



## ANALYSING THE OUTCOME OF PROXIMAL FEMORAL NAILING IN UNSTABLE INTER-TROCHANTERIC FRACTURES

### Orthopaedics

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### ABSTRACT

**Background :-** The purpose of the present study was to analyse the outcome of proximal femoral nail in unstable inter-trochanteric fractures according to Evans classification and also whether it actually altered the eventual functional outcome of the patient. **Methods:-** Thirty patients with fresh unstable inter-trochanteric fractures who were operated within 21 days of injury were recruited in the present study conducted in the Department of Orthopaedics, Unique super-speciality Hospital, from Dec. 2018 to Dec. 2020. Age Most of the patients in study belong to age group 51-60 years. **Results:-** We include all unstable fracture in our study. Thirty patients treated with PFN were included in the study. Majority of the patient in our study were between 51-70 years with a mean age of 51.9 years. The PFN required shorter incisions, less blood loss and operative times. The average Harris hip score came out to be 88 and 50% of the patients belonged to the 'excellent' group that was Harris hip score more than 90. Unstable inter-trochanteric fractures, treated with PFN, had significantly better outcomes with all patients having excellent results. **Conclusion:-** We conclude that proximal femoral nail is a very good implant in treating unstable intertrochanteric fracture as it is a closed procedure.

### KEYWORDS

Inter-trochanteric, Femur, PFN, Femoral nail, HSS.

### INTRODUCTION

Petrochanteric femur fracture are those occurring in the region extending from extra capsular basilar neck region to region along the lesser trochanter before the development of medullary canal. Intertrochanteric fractures are one of the most common injuries sustained predominantly in patients over sixty years of age but can occur in all adults. They are three to four times more common in women who are osteoporotic; trivial fall being the most common mechanism of injury<sup>1</sup>. This fracture is often a terminal event resulting in death due to cardiac, pulmonary or renal complications. Approximately 10 to 30% of patients die within one year of an intertrochanteric fracture<sup>2</sup>. The goal of treatment of an intertrochanteric fracture is the restoration of the patient to his or her pre-injury status as early as possible. This led to the concept of internal fixation of these fractures to increase patient comfort, facilitate nursing care, decrease hospitalization and reduce complications of prolonged recumbency<sup>3</sup>. Per-trochanteric femur fracture may be repaired with either a sliding hip screw or a trochanteric nail. A problem with sliding hip screw is collapse of femoral neck leading to loss of hip offset and shortening of leg. Although some such sliding is expected too much shortening is detrimental to hip function therefore a new intramedullary device proximal femoral nail was designed in 1996 which give an advantage of minimal invasive surgery. Osteoporosis in this age group makes fixation of these fractures a difficult task, and increases chances of complications like screw cut-out when dynamic hip screw is used to fix intertrochanteric fractures<sup>4</sup>. Classifications of Evan's, Boyd's, and A.O.'s are used commonly to classify intertrochanteric fractures.

Goal of treatment is to achieve accurate anatomical or non-anatomical but stable reduction, rigid fixation, and early mobilization of patient and prevent deformity at hip.

Stable fractures can be very well treated with dynamic hip screw alone with good results proven by various studies.

The type of implant used has an important influence on complications of fixation. Sliding devices like the dynamic hip screw have been extensively used for fixation. However, if the patient bears weight early, especially in comminuted fractures, these devices can penetrate the head or neck, bend, break or separate from the shaft.

Intramedullary devices like the proximal femoral nail have been reported to have an advantage in such fractures as their placement allowed the implant to lie closer to the mechanical axis of the extremity, thereby decrease the lever arm and bending moment on the implant.

The purpose of the present study was to analyse the outcome of proximal femoral nail in unstable intertrochanteric fractures according to Evans classification and also whether it actually altered the eventual functional outcome of the patient.

