

Intra-Procedural Monitoring of Perfusion Changes in Targeted Fibroids and Surrounding Uterine Wall During Uterine Artery Embolization

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Objective

To test the hypothesis that dynamic contrast enhanced (DCE) MRI can detect changes in uterine perfusion-dependent signal enhancement at the time of Uterine Artery Embolization (UAE) using a hybrid MR-IR unit.

Subjects and Methods

In this IRB-approved prospective study, UAE was performed in a hybrid MR-IR unit (Siemens Angio-MR Miyabi) in women with symptomatic uterine fibroids. This MR-IR unit contains a wide bore 1.5T MRI scanner (Espree), connected by a sliding table to an adjacent x-ray DSA unit (Artis dTA). Patients underwent initial anatomic dynamic contrast enhanced (DCE) MRI. Sequences included multiplanar saturation-recovery gradient-recalled echo (GRE; TurboFLASH) acquisitions pre- and post IV administration of 0.1 mmol/kg Gd-DTPA (TR-223ms, TE 1.22ms, bandwidth 650hz/px, 90 ns SR pulse, TI 160, FA 15, NEX 1; matrix 256 x 115 pixels; voxel size 3.5mm x 2mm x 8mm) and T2-TSE (TR 3610, TE 112, ETL 15; bandwidth 200hz/px; matrix 256 x 225; voxel size 1.1mm x 0.7mm x 4mm). Each patient was then transferred to the adjacent IR unit where UAE was performed using 500-700µm tris-acryl gelatin microspheres (Embospheres, Biosphere Medical) to a near stasis endpoint. Immediately after UAE, repeat DCE MRI was performed. For data analysis, a workstation (Leonardo) was used to measure relative signal-to-noise ratio (SNR) within each fibroid and the adjacent uterine wall. Mean relative SNR changes pre and post UAE were compared using a paired t-test, with alpha=0.05.

Results

UAE was technically successful in all 6 women (mean age 47 yr). A total of 10 fibroids (8 submucosal, 2 subserosal) were assessed. Mean relative SNR of the fibroids before UAE was 63.0 +/- 25.2, and after UAE was 40.5 +/- 19.3. This reduction in signal enhancement was statistically significant for axial (p= 0.0017) and sagittal (p= 0.0045) planes. Before UAE, mean relative SNR of the adjacent uterine wall was 62.6 +/- 11.3; after UAE, it was 28.6 +/- 15.9. This reduction in signal enhancement was also statistically significant for axial (p=0.0036) and sagittal (p=0.0016) planes.

Discussion

The optimal embolic endpoint for UAE is unknown. It is difficult to quantify sub-stasis endpoints when using conventional x-ray interventional radiology (IR) guidance. Although MRI can detect perfusion changes, intra-procedural perfusion changes within targeted uterine fibroids and the remaining uterine wall remain unknown. This prospective study demonstrates that immediate reductions in perfusion-dependent enhancement in a) the targeted uterine fibroids and b) the adjacent uterine wall can be detected after UAE using a hybrid MR-IR unit. Further studies are now warranted to compare long-term clinical outcomes to immediate changes in perfusion at the time of UAE.

