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Research Article

# A COMPARISON OF LONG PROXIMAL FEMUR NAIL V/S SHORT PROXIMAL FEMUR NAIL IN THE TREATMENT OF INTERTROCHANTERIC FRACTURES IN ADULTS AND ELDERLY

**Dr. S.K. Bhaskar[1], Dr. Hemeshwar Harshwardhan[2], Dr. Priyank Sharma[3], Dr. Mahesh Saini[4], Dr. Sunil Paliwal[5]**

*[1] Senior Professor, Department of Orthopaedics, J.L.N Medical College Ajmer, Rajasthan*
*[2]Senior Professor, Department of Orthopaedics, J.L.N Medical College Ajmer, Rajasthan*
*[3]Resident, Department of Orthopaedics, J.L.N Medical College Ajmer, Rajasthan*
*[4]Resident, Department of Orthopaedics, J.L.N Medical College Ajmer, Rajasthan*
*[5]Resident, Department of Orthopaedics, J.L.N Medical College Ajmer, Rajasthan*



**Corresponding Author:**

**Dr. Mahesh Saini**
Resident, Department of Orthopaedics, J.L.N Medical College Ajmer

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## ABSTRACT

**Aim:** The objective of the study was to evaluate and compare the clinical outcomes of short versus long proximal femoral nails (PFN) in the treatment of stable intertrochanteric (IT) fractures.
**Methods:** This was a hospital-based prospective study conducted over a two-year period, from July 2023 to July 2025, at the Department of Orthopaedics, Jawaharlal Nehru Medical College and Associated Group of Hospitals, Ajmer (Rajasthan). All the patients presenting with intertrochanteric fractures to the Department of Orthopaedics at JLN Medical College & Hospital, Ajmer, comprised the study population.
**Results:** The majority of patients in Group 1 (40%) fall within the 61-70 years age range, followed by 35% in the 71-80 years category. In Group 2, the highest proportion (40%) belongs to the 50-60 years age group, while 35% are in the 71-80 years range. In Group 1, 60% of the patients are male, while 40% are female. In contrast, Group 2 has a higher proportion of male patients (80%) and a lower proportion of female patients. In Group 1, the involvement is evenly distributed, with 50% of patients having left-sided involvement and 50% having right-sided involvement and in Group 2, right-sided involvement is more common (65%). All patients in both groups (100%) were classified as Type 1, with no cases of Type 2 observed. In Group 1, the majority of patients (85%) sustained injuries due to slip and fall, while 15% were injured in road traffic accidents (RTA).
**Conclusion:** Overall, both techniques are effective, but the long proximal femur nail may provide improved intraoperative efficiency without compromising long-term outcomes.

***Keywords****: clinical outcomes, proximal femoral nails, stable intertrochanteric fractures.*

## INTRODUCTION

Intertrochanteric fractures occur in the upper part of the femur, specifically between the extracapsular base of the neck and the area near the lesser trochanter, just before the medullary canal begins. This proximal metaphyseal zone contains cancellous bone with both compressive and tensile lamellar patterns, along with thin cortical bone, which are all vulnerable to injury. Such trauma leads to various fracture types and causes displacement of bone fragments and the muscles attached to them. Following surgical intervention, these anatomical structures are exposed to stress from multiple directions.[1]

The incidence of proximal femoral fractures has been rising globally, driven by an aging population, increased life expectancy, and a higher prevalence of osteoporosis among the elderly. Additionally, road traffic accidents have contributed to a significant number of these fractures in younger individuals.[2] Among proximal femoral fractures,

trochanteric fractures are particularly concerning due to their impact on mobility, independence, and overall quality of life. The burden of these fractures is expected to grow substantially, with estimates projecting 1.6 million cases by 2025 and 2.5 million by 2050.[3]

