Extraction of a Fractured, Well-Fixed Femoral Stem Using a Lateral Cortical Window Technique in Revision Hip Arthroplasty: A Case Report

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Learning Point of the Article:

In prosthetic fractures occurring at the metaphyseal-diaphyseal junction, creating a lateral cortical window maintains cortical integrity, eliminates the need for an extended trochanteric osteotomy, and allows direct access to the distal well-fixed stem. This approach is easy to replicate and significantly reduces operative time in complex revision hip arthroplasties.

Abstract

Introduction: Fractures of hip prostheses have been well established in medical literature. Various biomechanical studies have shown that the highest concentration of stress occurs over the lateral aspect of the middle third of the femoral stem. Complications at this focal point include stem subsidence, cortical breach, or perforation. The purpose of this report is to describe a modified technique using a lateral cortical window for the extraction of a fractured femoral stem of a hemiarthroplasty.

Case Report: We present a case of a 61-year-old female who complained of pain in the right thigh and difficulty walking, climbing stairs, and sitting cross-legged for 1 year. She had undergone right hip hemiarthroplasty 14 years ago for a neck of femur fracture elsewhere. On radiographs, she was diagnosed with a fracture of an Austin–Moore type prosthesis distal to the lesser trochanter. A revision total hip replacement was performed. The broken stem was retrieved by making a lateral cortical window using a high-speed burr. Extraction was performed using retrograde impaction by creating craters over the exposed stem using a tungsten carbide drill, and reconstructed with a diaphyseal long stem with a dual mobility cup and head.

Results: Immediate post-operative weight bearing was permitted. On X-rays, the cortical window showed good union, and with a Harris Hip score of 88, she was able to perform all her routine activities at 3 months. At 1 year after surgery, she is comfortable and asymptomatic.

Conclusion: Creating a lateral cortical window combined with retrograde impaction provides a reliable, bone-preserving method for the extraction of a fractured, well-anchored femoral stem in revision hip arthroplasty procedures.

Keywords: Femoral stem fracture, revision hip arthroplasty, cortical window.

Introduction

Fractures of hip prostheses have been well established in medical literature. The incidence of these failures ranges between 0.23% and 11% [1,2]. The peak stress concentration lies over the lateral aspect of the middle third of the stem as per various biomechanical studies [3]. These failures may occur due to varus position of the stem, deficient cement, overweight patients, metallurgical deficiency, or osteolysis of the bone [4]. With the introduction of modern cementing techniques and the evolution of metal alloys, the incidence of stem fracture after hip replacement has reduced significantly [2]. There are a few cases that present with a fracture of the stem of an Austin–Moore type

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Figure 1: Pre-operative radiographs showing a fracture of the long stem prosthesis distal to the lesser trochanter in the metaphyseal-diaphyseal region. In the frog-leg lateral view, a partial breach of the lateral cortex is observed (white arrow).

prosthesis.

Removal of a fractured femoral stem is technically demanding, time-consuming, and often involves compromising the bone biology of the proximal femur. An Extended Trochanteric Osteotomy is a commonly described method of extraction, but this technique has significant drawbacks such as extensive cortical flap creation, blood loss, non-union, abductor mechanism weakness, need for longer diaphyseal stems and delayed mobilization [5]. Multiple methods for extracting intact femoral components have been described in the literature, but few established approaches address the challenges of retrieving fractured stems.

In this report, we present a case of a fractured stem of an Austin–Moore type prosthesis and the extraction techniques we used in the revision hip arthroplasty in order to preserve the proximal bone biology, permit early weight bearing, and reduce the incidence of subsidence or iatrogenic fractures.

Case Report

A 61-year-old female presented to us with pain in the right thigh associated with difficulty walking, climbing stairs, and sitting cross-legged for 1 year. Her lifestyle as a monk required sitting on the floor for extended hours. She was a known case of hypertension and had a surgical history of a right hip uncemented hemiarthroplasty 14 years ago for a neck of femur fracture done outside our hospital. On pre-operative radiographs, an Austin–Moore type long stem component prosthesis was found fractured distal to the lesser trochanter with loosening, osteolysis, and evident lateral partial cortical breach of the proximal part of the stem (Fig. 1).

