

## ORIGINAL ARTICLE

# MANAGEMENT OF FAILED SUBTROCHANTERIC FRACTURES WITH A PROXIMAL FEMORAL NAIL BY A REVERSE SUPRACONDYLAR LOCKING PLATE

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## ABSTRACT

**Objective:** To show the advantages of distal femoral anatomical locking plates for salvaging failed subtrochanteric femoral fractures. **Material & Methods:** 11 patients (9 males, 2 females) with subtrochanteric fractures with nonunion following implantation with a PFN (10 patients) or an interlocking nail (1 patient) were managed by removal of the implant, open reduction, freshening of bony ends, and internal fixation by a reverse supracondylar locking plate along with autogenous corticocancellous bone grafting. All patients were followed up clinically and radiologically. Functional outcomes were assessed in terms of the Harris Hip score. **Results:** All patients showed union at an average of 23.2 weeks after revision surgery. The Harris Hip score at the most recent follow-up was 84.6. Functional outcomes were excellent in 18.1%, good in 45.4%, fair in 27.2%, and poor in 9% of patients. **Conclusion:** A reverse supracondylar locking plate can be used as a viable option for failed primary osteosynthesis in subtrochanteric fractures and is associated with good functional outcome.

**Keywords:** Failed subtrochanteric fractures, Proximal femoral nail, Reverse supracondylar locking plate

## INTRODUCTION

Subtrochanteric fractures account for approximately 25% of proximal femoral fractures and show a bimodal distribution. In adults, these fractures are usually associated with high-energy trauma and show complex patterns, while in the geriatric age group they are associated with trivial trauma because of osteoporosis and are spiral in nature.<sup>1-3</sup>

Subtrochanteric fractures are associated with a high rate of complications because of their unique anatomical and biomechanical characteristics, as this area is mainly composed of cortical bone, which is subjected to higher muscular forces by surrounding hip muscles, leading to higher stress across the fractures and instability.<sup>4</sup> Despite recent advances in technology and implant development, subtrochanteric fractures are still challenging for trauma surgeons.<sup>4</sup>

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They can be managed by either intramedullary or extramedullary implants; however, intramedullary implants, such as a proximal femoral nail (PFN), are reported to be biomechanically stronger and associated with superior results as compared to extramedullary implants.<sup>5,6</sup>

Fracture fixation with a PFN offers higher rotational stability to the proximal femoral region along with distal locking; however, the nailing technique has a steep learning curve and is technically demanding, and failure to adhere to the principles of the nailing technique results in failed osteosynthesis and subsequently nonunion.<sup>7,8</sup> This nonunion can be managed by revision with angled blade plates, dynamic hip screws, dynamic condylar screws, proximal femoral locking plates, or reverse supracondylar locking plates.<sup>4-9</sup> We evaluated the efficacy of reverse supracondylar locking plates in the management of failed osteosynthesis of subtrochanteric fractures that were initially managed with either a PFN or an interlocking nail.

## MATERIAL and METHODS

In a retrospective review study, we recruited 11 patients (9 males, 2 females) with an average age of 57.4 (range 27-63) years with nonunion of a subtrochanteric fracture following a PFN (10 patients) or an interlocking nail (1 patient). The average time of presentation following index surgery was 1 year and 2 months. All patients were treated at Aseer Central Hospital or Private Hospitals in the Abha region, Saudi Arabia, and all were assessed clinically, radiologically, and hematologically. A detailed clinical history was taken and all necessary investigations were performed to rule out any systemic cause of nonunion in the patients. Informed consent was obtained from all patients. All patients were managed by removal of the implant, open reduction, freshening of bony ends, and internal fixation by a reverse supracondylar locking plate along with autogenous corticocancellous bone grafting.

**Surgical Technique:** Regional or general anesthesia was administered to the patients. All patients were operated in a supine position on a traction table. The

