Case Report

A Painful Metal-on-Metal Total Hip Arthroplasty

A Diagnostic Dilemma

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Abstract: Infection, loosening, osteolysis, or other causes can lead to the development of pain about a previously well-functioning total hip arthroplasty. An inflammatory reaction unique to metal on metal arthroplasty can lead to a painful total hip. A synovial biopsy is needed to make this specific diagnosis, and included in the differential diagnosis is infection. The workup of infection includes obtaining a C-reactive protein and erythrocyte sedimentation rate. Elevations of both the C-reactive protein and erythrocyte sedimentation rate are felt to indicate possible infection. This case report describes both of these findings and the treatment rendered in a painful subluxing metal-on-metal total hip arthroplasty presenting with ongoing pain and a large effusion. **Keywords:** painful total hip, metal on metal, metal hypersensitivity, subluxation, infection.

The development of an inflammatory synovial reaction primarily associated with metal-on-metal (M-O-M) hip arthroplasty has been reported, with patients complaining of pain developing shortly after the index surgery typically associated with a large joint effusion [1,2]. First described by Willert et al in 2000 [3], a synovial tissue reaction to metal particulate debris leads to a perivascular lymphocyte dominated immunologic response (ALVAL, or Aseptic Lymphocytic Vasculitis-Associated Lesions), which has similarities to type IV hypersensitivity [2,4].

A painful M-O-M total hip arthroplasty adds the possible diagnoses of metal hypersensitivity or high bearing wear leading to excessive wear debris to the differential diagnosis of infection, loosening, osteolysis, or other causes. In the setting of a painful total hip arthroplasty with markedly elevated C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR), the presumptive diagnosis is infection [5]. The unique inflammatory reaction in a M-O-M hip may also increase these serum markers [6].

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This case report discusses the presentation, workup, and surgical treatment of a patient presenting with a painful M-O-M total hip. The patient was informed that data concerning the case would be submitted for publication, and she consented.

Case Report

A 63-year-old-woman (body mass index = 38.0) underwent cementless metal on metal (38 mm, high carbon content ball, Biomet, Warsaw, Ind) left total hip arthroplasty in December 2004. Shortly after surgery the patient heard a loud "pop" in her hip and felt as if the hip was subluxing anteriorly. Seven months after surgery, the patient noted increased groin pain. A hip arthroscopy in December 2005 found a macroscopically benign appearing synovium, no obvious infection, and apparent subluxation with motion of the hip. An intraoperative culture was negative. The arthroscopy initially decreased the groin pain, which then returned. In June 2006, the ESR was 113 (0-30 mm/h) and the CRP 6.6 (<0.8 mg/dL). A computed tomographic scan performed in August 2006 showed an anterior fluid collection, confirmed by ultrasound. A gallium scan was negative. Rheumatology consultation did not identify a systemic process.

The patient was referred to the senior author in January 2007 with complaints of mild to severe groin pain requiring oral narcotics for relief, and feelings of hip subluxation. Physical exam showed an antalgic gait, equal leg lengths, pain with straight leg raising felt in the groin, and abductor strength of 4/5 bilaterally.

