# Subtrochanteric Femur Fractures: Optimal Incision Location for Clamp-assistant Intramedullary Nailing

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## Summary

Subtrochanteric femur fractures are technically challenging fracture patterns to treat. Securing and maintaining closed anatomic reduction is often impossible given the strong deforming forces. Open reduction through a small lateral incision allows for more control over the proximal fragment to facilitate reduction maneuvers. When put in the appropriate anatomic location a single lateral incision can be used for proximal fragment control and reduction as well as the site for placement of the cephalomedullary component of an intramedullary nail (IMN). We describe a technique for ideal placement of this incision to minimize incision size and number, limit soft tissue disruption, and facilitate open reduction.

## Introduction

Subtrochanteric femur fractures are complex fracture patterns of the proximal femoral shaft associated with high complication rates and often require difficult reduction maneuvers to restore anatomic alingment[1] (Figure 1). These fractures normally are treated with antegrade reamed intramedullary fixation with fixation into the femoral head. Other options exist, like fixed-angled plates, but are less frequently used due to the success of intramedullary fixation. Reconstruction intramedullary nails are the preferred design because the cephalomedullary component increases device to bone contact points in the proximal fracture fragment.[1] Biomechanical studies revealed implant designs with more control in the proximal fragment, like reconstruction nails, allowed for less motion at the fracture site and improved stabilization in comminuted fracture patterns.[2]

Previous reports document the rates of malunion and non-union of subtrochanteric femur fractures.[3,4] As less than anatomic reductions are not accepted in these fracture patterns more surgeons are progressing to open reduction. Beingessner *et al.* recently published a retrospective cohort of patients with subtrochanteric femur fractures and more than half, 56%, required open reduction. In their series 55/56 patients who had open reduction, 98%, went onto union and maintained adequate alignment in both the sagittal and coronal planes.[5] These results indicate open reduction as a safe method for treating patients with these injuries. Once the decision has been made to perform open reduction, determining where to place the incision can be complex. Goals include maintaining control of the proximal fragment with enough purchase to overcome the strong deforming forces. It is also important to consider that if a cephalomedullary component will be used, incisions should not be in locations that result in an area of avascular tissue. If one could predict where the cephalomedullary component would need to enter the skin, then a single incision could be used for both proximal fragment control and the head-neck fixation component. The technique described has proven to be provide a reliable method for identifying the ideal location for this incision and is currently used in practice.

## Procedure

The patient with a subtrochanteric femur fracture is positioned either supine on a radiolucent (Jackson) table with the injured extremity draped freely and elevated compared to the contralateral side using a radiolucent bump or supine on a fracture table with the fractured limb placed in boot traction (Figure 1). Intravenous prophylactic antibiotics are given and the extremity is prepped and draped in the usual sterile fashion. An attempted closed reduction is performed by manipulating the limb with the use of traction and strategically placed bumps. If the fracture reduces easily, then a standard closed nailing is performed. If it is evident that the proximal fragment will not easily reduce, then the closed nailing is converted to a limited open nailing.

Location of the incision is determined by the following technique. The insertion jig with aiming arm for the cephalomedullary fixation is assembled on the back table (Figure 1). Once assembled, the jig is placed on the anterior aspect of the prepped limb (Figure 1). Using fluoroscopic guidance, the jig is positioned such that the jig is superimposed with the nail entry point (Figure 2). The proximal and distal boarders of an incision needed for placement of cephalomedullary fixation is marked with a surgical pen with the jig overlying the extremity (Figure 2). The markings are used as a guide to make an incision about 3 cm long just posterior


**Figure 1.** (A) Diagram depicting a subtrochanteric femur fracture with the deforming forces on the fracture fragments; (B) Patient positioned supine on radiolucent table with bump under hip in traction; (C) Jig assembled on back table; (D) Jig placed on anterior aspect of prepped limb.

to the mid-lateral axis of the femur (Figure 2). This incision can be extended proximally and distally as necessary for open reduction and proximal fragment control. Superficial dissection involves incising the iliotibial band. The vastus lateralis is raised off the intramuscular septum while being mindful of perforating vessels. Deep dissection allows access to the femur for the placement of reduction tools.

Access to the femur at this level allows for control of proximal fragment in the face of deforming forces causing flexion, abduction, and external rotation (Figure 2). The cephalomedullary component can be passed through the same incision (Figure 3). With this technique, open reduction and internal fixation with a cephalopmedullary device can be performed on complex subtrochanteric femur fractures through three small incisions (Figure 3).

