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## A prospective study to evaluate the complications in extracapsular proximal femur fractures treated with proximal femoral nail in a tertiary care centre, south India

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### Abstract

**Background:** Fractures of the proximal femur of the hip are relatively common injuries in adults. Several epidemiological studies show that the incidence of fractures of the proximal femur is increasing. Dissatisfaction with use of a sliding hip screw in unstable fracture patterns led to the development of intramedullary hip screw devices. This design offers potential advantages like more efficient load transfer, decrease tensile strength on the implant, controlled fracture impaction, reduces amount of sliding and therefore limits limb shortening and deformity.

**Objectives:** study to evaluate the complications related to proximal femur fractures treated with Proximal Femur Nail.

**Methods:** This is a prospective study of 30 cases of fresh intertrochanteric and subtrochanteric fractures admitted to a tertiary care center. Cases were taken according to inclusion and exclusion criteria. Results were evaluated by fracture union on X ray and descriptive statistics were used to analyze the data.

**Results:** In our series of 30 cases there were 23 males and 7 females, most of the patients were between 41 to 60 years. Mean age of 57.7 years, of cases were admitted due to slip and fall and with predominance of right side. A total of 11 (36.7%) cases had intraoperative complications. Around 6.6% had superficial wound infection as immediate postoperative complication. A total of 7 (23.3%) had delayed complications (delayed union, varus malunion, shortening of more than 1cm, knee joint stiffness).

**Conclusion:** From this study, we consider that Proximal Femoral Nail as a reliable implant for the treatment of intertrochanteric and subtrochanteric fractures. This implant found to have minimal intraoperative complications, immediate post-operative complications and delayed complications in intertrochanteric and subtrochanteric fractures. PFN remains the implant of choice in the management of extracapsular proximal femur fractures.

**Keywords:** Proximal femoral nail, intertrochanteric fracture, subtrochanteric fracture, femoral fracture, complications

### Introduction

Proximal femoral fractures are most commonly seen among people over 70 years of age. The incidence of these fractures has increased mainly due to increasing life span and also more sedentary life style brought by urbanization. But, among the younger population, proximal femoral fracture occurs mainly due to high velocity trauma, whereas in elderly population, it is most often due to trivial trauma. Other risk factors include white race, neurological impairment, malnutrition, impaired vision, malignancy, and decreased physical activity<sup>[1, 2]</sup>.

The incidence of intertrochanteric fractures is dependent on gender and races and varies from country to country. In the United States, the annual rate of intertrochanteric fractures among elderly females is about 63 per 100,000, in males 34 per 100,000<sup>[3]</sup>.

Intertrochanteric (IT) fractures can be managed by conservative or operative methods. The conservative methods were the treatment of choice before the introduction of new fixation devices and since conservative methods resulted in higher mortality rates and complications like decubitus ulcer, urinary tract infections, pneumonia, thromboembolic complications, these methods have been abandoned<sup>[2, 4]</sup>.

Even the trochanteric fractures can be managed by conservative means and there is usually union of fracture. If suitable precautions are not taken the fracture undergoes malunion leading to varus and external rotation deformity at the fracture site with shortening and limitation of hip movements [4].

Pertrochanteric and subtrochanteric fractures of femur possess clinical, structural anatomical and biomechanical characteristics that distinguish them from intracapsular fractures. Subtrochanteric fractures comprises about 10 to 34% of hip fractures [1].

The sub-trochanteric region is exposed to high stresses during routine activities and axial loading forces through the hip joint create a large moment arm, with significant lateral tensile stresses and medial compressive loads. In addition to these bending forces, muscle forces at the hip also create torsional effects that lead to significant rotational shear forces. In this sub-trochanteric region thickness of cortical bone is more and vascularity is less which produce healing disturbances.<sup>1</sup> High compressive and tensile forces of muscles separate the fracture fragments and cause instability of the sub-trochanteric fracture. Hence this fracture is difficult to manage and is associated with many complications including mal-union, delayed union, non-union and implant failure [1, 2, 5, 6].

