



Magellan Healthcare	
Clinical guidelines TRANSTHORACIC (TTE) ECHO	Original Date: October 26, 2009 Page 1 of 12
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INTRODUCTION:

Echocardiography also known as ‘cardiac ultrasound’ is a diagnostic test that uses ultrasound waves to create an image of the heart muscle. Ultrasound waves that rebound or echo off the heart can show the size, shape, and movement of the heart's valves and chambers as well as the flow of blood through the heart.

Transthoracic Echocardiograms (TTE) are used to evaluate structural heart disease, ventricular function and valve function. In children and small adults TTE provides accurate anatomic definition of most congenital heart diseases. Coupled with Doppler hemodynamic measurements, Transthoracic Echocardiograms (TTE) usually provides accurate diagnosis and noninvasive serial assessment. Transesophageal echocardiogram (TEE) is an alternative way to perform an echocardiogram where the probe is passed into patient’s esophagus. (See separate guideline on TEE.)

Initial Clinical Reviewers (ICRs) and Physician Clinical Reviewers (PCRs) must be able to apply criteria based on individual needs and based on an assessment of the local delivery system.

Indications for pediatric patients are presented first followed by indications for adult patients.

PEDIATRIC PATIENTS (PATIENTS UNDER THE AGE OF 18):

Indications for transthoracic echocardiography (TTE) for pediatric patients:

- A heart murmur (harsh murmur, diastolic murmur, or continuous murmur) present in such a way as to have a reasonable belief that congenital heart disease might be present.
- Chest pain upon presentation that is not obviously non-cardiac.
- Clearly abnormal ECG.
- Abnormal cardiac structure on a chest x-ray.
- Signs and/or symptoms of heart failure.
- Abnormal physical findings, including clicks, snaps, gallops, a fixed and/or split S2, and decreased pulses.
- Arrhythmia/palpitations, for evaluation of structural heart disease.

- Syndromic patients with a known syndrome associated with congenital or acquired heart disease (Down's syndrome, Noonan's syndrome, 22Q deficiency syndrome, William's syndrome, Trisomy Thirteen, Trisomy Eighteen, Allagille syndrome).
- Failed Pulse oximetry test for any newborn.
- Known or suspected connective tissue diseases that are associated with congenital or acquired heart disease.
- Known or suspected muscular dystrophies associated with congenital heart disease.
- Exposure to anthracycline medications generally in relation to chemotherapy.
- Premature birth where there is suspicion of a Patent Ductus Arteriosus.
- Kawasaki Disease.
- Suspected Rheumatic Fever.
- Family history of sudden death related to a finding that could be present on an echocardiogram.
- Adopted children for whom there is a suspicion of congenital heart disease (e.g. HCM), based on physical or clinical findings when there is a lack of family history information.
- Cyanotic patients without explanation.
- Suspicion of a fetal abnormality.
- Difficulty breathing with stridor and eating solid foods that might suggest a vascular ring.
- Hypertension.
- Known or suspected endocarditis, including all patients with an indwelling catheter who present with unexplained fever.
- Patients on anticoagulants (to evaluate for thrombus).
- Patients with prosthetic valves.
- Systemic diseases that are associated with cardiac findings, such as connective tissue diseases, sickle cell disease, and HIV infection.
- Patients with a first degree relative who is known to have a genetic acquisition, such as cardiomyopathies (HCM, DCM, ARVD/C, RCM, and LVNC).
- Thromboembolic events.
- Suspected pulmonary hypertension.
- Ventricular pre-excitation with no clinical or holter findings to suggest an arrhythmia, but with suspicion of Ebsteins anomaly, Tumors, HCM or clinical signs of heart failure.

Indications for postoperative/post-procedure pediatric patients:

- Upon first outpatient visit, to establish the patient's new hemodynamic baseline, and assess for potential complications such as pericardial effusions, residual shunts, obstruction at the site of repair, patency of surgical shunts, etc.
- On subsequent visits as needed to monitor as medications are weaned or to evaluate need for further surgical intervention.

