Wear Analysis of 29 Metal-on-Metal Hip Resurfacing Retrievals and Relationship with “Adverse Local Tissue Reaction”

INTRODUCTION:
There have been recent reports of adverse local tissue reactions (ALTR) following metal on metal hip replacements. The aim of our study was to examine differences in wear rates in retrievals with ALTR and those without ALTR, and assess differences in clinical and radiological findings between these two groups.

METHODS:
Wear measurements were made on 29 Conserve® Plus metal-on-metal femoral resurfacing components and 8 acetabular components in 25 patients (15F, 10M) from the senior author’s series of 1300, which were at least 2 years in vivo (28 from senior author, 1 from outside source). 6 hips in 5 patients were identified to have ALTR and classified according to the following criteria:

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<th>ALTR Category</th>
<th>Description of Adverse Local Tissue Reactions</th>
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<td>ALTR I</td>
<td>Osteolysis and failure but with no soft tissue mass. Osteolysis was either determined radiographically, or at retrieval upon sectioning of the femoral component (for osteolysis inside the femoral head or neck which could not be detected radiographically).</td>
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<td>ALTR II</td>
<td>Local fluid or solid mass with or without osteolysis. Masses were either discovered upon retrieval or identified using MARS-MRI.</td>
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<td>ALTR III</td>
<td>Metal Hypersensitivity determined by histological examination of periprosthetic tissues, with clinical symptom of pain, but without radiographic loosening or verified infection.</td>
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The rest of the 23 hips that did not exhibit features of ALTR I, II, or III were examined together as the non-ALTR group (23 femoral components and 5 acetabular components).

All 29 femoral and 8 acetabular components were measured with a Coordinate Measuring Machine (CMM) (BRT 504, Mitotoyo, Aurora, IL) at 300-400 points over the surface of the implant. Tissues were embedded in paraffin and stained with H&E. The possibility of metal hypersensitivity as manifested by histological diagnosis of high ALVAL score was done by one author (PC). The acetabular abduction and anteversion were measured using the anteroposterior radiograph using EBRA software (Einzel-Bild-Roentgen-Analys, University of Innsbruck, Austria). The contact-patch-to-rim (CPR) distance as described by Langton et al (based on the resultant force vector on the femoral component) was calculated for all hips.

Parametric data was analyzed using the Student’s t-test and non-parametric data with Mann-Whitney-U test. Correlations were tested using the Pearson test. P-value of 0.05 was significant.

RESULTS:
The ALTR group had significantly higher femoral linear wear rate (µm/year) than the non-ALTR group (Mann-Whitney U test, p=0.0008). The ALTR group had median femoral linear wear rate of 10.9µm/year (3.6-22.7) and the non-ALTR group had median of 1.7µm/year (0.6-7.7) (Figure 1). Although the ALTR group had higher median acetabular linear wear rate of 9.3µm/year compared to the non-ALTR group (1.5µm/year), this difference was not significant (Mann-Whitney U, p=0.1011) and this lack of significance may be due to small sample size.

DISCUSSION
Component wear in cases with ALTR was significantly higher compared to cases without ALTR. Our high wear findings were similar to the findings of Kwon et al who studied a group of 31 retrievals (9 with ALTR II pseudotumors and 22 controls). They concluded that pseudotumor formation is associated with increased wear at the metal-on-metal articulation, and that edge-loading may be an important mechanism that contributes to the high wear.

One limitation of our study was our small sample size: with only 6 ALTR cases and 23 without ALTR. Our high wear findings were similar to those of Kwon et al who studied a group of 31 retrievals (9 with ALTR II pseudotumors and 22 controls). They concluded that pseudotumor formation is associated with increased wear at the metal-on-metal articulation, and that edge-loading may be an important mechanism that contributes to the high wear.

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