



E-ISSN: 2395-1958  
P-ISSN: 2706-6630  
IJOS 2021; 7(4): 622-625  
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[www.orthopaper.com](http://www.orthopaper.com)  
Received: 07-06-2021  
Accepted: 09-07-2021

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## Short term results of Sub trochanteric femur fractures treated by Ender's nail and Plate: A study of 25 cases

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DOI: <https://doi.org/10.22271/ortho.2021.v7.i4i.2942>

### Abstract

**Introduction:** Fractures in sub-trochanteric regions are common in elder as well as younger population though force of injury varies. In younger age this results from high velocity trauma around hip while in elder population this may occur due to trivial trauma like simple fall. This type of fracture constitutes 10-30% of fractures around hip. Usually these type of fractures result in poor outcome because of difficult reduction due to muscle forces across fracture, comminution of fracture fragments and factors like osteoporosis. Treatment includes fixation of this fracture using various intramedullary as well as extra medullary side support implants. Proximal femoral nail is most commonly used implant as they share the load across the fracture. This type of fracture is having a very high failure rate resulting in non-union or varus mal-union with implant failure. The forces across the fracture are well countered by combining intramedullary as well side support implants. In this study we used Ender's Nails as intramedullary implant and with 4.5 mm Dynamic compression plate and 4.5mm and 6.5 mm screws as extra medullary implant that adds the rotational stability to bone implant construct.

**Materials and methods:** 25 patients operated from June 2015 to December 2019 were identified from the available records and included in the study. All the treatment documents of selected patients till their last follow-up were reviewed. During their last follow-up Harris Hip Score was counted and Tegner Activity scores were obtained.

**Results:** Out of 25, 18 were Male and 7 were female patients. Mean age of patients was 43. Most common mode of injury was road traffic accident. Fracture was united in all the patients (Union rate was 100%). 2 patients developed minor complication like nail backing out at knee joint. Harris Hip Scores is excellent in 20(80%) and good in 5(20%) numbers of patients. None of the patients were having movement restriction for hip and knee joint of the affected side.

**Conclusion:** Combination of intra medullary device like Ender's nail and extra medullary implant like Dynamic compression plate for sub-trochanteric fracture is having good functional results and they are beneficial in terms of cost of the implants and technical ease.

**Keywords:** Sub-trochanteric femur fractures, Enders nail, Plating, proximal femoral nail

### Introduction

Sub-trochanteric region in the femur consist of area of proximal femur that is 5 centimetre distal to lesser trochanter. Fractures in this region are common in young as well as elder age group. But mechanism differs between these age groups. In elder population this usually occurs as a result of low energy trauma while in Younger age group this type of injury usually results from high velocity injury<sup>[1, 2]</sup>. This region of bone is junction of metaphysis and diaphysis region and mainly consist of Cortical bone. Fracture in this region is very displaced due to strong muscle forces in this region and that is also reason of high chances of implant failure and prolonged healing of fractures in this region.

Owing to this reasons treatment of sub trochanteric femur fractures remain technically challenging even for experienced orthopaedic surgeon<sup>[3, 4]</sup>. Historically these fractures were treated conservatively by skeletal traction that resulted in non-union or mal-union with poor functional outcome but with an advancement of modern orthopaedics these injures are treated by operative methods. Widely treatment option of sub-trochanteric fractures is divided mainly into two groups, first is extra medullary implants like dynamic hip screw, dynamic condylar screw, AO 95 angled condylar blade plate etc<sup>[5, 6, 7, 8, 9, 10, 11]</sup>, second is intra medullary implants like proximal femoral nail, Gamma nails, Russell Taylor nail & Ender's nail, Cyrus nail etc.

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Among them most preferred ones are intramedullary implants [11, 12, 13]. But unfortunately, complications like mal union with varus deformity, shortening, breaking of implants and non-union are reported in both the groups [14]. To counter the forces across this region combining intramedullary and extra-medullary implants may give good results. Therefore, in this study we have fixed fractures using intra medullary Ender's nails and extra medullary Dynamic compression plate for femur. Ender's nail alone associated with rotational mal union and back out issues at entry site [15, 16]. Adding side support plate serve the purpose of rotational stability as well as extra strength to bone implant construct.

