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Case report

# An unusual presentation of catastrophic failure of hip arthroplasty with a thigh mass

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ABSTRACT

In the advent of increasing demand for total hip arthroplasty, surveillance of these patients is imperative to identify potential complications requiring revision surgery. This is especially important in the young population, as revision is usually necessary during their lifetime. We present a case of a young female patient with a history of total hip arthroplasty 17 years prior, who presented with left hip pain and anterior thigh mass. The prosthetic hip had progressed to catastrophic failure with the cobalt-chrome femoral head having eroded through the polyethylene and acetabular socket. This was associated with significant metal debris and large fluid collection in the thigh. The patient required complex revision surgery but could have had a much lesser procedure with earlier intervention.


## Introduction

Total hip arthroplasty is a common orthopaedic procedure with approximately 400,000 operations per year [1]. While typically, an operation predominantly performed for the elderly population, there are well-documented studies showing good outcomes in the younger population [2-5]. However, when compared with the elderly population, the excellent results are not often replicated because of their high activity levels [6]. Regardless of the age group, frequent reasons for revision surgery are bearing surface wear, aseptic loosening, instability, and infection [7-9]. Polyethylene bearing surface is the gold standard for hip replacement, and subsequent wear is a phenomenon often encountered with long-term follow-up of the patients. Polyethylene wear is often associated with osteolysis and implant loosening contributing to midterm to late revision in total hip arthroplasty, especially in young patients [9-11].

We present an unusual presentation of catastrophic failure of a total hip arthroplasty, with complete wear-through of the femoral head through the polyethylene liner and the acetabular socket with a large associated soft tissue thigh mass. Complete wear-through of the polyethylene is a well-described in literature. Heck et al. [12] in their 1995 survey of the American Association of Hip and Knee Surgeons found that complete polyethylene failure was seen in 172 metal-backed sockets (29 of 10,000). There are also a few case reports in literature highlighting complete wear-through of the femoral head through the polyethylene and metal-backed acetabular component, although this is a much more uncommon event [13-15].

Significant advances have been made with the advent of ultra-high-molecular-weight polyethylene, especially with highly cross-linked polymers, regarding improvement in wear rate [16]. To date, there does not seem to be a reported case of complete wear-through of highly cross-linked polymers. However, studies have shown decreased fracture toughness and resistance to fatigue crack propagation of highly cross-linked polyethylene, which can lead to a different kind of failure mode [17-19]. This highlights the need for discussion with the patient during the preoperative period of such possible event in the future. Close radiographic follow-up is helpful to identify and monitor any mode of failure to prevent a catastrophic wear and potential need for more complex surgery. This becomes important as prevalence of arthroplasty in the younger population increases [20].

## Case history

The patient was informed that data concerning the case would be submitted for publication, and she provided informed consent.

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**Figure 1.** Anterioposterior radiograph of original left total hip arthroplasty in the immediate postoperative period.

**Figure 3.** Anterioposterior radiograph of left total hip arthroplasty with complete wear of the polyethylene liner and the acetabular socket. The femoral head is mostly contained within the socket (17 years from surgery).

She is a 44-year-old woman with no medical history, nonsmoker, and with a body mass index of 19.9 kg/m$^2$, who presented to our office in 2014 as a referral with left hip pain. Her medical history is significant for a car accident in 1996, in which she sustained a left femoral head and neck fracture as well as ipsilateral femoral shaft fracture. She underwent open reduction and internal fixation for the femoral head and percutaneous screw fixation of the femoral neck fracture. She also underwent a retrograde intramedullary nailing for the femoral shaft fracture. Owing to persistent pain in the left hip, she underwent total hip arthroplasty 1 year later (Fig. 1). Components included DURALOC titanium cementless acetabular shell size 48 mm (Depuy, Warsaw, Indiana), ENDURON polyethylene liner with a 5.9-mm thickness at the dome (Depuy, Warsaw, Indiana), and press-fit anatomic medullary locking femoral stem with a 28-mm cobalt-chrome head (Depuy, Warsaw, Indiana). Gas plasma was the sterilization process used for that particular polyethylene liner. Postoperative course was unremarkable, and she resumed normal activity and work as a guidance counselor in an elementary school.

