International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2018; 4(2): 883-888

www.orthopaper.com
Received: 07-02-2018
Accepted: 08-03-2018

Dr. G Samynathan
M.S. Orthopaedics, Department of Orthopaedics, Trichy SRM Medical College and Research Centre, Trichy, Tamil Nadu, India

Dr. S Noordeen
M.S. Orthopaedics, Department of Orthopaedics, Trichy SRM Medical College and Research Centre, Trichy, Tamil Nadu, India

Correspondence
Dr. S Noordeen
M.S. Orthopaedics, Department of Orthopaedics, Trichy SRM Medical College and Research Centre, Trichy, Tamil Nadu, India

Functional outcome of subtrochanteric fracture fixed with long proximal femoral nail

Dr. G Samynathan and Dr. S Noordeen

DOI: https://doi.org/10.22271/ortho.2018.v4.i2m.127

Abstract
Background: Subtrochanteric fractures are fractures that occur in a zone extending from the lesser trochanter to 5cm distal to the lesser trochanter, however extension into the intertrochanteric region is common. These fractures account for 10-30% of all hip fractures. Closed proximal femoral nailing provides a rigid fixation with better control of rotation and axial translation, while preserving the hematoma and periosteal envelope to aid healing. We study the functional outcome in patients of subtrochanteric fractures of the femur fixed with long proximal femoral nail.
Materials and methods: These is a prospective study which was carried out from June 2015 to June 2017 in Vinayaka Missions Kirupananda Variyar Medical College and Hospital, Salem, Tamilnadu. In this study period 30 cases of Subtrochanteric femur fracture of hip were studied and operated with PFN.
Results: Cases were distributed across all other types with one case belonging to Type 4 fracture. Majority of the cases (18) were due to high energy trauma of Road traffic Accidents involving relatively younger patients. All except one patient underwent the surgery within 2 weeks of admission. The operating time for 60% cases was between 2-2.30 hours. The average length of Hospital stay was 14.8 days. At the end of five months, all except five patients could mobilise independently without any aid. 2 patients were using crutch and 3 patients were mobilizing using walker at 5 months of follow-up. We did not come across complications like fracture of femur and failure of fixation. None of the cases needed a reoperation. We feel that the Proximal Femoral nail is a better implant in treating subtrochanteric fracture of femur.
Conclusion: From this study PFN is a good implant for subtrochanteric fracture of the femur. Fractures united in all cases and postoperative functional outcome was satisfactory. Early mobilization is an advantage with PFN. PFN could be a preferred implant of choice in treating subtrochanteric fractures especially in elderly since it allows early and stable mobilization.

Keywords: Subtrochanteric femur, functional outcome, proximal femur nail

Introduction
Hip fractures rank in the top ten of all impairments worldwide in terms of loss in disability-adjusted years for people 50+ years old. [1] Consequences of hip fractures are significant in terms of lives lost and the associated negative impacts on hip fracture patients' functioning and quality of life [2]. Among the fractures of upper end of femur, intertrochanteric fractures and subtrochanteric fractures account for more than half of the hip fractures in elderly.
Subtrochanteric fractures account for 10-15% of all hip fractures [3]. Boyd and Griffin in 1949 called attention to subtrochanteric fractures as a variant of peritrochanteric fractures and noted their higher incidence of unsatisfactory results after operative treatment [4]. They are seen in older patients sustaining low velocity trauma and in younger patients involved in high velocity trauma. The biomechanical characteristics of the area, poor vascularity caused by the predominance of cortical bone and inadequacy of reduction and internal fixation are responsible for malunion, delayed union and mechanical failure of implants used in the treatment [5-12]. Several implant designs have been developed in order to facilitate ambulation and to reduce the risk of complications when treating subtrochanteric fractures.
As compared to conservative treatment, operative treatment is better tolerated by elderly because of greater comfort, early mobilization of patient, lower morbidity and mortality of patient [13]. The combination of compression, tensile, and torsional stresses in the region has challenged orthopaedists with problems of delayed union, and nonunion resulting in loss of

fixation, implant failure, and iatrogenic devascularization of the operative exposure site.

