Comparing serum metal ion levels between metal and ceramic surface bearings in primary total hip arthroplasty

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INTRODUCTION: Recent literature has increasingly compared metal and ceramic bearings in primary total hip arthroplasty (THA), including their mechanical properties, rates of wear, osteolysis, and dislocation, and overall survivorship. However, there is a paucity of literature comparing serum metal ion levels between ceramic and metal femoral heads in primary THA at mid-term follow up.

METHODS: Patients undergoing primary THA between January 2015 and May 2017 at a single center were included for analysis. All patients had an uncemented femoral stem, as well as a ceramic (n= 46) or cobalt chrome (n= 53) femoral head coupled with a highly cross-linked polyethylene liner. Serum metal ion levels, specifically cobalt (Co) and chromium (Cr), were acquired for patients who had a minimum 5-year follow up since the time of index surgery.

RESULTS: A total of 99 patients were included in this study. Of the 53 patients with a cobalt chrome (CoCr) femoral head, 48 patients (90.6%) had detectable serum chromium levels with an average of 0.39 mcg/L (range of 0.1 to 4.4 mcg/L), while 25 patients (47.2%) had detectable serum cobalt levels with an average of 0.56 mcg/L (range 0.5 to 1.0 mcg/L). In the 46 patients with a ceramic femoral head, 38 (82.6%) patients had detectable serum chromium levels with an average of 0.28 mcg/L (range of 0.1 to 1.9 mcg/L), while 16 (34.78%) patients had detectable serum cobalt levels with an average of 0.66 mcg/L (range 0.5 to 1.8 mcg/L). Two-tailed statistical T-tests were performed between ceramic and femoral heads and revealed no differences in serum metal ions for both chromium ($p=0.44$) or cobalt ($p=0.26$). Femoral head size was larger ($p=0.004$) in the ceramic cohort (mean 31.8mm) compared to the cobalt chrome cohort (mean 30.3mm), although neck taper length was not different between the two groups ($p=0.24$).

DISCUSSION AND CONCLUSION: Our study did not detect a significant difference in serum cobalt and chromium ion levels in patients undergoing primary THA with a ceramic or metal head bearing with a minimum 5-year follow-up.