

## A Prospective Study of Functional Outcome of Intertrochanteric Fracture of Femur Treated With Proximal Femoral Nail Fixation

Dr. Kommisetty Madhurima Naidu<sup>1</sup>, Dr. Konuganti Sridhar Reddy<sup>2\*</sup>

<sup>1</sup>Senior Resident, Department of Orthopaedics, Maheswara Medical College, Hyderabad.

<sup>2\*</sup>Assistant Professor, Department of Orthopaedics, Maheswara Medical College, Hyderabad.

Corresponding Author: Dr. Konuganti Sridhar Reddy

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### Abstract

**Introduction:** Intertrochanteric femur fracture is one of the most common fractures of the hip especially in the elderly with osteoporotic bones, usually due to trivial trauma. Age of patient, osteoporosis, general health, associated co-morbidities are some of the key factors to be considered for the successful treatment of these fractures.

**Materials and Methods:** In our institution, we have selected 24 cases of unstable intertrochanteric fractures for this prospective study. All cases enrolled were managed with the proximal femoral nail. These cases were studied from the mechanism of injury, classification, and treatment with the proximal femoral nail and their surgical and functional outcome with or without residual comp.

**Results:** Patients were followed up for an average period of 8.58 months. The mean Harris hip score was 88.75 at 6th month. The score was excellent in 12 patients, good in 10 patients, fair in 1 patient and poor in 1 patient. In our study of 24 patients with unstable intertrochanteric fracture, the average age incidence was 54.64 years. In the present study male: female was 5:3.

**Conclusion:** In unstable proximal femur fractures, PFN is a significant advancement in the treatment of unstable trochanteric fractures which has the unique advantages of closed reduction, preservation of fracture hematoma, less tissue damage, early rehabilitation and early return to work.

**Key Words:** Proximal femur, Intertrochanteric fractures, Subtrochanteric fractures, Proximal femoral nail

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### I. Introduction

Intertrochanteric femur fracture is one of the most common fractures of the hip especially in the elderly with osteoporotic bones, usually due to trivial trauma. Age of patient, osteoporosis, general health, associated co-morbidities are some of the key factors to be considered for the successful treatment of these fractures.<sup>1,2</sup>

Various types of implants are available for fixation. The ideal internal fixation device should be such that the patient can be mobilized at the earliest without jeopardizing the reduction, stability and union of the fracture. Recently intramedullary fixation devices have become increasingly popular because of its biomechanical advantage. The proximal femoral nail (PFN) is one of such implants which was developed by the AO/ASIF in 1996.<sup>3</sup> The main principle of this type of fixation is based on a sliding screw in the femoral neck-head fragment, attached to an intramedullary nail and this acts as a load sharing device unlike DHS which is load bearing device.<sup>4</sup>

Hence PFN i.e. intramedullary fixation device is biomechanically stronger implant. Despite being technically demanding surgical procedure these implants are gaining wide acceptance in treating unstable intertrochanteric fractures because of its advantages of being inserted through small exposure, preservation of hematoma and less blood loss.<sup>4,5</sup> Considering the advantages of PFN the present study was carried out to know the functional outcome of the patients treated by the same.

### II. Materials And Methods

In this prospective study was conducted in Department of Orthopaedics, Maheswara Medical College, Hyderabad. 24 cases of unstable intertrochanteric fractures cases from July 2017 to August 2018 were included. All cases of unstable trochanteric and subtrochanteric fractures operated by proximal femoral nail during this time period were taken up for study, which were studied prospectively after taking ethics committee approval and informed consent.

**Inclusion criteria:** Inclusion criteria were all trochanteric fracture classified as unstable by AO classification; age more than 25 years.

**Exclusion criteria:** Exclusion criteria were less than 25 yrs; malunited fracture; open fractures; pathological fractures of any other cause than osteoporosis; previous wound or bone infections; neurological and psychiatric disorders that preclude reliable assessment; increased femoral bow; medical co morbidities precluding the patient for internal fixation.

These cases were studied on the basis of mechanism of injury, classification and treatment with proximal femoral nail and their surgical and functional outcome with or without residual comp Descriptive statistics such as mean and standard deviation (SD) for continuous variables, frequencies and percentages were calculated for categorical Variables were determined.

### III. Results

In our study of 24 patients with unstable intertrochanteric fracture, the average age incidence was 54.64 years. In the present study male: female was 5:3. There was a male sex preponderance seen in our study. The mechanism of injury was accidental fall in 13 patients and road traffic accident in 11 patients. None of the patient had any associated injuries. Right hip was involved in 11 patients and left hip was involved in 13 patients. The mean duration between the injury and procedure was 17.28 days. The average operating time was estimated as 58 minutes.

