ambulate
        - Unable to walk 2 blocks on level ground
        - Unable to climb 1 flight of stairs
- Other Comorbidities
    - Severe chronic obstructive pulmonary disease (COPD) with pulmonary function test (PFT) documentation, severe shortness of breath on minimal exertion, or requirement of home oxygen during the day
    - Poorly controlled hypertension, with systolic BP > 180 or diastolic BP > 120 (and clinical urgency not to delay MPI)
- ECG and Echo-Related Baseline Findings

    - Prior cardiac surgery (coronary artery bypass graft or valvular)
    - Documented poor acoustic imaging window
    - Left ventricular ejection fraction ≤ 40%
    - Pacemaker or ICD
    - Persistent atrial fibrillation
    - Resting wall motion abnormalities that would make SE interpretation difficult
    - Complete left bundle branch block (LBBB)
- Risk-Related scenarios
    - High pretest probability in suspected CAD
    - Intermediate or high global risk in patients requiring type IC antiarrhythmic drugs (prior to initiation of therapy and annually)
    - Arrhythmia risk with exercise
- Previously unevaluated pathologic Q waves (in two contiguous leads) defined as the following:
    - > 40 ms (1 mm) wide
    - > 2 mm deep
    - > 25% of depth of QRS complex

ECG Stress Test Alone versus Stress Testing with Imaging

Prominent scenarios suitable for an ECG stress test WITHOUT imaging (i.e., exercise treadmill ECG test) require that the patient can exercise for at least 3 minutes of Bruce protocol with achievement of near maximal heart rate **AND** has an interpretable ECG for ischemia during exercise[4]:

- The (symptomatic) low or intermediate pretest probability patient who can exercise and has an interpretable ECG[4]
- The patient who is under evaluation for exercise-induced arrhythmia
- The patient who requires an entrance stress test ECG for a cardiac rehab program or for an exercise prescription
- For the evaluation of syncope or presyncope during exertion[27]

Duke Exercise ECG Treadmill Score[28]

Calculates risk from ECG treadmill alone**:**

- The equation for calculating the Duke treadmill score (DTS) is: DTS = exercise time in minutes - (5 x ST deviation in mm or 0.1 mV increments) - (4 x exercise angina score), with angina score being 0 = none, 1 = non-limiting, and 2 = exercise-limiting
- The score typically ranges from - 25 to + 15. These values correspond to low-risk (with a score of ≥ + 5), intermediate risk (with scores ranging from - 10 to + 4), and high-risk (with a score of ≤ - 11) categories

An uninterpretable baseline ECG includes[1]:

- ST segment depression 1 mm or more; (not for non-specific ST- T wave changes)
- Ischemic looking T waves; at least 2.5 mm inversions (excluding V1 and V2)

- LVH with repolarization abnormalities, pre-excitation pattern such as WPW, ventricular paced rhythm, or LBBB
- Digitalis use with associated ST segment abnormalities
- Resting HR under 50 bpm on a medication, such as beta-blockers or calcium channel blockers, that is required for patient's treatment and cannot be stopped, with an anticipated suboptimal workload

Global Risk of Cardiovascular Disease

Global risk of CAD is defined as the probability of manifesting cardiovascular disease over the next 10 years and refers to **asymptomatic** patients without known cardiovascular disease. It should be determined using one of the risk calculators below. A high risk is considered greater than a 20% risk of a cardiovascular event over the ensuing 10 years. **High global risk by itself generally lacks scientific support as an indication for stress imaging.** There are rare exceptions, such as patients requiring IC antiarrhythmic drugs who might require coronary risk stratification prior to initiation of the drug.

- **CAD Risk—Low**
  10-year absolute coronary or cardiovascular risk less than 10%.
- **CAD Risk—Moderate**
  10-year absolute coronary or cardiovascular risk between 10% and 20%.
- **CAD Risk—High**
  10-year absolute coronary or cardiovascular risk of greater than 20%.

Websites for Global Cardiovascular Risk Calculators*[29-33]

Risk Calculator	Websites for Online Calculator
Framingham Cardiovascular Risk	https://reference.medscape.com/calculator/framingham-cardiovascular-disease-risk
Reynolds Risk Score Can use if no diabetes Unique for use of family history	http://www.reynoldsriskscore.org/
Pooled Cohort Equation	http://clincalc.com/Cardiology/ASCVD/PooledCohort.aspx?example
ACC/AHA Risk Calculator	http://tools.acc.org/ASCVD-Risk-Estimator/
MESA Risk Calculator With addition of Coronary Artery Calcium Score, for CAD-only risk	https://www.mesa-nhlbi.org/MESACHDRisk/MesaRiskScore/RiskScore.aspx

*Patients who have already manifested cardiovascular disease are already at high global risk and are not applicable to the calculators.

Definitions of Coronary Artery Disease[1, 3, 6, 34]

Percentage stenosis refers to the reduction in diameter stenosis when angiography is the method and can be estimated or measured using angiography or more accurately measured with intravascular ultrasound (IVUS).

- Coronary artery calcification is a marker of risk, as measured by Agatston score on coronary artery calcium imaging. Its incorporation into global risk can be achieved by using the MESA risk calculator.
- Ischemia-producing disease (also called hemodynamically or functionally significant disease, for which revascularization might be appropriate) generally implies at least one of the following:
    - Suggested by percentage diameter stenosis ≥ 70% by angiography; intermediate lesions are 50 – 69%[35]
    - For a left main artery, suggested by a percentage stenosis ≥ 50% [1, 36, 37]
    - FFR (fractional flow reserve) ≤ 0.80 for a major vessel[36, 37]
    - Demonstrable ischemic findings on stress testing (ECG or stress imaging), that are at least mild in degree
- FFR (fractional flow reserve) is the distal to proximal pressure ratio across a coronary lesion. Less than or equal to 0.80 is considered a significant reduction in coronary flow.

Anginal Equivalent[1, 27]

Development of an anginal equivalent (e.g., shortness of breath, fatigue, or weakness) either with or without prior coronary revascularization should be based upon the documentation of reasons to suspect that symptoms other than chest discomfort are not due to other organ systems (e.g., dyspnea due to lung disease, fatigue due to anemia). This may include respiratory rate, oximetry, lung exam, etc. (as well as d-dimer, chest CT(A), and/or PFTs, when appropriate), and then incorporated into the evaluation of coronary artery disease as would chest discomfort. Syncope per se is not an anginal equivalent.

Abbreviations

ADLs	Activities of daily living
BSA	Body surface area in square meters
CABG	Coronary artery bypass grafting
CAD	Coronary artery disease
CMR	Cardiac magnetic resonance imaging
CTA	Computed tomography angiography
ECG	Electrocardiogram
FFR	Fractional flow reserve
IVUS	Intravascular ultrasound
LBBB	Left bundle-branch block
LVEF	Left ventricular ejection fraction
LVH	Left ventricular hypertrophy
MI	Myocardial infarction
MET	Estimated metabolic equivalent of exercise
MPI	Myocardial perfusion imaging
PCI	Percutaneous coronary intervention
PFT	Pulmonary function test
PVCs	Premature ventricular contractions
SE	Stress echocardiography
THR	Target heart rate
VT	Ventricular tachycardia
VF	Ventricular fibrillation
WPW	Wolf Parkinson White

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POLICY HISTORY

Date	Summary
May 2023	• Removed time limitation "within past two years" for further evaluation inconclusive prior CAD evaluation • Added coronary stenosis of unclear significance on coronary angiography • Clarified indication for combination PET/MPI in evaluation of cardiac sarcoidosis • Added indication for diagnosis of ATTR amyloidosis • Added statement on clinical indications not addressed in this guideline
February 2022	• Moved the sentence regarding utilization of suitable alternatives such as Stress Echocardiography to the General Information section • Placed Link to Overview Section in General Information • Clarified evaluation of possible ischemia in newly diagnosed heart failure by stating "with reasonable suspicion of cardiac ischemia (prior events, risk factors, or symptoms and signs)" • Clarified "intermediate lesions are 50-69%" for ischemia-producing disease • Added stress imaging approval for calcium score > 100 with low to intermediate probability symptoms • Deleted the requirement for diabetes when calcium score > 400 for stress imaging • Deleted "≤50%" from "LVEF ≤50% requiring myocardial viability assessment to assist with decisions regarding coronary revascularization" • Added Calcium score section: ○ Added stress imaging approval for calcium score > 100 with symptoms consistent with low to intermediate pretest probability • Added reminder *(SE diversion not required for CABG)* • Changed preoperative guideline to include intermediate risk surgery with one or more risk factors AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year • Changed solid organ transplant guideline to include stem cell transplant and "any" organ transplant • Added definition of surgical risk to preop guidelines • In Background section clarified the requirement for description of chest pain by adding sentence "The medical record should provide enough detail to establish the type of chest pain." • Added definition of Q waves

	• Deleted sentence regarding calcium scoring within the Global Risk Section • Deleted sentence regarding using calcium score solely for risk stratification • Deleted IFR references

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **HEART (Cardiac) PET**	**Original Date: July 1999**
CPT Codes: 78459, 78491, 78492, +78434	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_072	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

This guideline is for stress imaging, specifically Heart (Cardiac) PET imaging, with appropriate preference for suitable alternatives, such as stress echocardiography (SE) or myocardial perfusion imaging (MPI), when more suitable, unless otherwise stated (refer to Background section).

INDICATIONS FOR HEART PET[1-4]

SUSPECTED CAD (When neither SE nor MPI have provided or are expected to provide optimal imaging)

- **Symptomatic patients without known CAD (use Diamond Forrester Table)**
  - Low or intermediate pretest probability and unable to exercise *(SE diversion not required)*
  - High pretest probability *(SE diversion not required)*
  - Repeat testing in a patient with new or worsening symptoms and negative result at least one year ago **AND** meets one of the criteria above
- **Asymptomatic patients without known CAD** *(SE diversion not required)*
  - Previously unevaluated ECG evidence of possible myocardial ischemia including substantial ischemic ST segment or T wave abnormalities (see section in Background)

- Previously unevaluated pathologic Q waves (see section in Background)
- Unevaluated complete left bundle branch block

ABNORMAL CALCIUM SCORES (CAC)[3, 5-8] (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)

- ASYMPTOMATIC patient with a calcium score >400, not previously evaluated
- SYMPTOMATIC patient with prior CAC ≥ 100

INCONCLUSIVE CAD EVALUATION AND OBSTRUCTIVE CAD REMAINS A CONCERN (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)

- Exercise stress ECG with low-risk Duke treadmill score (≥5) (see section in Background) but patient's current symptoms indicate an intermediate or high pretest probability *(SE diversion not required for high pretest probability)*
- Exercise stress ECG with an intermediate Duke treadmill score (*SE diversion not required for symptoms consistent with high pretest probability*)
- Inconclusive/borderline coronary computed tomography angiography (CCTA) (e.g., 40 - 70% lesions)
- Non-diagnostic exercise stress test with physical inability to achieve target heart rate (THR) *(SE diversion not required)*
- An intermediate evaluation by prior stress imaging () *(SE diversion not required)*
- Coronary stenosis of unclear significance on previous coronary angiography[3]

FOLLOW-UP OF PATIENT'S POST CORONARY REVASCULARIZATION (PCI or CABG) (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)[3]

- **Asymptomatic, follow-up stress imaging** at a minimum of 2 years post coronary artery bypass grafting (CABG), or percutaneous coronary intervention (PCI), (whichever is later), is appropriate only for patients with a history of silent ischemia or a history of a prior left main stent

  OR

- For patients with high occupational risk (e.g., associated with public safety, airline and boat pilots, bus and train drivers, bridge and tunnel workers/toll collectors, police officers, and firefighters)

New, recurrent, or worsening symptoms post coronary revascularization are an indication for stress imaging, if it will alter management (SE diversion not required for typical anginal symptoms or symptoms documented to be similar to those prior to revascularization)

FOLLOW-UP OF KNOWN[3] CAD (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)

- **Follow-up of asymptomatic or stable symptoms** when last invasive or non-invasive assessment of coronary disease showed hemodynamically significant CAD (ischemia on stress test or FFR ≤ 0.80 or significant stenosis in a major vessel (≥ 50% left main coronary artery or ≥ 70% LAD, LCX or RCA)), over two years ago, without intervening coronary revascularization is an appropriate indication for stress imaging in patients if it will alter management

SPECIAL DIAGNOSTIC CONDITIONS REQUIRING CORONARY EVALUATION (When neither SE nor MPI have provided, or are expected to provide, optimal imaging)

