

## How accurate are noninvasive myocardial perfusion studies?

### Evidence-Based Answer

In general, stress echocardiography (SE) has a higher sensitivity than myocardial perfusion imaging (MPI) (SOR: **A**, meta-analysis). Myocardial contrast echocardiography (MCE) is also an accurate noninvasive test that may be used for the diagnosis of coronary artery disease (CAD) (SOR: **A**, meta-analysis). Combining perfusion and echo studies may increase overall sensitivity, but will reduce specificity (SOR: **B**, cohort study).

A 2010 meta-analysis included 23 RCTs comparing 2,310 patients undergoing MPI with 1,403 patients undergoing SE, all with left main coronary (>50% stenosis) or triple vessel coronary disease seen on prior coronary angiography.<sup>1</sup> Summary receiver-operative characteristic (SROC) curves for each modality revealed significantly higher area under curve (AUC) for SE (0.82) than for MPI (0.72) ( $P=.01$ ). The negative likelihood ratio (–LR) was significantly lower with SE than MPI, indicating that SE is a better test for ruling out disease (TABLE 1).

A 2008 meta-analysis reviewed 13 RCTs including 627 patients undergoing quantitative MCE, a bedside technique for assessing myocardial perfusion using microbubbles similar in flow to red blood cells.<sup>2</sup> It compared myocardial capillary blood volume (MCBV),

microbubble velocity (MV), and myocardial blood flow (MBF; the product of MCBV and MV) to the references of either coronary angiography (10 studies) or nuclear imaging (SPECT or PET; 1 study), or both (2 studies). MCBV, MV, and MBF were all significantly reduced in subjects with CAD compared with subjects without CAD as identified on the reference test. Data are summarized in TABLE 2.

A 2009 prospective study evaluated the effectiveness of adding MPI to standard wall motion (WM) criteria of dipyridamole-atropine stress echocardiography (DASE).<sup>3</sup> Four hundred consecutive patients presenting to a chest pain unit in whom acute coronary syndromes had been ruled out underwent DASE and MPI. Of these, 116 then underwent quantitative coronary angiography, based on either positive results on DASE or high clinical suspicion despite negative DASE results. Angiography detected >50% stenosis in 73 patients. Of these 73 patients, 46 had WM abnormalities seen on DASE and 71 had abnormalities seen on MPI. DASE had a 63% sensitivity with a 91% specificity (+LR 7, –LR 0.4) while DASE plus MPI had a 97% sensitivity with a 74% specificity (+LR 3.7, –LR 0.04). EBP

Daniel Herleth, MD  
Sarah Cole, DO  
Mercy FMR  
St. Louis, MO

1. Mahajan N, et al. *Heart*. 2010; 96(12):956–966. [LOE 1a]
2. Abdelmoneim SS, et al. *Eur J Echocardiogr*. 2009; 10(7):813–825. [LOE 1a]
3. Gaibazzi N, et al. *J Am Soc Echocardiogr*. 2009; 22(4):404–410. [LOE 2b]

**TABLE 1**

**Comparison of SE and MPI for diagnosing left main and triple vessel disease<sup>1</sup>**

Imaging type	Sensitivity	Specificity	Positive likelihood ratio	Negative likelihood ratio
Stress echocardiography (SE)	94%	40%	1.57	0.15 <sup>a</sup>
Myocardial perfusion imaging (MPI)	75%	48%	1.44	0.52

<sup>a</sup> $P<.001$  vs MPI.

**TABLE 2**

**MCE reserve parameters for diagnosing coronary artery disease<sup>2</sup>**

Reserve parameter	Sensitivity	Specificity	Positive likelihood ratio	Negative likelihood ratio
Myocardial blood volume (MCBV)	67%	52%	1.4	0.63
Microbubble velocity (MBV)	81%	77%	3.5	0.25
Myocardial blood flow (MBF)	80%	81%	4.2	0.25

MCE=myocardial contrast echocardiography.