In 1996, the Arbeitsgemein-schaft für Osteosynthesefragen AO/ASIF developed the proximal femoral nail (PFN) as an intramedullary device for the treatment of such fractures. In addition to all advantages of an intramedullary nail, it has several other favourable characteristics: it can be dynamically locked, allows early mobilization, has high rotation stability and is done with minimal soft tissue damage [14]. We report here the results of a prospective study carried out at our institute on 30 consecutive patients who had suffered a subtrochanteric fracture between June 2015 and June 2017 and were treated with a PFN.

Methodology

The present study was conducted in 30 cases with Subtrochanteric femur fracture of hip admitted in the department of orthopaedics in our institute for duration of two year from June 2015 to June 2017. The study was done after obtaining ethical clearance and getting written informed consent.

The aim of the study

- To study the clinical patterns of subtrochanteric femur fractures.
- To evaluate the outcome of subtrochanteric femur fractures treated with proximal femoral nails.
- To study various complications related to subtrochanteric femur fractures treated with Proximal Femoral Nail.

Acute subtrochanteric femur fractures, Patients aged between 18 years onwards, Pathological subtrochanteric femur fractures and Patients fit for surgery were included in this study. Whereas exclusion criteria were open fractures, Cases infected in the preoperative period, Fractures in patients below the age of 18 years and patients unfit for surgery.

Preoperative Management

The patients were maintained on traction preoperatively in cases whose surgical intervention was delayed for more than two days. All operations were performed under spinal/epidural anaesthesia. High risk patients had thrombosis prophylaxis with low molecular weight heparin subcutaneously during the hospitalization. Transfusion requirements, in-hospital complications, and length of hospital stay were recorded.

Principles of management

In those subtrochanteric fractures as a result of high-energy trauma, managing polytrauma dominates the initial fracture treatment. In many severely traumatized patients, the concept of damage control in acute management must be considered and practiced whenever it is appropriate.

Current treatment options

The goals of surgical treatment of subtrochanteric femur fractures are anatomic alignment, stable internal fixation, rapid mobilization of the patient, and early functional rehabilitation of the limb. The surgical techniques remain complex, and it is essential to have complete sets of instruments and implants and experienced surgical, nursing, and physiotherapy staff [15]. The restoration of the length and the correction of angular deformities are the primary goals of reduction. The reduced fracture should be repaired with stable internal fixation to allow early mobilization. The technique of internal fixation must follow the guidelines of minimizing the trauma to the soft tissues and the osseous fragments to facilitate fracture healing. In isolated closed subtrochanteric femur fractures that require surgery, perform internal fixation as soon as practical, and within the first 48 hours if possible.

Closed Method

The closed method follows the principle of anatomical realignment in which deformities in length and rotation are corrected to achieve a result that is as normal as possible. This procedure is applied with closed reduction and internal fixation. Closed reduction is usually performed with the use of a fracture traction table. Traction is applied with a transcondylar Steinmann pin under fluoroscopic control. When the fracture is reduced, fixation can be carried out with percutaneous implant insertion. The most common implant used is the intramedullary locked nail, which can be inserted through the greater trochanter after preparing the medullary canal. The interlocking designs help to fix all fracture types regardless of the degree of comminution. The closed method has several advantages in treating these difficult fractures; it does not disturb the fracture haematoma and keeps the soft tissue dissection around the fracture site to a minimum [16].

The medializing of the fixation within the medullary canal decreases the moment arm of the bending stress in the implant, and the load is shared with the osseous tissue. The disadvantage of this method is the demanding technique required in closed reduction, which necessitates good knowledge of the various muscle forces and the technique to correct deformities in various planes. C-arm exposure and free hand distal locking are potential disadvandages. Closed reduction with intramedullary fixation is the treatment of choice for subtrochanteric fractures [16].

The indications for use of the PFN included intertrochanteric fractures, subtrochanteric fractures, reversed fractures, pathologic fractures, and combined trochanteric-femur shaft fractures [17].

