

Primary Hemiarthroplasty for Management of Femoral Neck Fracture in a Patient with Ipsilateral Below-Knee Amputation: A Case Report with Review of Literature

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Learning Point of the Article:

Hemiarthroplasty for femoral neck fractures in lower limb amputees requires meticulous planning, and special maneuvers may be indicated for stump manipulation during surgery.

Abstract

Introduction: Femoral neck fractures in lower limb amputees are uncommon. Technical difficulties include patient positioning, stump manipulation, and poor bone quality due to osteoporosis. We report the case of a 55-year-old woman with a femoral neck fracture and an ipsilateral below-knee amputation (BKA), managed with hemiarthroplasty.

Case Report: The patient was diagnosed with a femoral neck fracture on the right side after she had a fall at home. She had undergone BKA due to complications of a diabetic foot 9 months earlier. We performed uncemented hemiarthroplasty with an Austin-Moore prosthesis using the posterior approach. No special devices or maneuvers were required for the manipulation of the stump during surgery. The post-operative period was uneventful, and the patient began weight-bearing with a walker and prosthetic limb about 10 days after surgery. Throughout the 25-month follow-up period, no clinical or radiological complications related to the hemiarthroplasty were identified, and her final Hip Disability and Osteoarthritis Outcome Score, Joint Replacement (HOOS, JR) score improved to 80.55. The patient succumbed to breast cancer 1 month following the most recent follow-up.

Conclusion: Hemiarthroplasty remains a reliable option for managing femoral neck fractures in below-knee amputees. However, difficulties in limb manipulation must be anticipated. Gentle handling and meticulous surgical technique are critical in avoiding iatrogenic complications.

Keywords: Hemiarthroplasty, Austin-Moore prosthesis, below-knee amputee, lower limb amputee, femoral neck fracture, femur neck fracture.

Introduction

Femoral neck fractures in lower limb amputees are uncommon and present a challenge to both orthopedic surgeons and the rehabilitation team. This can be challenging to manage due to technical difficulties, including patient positioning, ideal surgical approach, and stump manipulation for the reduction of prosthesis. In lower limb amputees, the incidence of ipsilateral hip fractures has increased, largely due to decreased bone mineral

density, particularly among those using prosthetic limbs [1]. We report the case of a 55-year-old woman with a femoral neck fracture and an ipsilateral below-knee amputation (BKA), managed with hemiarthroplasty.

Case Report

The patient, a 55-year-old woman, was brought to the hospital with a complaint of pain in the right hip after a fall at home. She

Author's Photo Gallery



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Access this article online

Website:
www.jocr.co.in

DOI:
<https://doi.org/10.13107/jocr.2026.v16.i04.7128>

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Submitted: 11/01/2026; Review: 01/02/2026; Accepted: March 2026; Published: April 2026

DOI: <https://doi.org/10.13107/jocr.2026.v16.i04.7128>

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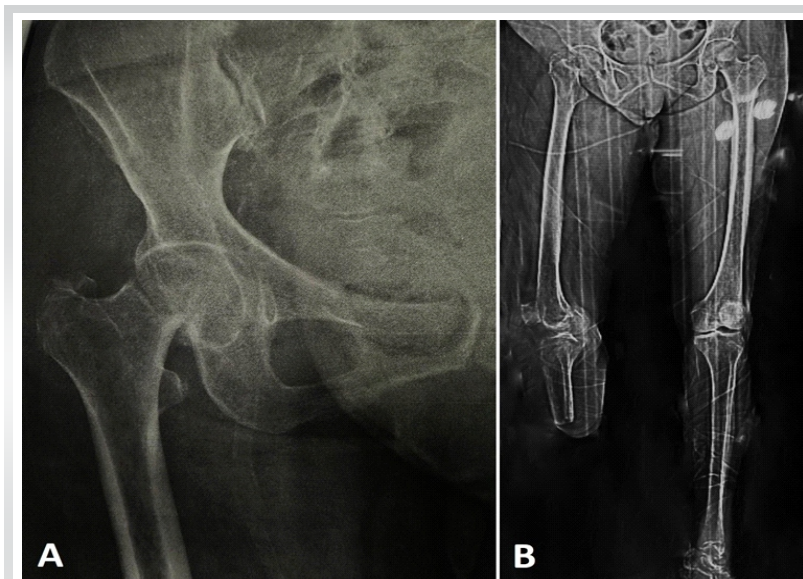