- Prior acute coronary syndrome (as documented in MD notes), without subsequent invasive or non-invasive coronary evaluation
- Newly diagnosed systolic heart failure or diastolic heart failure, *with reasonable suspicion of cardiac ischemia (prior events, risk factors*), unless invasive coronary angiography is immediately planned[2, 9, 10]
- Reduced LVEF ≤ 50% requiring myocardial viability assessment to assist with decisions regarding coronary revascularization. (Diversion from PET not required when LVEF less than or equal to 40%)[9-11]
- Ventricular arrhythmias
    - Sustained ventricular tachycardia (VT) > 100 bpm, ventricular fibrillation (VF), or exercise-induced VT, when invasive coronary arteriography is not the immediately planned test[12]
    - Nonsustained VT, multiple episodes, each ≥ 3 beats at ≥ 100 bpm, frequent PVC's (defined as greater than or equal to 30/hour on remote monitoring) without known cause or associated cardiac pathology, when an exercise ECG cannot be performed
- Prior to Class IC antiarrhythmic drug initiation (Propafenone or Flecainide), as well as annually in intermediate and high global risk patients (SE diversion not required)[13]
- Assessment of hemodynamic significance of one of the following documented conditions[14]:
    - Anomalous coronary arteries[15]
    - Muscle bridging of coronary artery [3, 16]
- Coronary aneurysms in Kawasaki's disease[17] or due to atherosclerosis
- Following radiation therapy to the anterior or left chest, at 5 years post initiation and every 5 years thereafter[18]
- To diagnose microvascular dysfunction in patients with persistent stable anginal chest pain with suspected ischemia and nonobstructive coronary artery disease (INOCA), as documented in provider notes (*no MPI diversion required*).
- **Cardiac Sarcoidosis[19-21]** (may be approved as a combination study with MPI for the evaluation and treatment of sarcoidosis)[22]

    - Evaluation and therapy monitoring in patients with sarcoidosis, after documentation of suspected cardiac involvement by echo or ECG, when CMR has not been performed
    - Evaluation of suspected cardiac sarcoid, after CMR has shown equivocal or negative findings in the setting of a high clinical suspicion[21]
    - Evaluation of CMR findings showing highly probable cardiac sarcoidosis, when PET could serve to identify inflammation and the consequent potential role for immunosuppressive therapy[21]
    - Initial and follow-up PET in monitoring therapy for cardiac sarcoid with immunosuppressive therapy, typically about 4 times over 2 years
- **Infective Endocarditis**
    - In suspected infective endocarditis with moderate to high probability (i.e., staph bacteremia, fungemia, prosthetic heart valve, or intracardiac device), when TTE and TEE have been inconclusive with respect to diagnosis of infective endocarditis or characterization of paravalvular invasive complications[23, 24]
- **Aortitis**
    - For diagnosis and surveillance of Aortitis, PET/CT or PET/MRI‡ hybrid imaging[25]
      ‡**NOTE:** If PET/MR study is requested, there is no specific CPT Code for this imaging study and a Health Plan review will be required.

PRIOR TO ELECTIVE NON-CARDIAC SURGERY (When neither SE nor MPI have provided or are expected to provide optimal imaging)

- An intermediate or high risk surgery with of one or more risk factors (see below), AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year[26-28]
    - **Risk factors:** history of ischemic heart disease, history of congestive heart failure, history of cerebrovascular disease, preoperative treatment with insulin, and preoperative serum creatinine >2.0 mg/dL.
    - **Surgical Risk:**
        - **High risk surgery:** Aortic and other major vascular surgery, peripheral vascular surgery, anticipated prolonged surgical procedures associated with large fluid shifts and/or blood loss
        - **Intermediate risk surgery:** Carotid endarterectomy, head and neck surgery, intraperitoneal and intrathoracic surgery, orthopedic surgery, prostate surgery
        - **Low risk surgery**: Endoscopic procedures, superficial procedure, cataract surgery, breast surgery
- Planning for any organ or stem cell transplantation is an indication for preoperative stress imaging, if there has not been a conclusive stress evaluation, CTA, or heart catheterization within the past year, at the discretion of the transplant service[29]

POST CARDIAC TRANSPLANT (SE diversion not required)[30]

- Annually, for the first five years post cardiac transplantation, in a patient not undergoing invasive coronary arteriography
- After the first five years post cardiac transplantation, patients with documented transplant coronary vasculopathy can be screened annually if invasive coronary arteriography is not planned

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BACKGROUND[31, 32]

PET Scan

- Indicated when all the criteria for MPI are met **AND** there is likely to be equivocal imaging results because of BMI, large breasts or implants, mastectomy, chest wall deformity, pleural or pericardial effusion, or prior thoracic surgery or results of a prior MPI
- Can identify regions of myocardial viability with hibernating myocardium (viable, with poor flow and contractility) by imaging with fluorine18 (F-18) fluorodeoxyglucose (FDG or 18-FDG) for this purpose.
- Useful in the evaluation of inflammation: e.g., evaluation and therapy monitoring in patients with sarcoidosis, after documentation of cardiac involvement by echo or electrocardiography (ECG), in place of, or subsequent to CMR if needed to help with an uncertain diagnosis

Coronary application of PET includes evaluation of **stable patients without known CAD**, who fall into two categories[2-4]

- **Asymptomatic**, for whom global risk of CAD events can be determined from coronary risk factors, using calculators available online (see Websites for Global Cardiovascular Risk Calculators section).
- **Symptomatic,** for whom we estimate the pretest probability that their chest-related symptoms are due to clinically significant (≧ 50%) CAD (below):

The 3 Types of Chest Pain or Discomfort

- **Typical Angina (Definite)** is defined as including **all 3** characteristics:
  - Substernal chest pain or discomfort with characteristic quality and duration
  - Provoked by exertion or emotional stress
  - Relieved by rest and/or nitroglycerine
- **Atypical Angina (Probable)** has only **2** of the above characteristics
- **Nonanginal Chest Pain/Discomfort** has only **0 - 1** of the above characteristics

The medical record should provide enough detail to establish the type of chest pain. From those details, The Pretest Probability of obstructive CAD is estimated from the Diamond

Forrester Table below, recognizing that in some cases multiple additional coronary risk factors could increase pretest probability[2, 3]:

Diamond Forrester Table

Age (Years)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain
≤ 39	Men	Intermediate	Intermediate	Low
	Women	Intermediate	Very low	Very low
40 – 49	Men	High	Intermediate	Intermediate
	Women	Intermediate	Low	Very low
50 – 59	Men	High	Intermediate	Intermediate
	Women	Intermediate	Intermediate	Low
≥ 60	Men	High	Intermediate	Intermediate
	Women	High	Intermediate	Intermediate

- **Very Low:** < 5% pretest probability, usually not requiring stress evaluation
- **Low:** 5 - 10% pretest probability of CAD
- **Intermediate:** 10% - 90% pretest probability of CAD
- **High:** > 90% pretest probability of CAD

OVERVIEW

ECG Stress Test Alone versus Stress Testing with Imaging

Prominent scenarios suitable for an ECG stress test WITHOUT imaging (i.e., exercise treadmill ECG test) require that the patient can exercise for at least 3 minutes of Bruce protocol with achievement of near maximal heart rate AND has an interpretable ECG for ischemia during exercise[3]:

- The (symptomatic) low or intermediate pretest probability patient who is able to exercise and has an interpretable ECG[3]
- The patient who is under evaluation for exercise-induced arrhythmia
- The patient who requires an entrance stress test ECG for a cardiac rehab program or for an exercise prescription
- For the evaluation of syncope or presyncope during exertion[33]

Duke Exercise ECG Treadmill Score[34]

Calculates risk from ECG treadmill alone**:**

- The equation for calculating the Duke treadmill score (DTS) is: DTS = exercise time in minutes - (5 x ST deviation in mm or 0.1 mV increments) - (4 x exercise angina score), with angina score being 0 = none, 1 = non-limiting, and 2 = exercise-limiting.

- The score typically ranges from - 25 to + 15. These values correspond to low-risk (with a score of ≥ + 5), intermediate risk (with scores ranging from - 10 to + 4), and high-risk (with a score of ≤ - 11) categories.

An uninterpretable baseline ECG includes[2]:

- ST segment depression 1 mm or more (not for non-specific ST- T wave changes)
- Ischemic looking T waves; at least 2.5 mm inversions (excluding V1 and V2)
- LVH with repolarization abnormalities, pre-excitation pattern such as WPW, ventricular paced rhythm, or left bundle branch block
- Digitalis use with associated ST segment abnormalities

Previously unevaluated pathologic Q waves (in two contiguous leads) defined as the following:

- > 40 ms (1 mm) wide
- > 2 mm deep
- > 25% of depth of QRS complex

Global Risk of Cardiovascular Disease

Global risk of CAD is defined as the probability of manifesting cardiovascular disease over the next 10 years and refers to **asymptomatic** patients without known cardiovascular disease. It should be determined using one of the risk calculators below. A high risk is considered greater than a 20% risk of a cardiovascular event over the ensuing 10 years. **High global risk by itself generally lacks scientific support as an indication for stress imaging.** There are rare exceptions, such as patients requiring IC antiarrhythmic drugs who might require coronary risk stratification prior to initiation of the drug.

- **CAD Risk—Low**
  10-year absolute coronary or cardiovascular risk less than 10%
- **CAD Risk—Moderate**
  10-year absolute coronary or cardiovascular risk between 10% and 20%
- **CAD Risk—High**
  10-year absolute coronary or cardiovascular risk of greater than 20%

Websites for Global Cardiovascular Risk Calculators*[35-39]

Risk Calculator	Websites for Online Calculator
Framingham Cardiovascular Risk	https://reference.medscape.com/calculator/framingham-cardiovascular-disease-risk
Reynolds Risk Score Can use if no diabetes Unique for use of family history	http://www.reynoldsriskscore.org/

Pooled Cohort Equation	http://clincalc.com/Cardiology/ASCVD/PooledCohort.aspx?example
ACC/AHA Risk Calculator	http://tools.acc.org/ASCVD-Risk-Estimator/
MESA Risk Calculator With addition of Coronary Artery Calcium Score, for CAD-only risk	https://www.mesa-nhlbi.org/MESACHDRisk/MesaRiskScore/RiskScore.aspx

*Patients who have already manifested cardiovascular disease are already at high global risk and are not applicable to the calculators.

Definitions of Coronary Artery Disease[2, 4, 6]

Percentage stenosis refers to the reduction in diameter stenosis when angiography is the method and can be estimated or measured using angiography or more accurately measured with intravascular ultrasound (IVUS).

- Coronary artery calcification is a marker of risk, as measured by Agatston score on coronary artery calcium imaging. Its incorporation into global risk can be achieved by using the MESA risk calculator.
- Ischemia-producing disease (also called hemodynamically or functionally significant disease, for which revascularization might be appropriate) generally implies at least one of the following:
    - Suggested by percentage diameter stenosis ≥ 70% by angiography; intermediate lesions are 50 – 69%[40]
    - For a left main artery, suggested by a percentage stenosis ≥ 50% or minimum lumen cross-sectional area on IVUS ≤ 6 square mm[2, 41]
    - FFR (fractional flow reserve) ≤ 0.80 for a major vessel[41]
    - Demonstrable ischemic findings on stress testing (ECG or stress imaging), that are at least mild in degree
- A major vessel would be a coronary vessel that would be amenable to revascularization if indicated. This assessment is made based on the diameter of the vessel and/or the extent of myocardial territory served by the vessel.
- FFR (fractional flow reserve) is the distal to proximal pressure ratio across a coronary lesion during maximal hyperemia induced by either intravenous or intracoronary adenosine. Less than or equal to 0.80 is considered a significant reduction in coronary flow.
- Newer technology that estimates FFR from CCTA image is covered under the separate NIA Guideline for FFR-CT.

Anginal Equivalent[2, 33]

Development of an anginal equivalent (e.g., shortness of breath, fatigue, or weakness) either with or without prior coronary revascularization should be based upon the documentation of reasons to suspect that symptoms other than chest discomfort are not due to other organ systems (e.g., dyspnea due to lung disease, fatigue due to anemia), by presentation of clinical data, such as respiratory rate, oximetry, lung exam, etc. (as well as d-dimer, chest CT(A), and/or PFTs, when appropriate), and then incorporated into the evaluation of coronary artery disease as would chest discomfort. Most syncope per se is not an anginal equivalent.