Subtrochanteric fractures are complicated by malunion and delayed union and 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].

Rigid Internal fixation and early mobilization has been the standard method of treatment. Strength of fracture implant assembly depends on the extra medullary devices (DHS, Intramedullary devices (PFN) [7]. The two primary options for treatment of subtrochanteric fractures are intramedullary fixation and extra medullary fixation [8].

The latest implant for management of intertrochanteric fracture is Proximal Femoral Nail (PFN). This implant is a cephalomedullary device and has many potential advantages efficient load transfer, less chance of implant failures, controlled impaction is maintained, therefore less chance of shortening and deformity [3, 9].

Usually, the sliding hip screw has been considered the choice because fracture union predictably occurs. The main problem with sliding hip screws is collapse of the femoral neck, leading to loss of hip offset and shortening of leg. Hence, a new intramedullary device Proximal Femoral Nail (PFN) was designed which gives an advantage of minimally invasive surgery [7, 9]. So, with this background we conducted this study to evaluate the complications related to proximal femur fractures treated with Proximal Femur Nail.

### Material and Methods

This prospective study was conducted at Department of Orthopaedics, Vydehi Institute of Medical Sciences and Research Centre, Bangalore with diagnosis of intertrochanteric fractures and subtrochanteric fractures during January 2017 to June 2018.

All the cases of intertrochanteric fractures and subtrochanteric fractures of femur during the study period were taken as study population after looking for into the inclusion and exclusion criteria. We got, around 38 cases during the study period with fracture femur and but only 30 cases were fitting into our

criteria. So, the final sample size we got was 30 cases.

### Inclusion criteria

1. Patients who are medically fit for surgery and given written informed consent for the procedure.
2. Adult patients aged more than 18 years.
3. Patients with closed extracapsular proximal femur fractures.

### Exclusion criteria

1. Intra capsular Fracture neck of femur.
2. Proximal femur fracture patients treated with other modalities
3. Compound Proximal femur fractures
4. Proximal femur fracture patients associated with severe cardiovascular diseases.
5. Patients with associated fractures of same or other limbs.

The study was started after taking Institutional Ethics Committee. The patients were informed about the study in all respects and informed consent was obtained from each patient and data was collected from the patients who gave informed consent.

The people who gave consent were included in the study and done the surgical intervention using Proximal Femur Nail after fracture reduction and followed all the necessary surgical steps.

Following parameters were collected intra-operatively: A. Total time of the surgery 2. Blood loss: it was counted approximately by counting 50ml /mop used. 3. Radiation exposure

After the surgery, standard postoperative protocol was followed. These are limb elevation over pillow and patient kept under observation in recovery room until stable then shifted to ward. Intravenous antibiotics were continued for first 48 hours and then shifted to oral. Blood transfusion was given depending on the requirement. Suction drainage was removed after 48 hours in case of open reduction. Static quadriceps exercises were started on third postoperative day. Active quadriceps and hip flexion exercises were started on 6<sup>th</sup> and 7<sup>th</sup> postoperative day. Dressing was done at 3<sup>rd</sup>, 6<sup>th</sup> and 10<sup>th</sup> postoperative day. Sutures were removed on 12<sup>th</sup> postoperative day. Patients were advised to walk non-weight bearing walking on axillary crutches as soon as tolerable. Partial weight bearing started at about 6 weeks postoperatively. Full weight bearing walking was allowed after assessing for radiological and clinical union.

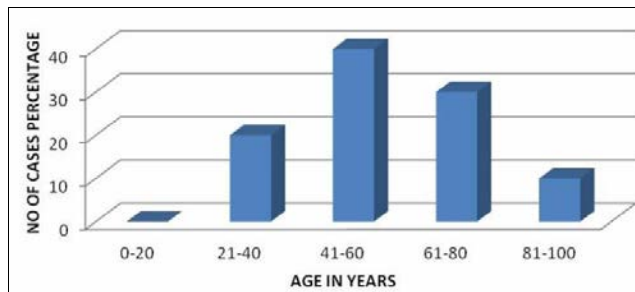
Patients were discharged from the hospital when they were able to ambulate independently with or without walking aids. Clinical follow up at 6 weeks, 3 months, 6 months, 12 months regarding disability and functional outcome.

