

Case Report

Management of infected nonunion neck of femur fracture on an ipsilateral above knee amputation limb planned for total hip arthroplasty

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Background

Total hip arthroplasty (THA) is widely used to alleviate pain and restore mobility in patients with advanced hip pathologies. However, performing THA in patients with ipsilateral above-knee amputations (AKA) complicated by infected nonunion neck of femur fractures and avascular necrosis (AVN) presents significant challenges. These include addressing infection control, anatomical alterations, and increased mechanical demands on implants.

Case Presentation

We report a case of a 22-year-old male with an ipsilateral AKA following a motor vehicle accident, which resulted in a closed neck of femur fracture, open supracondylar femur fracture, and open midshaft tibia fracture. Initial surgical management involved screw fixation and external fixation; however, subsequent gangrene necessitated AKA. Persistent infection at the femoral neck site was treated with multiple debridement procedures, antibiotic therapy, and first-stage revision surgery using an antibiotic-loaded cement spacer. After confirming infection eradication via negative cultures and a low CRP level, second-stage revision THA was performed. A dual-mobility liner and cemented femoral stem were utilized because of osteopenia and concerns over abductor muscle

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integrity. Postoperatively, the patient demonstrated excellent functional recovery and regained independent mobility with the prosthesis.

Discussion

THA in patients with ipsilateral AKA poses unique surgical challenges including stump manipulation, femoral preparation, and infection control. Two-stage revision surgery remains the gold standard for managing chronic infections, and a multidisciplinary approach is critical for success. Dual-mobility implants and precise preoperative planning are key to achieving stability and function in such cases.

Conclusion

This case highlights the feasibility and positive outcomes of THA in complex scenarios involving the ipsilateral AKA and infection. Meticulous infection management, careful implant selection, and individualized rehabilitation plans are pivotal in achieving functional recovery and improving quality of life. This report underscores the importance of a tailored approach in managing such challenging cases.

INTRODUCTION

Total hip arthroplasty (THA) is a well-established and effective procedure aimed at alleviating pain and improving mobility in patients with advanced hip joint osteoarthritis, fractured femoral neck, or avascular necrosis (AVN) of the femoral head (Ferguson et al. 2018). However, limited data exist regarding the technical challenges and outcomes of performing THA in patients with ipsilateral above-knee amputations (AKA) complicated by infected nonunion neck of femur fractures. Younger amputees often have greater functional demands than older patients and require implants to withstand increased stress while carrying a higher risk of revision surgery and dislocation. Performing THA in this population necessitates a meticulous and comprehensive approach because of the unique challenges these cases present (Di Martino et al. 2024). This report details the outcome of THA performed on a limb with an AKA complicated by an infected nonunion neck of femur fracture and AVN of the femoral head.

CASE PRESENTATION

A 22-year-old man presented to our hospital in December 2020 following a motor vehicle accident. The patient had no significant medical, family, or allergy history. He worked in a metal factory and occasionally smoked. The sustained injuries included a closed fracture of the right neck of the femur, an open right supracondylar femur fracture (Gustilo 3C), and an open midshaft fracture of the right tibia (Gustilo 2) (Figures 1, 2, and 3).

Initial management involved screw fixation of the femoral neck, wound debridement of the right thigh, and placement of an external fixator across the right knee (Figures 4 and 5), followed by a one-week course of intravenous cefuroxime. By January 2021, the right leg had become gangrenous and deemed nonviable. Right above-knee amputation (AKA) with adductor myodesis was performed, followed by intravenous cefuroxime for another week.

