

Original Research Article

# Intertrochanteric and subtrochanteric fractures outcome on surgery

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## Abstract

**Background:** Intertrochanteric and subtrochanteric fractures are leading cause of hospital admissions in elderly people.

**Aim:** This study was done to analyze the surgical management of proximal third fractures of femur using Proximal Femoral Nail fixation.

**Materials and methods:** 20 cases there were 15 male and 5 female patients of intertrochanteric and subtrochanteric fractures, which were treated with Proximal Femoral nail.

**Results:** Mean age of 60.4 years. 50% of cases were admitted due to slip and fall and with slight predominance of right side. Out of 20 cases, 10 were trochanteric and 10 were subtrochanteric. In Trochanteric class 60% were Boyd and Griffin type 2, in Subtrochanteric class 40% were Seinsheimer type 3a and 20% were 2b. Mean duration of hospital stay is 19.33 days and mean time of full weight bearing is 12.6 weeks. Out of 20 cases 2 cases expired before first follow up and 1 case lost for follow up. Out of 17 remaining cases 9 were Trochanteric and 8 were Subtrochanteric. Good to excellent results are seen in 100% cases of trochanteric fractures and 87.5% cases of subtrochanteric fractures.

**Conclusion:** We consider that PFN is an excellent implant for the treatment of proximal third fractures of femur.

## Key words

Intertrochanteric fracture, Subtrochanteric fractures, Proximal Femoral nail.

## **Introduction**

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Intertrochanteric and subtrochanteric fractures are devastating injuries that most commonly affect the elderly, but it is not uncommon in younger age group, have a tremendous impact on both the health care system and society in general. Peritrochanteric fractures mainly comprise of fractures of trochanter and subtrochanteric region. Trochanteric fractures occur in the younger population due to high velocity trauma; whereas in the elderly population it is most often due to trivial Trochanteric fractures are common in the elderly people.

Trochanteric fractures treated without surgical intervention malunion with coxa vara deformity resulting in shortening of limb and limp is commonly seen. It is also associated with complications of prolonged immobilization like bedsores, deep vein thrombosis and respiratory infections. Since this fracture is more common in the elderly patients, the aim of treatment should be prevention of malunion, and early mobilization. Taking all the factors into consideration surgery by internal fixation of the fracture is ideal choice.

There are various forms of internal fixation devices used for Trochanteric Fractures, of them the most commonly used device is the Dynamic Hip Screw with Side Plate assemblies. This is a collapsible fixation device, which permits the proximal fragment to collapse or settle on the fixation device, seeking its own position of stability.

The latest implant for management of trochanteric fractures is proximal femoral nail, which is also a collapsible device with added rotational stability. This implant is a centromedullary device and biomechanically more sound. It also has other advantages like small incision, minimal blood loss. Intertrochanteric and subtrochanteric fractures of femur posses clinical, structural, anatomical and biomechanical characteristics that distinguish

them from intracapsular fractures.

Subtrochanteric fractures comprise about 10 to 34% of hip fractures [1]. Subtrochanteric fractures are complicated by malunion and delayed or nonunion. The factors responsible for these complications in subtrochanteric fractures are high stress concentration, predominance of cortical bone and difficulties in getting biomechanically sound reduction because of comminution and intense concentration of deforming forces [2].

Many internal fixation devices have been recommended for use in subtrochanteric fractures, because of high incidence of complications reported after surgical treatment with each implant. A lack for satisfactory implant in surgical treatment of subtrochanteric fractures has led to series of evolution in design of a perfect implant.

Subtrochanteric femoral fractures are associated with high rates of non-union and implant failure, regardless of the method of fixation. Only recently has a better understanding of biology, reduction techniques and biomechanically improved implants allowed subtrochanteric fractures to be addressed with consistent success.

## **Materials and methods**

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The present study consists of 20 adult patients of intertrochanteric and subtrochanteric fractures, which are treated with Proximal Femoral nail in Mahatma Gandhi Memorial Hospital, attached to Kakatiya Medical College, Warangal, Telangana state. All these patients included in the study were followed up at regular intervals.

