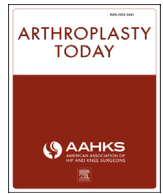




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Case report

Delayed diagnosis of catastrophic ceramic liner failure with resultant pelvic discontinuity and massive metallosis

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ABSTRACT

With newer-generation ceramic components used in total hip arthroplasty, component fracture is a rare complication. However rare, when ceramic component fracture does occur, prompt identification and revision is necessary as delay can lead to dramatic failure with resultant metallosis as the extremely hard ceramic debris abrades remaining components. We present a case of a 70-year-old woman with ceramic liner fracture and an estimated 10-year delay in intervention with failure resulting in pelvic discontinuity and massive metallosis with associated cutaneous manifestation. She was treated with a complex revision and reconstruction and is 2 years postrevision without major complication.

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Introduction

Ceramic liner fracture, although rare, is a described complication of ceramic-on-ceramic (CoC) total hip arthroplasty. Prompt identification and treatment of ceramic liner fracture is imperative as delay can lead to rapid and dramatic consequences. The CoC bearing couple exhibits the best wear properties of all total joint bearing surfaces with reported ceramic head wear rate of 0.1 mm³ per year and ceramic liner wear rate of 0.04 mm³ per year [1]. Additionally, it has the lowest coefficient of friction of all bearing surfaces used in total joint arthroplasty [2–4]. Furthermore, the wear particles are inert and therefore do not pose an increased carcinogenic risk [5,6]. Unfortunately, CoC systems exhibit low toughness and are highly brittle. Beyond those disadvantages, CoC systems are more expensive than metal-polyethylene couples [7] and some carry a risk of squeaking (<0.5%–11%) [8–12].

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Early endeavors in the United States into the CoC bearings in the 1970s and 1980s yielded unsatisfactory clinical results with overall 10-year survivorship of between 75% and 84% [13,14] due to increased risk of aseptic loosening and ceramic component fracture. The rate of fracture for these ceramic components was reported to be between 3% and 5% and was attributed to large grain size, the presence of inclusions and grain boundaries, and poor taper tolerances. Advances in ceramic materials have largely addressed these issues to maintain superior wear characteristics while improving mechanical properties [15].

Ceramic component fracture is considered a major complication and universally requires early revision [3,15]. If not identified and revised early, a fractured ceramic component can lead to catastrophic material deterioration and massive destruction of bone and tissues due to metal debris from abrasive effects of alumina particles on the metal stem, neck, or socket [3]. We present a case of ceramic liner fracture with an estimated 10-year delay in intervention with catastrophic failure resulting in pelvic discontinuity and metallosis. To the authors' knowledge, there is only one other reported similar case which represented a 1-year delay in diagnosis and less severe manifestations [16]. Additionally, the authors believe that although skin discoloration attributable to metallosis is a rare but reported entity, this represents the first described cutaneous manifestation of metallosis in a CoC bearing couple [17–19].



Figure 1. Cutaneous manifestation of severe metallosis.

Case history

In the case we report here, the patient had a fractured ceramic liner a decade before presentation to our clinic. In June 2014, the patient, a 70-year-old woman, presented to our clinic for evaluation. She had undergone primary total hip arthroplasty 11 years before presentation with a Wright Medical (Arlington, TN) CoC bearing with Conserve acetabular and Profemur modular femoral components. She reported that 1 year after her primary surgery, she

began experiencing pain and grinding sensations as well as hearing crunching noises, she denied any specific traumatic event that lead to this. As a result of her pain and significantly decreased range of motion, she was a wheelchair ambulator for several years before presentation. She was not seen by her operating surgeon and no workup was done until her presentation to our clinic. There was large ecchymotic-type discoloration of the skin overlying the lateral hip (Fig. 1) which represents the cutaneous manifestation of particulate metal debris. Radiographic evaluation on the day of presentation (Figs. 2 and 3) demonstrated catastrophic failure of the prosthesis with significant periacetabular bone loss and the femoral head was shown to have worn through the acetabular shell and was in an intrapelvic position. The liner was not visualized radiographically. Preoperative infectious workup showed no elevation in erythrocyte sedimentation rate or C-reactive protein. Intraoperative frozen section showed less than 5 neutrophils per high power field and cultures showed no growth. Preoperative cobalt and chromium blood levels were also obtained and found to be within normal limits.

Intraoperatively, upon incising through the skin and into subcutaneous tissue there was immediate and obvious infiltration of gray-black discoloration consistent with microscopic metal debris which extended through the fascia and became more intense as the hip was approached. The gluteus medius muscle fibers were completely infiltrated with metallosis debris and there were large sections of the muscle belly and tendon that were frankly necrotic. There was a massive amount of similar friable black-stained tissue lining the joint with pockets extending posteriorly in proximity to the sciatic nerve and into the sciatic notch. There was a significant amount of lysis superior to the cup in the ilium and pockets extending inferiorly into the obturator foramen and anteriorly into the psoas gutter. There was a lytic lesion extending in a transverse pattern up into the sciatic notch. The medial wall was not intact with an approximately 8 × 6 cm elliptical defect centrally. There was a pelvic discontinuity with the ischium and pubis freely mobile. There was an ectatic defect extending off the ilium, but with the superior rim somewhat intact. An extensive and thorough debridement was undertaken although given that the infiltration extended within the pelvis, complete debridement was not safely possible.

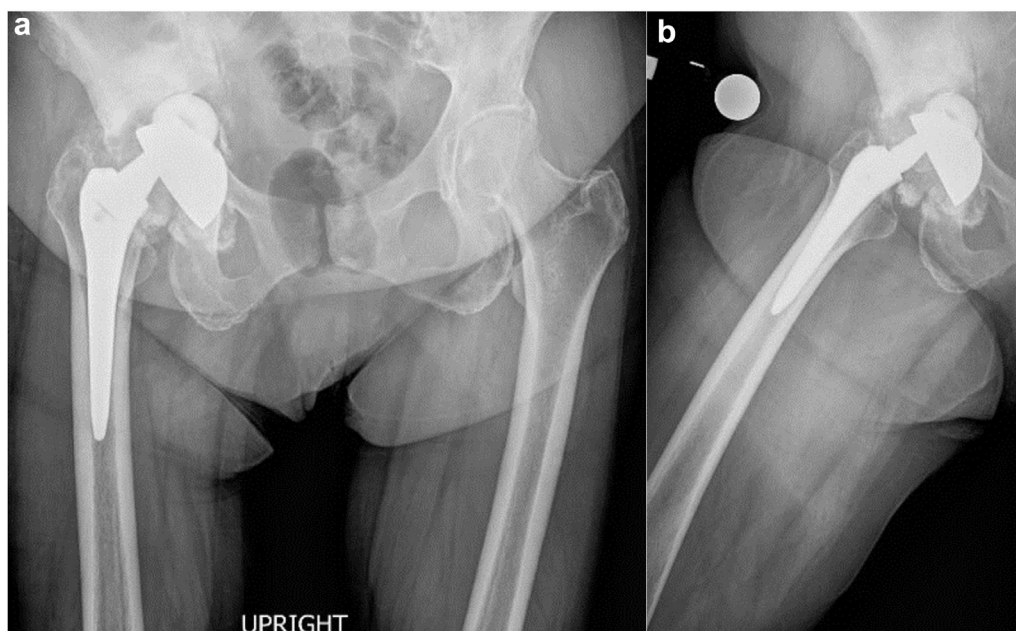


Figure 2. Anteroposterior (AP) pelvis (a) and (b) lateral radiographs at presentation.

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