In May 2021, the patient presented with wound breakdown at the AKA stump and purulent discharge at the femoral neck screw fixation site. Surgical interventions in-

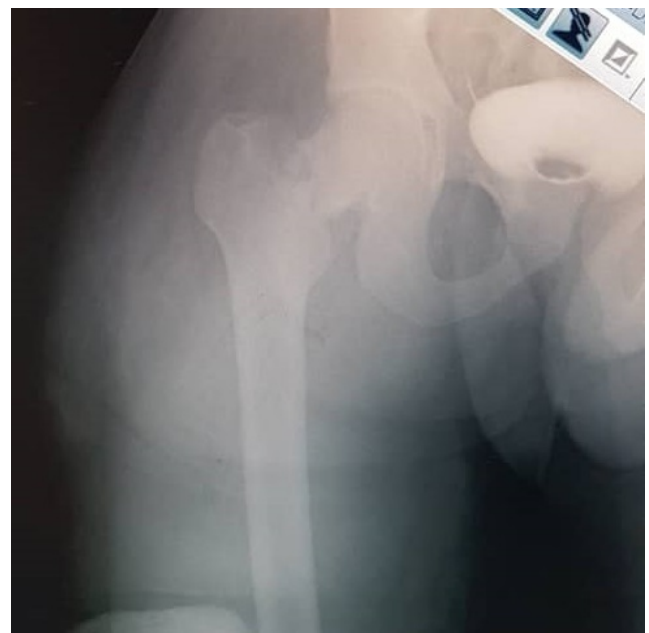


Figure 1

cluded debridement of the right thigh, right hip arthrotomy and washout, and removal of cannulated screws to treat septic arthritis of the right hip. Laboratory tests showed a CRP of 147 mg/L, and cultures isolated *Enterobacter cloacae*, which was treated with a six-week course of intravenous Tazocin. Given the advanced stage of femoral head AVN and persistent infection, THA was deemed the most suitable treatment option because alternatives such as core decompression with vascularized bone grafting or derotation osteotomy were not feasible. The patient was scheduled for two-stage revision surgery, and the associated risks and complications, particularly at a young age, were explained to him.

FIRST-STAGE SURGERY

The first-stage revision surgery was performed in December 2021. Preoperative radiographs (Figure 6) revealed an AVN of the right femoral head, nonunion of the femoral neck,



Figure 2



Figure 4



Figure 3



Figure 5

and osteopenia of the proximal femur. Surgical procedures included debridement of the AKA stump and removal of the native femoral head, followed by the insertion of an antibiotic-loaded cement spacer. Postoperative cultures again identified *Enterobacter cloacae*, necessitating a six-week course of intravenous Meropenem. A postoperative radiograph (Figure 7) showed the placement of an articulated antibiotic-loaded cement spacer. By February 2022, after a two-week antibiotic-free period, the patient's CRP level had

decreased to 18.2 mg/L. Hip aspiration performed in June 2022 showed a further decrease in CRP to 10.2 mg/L, with negative cultures.

SECOND-STAGE SURGERY

In July 2022, second-stage revision surgery with THA was performed. The intraoperative alpha-defensin test results

