



Case Report

Intracapsular fracture of the proximal femur in a bilateral above-knee amputee: A case report with technical tips for intraoperative positioning and literature review

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ABSTRACT

Intracapsular fractures of the proximal femur are one of the most common fractures of the lower limbs. Most cases require osteosynthesis with suitable implants, and intraoperative positioning of the patient on the fracture table is a prerequisite to facilitate fracture manipulation, traction, reduction and fluoroscopy assessment. However, positioning the limbs of bilateral above-knee amputees for internal fixation of related proximal femoral fractures is a difficult task, which requires customized inventory for effective limb positioning and fracture manipulation. This study reported a rare case following a crush injury of bilateral lower limb in a road traffic accident, and described some technical tips of acute femoral neck fractures in bilateral above-knee amputation. The patient was managed with immediate guillotine amputation and later secondary wound closure followed by internal fixation of the right-sided femoral neck fracture with multiple cancellous cannulated screws.

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Introduction

Hip fractures are considered one of the major causes of morbidity and mortality in adults.¹ Nevertheless, they are seldom seen in patients with lower-limb amputations.² Management of hip fractures for lower-limb amputee has always been a daunting task for orthopaedic surgeons, as it demands special consideration of patient positioning on a fracture table, fracture manipulation/reduction, and the choice of surgical procedure. There are few studies in the literature discussing the techniques of patient positioning on a fracture table and methods to aid in closed or open reduction.^{3,4} These surgical tips were described concerning the single-limb amputee, where the unaffected limb positioning was not a problem and the cross-leg image intensifier positioning allows the intraoperative fluoroscopic assessment in both anteroposterior and lateral views. However, it may not be possible in the case of bilateral above-knee amputee.

There are only a few studies reporting hip fracture in a bilateral lower-limb amputee.^{2,5,6} However, so far to the best of our knowledge, no case has been reported with simultaneous

intracapsular femoral neck fracture with bilateral above-knee amputation managed with osteosynthesis.

We presented an unusual case of simultaneous femoral neck fracture in a 50-year-old man with bilateral traumatic above-knee guillotine amputation, which occurred during the same traumatic event. This report described the technical difficulties in performing surgical fixation of femoral neck fracture and techniques, which facilitate intraoperative limb positioning and fluoroscopy assessment. The patient agreed to submit the case data for publication.

Case report

A 50-year-old man presented to the emergency department in a road traffic accident with bilateral lower-limbs crush injury following rolling over of the front wheels of the vehicle. Primary advanced trauma life support management was performed and the patient was hemodynamically stable. As both the lower-limbs were non-salvageable, primary bilateral above-knee guillotine amputation was done. The patient also had a simultaneous femoral neck fracture on the right side (Fig. 1), but the same sitting operative fixation for femoral neck fracture could not be done as the patient also had a head injury and was not fit for prolonged anaesthesia. Later, bilateral trans-femoral amputation stumps were revised and secondary wound closure was done. A week later, a surgical

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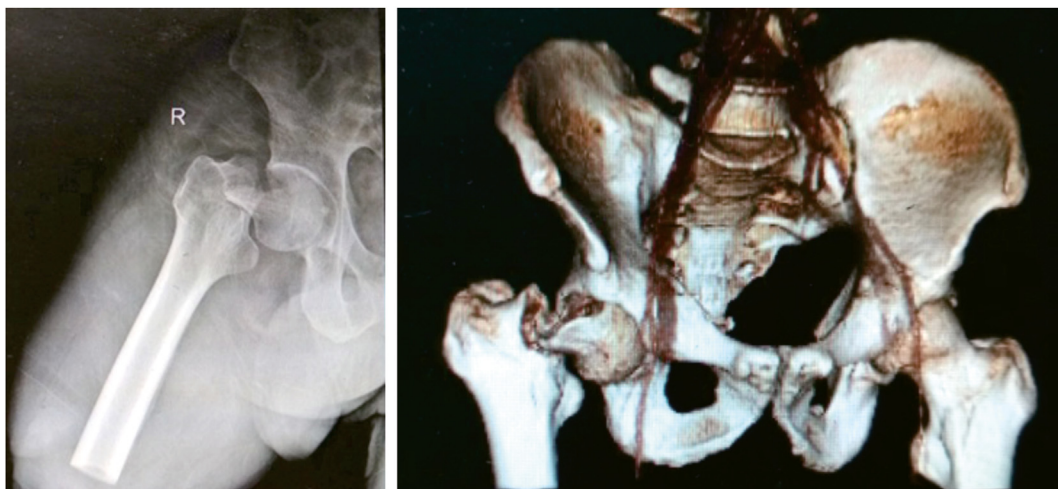


