# Results of Proximal Femoral Nail in Intertrochanteric Fracture of Femur

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**Abstract :**

**Introduction:** Intertrochanteric Femur fractures comprise approximately half of all hip fracture caused by low energy mechanism. Risk factors including increasing age, female gender, osteoporosis, and gait abnormality. Internal fixation options fall into two categories: intramedullary fixation or plating.PFN (Proximal Femoral Nail) is load bearing device with rotational stability. **Methods:** A prospective study in 70 patients above 31 years of age of proximal femur fractures operated with PFN at our institute in tertiary center in government setup - meeting the inclusion and the exclusion criteria with follow up of 5 – 24 months. Final outcome was measured with Harris Hip Score. **Results:** Low velocity injury was the cause of fracture in the majority (elderly female) patients. Boyd & Griffin type 2 was the commonest type following fall while walking. The operations were completed within 2 hours in 98% of the patients. The functional result according to Harris Hip Score was found to be excellent in 51.42%, good in 31.42%, fair in 10% and poor in 7.14% of patients. **Conclusion:** Intertrochanteric fractures commonly occur in elderly persons, usually following minor trauma. PFN offer less invasive option for fixation.PFN should always be considered for management of intertrochanteric fractures in young as well as elderly patients who have multiple pre-existing illness.

**Key words:** Proximal Femoral Nail, Intertrochanteric Fracture

## Introduction :

Intertrochanteric Femur fractures comprise approximately half of all hip fracture caused by low energy mechanism. These hip fractures occur in characteristic population with risk factors including increasing age, female gender, osteoporosis, a history of fall and gait abnormality. In spite of great advances made in the field of trauma in last 50 years management of this fracture has always remained subject of debate. There are several internal fixation options for managing these fractures that generally fall into two categories: some form of intramedullary fixation or some form of plating. Proximal Femoral Nailing is load bearing device with rotational stability and also short lever arm in addition to indirect fracture reduction.

Due to largest tertiary care hospital of country, large number of patient having intertrochanteric fracture are treated at our institute. Therefore, in present series, I have studied Intertrochanteric Femur fractures and their management with Proximal Femoral Nailing in 70 cases.

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## Methods:

The study participants were patients with Inter-trochanteric fracture of femure attending our institute. Distribution of patients was done according to Inter trochanteric (BOYD'S AND GRIFFIN) [1] classification. We have done a prospective study proximal femur fractures of femur operated with proximal femoral nailing[2] at our institute with follow up of 5 – 24 months. Methods of Collection of Data were by History, by follow up at interval of 1, 2, 4 and 6 months, by clinical examination and by analyzing case papers. On admission, patients were first examined thoroughly in primary survey for vital data and other major associated injuries in head, thorax, abdomen or spine along with local injuries.

## Proximal Femoral Nailing:

## Surgical Steps:

Patients were given spinal or epidural anesthesia and shifted to a radiolucent fracture; table in a supine position with perineal post. Operative leg was slightly adducted and put on traction. Opposite limb was put in a full abduction as to give space for the C-arm in

between the legs. Reduction was achieved by traction and internal rotation primarily mid adduction or abduction as required. Reduction was checked in a C-arm with anterior -posterior and lateral view.

**Methods to achieve reduction [3,4] by closed means:**

1. If indirect reduction was not satisfactory the following methods were used
2. Insertion of Stein Mann pin in the proximal fragment and manipulation so as to correct the deformity.
3. Manipulate the proximal fragment with nail insertion.
4. Maintaining relative adduction in operative limb by;
   A. Pulling the chest and abdomen part of the patient towards the normal unaffected side by servant or chest straps.
   B. Keeping the jig close to the body and inserting the nail in this position.

Limb was scrubbed, then painted and draped under sterile condition; A 5 cm incision was taken above the tip of the greater trochanter and deepened to the gluteus medius muscle. Tip of the greater trochanter palpated and minimal muscle attachment was cleared off. After this PFN was fixed in a following manner:

1. Entry Point at tip of greater trochanter
2. Guide wire insertion[5]
3. Reaming of the proximal femur
4. Nail insertion
5. Placing the guide wire pins
6. Insertion of the screw
7. Distal screws insertion

Parameters noted intra-operatively were: Total time of the surgery and Blood loss; latter was counted approximately by counting 50ml per mop used.