After the patient with subtrochanteric and intertrochanteric fracture was admitted to hospital all the necessary clinical details were recorded in proforma prepared for this study. After the completion of the hospital treatment patients were discharged and called for follow up (clinical and radiological evaluation). The patients were followed up till fracture union and

function recovery after surgery at regular interval.

As soon as the patient with suspected subtrochanteric or trochanteric fracture was seen, necessary clinical and radiological evaluation done and admitted to the ward after necessary resuscitation and splintage using skin traction.

### Inclusion criteria

Sub trochanteric fractures, Stable and unstable intertrochanteric fractures (Reverse oblique fractures and Inter trochanteric fractures with loss of posteromedial cortex)

### Exclusion criteria

Open hip fractures, Pathological fractures, Periprosthetic fractures, Pediatric fractures (before physal closure)

The following investigations were done routinely on all the patients preoperatively and also Pelvis with both hips - AP view, Involved side hip with femur AP and Lateral view and Chest - PA view in necessary patients.

All the patients were evaluated for associated medial problems and were referred to respective departments and necessary treatment was given. All the patients were operated on elective basis after overcoming the avoidable anaesthetic risks. Functional assessment based following hip scoring system adopted [3].

### Results

The following observations were made from the data collected during this study of proximal femoral nail in the treatment of 20 cases of intertrochanteric and subtrochanteric fractures of femur in the Department of Orthopedic Surgery, Mahatma Gandhi Memorial Hospital, Warangal, between November 2012 and June 2014.

In our series maximum age was 92 years and minimum age 26 years. Most of the patients were between 60 to 75 years. Mean age was 61.4 years (Table – 1).

**Table - 1:** Demographic distribution.

Age group	No. of cases	Percentage
0-20	0	0%
21-40	3	15%
41-60	6	30%
61-80	10	50%
81-100	1	5%
<b>Sex</b>		
Male	15	75%
Female	5	25%
<b>Side affected</b>		
Right	11	55%
Left	9	45%
<b>Mode of injury</b>		
Motor vehicle accident	4	20%
Fall from height	6	30%
Slip and fall	10	50%
<b>Fractures Classification</b>		
<b>Trochanteric fractures - Boyd and griffin classification</b>		
1	3	30%
2	6	60%
3	1	10%
4	0	0%
<b>Subtrochanteric fractures - Seinsheimer classification</b>		
I	0	0%
2A	1	10%
2b	2	20%
2c	2	20%
3a	4	40%
3b	1	10%
4	0	0%
5	0	0%

Intra-operative and post-operative complications were as per Table – 2. Assessment of results was as per Table – 3. All patients were followed at 6 weeks, 12 weeks, 6 months and some patients up to one year and further if necessary. One patient lost for follow up. At each follow up radiograph of operated hip with upper half femur was taken and assessed for fracture union and implant failure and screw cut out.

**Table - 2:** Complications.

Intra-operative complications	No. of cases	Percentage
Fracture of lateral cortex	1	5%
Fracture displacement by nail insertion	0	0%
Failure to get anatomical reduction	3	15%
Jamming of nail	0	0%
Failure to put derotation screw	3	15%
Failure of distal locking	2	10%
Breakage of guide wire	1	5%
Breakage of drill bit	1	5%
Varus angulation	3	15%
Post-operative complications		
Hip joint stiffness	00	0%
Knee joint stiffness	01	8.33%
Delayed union	02	16.66%
Nonunion	00	0%
Shortening	01	8.33%
Varus malunion <100	03	24.99%
Implant failure	00	0%

**Table - 3:** Assessment of Results.

Mean duration of hospital stay	19.33 days
Mean time to full weight bearing (in weeks)	12.6
Mobility after surgery	
Independent	13
Aided	4
Non-ambulatory	0
Mean range of movements (4 weeks postoperatively)	
Hip joint -0 to 110	17/17
Knee joint -0 to 120	16/17

### Anatomical Results

Anatomical results were assessed by presence or absence of deformities, shortening, hip and knee range of motions. In our study one patient had shortening >1cm, three patients had varus malunion <10 degrees. One patient had post septic arthritis knee stiffness. Functional results of fractures were as per **Table - 4**.

