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CORR Insights®: What Are the Predictors and Prevalence of Pseudotumor and Elevated Metal Ions After Large-diameter Metal-on-metal THA?

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Where Are We Now?

The varied effects of metal-ion release from hip arthroplasty implants demand ongoing attention from the scientific

This CORR Insights® is a commentary on the article “What Are the Predictors and Prevalence of Pseudotumor and Elevated Metal Ions After Large-diameter Metal-on-metal THA?” by Bayley and colleagues available at: DOI: [10.1007/s11999-014-3824-2](https://doi.org/10.1007/s11999-014-3824-2).

The author certifies that he, or any member of his immediate family, has no funding or commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article.

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This *CORR Insights®* comment refers to the article available at DOI: [10.1007/s11999-014-3824-2](https://doi.org/10.1007/s11999-014-3824-2).

community. Liberated metal ions, especially cobalt and chromium, can initiate a wide variety of pathologic local and systemic reactions in the host. The more dramatic systemic effects, such as cardiomyopathy and neuropathy, fortunately appear to be relatively uncommon. The practicing hip surgeon, however, is keenly aware of the periarticular damage noted at the time of revision when an adverse local tissue reaction (ALTR) to metal debris is encountered. Adverse local tissue reaction, including pseudotumors, were once thought to be a rare problem seen only in metal-on-metal (MoM) bearing hip arthroplasties. Today, dual-modular neck femoral implants, and even modular cobalt-chrome femoral heads have been implicated in the generation of elevated ion levels and ALTR.

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The ongoing controversies related to liberated metal ions include the following: (1) What is the prevalence of adverse local and/or systemic reactions to metal debris? (2) What are the risk factors, both patient-related and implant-related, for the development of these adverse reactions? (3) How can we best screen at-risk patients for the presence of these adverse reactions? (4) What is the natural history of pseudotumors identified using cross-sectional imaging in the asymptomatic patient?

Where Do We Need To Go?

The current study by Bayley et al. attempts to address the first two of these questions. Specifically, the investigators sought to determine the prevalence of pseudotumors after single-design large-diameter MoM THA using high-resolution ultrasound, and to identify risk factors associated with pseudotumor formation and elevated metal ion levels. After a mean

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followup of 4 years, the prevalence of pseudotumor was 20% (38 of 191 hips). No risk factors could be identified that were predictive of the development of a pseudotumor; however, several risk factors were predictive of elevated metal ion levels (bilateral MoM THAs, smaller femoral head size, female sex, lower patient BMI).

The results of this study highlight the difficulties encountered when attempting to identify which patients may be experiencing asymptomatic ALTR. Specifically, there is no measurement (implant size or position, metal ion level, age, BMI) that allows one to counsel a patient that he or she is free from the risk of asymptomatic ALTR. This study is limited in its ability to answer the ongoing controversies, as it examines a relatively small patient cohort with a single design of MoM THA. This study cannot directly address the best methods of patient screening or the natural history of the pseudotumors noted

during screening ultrasound. Furthermore, the size and type of metal particles released may be design-specific. The prevalence of pseudotumors in this patient cohort cannot necessarily be generalized to other hip arthroplasty designs.

How Do We Get There?

Considerable further research will be needed in order to gain a more complete understanding of the interaction between the host and metal ions liberated at the site of a hip arthroplasty. To describe the true prevalence of adverse reactions, we will need to pursue screening-laboratory and imaging studies across a wide variety of patients and implant types at progressively longer periods of followup. In order to achieve adequate statistical power, much larger patient cohorts will need to be examined if we are to identify the risk factors for these

adverse reactions. Additionally, surgeons need to know the best way to screen patients for adverse reactions, which will require an analysis of both accuracy and cost-effectiveness. Further advances in cross-sectional imaging modalities and the measurement of synovial fluid metal ion levels may hold promise as improved screening tools for future practice. Finally, careful surveillance and longer term followup will be needed to gain a better understanding of the natural history of these lesions once identified.

For now, it would appear that all symptomatic THA patients should have a formal laboratory and imaging evaluation for adverse metal reactions. The ideal management of asymptomatic patients with higher-risk implant systems, such as MoM bearings and certain dual-modular neck stem designs, remains uncertain. It is hoped that further research, as indicated above, will help to answer this challenging clinical problem.