Primary aim of the study was to evaluate the results of this method of fracture fixation in terms of radiological union and to know the functional outcome by using Tegner activity score and Harris hip score and to know any complications like mal-union, varus deformity, non-union, implant failure, shortening, functional outcomes and treatment cost.

### Materials and Methods

A retrospective study of the 25 patients having fracture with severe comminution sub-trochanteric femur fractures treated by Enders nail and plating were included in the study. Patients were selected from the available records and those who were available for follow-up and who were having one year of follow-up were included in the study. Patients were called for follow-up and their records were examined and at the last follow-up they were examined for the results. Hip and knee joint movements were measured, Harris Hip scores was calculated for each patient and Tegner activity scale was obtained at pre-injury level and post injury level at 1 year.

Inclusion criteria for this study were: (1) Closed sub-trochanteric femur fractures (2) Age more than 18 years (3) Normal neurovascular status. Exclusion criteria were (1) compound fracture (2) age <18 years (3) Associated fractures in distal femur or tibia (4) Patients with less than 12 months follow up (5) Seinsheimer's type 1 and 2 fractures.

Fractures were classified using Seinsheimer's classification [17]. All patients were admitted through casualty department after evaluating associated injuries thereafter fracture is primary stabilized by skin traction and according to antero-posterior and lateral roentgenogram fractures classified into Seinsheimer's type and treated accordingly. Out of 25 patients 8 (32%) belong to Seinsheimer's type 3(a) 7(28%) to type 3b, 7(28%) to type 4 and 3(12%) belongs to type 5. (Table 1 and 2). Operative notes were reviewed to obtain operative time and amount of blood loss. Post-operative x-rays were reviewed to look for degrees of varus deformity and amount of shortening. At final follow up all patients were evaluated by using Harris hip score and Tegner functional scoring.

### Technique of surgery

All patients were operated on Hip traction table, in supine position, under image intensifier guidance under regional anaesthesia or general anaesthesia. 1<sup>st</sup> Ender's nail is inserted from supra condylar region of femur from medial side and 2<sup>nd</sup> ender's nail is inserted from lateral side. While inserting ender's nails first they are advanced up to fracture and then using lateral approach to femur open reduction of fracture is done while doing so ender's nails provide intra medullary scaffold to aid in reduction after that these nails are advanced in proximal fragment preferably either both towards greater trochanter or one towards greater trochanter and other towards neck. Then 4.5 mm narrow Dynamic compression plate or proximal femoral locking plate is fixed using 4.5 mm of

cortical and 6.5 mm of cancellous screws. For insertion of screw one cortex of bone was initially drilled with drill bit and then 2.5 mm k wire is inserted to drill the opposite cortex in order to prevent breaking of drill bit due to entrapment between Enders nails. Then wound was closed in layers.

Active and passive physiotherapy of knee initiated once patient is pain free. Patient is advised for non-weight bearing mobilization with crutches. Stitches are removed between 12 to 15 days. Patients are asked for follow-up at 1.5 months, 3 months, 6 months and 1 year. Usually around 3<sup>rd</sup> month post operatively partial weight bearing is started with complete weight bearing around 4 to 5 months of post-operative period.

### Results

Total 25 patients were included in study including 18(72%) and 7(28%) female. Mean age of the patient was 43 (ranging from 17 to 80) years. Most of the patients were of road traffic accidents. Out of 25 patients 8 (32%) belong to Seinsheimer's type 3(a) 7(28%) to type 3b, 7(28%) to type 4 and 3(12%) belongs to type 5 (Table 1). Average hospital stay was 6 days. Average duration of surgery was 95 minutes with standard deviation of 14.29 minutes. Average blood loss was 250 ml with standard deviation of 50 ml. All patients achieved 100 to 120 degrees of range of knee movement. There was issue of back out of Enders nail in two cases (8%) in one case this was managed by punching of ender's nail while in another case it was removed as fracture was already united. All patients achieved 100 to 110 degrees of hip flexion, 30 to 40 degrees of abduction of hip and good range of movements across the hip. In this case study mean pre injury Tegner score level was 3.12 and mean post injury Tegner score level is 2.56 with t-value is 1.67832. (p-value 0.049892). Average time for radiological signs of union was six to twelve weeks. One out of 25 patient developed wound infection that subsided with minor debridement and antibiotics. 80% (20) patients having excellent & 20% (5) patient having good Harris hip scores. There was no rotational mal alignment. There was no varus deformity as measured by neck shaft angle on follow up x-ray and clinically by measuring limb length.