Patient had excellent clinical results with her hip replacement, until she was seen in 2009 for left hip pain. Radiographs revealed polyethylene wear with impending wear-through; however, no surgical treatment was offered at that time (Fig. 2). She had no further follow-up until 2014, when she returned with a 3-month history of left hip pain and a progressively enlarging painful anterior thigh mass. She denied any infectious signs and symptoms. As a result of the pain, she was dependent on a walker for ambulation. Furthermore, she was unable to work and severely limited even with activities of daily living. Radiographs revealed left total hip prosthesis with complete wear-through of the femoral head through the polyethylene liner and the acetabular component (Fig. 3). Infectious workup resulted negative (normal C-reactive protein and estimated sedimentation rate). She underwent a computed tomography (CT)–guided hip aspiration. CT scan of the hip confirmed the acetabular protrusion of the femoral head and an anterior thigh fluid-filled mass (Fig. 4). Fluid aspiration was noted to be “dark/motor oil” in color and consistency. Samples from the hip joint and mass aspiration were negative for infectious etiology.

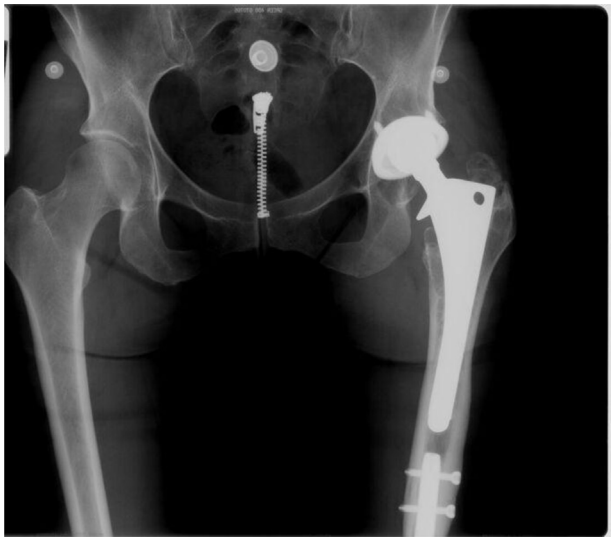

**Figure 2.** Anterioposterior radiograph of original left total hip arthroplasty with impending polyethylene wear-through (12 years from surgery).

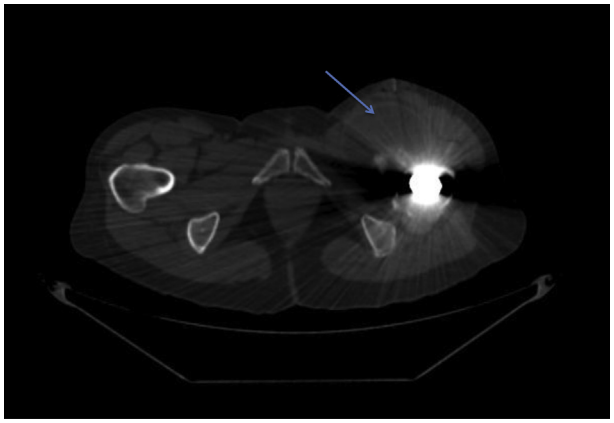

**Figure 4.** Axial computed tomography scan image demonstrating homogenous fluid collection in the anterior compartment of the left thigh (arrow).