Abbreviations

ADLs	Activities of daily living
BMI	Body mass index
CABG	Coronary artery bypass grafting
CAC	Coronary artery calcium
CAD	Coronary artery disease
CCTA	Coronary computed tomography angiography
CMR	Cardiac magnetic resonance imaging
CT(A)	Computed tomography (angiography)
DTS	Duke Treadmill Score
ECG	Electrocardiogram
FFR	Fractional flow reserve
IVUS	Intravascular ultrasound
LBBB	Left bundle-branch block
LVEF	Left ventricular ejection fraction
LVH	Left ventricular hypertrophy
MESA	Multi-Ethnic Study of Atherosclerosis
MET	Estimated metabolic equivalent of exercise
MI	Myocardial infarction
MPI	Myocardial perfusion imaging
MR(I)	Magnetic resonance (imaging)
PCI	Percutaneous coronary intervention
PET	Positron emission tomography
PFT	Pulmonary function test
PVCs	Premature ventricular contractions
SE	Stress echocardiography
TEE	Transesophageal echocardiography
THR	Target heart rate
TTE	Transthoracic echocardiography
VF	Ventricular fibrillation
VT	Ventricular tachycardia
WPW	Wolff-Parkinson-White

Policy History

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May 2023	• Removed time limitation "within past two years" for further evaluation inconclusive prior CAD evaluation • Added coronary stenosis of unclear significance on previous coronary angiography. • Added indication for evaluation of ischemia and nonobstructive coronary artery disease (INOCA) • Clarified indication for PET/MPI combination study for evaluation of cardiac sarcoidosis • Added statement on clinical indications not addressed in this guideline
February 2022	• Moved the sentence regarding utilization of suitable alternatives such as Stress Echocardiography to the General Information section • Clarified "intermediate lesions are 50-69%" for ischemia-producing disease • Clarified evaluation of possible ischemia in newly diagnosed heart failure by stating *"with reasonable suspicion of cardiac ischemia (prior events, risk factors, or symptoms and signs)"* • Placed Link to Overview Section in General Information • Added stress imaging approval for calcium score > 100 with low to intermediate probability symptoms • Deleted the requirement for diabetes when calcium score > 400 for stress imaging • Added Calcium score section: ○ Added stress imaging approval for calcium score > 100 with symptoms consistent with low to intermediate pretest probability • Added reminder *(SE diversion not required for CABG)* • Changed preoperative guideline to include intermediate risk surgery with one or more risk factors AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year • Changed solid organ transplant guideline to include stem cell transplant and "any" organ transplant • Added definition of surgical risk to preop guidelines • In Background section clarified the requirement for description of chest pain by adding sentence "The medical record should provide enough detail to establish the type of chest pain. " • Added definition of Q waves

	• Deleted sentence regarding calcium scoring within the Global Risk Section • Deleted sentence regarding using calcium score solely for risk stratification • Deleted redundant statement on viability • Deleted IFR references

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Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **MUGA (Multiple Gated Acquisition) Scan**	**Original Date: September 1997**
CPT Codes: 78472, 78473, 78494, +78496	**Last Revised Date: April 2023**
Guideline Number: Evolent_CG_027	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

Indications for Multiple Gated Acquisition (MUGA) Scan[1]

- To evaluate left ventricular function in a patient with coronary artery disease, valvular heart disease, myocardial disease, or congenital heart disease, in any of the following scenarios:
  - When ventricular function is required for management, and transthoracic echocardiography (TTE) or other imaging has proven inadequate[2, 3]
  - When there are conflicting results between other testing (i.e., Myocardial Perfusion Imaging and TTE) in the measurement of ejection fraction (EF), and the results of the MUGA will help in the management of the patient
  - Prior TTE has demonstrated systolic dysfunction (EF < 50%) and management will change based on the results of the MUGA scan
- In the course of treatment with cardiotoxic medication when TTE images are inadequate to evaluate left ventricular systolic function[2-6]:
  - Baseline assessment prior to initiation of therapy
  - Monitoring during therapy. The frequency of testing should be left to the discretion of the ordering provider but in the absence of new abnormal findings, generally no more often than every 6 weeks while on active therapy

- Long term surveillance after completion of therapy may be required, especially for those who have been exposed to anthracycline medication. The frequency of testing is generally every 6-12 months, or at the discretion of the provider

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BACKGROUND[2, 7-9]

Multiple-gated acquisition (MUGA) scanning uses radiolabeled red blood cells to scan right and left ventricular images in a cine loop format that is synchronized with the electrocardiogram.

A prior MUGA scan is not an indication for repeat MUGA (if another modality would be suitable, i.e., TTE).

Abbreviations

EF	Ejection Fraction
MUGA	Multiple Gated Acquisition (nuclear scan of ventricular function)
TTE	Transthoracic echocardiography

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POLICY HISTORY

Date	Summary
April 2023	• Added statement on clinical indications not addressed in this guideline
February 2022	No significant changes

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **BRAIN PET SCAN**	**Original Date: July 1999**
CPT Codes: 78608, 78609	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_071	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

INDICATIONS FOR BRAIN PET SCAN

Known brain tumor or cancer[1, 2] when brain MRI is indeterminant or insufficient to:

- Differentiate radiation necrosis or post-treatment change from residual/recurrent tumor
- Differentiate low from high grade glioma
- Evaluation of primary brain lymphoma
- Evaluation of meningiomas (FDG or SSTR analogs (such as GA-68 Dotatate))
- To guide intervention/biopsy

To determine operability of refractory seizures[3-5]

Post-treatment/procedural evaluation

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed.

Mild Cognitive Impairment or Dementia[6]

- For the detection of early Alzheimer's disease†;
- For the differentiation between Alzheimer's disease, dementia with Lewy body disease (DLB)

and frontotemporal lobar degeneration (FTD)†; or

- To assess for the presence of beta amyloid plaque in Alzheimer's disease when being considered for treatments that target beta-amyloid plaque (such as Aduhelm)†

†Note: **AFTER** an initial insufficient evaluation with a Brain MRI‡ and the following 2 criteria have been met[7, 8]:

- Objective cognitive impairment[9, 10] has been demonstrated by:
  - Either by Mini Mental Status Evaluation (MMSE) or Montreal Cognitive Assessment (MoCA) less than 26[11]
  - **OR** by Neuropsychological testing showing at least mild cognitive impairment[12, 13]
- Potential treatable causes have been assessed and addressed,[9] such as:
  - Metabolic causes, such as thyroid or vitamin deficiency, anemia, or toxic metabolic encephalopathy
  - Medication side effects[14]
  - Medical causes, such as vascular or traumatic or inflammatory

‡**Note:** Brain CT is acceptable if brain MRI is contraindicated. However, Brain CT cannot be substituted for MRI when Brain PET is requested for evaluation of amyloid plaque because MRI is a prerequisite to beta-amyloid targeted treatment.

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BACKGROUND

Positron Emission Tomography (PET) scanning can be used to assesses brain metabolism and perfusion. Uses include identifying epileptic foci prior to surgery, differentiation of residual tumor versus scar, helping differentiate inconclusive findings on Brain MRI and identifying causes of cognitive decline.[15]

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POLICY HISTORY

Date	Summary
May 2023	• Added that Dotatate is now FDA approved for meningioma imaging • General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Added statement regarding further evaluation of indeterminate findings on prior imaging • Additional resources removed
May 2022	• Updated references and background • Removed FDG from Indications title • Added meningioma when MR is inconclusive

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines: **Single Photon Emission Computed Tomography (SPECT), including** • **Bone/Joint** • **Non-Bone Infection/Inflammation** • **Tumor** • **Cardiac** • **Neck** • **Lung** • **Brain** • **Radionuclide Cisternography (CSF)** • **Renal** • **Abdomen/Pelvis**	**Original Date: July 2008**
CPT Codes: **78803 (SPECT), Single Area, single day** **78830 – SPECT/CT, single area, single day** **78831 – SPECT, multiple areas** **78832 – SPECT/CT, multiple areas** **78835 – Radiopharmaceutical quantification measurement**	**Last Revised Date: May 2023**
Guideline Numbers: Evolent_CG_078	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

SPECT: Single-Photon Emission Computed Tomography (SPECT) is a nuclear medicine imaging technique used to localize data from gamma ray emitting injected radiopharmaceuticals to specific anatomical locations within the patient. The resulting 3D images can be reconstructed in multiple planes much like a CT scan uses XR, SPECT utilizes nuclear scintigraphy. The ability to manipulate the imaging data into distinct multiplanar slices improves the diagnostic capability and spatial resolution while using the same pharmaceutical as with traditional planar bone scan. Radiopharmaceuticals used vary based on the clinical indication. The technique is applied in brain, cardiac, pulmonary, abdominal, endocrine, and musculoskeletal imaging.

SPECT can be used localize a tumor, inflammatory process, or radioactive tracer distribution. Vascular flow and blood pool imaging are included if performed. The 78803 code represents single–day imaging of a single area, such as the head, neck, chest, or pelvis, or a single acquisition on one day.

SPECT/CT: (Single-photon emission computed tomography combined with Computed Tomography) is now available in many places. The CT portion helps correct the attenuation (decrease) of photons from the target as they get absorbed/reflected by the soft tissues before reaching the detector. CT helps with anatomic localization much like the CT of PET/CT.

When SPECT/CT is requested, additional CT approvals are NOT needed/provided (unless approvable for other separate indications per guidelines for that body part). The CT portion of a SPECT/CT is included in the specific CPT (i.e., 78830 – SPECT/CT, single area, single day and 78832 – SPECT/CT, multiple areas).

This guideline includes both to SPECT and SPECT/CT when routine dynamic and planar imaging is, or is projected to be, insufficient for the following indications (select 'ctrl' then 'left click' to jump to section)[1-6]:

Other Indications

Further evaluation of indeterminate findings on prior imaging (unless follow up is otherwise specified within the guideline):

- For initial evaluation of an inconclusive finding on a prior imaging report that requires further clarification
- One follow-up exam of a prior indeterminate MR/CT finding to ensure no suspicious interval change has occurred. (No further surveillance unless specified as highly suspicious or change was found on last follow-up exam.)

BONE/JOINT

MALIGNANCY

Note: For known bone metastases, whole body planar bone scan for staging and restaging is typically sufficient

- Screening evaluation of patients with malignancy presenting with elevated alkaline phosphatase, bone pain, or new pathological fracture
- Staging or Restaging evaluation when recent overlapping whole-body imaging (CT or PET/CT of the neck, chest, abdomen and pelvis) has not been performed, cannot be performed, or is inconclusive in evaluation of bone metastases
- Staging and restaging for radionuclide bone therapy for predominant bone metastases

INFECTION

- Osteomyelitis: a plain x-ray **AND** an MRI of the area have been performed, unless MRI is contraindicated, technically limited or inconclusive[5, 6]
- Discitis: MRI is contraindicated, technically limited or inconclusive

BONE VIABILITY

- Detection of early avascular necrosis, bone infarct, or bone graft viability when patient has had a plain x-ray; and MRI is contraindicated or inconclusive[7]

TRAUMA

- Extremities: Detection of stress fractures and other occult skeletal trauma when there is persistent pain in the suspected area after negative or inconclusive x-ray and MRI[8]
- Spine:
    - For indications such as spondylolysis or determination of age of fracture after CT/MRI is inconclusive[9]
    - Spondylolysis evaluation in a child, with persistent pain after MRI and conservative treatment, in determining further treatment plan[10, 11]

INCONCLUSIVE

- Inconclusive MRI/CT

- Identification of a primary etiology (via most reactive/ inflammatory changes) when multiple etiologies are identified by MRI/CT, **AND** intervention planning is needed (includes primary facet joint target localization)[9, 12-16]

POSTOPERATIVE

- Evaluation of persistent symptoms in postoperative spine/joints/bones, after X-ray and CT are negative/inconclusive[9, 17-22]

EXTREMITIES

- For evaluation of unexplained extremity pain when clinical criteria and other imaging (x-ray, **AND** MRI/ Ultrasound/ CT) evaluation is inconclusive (e.g., differentiating complex regional pain syndrome from other causes of pain)[23-26]

FOLLOW-UP

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

NOTE: Inconclusive includes the scenario when imaging findings do not explain patient clinical symptoms or lack of treatment efficacy.

BONE SPECT: Due to advances in cross-sectional imaging, the technique currently has limited indications for detecting bone pathology. It is most used in patients who have been found to have an unexpected single area abnormality on a planar (screening) bone scan. It is also used in those who cannot undergo MRI or CT imaging or to clarify the findings on MRI or CT. Although vast majority of bone scan indications have been replaced by MRI or CT over the decades, the recent advent of SPECT has shown comparable or complementary performance versus MRI for some indications as those listed above.[23, 24, 27, 28] For patients with impaired renal function who cannot receive iodinated or gadolinium-based contrast agents or undergo MRI for other reasons, SPECT imaging can improve the performance of conventional planar nuclear bone imaging.

TRACERS: Nuclear medicine bone imaging is commonly performed with Technetium-99m-MDP (methylene diphosphonate). For indications such as infection or inflammation, Indium-111/ Technetium-99m-HMPAO (hexamethylpropyleneamine oxime) labelled white blood cells, or Gallium-67 (for spine/sternum) can be used. Gallium is typically used for discitis evaluation, and imaging can be carried out to 2-3 days post tracer injection for better target-to-background ratio. Technetium-99m sulfur colloid scan is typically used concordantly for marrow mapping, to distinguish bone marrow from infection site.

Although 18F-labelled sodium fluoride (NaF) PET scanning is highly sensitive for detecting bone lesions, its routine use has not replaced conventional bone scanning due to the latter's "effectiveness, widespread availability, low cost and favorable dosimetry".[4] If a bone SPECT is not sufficient, specific PET tracers that detect both soft tissue and bone metastases (e.g., F18-FDG, F18- Fluciclovine, Ga68-Dotatate) have replaced largely the need for a separate NaF PET.

CRPS: In the evaluation of complex regional pain syndrome (CRPS), formerly reflex sympathetic dystrophy, three phase bone scintigraphy (flow, blood pool, and delayed images) and MRI imaging sensitivities reported in the medical literature, ranges widely.[26] In general, scintigraphy is more specific than MRI. SPECT imaging, however, is not routinely used for this indication.

NON-BONE INFECTION / INFLAMMATION

When primary standard modality of CT / CTA / MRI / Ultrasound are inconclusive, limited, or cannot be done,[29] including:

- Fever of Unknown Origin when CT/MR are negative/inconclusive/limited
- Non-bone infection/inflammation when primary standard imaging is negative/ inconclusive, including infections related to
    - Transplant and vascular grafts when ultrasound / CTA are negative/inconclusive/limited[30, 31]
    - Prosthetic valves when echocardiography AND Coronary CTA are inconclusive[32]
    - Cardiac implantable devices when echocardiography is inconclusive[32]

BACKGROUND

Infection-seeking tracers labelled with single-photon-emitting radionuclides include autologous leukocytes [white blood cells (WBC)] labelled with 99mTc-hexamethylpropyleneamine oxime (HMPAO) or 111In-diethylenetriaminepentaaceticacid (DTPA). Imaging is typically completed the same day (for Technetium-Tc labelled agents) or the 2nd day (for Indium-labelled agents). SPECT localizes the infection agent accumulation to the anatomic site more precisely than does planar imaging. The tracer activity is not affected by artifact from implants and devices. They are typically used when other modalities such as CT or MRI have not yielded conclusive results or have not explained clinical status.