Figure 1: (a) Pre-operative radiograph of the right hip showing a fracture in the neck of the femur, (b) full-length scanogram of both the lower limbs.

had undergone a BKA of the right lower limb 9 months earlier due to complications of a diabetic foot. After the amputation, she began walking with a below-knee prosthesis and a walker inside her domicile. Based on the observations of her family members, she had not fully adapted to the prosthesis, which eventually led to a fall while walking on a patch of unpaved ground in the courtyard of her domicile. Radiographs revealed a right-sided femoral neck fracture (Fig. 1a). We also obtained a scanogram of the lower limbs (Fig. 1b). She was a known case of Type II diabetes mellitus. At the time of presentation, she had maintained good glycemic control with the use of oral hypoglycemic drugs. The patient was from a low socioeconomic background. After carefully deliberating the pros and cons of osteosynthesis and hemiarthroplasty, we advised hemiarthroplasty to the patient. Physical examination did not reveal any vascular or neurological complications. The stump was healthy except for a pressure sore on the lateral aspect of the leg due to the ill-fitting socket of the prosthesis (Fig. 2a and b).

After medical clearance and pre-anesthetic evaluation, we performed uncemented unipolar hemiarthroplasty under spinal anesthesia through the posterior approach to the hip using an Austin-Moore prosthesis (AMP). The patient was kept in the left

lateral position. Anticipating difficulty in maneuvering the limb during surgery, we kept a bone hook and Schanz pins ready. Perumal et al. have described a technique for above-knee amputees (AKA) where two perpendicular Schanz pins (anteroposterior and sagittal) are placed in the distal part of the stump to help in limb manipulation during surgery [2]. Intraoperative limb manipulation was more straightforward than anticipated. We did not require the placement of Schanz pins or any special maneuvers (Fig. 2c). We manipulated the limb gently while making the neck cut and preparing the femoral canal to avoid iatrogenic fractures and inadvertent injuries to the adjacent structures. The head size was found to be 43 mm. A 43 mm AMP was implanted, and the prosthesis was relocated into the hip joint. The wound was closed in layers. The post-operative period was uneventful.

After surgery, we started hip and knee range of motion exercises for the patient. An order was placed for a new below-knee prosthesis as the old one had a poor fit. The new prosthesis arrived in 1 week, after which the patient underwent guided rehabilitation and gait training. She was able to bear weight on the operated limb with ease 10 days after the surgery with the below-knee prosthesis and support of a walker. Suture removal was done on the 10th post-operative day.

The patient was followed regularly during the first 6 months after surgery (Fig. 3). About 10 months postoperatively, she was diagnosed with breast cancer and subsequently began receiving treatment at another hospital. At her most recent evaluation, 25 months after the hemiarthroplasty, her Hip Disability and Osteoarthritis Outcome Score, Joint Replacement (HOOS, JR) score was 80.55. There were no clinical concerns, and

