Coronary Imaging in a Multi-Disciplinary World

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As a relatively young technology within the arena of cardiovascular imaging, MRI competes with many more or less established alternative techniques.

MRI accommodates numerous approaches for detection of obstructive coronary artery disease. Other noninvasive modalities, such as SPECT, echocardiography and PET apply similar approaches to detect coronary obstruction and determine cardiovascular risk. Stress-echocardiography has been augmented by use of intravenous contrast media, and tissue-Doppler imaging improves the assessment of regional contractility.

MRI and CT both offer reliable noninvasive imaging of the great thoracic vasculature. While MR may be preferred for elective, serial assessments, CT is better suited for acute vascular conditions, such as pulmonary embolism or aortic dissection.

In a recent meta-analysis of 41 studies that compared MR coronary angiography and conventional X-ray angiography, the authors concluded that despite technical innovations over the past decade, diagnostic accuracy and reliability has yet not reached a level that allows widespread use. State-of-the-art multi-detector spiral CT (MDCT) scanners are equipped with up to 64 thin detector rows, scan the heart in 10 seconds, and provide detailed images of the coronary arteries during different phases of cardiac contraction. While the temporal resolution has improved substantially, beta-receptor blockers are recommended to avoid motion artifacts. Particularly in the absence extensive calcification, MDCT allows reliable detection of obstructive disease, and use of this technique to detect or exclude coronary artery disease, particularly in patients with a low-to-moderate pre-test likelihood, is expanding rapidly. In addition to imaging of coronary calcium, CT visualizes non-calcified plaque. Although the fundamental capacity to distinguish (non-calcified) plaque components by CT is limited, noninvasive quantification of coronary plaque burden may have scientific and prognostic value.

The combination of accuracy, accessibility and cost make echocardiography the undisputed clinical standard for assessment of ventricular function. When high accuracy (in irregularly shaped ventricles) or reproducibility is critical, or in the absence of an acoustic window, other techniques including MRI can be used. Alternatively, intravenous contrast or three-dimensional data acquisition improves accuracy of echocardiography.

Delayed-contrast MR, as well as low-dose dobutamine MR allows detection of non-viable tissue and predicts contractile recovery after myocardial infarction or revascularization. MR needs to compete with previously mentioned established techniques such as nuclear imaging, low-dose dobutamine-echocardiography, positron-emission tomography. In addition myocardial perfusion imaging by ultrasound, tissue-Doppler or Doppler strain imaging, and contrast-enhanced CT have been used for detection of viable and non-viable myocardium.

MRI offers a potentially preferable alternative to many established cardiovascular imaging techniques. Nevertheless, a transition from established imaging techniques to MRI requires more clinical evidence and time. Meanwhile, other modalities are entering the arena and methodological innovations have improved the accuracy of conventional techniques.