### AIMS AND OBJECTIVES

1. To analyze the results of intertrochanteric fractures treated by proximal femoral nail (PFN) with regards to- I.Amount of blood loss during surgery II.Duration of surgery III.Post operative complications IV.Number of implant failures/loss of fixation as seen by neck shaft angle. V.Limb length shortening
2. To study the anatomical outcome by X-ray radiography, neck shaft angle.
3. To study the functional outcome by the Harris hip score.

### MATERIAL AND METHODS:-

#### Study Site

UNIQUE SUPERSPECIALITY HOSPITAL, INDORE. Department of Orthopaedics. STUDY POPULATION: Patients attending in the emergency department of Unique Super-speciality hospital, indore M.P.

#### Study Design: Prospective case study

#### Sample Size:

Previously researchers have performed studies on radiological and clinical outcome in patients presenting with inter-trochanteric fractures. The good to excellent found in these articles ranges between 70 – 95%<sup>15</sup>. Therefore, assuming (p)=80% as the good to excellent outcome with 10% margin of error, the minimum required sample size at 5% level of significance is 61 patients.

Since the study is time bound, all consecutive patients meeting the eligibility criteria during the study period were enrolled. It is expected from the previous experience that about 30 patients were enrolled.

#### Stud Y Period: Dec.2018 to Dec.2020

#### Inclusion Criteria For Study

- Adults (age 35 year and more)
- Inter-trochanteric fractures operated within 21 days of injury
- Unstable Intertrochanteric fracture according to Evan's classification
- Normal opposite hip

#### Exclusion Criteria For Study

- Pure subtrochanteric fractures

- Bilateral intertrochanteric fractures
- Any open injury
- Associated with vascular injury
- Pathological fracture
- Polytrauma patient
- Patients having reinjury at old intertrochanteric fracture site
- Patients not willing to participate in the study

#### METHODOLOGY AND STATISTICAL METHOD-

Descriptive statistics was analyzed with SPSS version 17.0 software. Continuous variables are presented as mean  $\pm$  SD. Categorical variables are expressed as frequencies and percentages. The Pearson's chi-square test or the chi-square test of association was used to determine if there is a relationship between two categorical variables.  $P < 0.05$  was considered statistically significant.

**Study Tools:** Basic Operating set ,Proximal femoral nail set

#### Study Technique:

The study has been conducted in the Department of Orthopaedics, Unique Super-speciality Hospital, Indore after obtaining informed consent from the patients & written clearance from the scientific and ethical committee.

#### Preoperative Planning:

Imaging studies: Standard good quality antero-posterior & lateral radiographs with bilateral pelvis with both hip were taken.

Investigations: All routine investigations which included.

#### OBSERVATIONS AND RESULTS

Thirty patients with fresh unstable intertrochanteric fractures who were operated within 21 days of injury were recruited in the present study conducted in the Department of Orthopaedics, Unique super-speciality Hospital, from Dec. 2018 to Dec. 2020. Age Most of the patients in study belong to age group 51-60 years. The mean age was 51.9 median age 54.5. Minimum and maximum age was 23-77. Sex distribution. There were 17 males (56.7%) and 13 females (43.3%) in the study population. Mode of injury: Majority of number of cases were due to fall by self 80% (low velocity) and few were due to road traffic accident 20% (high velocity trauma). Side-wise distribution :-Right sided (53.3%) inter-trochanteric fracture was more common than left side (46.7%).

Evans Classification:-Fractures were classified according to Evans classification. All the fracture type in the study population was unstable type.

Boyd and griffin classification Most of the cases 50% belonged to the comminuted type that is type II of boyd griffin classification. 20 % belonged to the reverse oblique type that was type III. Rest 30% belonged to type IV

#### Co morbidities:-

Diabetes (10%) was found to be more than hypertension (6.7%) in some of the cases. Blood loss:-Maximum blood loss was 500ml and minimum was 50 ml. The average blood loss came out to be 190 ml. Neck shaft angle:-The neck shaft angle ranged from minimum of 110 degrees to maximum 138, average being 128 degrees.

