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

Savajiyani Dixit N, SD Ramavat and Jain Meet A

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 [1, 2]. 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 [3, 4]. 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 injuries 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 [5, 6, 7, 8, 9, 10, 11], second is intra medullary implants like proximal femoral nai, Gamma nails, Russell Taylor nail & Ender’s nail, Cyrus nail etc.
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 subtrochanteric 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 of proximal femur (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). 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 [3,4]. 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 [18, 19]. 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 [20] 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. Beingessner 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.

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.

References
1. Boyd AD, Wilber JH. Patterns and complications of femur fractures below the hip in patients over 65 years of age. J Orthop Trauma 1992;6(2):167-74.
2. Nieves JW, Bilezikian JP, Lane JM, Einhorn TA, Wang Y, Steinbuch M et al. Frailty fractures of the hip and femur: incidence and patient characteristics. Osteoporos Int 2010;21(3):399-408.
3. Chapman MW, Campbell WC. Chapman's Orthopaedic Surgery. 3rd ed. Philadelphia, Pa: Lippincott Williams & Wilkins 2001.
4. Rockwood CA, Green DP, Bucholz RW, Heckman JD. Rockwood, Green, and Wilkins' Handbook of Fractures. 5th ed. Philadelphia, Pa: Lippincott Williams & Wilkins. 2001.
5. Kinast C, Bolhofner BR, Mast JW, Ganz R. Sub trochanteric fractures of the femur. Results of treatment with the 95 degrees’ condylar blade-plate. Clin Orthop. 1989;(238):122-30.
6. Sanders S, Egoi KA. Adult per articular locking plates for the treatment of pediatric and adolescent sub trochanteric hip fractures. Bull NYU Hosp Jt Dis. 2009;67(4):370-3.
7. Sanders R, Regazzoni P. Treatment of sub trochanteric femur fractures using the dynamic condylar screw. J Orthop Trauma 1989;3(3):206-13.
8. Vaidya SV, Dholakia DB, Chattreea A. The use of a dynamic condylar screw and biological reduction techniques for sub trochanteric femur fracture. Injury. 2003;34(2):123-8.
9. Hasenboehler EA, Agudelo JF, Morgan SJ, Smith WR, Hak DJ, Stahel PF. Treatment of complex proximal femoral fractures with the proximal femur locking compression plate. Orthopedics 2007;30(8):618-23.
10. Massoud EI. Fixation of sub trochanteric fractures: Does a technical optimization of the dynamic hip screw application improve the results? Strategies Trauma Limb Reconstr 2009;4(2):65-71.
11. Brien WW, Wiss DA, Becker V. Subtrochanteric femur fractures: a comparison of the Zickel nail, 95 degrees’
12. Wiss DA, Brien WW. Subtrochanteric fractures of the femur. Results of treatment by interlocking nailing. Clin Orthop Trauma. 1991;5(4):458-64.
13. Queally JM, Harris E, Handoll HH, Parker MJ. Intramedullary nails for extracapsular hip fractures in adults. Cochrane Database Syst Rev. 2014;12(9):CD004961.
14. Werner-Tutschku W, Lajtai G, Schmiedhuber G, Lang T, Pirkl C, Orthner E. Intra- and perioperative complications in the stabilization of per- and subtrochanteric femoral fractures by means of PFN. Unfallchirurg 2002;105:881.
15. Levy RN, Siegel M, Sedlin ED, Siffert RS. Intertrochanteric, and sub trochanteric fractures of the hip. J Bone Joint Surg Am 1983;65(1):66-9.
16. Ladani Himanshu G. Study of Ender’s Nailing in Subtrochanteric Fracture of Femur in Adults. National Journal of Integrated Research in Medicine 2015;6(2):20-25.
17. Seinsheimer F. Subtrochanteric fractures of the femur. J Bone Joint Surg Am 1978;60(3):300-6.
18. Hoskins W, Bingham R, Joseph S, Liew D, Love D, Bucknill A et al. Subtrochanteric fracture: the effect of cerclage wire on fracture reduction and outcome. Injury 2015;46(10):1992-5.
19. Beingessner DM, Scolaro JA, Orec RJ, Nork SE, Barei DP. Open reduction and intramedullary stabilisation of sub trochanteric femur fractures: A retrospective study of 56 cases, Injury 2013;44(12):1910-5.
20. Levy RN, Siegel M, Sedlin ED, Siffert RS. Intertrochanteric, and sub trochanteric fractures of the hip. J Bone Joint Surg Am 1983;65(1):66-9.
21. Werner-Tutschku W, Lajtai G, Schmiedhuber G, Lang T, Pirkl C, Orthner E. Intra- and perioperative complications in the stabilization of per- and subtrochanteric femoral fractures by means of PFN. Unfallchirurg 2002;105:881.