

Management of a Chronically Infected and Unstable Revision Hip Prosthesis with Total Femur Arthroplasty and Antibiotic Cement – Case Report and Review of the Literature

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Abstract: Background: Infection, instability, periprosthetic fracture, and severe bone loss are troublesome issues in revision hip arthroplasty. The occurrence of all four together represents a unique therapeutic challenge.

Literature Review: Total femoral arthroplasty is described following tumor resection and in revision arthroplasty with severe bone loss. In these complex cases infection remains a significant concern with rates between 0 and 47% reported. For cases with infection, 2-stage revision procedures have been developed using antibiotic beads or custom total femur antibiotic spacers. However, these techniques involve long periods of non-weight-bearing that may be poorly tolerated in an older population.

Case Presentation: A patient with a chronically infected and dislocating long-stemmed revision hip arthroplasty presented with a severely comminuted distal femur fracture. A 1-stage revision was successfully performed using a modular total femur prosthesis coated with antibiotic cement.

Conclusion: This is the first reported instance of a successful 1-stage revision for infection and severe bone loss using total femur prosthesis. This technique may allow for early mobilization and the avoidance of multiple surgical procedures.

Keywords: Total Femur Arthroplasty, Revision Arthroplasty, Infection, 1-Stage Revision, Hip Arthroplasty.

BACKGROUND

Total femoral arthroplasty (TFA) has been described following femoral resection for bone tumors [1-6] as well as in cases of revision arthroplasty with severe bone loss [7-9].

The problem of revising infected implants with TFA has been addressed using 2-stage protocols but involve long periods of non/partial weight bearing and high dislocation rates [7, 10].

While single stage revision has been performed for infected hip [11-13] and knee [14-16] arthroplasty with good results, 1-stage revision with TFA has not been explored. Proposed advantages of this approach include avoidance of multiple surgical procedures, improved cost-effectiveness, reduced stiffness, and improved function and patient satisfaction.

This case report is the first to describe a single stage revision of an infected and unstable revision hip arthroplasty with severe bone loss using TFA with antibiotic cement.

CASE PRESENTATION

Patient History

The patient was a 72-year-old female previously known for anxiety, chronic obstructive pulmonary disease and gastroesophageal reflux.

She had a long history of problems with her left hip presented in Figure 1.

In summary, the patient suffered a displaced fracture-dislocation of the femoral neck in 1996 that was treated with open reduction and internal fixation. She then developed a pseudo-arthrosis and Brooker grade 4 heterotopic ossification.

In 1998 she had a total hip arthroplasty with ectopic bone excision through a combined anterior/ posterior approach.

The patient was well until 2000 when she developed progressive pain. This was investigated with blood tests and bone-gallium scan which were negative. She subsequently underwent total revision arthroplasty in 2002 for aseptic loosening. A 28mm femoral head was used and peri-operative cultures were negative.

Less than two weeks following the revision procedure the patient dislocated her hip posteriorly. She was treated with closed reduction and limitations

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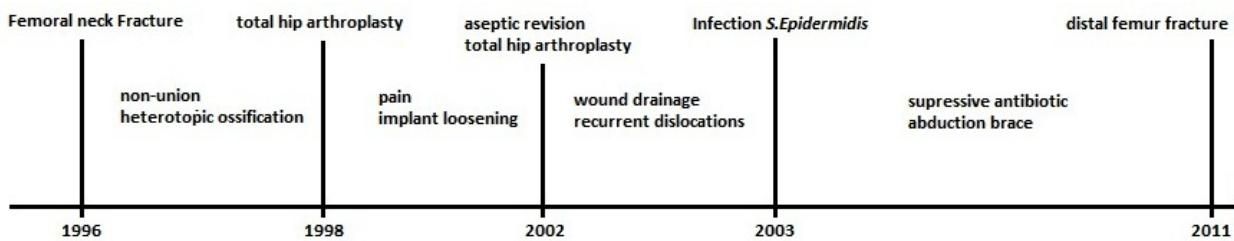


Figure 1: A Timeline Flowchart of the Patient's Evolution from a Femoral Neck Fracture-Dislocation to a Chronically Infected, Unstable Revision Hip Arthroplasty.

for flexion, adduction, and internal rotation. The patient also reported discharge from the operative site that persisted for 2 months and was treated with a 10-day course of Cephalexin. A repeat work-up for infection was not completed at this time.

The patient developed recurrent dislocations (9 times in 2002/2003) and was prescribed an abduction orthosis. She was able to ambulate short distances with a cane but was severely limited in her activities.