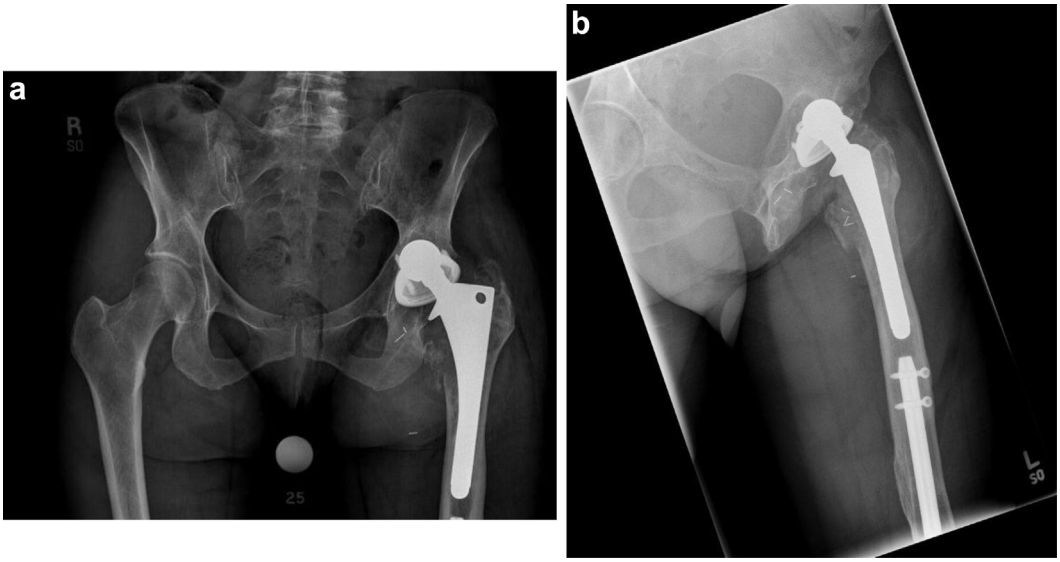


**Figure 5.** Anterioposterior (a) and frog-leg lateral (b) radiographs of left total hip arthroplasty with complete wear of the polyethylene liner and the acetabular socket resulting in femoral head protrusion into the pelvis (3-month interval from Fig. 3)

She was subsequently referred to our practice for revision arthroplasty.

Since her last visit with her original arthroplasty surgeon, her symptoms had worsened and the thigh mass had continued to increase in size. She had a tender, fluctuant mass in the anterior compartment of the thigh, which measured about 10 by 16 cm. She also perceived a leg length discrepancy, with the left leg shorter than the right. Her examination revealed an antalgic gait with leg length discrepancy of 1 cm. She was able to flex to 90°, and her internal and external rotation was limited to 5° because of pain. Initial laboratory values such as complete blood cell count and basic metabolic panel were within normal limits. Repeat imaging revealed worsening protrusion of the femoral head through the acetabular socket (Fig. 5a and b).

After thorough discussion of the surgical options and technical challenges as well as the risks and benefits, the patient elected to proceed with revision surgery. The prior posterolateral approach was used. On entering the joint capsule, there was an expulsion of a large amount of metal-stained black fluid (Fig. 6). There was also significant metal debris about the hip joint with severe secondary remodeling and capsular destruction. Reactive tissue was excised from the joint space. The proximal femur and acetabulum had undergone significant osteolysis. The anterior thigh mass, which was previously seen on CT imaging, was decompressed with the expression of about 500 mL of dark metal-stained fluid. There was no evidence of pseudotumor. The femoral head had eroded through the polyethylene. There was complete erosion of the metal portion of the titanium socket and bony destruction beneath this (Fig. 7a and b). The cobalt-chrome femoral head had no identifiable wear. The femoral stem had good stability, thus did not require revision. The acetabular osteolysis was addressed with 30 mm of particulate bone graft using an impaction bone grafting technique. We used a 56-mm trabecular metal acetabular component (Zimmer, Warsaw, IN) with a 32-mm Longevity polyethylene liner (Zimmer) and a 32-mm femoral cobalt-chrome head (Depuy). With the final implants in position, excellent stability and trialing was achieved. Her 1-cm leg length discrepancy was corrected. Samples sent to pathology revealed synovial tissue with marked metal debris and histolytic reaction. The retrieved acetabular component was 48 mm in diameter, and the femoral head was 28 mm in diameter. The polyethylene liner was severely damaged to determine its size.

