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Could cardiac CT revolutionize the practice of cardiology?

REVOLUTIONARY CONCEPTS do not come along often in cardiovascular medicine, but when they do, we make progress. For example, the discovery of the role of the neurohormonal axis in heart failure and the concept of the vulnerable plaque in acute coronary syndromes have radically changed the practice of cardiology over the last 20 years. *See related article, page 127*

We are also witnessing amazing technological advances in cardiac imaging. Often these occur before we develop an understanding about how they ought to be applied. In cardiac ultrasonography, the development of hand-carried devices, three-dimensional imaging, and strain rate imaging were examples of technology outpacing the development of clinical applications.

■ CORONARY CT SHOWS PROMISE

Although computed tomography (CT) has been one of the most valuable imaging tests in general radiology for many years, it had gained only limited acceptance in cardiac imaging until recently. Echocardiography and magnetic resonance imaging are either superior, more convenient, or both for evaluating ventricular function and heart valves, while nuclear scintigraphic imaging remains the gold standard for evaluating myocardial perfusion. What, then, could CT do better?

Both electron-beam CT and, more recently, spiral multi-detector CT now have sufficient spatial and temporal resolution to image the coronary arteries. Both systems can be used to detect the presence, extent, and location of coronary calcifications. Although it is controversial whether evaluating calcification adds to

the assessment of conventional risk factors, the potential of CT for evaluating the coronary anatomy is great. Using intravenous contrast, three-dimensional images of the coronary tree can also detect the presence of luminal obstruction and noncalcified atherosclerotic plaques.

■ A BETTER TEST IS NEEDED

Clinical risk factor assessment and stress testing are good prognostic indicators, but they cannot establish with absolute certainty the presence or absence of coronary artery disease. The presence of risk factors does not always equal the presence of disease. And quite often, stress test results are nondiagnostic or inconclusive, and many patients eventually require invasive coronary angiography or go on to have an acute coronary syndrome.

An estimated 1 in 20 patients who present to the emergency room do so because of chest pain. Emergency physicians have historically missed approximately 3% to 5% of myocardial infarctions.¹ On the other hand, 20% to 40% of patients undergoing invasive coronary angiography in the United States have no coronary disease or require no intervention.²

An imaging test that could rapidly exclude significant coronary disease could reduce unnecessary invasive testing or incorrect diagnoses and help triage patients with acute chest pain. It could also provide direct visual evidence to patients and physicians to justify or to evaluate the long-term use of drugs such as statins for primary prevention in situations in which the risks and potential benefits are unclear.

■ CORONARY CT NEEDS MORE VALIDATION

In this issue of the *Journal*, Schoenhagen and coworkers review the status of CT in cardiac

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imaging.³ Their article elegantly covers the technical aspects and the clinically established cardiovascular applications of CT. They also provide a balanced view of the potentials and limitations of CT coronary imaging.

Although coronary imaging is the greatest potential application of cardiac CT, it still requires extensive validation. Meanwhile, it should be applied judiciously, only in selected cases. With today's technology, image quality is often compromised in obese patients or those with irregular heart rhythms. Coronary obstruction may be difficult to evaluate in patients with extensive coronary calcifications and in small branches or distal segments. Furthermore, as with invasive coronary angiography, CT angiography should not replace stress testing for guiding the decision to perform revascularization, particularly in patients with atypical symptoms or no symptoms whatsoever.

At this point it is premature to know whether the widespread use of cardiac CT will improve outcomes or increase or lower the cost of cardiovascular health care. However, most experts in cardiac diagnostic imaging recognize that cardiac CT has a great potential to revolutionize the practice of cardiovascular medicine. Patients who experience symptoms and have normal or equivocal stress results could still have coronary disease. This could be ascertained noninvasively with a CT study.

This revolution goes beyond the ability of visualizing noninvasively what previously could be seen only by invasive means. More importantly, using CT, physicians could move away from determining "probability" to establishing a definitive diagnosis of the disease that remains the leading cause of death in the United States and most of the developed world. 

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