Intertrochanteric fractures frequently occur in elderly individuals, especially those with osteoporosis or other underlying conditions. Like most hip fractures in this population, these injuries often result from a lateral fall impacting the greater trochanter. The incidence, complexity, and likelihood of unstable intertrochanteric fracture patterns are closely associated with the extent of trochanteric bone loss due to osteoporosis. Although the direction of impact influences the general risk of sustaining a hip fracture, there is no definitive link between impact direction and the specific site or type of fracture.[4] In older adults, unstable intertrochanteric fractures are associated with a high mortality rate, approaching 20% within the first year following surgery.[5]

Clinical assessment of intertrochanteric fractures typically focuses on the number, size, shape, location, and degree of displacement of fracture fragments. Comminution, particularly involving the posteromedial cortex, plays a significant role in increasing the risk of fixation failure. When multiple fragments involve this area, they tend to displace into varus and retroversion, classifying them as unstable fractures.[6] Femoral intertrochanteric fractures are currently managed using either short or long cephalomedullary (CM) nail constructs.[7] Short CM nails are relatively easier to insert and allow for straightforward distal interlocking, but they carry risks such as thigh pain or secondary fractures occurring at or just below the nail tip.[8] On the other hand, long CM nails, which span the length of the femoral canal, may provide biomechanical advantages. However, placing distal locking screws with these longer nails can prolong the surgical procedure and increase radiation exposure.[9] As a result, some surgeons opt for short CM nails or use long nails without distal locking[10], favoring these options for their simplicity and shorter operative time.[11] Trochanteric hip fractures are presently treated using both short and long cephalomedullary nail systems. While each option offers specific advantages, there remains ongoing debate regarding the optimal choice. Recent studies have indicated that short intramedullary devices are associated with reduced intraoperative blood loss and shorter surgical durations compared to their longer counterparts.[12] Conversely, some evidence suggests that long cephalomedullary nails may offer the benefit of lowering the long-term risk of ipsilateral femoral fractures.[13]

The objective of the study was to evaluate and compare the clinical outcomes of short versus long proximal femoral nails (PFN) in the treatment of stable intertrochanteric (IT) fractures.

## MATERIALS AND METHODS

This was a hospital-based prospective study conducted over a two-year period, from July 2023 to July 2025, at the Department of Orthopaedics, Jawaharlal Nehru Medical College and Associated Group of Hospitals, Ajmer (Rajasthan). All the patients presenting with intertrochanteric fractures to the Department of Orthopaedics at JLN Medical College & Hospital, Ajmer, comprised the study population.

### INCLUSION CRITERIA

- Adult patients of both sexes aged between 18 and 80 years.
- All cases of traumatic, stable intertrochanteric fractures.
- Patients who were willing to undergo treatment and provided informed written consent for necessary investigations and surgical intervention.

### EXCLUSION CRITERIA

- Open fractures.
- Associated ipsilateral fractures such as distal femur and proximal tibial fractures.
- Pathological fractures.
- Pre-existing diseases or deformities affecting the injured hip.
- Cases with delayed presentation to the hospital or old neglected fractures.
- Patients deemed unfit for surgery.
- Unstable intertrochanteric fractures.

### METHOD OF DATA COLLECTION

Following admission of a patient with an intertrochanteric fracture to the hospital, all necessary clinical details were recorded using a structured proforma. This included demographic information, detailed history, clinical examination findings, investigation results, and surgical interventions.

Patients were randomly assigned to two groups:

- Group 1: Treated with short PFN.
- Group 2: Treated with long PFN.

Emergency management of life-threatening conditions followed the standard ABC protocol (Airway, Breathing, Circulation). The injured limb was immobilized using a Bohler-Braun (BB) splint with skin traction, and skeletal traction

was applied if surgery was delayed. After stabilization of vital signs, radiographs of the affected limb were obtained. Standard imaging included an anteroposterior (AP) view of the pelvis with both hips and full-length AP and lateral views of the affected thigh to assess the fracture pattern.

