

presenting a unique challenge to good image quality. The patient's cooperation, preparation and body habitus must first be addressed and given due diligence before the exam can progress.

Discussion:

Motion can be discussed in two categories. The first is voluntary motion or that which can be controlled. The second is involuntary or that which the patient cannot control. Both of course are issues in MR as any motion causes misregistration artifacts and blurring of pixel data.

Motion Correction Techniques can be divided into the following categories

- Hardware
 - Fast scanning capabilities
 - Sequences like GRE that can be Breath Hold
 - Coils
 - Higher channel coils for better signal and shorter scan times
 - Gating equipment
 - Compensates for artifact by manipulation of Kspace
 - Can be Respiratory, Cardiac or both
- Software:
 - Flow compensation
 - Adds a gradient lobe to null slow flowing spins
 - Navigator Sequences
 - Attempt to “sense motion” and exclude it from contributing to important part of the data
 - Works well for both Breathing and cardiac motion
 - May influence contrast properties and care must be taken to maintain the parameters necessary for the protocol
 - Fast scanning capabilities
 - Parallel imaging cutting scan time and averaging motion

- SNR can suffer therefore other parameters may need to be adjusted for the exam
- Post Processing
 - Some exams require analysis of images after the exam is complete. Motion artifact can severely degrade these processes and even render them impossible.
- Patient Prep:
 - Soft skills to obtain cooperation
 - Pre-screening prior to exam
 - Prep if needed should be included in the instructions several days prior to the exam
 - Dealing with any issues that might preclude the patient from tolerating a MR exam
 - Claustrophobia is a very common issue in MR scanning. Failing to screen for and deal with this often causes failure to either complete the exam and/or poor image quality
 - Pain or other disease manifestations must be included a patients pre-scan work-up
 - Meds for any medical issue can help some patients tolerate the exam
 - Explanation of entire procedure and need for the patient to actively participate
 - Constant communication with and to the patient throughout the exam
 - Medication
 - Sedatives and pain relievers as discussed above
 - Drugs to help with involuntary motion such as Peristalsis
 - Bowel Prep
 - Withholding food/drink
 - Cleansing procedures

- Motion restricting devices
 - Straps/pads etc

Conclusion:

With the proper preparation and usage of all available tools most patients can be scanned with success and excellent image quality. MR is not an exam that easily fits in a “routine” category. Each of our patients requires different solutions. MR technologists use a large array of imaging techniques as needed before during and even after the MR exam. Each vendor has software and hardware solutions geared to providing tools for the technologist. Protocols can be built that have ready solutions but the technologist must always be prepared to morph the exam to the patient’s individual needs and concerns.