Editorial Comment

Thallium-201 Scintigraphy in Risk Assessment for Ambulatory Patients With Chest Pain: Does Everyone Need Catheterization?*

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Optimal management of patients with symptomatic coronary artery disease, either suspected in those with chest pain or confirmed in those who have had a myocardial infarction, requires accurate, safe and inexpensive assessment of risk for subsequent adverse events (myocardial infarction or death) or the need for intervention (coronary artery bypass grafting or coronary angioplasty). Clinical variables, electrocardiographic (ECG) exercise stress testing, rest and exercise radionuclide evaluation of ventricular function and myocardial perfusion and cardiac catheterization are popular diagnostic techniques to assess relative risk in this patient population.

The ideal test (or tests) would separate high risk patients who require more aggressive management from low risk patients who can be managed conservatively. Although coronary arteriography, required before interventions, accurately defines the severity of coronary artery stenosis and ventricular function at rest, it is relatively expensive, involves a small risk of morbidity and mortality and provides largely anatomic information. Diagnostic tests performed during exercise augmentation of existing imbalance of oxygen supply and demand in combination with ECG or radionuclide monitoring provide physiologic information on myocardial ischemia. Exercise ECG stress testing and thallium-201 scintigraphy offer the advantages of lower cost, lower risk, less morbidity and, in theory at least, the ability to assess the physiologic consequences of myocardial ischemia. With its limitations, however, coronary arteriography has generally withstood the test of time, being a consistent predictor of subsequent morbidity.

Thallium scintigraphy in postinfarction patients. Establishing guidelines for optimal utilization of the available techniques requires a clear definition of the patient population in which they are to be used. After acute myocardial infarction, exercise scintigraphic evaluation of perfusion (with thallium-201) and function (with radionuclide ventriculography) clearly identifies high and low risk groups (3,4). On thallium imaging, the presence of multiple defects, redistribution or increased lung uptake of thallium places patients in a high risk category for subsequent adverse cardiac events. These scintigraphic findings have a greater predictive sensitivity than do the number of diseased vessels or the left ventricular ejection fraction at rest. An abnormal ejection fraction response at peak exercise on radionuclide ventriculography implies a similar poor prognosis. Patients with a single thallium abnormality or a normal ejection fraction response have a much lower risk for these adverse events. In studies performed after acute myocardial infarction, a proportion of patients, including those with recent angina pectoris, severe congestive heart failure or complex ventricular arrhythmias, are excluded. Thus, as many as 15 to 30% of all patients with myocardial infarction may require cardiac catheterization as the initial study if they have a complicated or unstable course or the noninvasive studies fail to provide diagnostic information (5).

Predictive value of quantitative thallium scintigraphy in patients with chest pain. The findings from this patient group cannot be applied to ambulatory patients evaluated for chest pain with or without a prior myocardial infarction. This study by Kaul et al. (6) in this issue of the Journal examines the relative predictive ability of clinical variables, ECG exercise stress testing, quantitative exercise thallium scintigraphy and cardiac catheterization in a large group of ambulatory patients evaluated for chest pain between 1978 and 1981 in Boston. A previous report by Kaul et al. (7) considered a similar group of patients studied during the same time period in Virginia. Combining the two series, Kaul et al. report on >500 patients who were followed up for an average of 5 years. Only patients with cardiac catheterization were included and they represented 12% (Boston) and 10% (Virginia), respectively, of all patients in the two institutions who had exercise thallium scintigraphy during this period. Forty-four percent of patients in both studies had remote myocardial infarction. The broad conclusion of both series is that quantitative exercise thallium-201 scintigraphic variables, either alone or in combination with exercise data, are powerful predictors of subsequent death, nonfatal myocardial infarction or coronary artery bypass surgery. Newer approaches to thallium scintigraphy, such as single photon

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emission computed tomography (SPECT), may enhance the accuracy of quantitating the mass of ischemic myocardium in the future, as has been suggested experimentally (8,9).

In the present report (6), the quantitative heart/lung thallium-201 activity ratio, reflecting exercise-induced ischemic left ventricular dysfunction, was a better predictor of adverse late cardiac events than was any clinical, exercise or cardiac catheterization variable. In the Virginia series (7), the number of diseased coronary arteries was the best single predictor of future cardiac events, however, the combination of exercise variables and the number of thallium-201 segments with redistribution had a predictive power equal to that of the coronary anatomy. Increased lung thallium activity was not predictive of adverse events in that study. The difference in the results between the two studies may be due to the method of calculating the heart/lung thallium ratio. Although both studies used quantitative methods of analysis for myocardial thallium distribution, lung thallium activity was analyzed quantitatively in the Boston series whereas the studies from Virginia used a visual method.

Variables of thallium scintigraphy predicting high risk. In the present study (6), either the presence of abnormal heart/lung thallium activity or the presence of thallium redistribution placed the patient in a high risk group, similar to the multivessel disease group identified by catheterization. This is graphically illustrated in the survival curves in their figures 1 to 3. Lack of thallium redistribution or a normal heart/lung activity ratio placed a patient in a low risk group similar to the one vessel disease or no coronary disease group classified by catheterization. Of note, the thallium variables retained their power as a predictor of late events when patients with prior myocardial infarction were excluded and when coronary artery bypass surgery was excluded as a late end point. Although not emphasized by Kaul et al., their study reaffirms several others (10,11) in showing that patients with normal thallium scintigraphy (either with or without associated anatomic coronary artery disease) have an exceptionally low event rate of about 0.5% per year. These results are similar to and supportive of findings in an earlier report by Ladenheim et al. (12) on >1,600 patients without prior myocardial infarction who were evaluated for chest pain with exercise thallium imaging. Only 8% of these patients had cardiac catheterization. The investigators found, as did Kaul et al. (6), that thallium imaging stratified patients into very low (0.4% per year) and high (75% per year) risk groups for adverse cardiac events.

Conclusions. Several caveats have to be noted before conclusions can be drawn from this and similar studies. This study was retrospective. Only ambulatory patients evaluated for chest pain who had both exercise thallium scintigraphy and cardiac catheterization were enrolled, and patients undergoing coronary artery bypass grafting within 3 months of testing were excluded. Thus, patients with a high risk, requiring early surgery, and possibly those with a low risk, not requiring cardiac catheterization, were excluded. Caution should be used in applying these results to a different patient population. Both of the participating institutions have an exceptionally extensive experience with quantitative thallium scintigraphy. Thallium imaging in less experienced hands or using only qualitative visual analysis may not be as useful. For these reasons, all may not agree with the authors' conclusion that "it may be more cost effective to use exercise thallium imaging for risk stratification in ambulatory symptomatic patients." Nevertheless, Kaul and colleagues (6) have provided an important data base from which such decisions can be considered. Their data certainly lend support to the thesis that patients with a low risk profile by thallium exercise scintigraphy can be managed conservatively.

References