## Discussion

We started using this technique for all subtrochanteric femur fractures that cannot be treated with closed reduction

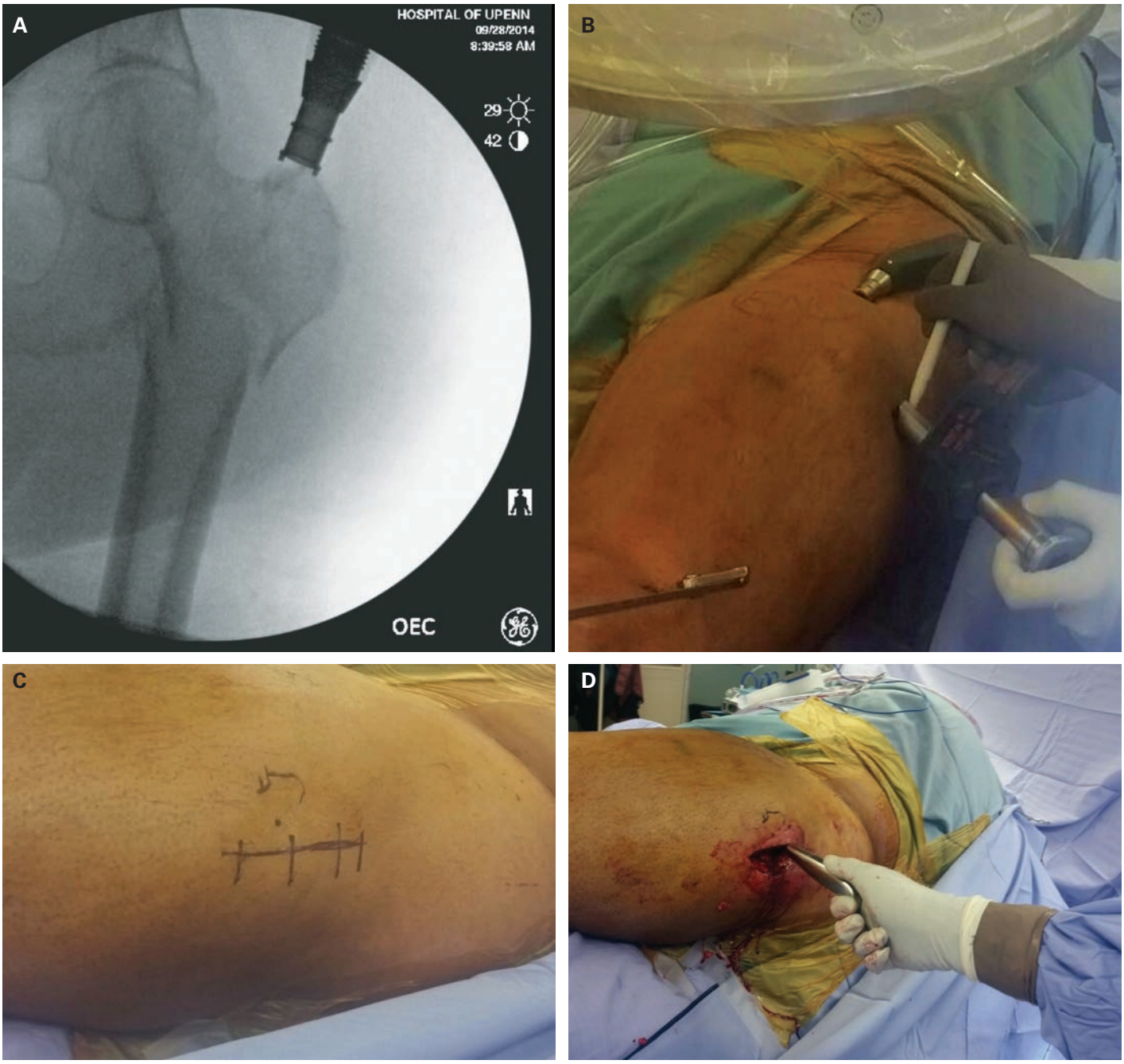


**Figure 2.** (A) Jig superimposed on anterior aspect of prepped limb for determining incision placement; (B) Location of incision for cephalomedullary fixation & open reduction marked out; (C) 3cm incision marked of just posterior to the mid-lateral axis of the femur; (D) Single incision being used for open reduction.

methods at our institutions. Patients of various BMI's, both high and low, are amenable to this method. This technique is easily reproducible, takes minimal operative time, and decreases the likelihood of necrosing skin by minimizing the need for multiple incisions. The method described is an expansion on the previously described technique by Afsari *et al.* in JBJS 2010, where they first detail the use of reduction clamps and cerclage wires for open reduction methods in complex subtrochanteric femur fractures. By placing an incision in the correct location one can transform a complex femur fracture to a simpler pattern and therefore less stressful procedure.[6] As these fracture patterns continue to increase in numbers as the population ages, it becomes all the more important for adult orthopaedic surgeons taking trauma call to know the techniques available to facilitate optimal treatment of complex fracture patterns.

