

Primary Total Hip Arthroplasty for a Displaced Femoral Neck Fracture in an Above-the-Knee Amputee: A Case Report

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Learning Point of the Article:

A temporary Steinmann pin can be utilized as a simple minimally invasive lever arm for limb control during total hip arthroplasty in above knee amputees.

Abstract

Introduction: Femoral neck fractures in patients with ipsilateral above-knee amputations are uncommon and present unique diagnostic, biomechanical, and surgical challenges. The absence of a distal limb limits fracture reduction, intraoperative manipulation, and implant positioning, making standard treatment techniques difficult to perform. Although several fixation and arthroplasty strategies have been described for lower-extremity amputees, reports detailing primary total hip arthroplasty (THA) for displaced femoral neck fractures in young above-knee amputees remain scarce. This case highlights a practical surgical technique utilizing a temporary Steinmann pin as a lever arm to facilitate femoral control during arthroplasty and contributes to the limited orthopedic literature on management of these complex injuries.

Case Report: A 47-year-old Caucasian male with a history of traumatic left above-knee amputation sustained a displaced femoral neck fracture following a ground-level fall. Clinical evaluation and imaging demonstrated a displaced intracapsular femoral neck fracture with significant posterior tilt. Additional risk factors for fixation failure included tobacco use and poor bone quality. Given the patient's age, functional demands, and elevated risk of nonunion and osteonecrosis with internal fixation, primary THA was selected. During surgery, a fully threaded Steinmann pin was inserted into the residual femoral stump and used as a temporary lever arm to facilitate limb manipulation, femoral preparation, implant positioning, and stability assessment. The procedure was completed without complications, and the patient demonstrated satisfactory post-operative recovery with restoration of mobility and pain relief.

Conclusion: This case demonstrates that primary THA may be a viable treatment option for select young above-knee amputees with displaced femoral neck fractures when multiple risk factors for fixation failure are present. The use of a temporary Steinmann pin provides a simple, reproducible, and minimally invasive method for intraoperative control of the residual limb. This technique may assist orthopedic surgeons managing complex hip fractures in amputee patients and expands the limited body of literature regarding arthroplasty strategies in this challenging population.

Keywords: Femoral neck fracture, above-knee amputation, total hip arthroplasty, Steinmann pin, hip fracture.

Introduction

Femoral neck fractures in young patients present a challenging clinical problem, with preservation of the native hip traditionally favored through internal fixation. However, displaced fracture

patterns, poor bone quality, and patient-specific risk factors may predispose to fixation failure, nonunion, and avascular necrosis. In select cases, arthroplasty may offer a more predictable outcome despite concerns regarding implant longevity.

Author's Photo Gallery



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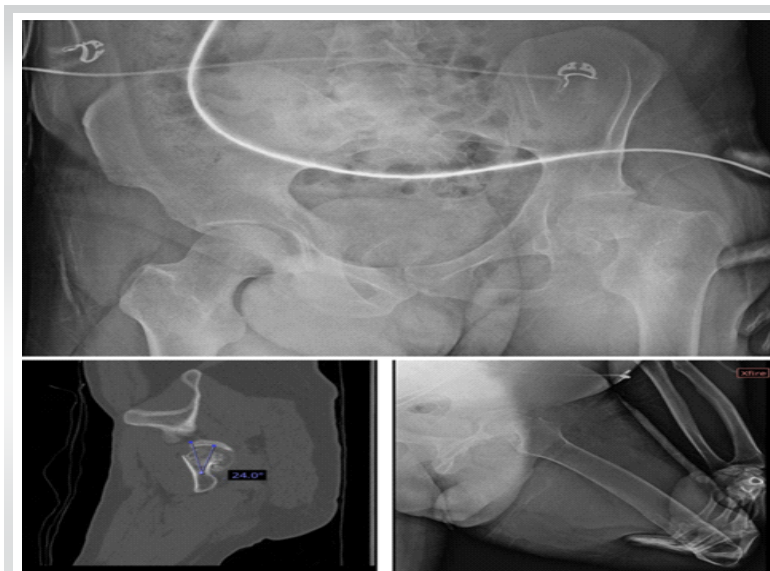


Figure 1: Pre-operative radiograph and axial computed tomography demonstrating displaced transcervical femoral neck fracture with posterior tilt ($\sim 24^\circ$) in a left above-the-knee amputee.

