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# Rapid Complete Acetabular Destruction in Metal-on-Metal Total Hip Arthroplasty

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## Abstract

Adverse local tissue reaction, osteolysis, and subsequent increased incidence of failure have been associated with metal-on-metal (MoM) total hip arthroplasty (THA). We present the case of a 68-year-old woman with rheumatoid arthritis who has undergone left THA with a MoM bearing. Seven years postoperatively, she presented with 6 weeks of severe left hip pain. Sequential radiographs and advanced imaging demonstrated a rapid onset of extensive acetabular osteolysis with pelvic discontinuity and pseudotumor formation. She underwent revision THA using a cup-cage construct with a satisfactory outcome. In this article, we review current evidence-based management options for pelvic discontinuity, as well as other complications related to MoM THA.

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In 2007, metal-on-metal total hip arthroplasty (MoM THA) comprised up to 31% of THA case volume in North America.<sup>1</sup> The prevalence of devastating complications, such as adverse local tissue reaction (ALTR), osteolysis, and aseptic lymphocyte-dominated vasculitis-associated lesions, associated with these implants has since resulted in most surgeons discontinuing the use of MoM THA in their patients. Strategies to manage complications from MoM THA vary depending on patient characteristics, extent of the soft-tissue and/or bony destruction, implant track record, and the nature of adverse events.<sup>2</sup>

Adverse local tissue reaction results from a biologic reaction to chromium (Cr) and cobalt (Co) metal debris that infiltrates local tissue, over time leading to inflammation and possible osteolysis (adverse reaction to metal

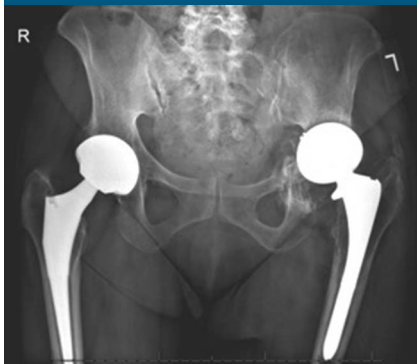
debris). Large acetabular defects and pelvic discontinuity stemming from MoM THA osteolysis can be particularly challenging to manage. Cup-cage constructs present a viable option for use in cases with severe acetabular defects leading to pelvic discontinuity, with good mid-term results reported.<sup>3</sup>

We present the management of the case of a patient who underwent MoM THA and subsequently had rapid acetabular destruction, osteolysis, pseudotumor formation, pelvic discontinuity, and dissociation of the cup from the acetabulum, leading to the inability to ambulate.

## Case History

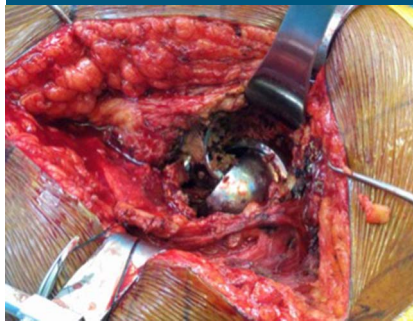
In the case of interest, a 68-year-old woman with a history of inflammatory arthritis had left MoM THA

Figure 1



Pelvis AP radiograph of the case patient in July 2016 before surgical intervention. Significant acetabular continuity is noted with superior migration of the prosthesis and surrounding osteolytic reaction.

Figure 2



Intraoperative image showing extensive pseudotumor formation with destruction of the abductor musculature.

performed in 2008. The patient had had an uneventful postoperative course, after which she returned to her activities of daily living without the use of an assistive device. She had right metal-on-polyethylene THA (Continuum cup, M/L taper stem, Zimmer) in 2014 with similarly satisfactory results. She was seen for a regularly scheduled follow-up visit in April 2015, at which time she had no complaints and radiographs appeared to demonstrate no discernible complications of her hip arthroplasty. In July 2016, she presented complaining of persistent, worsening left hip pain localized to the groin without radiation and reported shortening of the left lower extremity. She denied any history of trauma.