Indications for follow-up echocardiograms for pediatric patients:

- Congenital Heart Disease (CHD) with a change in clinical status.
- Kawasaki Disease, upon diagnosis, two weeks later and 4 to 6 weeks later. If any coronary abnormalities are present, echocardiograms may need to be more frequent as clinically indicated.
- Valvular regurgitation that is more than mild in asymptomatic child may require annual echocardiogram to assess chamber size and progressive regurgitation.

- Valvular stenosis:
 - Pulmonic Stenosis (PS):
 - Mild to moderate PS in an infant: repeat at 2 weeks and 6 weeks to assess for increasing gradient as PVR drops.
 - Moderate PS in an infant: every 1-3 months for on-going surveillance after the 6-week study.
 - Mild PS in asymptomatic child: every 2-3 years to assess for progression of stenosis.
 - Moderate to severe: annually to assess for progression of stenosis and development of RVH.
 - Aortic Stenosis (AS):
 - Mild AS in an infant: every 6 months, or more depending on the patient's clinical status and rate of progression.
 - Mild in an asymptomatic child: every 1-2 years to assess for progression of stenosis.
 - Moderate AS in an infant: every 1-3 months to assess for progression and indication for valvuloplasty.
 - Moderate to severe AS: at least every 6-12 months to assess for progressive stenosis, LVH, post-stenotic dilation.
 - Mitral Stenosis (MS):
 - MS from Rheumatic Heart Disease on no meds with no symptoms may require an annual echocardiogram.
 - MS with CHF on medications may require an echocardiogram every three to 6 months.
 - Tricuspid Stenosis (TS):
 - A rare indication that would be based on the patient's course of treatment and clinical symptoms.
- Shunt lesions:
 - Ventricular Septal Defect (VSD):
 - Infants with VSD: repeat echocardiogram at 2 weeks and 6 weeks to assess for increasing shunt as the PVR drops.
 - Small VSD: annual echocardiogram to assess for associated lesions depending on location of defect, i.e. aortic regurgitation, development of DCRV.
 - Moderate to large VSD: Close follow up in response to patient's clinical status, to assess for LV dilation, mitral regurgitation, associated lesions.
 - Atrial Septal Defect (ASD):
 - Moderate to large ASD: at 6 months intervals to assess for progressive RV dilation, tricuspid regurgitation.
 - Small ASD: every 1-3 years, depending on age of patient.

NOT INDICATED unless there is treating physician input during a peer-to-peer discussion that supports the need for an echocardiogram.

- Chest pain that changes with inspiration.
- Clear Orthostatic Hypotension.
- Chest pain that increases upon palpation.

- High cholesterol/triglycerides in children who have no other indication for an echocardiogram.
- Isolated prolonged QT syndrome with no clinical or holter evidence of an arrhythmia or other physical findings.

NOT INDICATED:

- Attention Deficit Disorder with no other relevant findings.
- A sports physical with normal history, physical and ECG.
- Parental request as the sole reason for an echocardiogram.
- All patients with a 1st degree relative with an inherited form of cardiomyopathy where the patient has been definitively excluded by genetic testing.

See “Additional Information” below

ADULT PATIENTS

Indications for transthoracic echocardiography (TTE):

ACCF/ASE/AHA/ASNC/HFSA/HRS/SCAI/SCCM/SCCT/SCMR based Appropriate Use Criteria, including updates through September, 2017

ACCF et al. Criteria # TTE (Indication and Appropriate Use Score)	INDICATIONS	APPROPRIATE USE SCORE (4-9); A= Appropriate; U=Uncertain
General Evaluation of Cardiac Structure and Function		
<i>Suspected Cardiac Etiology—General With TTE</i>		
1	<ul style="list-style-type: none"> • Symptoms or conditions potentially related to suspected cardiac etiology including but not limited to chest pain, shortness of breath, palpitations, TIA, stroke, or peripheral embolic event 	A(9)
1a	<ul style="list-style-type: none"> • Respiratory failure or hypoxemia of uncertain etiology if cardiac structural or myocardial disease is a consideration 	A(8)
2	TTE with contrast for <ul style="list-style-type: none"> • Prior testing that is concerning for heart disease or structural abnormality including but not limited to chest X-ray, baseline scout images for stress 	A(9)