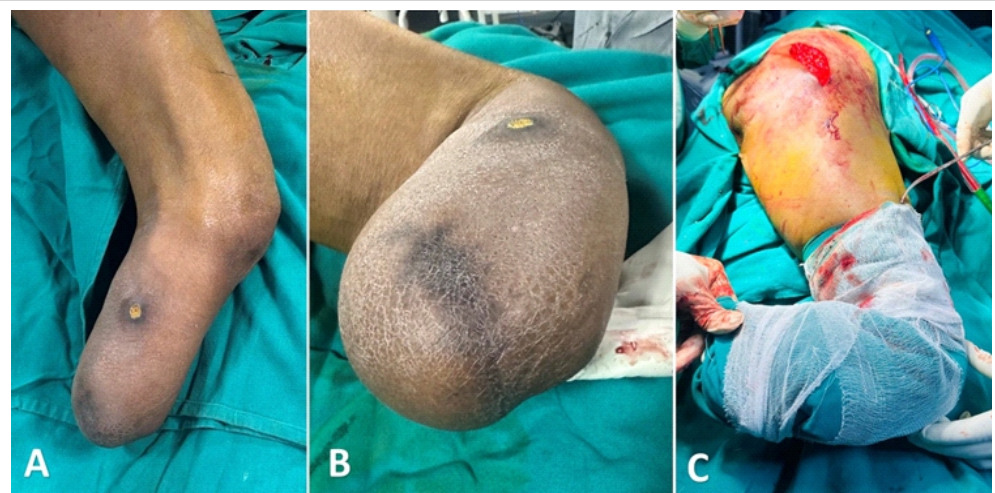


Figure 2: (a) Skin condition of the amputation stump, (b) Pressure sore due to an ill-fitting prosthetic limb on the lateral aspect of the leg, (c) Image to demonstrate the positioning of the stump during surgery.

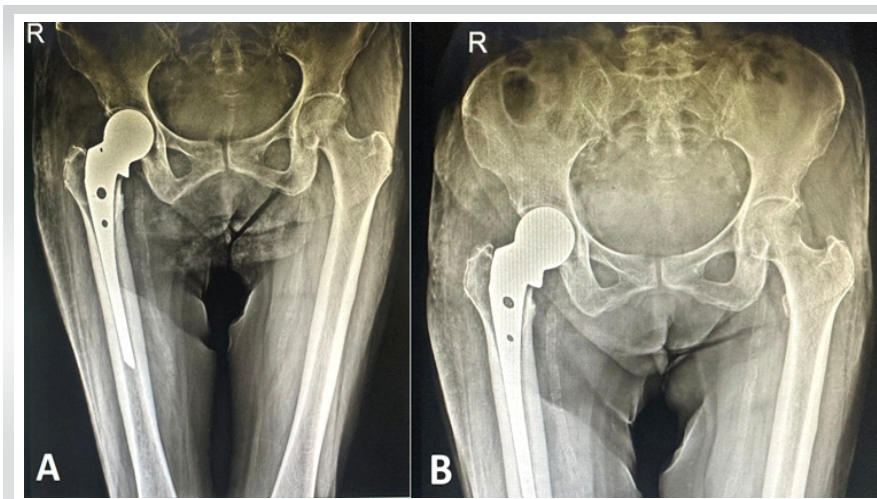


Figure 3: (a) Immediate post-operative radiograph, (b) radiograph at 6 months of follow-up.

radiographs showed no evidence of prosthetic loosening or subsidence (Fig. 4). Unfortunately, she succumbed to breast cancer 1 month later. Throughout the 25-month follow-up period, no clinical or radiological complications related to the hemiarthroplasty were identified.

Discussion

Femoral neck fractures in the setting of BKA are uncommon and very challenging to treat. There are no well-established guidelines, and only a few studies have reported long-term outcomes among amputees [3]. Osteosynthesis for femoral neck fractures is often challenging and has a high risk of complications and failure rates due to altered limb biomechanics, including risk of avascular necrosis, osteoporosis, muscle atrophy, and early onset of hip osteoarthritis [4].

Limb amputation leads to musculoskeletal changes in both the amputated and contralateral limbs, including increased osteoporosis on the amputated side, higher rates of osteoarthritis in the intact limb, and muscle wasting on both sides due to anatomical and surgical factors [5, 6]. Studies have shown that lower extremity amputees are at a higher risk of ipsilateral hip fractures, attributed to reduced bone density and the mechanical stresses imposed by prosthetic use [7, 8].

Although bipolar hemiarthroplasty and total hip arthroplasty (THA) are generally preferred for femoral neck fractures, an AMP was chosen in this case due to the patient's significant financial constraints. In addition, THA involves longer operative time and higher resource requirements. Hence, after discussion with the patient and her family members, unipolar hemiarthroplasty with an AMP was considered a pragmatic option to facilitate early pain relief and mobilization. Several cases of femoral neck fractures in lower limb amputees have

been reported in the literature (Table 1), managed using osteosynthesis [9, 10], bipolar hemiarthroplasty [2, 4, 11], or THA [12, 13, 14].

However, there are no reported cases of a unipolar hip prosthesis being used for the treatment of ipsilateral femoral neck fractures in below-knee amputees. Arango et al. reported a case of bilateral femoral neck fractures occurring 6 months apart in a bilateral lower limb amputee, successfully managed with staged hemiarthroplasties using different stem designs based on the level of amputation [15].

