Aseptic Lymphocyte-Dominated Vasculitis-Associated Lesion (ALVAL) in Metal-on-Metal Hip Resurfacing Arthroplasty: Clinical Outcomes and Implant Analysis in Patients with Low Serum Metal Ion Levels

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INTRODUCTION:
Aseptic Lymphocyte-Dominated Vasculitis-Associated Lesion (ALVAL) is a recognized but infrequent complication following metal-on-metal (MoM) hip resurfacing arthroplasty (HRA), associated with poor clinical outcomes. While previous studies have analyzed the development of ALVAL in patients, those cases have been combined with cases of high metal ion concentrations, which may affect the presentation of clinical symptoms. This potentially confounds results by including patients with overt metallosis or excessive metal debris within the ALVAL diagnosis. The current literature lacks a detailed characterization of the clinical manifestations and patient-reported outcomes in patients with a specific failure mechanism of ALVAL. Given the rarity of this clinical scenario and the limited evidence available, a focused investigation of this distinct patient population is warranted to guide clinical management.
METHODS:
We conducted a retrospective review of a high-volume HRA surgeon's case log from, January 1, 2008 to May 31, 2024, to identify cases of true ALVAL. Confirmation of ALVAL through histological findings in magnetic resonance imaging (MRI) and pathological findings at the time of revision surgery to total hip arthroplasty (THA) was first assessed. Patients who had high metal levels greater than 7 µg/L were excluded because their symptoms could be confounded with those of metallosis. Next, the clinical manifestation of symptoms and date onset were collected, along with patient-reported outcome measures (PROMs) and implant component measurements analyzed on anteroposterior (AP) radiographs. Specific PROMs assessed were modified Harris Hip Score (mHHS), Hip Disability and Osteoarthritis Outcome Score - Joint Replacement (HOOS-JR), Visual Analog Scale (VAS), and University of California - Los Angeles (UCLA) Activity Score, which were assessed preoperatively before revision surgery and then at 1 year and final follow-up postoperatively. Mann-Whitney U tests were conducted to evaluate statistical significance between different follow-up time points for each PROM.
RESULTS:
We identified 20 hips with ALVAL confirmed through preoperative MRI and postoperative revision surgery pathology findings. All these hips had both chromium and cobalt levels below 7 µg/L preoperatively before revision surgery, isolating ALVAL as the main cause. The median time for initial manifestation of symptoms associated with ALVAL after initial HRA was 3 years [1, 8], and the most common first manifestation reported was groin pain. Mean values for each of the 4 PROMs were compared pre-revision and post-revision at different timepoints and tested for significance. mHHS and HOOS-JR both had significant differences between the pre-revision (65.12, 57.03, respectively) and 1-year after revision timepoints (90.60, 88.51), as well as the final follow-up timepoints (88.76, 86.28). There was no significant difference in VAS 1-year after revision (4.30 to 2.47), but there was at the final follow-up (4.30 to 1.46). Moreover, there was no significant improvement in UCLA at the final follow-up (5.64 to 7.08), but there was between the pre-revision (5.64) and the 1-year after revision timepoints (7.60). The average final follow-up time point for PROMs was 5.3 years after revision to THA.
DISCUSSION AND CONCLUSION:
Our study uniquely isolates ALVAL cases with serum cobalt/chromium <7 µg/L, distinguishing it from cases confounded by factors such as metallosis or excessive metal debris. Our findings demonstrate delayed symptom onset (median 3 years post-HRA) and significant postoperative improvements in mHHS, HOOS-JR, and VAS at final follow-up after revision to THA, while UCLA activity scores increased but not significantly. The selection of patients with metal ion levels within the expected range for hip resurfacing indicate a mechanism of failure separate from metallosis. This is the first study to characterize the symptom onset of ALVAL and assess their PROMs pre- and post-revision surgery.