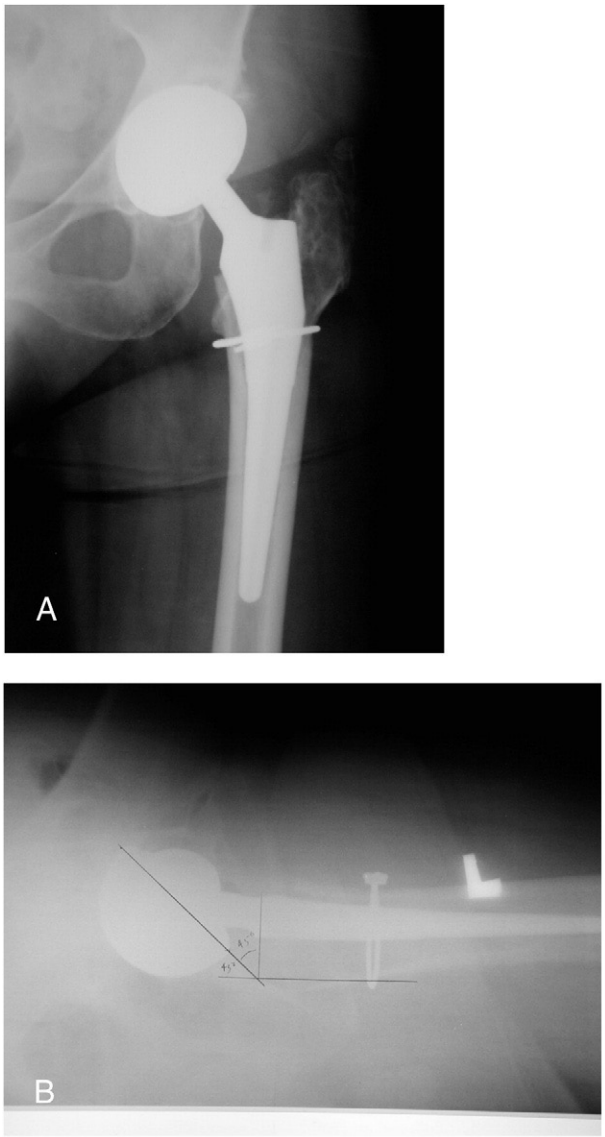

Fig. 1. (A) Anteroposterior radiograph of the left hip, showing acetabular inclination of approximately 45°. (B) Cross-table lateral of the left hip showing excessive radiographic anteversion of 45°.

Radiographs showed fixed components with radiographic acetabular anteversion of approximately 45° and inclination 45° (Fig. 1A, B). Laboratory studies showed ESR 99 (0-30 mm/h) and CRP 3.9 (<0.8 mg/dL). Aspiration returned 40 cc of cloudy serosanguineous fluid with a cell count of 210 white blood cells (WBCs), 15 red blood cells (RBCs), 95% polymorphonuclear leukocyte (PMNs), and culture was negative at 7 days. Infectious disease consultation was obtained prior to revision surgery.

At revision, more fluid and caseous yellow material were seen. Metal staining was seen. The femoral component was felt to be bone ingrown. The acetabular component was inset to the anterior acetabular wall at least 1.5 cm, consistent with increased anteversion, with the posterior aspect of the component at the level of the posterior rim (Fig. 2A, B). The femoral head showed burnishing consistent with the arthroscopic finding of subluxation and was replaced. The acetabular component was felt to be excessively anteverted and the component was removed. The intraoperative cell count was 1900 WBCs, 300 RBCs, 96% PMNs. Frozen sections showed features consistent with mild chronic, not acute, inflammation. The evidence did not favor infection, and a new acetabular component was placed, with a lateralized polyethylene liner and a 36 mm chrome-cobalt head. Intraoperative range of motion testing revealed no component impingement.

All cultures (aerobic, anaerobic, final at 7 days; acid-fast bacillus (AFB), 6 weeks; and fungal, 4 weeks) showed no growth at final reading. The infectious disease consultant recommended 6 weeks of intravenous Vancomycin as a precaution against failure to diagnose an occult infection. Two specialized pathology laboratories independently identified a perivascular lymphocytic inflammatory response and necrosis (Fig. 3A and B) that were not clearly consistent with metal sensitivity or a response to excessive wear debris, since histiocytes containing wear debris were not a feature of the tissues.

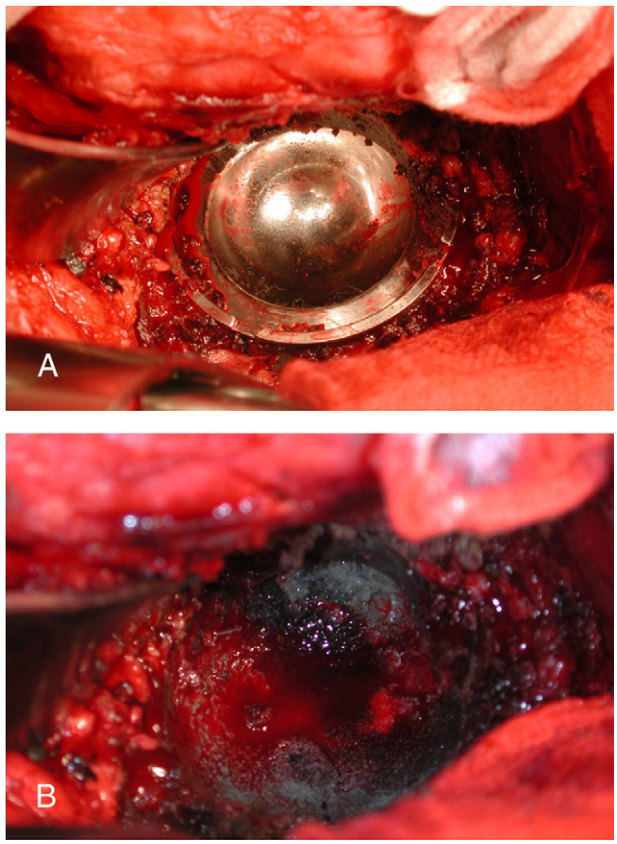

Fig. 2. (A) Acetabular component in vivo. Metallic debris is seen. (B) Periacetabular tissue with metal staining after removal of component.