The fracture was classified and immobilized. Written informed consent was obtained from patients and their relatives for internal fixation. All patients were kept nil per oral overnight. Appropriate nail size was determined clinically and radiologically. Surgical fixation was then performed using either a short or long PFN, with 20 patients in each group.

**POSTOPERATIVE PROTOCOL**

- Vital signs (pulse, blood pressure, respiratory rate, temperature) were monitored regularly.
- The affected limb was elevated, and the patient was observed in the recovery room until stable, after which they were transferred to the orthopedic ward.
- Intravenous antibiotics were administered for the first three days, then transitioned to oral antibiotics.
- Blood transfusion was given as required.
- Static quadriceps exercises were initiated on the first postoperative day.
- Active quadriceps and hip flexion exercises began on the third postoperative day.
- Wound dressings were done on the 2nd, 6th, and 10th postoperative days.
- Sutures were removed on the 12th postoperative day.
- Patients were encouraged to begin partial weight-bearing ambulation as tolerated.
- Full weight-bearing was allowed after confirming clinical and radiological evidence of fracture union.

**FOLLOW-UP**

Postoperative radiological evaluation was performed, and patients were followed up at 6 weeks, 12 weeks, 6 months, and 12 months. Fracture healing was assessed clinically (based on pain and movement at the fracture site) and radiologically (presence of bridging callus or trabeculation across the fracture site). Functional outcomes were evaluated using the Harris Hip Score.

**RESULTS**

Table 1: Baseline characteristics

| **Age Distribution (in years)** | **Group 1** | | **Group 2** | |
|---|---|---|---|---|
| | No. of Patients | Percentage | No. of Patients | Percentage |
| **50-60** | 3 | 15 | 8 | 40 |
| **61-70** | 8 | 40 | 4 | 20 |
| **71-80** | 7 | 35 | 7 | 35 |
| **>80** | 2 | 10 | 1 | 5 |
| **Gender** | | | | |
| **Female** | 8 | 40 | 4 | 20 |
| **Male** | 12 | 60 | 16 | 80 |
| **Side distribution** | | | | |
| **Left** | 10 | 50 | 7 | 35 |
| **Right** | 10 | 50 | 13 | 65 |
| **Boyd and Griffin Classification** | | | | |
| **Type 1** | 20 | 100 | 20 | 100 |
| **Type 2** | 0 | 0 | 0 | 0 |
| **Mode of injury** | | | | |
| **RTA** | 3 | 15 | 6 | 30 |
| **Slip & Fall** | 17 | 85 | 14 | 70 |

The majority of patients in Group 1 (40%) fall within the 61-70 years age range, followed by 35% in the 71-80 years category. In Group 2, the highest proportion (40%) belongs to the 50-60 years age group, while 35% are in the 71-80 years range. The difference in mean age between the two groups was not statistically significant. In Group 1, 60% of the patients are male, while 40% are female. In contrast, Group 2 has a higher proportion of male patients (80%) and a lower proportion of female patients (20%). The difference in gender distribution between the two groups was not statistically significant. In Group 1, the involvement is evenly distributed, with 50% of patients having left-sided involvement and 50% having right-sided involvement. In Group 2, right-sided involvement is more common (65%), while left-sided involvement is observed in 35% of patients. The difference between the two groups was not statistically significant. All patients in both groups (100%) were classified as Type 1, with no cases of Type 2 observed. There was no difference between the groups, as

indicated by a P-value of 1. In Group 1, the majority of patients (85%) sustained injuries due to slip and fall, while 15% were injured in road traffic accidents (RTA). Similarly, in Group 2, slip and fall was the most common cause (70%), followed by RTA (30%). The difference in the mode of injury between the two groups was not statistically significant.