**Post Operative Protocol:**

Patients were given antibiotics- inj. Ceftriaxone 1gm i.v. 12 hourly and the same was continued for first 7 days and then they were shifted to oral antibiotic. Suction drainage was removed after 48 hours in case of open reduction. I.V. analgesics were given for 1st day followed by oral analgesics when necessary. Quadriceps physiotherapy was given. Non weight bear walking after suture removal, Partial weight bear walking at around 8 week and Full weight bear walking was allowed after assessing for radiological and clinical union.

**Radiological assessment:** Following points were noted

Union: Lines visible – Hazy – Obliterated – Disappear

Implant: Back out of screw / cutting of screw / breakage of nail or screw

Bone structure: Normal / Osteoporotic

Post-operative assessment done by using the Harris Hip Score (HHS) Grading as below:

| Grading | Result |
|---|---|
| <70 | Poor |
| 70-79 | Fair |
| 80-89 | Good |
| 90-99 | Excellent |

Study Hip: Left sided & Right sided both.

**HARRIS HIP SCORE [6]**

**Assessment by Harris Hip Score**

**Pain (Check one)**

- None or ignores it (44)
- Slight, occasional, no compromise in activities (40)
- Mild pain, no effect on average activities, rarely moderate pain with unusual activity; may take aspirin (30)
- Moderate Pain, tolerate but makes concession to pain. Some limitation of ordinary activity or work. May require occasional pain medication stronger than aspirin (20)
- Marked pain, serious limitation of activities (10)
- Totally disabled, crippled, pain in bed, bedridden (0)

| | |
|---|---|
| **Limp**<br>• None (11)<br>• Slight (8)<br>• Moderate (5)<br>• Severe (0) | **Stairs**<br>• Normally without using a railing (4)<br>• Normally using a railing (2)<br>• In any manner (1)<br>• Unable to do stairs (0) |
| **Support**<br>• None (11)<br>• Cane for long walks (7)<br>• Cane most of time (5)<br>•· One Crutch (3)<br>•· Two crutches/not able to walk (0) | **Distance Walked**<br>• Unlimited (11)<br>• Six blocks (8)<br>• Two or three blocks (5)<br>• Indoors only (2)<br>• Bed and chair only (0) |
| **Range of Motion Scale**<br>$211^0 - 300^0$ (5) $61^0 - 100^0$ (2)<br>$61^0 - 210^0$ (4) $31^0 - 60^0$ (1)<br>$01^0 - 160^0$ (3) $0^0 - 30^0$ (0) | **Put Shoes and Socks**<br>With ease (4)<br>With difficulty (2)<br>Unable (0) |
| **Sitting**<br>Comfortably in ordinary chair for one hour (5)<br>On a high chair for 30 minutes (3)<br>Unable to sit comfortably in any chair (0) | **Range of Motion (*Indicates Normal)**<br>Flexion ($*140^0$)<br>Abduction ($*40^0$)<br>Adduction ($*40^0$)<br>External Rotation ($*40^0$)<br>Internal Rotation ($*40^0$) |
| **Absence of Deformity** (All yes = 4, Less than 4 = 0)<br>Less than 300 fixed flexion contracture? Yes / No<br>Less than 100 fixed abduction? Yes / No<br>Less than 100 fixed internal rotation in extension? Yes / No<br>Limb length discrepancy less than 3.2 cm? Yes / No | |
| **Inter Public Transportation**<br>Yes (1)<br>No (0) | **Total Harris Hip Score**<br>**Range of Motion Score** |