### Discussion

Sub trochanteric femur fractures are difficult to treat owing to marked comminution of the fracture fragments, large amount of the muscle forces in this region of the femur and relatively high rate of non-union in this region<sup>[3,4]</sup> The principle of treatment of sub trochanteric femur fracture is good anatomical reduction and stable internal fixation. That is usually achieved by open reduction of fracture fragments and fixation by using either intramedullary or extra-medullary side support implants. Among them intra medullary devices are preferred as they are load sharing device but they are technically difficult and costly<sup>[18, 19]</sup>. While in obese patient difficulties are more for insertion of cephalomedullary nail. Being an extra medullary plus intramedullary fixation, this technique is having advantages of both. Another advantage is that abductor mechanism is not disturbed that leads to good range of motion of hip joint post operatively and abductor lurch is not seen at final follow-up. Ender's nails are usually associated with back out at knee joint which leads to knee joint disturbance<sup>[20]</sup> this was not a major issue in this study, this may be due to insertion of screws of plate that may prevent gliding of the nail inside canal with good three-point fixation. Another advantage is that fractures with intertrochanteric extension and greater trochanteric wall comminution can be dealt with this technique as plate

buttresses the lateral wall.

Sanders *et al.* [7] in his study of sub trochanteric femur fractures treated by dynamic condylar screw had union rate 77.3% and functional results were excellent and good in 68%. In this study no non-union or implant failure occurred and functional results were 80% excellent and 20% good. In his series sander had failure due to comminution but this modality of fixation works equally well in fractures with great comminution.

Wayne Hoskins *et al.* [18] in his study published in injury journal July 2015 had good results with open reduction and fixation with added cerclage wire. Without cerclage wiring he was having displacement and complication rate of 11.4%. In this study fracture was treated by open reduction without any failure of fixation. Among the treated case cerclage wiring was performed in only one case with very long fracture extension in shaft otherwise it is not required in this modality of fixation.

Daphne M. Beingsner *et al.* [19] in his study of 56 cases treated by open reduction and intramedullary fixation had 98% success rate and 2% failure. while in this study there

isn't any single case of failure.

Only drawback of this study is case series is small as compared to other study so further study with regard to this type of fixation is required.

Werner-Tutschku W *et al.* in his study sample number is 70 and complication occurred in 18 cases including cut-out of the hip-screw in 6 cases varus defect position (CCD angle <125 °) while in this study sample size was 25 and minor complication occurred in 3 cases. [14]

In this study all patients are having pain free one leg stance as abductor mechanism of hip is well preserved in this technique. And patient's satisfaction in terms of result was also good. Therefore, this modality of treatment can be considered having advantage of cheaper cost, good fixation, and good union, technically less difficult and patient's satisfaction compare to other modalities.

Limitations of this study are 1) Number of study samples are less 2) Patients with One year follow up results are available so further follow-up will be required to know long term complications.



**Fig 1:** showing radiographic preoperative intraoperative as well as postoperative images of sub-trochanteric fracture

### Future of study

In future more patients will be added to this study and previously operated patients will be followed for any delayed complication and we will add newer implants like locking plates in place of 4.5 mm Dynamic compression plate.

### Conclusion

Treatment of sub trochanteric femur fractures by Enders nail and plate is technically very surgeon friendly because no specialized instruments assembly is required. This type of fracture fixation can be used for sub-trochanteric femur fracture with comminution that is difficult to treat with only intramedullary or extra medullary device as this modality of treatment is having good clinical and radiological outcomes.

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