#### Limb Length Discrepancy:-

The average limb length discrepancy was 0.21 cm. Radiological union:-The average radiological union was seen at 12.86 weeks the range was from 8 to 24 week. Full weight bearing:-In our study we started weight bearing in 14.2 weeks range was from 8 to 24 weeks ;Outcome.

**Table No.1-- Patients % According To Boyd And Griffin Classification**

| Boyd and griffin classification | Percentage |
|---------------------------------|------------|
| II                              | 50.0%      |
| III                             | 20.0%      |
| IV                              | 30.0%      |

**Table No.2 Showing Different Parameters Function Comparison**

| Parameters    | Mean | $\pm$ SD |
|---------------|------|----------|
| Age           | 51.9 | 13.68    |
| Duration (Hr) | 1.69 | 0.35     |

|                              |        |       |
|------------------------------|--------|-------|
| Blood Loss                   | 191.67 | 96.57 |
| Angle                        | 128.67 | 4.8   |
| Radiological Union (W)       | 12.86  | 3.63  |
| Partial Wt Bearing (W)       | 4.77   | 2.19  |
| Complete Wt Bearing (W)      | 12.2   | 3.13  |
| Limb length discrepancy (Cm) | 0.21   | 0.26  |
| Interval (D)                 | 14.27  | 4.72  |

**Table No. 3 Comparison Of Complications**

| Early Complications | %    | Late Complication | %     |
|---------------------|------|-------------------|-------|
| Open Reduction      | 10%  | Z Effect          | 6.70% |
| Infection           | 6.7% | Varus Collapse    | 6.70% |
| Difficult Reduction | 3%   | Infection         | 3.30% |

**Table No.4: Cross Leg Sitting**

| Cross Leg  | %     |
|------------|-------|
| Able       | 83.3% |
| Difficulty | 10.0% |
| Unable     | 6.7%  |

**Table No.- Harris Hip Score**

| HARRIS HIP SCORE | %     |
|------------------|-------|
| <70              | 6.7%  |
| 71-80            | 6.7%  |
| 81-90            | 36.7% |
| >90              | 50.0% |

**Range Of Motion:- Table No. 6**

|                   | Mean $\pm$ SD     | Median | Min – Max |
|-------------------|-------------------|--------|-----------|
| HARRIS HIP SCORE  | 88.00 $\pm$ 7.94  | 90.50  | 67 – 98   |
| FLEXION           | 97.17 $\pm$ 16.28 | 110.00 | 45 – 110  |
| ABDUCTION         | 15.00 $\pm$ 5.57  | 20.00  | 5 – 20    |
| ADDUCTION         | 2.83 $\pm$ 2.84   | 5.00   | 0 – 10    |
| INTERNAL ROTATION | 4.17 $\pm$ 1.90   | 5.00   | 0 – 5     |
| EXTERNAL ROTATION | 12.83 $\pm$ 5.20  | 15.00  | 0 – 30    |

**Table No. 7 Analysis Of Outcome**

| Parameters              | <70  | 71-80 | 81-90  | >90   |
|-------------------------|------|-------|--------|-------|
| Interval (D)            | 12   | 15    | 16.73  | 12.67 |
| Duration (Hr)           | 2.25 | 1.75  | 1.79   | 1.53  |
| Blood Loss              | 325  | 200   | 209.09 | 160   |
| Angle                   | 113  | 124   | 123.18 | 123.4 |
| Radi Union (W)          | 13   | 12    | 8.36   | 8.67  |
| Partial Wt Bearing (W)  | 5    | 8     | 4.55   | 4.47  |
| Complete Wt Bearing (W) | 13   | 13    | 7.27   | 6.4   |
| Lld (Cm)                | 0.5  | 0.5   | 0.25   | 0.1   |

This chart shows the various parameters divide according to the harris hip score groups that is poor, fair, good, excellent.

