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# Minimally invasive clamp-assisted reduction and cephalomedullary nailing without cerclage cables for subtrochanteric femur fractures in the elderly: Surgical technique and results

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ABSTRACT

*Introduction:* The treatment of subtrochanteric fractures in the elderly remains technically challenging, due to instability and osteoporosis, with high reoperation rates. Even if intramedullary nailing is the most reliable treatment, reduction is difficult and cerclage wiring remains controversial. The purpose of this study was to evaluate 26 consecutive subtrochanteric fractures in elderly patients treated with a minimally invasive clamp-assisted reduction and cephalomedullary nailing without cerclage wiring.
*Patients and methods:* A retrospective analysis was conducted between January 2010 and September 2013. Data obtained from the medical records included patient's age, sex, classification of the fracture, the quality of reduction after surgery, and the presence of postoperative complications, especially fracture displacement and delayed union or nonunion.
*Results:* Twenty-six patients had adequate radiographic and clinical follow-up. Mean age was 84.4 (range 75–96) years. The mean duration of follow-up was 7.6 months (6–14 months). Mean surgical time was 74.42 min (range 45–115 min). Twenty-four (92.3%) showed acceptable varus/valgus alignment, and no sagittal plane malunions were noted. The tip-apex distance was <25 mm in all cases. Distraction at the fracture was <10 mm in 21 fractures. Three patients had limb length discrepancy of 1 cm. All fractures healed uneventfully.
*Discussion:* Reducing the fracture before nailing is mandatory to achieve good results. Minimally invasive clamp reduction without cerclage wires, even if challenging, has proven to be a safe, reproducible, and effective surgical technique, with at least the same results as other series.


## Introduction

The subtrochanteric region of the femur is the area extending from 5 cm below the lesser trochanter to the junction of the proximal and middle one-third of the femur. These fractures are seen either in young patients involved in high-energy trauma or in older osteopenic patients after a low-energy fall [1]. In elderly patients, this fracture has a substantial negative effect on both their short- and long-term quality of life [2].

The treatment of these fractures remains challenging, even to experienced fracture surgeons, given the high rate of complications associated with the intense concentration of deforming forces, decreased vascularity of the region, instability, and osteoporosis [3].

Different implants are used for treating these fractures, with high reoperation rates up to 8%, regardless of the fixation method. Intramedullary fixation offers mechanical and biologic advantages over extramedullary devices [4–8], but may be challenging if trying to treat the fracture by closed reduction on a traction table.

Many techniques and tools have been described to maintain reduction during nailing. The most common is the use of cerclage

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cables, although their use for reduction before fixation of subtrochanteric fractures is still a subject of debate.

The purpose of this study was to evaluate 26 consecutive subtrochanteric fractures in elderly patients treated with a minimally invasive clamp-assisted reduction and cephalomedullary nailing without cerclage wiring. We evaluate the reduction quality, complications of the minimally invasive approach, reproducibility of the surgical technique, and maintenance of the reduction.

## Patients and methods

A retrospective analysis was conducted using data from patients treated for subtrochanteric fracture in our hospital between January 2010 and September 2013. Exclusion criteria included patients <75 years, previous ipsilateral hip or femoral surgery, non-osteoporotic pathologic fractures, and those deceased before 1 year after surgery. We also excluded all patients whose fracture reduced anatomically with closed reduction.

### *Surgical technique*

Surgery is performed with the patient supine on a radiolucent fracture table, with the fractured limb placed in boot traction and the contralateral limb in hemilithotomy position to allow proper lateral views and distal locking.

Traction is applied and reduction is checked under fluoroscopy on the anteroposterior (AP) and lateral views. If closed reduction is achieved, a standard procedure of anterograde cephalomedullary nailing is performed. However, if the characteristic deformities are present, then reduction of the fracture through a minimally invasive approach is performed prior to nailing. Three types of displacements are described: first, the usual displacement in flexion, abduction, and external rotation seen in the majority of the subtrochanteric fractures; second, when the main deforming force is the abduction (the so-called reverse-obliquity intertrochanteric fractures); and, third, the iatrogenic displacement of fractures with proximal extension during the surgical procedure.

If the proximal fragment is displaced in flexion, abduction, and external rotation, after preoperative skin preparation with povidone-iodine and draping in a sterile fashion, a 5–6-cm incision is performed on the lateral side of the thigh, at the fracture site. The fascia lata is incised, and blunt dissection of the vastus lateralis is performed until the fracture site is palpated. Then a reduction clamp (we usually use a Verbrugge bone-holding forceps) is placed to reduce the fracture under fluoroscopy control. In most subtrochanteric fractures, it is usually positioned from anterior to posterior to close the gap. Then, some degree of rotation of the distal fragment is performed to correct this deformity. Abduction is usually corrected when the clamp is in position (Fig. 1).

