Metallosis-induced Iliopsoas Bursal Cyst Causing Venous Obstruction and Lower-limb Swelling After Metal-on-metal THA

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The formation of iliopsoas bursal cystic lesions after total hip arthroplasty is an infrequently reported condition. This article describes an unusual complication of a current-generation metal-on-metal total hip arthroplasty.

A woman presented with unilateral spontaneous lower-limb swelling that developed 5 years postoperatively. It occurred secondary to venous obstruction by a metallosis-induced iliopsoas bursal cyst associated with markedly elevated intralosomal cobalt and chromium levels. Metal artifact reduction sequence magnetic resonance imaging showed that the bursal cyst was communicating with the hip joint and that it severely compressed the common femoral vein. Based on the findings of high local tissue metal ions and vertical cup positioning causing edge loading, the authors proposed an inflammatory reaction to metal debris that tracked into the iliopsoas bursa and formed a cyst. The patient underwent revision of the excessively vertical acetabular component and conversion to a ceramic-on-ceramic bearing interface, drainage of the bursal cyst, and synovectomy. No signs existed of local recurrence at 1-year follow-up.

To the authors’ knowledge, the occurrence of metallosis-induced iliopsoas bursitis with secondary pressure effects after contemporary metal-on-metal total hip arthroplasty has not been reported. When treating hip dysplasia, one must avoid maximizing cup–host bone contact at the risk of oververticalization. Iliopsoas bursal cystic lesions can lead to severe vascular compressive symptoms with no ominous radiographic findings. Physicians and orthopedic surgeons should be aware of the possibility of this complication in patients with unexplained unilateral lower-limb swelling.

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The formation of iliopsoas bursal cystic lesions after total hip arthroplasty (THA) is a rare and infrequently reported condition.1-6 Iliopsoas bursal cystic lesions develop in response to intra-articular derangement and increased intra-articular pressure due to particulate wear debris with or without component loosening or osteolysis.1-6 Iliopsoas bursal cystic lesions may be detected incidentally or can present as pain or a groin mass. Rarely, they present as lower-limb swelling from severe vascular compression.1,5,7 Vascular compression and limb swelling have been described with metal-on-polyethylene THA due to iliopsoas bursal lesions.1-5 It has also been reported due to pseudotumors with metal-on-metal resurfacing.7 One report described this lesion in an old-generation cemented McKee-Farrar metal-on-metal prosthesis (Howmedica, London, United Kingdom); however, it was due to an intrapelvic cyst containing cement debris that communicated with the hip joint through an acetabular medial wall defect and occurred in response to acetabular component loosening.8

This article describes a case of venous compression leading to a groin mass and significant lower-limb swelling following metal-on-metal THA. To the authors’ knowledge, this is the first report that describes an iliopsoas bursal cystic lesion with a current-generation metal-on-metal articulation without component loosening or osteolysis.

The patient gave informed consent for data concerning her case to published.

Case Report

In March 2006, a 54-year-old woman underwent an uneventful right metal-on-metal THA for symptomatic arthritis secondary to hip dysplasia. The components were an S-ROM stem with a 28-mm head and a press-fit acetabular component (DePuy, Warsaw, Indiana) and an Ultamet metal liner (Pinnacle 100; DePuy). She made a good recovery and remained well for 5 years.

In June 2011, she presented with progressive unilateral limb swelling that worsened with walking. Clinical examination revealed an edematous limb that measured 4 cm greater in diameter than the contralateral limb at the mid-calf level. Hip examination revealed a nontender, firm mass in the right groin. Neurovascular examination revealed intact motor and sensory function with palpable distal pulses.

Duplex ultrasonography showed no venous thrombosis up to the common femoral vein. Plain radiographs of the hip showed no interval changes from previous radiographs or signs of loosening. The cup inclination and anteversion angles were 59° and 20°, respectively, as measured by the Einzel-Bild-Koentgen-Analyse software (EBRA-CUP/SP2, Innsbruck, Austria) (Figure 1).

Blood workup revealed an erythrocyte sedimentation rate of 5 mm/h and a C-reactive protein of 2.4 mg/L. Ultrasound examination of the groin demonstrated an 8.2×3.8×4-cm heterogeneous collection lateral to the right femoral neurovascular bundle, which was aspirated and yielded 40 cc of greenish-black material. The aspirate showed no organisms on staining or culture, including that for acid-fast bacilli and fungi. Determination of metal ions concentration of the aspirate revealed high levels of chromium and cobalt (cobalt, 17 ug/g [standard, 0-0.5 ug/g]; chromium, 83 ug/g [standard, 0-1.9 ug/g]).

Metal artifact reduction sequences showed an iliopsoas bursal cyst measuring 9 cm in length×4 cm in transverse×4 cm in anteroposterior dimension, with some debris in the collection. The iliopsoas cystic lesion was communicating with the hip joint and compressed the common femoral vein (Figure 2).

Based on the findings of high local tissue metal ions and vertical cup positioning causing edge loading, the authors proposed an inflammatory reaction to metal debris that tracked into the iliopsoas bursa, forming a cyst that secondarily compressed the common femoral vein and resulted in limb swelling.

The authors removed the implicated source of metal debris through revision.
of the malpositioned acetabular component and conversion of the metal-on-metal bearing to ceramic-on-ceramic.

