

Pseudotumor vascularity alters surgical plan during revision of metal-on-metal total hip arthroplasty – A Case Report and Review of Literature

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INTRODUCTION

Demonstrating enhanced durability when compared to metal-on-polyethylene (MoPE) implants, decreased association with osteolysis, and enhanced stability with larger prosthetic femoral heads, a metal-on-metal (MoM) hip arthroplasty resurgence began in the 1990s.¹ Despite high implant survival rate, unique complications have emerged specific to the MoM prosthetics, collectively identified as adverse reactions to metal debris (ARMD) with specific diagnoses including pseudotumors, metallosis, infection, and aseptic lymphocytic vasculitis associated lesions (ALVAL, type IV hypersensitivity reactions).³⁻⁵

Pseudotumors, with an incidence of up to 30-40% in asymptomatic patients at prolonged MoM hip follow-up, have been identified as a unique source of complication, causing spontaneous hemorrhage, venous thrombosis, and edema.⁷⁻¹³ While the presence of a pseudotumor may not definitively indicate need for revision arthroplasty, characterization of lesion morphology as thick-walled and cystic or solid increases the risk of revision due to symptoms such as hip discomfort, weakness, and instability.¹³⁻¹⁵

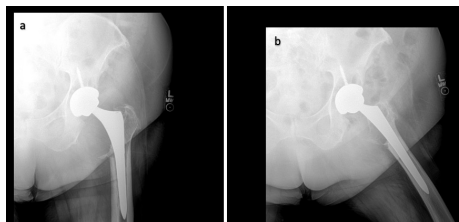
Here we present a case of abnormal vascularity associated with a pseudotumor 14 years post MoM total hip arthroplasty contributing to aberrant intraoperative hemorrhage, requiring modified approach to surgical revision arthroplasty. This patient consented to her case being presented for presentation and publication.

CASE PRESENTATION

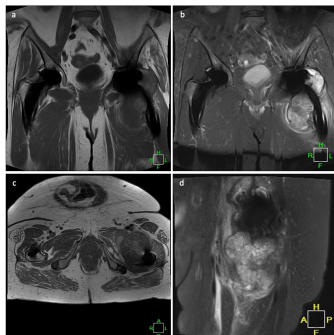
A 69-year-old woman (BMI 41.6) presented to the urgent care complaining of acute-on-chronic left hip pain. The patient had a history of metal-on-metal hip arthroplasty 14 years prior, noting she had previously been satisfied with her hip for 12 years,

Examination demonstrated a well-fixed cementless total hip arthroplasty with no signs of loosening. Imaging showed interval bone destruction involving the medial proximal femoral shaft and nearby the entire lesser trochanter, with developing lucency at the medial margin of the greater trochanter, as well as in the superior acetabulum.

Labs demonstrated elevated ESR and CRP.



A metal reduction MRI demonstrated pseudotumor infiltration of the proximal femur medially measuring 12 x 9 x 14 cm. The mass surrounded the femoral neck, infiltrating and destroying the proximal femur. Musculature demonstrated advanced fatty atrophy of the left gluteus minimus and iliopsoas complex.



Multiple joint aspirations demonstrated no culture growth, indicating likely metallosis.

The decision was made to utilize a direct anterior approach for revision to retain the scamed down posterior structures and reduce the risk of future dislocation.

Pre-operative x-rays demonstrated continued progression of bone loss, as well as extension of the calcific rim forming at the distal perimeter of the pseudotumor.

The patient was positioned in the supine position on a HANA table for a direct anterior approach.

Following exposure of the inferior aspect of the hip capsule, brisk bleeding was encountered, only controllable with direct pressure. The structure, appearing to be a vein, was adhered to or embedded within the joint capsule or pseudotumor.

Vascular surgery was consulted, performing direct repair to the vascular structures, and the joint decision was made to further characterize the vascular anatomy with CT angiography prior to proceeding with the intended revision procedure.

CT angiography demonstrated anterior displacement of the left femoral vessels and lateral circumflex by the pseudotumor. Via interventional angiography, branches of the profunda femoris were embolized. Hyperemia was noted originating from the medial and lateral circumflex vessels, both of which were embolized to partial stasis.