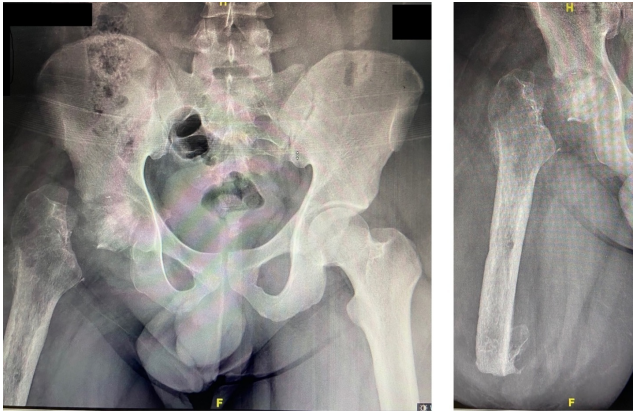


Figure 6

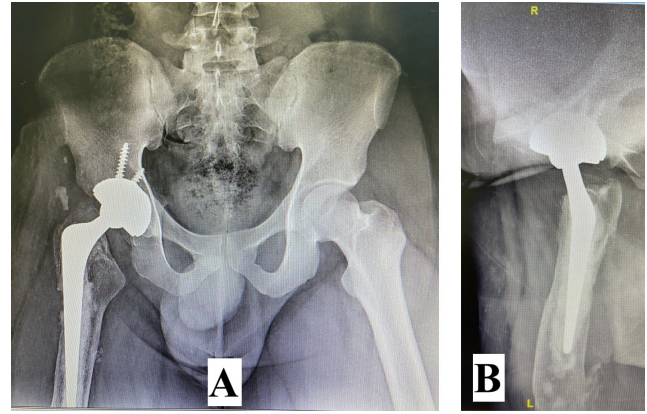


Figure 8



Figure 7



Figure 9

were negative. The patient was placed in the lateral decubitus position and surgery was performed under combined spinal-epidural anesthesia. A direct lateral approach was used because of existing surgical scars on the lateral aspect of the right hip. The cement spacer was securely fixed and removed using an OSCAR Cement Removal System (DePuy Synthes, Warsaw, IN, USA) and curved osteotomes. The OSCAR system uses high-frequency vibrations to efficiently loosen bone cement, preserve native bone, and optimize surgical outcomes (DePuy Synthes, n.d.).

The femoral canal was thoroughly irrigated with saline before acetabular preparation. A 46-mm uncemented acetabular shell was aligned with the transverse acetabular ligament. Bone-holding forceps were used to clamp the proximal femur, aid femoral stem preparation, and reduce the components. The residual proximal femoral stump measured 220 mm, allowing for the use of a 150-mm cemented femoral stem secured with Simplex P bone cement containing 1 g of tobramycin. The lateral cortex of the femur at the previous screw insertion site was plugged manually during cementation. Component anteversion was determined using the Ranawat test (Ranawat and Maynard 1991), and hip stability was confirmed using the Shuck test. A dual-mobility liner was used because of concerns regard-

ing abductor muscle integrity from multiple prior surgeries. The final construct included a 36-mm dual-mobility liner and 22-mm femoral head. Postoperative radiographs (Figure 8) confirmed the appropriate implant placement. Postoperatively, intravenous Cefuroxime was given for three days followed by oral Cefuroxime for three weeks.

The patient's postoperative course was uneventful. He was fitted with a right transfemoral prosthesis three months post-surgery and followed up for two years, with radiographs at the two-year mark showing stable implants (Figure 9). Table 1 summarizes the injuries, diagnoses, investigations, and treatments of the patients. Although the patient had transitioned from his previous occupation as a metal factory worker to an administrative clerk, he resumed an active lifestyle, performing fitness exercises, riding a motorcycle, and climbing stairs with his prosthesis, albeit with some modifications.

Table 1. Summary of events for the patient

Timeline	Clinical features, diagnosis, and surgical treatment	Investigation results and antibiotics
December 2020	Diagnosis – Close right neck of femur fracture, open right supracondylar femur fracture Gustilo 3C and open fracture mid shaft right tibia Gustilo 2. The patient underwent screw fixation of the right neck of the femur, wound debridement of the right thigh, and across right knee external fixator.	Intravenous Cefuroxime for one week.
January 2021	The right leg was not viable postoperatively, and he subsequently underwent right AKA.	Intravenous Cefuroxime empirically for one week.
May 2021	Presented with wound breakdown over his right AKA stump and pus discharge from the screw fixation site. The patient underwent wound debridement, right hip arthrotomy washout, removal of cannulated screws over the right femoral neck for Right hip septic arthritis and wound debridement of the infected right AKA stump.	CRP 147mg/L. Tissue cultures grew <i>Enterobacter cloacae</i> , and the patient was treated with intravenous Tazocin for six weeks based on sensitivity.
December 2021	Preoperative radiograph is depicted in Figure 1. The patient underwent first stage revision surgery. Debridement and exploration of the right AKA stump were performed. The native femoral head was removed, and an articulated antibiotic-loaded cement spacer (Simplex P bone cement with 1g of tobramycin) was inserted.	CRP 68.9mg/L. Intraoperatively, there were no signs of infection; however, bone cultures again grew <i>Enterobacter cloacae</i> . Patient was treated with six week course of IV Meropenam based on sensitivity.
February 2022	Antibiotics free for two weeks.	CRP 18.2mg/L
June 2022	Right hip joint aspiration. Preoperatively, the patient was ambulating using two crutches.	CRP 10.2mg/L The cultures were negative for growth.
July 2022	The patient underwent second stage revision surgery with THA. He was seen by a physiotherapist for muscle strengthening exercises following his AKA and the rehabilitation unit for prosthetic training at monthly intervals.	Alpha-defensin negative. Intraoperative cultures were negative. Intravenous Cefuroxime for three days followed by oral Cefuroxime for three weeks.
November 2022	The surgical wound completely healed. The patient has been on a right transfemoral prosthesis (quadrilateral socket with a lanyard suspension system and four bar knee joint). He began weight bearing as tolerated by both crutches for the first 6 weeks.	-
January 2023	The patient was able to ambulate independently without crutches using a right transfemoral prosthesis.	-
November 2024	The patient had grade four muscle power during right hip flexion, extension, and abduction. The range of motion for right hip flexion was 0-90°, extension was 0-30° and abduction was 0-45°.	-

