

“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.
- **MPI is based upon the expectation of relatively reduced blood flow** in a myocardial segment during exercise or pharmacologic coronary microvessel 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 patient 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, when the baseline EKG does not already have substantial abnormality (e.g. a 1 mm ST segment depression at baseline, left bundle branch block, ventricular pacing, PVCs, or pre-excitation).
- 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 patients, 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.**
- **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.

Radiation Exposure

MPI: 7 - 24 mSv

SE: 0 mSv

Annual Background: 3 mSv

Radiation exposure should be limited when possible.



Clinical Applications that Prefer MPI:

- I. Technique Related
 - A. Obesity with BMI over 40 or poor acoustic imaging window, even with use of contrast
- II. Functional Capacity Related
 - A. Physical infirmities precluding a reasonable ability to exercise for at least 4 METS or at least 3 full minutes of Bruce protocol
 - B. Patients who cannot walk up a single flight of stairs at even a slow pace or even perform ADLs based upon documented limitations
- 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.)
- IV. EKG Related
 - A. Pacemaker or ICD
 - B. Left bundle branch block
 - C. Poorly controlled atrial fibrillation
 - D. Frequent PVCs
 - E. Ventricular Pre-excitation (WPW)

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§ionRank=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](https://doi.org/10.1016/S0195-668X(02)00634-6)
4. [Heijenbrok-Kal MH¹, 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.esccardio.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 patient specific dose metrics between chest radiography, tomosynthesis, and CT for adult patients of wide ranging body habitus, *Med Phys*. 2014 Feb; 41(2): 023901
2. Doses_from_Medical_X-ray_Procedures: Includes multiple references
https://hps.org/physicians/documents/Doses_from_Medical_X-Ray_Procedures.pdfpdf
3. 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.