Performing total hip arthroplasty (THA) in patients with ipsilateral above-the-knee amputations introduces additional technical complexity. The absence of a distal lever arm complicates limb manipulation, femoral preparation, and assessment of stability and version [1]. Several techniques have been described to address these challenges, though many require specialized equipment or extensive soft-tissue dissection, given common hip flexor and abductor contractures [2].

We present a case of THA for a displaced femoral neck fracture in a young above-the-knee amputee, highlighting a simple intraoperative technique using a Steinmann pin to facilitate controlled limb manipulation. The patient's written informed consent to publish this case report was obtained.

Case Report

A 27-year-old male presented with acute left hip pain following a first-time seizure. His medical history was significant for a traumatic left above-the-knee amputation following a motorcycle collision in 2019 after failed limb salvage surgeries. Before the current injury, he ambulated independently with a prosthesis and reported occasional phantom limb pain without residual stump site complications or contractures.

Radiographs and computed tomography (CT) demonstrated a displaced left

transcervical femoral neck fracture with approximately 24° of posterior tilt on CT imaging (Fig. 1).

The patient reported daily tobacco and occasional alcohol use with no further medical history. On physical examination, he was neurovascularly intact with no other associated injuries. He was subsequently cleared for surgery from a multidisciplinary standpoint after a normal appearing electroencephalogram and further diagnostic testing. A shared patient decision-making discussion was held regarding operative management, including risks and benefits of open reduction and internal fixation versus THA. Given the degree of displacement, posterior tilt, smoking history, and desire for definitive surgical management, THA was selected.

Surgical technique

The patient received intravenous antibiotics preoperatively for infection prophylaxis and was positioned in the right lateral decubitus position under general anesthesia. A modified anterolateral approach to the hip was performed through a longitudinal incision centered over the anterior tip of the greater trochanter. Approximately 30% of the anterior abductor complex was subperiosteally elevated to allow capsular exposure.

Due to the absence of a distal limb for manipulation, a small stab incision was made along the distal anterolateral aspect of the femoral stump. This location was proximal enough to engage the diaphyseal bone while also avoiding contact with his prosthesis. Blunt dissection was carried down to the femoral

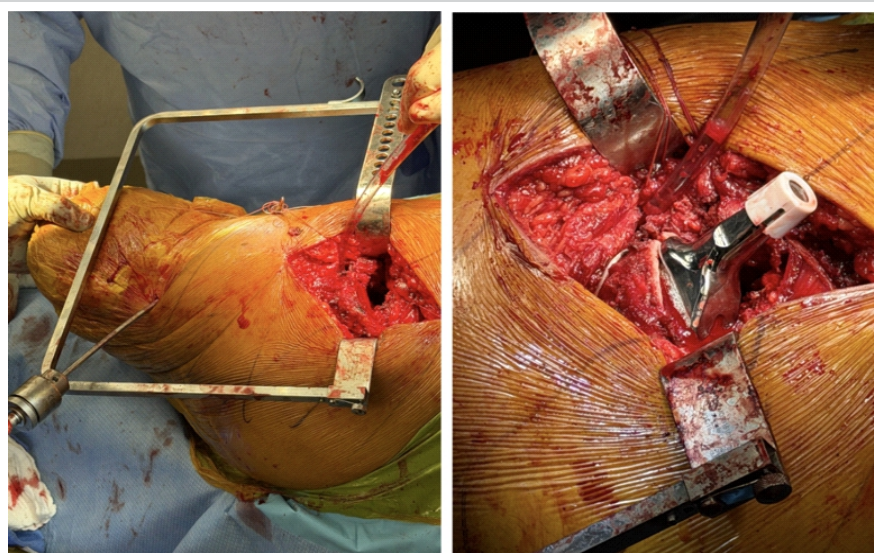


Figure 2: A fully threaded Steinmann pin inserted into the distal anterolateral femoral stump provides a temporary lever arm to control rotation and flexion of the residual limb during acetabular and femoral preparation. High-offset femoral stem implanted with $10\text{--}15^\circ$ anteversion, demonstrating restoration of leg length and soft-tissue balancing. Calcar fragment secured with cerclage cable.



Figure 3: Anteroposterior left hip and pelvis radiographs demonstrating appropriate alignment and stable fixation of acetabular and femoral components. Calcar fragment secured with cerclage cable.

radiographs demonstrated appropriate component positioning without evidence of complication. Plans were made for protected weight-bearing, early mobilization, and inpatient seizure evaluation (Fig. 3).

At 6-month follow-up, the patient's wounds had completely healed without sequela. The patient was back to using his prosthesis for ambulation without assisted devices. Both stationary pain and pain with ambulation had been alleviated in the previously fractured left hip. The patient reported no additional concerns, pain in thigh, or additional adverse effects.