ACCF et al. Criteria # TTE (Indication and Appropriate Use Score)	INDICATIONS	APPROPRIATE USE SCORE (4-9); A= Appropriate; U=Uncertain
	echocardiogram, ECG, or cardiac biomarkers	
<i>Arrhythmias With TTE</i>		
4	<ul style="list-style-type: none"> Frequent VPCs or exercise-induced VPCs 	A(8)
5	<ul style="list-style-type: none"> Sustained or nonsustained atrial fibrillation, SVT, or VT 	A(9)
<i>Presyncope/Syncope With TTE</i>		
7	<ul style="list-style-type: none"> For syncope/presyncope when there is reason to suspect a cardiovascular abnormality, not for any and all syncope/presyncope. 	A(9)
9	<ul style="list-style-type: none"> Syncope and no other symptoms or signs of cardiovascular disease 	A(8)
<i>Perioperative Evaluation With TTE</i>		
14	<ul style="list-style-type: none"> Routine perioperative evaluation of cardiac structure and function prior to noncardiac solid organ transplantation 	U(6)
<i>Pulmonary Hypertension With TTE</i>		
15	<ul style="list-style-type: none"> Evaluation of suspected pulmonary hypertension including evaluation of right ventricular function and estimated pulmonary artery pressure 	A(9)
17	<ul style="list-style-type: none"> Routine surveillance (≥ 1 y) of known pulmonary hypertension without change in clinical status or cardiac exam 	A(7)
18	<ul style="list-style-type: none"> Re-evaluation of known pulmonary hypertension if change in clinical status or cardiac exam or to guide therapy 	A(9)
TTE for Evaluation of Valvular Function		

ACCF et al. Criteria # TTE (Indication and Appropriate Use Score)	INDICATIONS	APPROPRIATE USE SCORE (4-9); A= Appropriate; U=Uncertain
<i>TTE for Initial Evaluation of Valvular Function in an Asymptomatic Patient</i>		
19	<ul style="list-style-type: none"> Asymptomatic patient with unexplained heart murmur or abnormal heart sounds, with reasonable suspicion of valvular heart disease 	A(9)
20	<ul style="list-style-type: none"> History of rheumatic heart disease 	A(9)
21	<ul style="list-style-type: none"> Known systemic or acquired disease associated with valvular heart disease 	A(9)
22	<ul style="list-style-type: none"> First degree family member has history of bicuspid aortic valve 	A(8)
23	<ul style="list-style-type: none"> Exposure to medications that could result in development of valvular heart disease 	A(7)
<i>Murmur or Click With TTE</i>		
34	<ul style="list-style-type: none"> Initial evaluation when there is a reasonable suspicion of valvular or structural heart disease 	A(9)
37	<ul style="list-style-type: none"> Re-evaluation of known valvular heart disease with a change in clinical status or cardiac exam or to guide therapy 	A(9)
<i>Native Valvular Stenosis With TTE</i>		
39	<ul style="list-style-type: none"> Routine surveillance (≥ 3 y) of bicuspid aortic valve, aortic sclerosis, or mild valvular stenosis, without a change in clinical status or cardiac exam 	A(7)
41	<ul style="list-style-type: none"> Routine surveillance (≥ 1 y) of moderate or severe valvular stenosis without a change in clinical status or cardiac exam 	A(8)

ACCF et al. Criteria # TTE (Indication and Appropriate Use Score)	INDICATIONS	APPROPRIATE USE SCORE (4-9); A= Appropriate; U=Uncertain
43a	<ul style="list-style-type: none"> Re-evaluation (<1 y) in patients with moderate or severe aortic stenosis, who will be subjected to increased hemodynamic demands (e.g. noncardiac surgery, pregnancy) 	U(6)
43b	<ul style="list-style-type: none"> Re-evaluation of an asymptomatic patient with severe aortic stenosis (6-12 months) without change in clinical status or cardiac exam 	U(6)
43c	<ul style="list-style-type: none"> Re-evaluation after control of hypertension in low flow – low gradient severe aortic stenosis with preserved ejection fraction 	A(7)
<i>Native Valvular Regurgitation With TTE</i>		
44	<ul style="list-style-type: none"> Routine surveillance (≥ 3 y) of mild valvular regurgitation without a change in clinical status or cardiac exam 	U(4)
45	<ul style="list-style-type: none"> Routine surveillance (<1 y) of moderate valvular regurgitation without a change in clinical status or cardiac exam 	U(6)
46	<ul style="list-style-type: none"> Routine surveillance (≥ 1 y) of moderate valvular regurgitation without change in clinical status or cardiac exam 	A(8)
46a	<ul style="list-style-type: none"> Re-evaluation of asymptomatic patient 6-12 months) with severe aortic regurgitation with preserved ejection fraction and normal left ventricular size 	U(6)
46b	<ul style="list-style-type: none"> Re-evaluation of asymptomatic patient 6-12 	A(7)

