Functional Cardiac Imaging

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Abstract:

The primary function of the heart is to pump blood against a positive pressure gradient. Microscopically, the mechanical work needed to pump blood from low to high pressure is achieved by the contraction of collective groups of individual myocytes. Myocyte contraction itself requires that the myocytes are both alive and are receiving an adequate blood supply. Thus the evaluation of cardiac function in patients with known or suspected heart disease seeks to answer three fundamental questions about the myocardium: 1) is it moving normally (yes/no); 2) is it perfused (yes/no at rest and stress); and 3) is it alive, or viable (yes/no)? Over the past two decades a number of different MRI strategies have been described which address these three primary questions, yet only recently has the field of cardiovascular MRI matured to the point where "standard" approaches have begun to emerge. Currently, most if not all cardiovascular MRI sites evaluate regional and global contractile function (is it moving normally?) using breath hold segmented steady state free precession (SSFP) MRI pulse sequences. Similarly, most sites evaluate myocardial viability (is it alive?) using an MRI contrast agent in combination with a breath hold segmented inversion-recovery fast low angle shot (IR-FLASH) MRI pulse sequence. For perfusion, however, there is less agreement as to which pulse sequence to run and, in addition, debate continues regarding whether and how to use pharmacological stress agents such as dobutamine, adenosine, and dipyridamole. In this lecture, we will discuss both the choice of MRI pulse sequences as well as the choice of MRI scan protocols currently being used to evaluate cardiac function in a clinical setting. Perhaps more importantly, however, we will begin to address the complexities of assigning physiologic meaning to the images in the context of both the underlying disease as well as common technical pitfalls which can adversely affect the accuracy of the final clinical diagnosis.