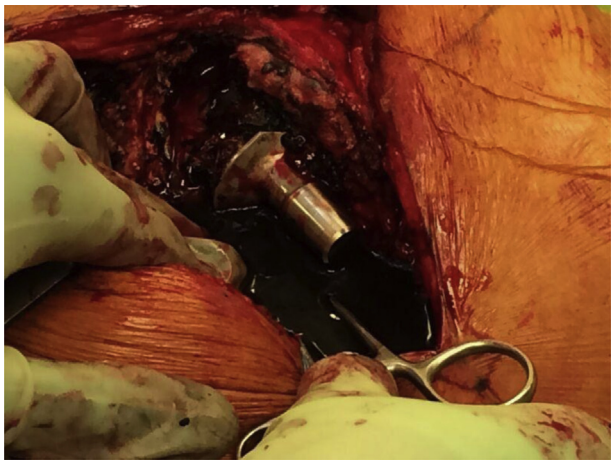

**Figure 6.** Intraoperative photograph demonstrating a large volume of metal-stained fluid and metal debris.

Patient's last follow-up visit was 20 months postoperatively. She was back to full activities without assistive devices. She is pain free and has been very active including jogging against our advice. Radiographs revealed progressive osteointegration of the acetabular socket and particulate bone graft (Fig. 8a and b). She will return every 5 years to monitor her prosthesis or sooner if she experiences any symptoms with her hip.

## Discussion

This is an unusual presentation of catastrophic failure of total hip arthroplasty, with complete wear-through of the femoral head through the polyethylene liner and the acetabular socket. After the polyethylene wear-through, the cobalt-chrome head had come into contact with titanium acetabular socket with eventual wear-through of the acetabular component. The generated debris (polyethylene and titanium) resulted in severe bone destruction and an impressive fluid-filled mass in the anterior compartment of the thigh.

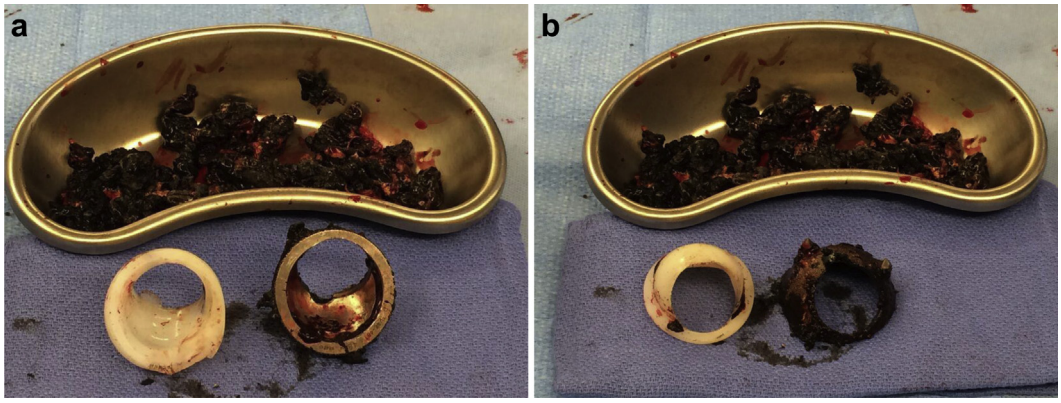


**Figure 7.** Intraoperative photographs of the complete wear-through of the polyethylene liner and acetabular socket with surrounding metal debris. Inner (a) and outer surfaces (b) of the components.

