Enhanced vs unenhanced cardiac stress imaging

TO THE EDITOR:

Dr Hayes and Dr McBride ("Diagnosing coronary heart disease: When to use stress imaging studies," *J Fam Pract* 2003; 52:544–551) present recommendations about when to do cardiac stress imaging studies ("enhanced") rather than standard treadmill stress testing ("unenhanced") for diagnostic triaging of patients with possible coronary disease. Exploring various strategies using clinical decision-making tools may not lead everyone to Hayes's and McBride's conclusion. Specifically, for patients who can walk (and, therefore, are not immediately triaged to an imaging modality), their recommendation is that patients with "intermediate" probability undergo unenhanced treadmill testing.

To simulate "intermediate" probability, I have done calculations with pretest probabilities of 20%, 40%, and 60%. I have used some representative sensitivities and specificities, consistent with those reported by Hayes and McBride: a sensitivity of 65% and specificity of 70% for standard treadmill testing, and a sensitivity of 85% and a specificity of 80% for enhanced testing.

For unenhanced testing, of 100 hypothetical individuals with a 20% pretest probability of (significant) coronary artery disease (CAD), 7 of 20 with CAD would be misclassified (negative test but with CAD), potentially risking subsequent presentation as sudden death or MI. Of 80 without disease, 24 would have positive tests, with the potential attendant ensuing cascade of events for subsequent evaluation. In total, 31/100 would be misclassified, for a test accuracy of 69%.

Using an enhanced test, 3 (rather than 7) of 20 with CAD would be missed. Of the 80 patients without CAD, 16 would have positive tests, meaning 8 fewer per 100 may be triaged to invasive testing and its attendant risks. Overall test accuracy would be 81%.

Assuming a higher-risk patient group with a pretest probability of 40%, unenhanced testing would miss 14 of 40 patients with CAD and yield false-positive results in 18 of 60. Enhanced testing would miss 6 of 40 patients with CAD and misclassify 12 of 60 without disease. In total, 14 fewer of each 100 patients tested would be misclassified using enhanced testing.

Assuming a 60% pretest probability, unenhanced testing would miss 21 of 60 patients with CAD and yield false-positive results in 12 of 40. Enhanced testing would miss 9 of 60 patients with CAD and misclassify 8 of 40 without disease. In total, 16 fewer of each 100 would be misclassified.

Using the 40% pretest probability scenario to illustrate, with unenhanced testing, the predictive value of a negative test is 75%, which leaves a 25% chance the patient has the patient has coronary disease. With the enhanced test, the predictive value of a negative test is 89%. Personally, I can hardly image a physician sitting in the examination room with a patient and saying, "Wow, before this test I thought the chance you had (significant) coronary disease was 40%. You 'passed' the test—so the chance is only 25%. I'm sure we'll both sleep well tonight knowing the chance is only 25%." I would be much more comfortable explaining that the chance is now around 10%, but that we would need to up the risk ante substantially (cardiac catheterization) to further elucidate risk.

I recognize the comparative expense of enhanced tests but, in the case of the number-one killer disease, I want neither the avoidable increase in risk of a false negative result—

Until more helpful noninvasive testing is available, we are limited in our diagnostic capabilities

with potential attendant death or MI from undiagnosed CAD—or increased risk of a false-positive result—with attendant risk of (potentially avoidable and unnecessary) cardiac catheterization, from which I have seen life-altering complications. I would also note that, as acknowledged in Hayes's and McBride's article, unenhanced test sensitivity and specificity is worse in women. This makes an already (in my opinion) borderline marginal test little better than a coin flip.

Having worked the math on numerous occasions, I personally do unenhanced stress tests only in extremely low pretest probability situations—and then only in men and never in women.

Gary N. Fox, MD,
Mercy Health Partners Family Practice Residency Program, Toledo, Ohio

DRS MCBRIDE AND HAYES RESPOND:

We appreciate the careful thoughts and calculations of Dr Fox regarding the issues of use of imaging and nonimaging cardiac stress testing. This is a classic dilemma involving the prevalence of the disease in the patient population tested, and the sensitivity, specificity, and predictive values of the tests utilized. We agree completely that nonimaging (unenhanced) stress testing is best utilized in the evaluation of only those with low pretest probability of coronary artery disease. However, as stated in our article, the cost of testing is a reality, with the cost of exercise echocardiograms at least $800–$1000, and the cost of exercise testing with radionuclear imaging starting at $1600, in most centers. Suggesting that using only stress testing with imaging for all women is not practical, especially if the pretest probability of coronary artery disease is very low.

Dr Fox fails to acknowledge that stress testing offers considerably more information than the predictive value of the presence of an obstructive lesion of coronary artery disease. A high level of functional capacity and normal hemodynamics is a powerful predictor of a favorable prognosis, so the risk of sudden death in those patients with angina is very low. Stress testing interpretation also utilizes other variables in predicting outcomes beyond ST segment changes, and there are a number of standardized predictive nomograms utilizing additional variables, including functional capacity, heart rate recovery, and systolic blood pressure recovery, which enhance the predictive value of stress testing. As Dr Fox's analysis clearly points out, however, until more helpful noninvasive testing is available, we are limited in our diagnostic capabilities. Since doing angiograms on all patients with chest pain is not reasonable, a carefully constructed clinical evaluation plan using the best tests available, with their inherent limitations of predictive value, is the best we can offer.

Sharonne N. Hayes, MD, FACC,
Mayo Clinic College of Medicine, Director, Mayo Clinic Women's Heart Clinic, Rochester, Minn;
Patrick McBride, MD, MPH,
Department of Medicine (Cardiovascular Medicine) and Family Medicine, Director, UW Preventive Cardiology, University of Wisconsin, Madison

CORRECTION

The following sentence appeared on page 805 of the September issue:

"A case-control study in Bangladesh suggests that breastfed infants have a higher incidence of rotavirus diarrhea, but selection of diarrhea patients as controls may have underestimated the protective effect."

It should have read as follows:

"A case-control study in Bangladesh suggests that breastfed infants have a higher incidence of rotavirus diarrhea, and although breastfeeding was not found to provide overall protection from developing gastroenteritis, exclusive breastfeeding appeared to protect against severe rotavirus diarrhea for infants less than two years of age."