In the initial cases our operating time was on the higher range, with experience the operating time reduced. We used short nail in 18 cases and long nail in 6 cases. We used longer nail for unstable reverse oblique and fractures with subtrochanteric extension to minimize periprosthetic fracture from stress raiser effect from the tip of the nail. Mismatch between nail curvature and femoral bow will result in impingement of the tip of the nail over the anterior cortex. We have no cases of femoral shaft fractures. Radius of nail curvature should be ranged 186-300 cm. We have encountered distraction at the fracture site on passing the nail in 4 cases, in these cases the fracture is reduced and temporarily stabilized with a 2 mm 'K' wire passed along the anterior cortex so as not to interfere with the passage of nail. In 3 cases we had encountered with varus reduction. In our study, 9 of our patients had abductor lurch which gradually decrease with time. All of our patients could partial weight bear by the end of 2 weeks. None of the patient was using walking aid beyond 3months. In our series, 6 patients had varus collapse with an average of 10 degree. This is attributed to excessive sliding and collapse secondary to fracture comminution and premature weight bearing. There were 3 cases with failure of derotation screw at the junction of threaded portion and the screw shaft. Among the three, one patient had varus reduction, one had distraction at the fracture site, one patient had associated nail breakage with fracture in varus malunion from premature weight bearing. The patient with implant failure attended the OPD after around 5 months. Even though the patient had implant failure with malunion, the patient had a good functional outcome. The average time for fracture union was 11.12 weeks (range: 8-22 weeks).

Consolidation was observed in all the patients after 5 months. Patients were followed up for an average period of 8.58 months and the results were analyzed by using the Harris hip scoring system. Among these patients union occurred in all patients with no non-union. Malunion occurs in one case with implant failure. The mean Harris hip score was 88.75 at 6th month. The score was excellent in 12 patients, good in 10 patients, fair in 1 patient and poor in 1 patient.

AO Classification	Number of Patients	Percentage of patients (%)
<b>Type A1</b>	-	-
<b>Type A2.1</b>	-	-
<b>Type A2.2</b>	9	37.50%
<b>Type A2.3</b>	7	29.16%
<b>Type A3.1</b>	2	8.33%
<b>Type A3.2</b>	-	-
<b>Type A3.3</b>	6	25%

**Table 1: Classification**

I. PAIN (44 POSSIBLE)		3. Walking distance	
A. None or ignores it	44	a. > 1 km	11
B. Slight, occasional, no compromise in activities	40	b. 0.5-1 km	8
C. Mild pain, no effect on average activities, rarely moderate pain with unusual activity	30	c. 100-500 m	5
D. Moderate pain, tolerable but with limitations in ordinary work or life	20	d. Only inside the house	2
E. Marked pain, serious limitation of activities	10	e. Confined to chair or bed	0
F. Totally disabled, crippled, pain in bed	0	<b>B. Activities (14 possible)</b>	
<b>II. FUNCTION (47 POSSIBLE)</b>		1. Stairs	
<b>A. Gait (33 possible)</b>		a. Normally without using a railing	
1. Limp		b. Normally using a railing	
a. None	11	c. In any manner	
b. Slight	8	d. Not able to do stairs	
c. Moderate	5	2. Shoes and socks	
d. Severe	0	a. With ease	
2. Support		b. With difficulty	
a. None	11	c. Unable	
b. Cane for long walks	7	3. Sitting	
c. Cane most of the time	5	a. Comfortably in ordinary chair for 1 hour	
d. One crutch	3	b. On a high chair for one-half hour	
e. Two canes	2	c. Unable to sit comfortably in any chair	
f. Two crutches	0	4. Uses public transport	
g. Not able to walk	0	1	
		<b>TOTAL</b>	

\* Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty. An end-result study using a new method of result evaluation. J Bone Joint Surg Am. 1969 Jun;51(4):737-55.

Figure 1: Harris hip score



Figure 2: (A,B) Preoperative X-ray; (C,D) Immediate postoperative picture; (E)4<sup>th</sup> week post OP; (F)16<sup>th</sup> week post OP.