Operative procedure

The operations are performed within 3 days of the accident on a fracture table thus achieving adequate reduction. Restoration of femoral length and rotation and correction of femoral head and neck angulation to restore adequate abductor tension and strength are essential to restoring maximal ambulatory capacity.

The patient was positioned supine on the fracture table under spinal or general anesthesia as the condition of the patient permitted. The fracture was reduced by longitudinal traction and the limb was placed in neutral or slight adduction to facilitate nail insertion through the greater trochanter. Prior to positioning and draping, the opposite extremity measurements of rotation and length of this extremity should be determined.

A straight lateral incision was made from tip of the greater trochanter, extending 4-6 cm proximally; the gluteus maximus muscle was dissected in line with its fibers. Where open reduction was required we extended the incision distally, incising the iliotibial band in line with the skin incision.

The entry portal for the PFN was made at the tip of the greater trochanter, halfway between its anterior and posterior extent. A ball tipped guide wire was inserted at the tip of the greater trochanter under C-arm control. The guide wire is advanced into the femoral shaft in such a way that it is located in the middle of the shaft in both directions. In cases where standard PFN was used, we manually reamed the proximal part of the femur with a 14 mm reamer; while where long PFN was used we had to ream the distal femur also with increasing diameters of reamers up to 11 mm.

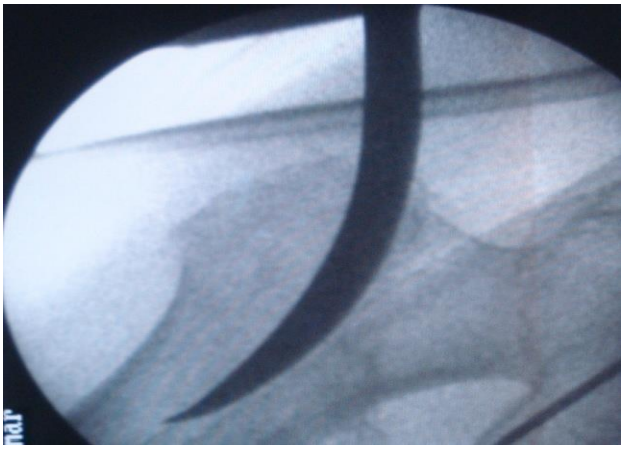


Fig 1: entry using bone awl

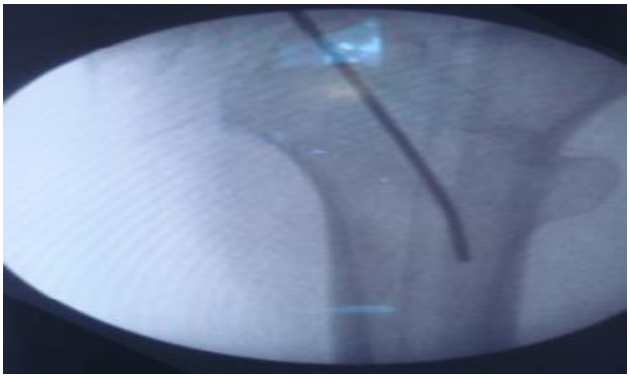


Fig 2: Insertion of guide wire

After mounting the appropriate sized nail on the insertion device the nail was introduced manually into the femoral shaft. Via the aiming arm, which was attached to the insertion device, first the guide wire for the neck screw was introduced into the femoral neck in such a way that the 8 mm screw was placed in lower half of the neck on the antero-posterior view and centrally on the lateral view.

Thereafter, the guide pin for the 6 mm antirotational hip pin was introduced. The hip pin was introduced first with the tip just about 25 mm medial to the fracture line, and then the neck screw of appropriate size was inserted. Afterwards depending on the type of fracture, distal interlocking either statically or dynamically was achieved via the same aiming arm in standard PFN and with free hand in long PFN. The stability of the construct was assessed and wounds were closed in layers over negative suction drain. Antiseptic dressing was done. Per-operatively one dose of antibiotic was also administered

Postoperative Management

Dressing should be applied. The limb may be elevated in order to reduce swelling and facilitate drainage. Mobilization can be started once the patient's condition allows. Weight-bearing is determined by the fracture pattern. In fractures with posteromedial bony contact, graduated weight-bearing can be started early. In fractures with high degrees of comminution, weight-bearing should be delayed until callus is seen.

