



## FUNCTIONAL AND RADIOLOGICAL OUTCOMES OF PROXIMAL FEMORAL NAILING VERSUS DYNAMIC HIP SCREW IN INTERTROCHANTERIC FEMUR FRACTURES

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### ABSTRACT

**Background:** Intertrochanteric femur fractures are common orthopedic injuries associated with significant morbidity, particularly among elderly individuals. Early mobilization and stable fixation are essential for reducing complications and restoring functional independence. Proximal Femoral Nailing (PFN) and Dynamic Hip Screw (DHS) are commonly used fixation methods for these fractures.

**Aim:** To compare the functional and radiological outcomes of PFN and DHS fixation in intertrochanteric femur fractures.

**Materials and Methods:** This prospective observational study was conducted at Dindigul Medical College from 2025 to 2026 over a period of one year. A total of 120 patients aged between 50 and 60 years with intertrochanteric femur fractures were included. Patients were divided into two groups: PFN group (n=60) and DHS group (n=60). Functional outcome was assessed using the Harris Hip Score (HHS), while radiological outcome was evaluated based on fracture union and postoperative complications.

**Results:** The PFN group demonstrated significantly shorter operative duration ( $68 \pm 12$  min vs  $92 \pm 15$  min), lower intraoperative blood loss ( $120 \pm 35$  mL vs  $240 \pm 50$  mL), and shorter hospital stay compared to the DHS group. Mean fracture union time was earlier in the PFN group ( $14.2 \pm 2.1$  weeks) than in the DHS group ( $16.8 \pm 2.6$  weeks). Excellent-to-good functional outcomes were more frequently observed in patients treated with PFN. Delayed union and implant-related complications were comparatively higher in the DHS group.

**Conclusion:** PFN provides superior functional recovery, earlier radiological union, reduced operative morbidity, and fewer postoperative complications compared to DHS fixation in intertrochanteric femur fractures.

**Keywords:** Intertrochanteric Fracture, Proximal Femoral Nail, Dynamic Hip Screw, Harris Hip Score, Functional Outcome.

### INTRODUCTION

Intertrochanteric fractures of the femur represent one of the most frequently encountered injuries in orthopedic trauma practice, particularly among the elderly population. These fractures occur in the region extending from the extracapsular area between the greater and lesser trochanters and are commonly associated with osteoporosis, trivial falls, and reduced bone mineral density (1).

The increasing life expectancy and growing geriatric population have contributed to a rising incidence of proximal femoral fractures worldwide, thereby imposing a substantial socioeconomic burden on healthcare systems due to prolonged hospitalization, rehabilitation, and loss of functional independence (2).

The primary objective in the management of intertrochanteric fractures is to achieve stable fixation that allows early mobilization, restoration of pre-injury functional status, and prevention of complications associated with prolonged immobilization such as deep vein thrombosis, pulmonary complications, pressure sores, and muscle wasting (3). Conservative management, once commonly practiced, has largely been abandoned because of the high rates of morbidity and mortality observed in bedridden elderly patients. Consequently, surgical fixation has become the gold



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standard treatment for most intertrochanteric femur fractures (4).

Among the various fixation methods available, Dynamic Hip Screw (DHS) has long been regarded as the standard implant for stable intertrochanteric fractures due to its biomechanical reliability and satisfactory clinical outcomes. DHS functions as an extramedullary device that permits controlled collapse and compression at the fracture site, thereby facilitating union (5). However, several limitations of DHS have been documented, particularly in unstable fracture patterns, including excessive collapse, medialization of the shaft, implant failure, and prolonged rehabilitation due to extensive soft tissue dissection and greater blood loss during surgery (6).

Proximal Femoral Nailing (PFN), introduced as an intramedullary fixation device, has gained increasing popularity because of its biomechanical advantages and minimally invasive technique. The intramedullary location of the implant decreases the bending moment and provides better load-sharing characteristics, especially in unstable fractures. PFN also offers the advantages of smaller incisions, reduced intraoperative blood loss, shorter operative time, and earlier postoperative mobilization when compared with DHS (7). Despite these theoretical and practical advantages, controversy persists regarding the superiority of PFN over DHS in terms of functional recovery, radiological union, and postoperative complications.

Several studies have compared PFN and DHS fixation methods; however, variations in patient demographics, fracture configuration, surgical expertise, and follow-up protocols have resulted in inconsistent conclusions. Furthermore, data from regional tertiary care centers in South India remain relatively limited. Therefore, the present prospective observational study was undertaken at Dindigul Medical College to evaluate and compare the functional and radiological outcomes of Proximal Femoral Nailing and Dynamic Hip Screw fixation in patients with intertrochanteric femur fractures.