In 2003, the patient presented at another hospital for a second opinion. An infectious work-up revealed a large collection of fluid (7x5x6cm) in contact with the femoral prosthesis and evidence of a fistula tract extending laterally to the surgical scar. An aspiration and culture was performed and grew *Staphylococcus epidermidis*.

Treatment options were discussed with the patient at that time and she opted for suppressive antibiotics. Trimethoprim-Sulfamethiazole was prescribed as long-term therapy.

Current Episode

In March 2011, the patient fell and sustained a severely comminuted intra-articular fracture of the left distal femur. Osteosynthesis was impossible so the distal femur was temporarily replaced with an antibiotic cement spacer and the patient was transferred to our institution for management.

Our initial evaluation demonstrated no significant leg length discrepancy, no evidence of infection, and a normal neurologic and vascular exam.

Anteroposterior and lateral radiographs of the left hip, femur and knee were performed and showed a revision hip arthroplasty with displaced distal femur cement spacer (Figure 2). The greater trochanter was absent and the overall bone quality was suboptimal. There was inadequate bone for fixation of a distal femoral prosthesis.



Figure 2: AP radiograph of the chronically infected revision hip arthroplasty and distal dislocated prosthetic. Of note is the bone loss, in particular the loss of the greater trochanter as well as the distal femur following a complex fracture.

The infectious disease service was consulted and the patient's suppressive antibiotic was continued. Nineteen days post-operatively, the white blood cell count was normal and CRP slightly elevated at 9.7. A guided aspiration of the hip joint was performed and returned 3ml of cloudy fluid. Cultures were positive for *Staphilococcus epidermidis*.

After discussion with the consultants and the patient it was determined that a single-stage revision procedure with a total femoral prosthesis coated in antibiotic cement was the best treatment option.

The goals were:

- 1) Eradication of prosthetic infection
- 2) Treatment of recurrent hip dislocations
- 3) Treatment of distal femur fracture

- 4) Early mobilisation

- 5) Avoidance of multiple surgical procedures

The surgery was performed under general anesthesia with the patient in right lateral decubitus. Purulent material was found in contact with the proximal aspect of the prosthesis and two deep cultures were taken. The abductor mass was atrophied and the acetabulum was easily removed by hand. A thorough debridement of all foreign material, bone, and necrotic material was performed followed by jet-lavage with saline (Figure 3).

A trial Zimmer modular prosthesis (Zimmer® Segmental System) was constructed and adjusted according to muscle tension and hip stability. The definitive prosthesis was coated along the entire shaft with cement impregnated with 4g Tobramycin (Antibiotic Simplex, Stryker) and allowed to dry before