#### DISCUSSION

Inter-trochanteric fractures are globally viewed as an injury best treated with surgical repair. The goals of operative treatment are strong and stable fixation of the fracture fragments, early mobilization of the patient, recovery of the patient to his or her pre-operative status at the earliest and to maintain the limb length. The PFN acts as a buttress in preventing the medialisation of the shaft. The entry portal of the PFN through the trochanter limits the surgical insult to the tendinous hip abductor musculature only, unlike those nails which require entry through the piriformis fossa. The anti-rotation and the compression screws of the PFN adequately compress the fracture, leaving between them a bone block for further revision, should the need arise. As the amount of iatrogenic soft tissue insult is minimal the use of PFN in the treatment of intertrochanteric fractures may have positive effect on the speed at which walking is restored.

#### AGE

All the fractures that occurred in patients younger than 50 years were either due to fall from height or road traffic accident. This supports the view that bone stock played an important role in causation of fracture in elderly, which occurred after trivial trauma. The intertrochanteric region was the most common site of senile osteoporosis. Hip joint being a major joint in the mechanism of weight bearing, the already weakened part cannot withstand any sudden abnormal stress. The space between bony trabeculae is enlarged and loaded with fat, whilst ensheathing compact tissue is thinned out and calcar is atrophied.

Majority of the patients in present study that is 36.7% belonged to the

age group 51-60. Mean age in years for our group was 51.9 years. Age group less than 40 years constituted 26%, 41-50 years comprised of 13% and more than 60 were 23%.

In 2015 B James et al found that the age ranged from 14 to 74 years and mean was 62.09 years<sup>8</sup>. In S Nagraj et al(2014) series, age ranged from 5<sup>th</sup>- 8<sup>th</sup> decade of life, mean age being 70.6 years. Endigeri et al in 2015 found that the mean age in their study was 57 years. In P Tank et al(2016) series – majority of the patients belonged to age group 61 to 70 years that comprised of 34% of the total<sup>7</sup>. A study in 2016 by Jonnes et al. They observed that the average age of patients was 60 years ranging from 27 to 85 years<sup>5</sup>. So the average age of our study coincided with the average age of other studies.

#### MODE OF INJURY

Most common mode of injury in our study was fall by self at home 80% that is low velocity trauma seen in elderly patients and high velocity trauma 20% road traffic accident in adults. In Endigeri et al.(2015) study, the most common mode of injury was low energy trauma due to fall in elderly(62%). In the young age group, fracture was due to high energy trauma. The mode of injury in various study was low velocity trauma mostly fall at home relating to the osteoporotic changes<sup>9</sup>. A study in 2016 by Jonnes et al. They observed that intertrochanteric fractures due to trivial trauma (77%) was more common mode of injury, followed by road traffic accidents (23%)<sup>5</sup>.

#### SEX

Most of the patients in our study were males that is 56.7% and the females constituted the rest of the 43%. This clearly reflected the preference and better acceptance of surgery by males and higher incidence of introchanteric fractures of femur in male population due to their more active lifestyles. This variation is probably because our study measured the male female ratio amongst operated fractures that reported for follow up and not the actual sex incidence for all trochanteric fractures.

In Endigeri et al.(2015) series, they found that the incidence of intertrochanteric fractures in males was more common that is 64 %<sup>9</sup>. S Nagraj et al in 2014 found that the incidence of intertrochanteric fractures in males was more common around 60%<sup>6</sup>. In B James et al.(2015) series, they found that the incidence of intertrochanteric fractures in males was more common that was 63.64% .P Tank et al. (2016) series, found that the male : female ratio was 2:3 that is female were more common<sup>7</sup>. A study in 2016 by Jonnes et al. Observed that males(53%) were more commoner than females(47%)<sup>5</sup>.