On physical examination, it was noted that her incision was completely healed and she had tenderness to palpation at the left groin and over the pubic tubercle. A leg

length discrepancy of 4.5 cm was seen, with the left shorter than the right. Radiographs showed severe left acetabular osteolysis with dissociation of the acetabular component from the pelvis (Figure 1). Judet views confirmed pelvic discontinuity, with complete disruption of Köhler and iliopubic lines and migration of the acetabular component. The femoral component appeared stable. CT of the chest, abdomen, and pelvis and bone scan revealed no metastatic disease. Metal artifact reduction sequence MRI showed pseudotumor formation with abductor musculature destruction. Laboratory testing revealed a Co level of 7.4  $\mu\text{g/L}$  ( $<1$ ) and Cr level of 14.9  $\mu\text{g/L}$  ( $<5$ ). Left hip aspiration showed 230 nucleated cells with 83% polymorphonuclear leukocytes and 13% lymphocytes. Cultures were without growth. Findings were consistent with failed MoM THA with pseudotumor formation and acetabular osteolysis provoking pelvic discontinuity.

The patient underwent revision THA in August 2016. Intraoperatively, significant tissue destruction was seen with erosion of the abductor musculature and severe osteolysis at the acetabulum and proximal femur. Watery, grayish fluid and a large pseudotumor were encountered during exposure (Figure 2). As expected, the acetabular component was grossly loose. The femoral component was stable. Upon disimpaction of the femoral head, signs of corrosion at the trunnion/head interface were seen. There was severe anterior and posterior wall and column loss, and pelvic discontinuity was confirmed, with gross motion between segments. A cup-cage construct was used to re-establish continuity of the pelvic ring. A 74-mm fully porous cup (Redapt, Smith & Nephew) was placed with attention to maximal bony contact. The cup was placed with multiple screws, followed by an osteosynthesis cage (Zimmer). A 54-mm dual mobility shell was then cemented into the porous cup with appropriate version and abduction (Polar, Smith & Nephew). The femoral component was retained, and the trunnion was polished clean of corrosion by-products. A 28-mm, +16, 12/14 taper femoral head was placed. The patient was instructed to practice partial weight-bearing for 6 weeks postoperatively.

At her most recent, 5-month follow-up, her pain was well controlled, and she was ambulating using a cane and often capable of ambulating long distances unassisted. Radiographs continued to demonstrate a well-fixed cup-cage construct with no signs of device loosening or failure (Figure 3).

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## Discussion

### Painful Metal-on-Metal Total Hip Arthroplasty: Differential Workup and Management

Given the relative infancy of the issue of problematic MoM THA, management remains variable.<sup>4</sup> After a patient has been categorized as having symptomatic MoM THA, initial evaluation begins with a thorough history and physical examination. Reports of pain or palpable fullness about the hip should arouse the treating surgeon's suspicion to the possibility of reaction to metallic debris. A pain-free postoperative period followed by an insidious onset of gradually worsening of symptoms can be expected in patients with metallosis. Surgical reports should be sought and poorly performing/recalled implants identified.<sup>5</sup>

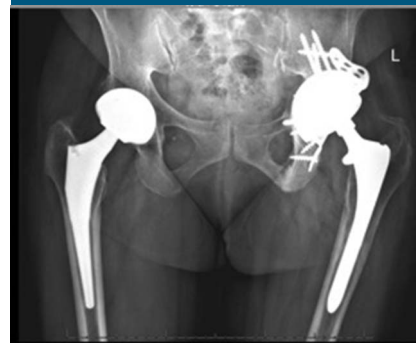
To exclude infection, laboratory evaluation with erythrocyte sedimentation rate and C-reactive protein level, as well as serum levels of Co and Cr, should be performed. Preoperative hip aspiration should be obtained, with unique attention to performance of the manual cell count, as MoM debris can result in fictitiously elevated numbers when counted by automated systems. Leukocyte differential can be informative, with a larger percentage of polymorphonuclear leukocytes expected with infection versus lymphocytes in metallosis. Samples should be sent for standard culture series.<sup>6</sup>