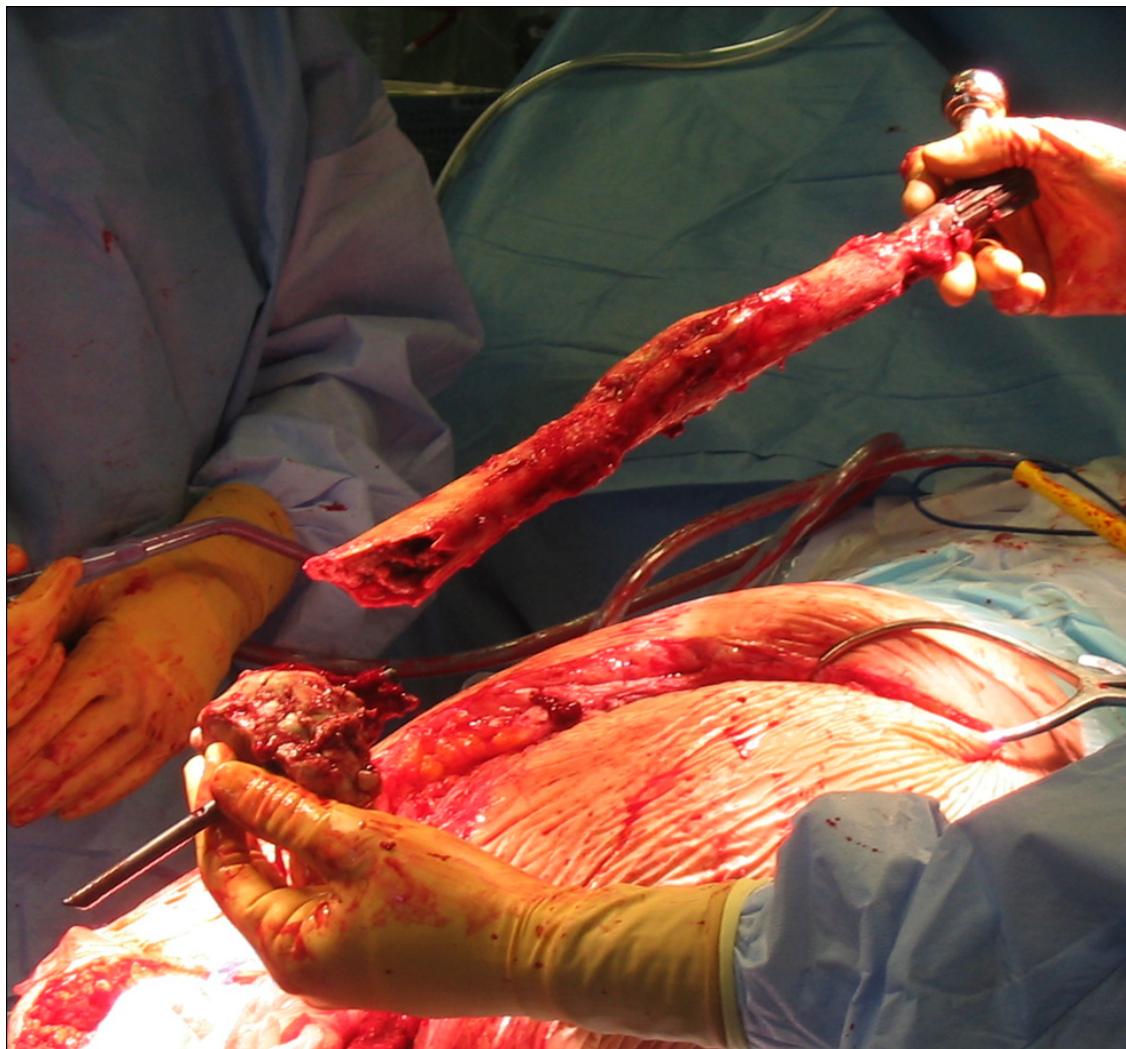


Figure 3: Peri-operative view of the removed femur and prostalac.

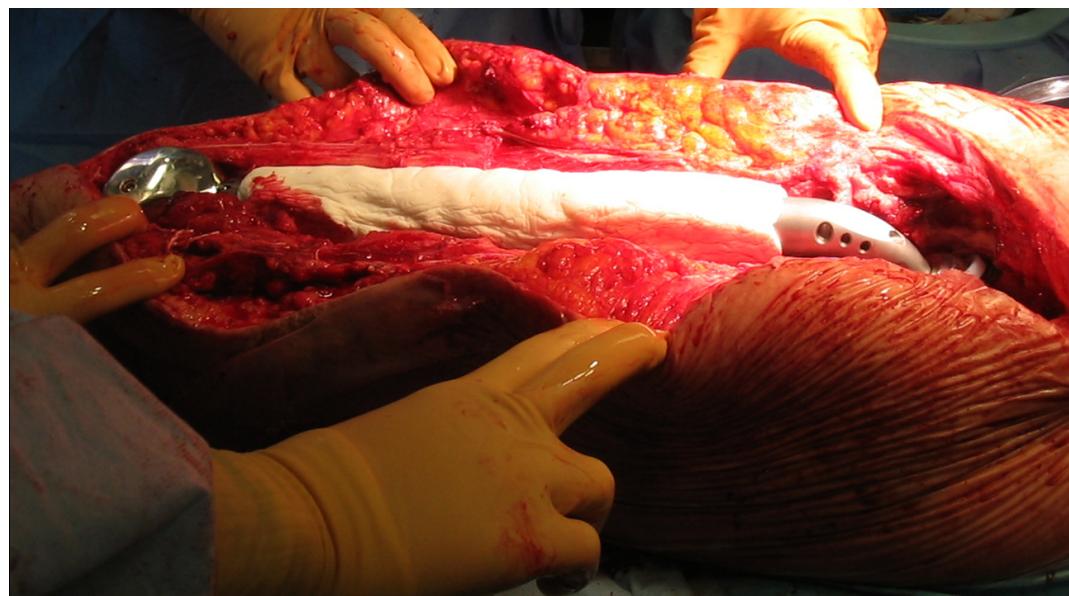


Figure 4: The total femur prosthesis coated with antibiotic cement in final position.

insertion into the patient (Figure 4). A 36mm femoral head was used and peri-operative movement and stability of the hip were excellent.