ACCF et al. Criteria # TTE (Indication and Appropriate Use Score)	INDICATIONS	APPROPRIATE USE SCORE (4-9); A= Appropriate; U=Uncertain
	months) with severe mitral regurgitation	
<i>Prosthetic Valves With TTE</i>		
47	<ul style="list-style-type: none"> Initial postoperative evaluation of prosthetic valve for establishment of baseline, typically 6 weeks to 3 months postoperative. 	A(9)
49	<ul style="list-style-type: none"> Routine surveillance (≥ 3 y after valve implantation) of prosthetic valve if no known or suspected valve dysfunction 	A(7)
50	<ul style="list-style-type: none"> Evaluation of prosthetic valve with suspected dysfunction or a change in clinical status or cardiac exam 	A(9)
51	<ul style="list-style-type: none"> Re-evaluation of known prosthetic valve dysfunction when it would change management or guide therapy 	A(9)
51a	<ul style="list-style-type: none"> Evaluation prior to pregnancy in patients with a prosthetic valve and no echocardiography within the past year. 	A(9)
<i>Infective Endocarditis (Native or Prosthetic Valves) With TTE</i>		
52	<ul style="list-style-type: none"> Initial evaluation of suspected infective endocarditis with positive blood cultures or a new murmur 	A(9)
55	<ul style="list-style-type: none"> Re-evaluation of infective endocarditis at high risk for progression or complication or with a change in clinical status or cardiac exam, or when findings might change management 	A(9)
56a	<ul style="list-style-type: none"> Re-evaluation of prior TTE/TEE finding for 	A(8)

ACCF et al. Criteria # TTE (Indication and Appropriate Use Score)	INDICATIONS	APPROPRIATE USE SCORE (4-9); A= Appropriate; U=Uncertain
	interval change (e.g. resolution of vegetation after antibiotic therapy) when a change in therapy is anticipated	
56b	<ul style="list-style-type: none"> Re-evaluation of patient with infective endocarditis at high risk of progression of complication (e.g., extensive infective tissue/large vegetation on initial echocardiogram, or staphylococcal, enterococcal, or fungal infections) in the absence of clinical change 	A(7)
TTE for Evaluation of Intracardiac and Extracardiac Structures and Chambers		
57	<ul style="list-style-type: none"> Suspected cardiac mass 	A(9)
58	<ul style="list-style-type: none"> Suspected cardiovascular source of embolus 	A(9)
59	<ul style="list-style-type: none"> Suspected pericardial conditions 	A(9)
61	<ul style="list-style-type: none"> Re-evaluation of known pericardial effusion to guide management or therapy 	A(8)
62	<ul style="list-style-type: none"> Guidance of percutaneous noncoronary cardiac procedures including but not limited to pericardiocentesis, septal ablation, right ventricular biopsy, cardiac valvular and structural interventions, radiofrequency ablation, or pericardiocentesis. 	A(9)
TTE for Evaluation of Aortic Disease		
63	<ul style="list-style-type: none"> Evaluation of the ascending aorta in the setting of a known or suspected connective tissue disease or genetic condition that predisposes to aortic 	A(9)