**Table - 4:** Functional Results of Fractures.

Functional results of trochanteric fracture	No. of cases	Percentage
Excellent	6	66.66%
Good	3	33.33%
Fair	0	0%
Poor	0	0%
Subtrochanteric Fracture		
Excellent	1	12.5%
Good	6	75%
Fair	1	12.5%
Poor	0	0%

### Discussion

The treatment of fractures of the proximal femur is still associated with some failures. The reasons are disregard for biomechanics, overestimation of the potentials of new surgical techniques or new implants or poor adherence to established procedures. High stress concentration that is subject to multiple deforming forces, slow healing time because of predominance of cortical bone, decreased vascularity, high incidence of complications reported after surgical treatment compels the surgeon to give a second thought regarding selection of the proper implant.

The most common current modes of fixation are Blade plate systems, Sliding screw systems and Intra medullary devices. From the mechanical point of view, a combined intra medullary device inserted by means of minimally invasive procedure seems to be better in elderly patients. Closed reduction preserves the fracture haematoma, an essential element in the consolidation process. Intra medullary fixation allows the surgeon to minimize soft tissue dissection there by reducing surgical trauma, blood loss, infection, and wound complications.

PFN is a novel, modern intra medullary implant based on experience with the gamma nail. The currently used gamma nail as an intra medullary device also has a high learning curve with technical and mechanical failure rates of about 10%.The gamma nail is susceptible to fail at its weakest point, the lag screw-implant interface.

The Arbeitsgemeinschaft für Osteosynthesefragen (AO ASIF) in 1996, therefore developed the proximal femoral nail with an antirotational hip pin together with a smaller distal shaft diameter which reduces stress concentration to avoid these failures. Proximal femoral nail has all advantages of an intra medullary device, such as decreasing the moment arm, can be inserted by closed technique, which retains the fracture haematoma an important consideration in fracture healing, decrease blood loss, infection, minimizes soft tissue dissection and wound complications.

In an experimental study, Gotze, et al. [4] compared the loadability of osteosynthesis of unstable per and subtrochanteric fractures and found that the PFN could bear the highest loads of all devices.

Simmermacher, et al. [5], in a clinical multicentric study, reported technical failures of PFN after poor reduction, malrotation or wrong choice of screws in 5% of the cases. In our study poor reduction occurred in three cases, three with varus malreduction. A cut out of the neck screw occurred in 0.6% cases in the study conducted by Simmermacher but we did not encounter such complication in our study. Anatomical fracture reduction was found in 86% of the patients and full weight bearing stability was achieved in 94%. In our study acceptable anatomical reduction was obtained in 85% cases. An intra-operative fracture displacement during manual introduction of the nail into the femoral shaft has not been reported with the gamma nail but this has been a problem with the PFN. One reason may be the entry point of the PFN at the tip of the greater trochanter is located directly in the fracture region which can cause intra-operative fracture displacement.

However, Simmermacher, et al. [5] had no cases of intra-operative fracture displacement using the PFN mainly in 31-A2 fractures. In our study we had no case of intra-operative fracture displacement after nail insertion. In comparison

to gamma nail, we found no fracture of the femoral shaft and no break in the implant.

W. M. Gadegone and Y. S. Salphale [6], in 2007, reported a study on Proximal femoral nail – an analysis of 100 cases of proximal femoral fractures with an average follow up of 1 year. Postoperative radiographs showed a near-anatomical fracture reduction in 88% of patients. The fracture consolidated in 4.5 months. No perceptible shortening was noted. Of the patients, 7% had superficial infections which were controlled with antibiotics, 82% had a full range of hip motion. In our Study we had 85% near normal anatomical fracture reduction and fracture consolidated in 12.6 wks. One case we had shortening of more than 1 cm. near normal range of hip motion. We encountered no nonunion. No cases of implant failure were observed.

Metin Uzun, et al. [7], in 2009, in a study of 35 patients reported Long-term radiographic complications following treatment of unstable intertrochanteric femoral fractures with the proximal femoral nail and effects on functional results. Reduction was assessed as good or acceptable in all the patients. Complete union was achieved in all but two patients. The mean Harris hip score was 82.1. The results were excellent in 11 patients (31.4%), good in 15 patients (42.9%), fair in seven patients (20%), and poor in two patients (5.7%).

