AbstractID: 2309 Title: Optimizing MRI Protocols - SNR, CNR, and Spatial Accuracy

MR images are noted for their high degree of soft tissue contrast compared to other noninvasive imaging modalities. The contrast relationships between tissues can also be easily manipulated to enhance or degrade the signals received from particular tissue types when pursuing specific clinical objectives. This presentation goes through the basic image acquisition parameters that can be altered to manage MR image quality. The three primary image contrast categories: T1-weighted, T2-weighted and proton density-weighted images are introduced. The degree to which an image is defined along this contrast continuum is fundamentally determined by the timing parameters: time-to-echo (TE), repetition time (TR) and also the radio frequency pulse nutation angle. The contrast-to-noise ratio (CNR) metric is introduced as a method of determining specific contrast relationships between tissues.

Although MR image optimization focuses on image contrast relationships, interactions amongst the signal-to-noise ratio (SNR), spatial resolution and imaging speed must also be taken into consideration to achieve the optimal image quality. Under certain conditions signals from particular types of tissues, such as adipose or cerebrospinal fluid, can be entirely eliminated. MR angiographic methods are also briefly discussed and presented as an example of how physiological conditions may be important for determining the optimal MR imaging method. Roles for the use of exogenous agents administered to alter tissue contrast are reviewed. At low magnetic field strengths, the desire to maximize SNR can also compromise the spatial accuracy of the study. The changes in SNR and relaxation times of tissues that occur at different magnetic field strengths are introduced and their impact on the selection of appropriate imaging parameters reconciled.

At the end of this presentation the attendee shall:

- understand the primary types of image contrast used in clinical MRI and the relationships between pulse timing parameters and relaxation times of tissue on the acquired MRI signal.
- be aware of the interactions between SNR, spatial resolution and imaging speed and their relative weighting in defining image quality for a variety of clinical situations.
- be familiar with circumstances under which patient physiology and magnet field strength may require modification of image acquisition parameters to achieve optimal image quality.