Discussion

Management of displaced femoral neck fractures in young patients traditionally favors reduction and internal fixation to preserve the native hip despite substantial fixation failure rates remaining substantial with fracture displacement, poor bone quality, and comorbidities [3,4,5,6]. These challenges are amplified in patients with ipsilateral lower extremity amputation, who experience profound musculoskeletal and biomechanical adaptations following limb loss [7,8,9]. Lateral shifting of the center of gravity after amputation increases shear forces across the femoral neck, creating a biomechanically unfavorable environment for fracture healing, even when reduction appears satisfactory [1,10]. Consequently, the likelihood of revision surgery may be high in select cases.

To the best of our knowledge, reports of THA in amputee patients are limited, and those that are reported are almost exclusively limited to below-the-knee amputees. In patients with more proximal levels of amputation, the absence of a distal lever arm complicates intraoperative procedures such as hip dislocation, femoral preparation, and accurate component positioning. In this case, a fully threaded Steinmann pin in the anterolateral femoral stump provided a temporary lever arm, allowing controlled manipulation of the residual limb during acetabular exposure, femoral preparation, and trialing.

The decision to proceed with primary THA was influenced by factors associated with fixation failure, including complete fracture displacement, significant posterior tilt on axial CT imaging, active tobacco use, and compromised bone quality [10,11,12,13,14]. While arthroplasty in young patients raises concerns regarding implant longevity and future revision, these risks were weighed against the high probability of non-union or avascular necrosis following internal fixation in a biomechanically unfavorable environment [7,15]. THA-

cortex, and a fully threaded Steinmann pin was drilled into the anterolateral cortex of the femoral shaft. This provided a temporary lever arm, allowing controlled external rotation, flexion, and positioning of the femur throughout the procedure (Fig. 2).

A T-type capsulotomy was performed, and the hip was dislocated anteriorly, revealing the femoral neck fracture and associated hematoma. A standard femoral neck osteotomy was performed, and the femoral head was removed. The acetabulum was sequentially reamed to 54 mm, revealing osteoporotic bone. A 54-mm acetabular shell was implanted with 40–45° of abduction and approximately 20° of anteversion, supplemented with a single screw for fixation. A 40-mm liner was inserted.

Using the Steinmann pin for controlled manipulation, the femoral canal was prepared and broached to size 10. Trial reduction demonstrated excellent stability and restoration of leg length. A small posterior-medial calcar cortical delamination was noted and secured with a cerclage cable. A size 10 high-offset femoral stem was implanted with 10–15° of anteversion, and a 40-mm ceramic head with neutral neck length was impacted.

The hip was reduced and demonstrated excellent stability through a full range of motion, utilizing the fully threaded Steinmann pin. The wound was irrigated, the capsule and abductors were repaired, and layered closure was performed. A negative-pressure wound dressing was applied. Distally, the former Steinmann pin site was irrigated and closed with 3-0 nylon suture.

Postoperative course

The patient tolerated the procedure well and was transferred to the post-anesthesia care unit in stable condition. Post-operative

specific risks, including instability and infection, were mitigated through careful component positioning, use of a large femoral head, meticulous soft-tissue repair, and application of negative-pressure wound therapy.

This case highlights the complexity of managing femoral neck fractures in amputee patients and the paucity of literature-guided surgical decision-making. While limited by its single-case design, it demonstrates that primary THA, combined with a simple limb-control technique, may be a reasonable and reproducible option in select above-the-knee amputees with high-risk fracture patterns.

Conclusion

Primary THA is a reasonable option for select above-the-knee amputees who sustain displaced femoral neck fractures with multiple risk factors for fixation failure. A fully threaded Steinmann pin placed in the residual femoral stump provided simple, reproducible intraoperative limb control without extensive soft-tissue dissection or specialized instrumentation.

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

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Clinical Message

Displaced femoral neck fractures in young above-the-knee amputees present unique biomechanical and technical challenges. This case demonstrates that primary total hip arthroplasty can be considered when multiple risk factors for fixation failure are present, including fracture displacement, significant posterior tilt, tobacco use, and poor bone quality. The use of a fully threaded Steinmann pin placed within the residual femoral stump provides a simple, safe, and effective method for intraoperative limb control, facilitating femoral preparation, component positioning, and stability assessment without extensive soft-tissue dissection or specialized instrumentation. This technique may serve as a valuable adjunct for surgeons managing complex hip arthroplasty cases in patients with proximal lower-extremity amputations.



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