After ruling out infection, a single-stage revision surgery was planned. A modified Hardinge approach was used. The femoral head was dislocated while putting a bone hook around the neck to prevent a fracture around the peritrochanteric area during dislocation. The shoulder of the prosthesis was cleared of soft tissue and bone. An osteotome was used to separate the proximal broken stem from the bone, which was delivered out using a universal stem extraction system with a bone hook, slap hammer, and closed-loop stem extractor.

We first attempted the trephine technique using K-wires around the distal broken stem to loosen it, but we were unsuccessful (Fig. 2). The skin incision was then extended, and a 4 × 2 cm cortical window was created through the lateral femoral cortex distal broken stem centered along its longitudinal midpoint using a high-speed burr. A tungsten carbide drill was used to create two craters over the prosthesis, and with the use of an osteotome, the broken stem was engaged and hammered proximally through the canal and delivered out. The cortical

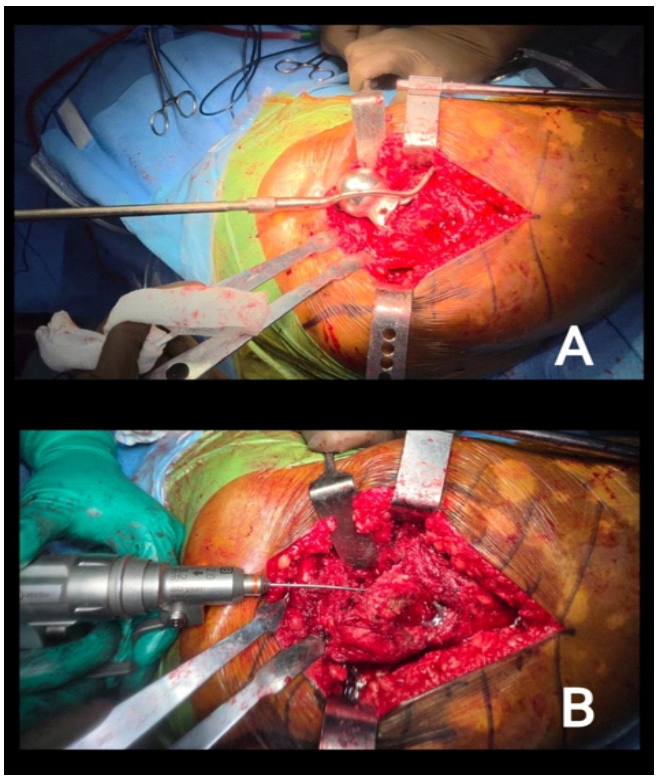

Figure 2: Intraoperative images demonstrating the universal stem extraction system using a bone hook, slap hammer, and a closed stem extractor to remove the proximal fractured prosthesis (a). In the fourth image, an intramedullary trephine technique is undertaken with K-wires to loosen the distal stem prosthesis (b).