At every visit patient was assessed clinically regarding hip and knee function, walking ability, fracture union, deformity and shortening. X-ray of the involved hip with femur was done to assess fracture union and implant bone interaction.

Data were entered in Microsoft Excel and descriptive statistics were analysed using Epi-Data Analysis V2.2.2.182 in the form of frequencies and proportions.

### Results

A total of 30 cases with Intertrochanteric and Subtrochanteric fractures of proximal femur were assessed, among them 23 (76.7%) and 7 (23.3%) were males and females respectively. The mean age of the participants was 57.7±12.6 years and 12 (40%) were in the age group of 41- 60 years, followed by 9 cases in the age group 61-80 years.



**Fig 1:** Age distribution of the study population

The commonest mode of injury was slip and fall (46.7%) followed by road traffic accidents, around 18 (60%) of them had injury to the right leg. About 19 (63.3%) of the people had intertrochanteric fracture and rest had subtrochanteric fracture (Table 1).

**Table 1:** Shows the characteristics of injury and fracture among the study group.

Characteristics of Injury and Fracture	Frequency(n=30)	Percentage
<b>Nature of Violence</b>		
Motor Vehicle Accidents (RTA)	12	40.0
Fall from height	4	13.3
Slip and fall	14	46.7
<b>Side Affected</b>		
Right	18	60.0
Left	12	40.0
<b>Type of Proximal Femoral Fracture</b>		
Intertrochanteric Fracture	19	63.3
Subtrochanteric Fracture	11	36.7
<b>Boyd and Griffin classification of Intertrochanteric Fracture (n=19)</b>		
Type I	3	15.8
Type II	7	36.8
Type III	6	31.6
Type IV	3	15.8
<b>Seinsheimer Classification of Fracture (n=11)</b>		
Type I	1	9.0
Type IIa	2	18.2
Type IIb	2	18.2
Type IIc	1	9.0
Type IIIa	3	27.4
Type IIIb	2	18.2
Type IV	0	0
Type V	0	0

These 30 cases undergone surgical management using proximal femoral nail and our study, we considered various intraoperative parameters such as duration of radiographic screening - more exposure in case of comminuted fractures with difficult reduction. We took less exposure time in case of comminuted fractures where reduction was not a problem. The duration of surgery was more in case of Subtrochanteric fractures and in cases of open reduction. The blood loss was more in open reductions (counted by soaked mops) (Table 2)

**Table 2:** Shows the intraoperative details among the study group.

Intraoperative details	Mean	Standard Deviation
<b>Intraoperative details</b>		
• Mean duration of screening (in seconds)	80	12.8
• Mean duration of operation (in minutes)	90	18.3
• Mean blood loss (in milliliters)	120	20.5

**Table 3:** Intraoperative, immediate postoperative and delayed complications among the study group.

Complications	Frequency (n=30)	Percentage
<b>Intraoperative Complications</b>		
• Open reduction	3	10.0
• Failure to get anatomical reduction	2	06.6
• Failure to put derotation screw	2	06.6
• Varus angulation	2	06.6
<b>Immediate Postoperative Complications</b>		
• Superficial Wound Infection	2	06.6
<b>Delayed Complications</b>		
• Delayed Union	2	06.6
• Varus Malunion	2	06.6
• Implant Failure	0	0
• Non-union	0	0
• Shortening of more than 1cm	1	03.3
• Knee Joint Stiffness	2	06.6

In our study, we encountered certain complications intraoperatively and most of these complications occurred in first few cases. In 10% (3) of our patients we had to do open reduction, 6.6% (2) failed to achieve anatomical reduction. A total of 11 (36.7%) cases had intraoperative complications. Only in two cases (6.6%) found superficial wound infection as immediate postoperative complication. (Table 3).