Fig. 1. Picture depicting preoperative radiographic images in bilateral above-knee amputation of a 50-year-male patient with a right-side femoral neck fracture.

procedure of femoral neck fracture was planned for the patient. Taking into account the patient's age, work demands, and increased risk of stump infection, multiple cannulated cancellous screws (CCS) osteosynthesis was preferred over arthroplasty.

Surgical procedure

The patient was placed on the fracture table without any traction. The unaffected limb was kept in flexion and abduction by binding it firmly with an elastic bandage, and was tied to the side attachments of the operative table (Fig. 2). This simple technique allowed us to assess the fixation of the affected femoral neck under an image intensifier. Closed reduction of femoral neck fracture was attempted by applying manual traction and rotation manoeuvres on the affected side amputee stump using a 4.5 mm Schantz pin inserted into the proximal femur shaft at the level of the lesser trochanter, but reduction could not be achieved. Thus, open reduction using the anterior Smith Peterson approach was executed. The fracture was then fixed using four 7.0 mm CCS, and

reduction and fixation were confirmed in both anteroposterior and lateral views under an image intensifier (Fig. 3).

On the first postoperative day, the patient was mobilized in a wheelchair and started on intensive chest physiotherapy. Both residual stumps were healthy during the immediate postoperative period and did not show any signs of infection. Two weeks after the operation, all the sutures at the surgical sites were removed, and all wounds healed without any complications. After six weeks of follow-up, the patient's stumps were mature and could be implanted with prosthesis. Above-knee ischial support prosthesis was implanted on the left side, and the patient was taught gait training with the use of a walker. At 10 weeks, the union of the right fractured neck and femur was healed clinically and radiologically. Therefore, the prosthesis was applied to the right-side femoral stump as well. The patient was advised partial weight bearing on the right side with the help of a walker. At 12 weeks post-operatively, the patient was advised full weight bearing on the right side with bilateral above-knee prosthesis in situ. At present, after 12 months of surgery, the patient walks freely without any support