The patient's suppressive antibiotic therapy was stopped and Vancomycin prophylaxis was administered for 72 hours. Full weight-bearing was begun immediately but no flexion $\leq 90^\circ$, internal rotation, or active abduction was permitted for 6 weeks. She suffered no complications aside from a hematoma that drained spontaneously on postoperative day 6. Both perioperative cultures were negative.

At her 25 month follow-up the patient was ambulating pain free with a cane. She reported no instability and was very satisfied. The surgical site was healed and ESR and CRP at 17 months were normal. Follow-up radiographs were unremarkable.

DISCUSSION

The patient in this case presented with three major problems: severe proximal and distal femoral bone loss, recurrent hip dislocations, and chronic infection. These were successfully managed with a 1-stage revision procedure using TFA coated with antibiotic cement.

TFA and Severe Bone Loss

Our patient presented with severe bone loss secondary to a revision hip prosthesis, peri-trochanteric osteolysis, and a comminuted distal femur fracture treated by excision and cement spacer. The remaining

bone was of poor quality likely as a result of stress shielding combined with chronic infection.

TFA has been used since 1965 to manage severe bony deficits due to resection of bone tumors [1-6], or complex revision arthroplasty [7-9]. As with our patient, this remains a valid option to manage severe bony deficit but is associated with 9-14% [7-9] infection in the aseptic revision. In these cases, consideration may be given to coating the TFA with antibiotic cement to reduce the risk of post-operative infection primarily.

TFA and Recurrent Dislocation

Our patient presented with a chronically dislocating hip prosthesis. This was likely secondary to a combination of factors including an incompetent abductor mechanism, inadequate anteversion of the acetabular component, a small femoral head, and a loose chronically infected prosthesis.

While TFA has been associated with 0-12% recurrent dislocations [6] this was often with custom-made prosthesis that allowed little to no modification peri-operatively. The modularity of the prosthesis used in this case allowed for multiple factors contributing to instability to be addressed at the same time: anteversion of the femoral component; length of the prosthesis and soft tissue tension; and femoral head size [17]. The incompetence of the abductor mass cannot be addressed with these manoeuvres but should instability persist, a constrained [18] or dual mobility [19] prosthesis may be considered.

TFA and Infection

Our patient presented with a chronically infected hip prosthesis as defined by the Musculoskeletal Infection Society (MSIS) workgroup on prosthetic joint infection(PJI) [20]: a sinus tract demonstrated on infectious workup in 2003 and a pathogen isolated by culture from two separate samples. Unfortunately the peri-operative cultures did not grow but the patient was under chronic suppressive antibiotic therapy at the time and few samples were taken.

While revision to TFA in the septic hip arthroplasty has been explored in the literature, only 2-stage protocols have been discussed. Fountain *et al.* [7] was successful in eradicating infection in 86% of cases (12/14) but had recurrent dislocations in 43% (5/14). Sherman *et al.* [10] also described a case using a custom total femur spacer but required a prolonged period of partial weight bearing (3 months).

Single stage revisions have multiple advantages including avoidance of multiple surgical procedures, improved cost-effectiveness, and improved function and patient satisfaction. Single stage revision has been performed for infected hip [11-13] and knee [14-16] arthroplasty with 83-100% success in eradication of infection, but single stage revision for the infected hip arthroplasty with TFA has not been explored.

The Importance of a thorough debridement in the setting of infection cannot be overemphasized. Additionally, dead space management [12] is primordial to eliminate foci of avascular tissue or seroma that can serve as a start point for infection recurrence. TFA involves the removal of the entire femur and allows for excellent exposure to perform a thorough debridement of surrounding muscle and fascia. The addition of antibiotic cement helps fill the dead space in the thigh and allows for the delivery of high-dose local antibiotics for an extended period.

CONCLUSION

This case describes a 1-stage revision of an infected and unstable revision hip arthroplasty with severe bone loss using total femur arthroplasty.

A 1-stage modular TFA with antibiotic cement coating is a reasonable option for management of extreme cases with severe bone loss, recurrent dislocation, and chronic infection. Advantages of include early mobilization, improved cost-effectiveness, and improved function and patient satisfaction.

Additionally, TFA remains a limb salvage procedure with high reported complication rates. Coating TFA with antibiotic cement offers no mechanical disadvantage and may be considered in primary prevention of infection.

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