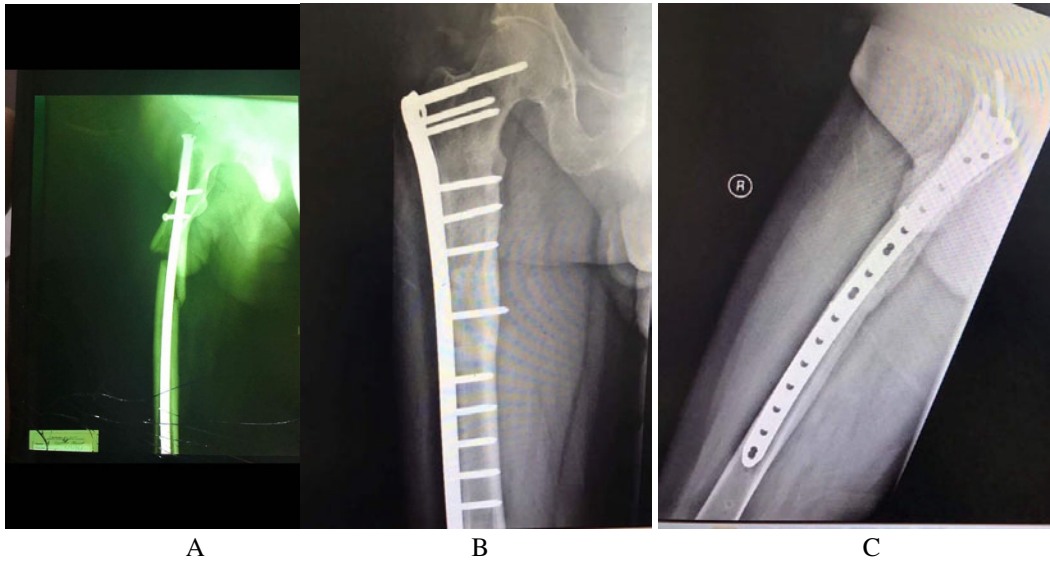
C-arm was kept between both lower limbs of the traction table. Firstly, the implant was removed, and then the fracture was opened through a lateral approach. The fracture sites were freshened up, opposed to each other with the help of reduction forceps, and held temporarily with Kirschner wires. After reduction and temporary fixation, a suitable length of the supracondylar plates at the opposite side was taken, and they were held on the lateral surface with Kirschner wires. After checking the position of the plate on the C-arm, a proximal screw was inserted initially in the neck region to hold the plate, followed by compression at the fracture site, if possible, and then the rest of the proximal and distal locking screws were inserted sequentially under C-arm guidance. A corticocancellous graft was harvested from the ipsilateral iliac crest and inserted at the fracture site. The wound was closed in layers. Postoperatively from the second day onward, nonweight-bearing, hip-range motion exercises were begun as the patients started tolerating pain. All patients were kept on nonweight-bearing exercises for six weeks initially, followed by partial weight-bearing exercises for a further six weeks. At 3 months postoperatively, after radiological signs of consolidation were observed, the patients were allowed full weight-bearing exercises; otherwise, weight-bearing was delayed. All patients were followed initially at 6-week intervals for 3 months, followed by 3-month intervals, to assess union and other complications. All patients were followed up clinically and radiologically. Functional outcomes were assessed in terms of the Harris Hip score.

## RESULTS

All patients were followed up for a minimum 39-month period. All patients showed union at an average period of 23.2 weeks after revision surgery (Fig. 1). One patient developed a superficial surgical site infection, which was treated by debridement and a prolonged course of antibiotics; the infection healed. The Harris Hip score at the most recent follow-up was 84.6.

The outcomes were excellent in 18.1%, good in 45.4%, fair in 27.2%, and poor in 9% of patients.

Harris Hip Score	Number	Percentage
Excellent	2	18.1
Good	5	45.4
Fair	3	27.2
Poor	1	9.0



**Figure 1:** Salvage of nonunion of a femoral subtrochanteric fracture intramedullary interlocked with a nail and a reverse supracondylar locking plate.

## DISCUSSION

In our study, we examined a cohort of patients with failed subtrochanteric fractures after intramedullary osteosynthesis. The treatment of subtrochanteric fractures is associated with many complications, mainly infection, malunion, delayed union, pseudoarthrosis, and nonunion.<sup>4,10</sup> Most complications arise because of either the wrong choice of an implant or an inefficient technique for implant insertion.

Intramedullary implants are preferred because of their biomechanical properties, shorter operative time, and minimally invasive fixation with less tissue stripping.<sup>4,10-13</sup> A PFN is the most frequently used implant for unstable trochanteric fractures as it

provides rotational stability to the proximal segment; however, a wrong technique entailing poor reduction, a wrong nail-entry site, or improper positioning of the proximal hip screws leads to screw back-out, and varus collapse re-operation rates of 4% to 28% have been reported with a PFN in primary subtrochanteric fracture fixation.<sup>9,14</sup>

In our study, we revised all patients with a reverse supracondylar locking plate and observed that more than half of our patients had a good to excellent outcome. We used an opposite supracondylar locking plate as it fits the anatomy of the proximal femur at the other side. This locking plate has advantages as it offers more locking screws for the proximal femur, a stable angular construct for

osteoporotic geriatric patients, and a minimally invasive way of implementation. In their study on a similar cohort of patients with a failed PFN, Vaishya et al.<sup>9</sup> observed union in all patients with an opposite distal femoral locking plate.

## CONCLUSION

Based on our results, we can recommend that a reverse supracondylar locking plate can be used as a viable option for failed primary osteosynthesis in subtrochanteric fractures; however, because of a limited number of patients, we advocate further research to establish the advantages of a reverse supracondylar locking plate as implant of choice for the management of nonunion of subtrochanteric fractures.

The study was conducted in a limited number of patients. Although the study was carried out by the same surgeon in the final surgery using this technique, the first procedure may have been done at a different center.

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