Results

Patients were distributed across all age groups. In our study most number of patients were in between 30-70 years of age. In our study we came across more male patients when compared to total number of female patients.

Table 1: Side of injury

Side of injury	No. of cases	Percentage
Right	17	56.7
Left	13	43.3
Total	30	100

In present study, right sided involvement is more when compared to left sided involvement.

Table 2: Case Distribution according to Seinsheimer Classification

Fracture Type	No. of cases	Percentage
Type I	Nil	0.0
Type 2A	5	16.7
Type 2B	6	20.0
Type 2C	6	20.0
Type 3A	8	26.7
Type 3B	4	13.3
Type 4	1	3.3
Type 5	Nil	0.0
Total	30	100

We did not come across any Type 1 and Type 5 cases and also we came across one patient with Type 4 fracture.

Table 3: Mode of Injury

Mode of Injury	No. of cases	Percentage
Fall	12	40.0
RTA	18	60.0
Total	30	100

In present study in 60% of the cases, Road Traffic Accident (RTA) is the etiology for the fracture.

Table 4: General Health of the Patient

General Health	No. of patients	Percentage
Normal	18	60.0
Diabetes Mellitus	4	13.3
Hypertension	6	20.0
Cardiac conditions	2	6.7
Anemia	10	33.3
Peripheral Vascular Disease	Nil	0.0
Total	30	100

Ten of the patients were found to be anaemic and whole blood was transfused in the preoperative period.

Table 5: Number of Days to Surgery

Time to surgery	No. of cases	Percentage
0 – 7 days	18	60.0
1 – 2 weeks	11	36.7
> 2weeks	1	3.3
Total	30	100

In present study, all except one patient underwent surgery before 2 weeks

Table 6: Type of surgery

Type of surgery	No. of cases	Percentage
Open reduction	4	13.3
Closed reduction	26	86.7
Total	30	100

In present study, closed reduction was done for 86.7% of patients.

Table 7: Size of the PFN

Size of PFN	No. of cases	Percentage
9 mm	28	93.3
10 mm	2	6.7
11 mm	Nil	0.0
Total	30	100

Only two patients needed size 10 Proximal Femoral Nail. The rest had medullary canals appropriate for the size 9 nail. We didn't use 11 size nail for any of our patients.

Table 8: Operating Time (in minutes)

Operating time	No. of cases	Percentage
< 2 hours	10	33.3
2 – 2.30 hours	18	60.0
2.30 – 3 hours	2	6.7
Total	30	100

The operating time for 60% cases was between 2-2.30 hours. The time taken for surgery gradually decreased with familiarity of implant system.

Table 9: Postoperative Independence of Ambulation

	8 weeks	12 weeks	20 weeks
Walk Independently	6	18	25
Crutch	16	5	2
Walker	8	7	3

At the end of five months, all except five patients could mobilise independently. 2 patients were using crutch and 3 patients were using walker for mobilization.

Table 10: Time for fracture union

Time for union	Frequency	Percentage
12 – 14 weeks	9	30.0
14 – 16 weeks	21	70.0
> 16 weeks	0	0.0
Total	30	100

In our study the average time for radiological union of fracture was between 14 to 16 weeks.

Table 11: Functional Outcome

	6 weeks	6 months	12 months
Patients attending Follow up (%)	93	63	23
Squatting (%)	22	60	84
Walking 15 metres (%)	93	95	100
Rising from chair (%)	45	54	97

The type of fracture, according to Seinsheimer classification, did not affect functional outcome

Table 12: Complications

Complications	Frequency	Percentage
Infection	1	3.3
Anesthetic	1	3.3
Implant related	0	0.0
Limp length discrepancy	0	0.0
Nil	28	93.3
Total	30	100

In our study one patient had superficial wound infection which got subsided with intensive antibiotic therapy and another patient had anaesthetic complication.