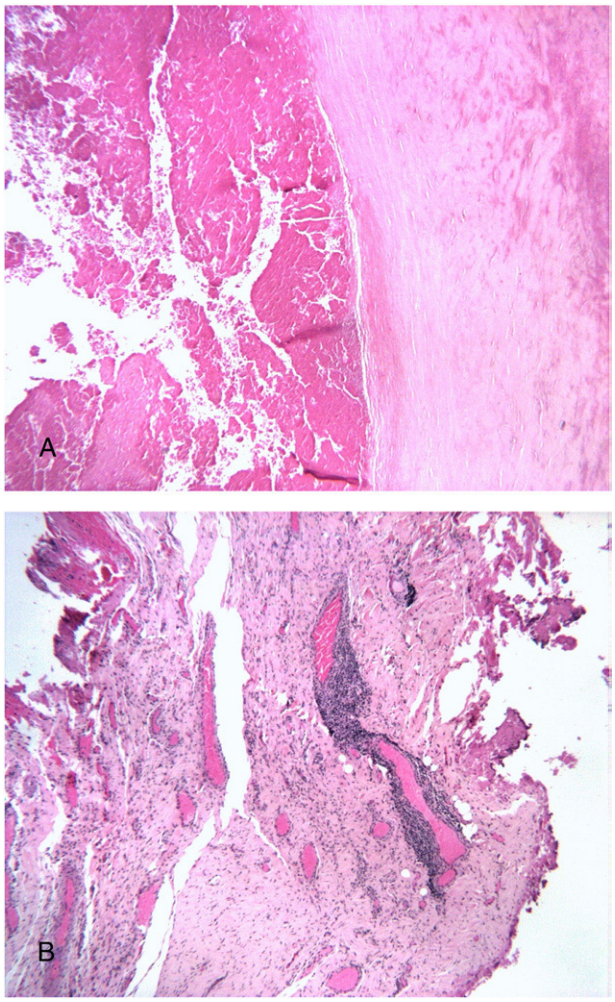

Fig. 3. (A) Light micrograph of necrotic fibrous tissue capsule lined with fibrin (hematoxylin and eosin; original magnification ×40). (B) Light micrograph of a dense perivascular lymphocytic aggregate which includes plasma cells (hematoxylin and eosin; original magnification ×40).

Evaluation of the removed bearing surfaces revealed moderate wear (femoral wear depth 14 μm, 24 μm on the socket), with a suggestion of edge loading. Synovial fluid cobalt was 4746.5 parts per billion (ng/mL) and fluid chromium 1176.4 parts per billion (ng/mL).

Six months after surgery, the ESR (22) and CRP (0.2) had normalized. Fourteen months after surgery, the patient noted only occasional slight groin discomfort and was no longer using pain medication.

Discussion

A painful M-O-M total hip arthroplasty may be more difficult to diagnose compared to other bearing articulations. Preoperatively, we believed that the mechanical subluxations were secondary to excessive acetabular anteversion likely resulting in increased wear and high local ion levels, causing an inflammatory effusion and pain. There was evidence of moderate wear, and also evidence of metal sensitivity. Although not all reported cases of metal hypersensitivity are secondary to component malpositioning, as bearing malposition in conventional metal on polyethylene total hip arthroplasty has been shown to increase polyethylene wear, a similar correlation would seem likely in M-O-M hip arthroplasty. At the time of revision surgery, the components were found to be osseointegrated, and this finding correlates with the patient initially obtaining pain relief after surgery. The above findings would not explain the dramatically elevated CRP and ESR.

The treatment dilemma was whether the elevations of the CRP and ESR were due to chronic undiagnosed infection despite the failure to identify an organism or if this was a case of pain from metal wear products, either allergy or a response to the higher wear produced by this malpositioned implant, or both. The histological findings were inconclusive regarding metal sensitivity. Although the elevation in polymorphonuclear cells in the synovial fluid was concerning, the preoperative (210 WBCs) and intraoperative (1900 WBCs) aspirations suggested inflammation not infection. In the authors' revision practice we have utilized cutoff of 3000 or greater white blood cells with 90% or greater PMNs to be suggestive of infection, pending the results of cultures [7].

We are not aware of any other published reports indicating this level of elevation of the ESR and CRP associated with metal hypersensitivity. There are two reports of metal hypersensitivity associated with elevations of the ESR and CRP [6,8]. In a report by Pandit et al [6], 3 of 17 patients with pseudotumors around metal-on-metal hip resurfacings had preoperatively elevated ESR, and CRP levels and were suspected of having an infection. Although operative cultures were negative and all 17 patients had similar gross and histologic findings, these 3 patients were treated empirically as "culture-negative infections."

With the increasing use of metal on metal articulations, the diagnostic dilemma described, of determining both the mode of failure (metal wear or allergy versus chronic infection), and the appropriate treatment (single versus two-stage revision), may be more frequently seen. In this case where infection was not felt to be likely, revision and reorientation of the acetabular component, and use of a non–M-O-M bearing, were performed to address both the mechanical subluxation and the metal hypersensitivity aspects of this case.

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