ACCF et al. Criteria # TTE (Indication and Appropriate Use Score)	INDICATIONS	APPROPRIATE USE SCORE (4-9); A= Appropriate; U=Uncertain
	aneurysm or dissection (e.g., Marfan syndrome)	
64	<ul style="list-style-type: none"> • Re-evaluation of known ascending aortic dilation or history of aortic dissection to establish a baseline rate of expansion or when the rate of expansion is excessive 	A(9)
65	<ul style="list-style-type: none"> • 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 or therapy 	A(9)
66a	<ul style="list-style-type: none"> • 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: <ol style="list-style-type: none"> 1. Aortic diameter >4.5 cm 2. Rapid rate of change in aortic diameter when an annual growth rate of ≥ 0.5 cm is suspected. 3. Family history (first-degree relative) of aortic dissection 	A(7)
TTE for Evaluation of Hypertension, HF, or Cardiomyopathy		
<i>Hypertension With TTE</i>		
67	<ul style="list-style-type: none"> • Initial evaluation of suspected hypertensive heart disease 	A(8)
69	<ul style="list-style-type: none"> • Re-evaluation of known hypertensive heart disease without a change in clinical status or cardiac exam 	U(4)
<i>HF With TTE</i>		

ACCF et al. Criteria # TTE (Indication and Appropriate Use Score)	INDICATIONS	APPROPRIATE USE SCORE (4-9); A= Appropriate; U=Uncertain
70	<ul style="list-style-type: none"> Initial evaluation of known or suspected HF (systolic or diastolic) based on symptoms, signs, or abnormal test results 	A(9)
71	<ul style="list-style-type: none"> Re-evaluation of known HF (systolic or diastolic) with a change in clinical status or cardiac exam without a clear precipitating change in medication or diet 	A(8)
72	<ul style="list-style-type: none"> Re-evaluation of known HF (systolic or diastolic) with a change in clinical status or cardiac exam with a clear precipitating change in medication or diet 	U(4)
73	<ul style="list-style-type: none"> Re-evaluation of known HF (systolic or diastolic) to guide therapy 	A(9)
75	<ul style="list-style-type: none"> Routine surveillance (≥ 1 y) of HF (systolic or diastolic) when there is no change in clinical status or cardiac exam 	U(6)
<i>Device Evaluation (Including Pacemaker, ICD, or CRT) With TTE</i>		
76	<ul style="list-style-type: none"> Initial evaluation or re-evaluation after revascularization and/or optimal medical therapy to determine candidacy for device therapy and/or to determine optimal choice of device 	A(9)
77	<ul style="list-style-type: none"> Initial evaluation for CRT device optimization after implantation 	U(6)
78	<ul style="list-style-type: none"> Known implanted pacing device with symptoms possibly due to device complication or suboptimal pacing device settings 	A(8)

ACCF et al. Criteria # TTE (Indication and Appropriate Use Score)	INDICATIONS	APPROPRIATE USE SCORE (4-9); A= Appropriate; U=Uncertain
<i>Ventricular Assist Devices and Cardiac Transplantation With TTE</i>		
81	<ul style="list-style-type: none"> To determine candidacy for ventricular assist device 	A(9)
82	<ul style="list-style-type: none"> Optimization of ventricular assist device settings 	A(7)
83	<ul style="list-style-type: none"> Re-evaluation for signs/symptoms suggestive of ventricular assist device-related complications 	A(9)
84	<ul style="list-style-type: none"> Monitoring for rejection in a cardiac transplant recipient 	A(7)
85	<ul style="list-style-type: none"> Cardiac structure and function evaluation in a potential heart donor 	A(9)
<i>Cardiomyopathies With TTE</i>		
86	<ul style="list-style-type: none"> Initial evaluation of known or suspected cardiomyopathy (e.g., restrictive, infiltrative, dilated, hypertrophic, or genetic cardiomyopathy) 	A(9)
87	<ul style="list-style-type: none"> Re-evaluation of known cardiomyopathy with a change in clinical status or cardiac exam or to guide therapy and manage post transplantation or post VAD patients 	A(9)
89	<ul style="list-style-type: none"> Routine surveillance (≥ 1 y) of known cardiomyopathy without a change in clinical status or cardiac exam 	U(5)
90	<ul style="list-style-type: none"> Screening evaluation for structure and function in first-degree relatives of a patient with an inherited cardiomyopathy 	A(9)
91	<ul style="list-style-type: none"> Baseline and serial re-evaluations in a patient undergoing therapy with cardiotoxic agents 	A(9)
TTE for Adult Congenital Heart Disease		