Wagner et al. described a transfemoral amputee who underwent cemented THA for a femoral neck fracture, highlighting the use of a Steinmann pin for limb control during the procedure [4]. Lancer et al. presented a rare case of bilateral displaced femoral neck fractures in a bilateral below-knee amputee managed with synchronous bilateral uncemented THA, achieving good functional recovery [12]. Perumal et al. detailed the surgical challenges of performing hemiarthroplasty in an AKA and recommended the use of Schanz pins for limb control and version alignment [2]. Tan et al. reported good results with hybrid THR in a below-knee amputee [16].

Walton et al., in a systematic review, summarized the existing literature on hip and knee replacements in amputees, noting



Figure 4: Follow-up radiograph at 25 months.

Table 1: Review and comparison of the current case with previously published reports

S.No.	Author (year)	Country of origin	Demographics	Amputation level	Approach used	Type of surgery	Device/implant used	Follow-up duration	Complications	Final outcome	Special comments
1	Prickett and Scanlon (1976)	United States of America	59 years, Female	Below knee	Posterior	THA	Cemented THA	9 weeks	None	Recovered	THA in BKA patients
2	Salai et al. (2000)	Israel	5 patients (Mean age: 54.8 years, 1 female, 4 male; 3 cases after failed fracture fixation, 2 primary THA)	Below knee	Anterolateral	THA	Uncemented THA	Mean 69 months	Minimal	Good long-term results, 1 patient passed away due to unrelated causes	THA in BKA patients
3	Anjum and McNicholas (2006)	United Kingdom	22 years, Male	Below knee	Lateral	Fixation	Not reported	Not reported	Not reported	Not reported	Improvised method of positioning using skin traction
4	Rethnam et al. (2008)	United Kingdom	73 years, Male	Bilateral below-knee	Lateral	Fixation	DHS	Not specified	None	Good outcome	Positioning of a bilateral below-knee amputee on the traction table was discussed.
5	Kandel et al. (2009)	Israel	68 years, Male	Above knee	Not reported	Bipolar Hemiarthroplasty	Bipolar prosthesis	5 years	None	Good outcome	Above-knee amputation
6	Pekmezci et al. (2010)	United States of America	51 years, Male	Knee disarticulation	Posterolateral	THA for hip osteoarthritis	Uncemented THA	18 months	None	Good result	THA in through-knee amputation
7	Berg and Bhatia (2014)	United Kingdom	58 years, Male	Left above-knee, right below-knee	Lateral	Fixation	DHS with a long plate	Not reported	Not reported	Not reported	Improvised fracture table setup
8	Meena et al. (2015)	India	28 years, Male	Above knee	Watson-Jones	Osteotomy	mi	1 year	None	Recovered	Neglected fracture management
9	Amanatullah et al. (2015)	United States of America	18 patients, Mean Age: 63.0±15.8 years	Below/Above knee	Various	THA	Cemented and uncemented THA	5.3±4.0 years	One (5.6%) patient had a dislocation, 2 (11.1%) had periprosthetic fractures, and 1 (5.6%) had aseptic loosening.	Generally favorable	THA after amputation
10	Freitas et al. (2015)	Brazil	28 years, Female	Transfemoral amputation	Lateral	Fixation	Cannulated screws	12 months	None	Good recovery	Young patient with a transfemoral amputation
11	Boussakri et al. (2015)	France	51 years, Male	Above knee	Lateral	Hemiarthroplasty	Bipolar prosthesis	30 months	None	Good functional result	Place bone forceps 5 cm below the lesser trochanter for limb manipulation
12	Masmoudi et al. (2016)	Tunisia	57 years, Female	Below knee	Lateral	THA	Cemented THA	36 months	None	Good recovery	Primary THA in BKA
13	Lancer et al. (2016)	United Kingdom	69, Male	Bilateral BKA	Posterior	Fixation of bilateral femoral neck fracture	Bilateral uncemented THA	3 months	None	Good recovery	Bilateral BKA, multiple comorbidities
14	Arango et al. (2016)	United States of America	62 years, Male	Right BKA, Left AKA	Posterior approach	Bilateral Hemiarthroplasty	Cemented Bipolar	2 years	None	Good functional recovery	Lung cancer patient with Bilateral amputations (BKA + AKA)
15	Perumal et al. (2017)	India	75 years, Male	Above knee	Lateral approach	Bipolar hemiarthroplasty	Cemented bipolar prosthesis	14 months	None	Good recovery	Application of Schanz pins for stump manipulation
16	Tan et al. (2018)	Malaysia	52 years, Female	Below knee	Posterior	THA	Hybrid THA	6 months	None	Good	Hybrid THA in a below-knee amputee
17	Wagner et al. (2020)	Argentina	63 years, Male	Above-knee (transfemoral)	Modified Gibson approach	THA	Cemented THA	15 months	None	Good result	THA in supracondylar amputation
18	Jain et al. (2022)	India	50 years, Male	Bilateral above-knee	Not specified	Fixation	Cannulated screws	Not specified	None	Recovered	Crush injury of bilateral lower limbs and right-sided neck of femur fracture. Technical tips for positioning
19	Walton et al. (2024)	United Kingdom	Various	Mixed (review)	Various	THR/THA, TKA (review)	Various (scoping review)	Review article	Various complications discussed	Variable outcomes	Scoping review of cases
20	Present study	India	55 years, Female	Below knee	Posterior	Hemiarthroplasty	Austin-Moore Prosthesis	25 months	None	Good	The patient succumbed to breast cancer.