#### SIDE

Majority of patients in the study had right sided intertrochanteric fracture that was around 53.3% and rest 46% had left sided fracture which was not significant. In B James et al(2015) series, they found that right sided intertrochanteric fracture were more common that is 54.54%<sup>8</sup>. In 2016 Tank et al. Found that right sided intertrochanteric fractures were more common in their study<sup>7</sup>. A study in 2016 by Jonnes et al. Observed that 50% of the fractures occurred on the left side and 50% on the right side showing no significant difference<sup>5</sup>.

#### BOYD AND GRIFFIN CLASSIFICATION

Most of the patients belonged to boyd griffin classification type II that constituted 50% of the total patients, type III constituted 20% and type IV constituted 30% of the patients. In B James et al.(2015) series, the most common type was found to be type III that comprised of 45.45% of the total<sup>8</sup>. In 2016 P Tank et al. Found most common type to be type II that is 30% and in this study they excluded type IV that is with subtrochanteric extension<sup>7</sup>.

#### PERI-OPERATIVE PARAMETERS TIME TAKEN FOR SURGERY

In our study the average time came out to be 100 min that is 1.69 hrs.

In S Nagraj et al(2014) series the average time taken for surgery was 66 min<sup>6</sup>. In 2015 James et al. Found the average time taken for surgery to be 90 min<sup>8</sup>. In P Tank et al (2016 ) study the average time taken for surgery was 80 min<sup>7</sup>. A study in 2016 by Jonnes et al. They observed that the average duration of surgery for PFN was 90.6 mins<sup>5</sup>.

Our operating time for PFN was comparable with most of the studies.

#### BLOOD LOSS

In our study the average blood loss was 190 ml measured by blood in suction machine and one mop equalling 50 ml. In few cases which were converted to open reduction the blood loss was more than 300 ml and required blood transfusion. 2 of our patients required 1 (62%) unit of PCV transfusion each. B James et al in 2015 found the average blood loss to be 100 ml<sup>8</sup>. A study in 2016 by Jonnes et al. They observed that the average blood loss during PFN procedure was 73ml<sup>5</sup>.

#### NECK SHAFT ANGLE

In our study the average neck shaft angle came out to be 128 degrees. On antero posterior view of the hip, angled formed by axis of femoral shaft and line along the axis of femoral neck passing through centre of head was measured. If the neck shaft angle is <125 degrees it is called coxa vara deformity and if angle is >135 degrees then it is called coxa valga deformity.

In 2003 Seung Yong Lee measured the neck shaft angle of 130 degrees at post-operative time and 128.8 degree at the last follow-up. Aithala P in 2013 found in their study that the mean neck shaft angle achieved post reduction was 132.4 degrees (38 patients) and at the final follow up was 131.9 degrees (33 patients) with insignificant difference (Mean difference of 0.5 degrees). In the study by S Tandon (2015) the average neck shaft angle was 128 degrees.

#### RADIOLOGICAL UNION

In our study the average time for radiological union was found to be 12.86 weeks evident on disappearance of fracture lines. There was some controversy regarding criteria for time of fracture union in different studies. Some used radiological while some use radiological and clinical union. We had used criteria for union as presence of bridging callus at fracture site. Clinically, absence of pain at fracture site and SLRT positive.

Salphale in 2016 found the average union time to be 11.5 weeks<sup>10</sup>. In S Nagraj et al (2014) series the average time seen for radiological union was 12 weeks<sup>6</sup>. In 2015 B James et al. The average time seen for radiological union was 12 weeks<sup>8</sup>. In our study the union was seen around the same time as compared to other studies.

#### COMPLETE WEIGHT BEARING

In our study the average time when we started full wt bearing according to the patients tolerability was found to be 14.2 weeks. In S Nagraj et al(2014) series the average weight bearing was started at 9 weeks<sup>6</sup>. In P Tank et al.(2016) series the average weight bearing was 10 weeks seen in 53% of the patients<sup>7</sup>. A study in 2016 by Jonnes et al. They observed that patients operated for PFN returned to the preinjury walking ability at the end of 8 weeks<sup>5</sup>.