ACCF et al. Criteria # TTE (Indication and Appropriate Use Score)	INDICATIONS	APPROPRIATE USE SCORE (4-9); A= Appropriate; U=Uncertain
92	<ul style="list-style-type: none"> • Initial evaluation of known or suspected adult congenital heart disease 	A(9)
93	<ul style="list-style-type: none"> • Known adult congenital heart disease with a change in clinical status or cardiac exam 	A(9)
94	<ul style="list-style-type: none"> • Re-evaluation to guide therapy in known adult congenital heart disease. 	A(9)
96	<ul style="list-style-type: none"> • Routine surveillance (≥ 2 y) of adult congenital heart disease following complete repair <ul style="list-style-type: none"> ○ without residual structural or hemodynamic abnormality ○ without a change in clinical status or cardiac exam 	U(6)
97	<ul style="list-style-type: none"> • Routine surveillance (< 1 y) of adult congenital heart disease following incomplete or palliative repair <ul style="list-style-type: none"> ○ with residual structural or hemodynamic abnormality ○ without a change in clinical status or cardiac exam 	U(5)
98	<ul style="list-style-type: none"> • Routine surveillance (≥ 1 y) of adult congenital heart disease following incomplete or palliative repair <ul style="list-style-type: none"> ○ with residual structural or hemodynamic abnormality ○ without a change in clinical status or cardiac exam 	A(8)

ACCF et al. Criteria # TTE (Indication and Appropriate Use Score)	INDICATIONS	APPROPRIATE USE SCORE (4-9); A= Appropriate; U=Uncertain
Transcatheter Aortic Valve Replacement		
99	<ul style="list-style-type: none"> For pre-TAVR evaluation: Assessment of number cusps and degree of calcification 	A(7)
100	<ul style="list-style-type: none"> Post TAVR at 30 days (6 weeks to 3 months also acceptable) and annually 	A(7-9)
100a	<ul style="list-style-type: none"> Post TAVR evaluation: Assessment of aortic regurgitation when there is suspicion of valvular dysfunction (<30 days) 	A(8)
100b	<ul style="list-style-type: none"> Post TAVR evaluation: Assessment of stroke with suspicion of valve dysfunction 	A(7)
TTE for Percutaneous Mitral Valve Repair		
101	<ul style="list-style-type: none"> Determination of patient eligibility 	A(8)
102	<ul style="list-style-type: none"> Reassessment for degree of MR and left ventricular function (pre-discharge, at 1, 6, and 12 m, and then annually to 5 y) 	A(9)

ADDITIONAL INDICATION:

- For evaluation of asymptomatic patients following repair of Atrial Septal Defect (ASD), Patent Foramen Ovale (PFO), Ventricular Septal Defect (VSD) or Patent Ductus Arteriosus (PDA), follow-up examination is only indicated within the first year following correction.

ACC GUIDELINES WITH “INAPPROPRIATE” DESIGNATION:

- Requests that meet ACCF/ASNC Inappropriate use score of (1-3) noted below OR meet any one of the following are not approvable:
- For same imaging test less than 52 weeks (1 year) apart unless specific guideline criteria states otherwise.
- For different imaging tests of same anatomical structure but different imaging type less than six (6) weeks (such as Heart MRI/CT) unless specific guideline criteria states

otherwise (i.e. CT/MRI and now wants Echocardiogram) without high level review to evaluate for medical necessity.

- Additional images for same-study (poor quality, etc.).