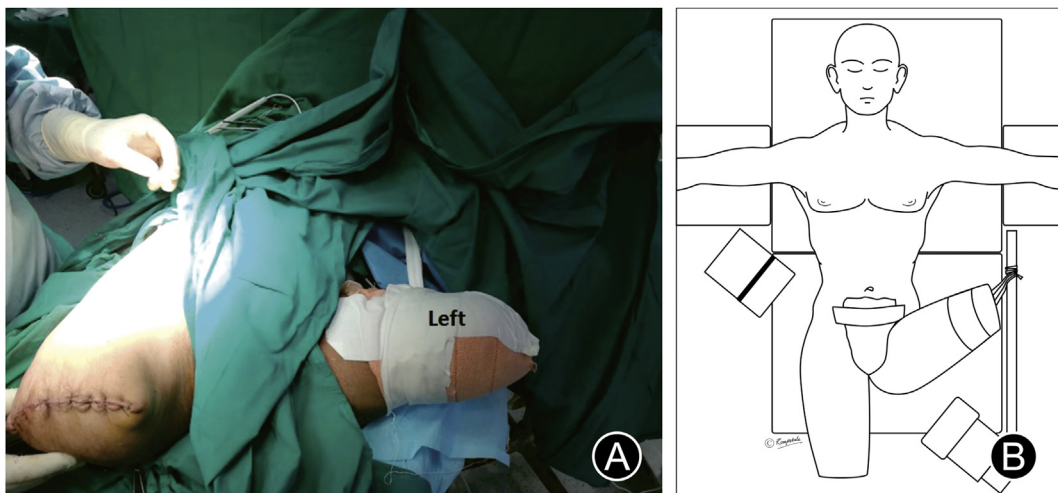


Fig. 2. (A) Clinical picture depicting intra operative positioning of the bilateral above-knee amputee stump. Left side stump was bounded firmly with elastic bandage and tied to operating table side attachments to maintain the left side hip in flexion and abduction. (B) Schematic representation of the intraoperative positioning of the patient with intra-operative use of image intensifier.

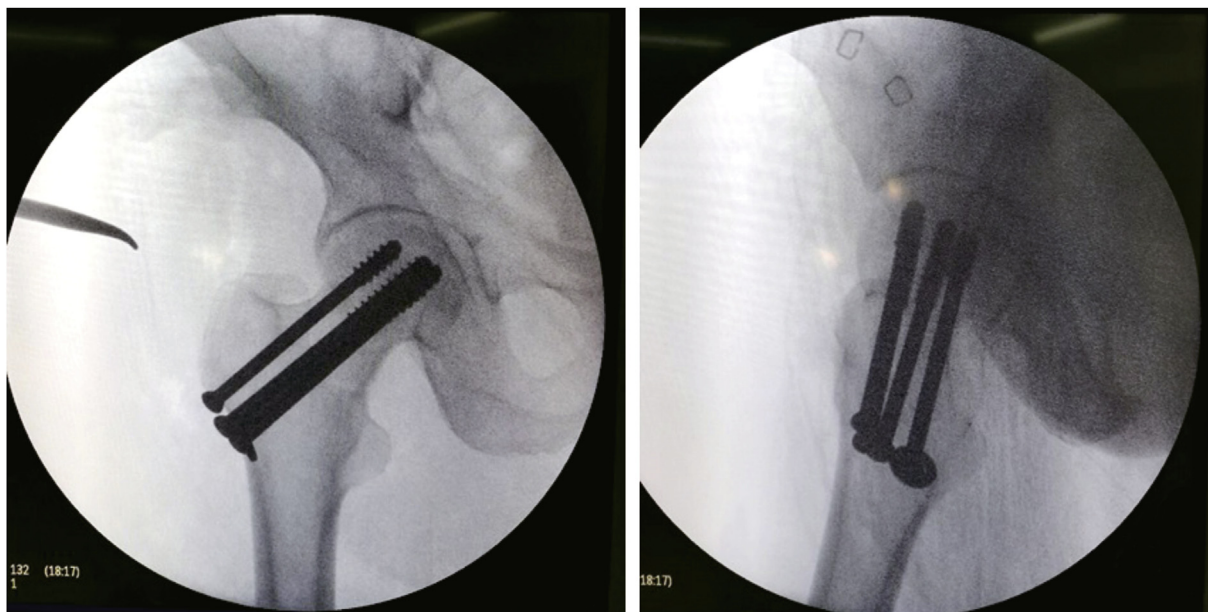


Fig. 3. Picture depicting intra operative fluoroscopic images with right neck of femur reduction and fixation with four cancellous cannulated screws.

and pain, and does not need any help for daily housework activities. Radiograph of the right hip showed union of femoral neck fracture with no evidence of avascular necrosis at one year follow-up (Fig. 4).