Table 2: Comparison of C-Arm Shoots, Surgery Duration radiological union between Group 1 and Group 2

| Parameter | Group 1 | | Group 2 | | P-Value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| **No. of C-arm Shoots** | 45.8 | 6.08 | 88.5 | 11.64 | <0.0001 |
| **Duration of Surgery (min.)** | 43.3 | 7.91 | 81.75 | 15.95 | <0.0001 |
| **Radiological union (in months)** | 4.7 | 0.8 | 5.1 | 0.91 | 0.14 |

The mean number of C-arm shoots in Group 1 is 45.8±6.08, whereas in Group 2, it is significantly higher at 88.5±11.64. This difference was statistically significant, with a P-value of <0.0001. The mean surgical duration in Group 1 is 43.3±7.91 minutes, whereas in Group 2, it is significantly longer at 81.75±15.95 minutes. This difference was statistically significant, with a P-value of <0.0001. The mean time for radiological union in Group 1 is 4.7±0.8 months, while in Group 2, it was slightly longer at 5.1±0.91 months. However, this difference was not statistically significant (P=0.14).

Table 3: Intraoperative Blood Loss (Mops Used) in Group 1 and Group 2

| Intra-op Blood Loss (mops used) | Group 1 | | Group 2 | |
|---|---|---|---|---|
| | No. Patients of | Percentage | No. of Patients | Percentage |
| **≤2** | 20 | 100 | 2 | 10 |
| **3-4** | 0 | 0 | 18 | 90 |
| **Total** | 20 | 100 | 20 | 100 |
| **Mean±SD** | 2±0 | | 3.15±0.58 | |
| **P-Value** | <0.0001 | | | |

In Group 1, all patients (100%) required ≤2 mops, whereas in Group 2, only 10% of patients required ≤2 mops, while the majority (90%) needed 3-4 mops. The mean blood loss in Group 1 was 2±0 mops, compared to 3.15±0.58 mops in Group 2. This difference was statistically significant, with a P-value of <0.0001.

Table 4: Comparison of Harris Hip Score (HHS) at 6 Months between Group 1 and Group 2

| HHS | Group 1 | | Group 2 | | P-Value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| **at 6 months** | 87.5 | 8.1 | 83.3 | 8.42 | 0.11 |

The mean HHS in Group 1 was 87.5±8.1, while in Group 2, it was slightly lower at 83.3±8.42. However, the difference was not statistically significant.

Table 5: Comparison of Functional Outcomes at 6 Months between Group 1 and Group 2

| Functional outcome (at 6 months) | Group 1 | | Group 2 | | P-Value |
|---|---|---|---|---|---|
| | No. Patients of | Percentage | No. Patients of | Percentage | |
| **Fair** | 5 | 25 | 7 | 35 | 0.79 |
| **Good** | 6 | 30 | 5 | 25 | |
| **Excellent** | 9 | 45 | 6 | 30 | |
| **Poor** | 0 | 0 | 2 | 10 | |
| **Total** | 20 | 100 | 20 | 100 | |

In Group 1, 45% of patients achieved an excellent outcome, 30% had a good outcome, and 25% had a fair outcome, with no patients in the poor category. In Group 2, 30% of patients had an excellent outcome, 25% had a good outcome, 35% had a fair outcome, and 10% had a poor outcome. The difference in functional outcomes between the two groups was not statistically significant.

Table 6: Comparison of Complications between Group 1 and Group 2

| Complications | Group 1 | | Group 2 | | P-Value |
|---|---|---|---|---|---|
| | No. of Patients | Percentage | No. of Patients | Percentage | |
| **NIL** | 18 | 90 | 16 | 80 | 0.98 |
| **Screw Cutoff** | 1 | 5 | 2 | 10 | |
| **Thigh Pain** | 1 | 5 | 0 | 0 | |
| **Infection** | 0 | 0 | 1 | 5 | |
| **Varus Deformity** | 0 | 0 | 1 | 5 | |
| **Total** | 20 | 100 | 20 | 100 | |

In Group 1, 90% of patients had no complications, while 5% experienced screw cutoff and 5% reported thigh pain. In Group 2, 80% of patients had no complications, while 10% experienced screw cutoff, 5% developed an infection, and 5% had varus deformity. The difference in complication rates between the two groups is not statistically significant.