Proximal femoral nail	Number of patients	Percentage
Long PFN 135 degrees	6	25
Short PFN 135 degrees	13	54.16
Short PFN 130 degrees	5	20.83

Table 2: Types of Proximal femoral nail used

Complications	Number of cases
Fracture displacement by nail insertion	3
Failure to get anatomical reduction	1
Failure to get anatomical reduction	3
Breakage of guide wire	1
Breakage of drill bit	0
Varus angulation	3

Table 3: Intraoperative complications

Functional Outcomes	3 <sup>rd</sup> Month		6 <sup>th</sup> month	
	Number of patients	percentage	Number of patients	percentage
Excellent	2	8.33	12	50
Good	9	37.5	10	41.66
Fair	6	25	1	4.16
Poor	6	25	1	4.16

**Table 4: Harris hip score**

Complications	Number of patients
Shortening	9
Superficial infection	1
Deep infection	1
Varus collapse	6
Lateral slide of proximal screws	6
Non union	0
'Z' effect	1
Implant failure	1
Mortality	0

**Table 5: Postoperative complications**

#### IV. Discussion

The successful treatment of intertrochanteric fractures depends on many factors: the age of the patient, the patient's general health, the time from fracture to treatment, concurrent medical treatment and the stability of fixation. The appropriate method and the ideal implant used for these fractures are still debated with proponents of the various approaches each claiming advantages over others. Many internal fixation devices have been recommended for the treatment of these fractures, including extramedullary and intramedullary implants.<sup>8,9</sup>

All of our patients could partial weight bear by the end of 2 weeks. None of the patient was using walking aid beyond 3months. In a study Pajarinen et al showed that the uses of PFN have a positive effect on the speed at which walking is restored.

in our series, 6 patients had varus collapse with an average of 10 degree. This is attributed to excessive sliding and collapse secondary to fracture comminution and premature weight bearing. There was lateral slide of lag screw in 9 cases. Lateral slide occurs more often in PFN than Gamma nail due to restricted sliding mechanism in gamma nail from rigid femoral neck screw nail assembly. This is also a factor for increased incidence of screw cut out seen in gamma nail which is rare in PFN. Herera et al in a comparative study of 250 petrochanteric fractures treated with the simple GN or the PFN system (125 fractures in each group) reported a statistically significant difference in the incidence of neck screw cutout (4%) and fracture below the nail (3.2%) in the GN group, whereas in the PFN group there was a higher incidence of secondary varus (7.2%) and collapse at the fracture site due to screw migration (8%).

The screw breakage is secondary due to increased stress from the fore mentioned contributing factors. Domingo et al prospectively evaluated 295 patients in whom the majority (59%) had an 31A2 intertrochanteric fracture and reported technical complications in 12% of the patients during the operation, 27% in the immediate postoperative period and late complications in 4%.<sup>14</sup> Banan et al reported a higher technical failure rate (8.7%) due to cut-out, 1 case of implant failure and 2 cases of fracture below the tip of the nail after a second fall, out of 60 patients with exclusively unstable trochanteric fractures.

One case had deep infection with secondary 'Z' effect. Initially we have done wound debridement and put the patient on parenteral antibiotics according to the culture sensitivity. The infection had settled and the inward migrated derotation screw is removed. The lag screw is tightened. Patient put on non weight bearing. Werner et al was the first that introduced the term Z-effect, detected in 5 (7.1%) of 70 cases. The incidence of cut-out of the neck screw in this study was 8.6%.

Schipper et al found a mean score of 66.80 (standard deviation=17.94) with a proximal femoral nail of PFN® type after one year. According to Pajarinen et al, patients who underwent osteosynthesis with a cephalo medullary nail, in unstable trochanteric fractures, presented a significantly faster return to their previous level of walking.<sup>10</sup>

Herrera et al reported on a study involving 250 patients treated with the PFN and Gamma nail cephalo medullary nails, in which around 50% of the patients had recovered their previous walking capacity, one year after the surgery. In the present study, we assessed the recovery of walking ability over the course of time. The greatest evolution in the quality of walking occurred over the first three months after the operation, such that none of our patients are walking with walking aid. In short, the PFN has distinct advantages over DHS and it has proved to be a better implant with adequate surgical technique. The requirement and follow up based changes in design of PFN from the pioneer Gamma mail will certainly decrease the complication rates and increases all the postulated advantages of intramedullary devices used in the treatment of trochanteric fractures.<sup>11</sup>

## V. Conclusion

Finally, we conclude that the PFN is a significant advancement in the treatment of unstable trochanteric fractures which has the unique advantages of closed reduction, preservation of fracture hematoma, less tissue damage, early rehabilitation and early return to work. Osteosynthesis using a PFN, used in unstable trochanteric fractures, resulted in low rates of clinical complications, excellent stabilization, few mechanical complications and adequate functional results. Thus the treatment of unstable intertrochanteric fracture with PFN had a more favourable outcome and it is the ideal implant of choice for unstable intertrochanteric fractures at present.

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