The patient was discharged post-op day three, with the revision procedure delayed for 6 weeks to maximize benefit from the ablation. Vascular would be available at the time of the revision, with the decision made to utilize a posterior approach to optimize visualization and avoid the anterior mass and accompanying vascularity.

The second procedure was performed in the lateral decubitus position with a posterolateral approach, utilizing her prior posterior incision.

The hip demonstrated substantial reactive tissue, primarily around the posteromedial femoral region, which was responsible for contained bone loss around the medial calcar. This was meticulously debrided, and the head was removed.

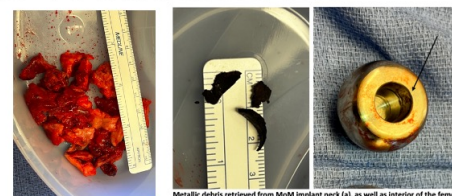


Figure 3: Metal debris retrieved from MoM implant neck (a), as well as interior of the femoral head (indicated by arrow)

- Within the hip, there was inadequate fluid for collection, so multiple cultures of the tissue were sent.
- The trunion demonstrated minimal wear, with accumulated metallic debris at the head neck junction, and was intact for reimplantation of another component.
- The introitus of the acetabular cup did not show substantial metallic debris or concern for metallosis.
- A thorough debridement was performed, however much of the mass was anterior and was inaccessible.
- The liner and ball were exchanged as intended, demonstrating improved stability.
- Bone graft substitute was placed into the contained lateral femoral defect to allow for adequate reconstitution of bone mass in the region. An additional pliable bone graft was placed along the medial aspect of the stem to reduce ongoing bone loss in this region.
- No large vascular structures were encountered, and the minimal necrotic tissue present was debrided.
- Specimen cultures were negative for growth, with capsule pathology demonstrating focal acute inflammation likely secondary to the trauma prior to the procedure, previous revision attempt or reaction to the failing metal on metal articulation.
- Post-operative x-rays demonstrated appropriate placement of new metal and polyethylene components, as well as bone grafting material.

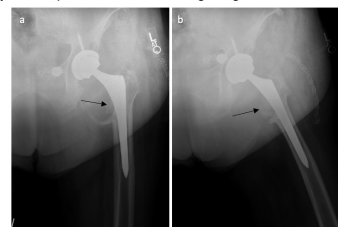


Figure 4: Post-operative AP (a) and Frog-leg (b) x-rays demonstrate appropriate placement of new revision ceramic ball and polyethylene hip liner with bone grafting material (indicated by arrows). A portion of the calcific rim that bordered the pseudotumor remains visible.

Four months post-operatively, the patient demonstrated appropriate postoperative recovery, with improvement in pain and function. Repeat imaging showed no change in overall alignment of the femoral stem or acetabular component. All intraoperative cultures were negative.

DISCUSSION

We present a case of abnormal hypervascularity associated with a pseudotumor 14 years post MoM total hip arthroplasty contributing to intraoperative hemorrhage requiring modified approach to surgical revision arthroplasty. The prevalence of joint replacement in the United States population continues to grow and unfortunately the revision burden has followed. Although a simple hip bearing exchange can be routine, this case is an example of how surgeons must always be ready to alter the plan if necessary. This case is particularly relevant with the ongoing trend of surgeries performed in an outpatient setting. This surgery was done in a hospital setting, as are most of the lead author's revision surgeries, however if it had been done in a surgery center, without a vascular surgeon available, the case would have been different. It is critical to prepare for any likely options but also be ready to shift the plan, get help and even abort the procedure if needed. This procedure was aborted after vascular consultation intraoperatively, and the approach was altered for the revision. Between the index procedure and the second revision, the patient underwent ablation of the aberrant vascular structures and under the recommendation of the vascular surgeon, the approach was switched to posterior. Ultimately, the patient was successfully treated with hip arthroplasty revision via a posterior approach.

Future research may be of value in determining whether there are specific pseudotumor indicators, clinically or on pre-operative imaging, that should guide operative setting selection and planning.

Despite a resurgence in their implantation in the 1990s, by 2015 between 13-36% MoM hip replacements require revision within 10-15 years post implantation.^{3,4,6} Increased revision rates have been ascribed in part to ARMD, including resultant pseudotumors.^{3,4}

While pseudotumors can result in significant pain, swelling, and extensive destruction to surrounding tissues, vascular complications related to MoM pseudotumors are less common. A review of literature identified case reports describing symptoms or presentations attributable to vascular adherence, neurovascular structure displacement, compression, or hemorrhage. Each of these cases is summarized in the following table.

