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EDITORIAL

# CMR and MSCT: What Is the Future?

As noted by our new president, Warren Manning, our membership is approaching 1000. Magnetic resonance continues to develop technologically. Several great scientists have now received the Nobel Prize for developments in magnetic resonance. Many important contributions have now been made for the cardiovascular applications of CMR. The Journal is proud to share the manuscripts describing the newest contributions in CMR with other important journals in cardiovascular medicine including: Circulation, Journal of the American College of Cardiology, and others.

Cardiovascular medicine has several diagnostic imaging technologies, and we are continually trying to identify the most effective, least harmful, and least costly strategy for use of these technologies. These include echocardiography, radionuclide imaging (including both SPECT and PET), and cardiac catheterization/x-ray coronary angiography. The newer technologies include CMR and multislice x-ray (high speed CT approaches). Each approach has its advantages and disadvantages for diagnosis and risk assessment. We must consider several issues for the future. What is the best approach to identify disease in its earliest stages, when it might be preventable? Which is the best approach to optimize diagnosis so that additional expensive testing becomes unnecessary? What is the best way to generate the most information? What is the best approach to identify high risk disease that has not yet been identified, e.g., ''vulnerable plaque''? Perhaps the most interesting contest is that between CMR and high speed multislice x-ray CT or electron-beam CT.

Computed tomography has been widely touted as a means to identify coronary atherosclerosis through calcium scoring. While there is little doubt that calcium in the coronary arteries identifies atherosclerosis, the cost effectiveness of calcium scoring over more traditional methods such as cholesterol fractionation, exercise stress testing, etc., remains controversial. Furthermore, the aggressive marketing of this technology for calcium scoring, even early in its widespread study, was a turn-off for many physicians. Nevertheless, the ''worried well'' population, who were willing to refer themselves or were involved in large risk assessment programs and were willing to pay out of pocket for the test, underwent such an evaluation. Many such individuals with a high calcium score saw a cardiologist, since they were looking for a low ''reassuring'' score than a high frightening score. Many such patients underwent additional expensive testing, to find some reassurance. In fact, the diagnostic performance of the calcium score was not impressive and it was relegated to a risk rather than a diagnostic factor such as increased LDL. Thus, the calcium score was not a test capable of evaluating functional significance of disease. The negative score suggested that the presence of atherosclerotic plaque was not likely, and a negative score correlated with a low short-term risk of cardiac events. On the other hand, a positive score confirmed coronary atherosclerotic plaque; as the amount of calcification increased, the likelihood of occlusive disease increased to a certain extent and a very high calcium score suggested moderate to high short-term risk for an event. Several colleagues have bought EBCT systems to evaluate calcium scores, although the test was not Medicare reimbursable. From a business standpoint, one would need to perform seven to nine scans a day to break even, according to an analysis performed by the Cardiovascular Roundtable. Imagine how much marketing, x-irradiation, and expense was needed to generate a profit.

The real importance of x-ray CT is its use to perform the less invasive coronary angiogram to replace standard catheter-based coronary angiography. With a large dose of IV radio opaque contrast medium and a substantial amount of x-irradiation, it is possible



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to generate pretty good coronary angiograms without cardiac catheterization/catheter-based coronary angiography. Multislice CT has been used by several groups for that purpose. The problem is that with the advent of improved MR strategies, including higher field magnets (i.e., 3 Tesla), better gradient coil construction, improved software, improved MR contrast agents, etc., CMR should be able to generate not only good quality coronary angiograms without x-rays, but also high quality evaluation of ventricular function, assessment of perfusion, evaluation of myocardial viability, and assessment of cardiac morphology in the same examination. Also, it is the only hope for detection of ''vulnerable plaque''. If replacement of the coronary angiogram is the only interest, multislice CT is a bit ahead. If the performance of a comprehensive evaluation of the heart is more interesting, with high odds for evaluating the coronary arteries, and potentially the detection of ''vulnerable plaque'' rather than the relatively stable calcified plaque, CMR is the technology of choice. By the way, the choice of being able to detect significant disease using dobutamine wall motion studies (3D for CMR vs. 2D for echo) or myocardial perfusion imaging using paramagnetic first-pass paramagnetic contrast agent, is another advantage of CMR. It is noteworthy that it is possible to generate a study providing ventricular functional evaluation, adenosine perfusion studies, viability evaluation, and a reasonable evaluation of the proximal coronary arteries within a 30-minute period (personal observation in the laboratory of Dr. Steve Wolff).

For CMR, the future is bright. For MSCT, such systems are penetrating the market, not only for cardiac applications, but also for all of the radiological applications.

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