BKA: Below-knee amputation, AKA: Above-knee amputation, THA: Total hip arthroplasty, DHS: Dynamic hip screw, TKA: Total knee arthroplasty

generally favorable outcomes but emphasizing the technical difficulties inherent to surgery in this population [3]. Jain et al. and Berg and Bhatia provided technical tips for internal fixation in bilateral AKA, stressing the need for innovative intraoperative positioning strategies [9,10]. Anjum and McNicholas described a novel method of applying skin traction to the BKA stump to secure the limb to the traction table [17]. Rethnam et al. discussed the challenges of positioning a bilateral below-knee amputee with an intertrochanteric fracture on a traction table. They suggested

that the boot of the traction table can be secured directly to the stump, or that the patient's prosthesis can be fitted onto the stump and the prosthetic foot then fixed to the boot, allowing effective application of traction during surgery [18].

Meena et al. presented a neglected femoral neck fracture in an AKA managed with valgus osteotomy, suggesting that fractures in amputees should be treated with similar urgency and principles as in non-amputees [19]. In comparison, our case involved a below-knee amputee with a femoral neck fracture successfully managed with unipolar hemiarthroplasty (AMP),



achieving good functional recovery without the need for complex intraoperative modifications.

This case adds to the limited body of literature on the management of ipsilateral femoral neck fractures in below-knee amputees. Hemiarthroplasty is a reliable treatment option with outcomes comparable to those reported in non-amputee populations when meticulous surgical technique is employed.

A limitation in this case report is that the patient was followed up on only for 2 years, as the patient succumbed to breast cancer. With a growing number of lower limb amputee populations around the world, future studies can analyze the long-term outcomes of various treatment modalities for femoral neck fractures in amputees, along with an analysis of biomechanical challenges unique to this patient population, which may influence surgical decision-making and rehabilitation strategies.

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 his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials 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

Conclusion

Hemiarthroplasty remains a reliable option for managing femoral neck fractures in below-knee amputees, offering the advantages of early mobilization, full weight-bearing, and return to daily activities. However, difficulties in limb manipulation must be anticipated. Gentle handling and meticulous surgical technique are critical in avoiding iatrogenic complications. Thorough pre-operative planning, with a readiness to adapt intraoperatively, is key to achieving successful outcomes in this unique patient population.

Clinical Message

Hemiarthroplasty for femoral neck fractures in lower-limb amputees requires careful planning and may need special stump manipulation techniques intraoperatively to facilitate reduction and accurate implant positioning.

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Conflict of Interest: Nil

Source of Support: Nil

Consent: The authors confirm that informed consent was obtained from the patient for publication of this article

How to Cite this Article

Sushruth G, Mane SS, Krishna M. Primary Hemi-arthroplasty for Management of Femoral Neck Fracture in a Patient with Ipsilateral Below-Knee Amputation: A Case Report with Review of Literature. *Journal of Orthopaedic Case Reports* 2026 April;16(04): 303-308.