For infections related to vascular grafts, nuclear medicine modalities are particularly useful to mapping the extent of the infection (focal uptake) for surgical planning. Primary imaging is first done with ultrasound for extracavitary graft and CTA for intracavitary graft.[30]

TUMOR

- Iodine imaging for subsequent post thyroidectomy staging of differentiated thyroid cancers, in the setting of[33]:

- Post thyroidectomy neck CT/MR showing residual unresectable thyroid tissue/ disease in the neck
- Distant metastases as seen on CT/MR
- Post thyroidectomy unstimulated thyroglobulin > 5-10ng/ml
- Radioactive iodine therapy is being considered for high risk or recurrent tumor
- Post radioiodine treatment (post therapy scan)
- During surveillance, with rising thyroglobulin or stable / rising antithyroglobulin antibodies or abnormal ultrasound neck

Note: Refer to neck for thyroid nodules

- For initial or restaging of Neuroendocrine tumors (typically In111-octreotide and Iodine-123 MIBG), for any part of the body,[34]
  - When CT/MRI OR PET imaging is not available, cannot be done, has contraindications, or is inconclusive
  - I-131 MIBG: when I131 MIBG therapy is being considered
  - In111- octreotide: Somatostatin analog therapy is being considered and Ga68 Dotatate PET is not available
- Imaging during / post therapy with therapeutic agents such as 131 Iodine, 177Lu-Dotatate, 111In Zevalin, when it can change management
- Lymphoscintigraphy with sentinel node localizations, for preoperative planning in melanoma, breast, head and neck, and gynecological cancers

BACKGROUND

Thyroid cancers are imaged by Iodine-123 or Iodine-131 tracers. Prior to treatment, sometimes a whole body I-123 imaging may be done if it is an aggressive cancer or if there is a suspicion of metastases. Whole body imaging with I-131 is acquired up to 10 days post therapeutic dosage with I-131 for thyroid cancers. Subsequent surveillance is done by monitoring thyroglobulin, thyroglobulin antibodies, and ultrasound neck. If there is concern for recurrence, typically whole body I-123 or I-131 imaging is done. SPECT is then done of the neck and of any other areas that need clarification on planar imaging.

Indium octreotide and Iodine MIBG (meta-iodobenzylguanidine) imaging are used to assess neuroendocrine tumors for somatostatin (SSTR) receptors to enable treatment with somatostatin analogs, such as octreotide acetate (Sandostatin).

177Lu-Dotatate is a treatment for neuroendocrine cancers that have SSTR expression as seen on Gallium-68 PET or Indium-111 pentetreotide/Octreotide imaging. 90Y-ibritumomab tiuxetan (or Zevalin®) is used as treatment for refractory non-Hodgkin's lymphoma and may need initial biodistribution assessment with Indium-111 ibritumomab tiuxetan. Therapeutic agents have gamma or bremsstrahlung radiation that can be harnessed to image and evaluate the biodistribution of the therapeutic tracer.

Lymphoscintigraphy with sentinel node mapping is often used in early-stage breast, melanoma, and gynecological cancers immediately prior to surgical resection of primary lesion. This evaluates initial lymph nodes draining the target region. These lymph nodes are resected during surgery to evaluate for possible involvement, in which case the cancer is upstaged.

CARDIAC

See MPI and MUGA guidelines.

NECK (NON-CANCER)

- Parathyroid adenoma: Clinically or laboratory proven hyperparathyroidism AND ultrasound of the neck has been completed. If CT is already done, it should be inconclusive.[35]
- Thyroid: Abnormal thyroid function tests and planar imaging is inconclusive for the location of a focal thyroid lesion.

BACKGROUND

Parathyroid adenomas are evaluated typically initially by cervical ultrasound. Parathyroid SPECT with Tc99m sestamibi or Iodine and sestamibi tracer combo has similar diagnostic performance to 4D-CT with less radiation dose.

Thyroid disorders that are diffuse typically do not need SPECT imaging. However, it may be needed in cases of differentiation of a single cold nodule in the background of multinodular goiter to direct biopsy. Iodine-123 tracer is typically used for these.

LUNG

- Quantification of lung function prior to lung resection/radiation
- Evaluation of congenital cardiac, thoracic, or pulmonary disease, or lung transplants or bronchopleural fistulae[36]
- Chronic thromboembolic pulmonary hypertension
- Suspected acute pulmonary embolism with comorbidities (such as COPD, left heart failure, pneumonia, tumor) AND chest x-ray has been performed, AND chest CTA cannot be performed or limited
- Calculation of lung shunt fraction prior to hepatic radioembolization

BACKGROUND

Ventilation perfusion scans are typically done for pulmonary embolism (PE) assessment when chest CTA cannot be performed, for young patients, or in pregnancy when they have a normal

chest x-ray (due to lower radiation exposure). SPECT of the ventilation images is markedly limited in the US as the two ventilation tracers used in the US (Tc99m DTPA, Xenon) are not highly amenable to SPECT imaging. This and the overdiagnosis of small insignificant PE on SPECT, like CTA, have enabled planar images to be the preferred method of evaluation of acute PE. However, for the purposes of lung surgery evaluation, congenital heart disease, and chronic pulmonary hypertension, the lung perfusion images have more significance, and these are amenable to SPECT with further increases in sensitivity and specificity.

BRAIN [37]

- For preoperative localization of epileptic foci after EEG, Brain MRI and PET are done and insufficient[38, 39]
- DAT scan[40-42]
    - To differentiate essential tremor and drug-induced parkinsonism from parkinsonian syndromes
    - For early/inconclusive parkinsonian features
    - For dementia: differentiating Dementia with Lewy Bodies (DLB) from other dementia types. If FDG PET was completed for this indication, and was inconclusive.
- To evaluate cerebrovascular reserve in planning appropriate endovascular/vascular intervention or neurovascular surgical approach[43, 44] - can include:
    - Evaluation for vascular diseases such as Moyamoya
    - Carotid balloon occlusion
    - Hyperperfusion syndromes
    - Shunting for idiopathic normal pressure hydrocephalus[45]
- Brain perfusion study for evaluation of brain death when CT or MRI already done and planar images are inconclusive[46]
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

BACKGROUND

Injected brain tracers used include 99mTc-bicisate (ECD; ethyl cysteinate dimer), 99mTc-exametazime (HMPAO; hexamethylpropylene amine oxime), and 99mTc-pentetate (DTPA; diethylenetriaminepentaacetic acid). I123 Ioflupane is used for DAT scan (Dopamine Transporter Scan). Brain imaging is routinely performed and included with brain SPECT imaging unless it is a done for brain death.. These tracers cross the blood brain barrier where they emit gamma rays that are detected by the imaging system. A 3D image of the brain is created using computerized techniques with the degree of radionuclide activity corresponding to neuronal activity or cerebral blood flow.

Epilepsy: 15–30% of patients with refractory focal epilepsy do not have distinct lesions on MRI. The next investigation for a possible surgically resectable epileptogenic focus includes PET. If this is negative or inconclusive, ictal (during seizure) brain SPECT can be obtained, which can reveal increased uptake at the epileptogenic area.

Stroke/ Trauma/ Presurgical planning: These situations are usually evaluated with brain MRI (or brain CT if there is a contraindication to brain MRI). However, if these results are inconclusive or limited, could not be performed, do not explain the clinical picture, or if additional information is needed for surgeries, Brain SPECT images are obtained, often to evaluate vascular reserve. Brain images are obtained at rest and after vasodilatory acetazolamide injection challenge. These may clarify inconclusive clinical or imaging abnormalities or assess vascular reserve for surgeries. This can also be done with other challenges as well, such as carotid balloon occlusion. In the assessment of transient ischemic disease, reduced perfusion can be seen earlier than changes on conventional imaging and may help plan appropriate therapeutic intervention. In traumatic brain injury (including whiplash, post-concussion syndromes), SPECT studies have shown areas of hypoperfusion without corresponding MRI or CT findings.[47]

Brain Death: This is typically used in the ICU setting, when clinical assessment and electroencephalography are less reliable in diagnosing brain death because of conditions such as severe hypothermia, coma caused by barbiturates, electrolyte or acid–base imbalance, endocrine disturbances, drug intoxication, poisoning, and neuromuscular blockade. Brain death scintigraphy may also be helpful in patients who are being considered as possible organ donors or when family members require documentation of lack of blood flow.

Dementia: Brain SPECT imaging has been largely replaced by brain PET due to better resolution.

DAT scan (Dopamine transporter Imaging): I123 Ioflupane tracer demonstrates the location and concentration of dopamine transporters (DATs) in the synapses of striatal dopaminergic neurons. This is decreased in presynaptic parkinsonian syndromes (Parkinson's disease, multiple system atrophy, and progressive supranuclear palsy) but is not affected in mimicking conditions such as essential tremor, drug-induced parkinsonism or psychogenic parkinsonism. It is also useful in the differentiation of Alzheimer dementia from Dementia with Lewy Bodies. The latter is in the spectrum of parkinsonism but may or may not have clinical symptoms of parkinsonism, such as bradykinesia, rigidity, or tremor at rest.

RADIONUCLIDE CISTERNOGRAPHY (CSF)

- CSF imaging (for evaluation of hydrocephalus, leak, shunt, normal pressure hydrocephalus, spontaneous intracranial hypotension) when[45]
    - Brain/spine or respective site imaging already performed with appropriate CT/ MRI / CT myelography, and deemed to be insufficient; AND
    - Planar images projected to be insufficient for localization of abnormality

- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

BACKGROUND

Cerebrospinal fluid (CSF) flow studies for the evaluation of obstructive or non-obstructive hydrocephalus of various etiologies or CSF leaks (CSF cisternography) are performed after the intrathecal administration of radionuclide. The radionuclides used for CSF flow studies are Indium-111 DTPA for cisternography and leaks.[48] Persistence of activity in the lateral ventricles after 24 hours of imaging is diagnostic of normal pressure hydrocephalus. Cine phase contrast MRI is the preferred technique for evaluating CSF flow dynamics and helps determines which patients with NPH will benefit from treatment.[49, 50]

To evaluate ventriculoperitoneal shunt patency, Tc-99m DTPA radionuclide is injected into the shunt reservoir. Normal shunt patency is confirmed by showing activity along the entire course of the shunt, ultimately spilling into the abdominal cavity.

CSF leaks are more commonly acquired either iatrogenic or post-traumatic[51] than congenital or spontaneous and can occur anywhere along the cranial spinal axis. Scintigraphy for detecting CSF leaks has been superseded by CT and MRI myelographic techniques or thin section skull base CT due to their better spatial resolution.[51, 52] Diagnosis using scintigraphy requires intrathecal administration of radionuclide followed by imaging typically at 3,6, 24, and 48 hours. Pledgets can be placed in the nasal cavity or auditory canal in the setting of CSF rhinorrhea and otorrhea, respectively. CSF leak path is traced. Initial diagnostic imaging is typically done with high resolution CT, CT/MR cisternography.[53-55]

Spontaneous idiopathic hypotension (SIH), also known as craniospinal hypotension, poses a diagnostic challenge due to its protean clinical symptoms, inconsistently demonstrated imaging findings on conventional MRI scanning, and lack of awareness of the diagnosis among clinicians. SIH often presents a variable mix of symptoms, including orthostatic headaches, visual defects or blurred vision, limb paresthesia, transient 3rd cranial nerve palsy, numbness in the face or limbs, cognitive deficits, behavioral changes, neck pain and stiffness, taste alteration, or parkinsonism. In this condition a CSF leak anywhere along the neuraxis is not detected in nearly one-third of patients thought to be due to the slow or intermittent nature of these leaks.[56] Radionuclide cisternography was found to be more sensitive than CT myelography in a few limited case series.[57-59] Imaging at multiple time points up to 48 hours, as well as direct and indirect signs, aid in the detection of intermittent or slow leaks, with lower radiation exposure than CT myelography.[60] SPECT-CT allows improved anatomical localization and characterization.[61, 62]

RENAL [63, 64]

Complex clinical scenarios involving the following indications wherein cross-sectional imaging and routine dynamic planar imaging alone is, or projected to be, insufficient:

- Evaluation of renal collecting system for trauma, surgery, obstruction in ADULTS, or with signs, symptoms, and laboratory findings supporting the need for such an evaluation in adults; **AND**
    - CT has been performed and is inconclusive or contraindicated
- For evaluation of renal collecting system for obstruction or vesicoureteral reflux in children and young females:
    - After ultrasound and VCUG (voiding cystourethrography) / VUS (voiding urosonography) are inconclusive or discordant with clinical picture[63, 65]
- For diagnosis of reno-vascular hypertension with signs, symptoms, laboratory findings, or other imaging supporting the need for such a diagnosis when
    - Duplex ultrasound is inconclusive; **AND**
    - MRA or CTA cannot be performed or is contraindicated; **AND**
    - The patient has adequate renal function (GFR >30) mL/min/1.73 m^2) to undergo the study[63]
- Further evaluation of renal perfusion and split function after completion of ultrasound, including in the setting of surgery, trauma, infection, congenital and mass abnormalities[63]
- Diagnosis of renal transplant complications after ultrasound has been performed[31, 63]
- Evaluation of renal infections and discrimination of pyelonephritis from cortical scarring[63]
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

BACKGROUND

Renal scintigraphy remains an important technique for evaluation of the renal circulation, parenchyma, and collecting system. Through the acquisition of serial images over time and graphic depiction of radionuclide activity, information about renal blood flow and function not typically afforded by cross-sectional imaging can be achieved through qualitative and quantitative means. Tailored studies utilizing the administration of diuretic or angiotensin-converting enzyme inhibitors, in conjunction with the radionuclide imaging agent, allow for evaluation of suspected hydronephrosis or renovascular hypertension, respectively. The ability to create 3D multiplanar images with the SPECT technique improves the diagnostic capability over traditional planar imaging.