The mean duration of hospital stay was 15 days and mean time to full weight bearing was  $14.97 \pm 1.9$  weeks.

All patients were followed at 6 weeks, 12 weeks, 6 months. At each follow up radiograph of the operated hip with upper half of femur was taken and assessed for fracture union and implant failure and screw cut out.

In this study, we encountered two cases (6.6%) of delayed union and two cases (6.6%) of malunion (varus < 10 degree). One case had shortening more than 1 cm who were treated with sole rise and two patients had knee stiffness which was improved after rigorous physiotherapy treatment. A total of 7 (23.3%) had delayed complications. Not seen any cases of non-union or implant failure or cutting of screws in the present study. (Table 3).

## Discussion

The successful treatment of per trochanteric fractures depends on many factors such as age of the patient, patient's general health, time from fracture to treatment, the adequacy of treatment, concurrent medical illness and stability of fixation. The most common causes of failure are disregard of biomechanics, overestimation of potentials of new surgical techniques or implants and poor adherence to established procedures. At present it is generally believed that all per trochanteric fractures should be internally fixed to reduce the morbidity and mortality of the patient. But the appropriate method and the ideal implant by which to fix the per trochanteric fractures is still in debate. Because each method having its own advantages and disadvantages<sup>[1]</sup>.

The most common mode of injury in our study was domestic fall 46.7% which is comparable to most Indian studies. This was also affected by the age as the older the patient more likely he/she getting the fracture by domestic falls. In our study trochanteric fractures contributed 63.3% of cases. 36.9% had type II Boyd & Griffin fracture followed by 31.6% were type 3.

Subtrochanteric fractures accounted for 36.7% of cases out of which Seinsheimer type 3a consisted of 27.27% cases, followed by type 2a, 2b, 3b which were 18.18%.

In our study, 10% (3) had to do open reduction, 6.6% (2) failed to achieve anatomical reduction. Only in two cases found superficial wound infection as immediate postoperative complication. Delayed complications such as of delayed union was found in two cases (6.6%) and two cases (6.6%) of malunion (varus<10 degree). One case had shortening more than 1 cm and two patients had knee stiffness which was improved after rigorous physiotherapy treatment. Not seen any cases of non-union or implant failure or cutting of screws in the present study. The study done by Gadegone WM *et al.* in 2007 reported that postoperative radiographs showed a near anatomical fracture reduction in 88% of patients. No perceptible shortening was noted. Of the patients 7% had superficial infections which were controlled by antibiotics, 82% had a full range of hip motion. One case of non-union because of distraction in high subtrochanteric fracture. In their study they had 95% of near normal anatomical reduction in fracture consolidation in 16.5 weeks. Two cases had shortening of more than 1 cm which is almost similar to our study<sup>[10]</sup>.

A study done by Kumar *et al.* found that, closed reduction was achieved in 68% cases and open reduction was required in 32% cases. Various intraoperative complications were seen in 12% and delayed complications in 26% of cases. Good anatomical results were achieved in 86% of cases and 14% were fair. This was similar to our study<sup>[11]</sup>.

A study done Mallya S *et al.* showed that, two patients had screw back out, two had screw cut out, and one had superficial infection and was healed with regular dressing<sup>[12]</sup>. The other studies also showed the same results with the proximal femoral nail<sup>[13, 14]</sup>.

### Conclusions

From this study, we consider that Proximal Femoral Nail as a reliable implant for the treatment of intertrochanteric and subtrochanteric fractures. This implant found to have minimal intraoperative complications, immediate post-operative complications and delayed complications in intertrochanteric and subtrochanteric fractures. Even though the learning curve of this procedure is steep with proper patient selection, good instruments, image intensifier and surgical technique, PFN remains the implant of choice in the management of extracapsular proximal femur fractures.

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### Declarations

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**Conflict of interest:** None declared

**Ethical approval:** Ethical approval taken from Institutional Ethics Committee, Vydehi Institute of Medical Sciences & Research Centre, Bangalore.

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