Discussion

Subtrochanteric fractures of femur are usually the result of high energy trauma. Because of complex stress configuration in this region and its non-homogenous osseous structure and geometry, fractures occur along the path of least resistance through the proximal femur [18].

In this present study cases were distributed across all age groups. We came across seventeen male patients and thirteen female patients. We did not come across any Seinsheimer Type 1 and Type 5 cases. Cases were distributed across all other types with one case belonging to Type 4 fracture. Majority of the cases (18) were due to high energy trauma of Road traffic Accidents involving relatively younger patients. Rest of the cases were due to low energy injuries like fall involving elderly patients. Ten of the patients were found to be anaemic and whole blood was transfused in the preoperative period. All except one patient underwent the surgery within 2 weeks of admission. Two patients with pre-existing cardiac disease were treated by the medical team prior to the surgical procedure. The operating time for 60% cases was between 2-2.30 hours. Operating time gradually decreased with increasing familiarity of the implant system.

The average length of Hospital stay was 14.8 days. At the end of five months, all except five patients could mobilise independently without any aid. 2 patients were using crutch and 3 patients were mobilizing using walker at 5 months of follow-up. One patient had a superficial infection at the surgical wound site which subsided with parenteral antibiotics. One patient had anaesthesia related complication. We did not come across complications like fracture of femur and failure of fixation. None of the cases needed a reoperation. We feel that the Proximal Femoral nail is a better implant in treating subtrochanteric fracture of femur. However, a comparative study with the other implants would be appropriate to make definitive conclusions.

In the Christian Boldin study (2003) proximal femoral fractures healed in all 55 patients. The longest consolidation time was 5 months which was one month more than the longest time seen in our series.

From the mechanical point of view, a combined intramedullary device inserted by means of a minimally invasive procedure seems to be better in elderly patients (Rosenblum *et al*. 1992, Prinz *et al*. 1996). All elderly patients did well functionally in our series.

Duration of hospital stay was comparable. Mean operation time in our study was 120-150 minutes on an average. We did not come across any implant related complications compared to the 11% seen in the study by Menezes *et al*. [19]. In this study fixation failure occurred in 3 patients(2%), which includes one cut out, one delayed union, one lateral displacement of antirotation screw (total 155 cases) [20].

Werner *et al*. detected 7.1% (5 out of 70) cases with Z effect. The incidence of cut out of neck screw in this study was 5.5% [21]. As compared to extramedullary implants the duration of stay in hospital by Parker *et al* which was 35 days, the average duration of stay in our series was 15 days. Walking

15 metres were comparable to the study by Ekstrom *et al.* [22] The present study included rising from squatting as a parameter. The results may not be comparable as Ekstrom *et al.* treated all proximal femoral fractures as compared to subtrochanteric fractures in our study. A larger study would be more relevant to our series for comparison

Case 1

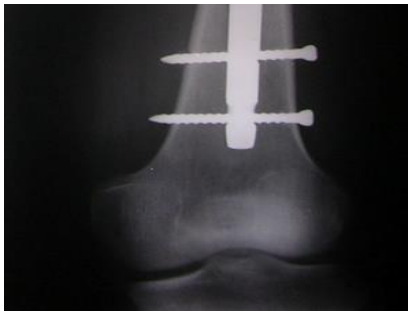
Pre-op X ray

Immediate post-op X ray

Case 2

Pre-op X ray

Immediate post op X ray



Distal locking

3 months follow-up

Conclusion

In conclusion PFN is a good implant for subtrochanteric fracture of the femur. The advantages include minimal exposure (closed technique), better stability and early mobilisation. Fractures united in all cases and postoperative functional outcome was satisfactory. PFN could be a preferred implant of choice in treating subtrochanteric fractures especially in elderly since it allows early and stable mobilization.