DISCUSSION

THA following an ipsilateral AKA is rare, accounting for only 0.067% of all THAs (Amanatullah, Trousdale, and Sierra 2015). Performing THA in such patients presents unique challenges related to surgical approach, stump manipulation, and femoral component preparation. The principal challenge in this case was management of the underlying hip joint infection. Initial debridement and removal of the femoral neck screws were followed by a six-week course of intravenous antibiotic therapy. Two-stage revision surgery was then performed, which is the gold standard for managing chronic prosthetic joint infections (PJI), with reported infection eradication rates exceeding 90% (Pangaud, Ollivier, and Argenson 2019).

CRP monitoring, negative hip aspiration cultures, and alpha-defensin tests confirmed resolution of infection before the second-stage revision. Extended antibiotic prophylaxis at three weeks postoperatively further reduced the risk of reinfection, consistent with the literature supporting prophylaxis durations of less than one month for successful outcomes (Fang et al. 2021).

Dual-mobility cups were employed to enhance stability, with dislocation rates reported to be significantly lower than those of unipolar cups (Van Beers et al. 2020). Preoperative planning including templating for acetabular component placement and femoral implant selection is critical. In this case, a sufficient proximal femoral stump length allowed for the use of a conventional cemented femoral stem chosen because of osteopenia.

Altered anatomy in AKA patients introduces additional technical challenges, such as a reduced lever arm for dislocation and relocation, limited bone stock, and increased fragility. While Steinmann pins are often used for manipulation in such cases (Diamond et al. 2013; Wagner and Quiroga 2020), this approach was avoided because of severe

osteopenia in the trochanteric region. Bone-holding forceps were used to manipulate the femur safely.

Favorable patient outcomes underscore the importance of meticulous infection control, careful preoperative planning, and appropriate implant selection. Currently, the patient is infection-free, ambulates independently, and leads an active lifestyle, highlighting the potential for positive outcomes in similar complex cases.

CONCLUSION

This case highlights the complexity of performing total hip arthroplasty (THA) in patients with ipsilateral above-knee amputation (AKA) and infected nonunion neck of femoral fractures complicated by avascular necrosis of the femoral head. Successful management requires meticulous preoperative planning, addressing the underlying infections, and

leveraging a multidisciplinary approach. The two-stage revision strategy, the use of advanced implant techniques, and tailored physiotherapy play pivotal roles in achieving infection control, implant stability, and functional recovery. Despite significant challenges, the patient regained mobility and improved quality of life, demonstrating that THA can be a viable option in such complex cases when performed with careful consideration of technical nuances and postoperative rehabilitation. This case underscores the importance of individualized treatment plans to overcome the unique surgical and functional obstacles in achieving favorable long-term outcomes.

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