Multislice CT Versus MRI for Noninvasive Detection of Coronary Artery Stenoses

Dewey M, Teige F, Schnapauff D, et al. Noninvasive detection of coronary artery stenoses with multislice computed tomography or magnetic resonance imaging. Ann Intern Med 2006;145:407–15.

Study Overview

Objective. To compare the diagnostic accuracy of multislice computed tomography (CT) and magnetic resonance imaging (MRI) for detection of clinically significant coronary stenoses (≥ 50%).

Design. Prospective, intention-to-diagnose study.

Setting and participants. Patients who were referred to a single tertiary care center in Berlin, Germany, were enrolled between 5 November 2003 and 16 September 2004 if they were scheduled to undergo conventional coronary angiography for suspected coronary artery disease (CAD), were aged ≥ 40 years, and had normal sinus rhythm. Patients were excluded if they had undergone previous conventional coronary angiography, coronary artery bypass grafting, or stenting; had unstable angina or acute myocardial infarction; were pregnant or breastfeeding; or had orthopnea.

Main outcome measures. The primary outcome was diagnostic performance of multislice CT and MRI. Secondary outcome measures were total room time for multislice CT, MRI, and coronary angiography and the amount of contrast administered for multislice CT and coronary angiography. Patients were asked to report their preference for 1 of the 3 imaging procedures.

Main results. Of 129 patients who completed the study, 108 patients with 430 vessels could be examined with both multislice CT and MRI and were used for analysis. In the per-patient analysis, the sensitivity of multislice CT was significantly higher than that of MRI (92% versus 74%; $P = 0.013$). Multislice CT was 82% sensitive for detecting clinically significant stenoses compared with 54% for MRI ($P < 0.001$). In the per-vessel analysis, specificity was 90% for multislice CT versus 87% for MRI ($P = 0.73$); negative predictive values were 95% and 90%, respectively ($P = 0.032$). The effective radiation dose used with multislice CT was not significantly different from that used with diagnostic cardiac catheterization. Finally, most patients (74%) indicated that they would prefer multislice CT for future diagnostic imaging ($P < 0.001$).

Conclusion. Among outpatients referred for a diagnostic coronary angiography, multislice CT was superior to MRI and may be a reasonable alternative to angiography.

Commentary

Although there are many approaches to making a diagnosis of CAD, invasive coronary angiography remains the gold standard. Visualizing stenoses in coronary vessels is critical to further management, such as angioplasty or heart bypass surgery. However, coronary angiography is not without risks. A small but significant proportion of patients develop complications at the puncture site where the catheter is introduced, including bleeding, thromboses, and pseudoaneurysms. Further, patients can develop more serious complications, such as renal failure and, occasionally, coronary artery dissection. Although uncommon, these complications result in substantial morbidity and mortality. Finally, coronary angiography can only be performed by a trained cardiologist, and such practitioners are not always available in rural or other health care settings. Given these factors, finding alternatives to screen patients for CAD would be clinically useful.

Dewey et al compared CT and MRI to coronary angiography. Each patient received multislice CT, MRI, and conventional coronary angiography. The authors found that CT had superior sensitivity and specificity compared with MRI for detecting coronary lesions and concluded that CT may be a reasonable alternative to angiography. However, certain aspects of the study limit this interpretation.

The biggest factor in determining whether CT is a useful alternative to conventional angiography is whether it can definitively rule out CAD (the negative predictive value). The negative predictive value is dependent on 2 factors: test characteristics (sensitivity and specificity) and the prevalence of the condition. If the sensitivity or specificity of CT found in this study was substantially higher than what could be expected in clinical practice, more false-negative results (patients with CAD being diagnosed as normal) would be seen, a clinically disturbing scenario. Why is this a concern? Radiologists involved in this study were likely more expe-

rienced with this new diagnostic technique and therefore more proficient with its use than the average radiologist. Therefore, it is likely that most radiologists' performances would be substantially lower if this study were performed across multiple practice settings.

Another important issue is that the prevalence of CAD in the study population was high (nearly 60%). In this context, approximately 10% of patients with a "negative" result on CT actually had CAD. However, if the prevalence of CAD was lower and the sensitivity and specificity remained the same, the false-negative rate would be lower as well.

Applications for Clinical Practice

Based on this study's findings, it is likely that multislice CT is superior to MRI for diagnosing CAD in high-risk patients. However, multislice CT should not yet be widely used as a reasonable alternative to angiography, mainly due to its potentially high false-negative rate. If new studies across many sites demonstrate that most radiologists can achieve sensitivity and specificity rates of 90% or above, this may be a very attractive approach among lower-risk patients with a low prevalence of disease.

—Review by Ashish K. Jha, MD, MPH