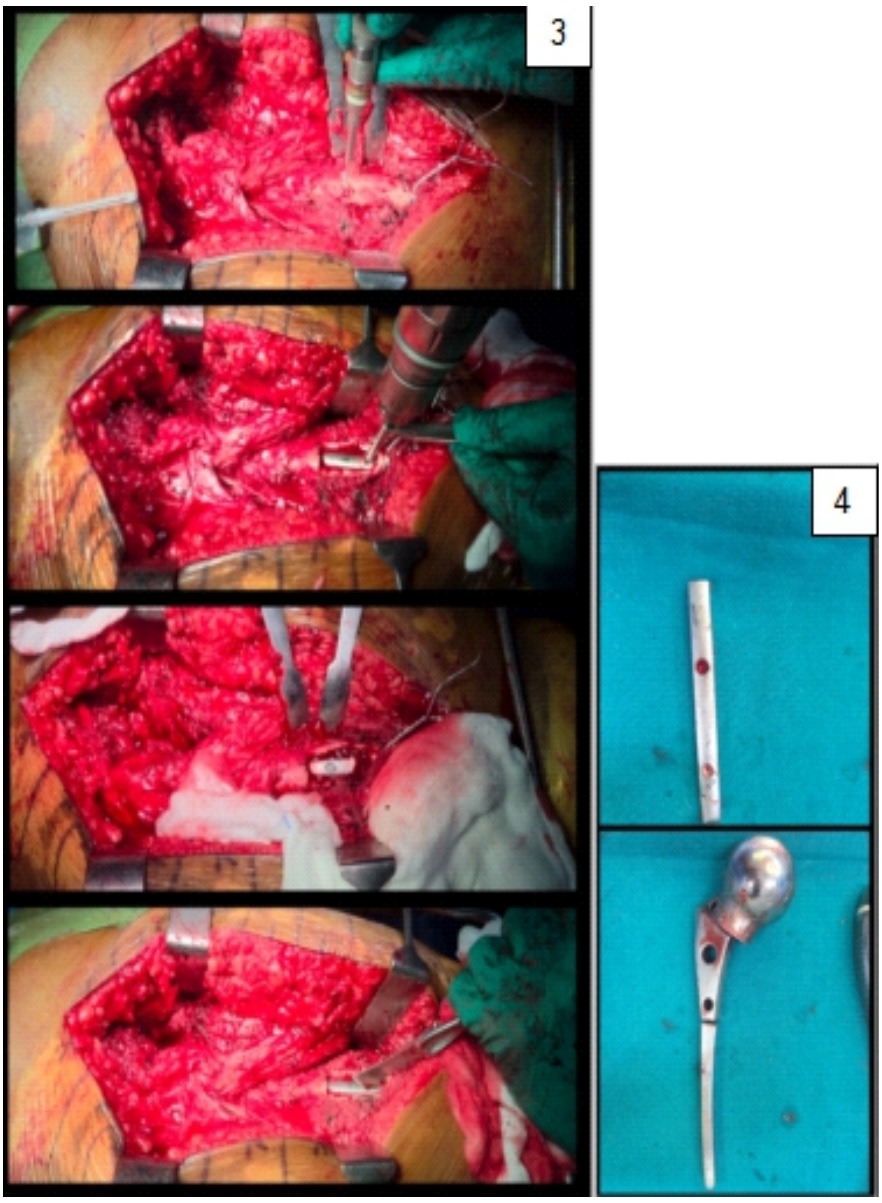

Figure 3: Intraoperative images showing a 4 × 2 cm lateral cortical window created using a high-speed burr and a crater made over the surface of the stem to allow stable engagement of an osteotome at an angle of 45° and undergo retrograde impaction for extraction.
Figure 4: Images of the fractured prosthesis removed.

window was repositioned and secured with cerclage wires (Fig. 3 and 4). A long diaphyseal stem was then press-fitted, and a dual mobility cup with ceramic head was implanted. The construct was stable and reinforced proximally over the greater trochanter with cerclage wires. The wound was closed using Vicryl, and the procedure was uneventful without any complications. The patient was mobilized and permitted full weight bearing over the operated leg the day after surgery with support of a walker (Fig. 5). At 6 weeks, she mobilized unaided and had a Harris Hip Score of 76. At the 3-month follow-up, she had good functional mobility with a Harris Hip Score of 88, with radiographic evidence of osseointegration, no subsidence or loosening with good alignment and position (Fig. 6). At a routine follow-up 1 year after surgery, she had no difficulty performing any physical activities and is satisfied with her surgical outcome.

Discussion

Fracture of the femoral stem in a hip hemiarthroplasty is a rare complication, and its extraction is one of the crucial steps in a revision hip arthroplasty. This type of failure could be due to mechanical failure, excess patient weight, high levels of physical activity, loosening or osteolysis, malposition of the components, or the presence of stress risers [3]. Stem fractures can occur at various sites, namely the femoral neck, junction between the modular neck and the stem, and at the metaphyseal-diaphyseal junction [6]. Removal of well-fixed components can be time-consuming, demanding, and could damage the remaining host bone.

Younger et al., in their landmark paper, described extended trochanteric osteotomy as a procedure for revision hip arthroplasty, and it is now one of the most common procedures performed for femoral stem extraction [7]. Complications in this procedure include lack of preservation of the proximal bone biology, abductor mechanism weakness, operative morbidity, and delayed weight bearing [8]. Paprosky et al. demonstrated an increase in stem fractures in revision hip arthroplasty after performing an ETO due to a reduction in proximal cortical support to the stem [5].