Discussion

Management of proximal femoral fractures in patients with lower-limb amputations presents significant challenges,² which increases further during the task of positioning, reduction and method of fixation of the fracture. Usually, in patients without lower-limb amputation, these fractures are reduced on a fracture table, and the fractured side foot was strapped in a boot attachment component of the fracture table, allowing traction and limb rotation aiding in fracture reduction. Whereas, the contralateral limb is firmly fixed to the thigh support groove assembly on the fracture table, and the hip joint is bent and abducted to prevent the contralateral limb from blocking the way, so as to facilitate the positioning of the intraoperative fluoroscopy image intensifier,

thereby allowing the anteroposterior and lateral intraoperative fluoroscopy image fracture site.

For patients with lower limbs amputation, this standard positioning cannot be performed, which increases the challenges faced by surgeons during fracture manipulation and reduction. When the level of amputation is high, the problem is exacerbated because the available stump for traction and rotation will be shorter, making reduction more difficult.⁶ Several studies have been reported in the literature, focusing on some positioning and reduction techniques for patients with proximal femoral fractures associated with amputation of the ipsilateral lower extremity. However, among them, the unaffected contralateral limb will not hinder its positioning on the fracture table, allowing the planned intraoperative osteosynthesis.^{4,5}

In 2006, Anjum et al.⁷ reported a case of femoral neck fracture in a 22-year-old patient with previous below-knee amputation, in which the patient was positioned on a fracture table and skin traction was applied to the stump by elastic bandage. The traction cord was attached to the traction device to aid in traction and manipulation of fracture. However, the same management becomes more cumbersome for bilateral above-knee amputation. So far to the best of our knowledge, there has been no case report of intracapsular femoral neck fracture with bilateral above-knee amputation, where osteosynthesis has been done. We have preferred osteosynthesis in the present case, considering the age of the patient and his high physiological demands.

Kandel et al.⁸ in 2009, reported a femoral neck fracture in a 68-year-old patient with previous above-knee amputation, who was treated with bipolar hemiarthroplasty via posterior approach. In the year of 2013, Davarinos et al.⁹ reported intertrochanteric fracture in a 51-year-old patient with an above-knee amputee. The patient was placed on a fracture table, the stump was firmly tied with an elastic bandage, and the traction device was connected with a crepe bandage to help close reduction and fixed with dynamic hip screws. Freitas et al.⁴ reported a femoral neck fracture in a 28-year-old patient with an above-knee amputee, in which closed reduction of fracture was obtained with the help of a 4.5 mm Schantz pin at the level of the lesser trochanter and fixed with three CCS. In 2015, Meena et al.¹⁰ reported a case of neglected femoral

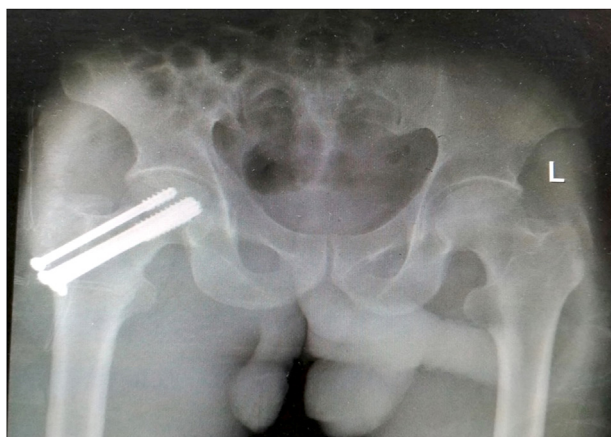


Fig. 4. Radiographic images of neck of femur fracture union without fracture collapse or avascular necrosis at one year follow-up.

Table 1
Summary and comparison of present case report with the available published case reports.