**Results:**

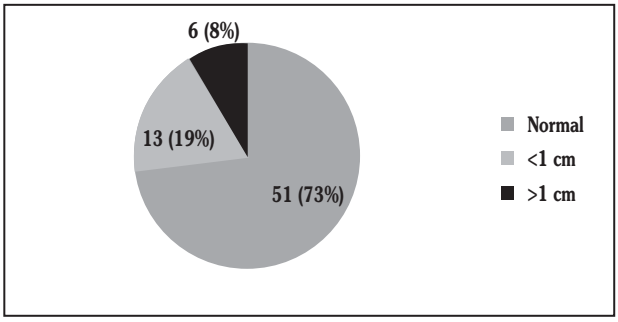
The commonest age group for intertrochanteric fractures was between 61 – 70 years (34%) followed by 51-60 years (23%) & least common was <40 years. On studying sex incidence, it was found that, Male: Female ratio was 2:3. (Mainly because of post-menopausal osteoporosis). Majority of the intertrochanteric fractures occurred followinglow velocity trivial trauma mostly associated with a domestic accident like fall in bathroom or fall from stairs. In our study right sided fractures were more common as compared to left side. Hypertension was more common co-morbid condition followed by diabetes among study participants. Out of 70 patients, 59 patients operated under spinal anesthesia and 11 patients operated with general anesthesia. Proximal femoral nailing is simple procedure and can be completed in short duration. In our study average time for procedure was 80 minutes while cases with other fracture and other procedure had taken longer time. Majority of the patients (60%) were discharged before 10$^{th}$ post operative day, while (40%) needed longer hospital stay. Weight bearing was classified into two parts, Partial weight bearing & Full weight bearing.

**Table 1: Distribution of patients according Inter trochanteric (BOYD'S AND GRIFFIN) [1] classification**

| Type of fracture | No. of patients |
|---|---|
| Type I | 25 |
| Type II | 30 |
| Type III | 15 |
| Type IV | 00 |

In study of 70 patients, we found that type 2 fracture of intertrochanteric were common, classified according to Boyd and Griffin classification. We have not taken patients with subtrochanteric extension (Boyd & Griffin type 4) in our study.

**Figure 1: Limb length discrepancy at 6 month follow up among study participants.**




Most of the patients were with equal limb length.13 patients had <1 and 6 patients had >1cm limb length discrepancy.

**Table 2: Post-operative Assessment of reduction among patients.**

| Assessment | No. of Patients |
|---|---|
| Acceptable | 55(78%) |
| Poor | 15 (22%) |
| Total | 70 (100%) |

The above table shows that reduction was acceptable in 78% cases with PFN, while it was poor in 22%.Anatomical alignment of the fracture or a valgus type or a diamond hughston variety of reduction were considered as acceptable reduction, which provide immediate stability and Poor reduction was that with no medial cortical contact and a varus of more than ten degrees compared to the opposite side.

**Table 3: Time taken for Partial weight bearing & walking by patients after surgery.**

| Duration in weeks | Proximal Femur Nail |
|---|---|
| Within 1$^{st}$ week | 4 (5%) |
| 1-3 | 40 (57%) |
| 4-6 | 25 (37%) |
| 7-10 | 1 (1%) |
| Total | 70 (100%) |

In the PFN group, 62% of patients were allowed partial weight bearing within 3 weeks of surgery, while 38% of patients after 3 weeks of surgery. In patients having proximation, communition, lateral wall deficients, severe osteoporosis, partial weight bearing was delayed & there was also post-operative collapse of fracture in these patients.

**Figure 2: Duration taken for full weight bearing by patients post-operatively**

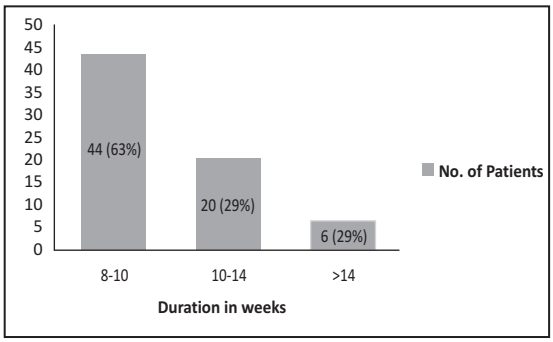



Table 5 shows that 63% were allowed full weight bearing within 10 weeks after surgery and 8 % were allowed to full weight bearing after 14 weeks.

