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Case report

A case of bone necrosis with pseudotumor following metal-on-metal total hip arthroplasty

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ABSTRACT

A case of bone necrosis with a pseudotumor following metal-on-metal total hip arthroplasty is presented. The patient showed no abnormal magnetic resonance findings 2 years postoperatively, but serum metal ion levels were elevated. The patient developed hip pain 3.5 years postoperatively, and bone necrosis with a pseudotumor was found. The present patient emphasized the fact that tissue necrosis associated with failed metal-on-metal bearing hip might not be limited to soft tissues, but bone necrosis could occur.

Introduction

A major complication that occurs after metal-on-metal (MoM) resurfacing or total hip arthroplasty (THA) is the development of pseudotumors. These lesions are the result of tissue reactions to metal debris with lymphocyte infiltration and soft tissue necrosis; however, their pathogenesis remains unclear. Recent studies demonstrated that pseudotumors can occur in asymptomatic hips after MoM hip resurfacing or THA [1-3]. Magnetic resonance imaging (MRI) provides sensitive screening of pseudotumors following MoM THA. MRI is ideally suited for assessment of these patients and complements standard clinical evaluation [4].

A prominent perivascular lymphoid infiltrate, commonly termed aseptic lymphocyte-dominated vasculitis-associated lesion, is frequently seen in the periprosthetic tissues around MoM hip implants [5,6]. Extensive necrosis is also seen in periprosthetic soft tissues.

The case of a patient who underwent MoM THA and developed a pseudotumor with not only periprosthetic soft tissues necrosis, but also bone necrosis, is presented. The patient was informed that data concerning her case would be submitted for publication, and she consented.

Case history

A 68-year-old woman was referred to our institution for evaluation and treatment of right hip pain. Her body mass index was 26.5 kg/m^2, and she had a history of hypertension and hyperlipidemia. She had undergone an uncomplicated primary MoM THA for end-stage osteoarthritis in July 2009. The arthroplasty was done with a 48-mm Cormet cup, a 40-mm metal head, and a proximally coated CTiII stem (Corin, Cirencester, UK). The inclination angle of the cup was 41°. The patient's postoperative recovery was uneventful, and she was asymptomatic until 2 years postoperatively. Her activity level was moderate, and she had no muscle weakness. Her Harris Hip Score was 97 points. Follow-up radiograph showed no abnormality. We prospectively perform MRI to detect pseudotumors in all patients after MoM THA [3]. The patient showed no abnormal MRI findings 2 years postoperatively. Serum cobalt levels were assayed using inductively coupled plasma mass spectrometry (Perkin-Elmer SCIEX Elan 6100 DRC ICP-MS system; Perkin-Elmer Instruments, Norwalk, CT) at Mayo Medical Laboratories (Rochester, MN), and chromium levels were assayed using a graphite furnace atomic absorption spectrometer (Z-5700; Hitachi Ltd, Tokyo, Japan) with polarization—Zeeman

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absorption at Mitsubishi Chemistry Medience Corporation, Ltd. (Tokyo, Japan) [3]. Serum metal ion levels showed an increased cobalt level (16.0 ppb [parts per billion]), but the serum chromium level was not elevated (0.6 ppb).

The patient developed pain in her right hip 3.5 years postoperatively, and she was referred to our institution. Radiograph showed severe acetabular osteolysis with pubic and ischial fractures. Femoral osteolysis was also found. It was decided that revision THA was needed, and the patient waited for admission. One month later, she felt severe right hip pain and was suddenly unable to walk. Radiograph showed hip dislocation with cup loosening (Fig. 1). MRI showed a pseudotumor (Fig. 2). The patient had no history of allergy to metal jewelry. A lymphocyte stimulation test was conducted before revision surgery, showing no reactivity to cobalt and chromium; however, nickel sensitivity was demonstrated. The serum cobalt ion level decreased to 5.2 ppb, and the chromium level increased to 3.6 ppb.

The patient underwent revision surgery in February 2013. Fluid and cyst wall cultures failed to grow bacteria. Because the femoral stem was well fixed, the stem was retained, and the head was exchanged for a new metal head. The dislocated acetabular shell was removed, and the new trabecular metal cup with a highly cross-linked polyethylene liner (Zimmer, Warsaw, IN) was implanted. Macroscopic examination showed surface damage on the retrieved metal liner and head, with corrosion of the trunnion and taper with metal debris attachment.

All samples of the pseudotumor were fixed in 10% neutral buffered formalin prior to processing and embedding in paraffin wax. Resected bone was fixed in neutral buffered formalin, decalcified in ethylenediaminetetraacetic acid, and embedded in paraffin. Sections were stained with hematoxylin and eosin and examined by light microscopy. Sections of the pseudotumor were also analyzed by immunohistochemistry using antibodies to T lymphocytes (CD3; DAKO, Glostrup, Denmark), B lymphocytes (CD20; DAKO), and macrophages (CD68; DAKO) to characterize the immunophenotype. Histology showed extensive necrosis and lymphocytic infiltration in periprosthetic tissues of the hip, with perivascular lymphocytes and diffusely distributed lymphocytes. There was not only soft tissue necrosis, but also bone necrosis (Fig. 3). Immunohistochemical examination suggested more CD20-positive B lymphocytes than CD3-positive T lymphocytes.

