Severe Metallosis Leading to Femoral Head Perforation

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abstract

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This article describes a case of severe metallosis in a 67-year-old woman who initially underwent primary total hip arthroplasty with a ceramic-on-ceramic articular bearing. This was subsequently revised to a metal-on-polyethylene articulation due to ceramic liner fracture. She presented with severe hip pain and a pelvic mass. Infective workup was negative. Perforation of the cobalt–chrome femoral head was observed intraoperatively. In addition, signs of extensive metallosis, including embedded ceramic debris from the primary procedure, were observed. To the authors’ knowledge, this is the first report of a ceramic fracture that led to cobalt–chrome femoral head perforation after subsequent revision total hip arthroplasty. The patient underwent successful revision surgery with a ceramic-on-ceramic coupling.

Ceramic materials are increasingly being used in total hip arthroplasty in younger patients. They have excellent tribological properties. However, they also have a lower elasticity and plasticity, which makes them susceptible to sudden material failure. Ceramic fracture is an uncommon yet problematic complication of total hip arthroplasty. Previous authors have reported the importance of performing thorough synovectomy following ceramic liner fracture. Revision surgery using couplings that have a lower hardness, such as metal-on-polyethylene, are best avoided due to their susceptibility to undergo abrasive wear from remaining ceramic particles. The authors advocate revision with ceramic-on-ceramic couplings after ceramic liner fracture.

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Alternative bearing surfaces for total hip arthroplasty (THA), such as ceramic couplings, have gained increasing popularity in recent years for their low-wear properties. Clinical outcomes have been excellent; however, these bearings have disadvantages, such as noise and catastrophic failure. To the authors’ knowledge, this is the first report of severe metallosis resulting in cobalt–chrome head perforation in a patient who previously underwent primary THA with a ceramic-on-ceramic coupling that was revised with a metal-on-polyethylene articulation because of cement liner fracture.

**Case Report**

A 67-year-old woman was referred to the authors’ institution reporting right hip pain after a revision THA performed 3 years previously. Eight years previously, she underwent primary THA using a ceramic-on-ceramic system for osteoarthritis. The hip was revised due to a fracture of the ceramic liner without a precipitating event. The liner and head were revised to polyethylene-on-cobalt-chrome at another hospital.

She presented to the current authors reporting pain and a right pelvic mass. Ultrasound and computed tomography (CT) scan (Figure 1) of the pelvis were performed. Images showed a complex loculated fluid collection in the right hemipelvis arising from the right hip, suggesting possible infection, although no history of systemic symptoms was found and inflammatory markers were normal. A CT-guided aspiration showed granulomatous tissue. Radiographs showed heterotopic ossification with radiodensity around the cup, ischium, and proximal femur (Figure 2).

Revision was undertaken using a trochanteric slide technique. Dark fluid indicating severe metallosis was present as the trochanteric osteotomy was performed. The metal head was perforated (Figure 3A). The liner showed eccentric wear superiorly with embedded ceramic debris (Figure 3B). After the liner was removed, curetting the cup holes caused dark fluid to gush out, accentuated by pressing on the abdomen. A large defect was found in the ischium, but no pelvic discontinuity was found.

A 62-mm TM cup (Zimmer, Ltd, Mississauga, Canada) with 3 screws was implanted after allografting the ischium. The stem was well fixed and not revised. A 40-mm ceramic head was used.

Eighteen months postoperatively, the patient was asymptomatic and mobilizing without aid.

**Discussion**

Ceramic materials are increasingly being used in THA in younger patients. They have excellent tribological properties, including corrosion resistance and biocompatibility. However, they also have a lower elasticity and plasticity, which makes them susceptible to sudden material failure. Ceramic fracture is an uncommon yet problematic complication of THA. To the authors’ knowledge, this is the first reported case where ceramic fracture led to perforation of a cobalt–chromium femoral head after subsequent revision THA.

A multicenter trial of 105 patients who underwent revision surgery with different bearing surfaces to treat ceramic fracture
showed that revision with ceramic femoral heads were at least as durable as the original implants at short-term follow-up. Cobalt–chrome heads provided satisfactory results; however, stainless steel heads showed excessive wear, and the authors advised against their use.

Severe wear of the cobalt–chromium head was also reported after ceramic failure in 6 bipolar cases. However, a series of 8 patients with more than 10 years of survivorship with metal-on-polyethylene after revision THA for ceramic fracture was reported after thorough synovectomy, highlighting its importance.

Metallosis may present on radiographs with an appearance similar to heterotopic ossification. Elimination of all ceramic particles is impossible. The higher wear of cobalt–chromium and stainless steel femoral heads used in revision surgery following ceramic fracture may be explained due to their having a lower hardness level than ceramics. Materials with a lower hardness level are susceptible to more abrasive wear when they come into contact with those with a greater hardness level. Because microscopic ceramic particles are going to remain from the primary procedure, they can cause more abrasive wear to these materials if they are used in revision surgery.

The authors advocate replacing the cup at revision, even if it appears macroscopically normal, because microscopic ceramic particles may be embedded. They further advise that ceramic-on-ceramic articulation be used after previous ceramic fracture to prevent further catastrophic failure, in accordance with other authors.

REFERENCES