Evolent
"Cardiac Solution" Program Tip Sheet

MYOCARDIAL PERFUSION IMAGING (MPI) vs. STRESS ECHOCARDIOGRAPHY (SE)

Main Points about the Two Tests:

- **Both tests have equal diagnostic accuracy** for coronary artery disease, with MPI showing greater sensitivity and SE showing greater specificity, however there is no radiation associated with stress echocardiography

- **MPI is based upon the expectation of relatively reduced blood flow** in a myocardial segment during exercise or pharmacologic coronary dilation, while **SE is based upon development of wall motion abnormality** provoked by myocardial ischemia during treadmill exercise or similar stress.

- **In order to perform a SE, one would prefer to have a member who could perform treadmill exercise well, along with a good acoustic imaging window, while MPI can be performed with either exercise or the pharmacologic option.** Exercise can also provide the additional information from the EKG, if the baseline EKG does not already have substantial abnormality (e.g., 1 mm or greater ST segment depression at baseline, left bundle branch block, ventricular pacing, evidence of prior MI as documented by significant Q waves on the baseline EKG).

- Even with MPI, an exercise modality is preferred over pharmacologic vasodilation due to the additional functional and EKG information inherent in exercise testing. However, **in some members, such as those with a pre-existing wall motion abnormality, left bundle branch block, ventricular paced rhythms, frequent PVCs, or pre-excitation (WPW), the related cardiac contraction pattern during exercise could obscure the effects of ischemia, making a pharmacologic approach more helpful.**

Radiation Exposure

MPI: 7 - 24 mSv

SE: 0 mSv

Annual Background: 3 mSv

Radiation exposure should be limited when possible.

- **The radiation exposure of SE is zero**, while MPI incurs a radiation dose of 7-24 mSv (the equivalent of about 117-400 PA & lateral chest X-rays), with an increase in lifetime radiation exposure and its associated cancer risk.

Clinical Applications that Prefer MPI:

I. Technique Related
   A. Obesity with poor acoustic imaging window, even with use of contrast

II. Functional Capacity Related
   A. Physical limitation precluding a reasonable ability to exercise for at least 4 METS or at least 3 full minutes of Bruce protocol

III. Comorbidity Related
   A. Prior cardiac surgery (CABG or valvular), CHF with left ventricular ejection fraction < 40%
   B. Severe COPD with PFT documentation, severe shortness of breath on minimal exertion, or requirement of home oxygen during the day
   C. Poorly controlled hypertension, with systolic BP > 180 or Diastolic BP > 120
   D. Medical instability or serious acute illness, where maximal exercise is not recommended or appropriate (e.g., acute myocarditis or pericarditis, active infective endocarditis, acute aortic dissection, etc.)
   E. High pretest probability of coronary disease- as determined by Diamond Forrester classification – which includes age, gender, and symptomology with a description of quality of pain, provocation, and relieving factors of pain
   F. Initiation and surveillance of a IC antiarrhythmic medication (Flecainide or Propafenone)

IV. EKG Related
   A. Pacemaker or ICD
   B. Left bundle branch block
   C. Atrial fibrillation

We do not endorse dobutamine stress echoes or require the patient perform this study if the patient cannot exercise (This is left to the discretion of the ordering physician)

Documentation for Tip Sheets

Stress Myocardial Perfusion Imaging and Stress Echocardiography

Documentation of comparable accuracy of stress echocardiography and myocardial perfusion imaging:

This is an excerpt from UpToDate, Author Askew JW and Editor Manning WJ, through Jan, 2018:

"Comparison of different imaging techniques — In general, stress radionuclide MPI using SPECT has slightly higher sensitivity, and stress echocardiography has slightly higher specificity for the detection of coronary artery disease; however, they have similar overall diagnostic accuracy." (Subscription required.) https://www.uptodate.com/contents/selecting-the-optimal-cardiac-stress-test?search=accuracy%20of%20cardiac%20stress%20testing&sectionRank=2&usage_type=default&anchor=H688183934&source=machineLearning&selectedTitle=1~150&display_rank=1#

References for UpToDate:

1. Fleischmann KE, Hunink MG, Kuntz KM, Douglas PS. Exercise echocardiography or exercise SPECT imaging? A meta-analysis of diagnostic test performance. JAMA 1998; 280:913.
2. Garber AM, Solomon NA. Cost-effectiveness of alternative test strategies for the diagnosis of coronary artery disease. Ann Intern Med 1999; 130:719.

Additional References:

3. Schinkel AFL, et al Noninvasive evaluation of ischaemic heart disease: myocardial perfusion imaging or stress echocardiography? *European Heart Journal*, Volume 24, Issue 9, 1 May 2003, Pages 789–800, https://doi.org/10.1016/S0195-668X(02)00634-6

4. Heijenbrok-Kal MH[1], Fleischmann KE, Hunink MG. Stress echocardiography, stress single-photon-emission computed tomography and electron beam computed tomography for the assessment of coronary artery disease: a meta-analysis of diagnostic performance. Am Heart J. 2007 Sep;154(3):415-23.

5. Marwick, THIS, Stress echocardiography, Heart, 2003, Jan; 89(1): 113-118; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1767520/

References which provide support for **comparability** of myocardial perfusion imaging and stress echocardiography, and also give **preferential consideration** of stress

echocardiography over myocardial perfusion imaging, **based upon radiation** considerations and similar value of the two types of studies:

1. Sicari, R, Stress echocardiography expert consensus statement, European Association of Echocardiography (EAE) (a registered branch of the ESC), European Journal of Echocardiography (2008) 9, 415–43 https://www.escardio.org/static_file/Escardio/Subspecialty/EACVI/position-papers/eae-sicari-stress-echo.pdf

2. Sicari R, Cortigiani L, The clinical use of stress echocardiography in ischemic heart disease, Cardiovascular Ultrasound, 2017, 15:7 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5361820/

References for Information on radiation doses:

1. Zhang Y, et al, Comparison of member specific dose metrics between chest radiography, tomosynthesis, and CT for adult members of wide ranging body habitus, Med Phys. 2014 Feb; 41(2): 023901

2. Fazel R, Dilsizian V, Einstein, AJ, et al, ASNC INFORMATION STATEMENT, Strategies for defining an optimal risk-benefit ratio for stress myocardial perfusion SPECT, Journal of Nuclear Cardiology, Published Online: 24 March, 2011 https://www.asnc.org/files/Optimal%20Risk-Benefit%20Ratio%20for%20SPECT.pdf

Comment on Radiation Doses:

The numerical values for myocardial perfusion imaging would appear to range from 7-24 mSv.

A chest X ray exam is variable depending upon the type and number of views, with body size affecting the dose as well. A reasonable estimate for a standard PA and Lateral Chest X ray series is about 0.06 mSv.

The usual annual background exposure is about 3 mSv/year.