Plain radiographs of the pelvis and affected hip should be obtained. THA should be evaluated for component positioning (ideally, with cup abduction  $<50^\circ$  and combined version  $<40^\circ$ ) and loosening, as well as signs of ALTR, such as osteolysis. Additional Judet views can be performed as necessary to evaluate the integrity of columns/walls, depending on the amount of acetabular destruction. CT can help characterize defects and be

used for preoperative planning. Metal artifact reduction sequence MRI can yield additional information regarding pseudotumor formation and soft-tissue destruction, particularly of the abductor musculotendinous structures necessary for stability after revision. Ultrasonography has also been suggested as a viable screening modality with high sensitivity for the presence of pseudotumor, although with lower specificity than MRI.<sup>7</sup>

When the decision for revision is made, options are dependent on multiple patient and implant characteristics. The extent of soft-tissue and bony destruction can range from simple change in the bearing surface to more complex reconstruction in cases of severe deficits. Prior authors have attempted to use these factors to help guide treatment.<sup>2</sup> Arguably, the most challenging problem is that of pelvic discontinuity, which can be acute, as in the case of periprosthetic fracture, or gradual as typically occurs with MoM THA and was observed in this case. In addition, osteolysis related to MoM THA presents the unique possibility of relatively decreased rates of osteointegration related to disruption of normal osteoblastic/osteoclastic activity with resultant failure of the revision construct. This is important to consider when selecting surgical constructs, including allografts, oblong cups with hooks and flanges, cup-cage constructs, and custom triflanges, with the latter two presenting the most viable options used in modern revision THA with pelvic disassociation.<sup>8</sup> More recently, an additional distraction technique has been described in which fixation of the superior and inferior hemipelvis to a highly porous metal cup provides pelvic stability through distraction of the discontinuity itself. In this method, the cup acts as a segmental replacement and the construct is augmented by screw fixation.<sup>8</sup>

Figure 3



Postoperative AP radiograph made at 5-month follow-up.

### The Cup-cage Construct for Pelvic Discontinuity in Revision Total Hip Arthroplasty

Classification systems that help guide treatment of acetabular bone loss in revision THA include the American Academy of Orthopaedic Surgeons, Paprosky, and Gross system, with the problem of pelvic discontinuity best categorized as American Academy of Orthopaedic Surgeons type IV and Gross type V defects. In these cases of major segmental column defects, a highly porous hemispherical cup is press fit into the approximate location of the native acetabulum, emphasizing maximum contact with bleeding bone. This is further secured in place with multiple screws affixing it into the ilium, ischium, and pubis. A cage is then placed, with the distal flange inserted into or laid onto the ischium and the proximal flange secured onto the outer table of the ilium with multiple screws. The purpose of the cage is to help offload the cup, allowing for ingrowth of the cup to occur. A polyethylene liner is then cemented into the construct in the appropriate amount of inclination and abduction. Revision survivorship with a cup-cage construct is excellent, with a study by Martin et al<sup>3</sup> reporting 100% 5-year revision-free implant survivorship.

## Summary

Metal-on-metal THA has been largely abandoned in the United States due in part to high early failure rates and potentially devastating ALTRs leading to soft-tissue destruction and osteolysis over time.<sup>9</sup> We reported on the case of a 68-year-old woman with MoM THA in which extensive bone loss resulting in pelvic discontinuity evolved rapidly over a period of 7 months. This severity of bone loss is rare in the literature, with previous series involving metallosis with concomitant infection. Our patient did not have signs of infection but possessed potential risk factors, including female sex and rheumatoid arthritis, which have been associated with failed THAs with pelvic discontinuity.<sup>10</sup> The patient underwent revision THA with a cup-cage construct with good results at 5 months after her surgery. This case

report illustrates the challenges of managing pelvic discontinuity and highlights the potentially devastating sequelae of MoM THA.

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