Laffosse elucidates a trephine technique via the intramedullary canal with K-wires and flexible osteotomes to loosen the stem from the bone-implant interface [6]. This technique does not address the extraction complexity in cases of longer stems and the higher incidence of iatrogenic fracture. Moreland et al. described a posterior cortical window to expose the distal broken stem and perform retrograde impaction, but this involved a posterior exposure during dissection [9]. Paumier and Doré developed a sarcophagus technique, where a series of lateral cortical windows were cut in order to access the long stem component while preserving the continuity of the cortex [10]. Although this technique addressed the longer stem

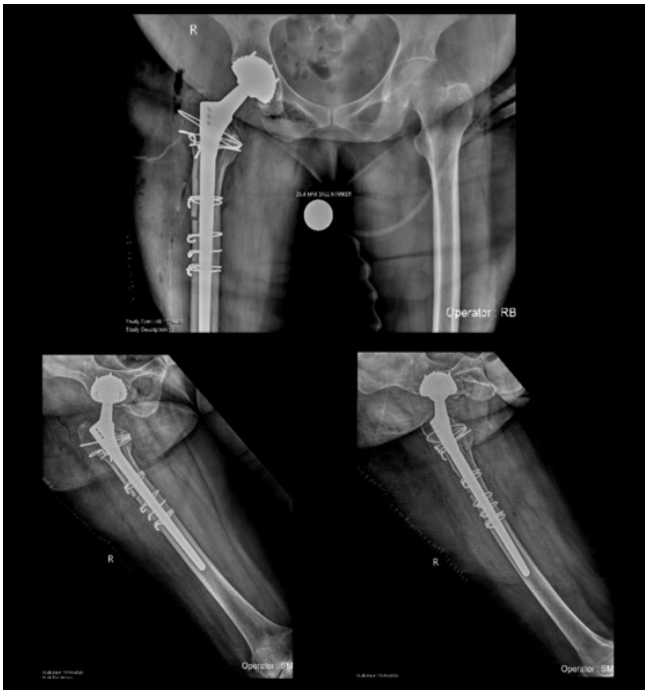

Figure 5: Post-operative radiographs in anteroposterior and lateral views of the right hip taken after weight bearing. A stable diaphyseal stem is seen with cerclage wires of the greater trochanter, with 3 cerclage wires over the cortical window and one cerclage wire above the window. An uncemented dual mobility cup and head are also seen.

Figure 6: Radiographs at 3 months after revision surgery showing a stable implant, with a maintained alignment and satisfactory osseointegration with no subsidence or loosening. The accompanying pictures show the patient comfortably capable of sitting cross-legged on the floor and on an examination couch.

extraction, it fails to address the risk of non-union, iatrogenic fracture, and delayed weight bearing.

In our procedure, we used rigid osteotomes to loosen and extract the proximal prosthesis along with the universal stem extraction system. Under radiographic guidance, using a Midas Rex high-speed burr, a lateral cortical window was created distal to the site of the fractured stem to access the long stem component. This crater was used to allow stable engagement of an osteotome into it at an angle of 45° and hammer out the stem via retrograde impaction. The cortical window was reaffixed and secured with 3 cerclage wires. We chose a long diaphyseal Wagner-type stem due to the initial component having a long stem and the cortical window being distal to the metadiaphyseal segment. This type of implant reduces the occurrence of stress risers. A dual-mobility cup and head were chosen as the patient expressed her desire to continue sitting cross-legged in order to pray. The limitations of our case were the requirement of revision hip instrumentation, equipment designed for the cortical window creation, which is not routinely accessible, a single case design, and a short follow-up duration. Further investigations through case series and biomechanical studies to validate this technique are warranted.

Conclusion

Fractured femoral stem extraction is a challenging orthopedic procedure. Many techniques have been described for revision hip arthroplasty. For fractures at the metaphyseal-diaphyseal junction, a lateral cortical window preserves the continuity of the cortex, negates the need for an extended trochanteric osteotomy, and provides the surgeon with direct access to the distal well-fixed stem. This technique is easily reproducible and time-saving in most complex revision hip arthroplasty cases.

Clinical Message

A lateral cortical window with retrograde impaction provides a reproducible, bone-preserving method for the extraction of a fractured, well-fixed femoral stem in revision hip arthroplasty procedures.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for her images and other clinical information to be reported in the journal. The patient understands that her names will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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