#### LIMB LENGTH DISCREPANCY (LLD)

In our study the average shortening seen was found to be 0.2 cm most of the shortening seen more than 0.5cm was in the patients of intertrochanteric fractures with sub trochanteric extension that is boyd griffin type IV. In S Nagraj et al(2014) series the average LLD was less than 2cm<sup>6</sup>. In B James et al(2015) series the average was found to be less than 1cm<sup>8</sup>. In P Tank et al (2016 ) study the average LLD was less than 1 cm in 13 of 70 patients and more than 1cm in 7 of 70 patients. A study in 2016 by Jonnes et al. They observed that the shortening was only 4.72 mm<sup>5</sup>. So as compared to other studies we found that the average limb length discrepancy was comparable to the other studies.

#### COMPLICATIONS

In our study out of all the 30 cases operated for PFN, 10% of the patients had to undergo open reduction and in 6.7% there was superficial infection. In 6.7% of the patients z effect was seen. In z effect the most proximal screw (antirotation) migrated inside towards the acetabulum and the second of the proximal screw (compression) migrated outwards. 6.7% of the patients developed varus collapse and one of the patient had delayed infection that constituted 3.3% of the total which was treated by draining the pus and parenteral antibiotics.

Salphale in 2016, they had two cases of delayed union due to failure to reduce the abducted trochanteric fragment which remained separated. In three cases there was marked prominence of the hip screws which was felt on the lateral aspect of the thigh and interfered with the mobility as noted on the six monthly follow up. In one patient, during the serial follow up, there was distal migration of the stabilising hip screw which got locked. But the fracture healed well without any complication. In one patient there was breakage of the distal interlocking bolt at 9 months, but the fracture united<sup>10</sup>.

Edengrin in 2015 in his study found that early complications included inadequate reduction in one patient (2%), failure to put derotation screw in one patient (2%), difficulty in distal locking in one patients (2%), varus deformity in one patient (2%), superficial infection in two patients (4%), implant failure in two patients (4%), and z effect in one patient (2%). Other complications included shortening in one patient (2%) and malunion in one patient (2%). Breakage of nail and inadequate fixation were considered implant failure<sup>9</sup>.

A study in 2016 by Jonnes et al. They observed that out of all the patients, 3 patients had jig miss match (20%), 1 underwent open reduction (6.7%) and in 1 patient only one cephalic screw was placed (6.7%) as the other screw could not be accommodated<sup>5</sup>.

### Harris Hip Score (HHS)

In our study the average Harris hip score was 88. Most of the patients belonged to the 'excellent' group that is HHS more than 90 and around 50% of the patients belonged to this group. The range of movements namely flexion, extension, external and internal rotation were good in most cases, excellent in a few. Poor results were seen in very few patients. The poor result was attributed to other associated factors namely a long interval between trauma and surgery & development of postoperative infection.

Salphale in 2016 found that the mean Harris hip score was 76.66 (range 70 – 93)<sup>10</sup>. In B James et al (2015) series most of the cases belonged to the good group that is the average HHS was between 80-90 and 45% belonged to this group. In P Tank et al (2016) series most of the patients belonged to the excellent group that is 51%<sup>7</sup>. A study in 2016 by Jonnes et al. They observed that the Harris hip score at the end of 12 months was 90. So as compared to other studies our group had significantly better Harris hip score. And our patients had returned to the pre existing state at the end of 6 month.

### CONCLUSION

We conclude that proximal femoral nail is a very good implant in treating unstable intertrochanteric fracture as it is a closed procedure. The blood loss was less. The time duration was less. The incision was small. It is a load sharing implant. The complication encountered like broken implant or varus collapse were less. We could achieve excellent range of motion. Early weight bearing was possible. Most of the patients scored excellent results according to the Harris hip score and they returned early to their functional activities.

Therefore we analysed that fixation of intertrochanteric fracture with proximal femoral nail is a good option.

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