ACCF/ASE/AHA/ASNC/HFSA/HRS/SCAI/SCCM/SCCT/SCMR based Appropriate Use Criteria, including updates through September, 2017

ACCF et al. Criteria # TTE (Indication and Appropriate Use Score)	INDICATIONS	APPROPRIATE USE SCORE (1-3); I= Inappropriate
General Evaluation of Cardiac Structure and Function		
<i>Arrhythmias With TTE</i>		
3	<ul style="list-style-type: none"> • Infrequent APCs or infrequent VPCs without other evidence of heart disease 	I(2)
6	<ul style="list-style-type: none"> • Asymptomatic isolated sinus bradycardia 	I(2)
<i>Evaluation of Ventricular Function</i>		
10	<ul style="list-style-type: none"> • Initial evaluation of ventricular function (e.g., screening) with no symptoms or signs of cardiovascular disease 	I(2)
11	<ul style="list-style-type: none"> • Routine surveillance of ventricular function with known CAD and no change in clinical status or cardiac exam 	I(3)
12	<ul style="list-style-type: none"> • Evaluation of LV function with prior ventricular function evaluation showing normal function (e.g., prior echocardiogram, left ventriculogram, CT, SPECT MPI, CMR) in patients in whom there has been no change in clinical status or cardiac exam 	I(1)
<i>Perioperative Evaluation With TTE</i>		
13	<ul style="list-style-type: none"> • Routine perioperative evaluation of ventricular function with no symptoms or signs of cardiovascular disease transplantation 	I(2)
<i>Pulmonary Hypertension With TTE</i>		
16	<ul style="list-style-type: none"> • Routine surveillance (<1 y) of known pulmonary hypertension without change in clinical status or cardiac exam 	I(3)
TTE for Evaluation of Valvular Function		
<i>Murmur or Click With TTE</i>		

ACCF et al. Criteria # TTE (Indication and Appropriate Use Score)	INDICATIONS	APPROPRIATE USE SCORE (1-3); I= Inappropriate
35	<ul style="list-style-type: none"> Initial evaluation when there are no other symptoms or signs of valvular or structural heart disease 	I(2)
36	<ul style="list-style-type: none"> Re-evaluation in a patient without valvular disease on prior echocardiogram and no change in clinical status or cardiac exam 	I(1)
<i>Native Valvular Stenosis With TTE</i>		
38	<ul style="list-style-type: none"> Routine surveillance (≥ 3 y) of mild valvular stenosis without a change in clinical status or cardiac exam 	I(3)
40	<ul style="list-style-type: none"> Routine surveillance (≥ 1 y) of moderate or severe valvular stenosis without a change in clinical status or cardiac exam 	I(3)
<i>Native Valvular Regurgitation With TTE</i>		
42	<ul style="list-style-type: none"> Routine surveillance of trace valvular regurgitation 	I(1)
43	<ul style="list-style-type: none"> Routine surveillance (< 3 y) of mild valvular regurgitation without a change in clinical status or cardiac exam 	I(2)
<i>Prosthetic Valves With TTE</i>		
48	<ul style="list-style-type: none"> Routine surveillance (< 3 y after valve implantation) of prosthetic valve if no known or suspected valve dysfunction 	I(3)
<i>Infective Endocarditis (Native or Prosthetic Valves) With TTE</i>		
53	<ul style="list-style-type: none"> Transient fever without evidence of bacteremia or a new murmur 	I(2)
54	<ul style="list-style-type: none"> Transient bacteremia with a pathogen not typically associated with infective endocarditis and/or a documented nonendovascular source of infection 	I(3)
56	<ul style="list-style-type: none"> Routine surveillance of uncomplicated infective endocarditis when no change in management is contemplated 	I(2)
TTE for Evaluation of Intracardiac and Extracardiac Structures and Chambers		
60	<ul style="list-style-type: none"> Routine surveillance of known small pericardial effusion with no change in clinical status 	I(2)
TTE for Evaluation of Aortic Disease		

