AbstractID: 14535 Title: Cardiovascular MR Imaging: Recent Improvements in Speed, Resolution, and Contrast

Within the last decade a number of “parallel acquisition” methods have been developed which allow reduction of acquisition time in MRI. With these, the MRI signal is simultaneously measured by multiple receiver coils, and the redundancy of information allows reduction in the number of necessary measurements. Such methods are particularly well suited to cardiovascular imaging, for which 3D images are generally desired. The practical limit of acceleration is primarily limited by the geometry of the RF receiver coils. MRI systems having coil arrays consisting of several dozen or more elements are becoming commonplace. Of these elements, eight or more might be activated for any one scan. When used in conjunction with other techniques, accelerations of ten-fold or more can be routinely obtained.

Even with acceleration methods, the generation of a high spatial resolution 3D MRI data set still requires scan times on the order of ten seconds or more. However, the unique aspect of MRI compared to other modalities that the data are acquired in Fourier space allows the reconstructed image to appear as if it were acquired in a much smaller time. This is allowed by preferential sampling of the low order spatial frequencies of Fourier space. These advances in parallel acquisition and in effective ordering of Fourier sampling now permit contrast-enhanced MR angiograms which are markedly superior in spatial and temporal resolution to what they were a decade ago. This thus addresses what is perhaps the principal disadvantage of MRI vs. other modalities for cardiovascular imaging, namely relatively long scan time. The intrinsic advantages of MRI thus can become a greater determinant of its ultimate utilization. These include the 3D nature of the data, the lack of ionizing radiation, the relatively small contrast dose, and the high vascular signal.

This presentation will briefly review the physics of the acceleration techniques, discuss the unique synergistic benefits of implementation in cardiovascular imaging, and illustrate the various points with results from multiple in vivo imaging studies.

Learning objectives:

1. Understand recently developed physics techniques which have allowed a 10x improvement in the speed of data acquisition for MR cardiovascular imaging

2. Understand the impact of improved speed on improvements in image quality.

3. Understand some of the relative advantages of MRI vs. other modalities in imaging the cardiovascular system.