Tubular secretion agents, such as ^{99m}Tc-MAG3, are used for diuretic renography because tubular tracers are much more efficiently extracted by the kidney than ^{99m}Tc-DTPA (diethylene triamine pentaacetic acid), and washout is therefore easier to evaluate. 99mTc-DTPA is filtered purely by the glomerulus and thus can be used both to image the kidney and to measure

glomerular filtration rate. T- 99m DMSA (Dimercaptosuccinic acid) is especially useful for pyelonephritis and scar evaluations.

OVERVIEW

Diuresis renography can evaluate severity of urinary tract obstruction and can differentiate an obstructed collecting system from a dilated, but non-obstructing, system. It can also provide the differential function in each kidney. Multiple follow-up exams may be needed to detect gradual improvement or worsening.

Captopril Renography is done by imaging before and after administration of acetylcholine esterase inhibitor in patients with high index of suspicion of renovascular hypertension. It is used to identify subgroup in whom hypertension caused by renal artery stenosis could potentially respond to revascularization.[63]

Renal scintigraphy can be used to screen for postoperative complications in renal allograft dysfunction. These can include infarcts, acute tubular necrosis (ATN), collecting system obstruction, urine leaks, drug-induced nephrotoxicity, and rejection. ATN is differentiated from acute rejection as it usually occurs within the first few days after transplantation whereas acute rejection occurs from one week to months after transplantation. Baseline study may be for future comparison.

Renal scintigraphy can also be used to assess differential function in each kidney and in each segment of the kidney for further treatment implications in cases of surgery, trauma, infection, and congenital and mass abnormalities.

ABDOMEN/PELVIS

- Hepatic radioembolization[66]
    - For evaluation of pulmonary and gastrointestinal shunts or dosimetry calculations prior to procedure (typically utilizing Tc MAA) (78835 – Radiopharmaceutical quantification measurement)
    - Post-procedure imaging in lieu of PET to determine dose effect/dose toxicity (using the Y90 radiation itself)[67](78835 – Radiopharmaceutical quantification measurement)
- For evaluation of the following:
    - Intermittent/occult gastrointestinal bleeding after initial workup is indeterminate/contraindicated (scopes, CTA)[68]
    - Indeterminate or vascular hepatic lesions or bleed, when CT/MRI are contraindicated/inconclusive[69, 70]
    - Indeterminate accessory splenic tissue/asplenia when CT/MRI are contraindicated/inconclusive[71]

- Liver transplant (and other hepatic surgery/radiation) preoperative and postoperative function and complications when ultrasound/CT/MR are indeterminate or contraindicated[69]
- Localization of:
    - Suspected ectopic/residual gastric tissue (e.g., Meckel's diverticulum)[68]
    - Abnormalities in hepatobiliary scintigraphy (e.g., biliary abnormalities/leaks) when ultrasound (in infants) or CT is inconclusive/contraindicated[69]
- Peritoneal imaging for evaluation of complications of shunts, dialysis, or peritoneal integrity, when CT is inconclusive/contraindicated[68]
- A follow-up study may be needed to help evaluate a patient's progress after treatment, procedure, intervention, or surgery. Documentation requires a medical reason that clearly indicates why additional imaging is needed for the type and area(s) requested.

BACKGROUND

Most indications utilize a series of standard planar images over time to determine the progression of the radionuclide through the respective system. However, SPECT improves anatomic localization, increases diagnostic certainty and accuracy, and decreases the need for delayed imaging.

99mTc-labeled autologous red blood cells (99mTc-RBCs) are injected in intermittent gastrointestinal bleeds and imaged intermittently up to 24 hours to localize bleeds. It can detect bleeding rates as low as 0.1 cc/min to 0.5 cc/min (vs CTA-0.3-1ml/min and angiography 0.5-1ml/min). SPECT increases the sensitivity and specificity of bleeding-site localization. It has lower radiation exposure than CTA, particularly relevant in children (e.g., Meckel diverticulum studies).[72]

Tc99m sulfur colloid (and sometimes Tc99m RBC) ARE used to identify indeterminate vascular hepatic lesions, such as hemangiomas and hemangioendotheliomas. Denatured Tc99m RBC is useful for identifying indeterminate accessory splenic tissue.

Hepatic radioembolization is used for liver-dominant malignancy or metastases that are unresectable. It involves intraarterial injection of yttrium-90 (Y90)-labeled glass or resin microspheres. **A Tc99m MAA nuclear scan (typically requiring SPECT)** is performed before the actual treatment with Y90. MAA, which is similar in size to the Y90 microspheres, mimics the distribution of the Y90 particles and should embolize within the tumor's hepatic arterioles, thus outlining the expected localization of the radiation. The scan is compared to a CTA/MRA to evaluate for any possible shunting of the treatment agent to the lungs or the GI tract. Coils can be placed as needed to minimize any shunting of Y90 to areas other than the desired target.

Post-procedure imaging (within 24 hours) with either SPECT or PET (at the discretion of the treating physicians) is then performed to confirm the final distribution of the Y90 and to calculate the actual radiation dose delivered to the tumor. Utilizing the Bremsstrahlung radiation of the Y90 embolization agent, SPECT can be completed with routine nuclear medicine collimators. However, due to their higher energy level (as compared to routine

nuclear medicine agents), the Y90 photons scatter and/or pass through the collimator septa and degrade the image quality. Alternatively, PET scanning can be done, again using the Y90 treatment agent itself; but for PET via a minor decay pattern that emits a positron (32 in every one million decays) that is detectable with PET scanners. FDG PET may be needed later (ideally performed >12 weeks after treatment) to access tumor response to this radiation, in accordance with the tumor-specific guidelines for FDG PET restaging so may still require inconclusive conventional imaging, if necessary for the type of cancer being treated.

Peritoneal imaging includes evaluation of patency of peritoneovenous shunts, diaphragmatic perforations, or peritoneal loculations, especially prior to intraperitoneal chemotherapy. This is accomplished by injection of Tc99m MAA into the peritoneal cavity.

SPECT in **hepatobiliary imaging** can help localize abnormalities by distinguishing superimposed bowel activity and clarifying biliary abnormalities and bile leaks. It may obviate the need for delayed imaging and increase diagnostic certainty. Imaging is achieved utilizing the IV administration of Tc99m-labeled iminodiacetic acid, which is excreted by hepatocytes like bile.

Liver transplant complications are best evaluated by ultrasound, CT, and MR; however, limited applications in pediatric patients may exist when radiation doses or sedation considerations exist.

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POLICY HISTORY

BONE/JOINT SPECT/SPECT CT SCAN

Date	Summary
May 2023	• Updated and explained CPT code and removed most mentions of SPECT/CT since CPT codes for SPECT/CT are not managed

April 2022	• Reorganized indications for clarity
	• Within MALIGNANCY
	  ○ Simplified staging or restaging evaluation by removing "for the following" and the sub-bullets for breast cancer, prostate cancer, primary bone cancers, and monitoring of cancers with predominantly bone metastases
	  ○ Clarified staging or restaging evaluation to be performed if other imaging has not been performed, is contraindicated, or is inconclusive in evaluation of bone metastases

NON-BONE INFECTION/ INFLAMMATION SPECT/SPECT CT

Date	Summary
May 2023	• Wording adjustment
April 2022	• No significant changes

TUMOR SPECT/SPECT CT

Date	Summary
May 2023	• Wording adjustment
April 2022	• Renamed GL as Single Photon Emission Computed Tomography (SPECT)

CARDIAC SPECT/SPECT CT – As addressed in MPI and MUGA guidelines

NECK SPECT/SPECT CT (NON-CANCER)

Date	Summary
May 2023	• Wording adjustment
April 2022	• No significant changes

LUNG SPECT/SPECT CT

Date	Summary
May 2023	• Wording Adjustment
April 2022	• No significant changes

BRAIN SPECT/SPECT CT

Date	Summary
May 2023	• Wording adjustment
April 2022	• Removed For patient with history of stroke or trauma with recent Bract CT or MRI based on updated ACR Appropriateness Criteria

RADIONUCLIDE CISTERNOGRAPHY (CSF) SPECT/SPECT CT SCAN

Date	Summary
May 2023	• Wording adjustment
April 2022	• No significant changes

RENAL SPECT/SPECT CT

Date	Summary
May 2023	• Wording adjustment
April 2022	• No significant changes

ABDOMEN/PELVIS SPECT/ SPECTCT SCAN

Date	Summary
May 2023	• Wording adjustment
April 2022	• For Hepatic radioembolization o Clarified Tc MAA for evaluation of pulmonary and GI shunts or dosimetry calculations o Clarified Y90 for post-procedure imaging in lieu of PET for dose effect/dose toxicity • In Background, added further details on Y90 and imaging

Reviewed / Approved by Clinical Guideline Committee

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Clinical guidelines **PET SCANS** **includes** • **PET** • **PET with CT Attenuation** • **PET/CT**	**Original Date: September 1997**
78811 - Limited area e.g. Chest, head/neck **78812 - Skull base to mid thigh** **78813 - Whole Body 78814 - With CT attenuation (Limited area e.g. Chest, head/neck)** **78815 - With CT attenuation (Skull base to mid thigh) 78816 - With CT attenuation (Whole Body)**	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_070-1	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

GENERAL NOTES:

ADULT AND PEDIATRIC MALIGNANCIES[1]: ONCOLOGICAL PET IS INDICATED FOR BIOPSY-PROVEN CANCER **OR** STRONGLY SUSPECTED CANCER BASED ON OTHER DIAGNOSTIC TESTING. The appropriateness of an ordered PET/CT study is dependent on which radiopharmaceutical will be used for the PET/CT.

INDICATIONS FOR FDG PET:

See Legislative Requirements for specific mandates for the State of Washington

The following list applies to biopsy-proven cancers **AND** lung nodules with no known history of malignancy**. This is NOT a comprehensive list. Additional indications for PET are found in the tables following this list.** The definitions regarding initial staging and restaging (**including time interval following treatment****) apply.

- Solid lung nodule > 8 mm and no prior PET – Indicated
- Mixed lung nodule* with solid component > 6 mm and no prior PET – Indicated
- Basal cell carcinoma of the skin – **Not indicated** for initial staging or restaging
- Castleman's Disease – Indicated for initial staging and restaging
- Cervical Cancer (stage IB1 or higher) – Indicated for initial staging and restaging**
- Chondrosarcoma – **Not indicated** for initial staging or restaging
- Ewing's Sarcoma* – Indicated for staging (all ages) and restaging age < 30
- Head and Neck Cancer – Indicated for initial staging and restaging**
- Non-Small Cell Lung Cancer – Indicated for initial staging and restaging
- Lymphoma (Hodgkin's and non-Hodgkins) – Indicated for initial staging and restaging
- Melanoma* – cutaneous – (stage III, IV) – indicated for initial staging and restaging
- Merkel Cell – Indicated for initial staging and restaging
- Osteosarcoma* – Indicated for initial staging (all ages) and restaging age < 30
- Peritoneal Mesothelioma – Indicated for initial staging and restaging
- Post Transplant Lymphoproliferative Disorder (PTLD) – indicated for initial staging and restaging
- Renal – **Not indicated** for initial staging or restaging
- Rhabdomyosarcoma (RMS) – Indicated for initial staging and restaging
- Small bowel carcinoma* – **Not indicated** for initial staging
- Soft Tissue Sarcoma* (other than RMS) – Indicated for initial staging (age < 30) and restaging (age < 30)
- Testicular Cancer – Seminoma* – **Not indicated** for initial staging
- Testicular Cancer – Non-Seminoma – **Not indicated** for initial staging or restaging
- Thymoma/Thymic Cancer – Indicated for initial staging and restaging

*See additional indications in table below

**If radiation or chemoradiation were given, 12 weeks must have elapsed since last radiation treatment. See table below for additional indications if < 12 weeks.

INDICATIONS FOR SPECIAL TRACER PET:

The following list applies to for biopsy-proven cancers for which a non-FDG tracer (special tracer) is indicated in the specific clinical scenarios described. **This is NOT a comprehensive list. Additional indications for non-FDG PET are found in the tables following this list.** The definitions regarding initial staging and restaging (including time interval following

treatment**) apply. Diagnosis needs to be confirmed by biopsy and tracer planned clearly indicated.

