Faster & Better: Emerging tools for Cardiovascular MRI in the Emergency Room

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Cardiovascular MRI technology continues to evolve in terms of its ability to rapidly and reliably produce accurate, functional, diagnostic information, and also in its capacity to provide quantitative results. Given the advantages provided by recent advances in image acquisition and reconstruction methods, a number of centers are beginning to explore the use of MRI as a means to triage patients presenting in the emergency room with acute chest pain. The imaging requirements in this patient population are especially stringent; time is of the essence to ensure rapid treatment of acute conditions, and diagnostic accuracy is critical in the decision to discharge or admit to the hospital. Currently utilized methods and decision algorithms based on electrocardiogram (ECG), cardiac enzymes, and non-invasive imaging by echocardiography and nuclear scintigraphy with or without stress are falling short of expectations, driving the investigative use of cardiovascular MRI and CT in the setting of acute chest pain.

This presentation will explore the latest advances in cardiovascular MRI methods that are especially applicable to the diagnosis of Acute Coronary Syndrome (ACS). Four basic techniques form the cornerstones for evaluation of patients with suspected ACS: cine imaging of cardiac function, T2 imaging of myocardial edema, first-pass imaging of myocardial perfusion, and late gadolinium enhancement imaging of myocardial infarction. While coronary MR angiography is also relevant and has been utilized in patients with acute chest pain, the evaluation of cardiac function and myocardial tissue characterization reflect the primary strengths of MRI when compared with other imaging modalities. Parallel imaging has played a major role in improving the performance, functionality, and reliability of cardiovascular MRI, and newer acceleration methods that take particular advantage of the temporally dynamic nature of cine and perfusion MRI will be discussed in some detail; these techniques have played a major role in advancing the real-time and single-shot imaging methods that are so critical to the evaluation of patients with chest pain. Additional advances in cardiovascular MRI technology relevant to the emergency room setting such as quantitative measurement of relaxation parameters and quantitative assessment of cardiac function will also be discussed.

Stress imaging also plays a key role in the evaluation of patients with acute chest pain, particularly to rule out ACS in low risk patients. Current guidelines recommend the use of exercise stress testing in patients presenting with symptoms suggestive of ACS but negative or indeterminate ECG and cardiac enzymes. Adenosine stress perfusion MRI has been shown to be effective in this low risk population. Recently developed MRI-compatible exercise equipment will enable investigation of the potential advantages of the combination of treadmill stress ECG testing with cardiovascular MRI in the setting of acute chest pain in low risk patients.