Noninvasive coronary angiography requires the ability to image structures as small as 1.5 mm, enveloped in tissue of quite similar composition, and rapidly moving in 3 dimensions within the body. Inaccuracies of measurements on the order of a few hundred microns make the difference between accurate diagnosis of a clinically significant lesion and a false test result. Computed tomography (CT) and magnetic resonance imaging (MRI) currently offer the potential to overcome these challenges in the pursuit of noninvasive assessment of coronary disease. A direct comparison of the 2 modalities to date has shown the current generation of 64-slice multidetector CT to provide more accurate coronary imaging (1,2), albeit at the cost of significant radiation exposure to the patient (3). Long scan times and operator dependency have also challenged the efficiency of MRI. The promise of performing noninvasive angiography free of ionizing radiation has provided a strong and ongoing stimulus to close this gap between MRI and CT. Improvements in parallel processing, multichannel receiver coils, and stimulus to close this gap between MRI and CT. Improve-

A doubling in the strength of the MRI field from 1.5- to 3.0-T theoretically translates into a doubling of the signal-to-noise ratio (SNR) obtained (4). In practice, the obtainable increase in SNR is on the order of 30% (5). This increase in SNR, in the currency of MRI, can subsequently be exchanged for improvements in temporal resolution, spatial resolution, or scan time. The demands of coronary magnetic resonance angiography (MRA) place each of these at a premium. Increased field strength, however, has notable drawbacks. All MR fields are inhomogeneous to some degree. Inhomogeneity results in imaging artifacts, and these artifacts become more pronounced in stronger magnetic fields (6). Stronger fields can also result in greater energy absorption by body tissues, limiting the utility of certain imaging sequences.

Much of the recent effort in MRA has focused on use of the newest steady-state free procession (SSFP) sequences (7). SSFP, however, is particularly susceptible to the artifacts generated at greater magnetic fields. A spoiled gradient echo technique, fast low-angle shot (i.e., FLASH), first described >20 years ago (8), has recently shown promise in overcoming these difficulties, with better image quality at 3.0-T compared with the use of SSFP (9).

In this issue of the Journal, Yang et al. (10) report the results of a single-center, prospective trial comparing the accuracy of 3.0-T whole-heart coronary MRA with conventional quantitative coronary angiography in a population with suspected coronary artery disease. They performed whole-heart coronary MRA with the use of FLASH sequences at 3.0-T, with a 9-min mean scan time. Yang et al. (10) also achieved a 50% reduction of scanning time compared with previously published reports with comparable diagnostic accuracy.

The diagnostic accuracy of the coronary MRA technique to detect a patient with a >50% stenosis demonstrated a sensitivity of 88.7%, a specificity of 82.1%, a positive predictive value of 86.5%, and a negative predictive value of 92%. These results are tempered by an inability to image more than one third of the participants (34 of 96) because of either the patient’s ineligibility for MRI or an unsuccessful attempt at scanning. A total of 12% of segments in scanned patients could not be assessed, although 98% of proximal segments were readable. The lack of ability of MRA to image all coronary arteries in all patients remains a consistent theme. Although this problem is a solvable one, manufacturers of MR equipment have not resolved this issue. As a result, coronary MRA is currently deployed only at specialized academic centers.

The results obtained in the present study compare favorably with other single-center studies of whole-heart coronary MRA at 1.5-T (11,12). These results are also quite similar to the recent experience with 64-slice multidetector CT angiography in both single- and multicenter studies with similar prevalence (i.e., ~55%, of true coronary disease [13,14]), although far fewer patients were excluded or scan failures in the CT studies.

Correlation with invasive angiography is a necessary initial comparative step for any new noninvasive technique. There is yet a large gap to be closed between catheterization...
and even the most accurate CT or MR approach, and it is unlikely that this gap will be closed in the foreseeable future. For the present, it is the high negative predictive value of noninvasive angiography that drives its potential clinical utility, particularly in permitting the exclusion of high-grade stenosis in proximal vessels. Even using the gold standard invasive approach, however, mere luminal stenosis has limited prognostic potential (15). There is little reason to believe that a simple lumenographic approach will meet the standards of the current focus on outcomes benefit for imaging studies (16).

A greater potential for noninvasive angiography lies in the ability to assess the burden of atherosclerotic disease in the vessel wall itself, rather than the degree of stenosis imposed by that disease (17). The use of noninvasive techniques to assess atheroma burden and plaque composition in this manner, although promising in early applications, merits rigorous evaluation for diagnostic and prognostic potential. We look forward to application of techniques like that described here by Yang et al. (10) toward this end.

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