**DISCUSSION**

For elderly patients with intertrochanteric femur fractures (IFF), the primary treatment goal is rapid restoration of joint function and pre-injury mobility. Comparing long and short proximal femoral nails (PFNs) reveals key differences: short PFNs offer shorter operative time, less blood loss, and easier insertion, making them suitable for stable fractures and elderly patients. However, they carry risks such as implant cutout, Z-effect, and reverse Z-effect in unstable fractures. Long PFNs provide superior biomechanical stability for comminuted or unstable fractures but may increase operative time and risk of distal femoral fractures and thigh pain. Both types achieve similar union rates and functional outcomes. Therefore, implant choice should be individualized, considering fracture characteristics, patient factors, and surgeon expertise to optimize recovery and reduce complications. Additionally, PFNA aligns better with the femur's physiological and mechanical axis, offering greater resistance to shear forces and rotational deformities.[14]

In Group 1, the majority of patients (40%) were in the 61-70 years age range, followed by 35% in the 71-80 years category. Conversely, in Group 2, the highest percentage (40%) fell within the 50-60 years range, with 35% in the 71- 80 years group. The mean age in Group 1 was 69.55±8.93 years, while in Group 2, it was slightly lower at 65.65±9.29 years. This difference was not statistically significant (P=0.18). Similarly, Kumar R et al[15] observed that patients in Group A had a mean age of 62.1 ± 15.77 years, while those in Group B had a younger mean age of 54.1 ± 10.8 years. The majority in Group A were between 61 and 80 years, whereas Group B patients were mainly in the 41-60 years range, with 11 female patients undergoing surgery. In Group 1, males constitute 60% of the patient population, while females account for 40%. Conversely, Group 2 has a higher proportion of male patients (80%) and a smaller percentage of females (20%). However, the difference in gender distribution between these two groups is not statistically significant (P=0.16). Similarly, Murthy BS et al[16] observed that in Group A (comprising 40 patients), 40% were male, and 15% were female, while Group B had a slightly higher proportion of males (52%) and females at 48%. According to the chi-square test, there was no statistically significant variation (p=0.3946) in gender distribution between the groups.

In Group 1, there is an even distribution of involvement, with 50% of patients having fractures on the left side and the other 50% on the right side. Conversely, in Group 2, right-sided fractures are more prevalent, accounting for 65%, while left-sided fractures occur in 35% of patients. However, this difference between the two groups is statistically insignificant (P=0.33). Similarly, Rahman M A K et al[17] observed that in Group A, left-sided trochanteric fractures occurred in 9 patients and right-sided fractures in 6 patients, while in Group B, 7 patients had fractures on the left and 8 on the right side. This study illustrates the Boyd and Griffin classification of patients in both Group 1 and Group 2. It was observed that all patients in these groups (100%) were classified as Type 1, with no reported cases of Type 2 fractures. The P- value of 1 further confirms the absence of any difference between the two groups. Similarly, Lonikar R et al[18] noted that the most frequently encountered intertrochanteric fracture type was Boyd and Griffin Type II, accounting for 56% of cases. Their findings showed that Type I fractures were present in 22% of patients (11 cases), followed by Type II in 56% (28 cases), Type III in 12% (6 cases), and Type IV in 10% (5 cases), indicating a more varied fracture distribution compared to the uniform Type 1 classification seen in the current groups.