At revision surgery, the same direct lateral approach was used as for the index operation. The iliopsoas bursa, which was in communication with the joint, was drained of copious amounts of milky, gray fluid. The synovium was highly inflamed and metal stained (Figure 3). No evidence existed of corrosion at the head–neck junction or of gross liner wear. After fluid drainage, an aggressive synovecctomy and partial bursal excision were performed.

The acetabular component was removed, and a new Biolox Delta Ceramic component with a ceramic-on-ceramic bearing interface (DePuy) was implanted at 40° of inclination and 20° of anteverision.

Histopathology showed evidence of aseptic lymphocytic vasculitis–associated lesions and classic foreign-body reaction. Areas were dense with perivascular lymphocytic infiltrate, and other areas were characteristic for foreign-body reaction of metal debris–containing macrophages and giant cell infiltrate (Figure 4).

Postoperatively, the patient had complete resolution of limb swelling within 6 months. Duplex ultrasounds were repeated twice and showed no evidence of venous thrombosis. At 1-year follow-up, the patient was doing well, and no signs existed of local recurrence.

Discussion

Metal-on-metal bearings of the hip are associated with elevated concentrations of metal ions in the hip joint and systemically. The deposition of metal ions and debris in periprosthetic tissue may cause an adverse reaction to metal debris, which may result in fluid or mass formation. Adverse reactions to metal debris includes a spectrum of inflammatory reactions to metal debris, including metallosis, aseptic lymphocytic vasculitis–associated lesions, and pseudotumors.

Adverse reaction to metal debris cases appear to develop more frequently in women implanted with metal-on-metal articulation with a wide spectrum of clinical presentations, ranging from small asymptomatic lesions to massive local infiltrating lesions causing severe symptoms. The exact etiology of these soft tissue reactions is unknown. However, the consensus is that they are reactions to high levels of particulate or ionic debris that result in cellular cytotoxicity, metal hypersensitivity, or both.

Amstutz et al reported that the cellular effects of metal particles vs metal ions differ. Particles cause a foreign-body response with activation of macrophages. In the absence of gross metallosis, metal ions stimulate lymphocytes, resulting in the activation of the immune system in what is thought to result in a type IV hypersensitivity reaction.

In addition to contributing to osteolysis and aseptic loosening, polyethylene wear debris has induced inflammatory reactions that might track to the iliopsoas bursa. Walsh et al reported polyethylene debris–induced pseudotumor formation following a metal-on-highly-cross-linked polyethylene bearing THA with histopathologic changes analogous to that seen with metal-on-metal bearings.

Limb swelling due to occlusive iliopsoas cyst is not exclusive for metal-on-metal bearings and has been reported in metal-on-polyethylene articulations. Some reports described isolated compressive symptoms; however, others described it in association with osteolysis or component loosening. The histological examination of the retrieved cysts demonstrated multinuclear giant cells containing fine polyethylene particles consistent with a foreign-body reaction.

Component malposition with metal-on-metal bearings is less forgiving than that with metal-on-polyethylene bearings. Vertical cup position of more than 50° leads to edge loading and excessive ion production. Higher wear rates were also associated with cup inclination greater than 50° when using metal-on-polyethylene or ceramic-on-ceramic bearings.

The iliopsoas bursa is the largest bursa in the body that overlies the hip joint capsule posterior to the iliopsoas tendon and lateral to the femoral vessels.
Although the iliopsoas bursa communicates anatomically with the hip joint in 15% of cases, it is unclear whether surgical trauma or inflammation due to wear debris could lead to communication. However, increased intra-articular pressure takes the path of least resistance into the iliopsoas bursa with secondary accumulation of the synovial fluid. A 1-way communication from the hip joint to the bursal cyst has been suggested, with possible herniation of the effective joint space under the inguinal ligament into the pelvis.

In the current patient, magnetic resonance imaging showed that the bursa communicated with the hip joint. The authors propose that edge-loading from the vertical cup position that generated excessive metal debris, combined with a direct route of access from the joint to the psosas bursa, contributed to the pathogenesis of this lesion.

The optimal management of these cysts is treating the cause by removal of the source of the metal debris. This usually includes revision surgery to a nonmetal-on-metal bearing interface combined with cyst drainage and debridement. In the current case, the authors preferred a ceramic-on-ceramic bearing over metal-on-polyethylene because of the relatively young age of the patient and to reduce any further burden of chromium and cobalt metal particles and ions.

Open excision without removal of the debris generator has been reported; however, it was associated with recurrence. Some authors advocate the need for complete excision through a separate approach, usually an ilioinguinal approach combined with revision surgery that can be staged or performed simultaneously.

This would be the case for a solid lesion, but a separate approach is probably not necessary for a fluid-filled cystic lesion. In the current patient, the cyst was debrided through the same approach, and the limb swelling resolved in the absence of continued stimulation from metal debris.

CONCLUSION

When treating hip dysplasia, one must aim for an average cup inclination of 40° and avoid maximizing cup–host bone contact at the risk of oververticalization. Iliopsoas bursal cystic lesions can lead to severe vascular compressive symptoms in the absence of ominous radiographic findings. Physicians and orthopedic surgeons should be aware of the possibility of this complication in patients with unexplained unilateral lower-limb swelling.

REFERENCES