Catastrophic Fracture of a Stable Metal Acetabular Component

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abstract

Various modes of failure of primary and revision total hip arthroplasty have been well documented in the literature over the past 30 years. Concerns over polyethylene wear, osteolysis, and hypersensitivity reactions leading to component loosening and early revision have been evaluated and reported in the literature. Routine follow-up is important to monitor for postoperative issues that might lead to the subsequent need for revision.

This article describes a case of a 64-year-old man who initially presented 11 years prior with an intertrochanteric fracture, which failed secondary to varus alignment and femoral head osteonecrosis. The fixation was converted to a total hip replacement using the S-ROM system (DePuy, Warsaw, Indiana). Subsequently, the patient was lost to follow-up after primary total hip arthroplasty and presented with a catastrophic fracture of the metal acetabular cup system. The failure was suggested by clinical presentation and confirmed by imaging studies showing a fractured acetabular shell with femoral head prosthesis resting in the superolateral ileum. The contributing factors that resulted in mechanical failure were polyethylene wear and component fracture. The acetabular component was revised with an in-growth cementless trabecular metal multihole cup (Zimmer, Warsaw, Indiana) with bone grafting of acetabular defects.

Routine assessments help educate patients and allow careful monitoring by physicians while establishing a radiographic timeline for the identification, progression, or lack of postoperative complications.

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doi: 10.3928/01477447-20120725-30

Figure: Anteroposterior (A) and lateral (B) radiographs showing an acetabular component fracture with the femoral component resting in the superolateral ileum.
Various modes of failure of primary and revision total hip arthroplasty (THA) have been well documented in the literature over the past 30 years. Polyethylene wear, osteolysis, and hypersensitivity reactions leading to component loosening and early revision have been evaluated and reported in the literature. Routine follow-up is important to monitor for postoperative issues that might lead to the subsequent need for revision.

**Case Report**

A 64-year-old man with a body mass index of 18 kg/m² presented with a 2-year history of worsening right hip pain with ambulation. The pain was described as lateral buttock pain with radiation to the groin. The patient initially presented 11 years previously with an intertrochanteric fracture, which failed secondary to varus alignment and femoral head osteonecrosis. The fixation was converted to a total hip replacement using the S-ROM system, HG-2 acetabular cup, and first-generation polyethylene (DePuy, Warsaw Indiana). Postoperatively, the patient was followed at 2 and 4 weeks and 2 and 4 months, with radiographs showing a well-seated prosthesis. The patient was subsequently lost to follow-up until the current presentation.

The patient was able to ambulate independently but required a walker. He was self-sufficient with activities of daily living at home, including acting as the primary caregiver to his father. He reported no history of trauma or infection in the affected hip. His medical history was significant for anemia, hypertension, significant alcohol abuse, and chronic kidney disease. The patient reported no current alcohol abuse and had no diagnosis of dementia.

On physical examination, the patient ambulated with an antalgic gait. A well-healed posterolateral scar was observed with no evidence of erythema or wound dehiscence. The hip was significantly foreshortened with poor range of motion and tenderness to palpation over the lateral aspect of the pelvis. Comparison with the contralateral hip showed a marked difference in the palpated level of the greater trochanter. Neurovascular examination showed no abnormalities in the affected limb.

Imaging revealed a fracture of the acetabular cup with the femoral head component dislocated into the posterolateral ilium (Figure 1). Laboratory tests for evidence of infection were negative. The patient’s laboratory results were significant for a creatinine of 2.4 secondary to his chronic kidney disease. Ultrasound-guided aspiration of the right hip yielded no joint fluid with contrast injected to confirm joint injection. In addition, no fluid was appreciated on ultrasound evaluation. Given the clinical presentation and catastrophic failure of the primary replacement, the authors revised the right THA with bone grafting of acetabular defects.

After induction with general anesthesia, the patient was placed in a left lateral decubitus position. The authors dissected through the superficial and deep fascia, and the anterior and posterior flaps were split and raised. The gluteus maximus tendon was released, and dissection continued to the external rotators in a subperiosteal approach. Clear fluid was expressed on deep incision, and the hip was found to be dislocated as above. Several fracture fragments from the acetabular component were prevalent, and a significant amount of metallosis with black, tarry tissue diffusely encompassing more than 40% of the connective tissue immediately surrounded the implant. Synovectomy and debridement of metallosis were performed in all quadrants of the hip, and tissue specimens were sent for pathology evaluation.

