Magnetic Resonance Imaging of Metal on Metal Hip Resurfacing Implants

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Introduction. Metal-on-metal (MOM) hip resurfacing is being used with increasing frequency in younger patients, but is associated with specific complications including metal hypersensitivity which may manifest as synovitis, bursitis or peri-prosthetic osteolysis (1). MRI is an effective means by which to assess painful hip arthroplasty and is the most accurate means by which to measure osteolysis (2,3). The purpose of this prospective, observational study was to review patterns of osteolysis and synovial proliferation in symptomatic and asymptomatic individuals following hip resurfacing.

Methods. All methods were approved by the local Institutional Review Board with informed consent of subjects before enrollment in the study. Patient cohort: Patients were divided into symptomatic and asymptomatic control groups. Demographic data was collected on patient sex, age, body-mass index (BMI) and the length of time since arthroplasty placement. Blood results of chromium (Ch) and cobalt (Co) ion levels were recorded. MR Image Acquisition: All scanning was performed using clinical 1.5 Tesla clinical scanners (GE Healthcare, Waukesha, WI) and a 3 element shoulder coil (MedRad, Indianola, PA) or 8 channel cardiac coil (GE Healthcare, Waukesha, WI). Standard of care 2D FSE scanning was performed in three planes with the parameters: TE: 26-34 ms, TR: 4033-4500 ms, ETL: 18; BW: ±100 kHz, FOV: 22 cm, NEX: 4-5, acquisition matrix: 512x352, slice thickness: 4 mm (4). Image Analysis: Images were evaluated for the synovial volume and volume of osteolysis via manual segmentation. Statistical Analysis: A Wilcoxon rank sum test was performed to compare synovial volume of the symptomatic and asymptomatic groups. The Spearman correlation coefficient (r) was calculated between synovitis and blood metal ion load in the symptomatic and asymptomatic patients. Statistical significance was taken at p<0.05.

Results. 55 subjects (28M, 27F, 52 ± 10 y.o.) have been scanned to date, comprising 60 cobalt-chromium MOM hip resurfacings. 43 patients (44 hips) had non-specific pain unexplained by radiographs and 12 patients (16 hips) were asymptomatic controls. The mean interval between arthroplasty placement and MRI was 1.8 ± 1.3 years. The mean subject BMI was 26.1 ± 4.9. Synovial expansion was present in 30 of 44 (68%) symptomatic hips and 11 of 16 (69%) asymptomatic hips. The mean synovial volume was 10.4 ± 33.9 cm³ in symptomatic hips and 2.1 ± 4.0 cm³ in asymptomatic hips. The presence or volume of synovitis did not differ significantly between the symptomatic and asymptomatic groups (p=0.17). Synovitis correlated with blood Co (r=0.5, p=0.01) and Ch (r=0.5, p=0.003) in the symptomatic patients. No correlation was found for either ions in the asymptomatic patients. Osteolysis was present in 6 of 44 (14%) symptomatic hips, with a mean volume of 1.8 ± 8.6 cm³. Osteolysis was not seen in the asymptomatic hips.

Discussion. This study evaluated patterns of synovitis and osteolysis in subjects with metal-on-metal hip resurfacing implants. Synovitis was detected in a similar proportion of symptomatic and asymptomatic individuals. Osteolysis was only detected in symptomatic individuals. Synovitis correlated to serum ion levels, suggesting that MRI can be used as an additional screening tool for an adverse response following hip resurfacing. Future studies will examine whether patients with synovitis are more likely to develop implant-related failure.

Significance. MRI can be used to assess hip resurfacing and may serve as a screening tool for those patients with an adverse response to a MOM prosthesis.

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