- Prostate Cancer* – **PSMA** PET Indicated for initial staging **ONLY** of non-metastatic[2] Gleason 8, 9, 10 disease (or grade group 3, 4 or 5 disease)
- Carcinoid, Well-differentiated Neuroendocrine tumors, pheochromocytoma and paraganglioma* – **SSTR** PET (such as Ga68-Dotatate, Ga68-Dotattoc and Cu64-Dotatate) Indicated for initial staging ONLY

FDG-PET/CT (fluorodeoxyglucose-positron emission tomography)

LUNG NODULE[3] seen on LDCT or CT+ contrast (without known malignancy)

- Solid Component of Dominant Nodule (either solitary or clearly dominant) ≥ 8mm **OR**
- Part solid/mixed nodules with the solid component 6 mm or larger **OR**
- Mixed nodule (i.e., ground glass and solid nodule) with solid component of the nodule ≥ 4mm on LDCT when there has been
  - Interval growth of the solid component of at least 1.5mm on subsequent LDCT scans
    OR
  - Interval development of a new mixed nodule on subsequent LDCT with the solid nodule component ≥ 4mm

FDG PET

ONCOLOGICAL INDICATIONS FOR FDG PET

(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
ADRENAL[4] (other than pheochromocytoma/ paraganglioma)	Indicated when conventional imaging (see Background) and biochemical evaluation are highly suggestive of adrenocortical carcinoma	with prior indeterminate imaging
AIDS-related KAPOSI SARCOMA[5]	If concerns for coexisting KSHV associated inflammatory cytokine syndrome (KICS), MCD, or KSHV+ lymphoma	**Not Indicated**
ACUTE LYMPHOBLASTIC LEUKEMIA (ALL)[6]	lymphomatous extramedullary disease	lymphomatous extramedullary disease

ONCOLOGICAL INDICATIONS FOR FDG PET
(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
ACUTE MYELOGENOUS LEUKEMIA (AML)[7, 8]	If suspected extramedullary involvement	If suspected/known extramedullary involvement
ANAL[9]	with prior indeterminate imaging (see Background). (can consider PET/MR‡‡)	with prior indeterminate imaging
BASAL CELL[10] (BCC of the skin)	**Not Indicated**	**Not Indicated**
BILIARY TRACT CANCER[11] (Cholangiocarcinoma, Gall Bladder Cancer)	With prior indeterminate imaging	With prior indeterminate imaging
BLADDER[12]	With indeterminate imaging and muscle invasive disease only when the indeterminate finding is outside of the urinary tract	With indeterminate imaging and suspected metastatic disease or recurrence outside of the urinary tract
BONE CANCER[13]		
• **Chondrosarcoma**	**Not indicated**	**Not indicated**
• **Chordoma**	With prior indeterminate imaging	With prior indeterminate imaging
• **Ewing Sarcoma and Osteosarcoma**	Indicated (all ages)[13]; PET can be approved in conjunction with MR of primary site	Age < 30: Indicated Age > 30: Indicated for known or suspected metastatic disease based clinical or imaging findings or when PET was used for initial staging PET can be approved in conjunction with MR of primary site (all ages)

ONCOLOGICAL INDICATIONS FOR FDG PET

(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
BREAST[14] *See special tracer section below for FES PET*	with prior indeterminate imaging	with prior indeterminate imaging
CERVICAL[15]	Indicated for stage IB1 and above (can consider PET/MR‡‡)	Indicated
COLORECTAL[16, 17]	with prior indeterminate imaging **OR** potentially surgically curable metastatic disease **OR** when considered for image-guided liver-directed therapies	with prior indeterminate imaging (including discordance between tumor markers (CEA) and imaging) **OR** potentially surgically curable metastatic disease **OR** when considered for image-guided liver-directed therapies
ENDOMETRIAL[18]	with prior indeterminate imaging	with prior indeterminate imaging
ESOPHOGEAL and ESOPHAGOGASTRIC JUNCTION (EGJ)[19] (includes EGJ tumors with epicenter < 2 cm into stomach)	Indicated if no evidence of metastatic disease	Indicated following preoperative chemoradiation or definitive chemoradiation; **OR** with prior indeterminate imaging
FALLOPIAN TUBE CANCER	with prior indeterminate imaging	with prior indeterminate imaging
GASTRIC[20] (includes EGJ tumors with epicenter >2 cm into stomach)	with prior indeterminate imaging AND no evidence of metastatic disease	with prior indeterminate imaging

ONCOLOGICAL INDICATIONS FOR FDG PET
(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
GESTATIONAL TROPHOBLASTIC CANCER[21]	with prior indeterminate imaging	with prior indeterminate imaging or at completion of chemotherapy when hCG is not a reliable marker
GIST[22]	with prior indeterminate imaging	with prior indeterminate imaging
HEAD and NECK[23] (including mucosal melanoma of the head and neck)	Indicated Additionally, Face/Neck MRI (or CT) may be indicated concurrently with PET if needed for surgical planning	Indicated Additionally, Face/Neck MRI (or CT) may be indicated concurrently with PET 3-4 months after end of treatment in patients with locoregionally advanced disease or with altered anatomy If final PET/CT is equivocal or borderline for residual disease, a repeat PET/CT at $\geq$ 6 weeks may help identify those that can be safely observed without additional surgery
HEPATOCELLULAR[24]	with prior indeterminate imaging	with prior indeterminate imaging
LEUKEMIA (refer to specific types listed in table when possible)	If there is lymph node involvement (lymphomatous features), soft tissue and/or extramedullary involvement (myeloid sarcoma) and/or if	If there is lymph node involvement (lymphomatous features), soft tissue and/or extramedullary involvement (myeloid sarcoma) and/or if

ONCOLOGICAL INDICATIONS FOR FDG PET
(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
	forms “chloromas” (leukemia tumor balls)	forms “chloromas” (leukemia tumor balls)
LUNG		
• **Non-Small Cell**[25]	Indicated	Indicated
• **Limited stage small cell**[25]	Indicated	Indicated prior to radiation or with indeterminate imaging
• **Extensive stage small cell**	**Not indicated** unless conventional imaging is unable to conclusively classify the stage as extensive (see Background)	**Not indicated** unless consolidative thoracic radiation is planned (see Background)
LYMPHOCYTIC LEUKEMIA		
• **Chronic (CLL) and Small (SLL)**[26]	For suspected high-grade transformation or to guide biopsy with prior indeterminate imaging	with accelerated CLL or to guide biopsy with prior indeterminate imaging (includes negative CT with rising tumor markers or if conventional imaging documents mets, IF clearly considering resection)
LYMPHOMA (Non-Hodgkins and Hodgkins)[27-32]	Indicated (can consider PET/MR‡‡)	Indicated (can consider PET/MR‡‡)
MELANOMA		
• **Cutaneous**[33]	stage III, IV indicated; indicated for dermal melanomas that lack epidermal involvement	Indicated for stage III, IV disease **OR** for workup of local satellite/in-transit and/or nodal recurrences (see Background)
• **Uveal**[34]	**Not indicated**	With prior indeterminate imaging

ONCOLOGICAL INDICATIONS FOR FDG PET
(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
MERKEL CELL[35]	Indicated	Indicated
MESOTHELIOMA (malignant)		
• **Pleural**[36]	Indicated for stage I-IIIA when the patient is a potential surgical candidate (see Background)	Indicated only prior to surgery for stage I-IIIA
• **Peritoneal**[37]	Indicated	Indicated
MULTIPLE MYELOMA[38]		
• **Smoldering myeloma** (asymptomatic)	Indicated	Indicated annually or possibly more frequently as clinically indicated (labs and/or symptoms to suggest progression)
• **Active myeloma**	Indicated	Indicated
• **Plasmacytoma**	Indicated	Indicated
NEUROBLASTOMA	Indicated when MIBG is negative, indeterminate, or there are discordant findings between MIBG and pathology	Indicated when FDG PET was used for initial staging or if MIBG has become indeterminate or discordant
NEUROENDOCRINE TUMORS:[39]		
• **Poorly differentiated**	with prior indeterminate imaging (see Background)	with prior indeterminate imaging (see Background)
• **Well-differentiated grade 3 with high Ki-67 (≥ 55%)**	Indicated after prior negative or indeterminate SSTR (dotatate) PET (see Background)	Indicated after prior negative or indeterminate SSTR (dotatate) PET (see Background)

ONCOLOGICAL INDICATIONS FOR FDG PET
(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
OVARIAN[40]	with prior indeterminate imaging	with prior indeterminate imaging (including discordance between tumor markers (CA-125) and imaging)
OCCULT PRIMARY[41]	with prior indeterminate imaging (see Background)	with prior indeterminate imaging (see Background)
PANCREATIC	With prior indeterminate imaging OR with any of the following high-risk features: • borderline resectable disease • markedly elevated CA19-9 >180 U/ml • large primary tumor/lymph nodes • very symptomatic (jaundice, symptomatic gastric outlet obstruction, venous thromboembolism, extreme pain and excessive weight loss)	When PET was used for initial staging and need to assess response to treatment in order to determine if now a surgical candidate
PENILE[42]	with prior indeterminate imaging	with prior indeterminate imaging
PERITONEAL CANCER[40] **(PRIMARY)**	with prior indeterminate imaging	with prior indeterminate imaging
POST TRANSPLANT LYMPHOPROLIFERATIVE DISORDER (PTLD)	Indicated when the diagnosis is made OR if suspected based on abnormal PE, abnormal imaging	Indicated

ONCOLOGICAL INDICATIONS FOR FDG PET
(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
	or abnormal labs (i.e., significantly elevated or rising viral titers)	
PROSTATE (FDG PET only) (see Prostate Special Tracer section)	**Not Indicated**	**Not Indicated**
RENAL[43]	**Not indicated**	**Not indicated**
SKIN SQUAMOUS CELL[44]	Indicated for biopsy proven ≥N1 or ≥M1 disease (lymph node or metastatic site has been biopsied and shows disease spread)	Indicated for biopsy proven ≥N1 or ≥M1 disease (lymph node or metastatic site has been biopsied and shows disease spread)
SMALL BOWEL CARCINOMA[45]	**Not indicated**	with prior indeterminate imaging
SOFT TISSUE SARCOMA[46]		
• **Rhabdomyosarcoma**	Indicated	Indicated
• **All other soft tissue sarcomas**	For patients <30 years old: Indicated For patients >30 years old: with prior indeterminate imaging	For patients < 30 yrs old: Indicated For patients <30 yrs old: with prior indeterminate imaging
TESTICULAR[47]		
• **Seminoma**	**Not Indicated**	with prior indeterminate imaging OR residual mass >3cm with normal AFP and beta-hcG and 6 weeks post chemotherapy

ONCOLOGICAL INDICATIONS FOR FDG PET
(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING (If this final PET/CT is equivocal or borderline for residual disease, an additional repeat PET/CT > 6 weeks later may help identify those that can be safely observed without additional surgery)
• **Non-Seminoma**	**Not Indicated**	**Not Indicated**
THYMOMA/THYMIC CANCER[48]	Indicated	Indicated
THYROID[49]		
• **Papillary, Follicular, Oncocytic (formerly Hurthle Cell)**	**Not Indicated**	with prior indeterminate imaging (including discordance between tumor markers (Tg, anti-Tg Ab) and imaging; see Background)
• **Anaplastic**	Indicated	Indicated
• **Medullary**	**Not Indicated** (see SSTR indications below)	With prior indeterminate imaging (including discordance between tumor markers (calcitonin, CEA) and imaging; see Background)
UTERINE (Endometrial Carcinoma and Uterine Sarcoma)[50]	with prior indeterminate imaging	with prior indeterminate imaging
VULVAR[51]	Indicated if ≥ T2 (extension beyond vulva/perineum) OR	Indicated

ONCOLOGICAL INDICATIONS FOR FDG PET

(SEE SPECIAL TRACERS SECTIONS FOR INDICATIONS OTHER TRACERS)

CANCER TYPE	INITIAL STAGING	RESTAGING
	with prior indeterminate imaging	

MISCELLANEOUS INDICATIONS FOR FDG PET

(excluding brain and cardiac PET which have separate Guidelines)

TYPE	INITIAL STAGING	RESTAGING
CASTLEMAN'S DISEASE	Indicated	Indicated
HISTIOCYTIC NEOPLASMS[52]:		
• **Langerhan's**	Indicated	Indicated if on active treatment for multiple bone disease, high risk bone disease or multisystem involvement
• **Erdheim Chester**	Indicated	Indicated if on active treatment
• **Rosai-Dorfman**	Indicated	Indicated if on active treatment

ǂ SARCOIDOSIS

- **ONLY** if conventional testing (CXR, CT and inflammatory serology) remain indeterminate for known sarcoid to determine:
  - if treatment might be helpful
  - extent of disease, if it will potentially change management
  - response to treatment
- **OR** if strongly supected sarcoid to determine most suitable site to biopsy

ǂ VASCULITIS

- In limited circumstances, with known vasculitis, AFTER conventional imaging (MRA/CTA/MR/CT) has clearly been shown to be insufficient to determine treatment

ǂ NEUROFIBROMATOSIS TYPE 1[53-56]

- When there is a concern for transformation of a neurofibroma to a Malignant Peripheral Nerve Sheath Tumor (MPNST) based on a change in imaging (such as rapid growth or change in texture on exam or imaging) and/or symptoms (new or worsening pain in the location of a known neurofibroma), then a single FDG-PET is indicated (see Background).
- Restaging of a known MPNST with PET requires indeterminate imaging prior to PET approval.

