Editorial

Cardiovascular Magnetic Resonance Imaging. An Opportunity for Fruitful Collaborations

PETER G. DANIAS

Cardiac MR Center, Hygeia Hospital, Maroussi, Greece, and Tufts University Medical School, Boston MA, USA

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Address:
Peter G. Danias

Hygeia Hospital
4 Erythrou Stavrou St.
15123 Maroussi
Athens, Greece
e-mail:
pdanias@hygeia.gr;
peter.danias@tufts.edu

Over the last several decades cardiovascular magnetic resonance imaging (CMR) has evolved into a mature clinical tool in cardiology. CMR is currently considered as the gold standard for measurement of left and right ventricular volumes, ejection fraction and myocardial mass. CMR also has unique advantages for tissue characterization and scar identification and is becoming established as the gold standard for assessment of myocardial viability. Diseases of the pericardium and myocardium, including cardiac tumors and hypertrophic, dilated and restrictive cardiomyopathies, can now be evaluated more thoroughly with CMR by obtaining near-histological information. Congenital and acquired diseases of the aorta and great vessels are among the main indications for CMR, as both anatomical and functional information can be acquired and integrated for a more accurate diagnosis. Valve diseases and primarily regurgitant lesions can be evaluated by CMR and a quantitative assessment of forward and backward flows can be obtained. Last but not least, imaging of the proximal coronary arteries is feasible in the vast majority of patients, and CMR is the current gold standard for assessment of suspected coronary anomalies and aneurysms of the epicardial coronary arteries. Among the rapidly developing applications for CMR, assessment of myocardial perfusion at rest and under vasodilation or inotropic stress has been gaining increasing acceptance for clinical use, as a growing body of scientific evidence suggests equivalence and possibly superiority of CMR compared to radioisotopic approaches for the diagnosis of coronary artery disease. The broad spectrum of clinical information that CMR can offer has established it as a valuable tool for the assessment of patients with congenital, myopathic, valvular and atherosclerotic coronary artery disease.

Compared to other imaging technologies, CMR has several advantages. It is entirely noninvasive and does not involve exposure to ionizing radiation. CMR can utilize a large field of view and images can be obtained in two-dimensional slices or three-dimensional volumes in unrestricted orientations. Spatial, contrast and temporal resolution can be exquisitely high, providing high degrees of accuracy and reproducibility. As the human tissues have a high natural contrast due to their different magnetic properties, there is commonly no need for contrast media. Even when contrast media are used, the possible toxicity or risk for allergic reactions is orders of magnitude lower than the risk associated with the iodinated contrast media used in X-ray radiography. Still, the greatest advantage of CMR is that it can combine anatomic and functional information and can assess virtually every aspect of the cardiovascular system.

Proficiency in CMR interpretation requires many skills. Firstly, a good know-

ledge of the underlying theoretical basis is necessary to appreciate safety issues related to CMR, as well as the potential and drawbacks of various imaging approaches. Basic magnetic resonance physics, data acquisition and image reconstruction algorithms, pharmacodynamic, pharmacokinetic and magnetic properties of contrast media are but some of the areas with which the CMR specialist needs to be familiar. Secondly, it is important to have a good spatial appreciation, so that structures can be conceived in three- or four-dimensional space from images that are obtained in conventional or non-conventional orientations. As the heart, valves and vessels are complex three-dimensional structures, the physician involved with CMR needs to integrate information appropriately from multiple points in space into the shape that these points represent. Thirdly, a good knowledge of normal cardiovascular anatomy and possible variations is essential, so that normal findings are appropriately interpreted as such. This is the only way that the published high specificity of CMR for detection of various diseases can be ensured. Lastly, but importantly, knowledge of cardiovascular pathology is essential, so that the plain image description will be transformed into clinically meaningful medical information. The latter is particularly challenging for rare and complex heart diseases, as is the case with complex congenital anomalies and the variety of surgical corrections that can be performed.

One of the issues that have come up in many discussions is who should perform CMR. In several instances a "turf-battle" has developed among cardiologists and radiologists, with the former claiming that they are the only ones who know cardiac anatomy, physiology and pathology and the latter claiming that they are the only ones who know magnetic resonance imaging and have the spatial conception abilities necessary for CMR interpretation. These adversarial attitudes are characterized by a narrow-minded approach of "keeping one's business". The almost certain end-result of this approach is a gradual deterioration of the quality of the clinical information provided, eventually leading to a decline in the utilization of CMR, i.e. "closing down one's business". An alternative approach is one that values appropriate training and education instead of specialty title. This approach requires that the CMR specialist, be it a cardiologist, radiologist or nuclear medicine physician, is appropriately trained to perform and interpret CMR, irrespective of the basic specialty title. According to this paradigm, a CMR cardiologist can be part of a radiology group, a CMR radiologist part of a cardiology group, a CMR nuclear medicine physician part of a cardiology group, etc. By default this approach emphasizes collaboration between specialty groups who have common goals: a) how to best serve the patient, b) how to best advance science, c) how to best utilize CMR and appropriately increase its applications and clinical volume. There are many examples worldwide where centers with a sincere and healthy collaboration between different specialties involved with CMR have generated spectacular progress in both the clinical arena and research output.

This is a unique time of growth and development of CMR. We should learn from the mistakes of others and not repeat them. We should adopt strategies that have been proven to work and be fruitful. Let us not stay within the walls of isolation: let us develop healthy collaborations among specialties. Let us keep an open perspective on CMR and this will undoubtedly reward us and promote the field of CMR wherever it is appropriate.