No. Study	Age (years)	Interval between amputation and hip fracture	Type of amputation		Hip fracture	Method of traction/manipulation	Approach	Operative procedure
			Level	Unilateral or bilateral				
1 Boussakri et al. ¹¹ (2015)	81	11 years	Above-knee	Unilateral	Femoral neck	Bone clamp in distal fragment	Hardinge	Bipolar hemi arthroplasty
2 Kandel et al. ⁸ (2009)	68	58 years	Above-knee	Unilateral	Femoral neck	Bone clamp in distal fragment	Posterior	Bipolar hemi arthroplasty
3 Perumal et al. ¹³ (2017)	75	Same acute traumatic event	Above-knee	Unilateral	Femoral neck	Two Schantz Pin in distal fragment perpendicular to each other	Lateral	Bipolar hemi arthroplasty
4 Berg et al. ² (2014)	58	—	Above-knee	Bilateral (Fractured side-above-knee, unaffected side - below-knee)	Femoral neck	Fractured limb (above-knee stump) - Steinman pin in distal femur attached to traction bow with traction arm. Unaffected limb (below knee stump) - placed into standard stirrup with hip flexed and abducted and secured with straps and crepe bandage.	Closed reduction	DHS
5 Meena et al. ¹⁰ (2015)	28	2 months	Above-knee	Unilateral	Femoral neck	_____	Watson Jones	DHS with valgus osteotomy
6 Freitas et al. ⁴ (2015)	28	11 years	Above-knee	Unilateral	Femoral neck	Schantz pin at level of LT	Closed reduction	CC screw fixation (3)
7 Anjum et al. ⁷ (2006)	22	—	Below-knee	Unilateral	Femoral neck	Skin traction attached to stump	Closed reduction	_____
8 Aqil et al. ⁶ (2010)	75	—	Above-knee	Bilateral	Intertrochanter	Fractured limb stump - thigh support of fracture table without any traction Unaffected limb stump - bound firmly to gutter support in flexion and abduction	Closed reduction	DHS
9 Davarinos et al. ⁹ (2013)	51	—	Above-knee	Unilateral	Intertrochanter	Stump firmly bound to traction end of traction table with adhesive fabric tape and crepe bandage	Closed reduction	DHS
10 Rethnam et al. ⁵ (2008)	73	—	Below-knee	Bilateral	Intertrochanter	Fractured limb stump - radiolucent leg support of fracture table without any traction Unaffected limb stump - bound firmly to leg support in flexion and abduction	Closed reduction	DHS
11 Ochi et al. ¹² (2017)	97	68 years	Below-knee	Unilateral	Intertrochanter	AL HARTHY method - in fracture table, inverting the traction boot	Closed reduction	Cephalo-medullary nail (gamma nail)
12 Present study	50	Same acute traumatic event	Above-knee	Bilateral	Femoral neck on the right side	Fractured limb stump: radiolucent table, Schantz pin in distal fragment (failed). Unaffected limb stump - bound firmly to side attachment with roller bandage in flexion and abduction	Open reduction	CC screw fixation

-: not mentioned, DHS: dynamic hip screw, LT: lesser trochanter, CC: cancellous cannulated.

neck fracture for three months in a 28-year-old male patient with an ipsilateral above-knee amputee, which was treated with open reduction by Watson-Jones approach followed by corrective valgus osteotomy and fixation with 120° double angled barrel plate. Boussakri et al.¹¹ in 2015, reported a femoral neck fracture in an 81-year-old patient (an above-knee amputee) treated with bipolar hemiarthroplasty through the Hardinge approach. Ochi et al.¹² in 2017, reported a case of intertrochanteric fracture in a 97-year-old below-knee amputee patient, in which the patient was positioned on the traction table, Al Harthy method of inverting the traction boot to accommodate the flexed knee of the stump was used to provide traction and reduction, and the internal fixation was done using cephalomedullary Gamma nail.

Quite a few studies only report hip fractures in bilateral lower-limb amputees. If the amputation level of the unaffected contralateral limb is more proximal, then the positioning of these patients becomes more challenging, as the size of the stump is a critical factor in positioning the contralateral limb to aid in fluoroscopy imaging during the surgery.