Our study demonstrates the mode of injury in Groups 1 and 2. In Group 1, a large proportion of patients (85%) sustained injuries due to slip and fall incidents, while 15% were injured in road traffic accidents (RTA). Similarly, in Group 2, slip and fall was also the most frequent cause (70%), followed by RTA in 30% of patients. However, the difference in the mode of injury between the two groups is not statistically significant (P=0.25). Likewise, Rahman M A K et al[17] observed that the short PFN group primarily experienced trivial falls (12 cases), along with 2 RTAs and 1 fall from height (FFH), whereas the long PFN group had 9 cases of trivial falls, 6 RTAs, and no FFH cases, showing some variations in injury mechanisms. Our work presents a comparison of surgical duration between Group 1 and Group 2. The mean operative time for Group 1 is 43.3±7.91 minutes, whereas Group 2 experiences a notably longer duration of 81.75±15.95 minutes. This difference is

statistically significant, with a P-value of <0.0001. Similarly, Rahman MAK et al[17] observed that the short PFN group had an average surgery time of 68.6 ± 6.62 minutes, ranging from 56 to 82 minutes, while the long PFN group had a higher mean duration of 78.6 ± 7.35 minutes, with a statistically significant p-value of 0.0005.

Our study highlights intraoperative blood loss, assessed by the number of mops used, in both Group 1 and Group 2. In Group 1, all patients (100%) required ≤2 mops, while in Group 2, a small proportion (10%) used ≤2 mops, and the majority (90%) needed 3-4 mops. The average blood loss in Group 1 was 2±0 mops, whereas it increased to 3.15±0.58 mops in Group 2, with a statistically significant difference (P < 0.0001). Similarly, Xu H et al[19] based on data from eight trials involving 781 patients, noted reduced blood loss (−158.20 mL), although the evidence was considered low quality due to high inconsistency ($I^2$ = 95%). This study demonstrates the comparison of radiological union time between Group 1 and Group 2. The mean radiological union time in Group 1 is 4.7±0.8 months, whereas it is slightly prolonged in Group 2 at 5.1±0.91 months. Despite this difference, it is not statistically significant (P=0.14). Similarly, Rahman M A K et al[17] observed that union was achieved in 26 patients, with an equal number (13 patients, 86.7%) in both the long and short PFN groups. The average union time was nearly identical, at 15.69 ± 2.72 weeks (range: 11–20 weeks) for the short PFN group and 15.77 ± 2.05 weeks (range: 12–19 weeks) for the long PFN group, with no statistically significant difference (P = 0.9332).

This study highlights the comparison of the Harris Hip Score (HHS) at the 6-month follow-up between Group 1 and Group 2. The mean HHS in Group 1 is 87.5±8.1, while in Group 2, it is marginally lower at 83.3±8.42. Despite the slight difference, it is not statistically significant (P=0.11). Similarly, Rahman M A K et al[17] reported comparable HHS outcomes, with a mean score of 81 ±11.62 in the short PFN group (range: 46 to 91) and 80.3 ± 10.83 in the long PFN group (range: 51 to 93), reflecting no statistically significant difference (P = 0.8657). Our study provides a comparison of complications observed between Group 1 and Group 2. In Group 1, 90% of patients experienced no complications, while 5% had screw cutoff, and another 5% reported thigh pain. Similarly, in Group 2, 80% of patients had an uncomplicated recovery, though 10% faced screw cutoff, 5% developed an infection, and 5% suffered from varus deformity. Despite these differences, the variation in complication rates between the groups is not statistically significant (P=0.98). Murthy BS et al[16] similarly noted that intraoperative complications were relatively rare, occurring in just 8% of patients treated with LONG INTERTAN, while no complications were observed among those treated with SHORT INTERTAN.

## CONCLUSION

This comparative study between long proximal femur nails (Group 1) and short proximal femur nails (Group 2) in the management of intertrochanteric fractures in adults and the elderly reveals that both treatment modalities are broadly similar in terms of demographic distribution, fracture classification, injury mechanism, and clinical outcomes at six months. However, the long proximal femur nail offers distinct intraoperative advantages, including reduced operative time, fewer fluoroscopic exposures, and less intraoperative blood loss. Although radiological union time, functional recovery, and complication rates slightly favour the long nail group, these differences are not statistically significant. Overall, both techniques are effective, but the long proximal femur nail may provide improved intraoperative efficiency without compromising long-term outcomes.

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