ǂ Adjudications should occur on a case-by-case basis

YTTRIUM-90 (Y90)

Y90 PET SCAN: Indicated when performed immediately after treatment of liver malignancy (primary or metastatic). The Y90 treatment is also the tracer for this and PET is performed within 24 hours of treatment (while Y90 is still detectible) to confirm the final distribution of the Y90. PET.

NON FDG PET TRACERS

Somatostatin Receptor (SSTR) PET FOR NET (Neuroendocrine Tumors) (GA68-DOTATATE, GA68-DOTATOC and CU64-DOTATATE)

CANCER TYPE	INITIAL STAGING	RESTAGING
CARCINOID,NEUROENDOCRINE TUMORS (NET)[57] OF THE GI TRACT, PANCREAS, LUNG, THYMUS AND UNKNOWN PRIMARY, PHEOCHROMOCYTOMA, PARAGANGLIOMA	Indicated (PET/MR‡‡ can be considered)	Indicated when there is progression or recurrence is known or suspected (based on labs and/or conventional imaging) and SSTR directed therapy is being considered (see Background) (PET/MR‡‡ can be considered)
MEDULLARY THYROID	with prior indeterminate imaging	with prior indeterminate imaging (including discordance between tumor markers (calcitonin, CEA) and imaging; see Background)

FES (fluoroestradiol F 18 (Cerianna®)) PET

CANCER TYPE	INITIAL STAGING	RESTAGING
BREAST CANCER	**Not Indicated**	Indicated for biopsy proven recurrent or metastatic **Estrogen Receptor Positive (ER-positive)** disease when receptor status of sites of disease will

Somatostatin Receptor (SSTR) PET FOR NET (Neuroendocrine Tumors) (GA68-DOTATATE, GA68-DOTATOC and CU64-DOTATATE)

CANCER TYPE	INITIAL STAGING	RESTAGING
		result in a change treatment (see Background)

PSMA TRACERS (such as F18 piflufolastat (Pylarify®), GA 68 PSMA-11, GA 68 gozetotide (Locametz®), and GA 68 gozetotide (Illuccix®)) For PROSTATE CANCER[2, 58]

CANCER	INITIAL STAGING	RESTAGING
PROSTATE CANCER **TRACERS:** **Initial staging**: **PSMA** is the ONLY tracer potentially approvable for initial staging **Restaging**: PSMA is the preferred tracer, see Background for other tracers such as Axumin® and 11-Choline[58].	**PSMA** PET is indicated for initial staging of non-metastatic[2] very high risk, high risk and unfavorable intermediate risk prostate cancer (see Background) (can consider PET/MR‡‡) Pelvic MRI may be indicated concurrently if needed for surgical planning	**PSMA** PET is indicated in the following situations (see Background): **Post-radical prostatatectomy:** • For PSA persistence: detectable PSA (0.1 ng/mL or greater) at 3 months post-operatively (only one level required) • For rising PSA on two or more occasions OR a rise to > 0.1 ng/mL if was previously undetectable For **known metastatic disease** with progression **on treatment** and either: • Rising PSA (on two consecutive levels) • Disease progression on imaging (i.e. bone scan) A single restaging PSMA PET 12 weeks after treatment with radioligand therapy (Lu-177/Pluvicto) is indicated

LEGISLATIVE REQUIREMENTS

- Washington
    - Washington State Health Care Authority Health Technology Assessment 20181116B Positron Emission Tomography (PET) scans for lymphoma[59]
        - PET scans (i.e., PET with computed tomography or PET/CT) for lymphoma is a covered benefit with conditions.
        - An initial staging scan is covered followed by up to three (3) scans per active occurrence of lymphoma:
            - When used to assess a response to chemotherapy, scans should not be done any sooner than three (3) weeks after completion of any chemotherapy cycle, except for advanced stage Hodgkin's lymphoma, after four (4) cycles of ABVD chemotherapy.
            - When used to assess response to radiation therapy, scans should not be done any sooner than eight (8) weeks after completion of radiation or combined chemotherapy and radiation therapy.
        - Relapse: Covered when relapse is suspected in the presence of clinical symptoms or other imaging findings suggestive of recurrence
        - Surveillance: Not covered

Washington State Health Care Authority oversees the Apple Health (Medicaid) program and the Public Employees Benefits Board (PEBB) Program[60]

BACKGROUND

USEFUL DEFINITIONS: The **cancer specific details for adjudication still apply.**

- **INITIAL STAGING** refers to imaging that is performed AFTER the diagnosis of cancer is made, and generally before any treatment**.**
- **RESTAGING** includes scans that are either needed **during active treatment (subsequent treatment strategy)** to determine response to treatment/monitor treatment, a single **end of treatment** study done within 6 months of completion of treatment, or when there is clinical **concern for recurrence** (i.e., new imaging, new signs, rising labs/tumor markers or symptoms relative to type of cancer and entire clinical picture) (recurrence is not required to be biopsy proven)
- **ACTIVE TREATMENT** includes chemotherapy, immunotherapy, radiation, as well as patients on "maintenance therapy" who have known, or existing, metastatic disease being held in check by this treatment. Allogenic bone marrow transplant and CART T-cell therapy should be considered 'active' treatment for at least 6 months after infusion/transplant and as such can be approved at 30 days, 100 days, and 6 months after the most recent infusion.
- **SUBSEQUENT TREATMENT STRATEGY:**

- For restaging or monitoring response during active treatment (including immunotherapy), and/or a single evaluation after completion/cessation of therapy. The interval should **ideally**‡ be 6-12 weeks after surgery, and 12 weeks after radiation (to avoid false positive findings that can be caused by treatment changes or healing).
    - ‡NOTE: a valid clinical reason explaining why the interval needs to be shorter than ideal must be present
- PET/CT can be performed 1 - 3 weeks after neoadjuvant chemotherapy or neoadjuvant chemoradiation if done for presurgical planning to evaluate for distant metastatic disease or to evaluate known metastatic disease located in areas separate from the site(s) being radiated.
- When an end of treatment PET scan performed at an appropriate post-treatment interval (see above) shows indeterminate findings, one additional repeat PET in 3 months is indicated.

- **INDETERMINATE IMAGING:** When indeterminate imaging is required prior to PET, this typically means conventional imaging (CT, MRI, OR Nuclear Medicine Scan (i.e. bone scan)) shows a finding that is indeterminate **AND** clarification of that finding with PET will potentially change management. When PET is not indicated for a cancer type in the guideline (i.e. literature does not support the use of PET), PET is **not indicated** even if indeterminate imaging is provided. The information provided should clearly explain why conventional imaging is insufficient to determine treatment or management and includes situations such as the following:
    - **New or residual masses** described as **indeterminate** on conventional imaging
    - **Biopsy guidance:** To determine the best location to biopsy either within a tumor that has necrosis on imaging **OR** to determine the best location to biopsy when there are findings on standard imaging that would require a significantly invasive procedure (such as laparoscopic or open surgical procedures) **AND** malignancy is highly suspected based on imaging.
- When **previous conventional imaging has been shown to be negative**, yet a **concurrent PET scan was positive** (i.e. conventional imaging was falsely negative/ missed lesions seen on PET), we do not require repeat conventional imaging prior to every subsequent PET (because conventional imaging was already shown to be insufficient). Appropriate interval criteria should still be met.
- **SURVEILLANCE PET** is generally **not approvable**. Surveillance means no active treatment, no current suspicion of recurrence and occurs 6 months or more after completion of treatment. Generally, this would be accepted only when ordered by the treating oncologist or clearly at their recommendation (not as routine follow-up ordered by PCP). **Possible exceptions for the following indications only:**

- Ewing's Sarcoma and Osteosarcoma in patients specified as high risk: every 3 months for 2 years, then every 4 months up to year 3 post completion of treatment.
- Small Cell Neuroendocrine Cervical every 3-6 months for the first 2 years post completion of treatment
- Diffuse Large B Cell Lymphoma when disease was only seen previously on PET: every 6 months for 2 years, then one at 12 months up to year 3 post completion of treatment.
- Gestational trophoblastic disease when hCG is not a reliable marker every 6-12 months for up to 3 years post completion of treatment
- Histiocytic neoplasms every 3-6 months for the first 2 years post completion of treatment
- Melanoma (stage 2b-4) specified as high risk every 3-12 months for 2 years, then every 6-12 months, up to 5 years after initial diagnosis[33, 61]
- Solitary plasmacytoma (up to 3 yrs after the diagnosis of plasmacytoma)[62, 63]

PET with CONTRAINDICATIONS to contrasted CT AND MRI:

When PET is requested for restaging due to the inability to image with contrasted conventional imaging, indeterminate non-contrasted studies must be provided prior to consideration of PET. The inability to image with contrasted conventional imaging includes contraindications to both CT (such as chronic renal failure with GFR < 30 **OR** significant iodinated contrast allergy) **AND** to MRI (such as gadolinium allergy, implanted device that is not MRI compatible, or GFR <40). When requested for surveillance due to the above reasons, PET can be considered during the time that the highest risk of recurrence for that cancer (typically the first two years after completion of treatment).

‡‡**PET/MR**: When PET/MR can be considered per the guideline, if the criteria are met for PET for that cancer and the plan is to do a PET/MR rather than a PET/CT, the PET scan can be approved. In the same way a separate approval for total body CT is not needed when a PET/CT is requested, a separate approval for the total body MR is not typically needed. However, until a PET/MR CPT code is implemented, unlisted MR in addition to PET can be considered on a case-to-case basis.

PET IN COMBINATION WITH DEDICATED SITE SPECIFIC MR (OR CT): Distinct from PET/MR, when PET is needed in addition to a dedicated site specific MRI (or CT), two authorizations may be issued: one for the PET scan and one for the site specific MRI (or CT). Clear indications for both must be provided.

STAGING: Staging for cancer is cancer-specific and is typically based on the TNM system of staging. T stage refers to the extent of the main (primary) tumor. N stage refers to the extent of

spread to lymph nodes. M stage refers to whether or not the cancer has metastasized to other parts of the body. Clinical stage (such as cT2b) is determined by physical exam, imaging and possibly biopsy. Pathologic stage (such as pT2b) is determined after the tumor has been resected. Certain cancers have additional information that is needed to stage the patient (such as PSA level in prostate cancer).

CANCER SPECIFIC BACKGROUND:

Adrenal Tumors: Features of an adrenal mass on conventional imaging that are suspicious for adrenocortical carcinoma (ACC) include: size > 4 cm, inhomogenous mass with irregular margins and/or has local invasion. If there is no history of another primary malignancy and these features are present on imaging, then PET is reasonable. If there is a history of another primary tumor and a metastasis is suspected, biopsy should be done first to determine tissue type. A biochemical evaluation is also done to evaluate for other tumor types (such as pheochromocytoma) for which a different tracer (such as dotatate) may be more appropriate.

Anal Cancer: Normal pelvic lymph nodes are often not seen on imaging. When pelvic lymph nodes are visualized on imaging, even if normal in size, that finding raises concern for disease spread and can be considered indeterminate.

Brain Tumors: When an oncologic PET is requested for a primary brain malignancy, it typically should be reordered as a Brain PET (CPT 78608 and 78609). This includes requests for recurrent meningioma when dotatate PET is requested.

Breast Cancer: Fluoroestradiol F 18 (Cerianna® or FES) is a new tracer that is specific for estrogen receptor positive (ER-positive) breast cancer. It is used in recurrent or metastatic breast cancer that was known to be ER-positive at initial diagnosis to determine how much of the current disease has functional estrogen receptors. This can help determine whether endocrine therapy is appropriate. This tracer is **NOT** indicated for ER-negative disease. An FES PET is NOT done to monitor response to treatment but instead is done ONLY when the receptor status of the recurrent or metastatic sites is in question. FES PET is **NOT** used for assessing the primary site of disease.

Langerhans Cell Histiocytosis is the most common type of histiocytosis, with variable presentations and sites involvement. Some studies suggest PET/CT may be more effective in detecting bone lesions compared with MRI and bone scans in assessing disease response as healing/treatment changes of bone lesions on conventional imaging may be delayed. However, PET/CT is not the modality of choice in assessing disease response of lung or brain lesions.

Lung Cancer – Small Cell: Initial Staging is classified as Limited Stage (LS) and Extensive Stage (ES). In limited stage disease, the disease burden is localized to the chest (Any T, Any N, M0) AND able to be encompassed in a tolerable radiation plan. Patients with disease OUTSIDE of the chest (M1) or T3-4 due to multiple lung nodules that are too extensive or have tumor/nodal volume that is too large to be encompassed in a tolerable radiation plan are classified as extensive stage. When a patient cannot clearly be classified as ES but there are findings on

imaging suggestive of disease (typically extra-thoracic findings such as a liver lesion), then PET may be used to help classify the extent of disease as ES or LS. If conventional imaging clearly shows ES disease, then PET is not indicated. **Restaging:** When radiation is planned (either for LS disease OR for ES disease that has responded to treatment), PET is indicated to determine radiation fields. Otherwise, disease reassessment/response to therapy is with conventional imaging[64].

Melanoma: Local satellite/in-transit recurrences are in the deep dermis or subcutaneous fat within or adjacent to the melanoma scar. They are recurrences that occur after an initial adequate wide excision, likely represent dermal lymphatic disease and do need imaging at diagnosis. Persistent disease, by contrast, is disease remaining in the melanoma scar after an initial resection (likely due to inadequate resection) and imaging would only be indicated if stage III or IV disease is present[33].