**Table 4: Occurrence of local complications among patients under study**

| Local complications | No. of Patients with Complication(n=20) |
|---|---|
| Screw backout | 3 |
| Implant failure | 2 |
| Peri-implant fracture | 1 |
| Non-union | 2 |
| Malunion | 1 |
| Infection | 2 |
| Avascular Necrosis | 1 |
| Varus Malalignment | 8 |

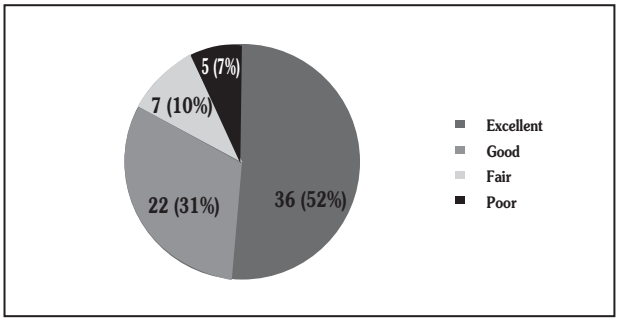
The total numbers of patients with complications were 20 (29%). Incidence of complications related to implant cut-out, implant migration correlated with patient specific factors, such as advanced age, presence of osteoporosis and position of implants, irrespective of the type of implant used. There were only two cases of infection and both were suffering from Diabetes mellitus. One Patient had bilateral avascular necrosis with fracture intertrochanteric.

**Table 5: X- ray findings of radiological union at 6 months Post-operatively.**

| Fracture line | PFN |
|---|---|
| Visible | 10 (16%) |
| Not visible | 60(84%) |
| Total | 70 (100%) |

The fracture line was visible in x-rays in only 16% of patients, while 84% showed radiological union at six months.

**Figure 3:Post-Operative Results based on Harris hip score**




In study of 70 patients, we obtained approximately 52% (36 Patients) excellent results and 31% good results. All of them performing their routine normal activity well. 5 patients had poor results. One of them had associated fracture shaft femur which went into non-union. Another 3 were old aged and had associated co-morbid conditions.

**Figure 4: Pre-Operative X - Ray:**

**Figure 5: Post-Operative X - Ray:**

**Figure 6: Post-operative Clinical presentation**

**Discussion:**

Intertrochanteric fracture commonly occurs in elderly patients, but increased mechanization and increased number of road traffic accidents results in this fracture occurring even in younger patients. There are various implants available for managing intertrochanteric fractures till date, but the search is still going on to decide the best method.

In the present study, 70 cases of intertrochanteric fractures treated operatively with proximal femoral nail (PFN), and the results were analyzed. In this series, low velocity injury (Domestic fall) was the cause of fracture in the majority (70%), especially in the elderly female patients. Boyd & Griffin type 2 was the commonest type (42%) following fall while walking etc. The operations were completed within 2 hours in 98% of the patients. For PFN minimum duration was 40 minutes and maximum duration was 150 minutes and mean duration was 80 minutes. All patients were operated on fracture table and the reduction was checked prior to surgery in the form of AP and lateral views by Image intensified television in all the cases.

On final follow up one patient had iatrogenic basicervical fracture, one patient had outward migration of screw, two patients had backout of derotation screw, 10 patients had varus collapse, five patients had abductor weakness on follow-up. On 6 month follow up, thirty patients had separated lesser trochanter with union of fracture but there was no limitation of movement & any residual deformity.

On review of literature very few such comparative studies were found and out of which largest international series was that of J. Pajarinen et al,[7] from Helsinki University Central Hospital, Helsinki, Finland and The Indian series was that of M. Porecha et al, [8] M.P. Shah Medical College, Guru Govind Singh hospital, Jamnagar, Gujarat, India.

Reduction was considered as "good" if the cortical congruence at the calcar region was restored, and if the displacement between the fragments did not exceed 2 mm in any projection. The ideal position for the screw in the femoral neck for the PFN was defined as being central on the lateral radiograph and central or inferior on the AP radiograph.