ACCF et al. Criteria # TTE (Indication and Appropriate Use Score)	INDICATIONS	APPROPRIATE USE SCORE (1-3); I= Inappropriate
66	<ul style="list-style-type: none"> Routine re-evaluation for surveillance of known ascending aortic dilation or history of aortic dissection without a change in clinical status or cardiac exam when findings would not change management or therapy 	I(3)
TTE for Evaluation of Hypertension, HF, or Cardiomyopathy		
<i>Hypertension With TTE</i>		
68	<ul style="list-style-type: none"> Routine evaluation of systemic hypertension without symptoms or signs of hypertensive heart disease 	I(3)
<i>HF With TTE</i>		
74	<ul style="list-style-type: none"> Routine surveillance (<1 y) of HF (systolic or diastolic) when there is no change in clinical status or cardiac exam 	I(2)
<i>Device Evaluation (Including Pacemaker, ICD, or CRT) With TTE</i>		
79	<ul style="list-style-type: none"> Routine surveillance (<1 y) of implanted device without a change in clinical status or cardiac exam 	I(1)
80	<ul style="list-style-type: none"> Routine surveillance (\geq1 y) of implanted device without a change in clinical status or cardiac exam 	I(3)
<i>Cardiomyopathies With TTE</i>		
88	<ul style="list-style-type: none"> Routine surveillance (<1 y) of known cardiomyopathy without a change in clinical status or cardiac exam 	I(2)
TTE for Adult Congenital Heart Disease		
95	Routine surveillance (<2 y) of adult congenital heart disease following complete repair <ul style="list-style-type: none"> o without a residual structural or hemodynamic abnormality o without a change in clinical status or cardiac exam 	I(3)

ADDITIONAL INFORMATION:

Pediatric Post-Operative Patients:

Congenital heart disease, which requires surgical palliation, is, by its very nature, quite varied. No written consensus criteria currently exists for monitoring post-operative patients, but rather is based upon the clinical experience and training of the Pediatric

Cardiologists caring for the patient. Criteria for performing an echocardiogram in the out-patient setting will vary greatly based upon whether the patient has a complex lesion, which must be repaired in stages, had post-operative complications, or is on medications which will be weaned over the ensuing weeks.

Murmurs:

A harsh murmur, diastolic murmur, or continuous murmur would be an indication for an echocardiogram. Soft systolic murmurs and vibratory murmurs in general would not be indications for an echocardiogram. There is an important caveat in regards to age. Existent literature suggests that young children particularly under the age of three can have what appear to be unremarkable murmurs that result in organic heart disease even when examined by experts. Great leeway should therefore be given when echocardiograms are performed under the age of 3 years.

TTE Accuracy:

In general, transthoracic echocardiography (TTE) is adequate for diagnosing IE and for identifying vegetations in cases where cardiac structures-of-interest are well visualized. Contemporary TTE has improved the diagnostic accuracy of infective endocarditis by ameliorating image quality; it provides an accurate assessment of endocarditis and may reduce the need for TEE. However accuracy may be reduced because of technical difficulties like obesity, chronic obstructive pulmonary disease, chest-wall deformities etc.

TTE versus TEE:

Specific situations where transesophageal echocardiography (TEE) is preferred over TTE and may be an appropriate initial study for evaluation of prosthetic device, suspected periannular complications, children with complex congenital cardiac lesions, selected patients with *Staphylococcus aureus* bacteremia, and certain pre-existing valvular abnormalities that make TTE interpretation problematic (e.g., calcific aortic stenosis). Transthoracic echocardiography is a valuable tool in the perioperative period.

Abbreviations

ACS = acute coronary syndrome
APC = atrial premature contraction
ASD = atrial septal defect
CABG = coronary artery bypass grafting surgery
CAD = coronary artery disease
CMR = cardiovascular magnetic resonance
CRT = cardiac resynchronization therapy
CT = computed tomography
ECG = electrocardiogram
HF = heart failure
ICD = implantable cardioverter-defibrillator
LBBB = left bundle-branch block
LV = left ventricular
MET = estimated metabolic equivalents of exercise
MI = myocardial infarction
PCI = percutaneous coronary intervention
PDA = patent ductus arteriosus

PFO = patent foramen ovale
RNI = radionuclide imaging
SPECT MPI = single-photon emission computed tomography myocardial perfusion imaging
STEMI = ST-segment elevation myocardial infarction
SVT = supraventricular tachycardia
TAVR = Transcatheter Aortic Valve Replacement
TEE = transesophageal echocardiogram
TIA = transient ischemic attack
TIMI = Thrombolysis in Myocardial Infarction
TTE = transthoracic echocardiogram
UA/NSTEMI = unstable angina/non-ST-segment elevation myocardial infarction
VPC = ventricular premature contraction
VSD = ventricular septal defect
VT = ventricular tachycardia

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Reviewed/Approved by  Michael Pentecost, MD, Chief Medical Officer