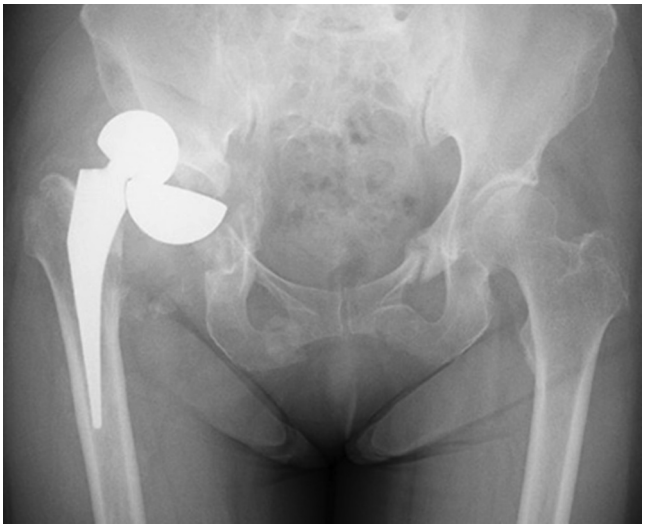

Figure 1. Radiograph shows hip dislocation with cup loosening, as well as severe acetabular osteolysis with pubic and ischial fractures.

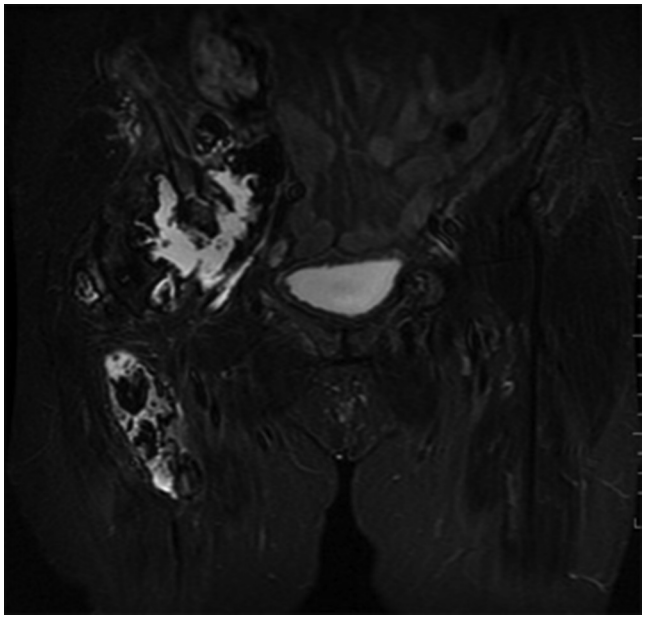

Figure 2. Coronal short tau inversion recovery magnetic resonance image shows a pseudotumor.

CD68-positive macrophage infiltration was also found. Post-revision serum cobalt and chromium levels decreased to 1.5 and 0.6 ppb, respectively. Three years postoperatively, the patient reported substantial resolution of pain and could walk without a limp. Her Harris Hip Score was 96 points. Radiographs showed no evidence of loosening. The femoral osteolysis was repaired spontaneously (Fig. 4).

Discussion

The present case highlights the fact that tissue damage occurring with MOM bearing hips can involve bone in addition to soft tissue. Hips with aseptic lymphocyte-dominated vasculitis-associated lesion have demonstrated soft tissue necrosis; however, acetabular bone necrosis has not been reported, to our knowledge. Only 2 cases with greater trochanteric necrosis were reported after MoM THA, although histological analysis was not included [7].

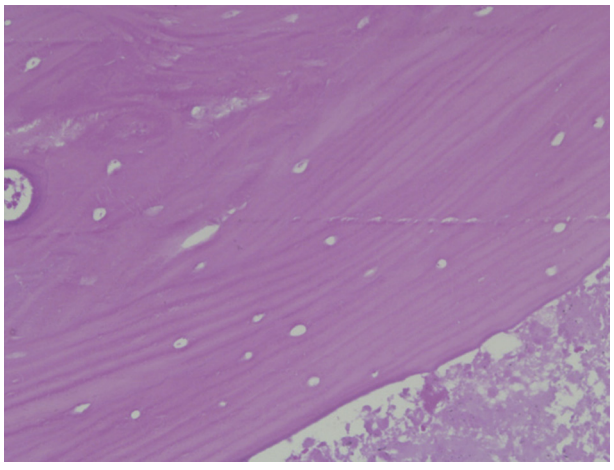

Figure 3. Histology shows bone necrosis (hematoxylin and eosin staining, original magnification ×100).