**Intra-operative difficulties in each group:** We encountered difficulty in finding entry point if the greater trochanter was broken. Post-operative infection was seen in 2 patients in the PFN group and needed change of antibiotics and dressings. Both were suffering from DM.

**Table 6: Comparison of our data with other studies**

| Sr. . No | Variable | Present Series | J. Pajarinen's Series | M. Porecha's Series |
|---|---|---|---|---|
| 1. | Anaesthesia | | | |
| | Spinal | 84% | 95% | 100% |
| | General | 16% | 05% | 00% |
| 2. | Open reduction | 0% | 0% | 6% |
| 3. | Good reduction | 78% | 70.4% | 90% |
| 4. | Duration of operation | 80 minutes | 50 minutes | 71 minutes |

**Table 7: Radiographic evaluation at final follow-up**

| Sr. . No | Variable | Present Series | J. Pajarinen's Series | M. Porecha's Series |
|---|---|---|---|---|
| 1. | Implant failure | 3% | 4.2 % | 2% |
| 2. | Neck screw cutout | 0% | 2.1% | 0% |
| 3. | Z effect | 5% | - | 2% |
| 4. | Nonunion | 3% | 4.2% | 0% |
| 5. | Peri-implant fracture | 1% | 0% | 0% |

Complications seen in the PFN group included implant failure (3%), Z-effect (5%) and non-union (3%). The total numbers of patients with complications were 10%. Z-effect seen in 5% of cases. This can be because of the underlying osteoporosis, improper position of screws (relatively long de-rotation screw), mismatching of implants and variable neck-shaft angle in our series.

**Functional analysis at final follow-up:**

The weight bearing was started early as per tolerance of the patients if we had achieved good reduction and stable fixation especially in young patients. Due to the lack of upper extremity strength and co-morbidities in the majority of the hip fracture population, the use of an assistive device to fully unload the repaired extremity is limited.

After PFN fixation, by 3$^{th}$ week, partial weight bearing was allowed in 57% of patients and full weight bearing was allowed to 53% of patients at the end of 10 week. All the patients had final follow up at 18 months of surgery with (mean-11.17 months, maximum-18 months and minimum-6 months). No notable differences were seen between implants in terms of fracture healing.

Based on all the above criteria the functional result according to Harris Hip Score was found to be excellent in 51.42%, good in 31.42%, fair in 10% and poor in 7.14% of patients.

**References:**


1. Boyd, H.B., and Griffin, L.L.: Classification and Treatment of Trochanteric Fractures. Arch. Surg., 58:853–866, 1949.
2. Rao, J.P., Banzon, M.T., Weiss, A.B., Rayhack, J.: Treatment of Unstable Intertrochanteric Fractures With Anatomic Reduction and proximal femoral nail Fixation. Clin. Orthop., 175:65, 1983.
3. Parker M. J. - Valgus reduction of trochanteric fractures - Injury 1993, May; 24(5), 313-6.
4. Kenneth J. Koval, Robert V. Cantu, Chapter 45-Intertrochanteric Fractures, Rockwood & Green's Fractures in Adults, 6th Edition, p-1794.
5. Tronzo, R.G.: Use of an Extramedullary Guide Pin for Fractures of the Upper End of the Femur. Orthop. Clin. North Am., 55:525–527, 1974.
6. Campbell's operative orthopedics, Chapter 6,12th edition,p-345.
7. Pajarinen J, Lindahl J,Michelsson O, Savolainen V Hirvensalo E Pertrochanteric femoral fractures treated with a dynamic hip screw or a proximal femoral nail: A randomized study comparing post-operative rehabilitation .J Bone Joint Surg 2005 ; 87-B: 76-81.
8. Porecha M M, Parmar D S, Chawada H R, Parmar R D Long proximal femoral nails versus sliding hip screw-plate device for the treatment of intertrochanteric hip fractures, A randomized prospective study in 100 elderly patients. The Internet Journal of Orthopedic Surgery. 2009; 12:1 032-035 Volume 12 Number 1.