LITERATURE REVIEW

| Citation | PL Demographics | Time Post Primary Procedure | Diagnosis | Intervention | Reported Outcomes |
|--|--------------------|---|---|--|---|
| Vascular Adhesion or Neurovascular Structure Displacement | | | | | |
| Masett et al. ¹⁷ | 60-year-old female | 8 years, 7 months following primary THA, post 2 nd dislocation | Extensive pseudotumor originating from hip THA in close contact with external iliac artery and vein and displacing femoral nerve, megalas | Extensive near-complete multidisciplinary approach to excision of intra- and extra-pelvic pseudotumor followed by revision THA and abductor mechanism reconstruction | At 8 weeks follow-up, abductor strength was 4/5 and patient was recovering well. |
| | 64-year-old female | 15 years post Resurfacing | Gross pseudotumor adherence to the back wall of the common femoral and femoral bifurcation | Excision of extra-pelvic pseudotumor including full-thickness profundus followed by conversion to total hip arthroplasty with multi-disciplinary team | Not reported |
| Hemorrhage | | | | | |
| Fliter et al. ¹⁸ | 62-year-old female | 5-years post revision THA | Hemorrhage into retroperitoneal pseudotumor in femoral canal measuring 48x42x150mm at peak | Patient declined surgery. Treated with activity modification and serial monitoring | Spontaneous regression of pseudotumor with associated improvement in symptoms and function. |
| Unilateral Vascular Compression | | | | | |
| Maurer-Ertl et al. ¹⁹ | 38-year-old female | 1 year post hip resurfacing | Pseudotumor, US negative for DVT | Marginal resection by excision and revision THA | Recurrence of swelling 10 mo. post resection; complete resolution after revision THA. |
| Parfitt et al. ²⁰ | 64-year-old male | 1 year 4 months | Pseudotumor, Ultrasound + for DVT. | IVC filter, thrombolysis, pseudotumor excision and revision metal-on-polyethylene THA | Good functional recovery with resolution of swelling. |
| Alqarni et al. ²¹ | 54-year-old female | 5 years | Pseudotumor, metal ion aspiration, negative for DVT | Pseudotumor excision and revision ceramic-on-ceramic THA | Complete resolution of swelling at 6 mo., no recurrence at 1 year. |
| Memon et al. ²² | 54-year-old female | 5 years (hip resurfacing) | Pseudotumor, serum metal ions, US + for DVT | IVC filter, anticoagulation, and revision ceramic-on-ceramic THA without excision | Significant improvement in swelling, occasional hip pain. |
| Kawakita et al. ²³ | 69-year-old female | 1 year 2 months | Pseudotumor, US negative for DVT | Pseudotumor excision with subsequent revision ceramic-on-ceramic THA 1 year later | Decreased leg swelling 3 months post resection. |
| Abdel-Hamid et al. ²⁴ | 75-year-old female | 6 years post hip resurfacing | Pseudotumor causing local compression of iliac veins, serum metal ions, US + for extensive DVT | IVC filter, anticoagulation, vascular surgery assisted excision, and revision ceramic-on-polyethylene THA | Significant improvement in swelling and majority of ADLs 9 months post-operatively |
| Loncioni et al. ²⁵ | 68-year-old male | 10 years post bilateral MoM arthroplasties | Pseudotumor (iliopsoas bursal mass), US negative for DVT | Revision arthroplasty and drainage of the fluid within the iliopsoas bursal effusion | Post-operative course complicated by Propionibacterium infection requiring irrigation and debridement with femoral head and polyethylene exchange |

CONCLUSION

This case report highlights potential pseudotumor hypervascularity and its impact on surgical approach during revision arthroplasty. In conjunction with the review of literature, this highlights the potential for vascular complications associated with MoM-induced pseudotumors, whether related to hypervascularity or compressive capabilities of these structures. Advanced pre-operative imaging may be advisable depending on the size and location of the pseudotumor, and consideration of operative setting is critical, as vascular consultation or an inter-disciplinary approach perioperatively may be prudent.

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