References

1. David J, Lavelle G. Fractures and dislocations chapter-52 in Campbell's operative orthopaedics, eleventh edition, 3:3237-3308.
2. Subtrochanteric fractures of femur treated with Zickel nail. Archortho. Bleg, 1994; 60:129-33.
3. Kyle RF, Cabanela ME, Russel TA. Fractures of the proximal part of the femur. Inst course lect, 1995; 44:227-53.

4. David LaVelle G. Chapter 52 Fractures and dislocations of Hip, Campbell's Operative Orthopaedics, 2008, Edited by S.T Canale, Eleventh Edition, 3:3262-3290
5. Parker MJ, Dutta BK, Sivaji C. Subtrochanteric fractures of femur. Injury, 1997; 28:91-95.
6. Edwards SA, Pandit HG, Clarke HJ. The long Gamma nail a DGH experience. Injury, 2000; 31(9):701-709.
7. Kyle RF, Cabanela ME, Russel TA. Fractures of the proximal part of femur, Instr Course Lect 1995; 44:227-253.
8. Leung KS, So WS, Shen WY. Gamma nails and dynamic hip screws for proximal femoral fractures: a randomised prospective study in elderly patients. J bone joint Surg Br. 1992; 74(3):345-351.
9. Radford PJ, Needoff M, Webb JK. Aprospective randomised comparison of proximal femoral nail and dynamic hip screw. J bone joint Surg Br. 1993; 75(5):789-793.
10. Seinsheimer F. Subtrochanteric fracures of femur. J Bone Joint Surg Am. 1978; 60(3):300-306.
11. Verettas DA, Galanis B, Kazakos K. Fractures of the proximal part of the femur in patients under 50 years of age. Injury 2002; 33(1): 41-45.
12. Warwick DJ, Circhlow TP, Langkamer VG. The proximal femoral nail in the management of subtrochanteric fractures of the femur. Injury. 1995; 26(4):241-244.
13. Cole PA, Bhandari M. What's new in orthoedic trauma? Journal of bone and joint surgery. 2005; 87:2823-2838.
14. Pavelka Kortus T, Linhart J. Osteosynthesis of proximal femoral fractures using short proximal femoral nails: Acta Chirurgiae Orthopaedicae et Traumatologiae Cechoslovaca. 2003; 70(1):31-8.
15. Chapman MW. Chapter 19 Factures of hip and proximal femur Chapman's Orthopaedic Surgery: 3rd edition, 617-643.
16. Kwok-sui Leung. Rockwood and Green's Chapter 46 Subtrochanteric Fractures; Fractures in Adults; Edited by Robert W Buchlz, J D Heckman, Sixth Edition, 2:827-1844.
17. Menezes DFA, Gamulin A. Is the Proximal femoral nail a suitable implant for treatment of all trochanteric fractures? Clinical Orthopaedics and related research Number, 2005; 439:221-227.
18. Carter D, Hayes W. The compressive Behaviour of bone as a two phase porous structure. The Journal of bone and joint surgery. 1977; 7:954-62.
19. Menezes Daniel FA, Gamulin Axel, Noesberger Bruno. Is the Proximal Femoral Nail a Suitable Implant for Treatment of All Trochanteric fractures? : SECTION II: ORIGINAL ARTICLES: Trauma, 2004; 20:221-227.
20. Minos Tyllianakis, Andreas Panagopoulos, Andreas Papadopoulo, Socratis Papasimos. Konstatinos Mousafiris from the University Hospital of Patras, Greece. Treatment of extra capsular hip fractures with PFN: Long term results in 45 patients ACTA Orthop. Belg. 2004; 70:444-454.
21. Belasco RU, Comfort TH. Analysis of treatment problems in subtrochanteric fractures of the femur. J trauma. 1978; 18:513-523.
22. Ekstrom W, Karlsson-Thur C. Fun.ctional outcome in Treatment of Unstable Trochanteric and Subtrochanteric Fractures With the Proximal Femoral Nail and the Medoff Sliding Plate. Journal of Orthopaedics and Trauma. 2007; 21(1):18-25.