Rethnam et al.⁵ reported in 2008, an intertrochanteric fracture of a 73-year-old patient with bilateral lower-limb below-knee amputation. The patient was positioned on a fracture table, the fractured limb was rested on a radiolucent leg support, the contralateral below-knee amputee stump was strapped to thigh support gutter component of fracture table, and the hip was placed in flexion and abduction. Since the intertrochanteric fracture was an un-displaced and reduced by manual traction and rotation, it was fixed with a dynamic hip screw.

Aqil et al.⁶ in 2010, reported an intertrochanteric fracture of a 75-year-old patient with bilateral above-knee amputation, in which the stump on the fractured hip side was placed on the thigh support of the fracture table without any traction component. Whereas the unaffected stump was bound firmly to thigh gutter support and placed in abduction and flexion, and in situ fixation was done with dynamic hip screw.

In 2014, Berg et al.² reported a femoral neck fracture in a 58-year-old patient with previous bilateral lower-limb amputation, in which the patient was placed on a fracture table and Steinmann pin was inserted into the distal femur of the fractured above-knee

stump. The traction bow and manual extension made of clamps pin fixed the traction arm by the pin. The traction bow and manual extension made of clamps pin fixed the traction arm by the pin, whereas contralateral below-knee stump was fixed firmly with tapes and crepe bandage to a standard stirrup with the hip flexed and abducted to aid fracture reduction and fixation with dynamic hip screw.

To the best of our knowledge, almost all the studies so far in the literature reported the management of hip fracture in a previously amputated limb (Table 1). Only a single case report by Perumal et al.¹³ reported the occurrence of above-knee amputation and femoral neck fracture in a 75-year-old patient during the same traumatic event, in which the patient was positioned in the lateral position and bipolar hemiarthroplasty was done with aid of two 6.5 mm Schantz pins in the femur shaft. The present case is the first one to report the simultaneous occurrence of femoral neck fracture with a bilateral traumatic above-knee amputation in the same traumatic event.

In this case, we preferred to use CCS to fix the femoral neck fracture instead of hemiarthroplasty. As the patient was young, there is always associated high risk of infection with arthroplasty in acute amputation. The patient's occupation requires an excellent range of hip motion, and the cost-effectiveness of CCS over hemiarthroplasty. Another important factor for a better outcome in such patients is postoperative rehabilitation, which includes a team of physiotherapists, prosthetists and psychiatrists. On the second day postoperatively, the patient was mobilized on the wheelchair and started on bilateral hip-strengthening exercises, intensive respiratory exercises, mental rehabilitation exercises and stump care measures. Now at 12 months follow-up, he is walking full weight-bearing without any support with bilateral above-knee ischial bearing prosthesis in situ with no signs of infection.

In summary, we reported a rare case of a 50-year-old male patient with high pre-injury activity level, who suffered simultaneous bilateral trans-femoral amputation and femoral neck fracture on the right side in the same traumatic event, and highlighted the challenges routinely encountered during the positioning of the patient, fracture manipulation, reduction and fixation of the fracture. This report also strengthened the use of CCS in the fixation of femoral neck fracture because it is a cost-effective, safe and less invasive surgical procedure, and there is less chance of infection in these types of traumatic amputations.

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Nil.

Ethical statement

Ethical approval not required as per our institute review board. All procedures performed in this study involving human participants were in accordance with the ethical standard of the institutional and/international research committee and with the 1964

Helsinki declaration and its later amendments or comparable ethical standards.

Declaration of competing interest

On behalf of all authors, the corresponding author states that there is no conflict of interest to disclose.

Author contributions

Aditya jain: Manuscript designing and editing, data analysis, surgical planning and follow-up and initial manuscript drafting. Hemant Bansal: Conceived and designed the analysis, Collection the data and wrote the paper. Samarth Mittal: Collection the data, data analysis and surgical planning and execution. Arvind Kumar: Surgical planning and supervision and final editing of the manuscript. Vivek Trikha: Performed the analysis

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