



FIGURE 270e-12 Stress and rest rubidium-82 myocardial perfusion positron emission tomography images (*top*), noncontrast gated computed tomography images (*lower right*), and selected coronary angiographic images obtained on a 59-year-old male patient with atypical angina. Despite the absence of significant coronary calcifications (Agatston calcium score = 0), the perfusion images demonstrated a dense and reversible perfusion defect involving the anterior and anteroseptal walls (*arrows*), reflecting significant obstructive disease in the left anterior descending coronary artery (LAD), confirmed on angiography. LM, left main artery.

As discussed above, the improved temporal and spatial resolution of modern multidetector CT scanners offer a unique noninvasive approach to delineate the extent and severity of coronary atherosclerosis. The extremely high sensitivity of this approach offers a very effective means for excluding the presence of CAD (high negative predictive value) (Table 270e-3). In the setting of high coronary calcium scores (e.g., >400), however, specificity is reduced because the blooming artifact of calcium does not allow one to evaluate the vessel lumen accurately. Given the high negative predictive value of CTA, a normal scan result effectively excludes obstructive CAD and abolishes the need for further investigation. As discussed below, this may be quite useful in patients with low-intermediate clinical risk presenting to the emergency room for chest pain. However, the limited capability of this technique to determine the severity of stenosis and to predict which obstructions are flow limiting can make abnormal scan results more difficult to interpret, especially in terms of the possible need of coronary revascularization. There are emerging data suggesting that by adding a stress myocardial perfusion CT evaluation (similar to stress perfusion CMR) (Fig. 270e-13, *top panel*) or an estimated fractional flow reserve (so-called FFR_{CT}) (Fig. 270e-13, *lower panel*), one can define the hemodynamic significance of anatomic stenosis. However, these are not in routine clinical use and remain emerging technologies.

As with invasive coronary angiography, assessments of the extent of CAD by CTA can also provide useful prognostic information. A low 1-year cardiac event rate has been reported for patients without obstructive CAD on CTA. For patients with obstructive CAD, the risk of adverse cardiac events increases proportionally with the extent of angiographically obstructive CAD.

Although CTA can be helpful in assessing patency of bypass grafts, the assessment of stents is somewhat more challenging because the limited spatial resolution of CT and stent diameter (<3 mm being associated with the highest number of partial lumen visualization and nondiagnostic scans) both contribute to limited clinical results.

CMR Imaging The two approaches used with CMR to evaluate known or suspected CAD include the assessment of regional myocardial perfusion or wall motion at rest and during stress, the latter being analogous to dobutamine echocardiography. Although treadmill or bicycle exercise stress CMR is practiced in a small number of specialized centers, the logistics for stress MRI studies currently require the use of pharmacologic stress agents including vasodilators or dobutamine. Myocardial perfusion is evaluated by injecting a bolus of a GBCA followed by continuous data acquisition as the contrast passes through the cardiac chambers and into the myocardium. Relative perfusion deficits are recognized as regions of low signal intensity (black) within the myocardium (Video 270e-4). In addition, LGE imaging allows detection of bright areas of myocardial scar (white), which further enhances the utility of this approach for diagnosis of CAD (Fig. 270e-14).

The major advantage of dobutamine CMR over dobutamine echocardiography is better image quality and sharper definition of endocardial borders from the blood pool. Consequently, dobutamine CMR appears to have better diagnostic accuracy than dobutamine echocardiography for detection of CAD, especially in patients with poor acoustic window (Table 270e-3). A limitation of high-dose dobutamine stress CMR is that it bears the potential risk of severe side effects, such as hypotension and severe ventricular arrhythmias in the inhospitable