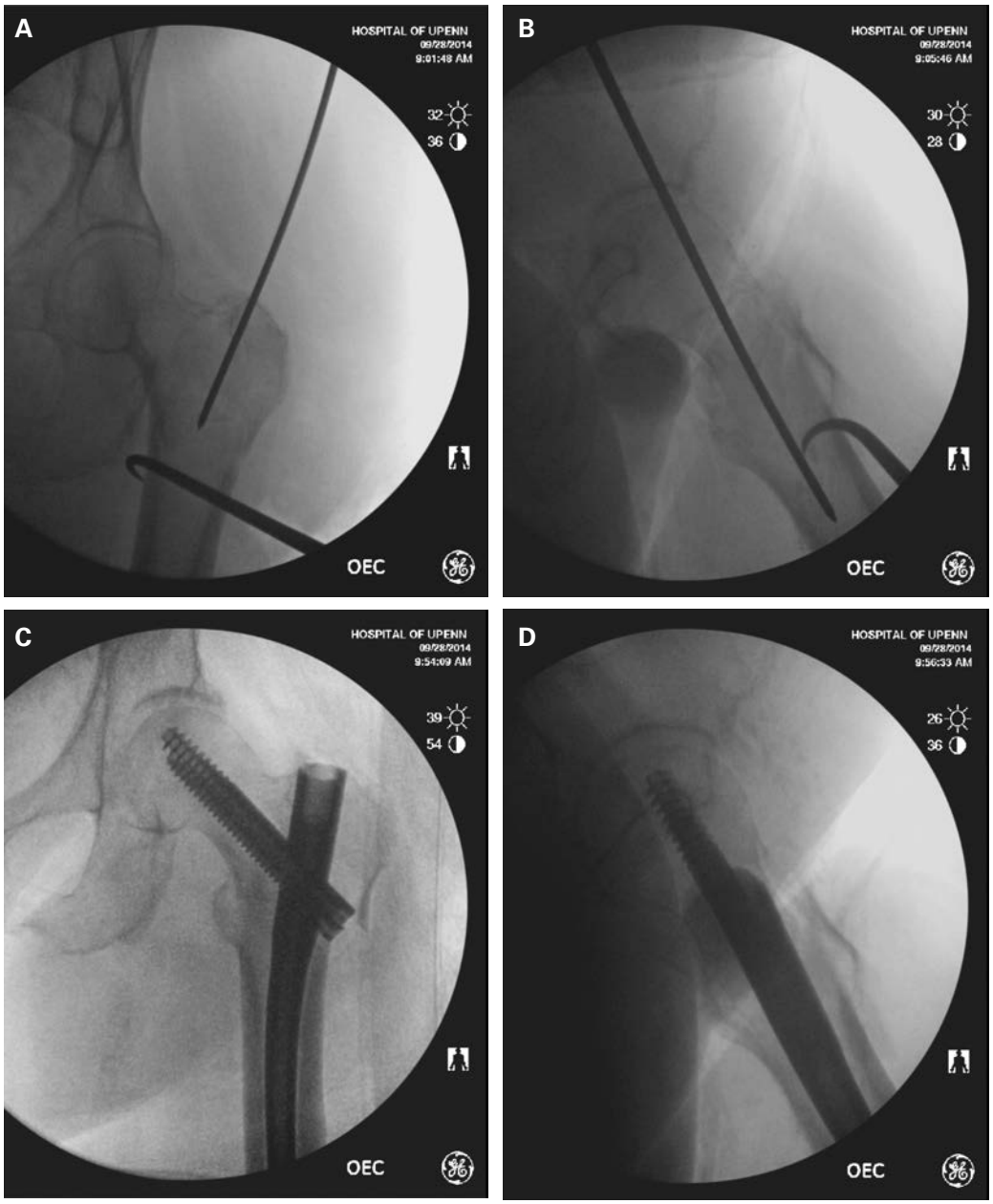


**Figure 3.** Fracture reduction held with intramedullary fixation being placed on AP (A) and lateral (B) radiographs; Final AP (C) and lateral (D) radiographs after cephalomedullary fixation.

## References

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