In 2009, the patient was noted to have polyethylene wear with impending wear-through. Often times, arthroplasty surgeons are faced with the decision to perform polyethylene exchange vs complete acetabular revision in asymptomatic patients. There is certainly no consensus in literature. One major concern for isolated polyethylene exchange is postoperative instability and dislocation [21-24]. In contrast, O'Brien et al [25] showed no dislocations with isolated polyethylene exchange. It is worth mentioning that usually patients spend less hospital days and decreased blood loss with polyethylene exchange alone [26]. Discussion with patients is important in discussing the risks and benefits of the 2 procedures. In our practice, we elect to proceed with polyethylene exchange alone when possible if significant wear is identified during surveillance postoperative imaging. Certainly, modular exchange or component revision should be offered earlier to avoid this sort of catastrophic progression of wear.

As mentioned earlier, this case underscores the importance of radiographic follow-up especially with the rising number of total hip arthroplasty in the younger population. In the United States, there are no established guidelines on follow-up for total hip patients. It is often surgeon dependent by taking into account patient factors and implants used. The American Association of Hip and Knee Surgeons recommends follow-up in every 3-5 years [27]. The British Orthopaedic Society has different recommendations depending on the Orthopaedic Data Evaluation Panel rating. Implants rated 10A should be followed up in the first year, once at 7 years, and every 3 years in asymptomatic patients without adverse radiographic signs. The rest of the implants are typically followed annually for the first 5 years, every 2 years for the second 5 years, and then every 3 years thereafter [28]. A 10A rating is awarded to implants as part of a cohort study with a minimum of 500 hips with survivorship better than or equal to 90% at 10 years [29]. In our practice, we follow our patients postoperatively at 6 weeks, 6 months, 1 year, 2 years, and then every 5 years. The follow-up becomes especially important in the younger population with the risk of wear being higher due to higher level of activity [9]. In patients with evidence of wear, closer follow-up is recommended to allow intervention before catastrophic failure.

## Summary

We presented a case of catastrophic hip failure with an associated thigh mass, which significantly had debilitated the patient. Radiographic polyethylene wear was observed a few years prior before she progressed to complete failure. That moment could have been a good opportunity to discuss polyethylene or acetabular revision. In the ever-growing arthroplasty population, surveillance becomes a very important tool to prevent such catastrophic failure. Patient ultimately underwent revision arthroplasty with excellent results.

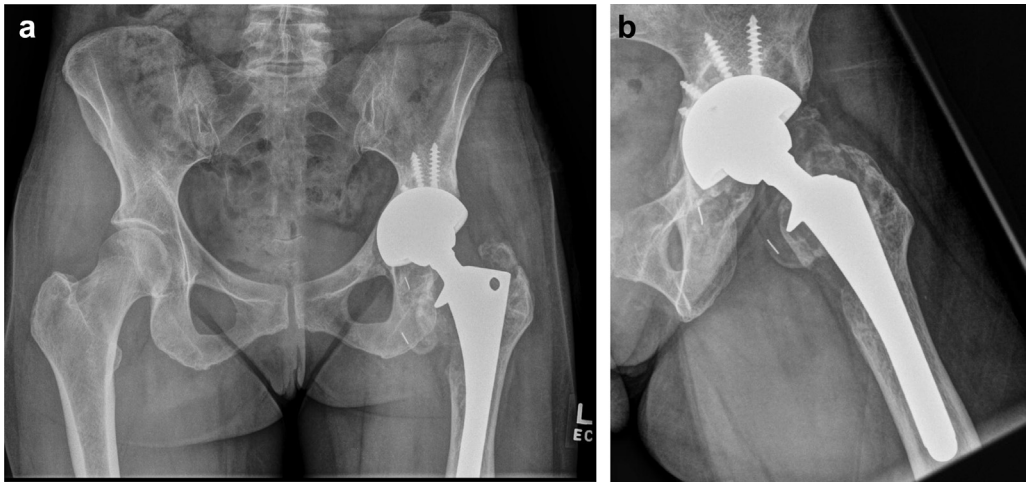


**Figure 8.** Anteroposterior (a) and frog-leg lateral (b) radiographs of the left hip revision arthroplasty 20 months postoperatively showing progressive healing of the bone graft and incorporation of the ingrowth acetabular component.

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