The skirted femoral head was removed from the S-ROM. The prosthesis had worn through the uncemented cup on its superior and posterior quadrants, with 2 screws still intact. This proved to be a complete dislocation of the hip with marked displacement from the acetabular cup.

After removal of the cup, the authors unveiled a significantly deficient acetabulum with a severely worn medial wall that migrated superiorly, but had superior ilium and anterior and posterior columns intact. The bony defects were impacted with allograft and placed an in-growth trabecular metal multihole cup (Zimmer, Warsaw, Indiana) in 45° of abduction and 20° of anteversion. Two 6.5-mm screws secured the cup with quality fixation.

The original femoral stem was mechanically stable, and a +36 femoral head with a highly cross-linked polyethylene standard liner was impacted. The hip was reduced, with the resulting range of motion of approximately 0° to 110° of flexion and extension, 45° of abduction, 40° of external rotation, and 50° of internal rotation. No instability of the hip was appreciated with provocative maneuvers. Pathology examination of intraoperative tissue samples confirmed metallic residue.

Postoperative radiographs were satisfactory (Figure 2), with acceptable position. Due to the significant amount of
bony loss appreciated intraoperatively, the patient was made nonweight bearing until further evidence existed of biologic stabilization of the acetabular component. The patient was mobilized on postoperative day 1. Protected weight bearing precautions were implemented 2 weeks postoperatively.

**Discussion**

It is important to follow patients after adult reconstructive procedures on a regular basis so that problems can be detected before the onset of catastrophic failure. Routine follow-up at intervals of 2 weeks, 2 and 6 months, 1 year, and every 1 to 2 years beyond is the current authors’ protocol for monitoring postoperative arthroplasty patients. A survey of members of the American Association of Hip and Knee Surgeons has endorsed variable protocols.¹

Authors have questioned whether routine follow-up is cost effective or necessary, but the existing literature has yet to establish a definitive answer. Hacking et al² reported that 4 (3.6%) of 110 patients undergoing revision THA were asymptomatic in the first 7 years after primary THA. Other studies have shown various follow-up practices and presented the need for a widely accepted blueprint.³ Some authors have suggested eliminating routine follow-up visits,⁴ having patients present for single postoperative visits at the 6- to 12-week point,⁵ or sending THA patients questionnaires⁶ as alternatives to more frequent routine appointments. Despite many studies, no universally accepted postoperative protocol has been achieved.

Routine follow-up assessments can detect early signs of asymptomatic complications, such as wear, loosening, infection, or elucidate symptoms that may or may not lead to escalating pathology in the course of postoperative management.

The catastrophic failure of THA components is rare and has not been extensively investigated, but 2 studies have shown rates of less than 0.5%.⁷,⁸ Risk factors contributing to catastrophic failure with accelerated wear include increased patient activity, foreign body debris, metallosis, thin polyethylene liner, component malposition, ceramic material, and femoral head size.⁹,¹² In the current patient, the failure mode was secondary to plastic failure in the liner and, subsequently, fracture of the acetabular component from biomechanical wear.

Chang et al¹³ retrospectively studied 31 hips in which massive metallosis was found on revision THA. They reported a 77% incidence of significant osteolysis in hips with metallosis, predominantly secondary to dissociation of a polyethylene liner from its shell (metal-on-polyethylene bearing surface). On average, revision THAs were performed 3 months after dissociation, which led to the conclusion that revision THA should be performed as early as possible to prevent the rapid progression of metallosis and catastrophic failure.¹³ In the current case, the patient reported that he was having symptoms but thought no significant issue existed until it progressed to a debilitating point. The combination of polyethylene wear and component fracture in the current case were contributing factors that resulted in his mechanical failure.

Routine assessments help to educate patients and allow careful monitoring by physicians while establishing a radiographic timeline for the identification or progression of postoperative complications or the lack thereof.

**References**

