Prognostic Benefits of Myocardial Perfusion Imaging

Assessment of patients with suspected coronary artery disease (CAD) has changed dramatically. At one time, the next step after an initial electrocardiogram (ECG) often was referral directly to angiography. Many patients were then revascularized based on the anatomic findings.[1] It is now understood that the extent of anatomic disease does not necessarily relate directly to the risk of cardiac death.[1] In recent years, the focus has shifted from simple diagnosis—finding anatomic CAD—to risk stratification—separating patients at risk from those not at risk for cardiac events.[1]

Nuclear myocardial perfusion imaging (MPI) provides accurate risk assessment in a variety of patient subsets by precisely measuring relative regional perfusion and myocardial function at rest and under stress.[1] Its main use for making management decisions is determining whether a patient with suspected or known CAD is at high enough risk for future cardiac events to justify invasive intervention.[1] MPI can serve as a clinically useful and cost-effective part of an overall CAD testing strategy.[2]

THE VALUE OF MYOCARDIAL PERFUSION IMAGING

Even after clinical, historical, and exercise treadmill testing (ETT) information is considered, MPI performed with either exercise or pharmacologic stress provides incremental prognostic information that is useful for accurate risk stratification and appropriate patient management decisions.[3] MPI has been shown to enhance prognostic stratification across the complete spectrum of scan results.[4]

To begin with, normal results of stress MPI accurately indicate a benign prognosis.[4] Clinical trials have shown that patients with normal scans—even patients with high pretest likelihood of disease—have very low rates of cardiac events. A review of multiple studies shows that normal results have been associated with an annual rate of myocardial infarction (MI) or cardiac death of less than 1%.[4-7] Such findings mean that unnecessary invasive procedures can be avoided in patients who otherwise would have been referred to catheterization.[4]

Because stress MPI adds incremental prognostic information over pretest clinical and ETT information, its effect on patient management can be both powerful and appropriate.[3,4,8]

By contrast, patients with moderately or severely abnormal scans have been shown to be at higher risk of such events.[1,3] A patient with severe perfusion abnormalities on stress MPI may have a 5- to 10-fold higher likelihood of cardiac death compared with a patient with no abnormalities.[1]

PRETEST LIKELIHOOD

Determining a patient's pretest likelihood of CAD is an important first step in risk stratification. If a patient has chest pain, the type of pain can indicate the pretest likelihood of disease. The classifications originally described by Diamond and Forrester are commonly used: typical chest pain = high likelihood; atypical chest pain = medium likelihood; and nonanginal chest pain = low likelihood.[9] Clinical risk factors also affect the likelihood of disease. Data from the Framingham Heart Study were used to create a prediction algorithm based on age, cholesterol levels, blood pressure, presence of diabetes, and smoking history.[10]

Those with a low pretest likelihood of disease may not need further evaluation.[11] In patients with a higher pretest likelihood of disease, the next step may be ETT.[12] Using the Duke Treadmill Score (DTS), those identified as low risk on ETT can be treated medically, while patients found to be at high risk usually should be referred for cardiac angiography.[12] Approximately half of patients undergoing ETT are classified by DTS as intermediate or moderate risk.[8] Guidelines recommend that these patients should be referred for additional testing. Exercise stress MPI is one option.[12] For patients unable to exercise to an adequate level for stress testing, guidelines state that pharmacologic stress may be preferable.[13]

IMPROVING PATIENT MANAGEMENT

Analysis of current referral patterns following stress MPI has shown that, because it adds incremental prognostic information over pretest clinical and ETT information, its effect on patient management can be both powerful and appropriate.[3,4,8] In patients with low to intermediate pretest risk, physicians' referrals to catheterization and revascularization based on MPI results were found to be in proportion to the extent and severity of scan results, and thus to the risk of cardiac events.[4,8] When incorporated into an overall testing strategy, stress MPI can enhance the effectiveness of testing.[3,4,14]

In addition to evaluating patients whose risk of cardiac events is unknown, MPI is useful for risk stratification in patients who have had an MI.[15] MPI is also used in the postprocedure evaluation and/or observation of patients who have undergone angioplasty, stenting, or bypass surgery.[16] And it can evaluate cardiac risk in patients who will be undergoing major noncardiac surgery.[17]

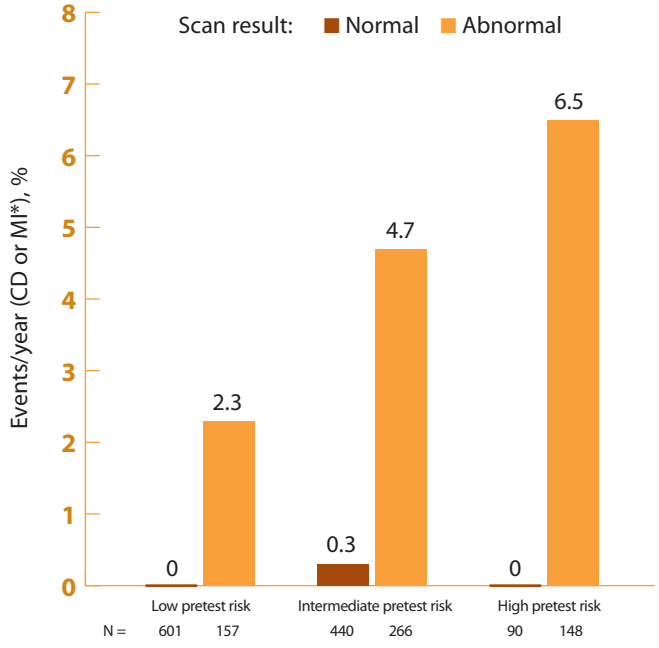
REPORTING MPI RESULTS

Because the pretest likelihood of disease can greatly affect a patient's final risk categorization, stress MPI reports often include relevant notations. These may include the type of pain the patient is experiencing, whether ECG and/or clinical evidence of ischemia was noted on the stress test, and the important clinical risk factors. If vasodilator stress testing is performed, certain hemodynamic responses in patients are important in assessing risk, and should be noted. To various degrees, higher resting heart rate (HR), lower peak HR, lower peak/rest HR ratio, and low peak systolic blood pressure may indicate higher risk of cardiac death.[18]

SUMMARY

Determining the extent of CAD and a patient's risk for cardiac events can be difficult. Often, the disease is found only after a patient has had a heart attack. Or, conversely, invasive testing may be performed unnecessarily. As detailed earlier, numerous studies have demonstrated that nuclear MPI, with either exercise or pharmacologic stress, effectively risk stratifies patients at all levels of pretest likelihood of CAD.

Cardiac Events According to Stress MPI Result and Prescan Likelihood of CAD



*CD = cardiac death, MI = nonfatal myocardial infarction.

Adapted from Berman, et al.[1]

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