Once reduction is achieved and maintained by the clamp, nailing is performed following the original operation technique provided by the implant company. In our series, we used either the standard proximal femoral nail antirotation or the long proximal femoral nail antirotation (PFNA; Synthes®, Oberdorf, Switzerland). Regarding nail length selection, we use a long nail in subtrochanteric fractures with diaphyseal extension. In the trochanter-diaphyseal fracture Seinsheimer type V, [9], we use a 240 mm medium nail, which has the added advantage of a guided distal locking screw.

We make a 4-cm incision just proximal to the great trochanter, and select the appropriate nail entry point (starting point) slightly medial to the tip of the great trochanter. The nail is then passed across the fracture while the fracture is held reduced. Once the nail is inserted, the corresponding guide wire is used to introduce the head/neck component of the nail (helical head/neck blade) and static locking screws distally, using the free-hand technique. In many cases, the reduction clamp was on the place where the guide wire should be introduced, and we had to change its position either proximally or distally to be able to introduce the head/neck blade. In our experience, removing the clamp once the nail is passed, but before introducing the head/neck blade, results in re-displacement of the proximal fragment in flexion. We recommend maintaining it during all the procedure, and removing it once the proximal and distal fixations are achieved. The wounds are closed in the usual fashion.

When the fracture line extends from the proximal medial to distal lateral through the intertrochanteric–subtrochanteric region (Seinsheimer IIC, the so-called reverse-obliquity intertrochanteric fractures), the main deforming force is in abduction. In these cases, forceps must be placed to close the gap from medial to lateral. The rest of the procedure is performed as described before (Fig. 2).

In more complex subtrochanteric fractures, with significant trochanteric and piriformis fossa comminution, even if may reduce anatomically on the traction table, inserting the reamer or the nail may displace the great trochanter laterally and posteriorly, leading to a poor reduction.

In this situation, a 5-cm incision is made on the lateral side of the greater trochanter, at the fracture site. The same technique is performed and the reduction clamp is placed to reduce the greater trochanter. Once reduced, the standard procedure is performed as usual, controlling any displacement under fluoroscopy (Fig. 3).

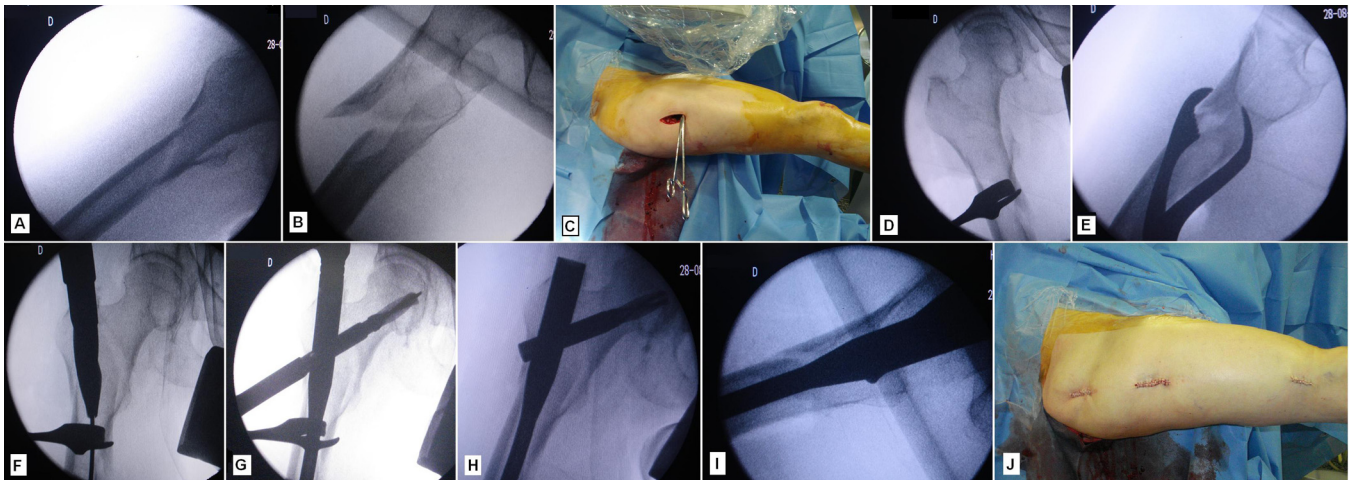


**Fig. 1.** Surgical procedure in subtrochanteric fractures with displacement in flexion, abduction and external rotation.