Hot Topics: MR Angiography

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The combination of parallel imaging, clever pulse sequence design, innovative coils, new reconstructive methods, 3 Tesla, ECG gating and newly available contrast agents are making spectacular advances in both time-resolved and high resolution 3D MR Angiography.

New 32 channel systems offer opportunities for up to 5-fold acceleration factors including both slice and phase directions before significant geometry factor SNR degradation kicks in. KT-BLAST/ KT-SENSE allows further acceleration in the time domain for enhancing temporal resolution.

High temporal resolution 3D MRA continues to advance with oversampling the center of k-space by radial sampling (VIPR) and spiral sampling. Combining with Phase Contrast eliminates under sampling artifact for background tissue signal smearing. In addition, sliding window reconstruction allows high spatial resolution with temporal resolution potentially as fast as the TR for 2D MRA and number of slices x TR for 3D MRA.

Time-resolved (cardiac-resolved) MRA is also possible without contrast agents utilizing ECG gating to subtract a diastolic image from various phases of systole or to image perpendicular to the plane of excitation at different phases of the cardiac cycle.

Combining ECG gating with 3D Gd MRA in the chest displays coronaries similar to CTA. Like CTA, the apparent benefits from sublingual nitroglycerin to dilate coronary arteries and beta blockers to reduce cardiac output, reduce cardiac motion and lengthen the motion-free period of diastole.

One of the most exciting advances is the correlation phase contrast flow profile measurements above and below stenoses as another indication of hemodynamic significance. Blood flow can also be controlled with tourniquets to extend the arterial phase window for peripheral and whole-body MRA, reducing venous contamination. Innovative coil designs including Total Imaging Matrix (TIM) which is now implemeted at 3T is simplifying routine whole body MRA. Use of higher flip angles with 3D Spoiled gradient echo sequences helps to overcome dielectric resonance artifacts that create B1 inhomogenities.