Radiographic complications mainly included secondary varus displacement in nine patients (25.7%). Secondary varus displacement was due to cut-out of the proximal screws (n = 2), screw loosening due to collapse of the fracture site (n = 2), and reverse Z-effect (n = 5). Radiological complication chiefly include 3 cases of varus malunion. We had no implant failure or reverse Z effect.

The aim of the study was to study the epidemiology of proximal third fracture femur in adults and anatomical and functional outcome

with this newer method of intra medullary fixation with PFN.

The assessment criteria for the efficiency of surgical technique included duration of surgery, number of intra-operative complications, blood loss and radiographic screening time. Clinical assessment includes post operative walking ability, hip and knee function, fracture union time, and implant bone interaction.

In our study, peritrochanteric fractures were more common due to slip and fall. Age ranged from 26 to 92 years with mean age of 60.4 years. Males were more common contributing of 75% of cases. Right sided fractures were more common in our study accounting for 55% of cases.

In our study Trochanteric fractures contributed 50% of cases, out of which Boyd and Griffin type 2 consisted of 60%, and 30% were type 1, 10% type 3. Subtrochanteric fractures accounted for 50% of cases out of which Seinsheimer type 3a consisted of 40% cases, followed by 2b of 20%.

The mean duration of radiation exposure was 90 seconds, mean duration of surgery was 90 minutes and mean blood loss was 130 ml. In the intra-operative period, one patient had fracture of

lateral cortex of the proximal fragment; there was one case of drill bit breakage and one case of guide wire breakage. We were unable to put derotation screw in three cases.

The mean duration of hospital stay was 19.33 days; mean time for full weight bearing was 12.6 weeks. Post operatively all patients were ambulatory of which three of them required walking aids. One patient had 2cms shortening after fracture union which was treated conservatively by sole rise. All patients enjoyed good range of hip and knee motion except in one who had stiffness of knee due to septic arthritis knee.

In our study 2 cases expired before first follow up due to old age and associated medical problems. 1 case lost for follow up. Over all 92.8% of our cases had excellent to good results. In our study, males (75%) were more commonly affected than females (25%) which is in coherent with study done by Pajarinen, et al. which is male: female ratio is 1:3 also correlate with other studies [9]. Comparison [5, 10,11] with other studies was as per **Table – 5**.

In our study, mean Harris Hip score was 89.8 which is comparable to that of Karn, et al. [12] (2011).

**Table - 5:** Mechanical complications of PFN system.

	<b>C Boldig, et al. [10]</b>	<b>Dominigo, et al. [11]</b>	<b>Simmermacher, et al. [5]</b>	<b>Present Study with PFN</b>
No. of patients	55	295	191	20
Cut out	2	4	1	0
Z effect	3	-	-	0
Reverse Z effect	2	-	-	0
Implant failure	-	-	1	0
Lateral cortex fracture	-	1	-	5%
Re operation rate	18%	3%	7%	0%
Duration of surgery	68 min	77 min	46 min	90 min
Bony union	100%	100%	98%	100%
Failure of fixation	0%	11%	0%	0%
Delayed union	-	-	2%	16.66%
Open reduction	10%	-	34.6%	0%

## Conclusion

The mode of injury for proximal third fractures of femur in the elderly is a trivial trauma, however in the young individuals it occurs following a high velocity trauma. Since in the elderly the mode of injury is a low velocity trauma, the incidence of associated injuries is less. Since the fracture is common in the elderly the incidence of associated diseases requiring medical attention is high. The fracture is more common in the elderly, early reduction and internal fixation increases patient comfort, facilitates nursing care, helps in early mobilization of the patient and decreases the duration of hospitalization. Anatomical reduction can be achieved by closed manipulative or open methods. As the incidence of comminution is high, these fractures may require a stable reduction and internal fixation. Bone grafting is required if there is a deficiency. Hence we conclude, though the learning curve of this procedure is steep, with proper patient selection, good instrumentation, image intensifier and surgical technique, PFN remains the implant of choice in the management of Proximal third fracture of femur.

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