Mesothelioma[36, 65]: The evaluation of recurrent pleural effusion and/or pleural thickening includes CT chest, thoracentesis and pleural biopsy. The diagnostic sensitivity of this investigation is 70-75%. If the first biopsy is non-diagnostic, there is a higher chance that subsequent biopsies will be non-diagnostic, thus a PET to guide subsequent biopsy is reasonable in this situation.

Multiple Myeloma: Making the diagnosis of myeloma is complex and may include bone marrow biopsy, cytometry, imaging etc. However, once the diagnosis of myeloma (multiple myeloma or plasmacytoma) is confirmed, PET may be considered.

Neuroendocrine Tumors (NET)[57]: a Somatostatin Receptor (SSTR) analog PET (commonly dotatate) is indicated at initial diagnosis to evaluate for metastatic disease. If a moderately invasive procedure is needed to confirm the diagnosis (i.e. open surgery), PET prior to this open biopsy may be reasonable when the clinical picture, labs and imaging are consistent with a NET. Restaging can be done with conventional imaging (CT/MRI). However, if progression is seen and/or SSTR directed therapy is being considered, then SSTR-PET is indicated. Because liver lesions are often not well imaged on SSTR-PET, a dedicated liver MRI at the time of SSTR-PET may be indicated if there are known or suspected liver metastases.

FDG PET may be more useful when a NET is metabolically active, such as in poorly differentiated NET and well differentiated grade 3 NET with a high Ki67 (≥ 55%). For poorly differentiated NET, indeterminate conventional imaging is needed prior to FDG PET. For well-differentiated grade 3 NET with a high Ki-67 (≥55%), a negative dotatate PET is required before an FDG PET can be considered.

Neurofibromatosis type 1 (NF1): Surveillance of lesions is completed with MRI (often whole body MRI.) Approximately 5% of patients with neurofibromatosis are thought to develop soft tissue sarcomas, most commonly malignant peripheral nerve sheath tumors (MPNSTs), a type of sarcoma. Risk factors for MPNST transformation include: whole *NF1* gene deletion, family history of MPNST, prior radiation therapy, large plexiform neurofibroma burden or multiple distinct nodular lesions on magnetic resonance imagining (MRI), neurofibromatous neuropathy,

and atypical neurofibroma(s). Once a PET has been done and was negative, rapid growth on conventional imaging and plan for biopsy need to be provided prior to consideration of another PET.

Occult Primary: The typical evaluation for a suspected metastatic malignancy includes a thorough physical exam, laboratory evaluation, CT of the Chest, Abdomen and Pelvis AND a biopsy of the site of disease. The biopsy results then indicate either a clear primary for which the relevant guideline is applied or an epithelial cancer (not site specific). Epithelial cancers are further classified as adenocarcinoma, carcinoma not specified, squamous cell carcinoma (SCC) or neuroendocrine carcinoma (see NET in guideline). If the primary is still not identified, further guidance is often complex and based on the site of disease identified.

Pheochromocytoma and Paraganglioma: Hypertension, tachycardia, sweating and syncope are typical symptoms. Biochemical workup includes catecholamines (such as metanephrines, normetanephrine, and/or dopamine). Elevations in catecholamines that are greater than two times above the upper limit of normal are usually present. Biopsy of a pheochromocytoma and paraganglioma that is biochemically active is contraindicated. Thus, when the clinical picture **AND** labs is consistent with pheochromocytoma/paraganglioma, the SSTR-PET can be approved without biopsy confirmation. However, if the catecholamines are not elevated (as above), in the setting of clinical concern and a mass, biopsy is required.

Prostate Cancer Initial Staging: PSMA is the only approvable tracer for initial staging. Risk groups are determined by the Gleason Score (on pathology report), PSA, clinical stage (by exam (digital rectal exam (DRE) and/or imaging such as pelvis MRI). This information may also be expressed as a grade group. The three risk groups for which PSMA PET is indicated are: very high risk, high risk and unfavorable intermediate risk. Any of the following criteria place the patient into one of these risk groups and PSMA PET may be approved for initial staging:

- Gleason score 8, 9 or 10
- Primary pattern 4 (Gleason 4+3=7)
- PSA > 20 AND Gleason score 3+3=6 or higher
- PSA > 10 AND Gleason score 3+4=7
- PSA > 10 AND Gleason score 3+3=6 AND clinical stage ≥ T2b
- Clinical stage ≥ T3a AND Gleason score 3+3=6 or higher
- Clinical stage ≥ T2b AND Gleason score 3+4=7 or higher
- ≥ 50% of cores positive for cancer in a random, non-targeted prostate biopsy
- Grade group 3, 4 or 5 disease

When **active surveillance** was selected as the initial plan of care, PSMA PET is indicated when the disease progresses to very high risk, high risk or unfavorable intermediate risk using the most recent Gleason score/biopsy result, clinical stage and PSA level.

A biopsy typically needs to be done confirming the diagnosis of prostate cancer prior to PSMA PET. If the PSA is > 50, when there is no clinical concern for infection nor has there been recent instrumentation **AND** there is an intent to treat the patient for prostate cancer without biopsy confirmation, PSMA PET can be considered. Situations where this may be reasonable are when the biopsy poses significant risk (i.e., anticoagulation or significant comorbidity) **OR** if treatment is urgently needed (such as spinal cord compromise from metastases)[66].

Patients who are **metastatic at diagnosis** (no prior treatment) are staged with conventional imaging[2]. PSMA PET can be considered if there are indeterminate findings on conventional imaging and specific details regarding how clarification of these findings with PSMA PET would change treatment are provided.

Prostate Cancer Restaging: PSMA is the preferred tracer for restaging of prostate cancer due to the increased sensitivity and specificity for detection of disease. There may be situations where Axumin or Choline are approvable tracers such as for detection of inconclusive findings on bone scan, when prior PET scans have used that tracer and direct comparison is needed or if PSMA is not available. For both Axumin and Choline, inconclusive conventional imaging is required and the reason that tracer is being requested instead of PSMA needs to be provided. When a PSMA PET has failed to detect a site of recurrence (i.e. PSMA PET was negative previously yet PSA continues to rise), a repeat PSMA PET may be approved as early as 6 months if the PSA doubling time is < 12 months.

Thyroid Cancer: Thyroid cancer can be grouped into three main histologic subtypes: Differentiated (including papillary, follicular, and oncocytic), Anaplastic and Medullary.

Differentiated thyroid cancer: As iodine is taken up by differentiated thyroid cancers, an iodine scan (I-123 and/or I-131) is often the first line imaging modality (in addition to ultrasound). When there is a discordance between the tumor marker (thyroglobulin or thyroglobulin antibody) and imaging (I-123 or I-131 scan) **AND** the thyroid tissue has been removed (total or completion thyroidectomy) or ablated, this indicates that the tumor may have de-differentiated and FDG PET is indicated. After therapy with I-131 it can take several months for Tg to disappear from the circulation, so an early elevated level does not necessarily indicate a recurrence/persistence of the cancer. For **papillary**, **follicular and oncocytic** thyroid cancer, FDG PET can be approved for the following:

- A total (or completion) thyroidectomy **OR** radioiodine iodine has been completed; **AND**
- Serum thyroglobulin (Tg) is >2 ng/ml (unstimulated or stimulated) **OR** there is a high anti-thyroglobulin antibody (anti-Tg Ab) >1 year after treatment **AND**
- A Negative current I-123 (or I-131) scan **OR** a Negative prior stimulated whole body I-123 (or I-131) scan done at Tg level similar to the current Tg level (a current scan is needed if on radioiodine sensitizing medications)

Anaplastic thyroid cancers are aggressive and imaging with FDG PET is appropriate.

Medullary thyroid cancers arise from the neuroendocrine parafollicular C cells of the thyroid and are not iodine-avid. Staging with SSTR PET is indicated for initial staging when indeterminate imaging is provided. For restaging, when calcitonin level is ≥ 150 pg/ml or CEA levels >5 ng/ml post-surgery **AND** indeterminate imaging (including negative CT/MRI with elevated calcitonin and/or CEA) is provided, PET is indicated. Typically the tracer for restaging is SSTR (dotatate), however, there may be situations where an FDG PET is reasonable.

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POLICY HISTORY

Date	Summary

May 2023	• Reorganized:
	  ○ Cancers where the guidance is straightforward into a list for ICRs and non-PET PCRs can approve/deny
	  ○ Definitions to background
	• Revised indeterminate imaging and contraindications to conventional imaging sections
	• Updated:
	  ○ Surveillance PET section with additional guidance
	  ○ Following Cancers to be consistent with updated version of NCCN
	  ▪ Adrenal: added indications in limited circumstances
	  ▪ Breast: changed to requiring inconclusive imaging and added a restaging indication for FES PET in special tracer section
	  ▪ Colorectal: added liver directed therapy and potentially curable M1 disease to restaging
	  ▪ Esophageal: initial staging clarified as indicated for non-metastatic, restaging changed from indicated to following chemoradiation or with indeterminate imaging
	  ▪ Small cell lung cancer: clarified staging in background section, limited stage: changed restaging to prior to radiation or with indeterminate imaging; for extensive stage: added indication for indeterminate imaging in initial staging, added indication when radiation is planned for restaging
	  ▪ Melanoma: added indication for satellite/in-transit and dermal melanomas that lack epidermal involvement
	  ▪ Neuroendocrine: separated types of NET, changed wording for poorly differentiated and well differentiated high grade in FDG section; added detail re what is needed for restaging in SSTR section
	  ▪ Renal: changed to not indicated
	  ▪ Skin squamous cell: added indication for biopsy proven lymph node positive and metastatic disease
	  ▪ Sarcoma: separated rhabdomyosarcoma as indicated (remainder require inconclusive imaging if > 30 yo)
	  ▪ Thyroid: moved most of detail into background section, made indications consistent with current NCCN guidance
	  ▪ MPNST: Added indication in section for NF1

	▪ Prostate cancer: Moved detail for initial staging and non-PSMA tracers into background; updated restaging indications • Regrouped the following Cancers in the table to coincide with grouping in NCCN: o Biliary Tract o Bone Cancers o Uterine Cancers • Added TNM explanation and cancer-specific background sections when needed for additional • General information moved to the beginning of the guideline with added statement on clinical indications not addressed in this guideline
May 2022	• Updated changes based on NCCN including updates most notably for prostate cancer, Hurthle, NETs • Clarified when PET may be approved prior to biopsy for lung nodules and when PET is unnecessary (e.g., disease clearly present in both sides of chest and/or outside the chest) • Added indications for rare specific histiocytic syndromes and for sarcoid and vasculitis for non-oncological indications • Added restaging for RCC and pancreatic cancer in specific situations • Added indications for Y90 PET scan (liver malignancy) • Updated definitions of clinical guidelines (PET, PET/CT, and PET with CT Attenuation) • Minor wording clarifications, table adjustments

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **TUMOR IMAGING PET - ANY SITE (UNLISTED PET)**	**Original Date: June 2007**
CPT Codes: G0235	**Last Revised Date: May 2023**
Guideline Number: Evolent_CG_070-2	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations*

IMPORTANT NOTE:

PET imaging, any site, not otherwise specified, is a non-covered CPT code.

POLICY HISTORY

Date	Summary
May 2023	• General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline
April 2022	No changes

Reviewed / Approved by Clinical Guideline Committee

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*Evolent	
Clinical guidelines **LOW FIELD MRI**	**Original Date: July 2009**
CPT Codes: S8042	**Last Revised Date: March 2023**
Guideline Number: Evolent_CG_064	**Implementation Date: January 2024**

GENERAL INFORMATION

- *It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. If applicable: All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.*
- *Where a specific clinical indication is not directly addressed in this guideline, medical necessity determination will be made based on widely accepted standard of care criteria. These criteria are supported by evidence-based or peer-reviewed sources such as medical literature, societal guidelines and state/national recommendations.*

IMPORTANT NOTE

Low Field MRI services are not considered to be medically necessary, are not approvable for payment, and cannot be approved.

BACKGROUND

MRI scanners with a field strength of greater than 1.0 Tesla (T) are considered high field. The typical high field MRI units in clinical practice range between 1.0 – 3.0 Tesla. In October 2017 the FDA cleared the first 7 T MRI units.[1] The definition of mid and low field MRI is more variable with mid field units having a lower field strength range of 0.3 to 0.5 and an upper limit under 1.0 T. Low field units have field strengths below 0.3 to 0.2 T. The major disadvantage of low field strength MRI relative to higher field scanners is lower signal to noise ratios, less homogeneity in the magnetic field, lower detection of calcification, hemorrhage, or gadolinium enhancement. Lee et al showed that low field (<0.5 T) units were effective in evaluating medial meniscal, anterior cruciate ligament, and rotator cuff tears but not effective for evaluating lateral meniscal tears, osteochondral defects, or shoulder superior labrum-anterior posterior (SLAP) ligament complex pathology.[2, 3]

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POLICY HISTORY

Date	Summary
March 2023	• General Information moved to beginning of guideline with added statement on clinical indications not addressed in this guideline • Removed Additional Resources
April 2022	No changes

Reviewed / Approved by Clinical Guideline Committee

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