## MATERIALS AND METHODS

### Study Design and Setting

This prospective observational study was conducted in the Department of Orthopaedics, Dindigul Medical College, over a period of one year from 2025 to 2026. The study aimed to compare the functional and radiological outcomes of Proximal Femoral Nailing (PFN) and Dynamic Hip Screw (DHS) fixation in patients with intertrochanteric fractures of the femur. Ethical clearance was obtained from the Institutional Ethics Committee prior to initiation of the study, and written informed consent was obtained from all participants.

### Study Population

A total of 120 patients diagnosed with intertrochanteric femur fractures were included in the study. Patients aged between 50 and 60 years presenting with fresh closed intertrochanteric fractures were considered eligible for inclusion.

### Inclusion Criteria

- Patients aged between 50 and 60 years
- Fresh intertrochanteric femur fractures
- Patients medically fit for surgery
- Patients willing for regular follow-up

### Exclusion Criteria

- Pathological fractures
- Open fractures
- Polytrauma patients
- Previous ipsilateral hip surgeries
- Subtrochanteric extension fractures
- Patients unfit for anesthesia or surgery (8)

### Preoperative Evaluation

All patients underwent detailed clinical examination and routine laboratory investigations at the time of admission. Radiological assessment included anteroposterior radiographs of the pelvis with both hips and lateral radiographs of the affected hip. Fractures were classified according to the Boyd and Griffin classification system to determine fracture stability (9).

### Group Allocation

Patients were divided into two groups based on the implant used for fracture fixation:

- **Group A:** Proximal Femoral Nailing (PFN) – 60 patients
- **Group B:** Dynamic Hip Screw (DHS) – 60 patients

The choice of implant depended on fracture morphology, bone quality, and surgeon preference.

### Surgical Technique

All surgeries were performed under spinal or combined spinal-epidural anesthesia on a fracture table under image intensifier guidance.

### Proximal Femoral Nailing Group

In the PFN group, closed reduction was attempted under fluoroscopic guidance. A proximal entry point was made through the tip of the greater trochanter, and intramedullary fixation was achieved using a proximal femoral nail with proximal lag screws and distal locking screws. The minimally invasive nature of the procedure allowed limited soft tissue dissection and preservation of fracture hematoma.

### Dynamic Hip Screw Group

In the DHS group, open reduction and internal fixation were performed through a standard lateral approach to the proximal femur. A guidewire was inserted into the femoral head and neck under fluoroscopic control, followed by placement of a lag screw connected to a side plate assembly (10).

### Postoperative Protocol

Postoperative intravenous antibiotics and analgesics were administered according to institutional protocol. Early mobilization was encouraged in all patients. Static quadriceps exercises and ankle pump exercises were initiated on the first postoperative day. Partial weight-bearing ambulation with walker support was started depending on fracture stability and intraoperative fixation quality. Full weight-bearing was permitted after evidence of radiological union (11).

#### Follow-up and Outcome Assessment

Patients were followed up at 6 weeks, 3 months, and 6 months postoperatively. Clinical and radiological evaluations were performed during each visit.

#### Functional Outcome

Functional outcome was assessed using the Harris Hip Score (HHS), which evaluates pain, functional activity, deformity, and range of motion. The outcomes were graded as:

- Excellent: 90–100
- Good: 80–89
- Fair: 70–79
- Poor: <70 (12)

#### Radiological Outcome

Radiological union was assessed by serial radiographs demonstrating bridging trabeculae across the fracture site and obliteration of the fracture line. Delayed union, implant failure, varus collapse, and screw cut-out were also documented.

#### Statistical Analysis

Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 25.0. Quantitative variables were expressed as mean  $\pm$  standard deviation, whereas qualitative variables were expressed as percentages. Student's t-test and Chi-square test were used for comparison between the two groups. A p-value less than 0.05 was considered statistically significant.

## RESULTS

### Demographic Characteristics

A total of 120 patients with intertrochanteric femur fractures were included in the present study. Among them, 60 patients underwent fixation using Proximal Femoral Nailing (PFN), while the remaining 60 patients were treated with Dynamic Hip Screw (DHS). All patients completed the minimum follow-up period of six months and were available for final evaluation.

The demographic characteristics of both study groups were comparable. The mean age of patients in the PFN group was  $56.2 \pm 4.1$  years, whereas the DHS group had a mean age of  $55.8 \pm 3.9$  years. Most patients belonged to the 55–60 years age category. Male predominance was observed in both groups.

The age-wise distribution of patients is illustrated in **Figure 1** and summarized in **Table 1**.

### Fracture Pattern Distribution

Fractures were classified according to the Boyd and Griffin classification system. Type II fractures constituted the majority of fracture patterns observed in both groups. Stable fractures were more commonly treated with DHS fixation, while unstable fracture patterns were predominantly managed using PFN. The distribution of fracture types between the two groups is presented in **Table 2**.

### Operative Parameters

Comparison of intraoperative variables demonstrated significant differences between the two treatment modalities. The mean operative duration in the PFN group was  $68 \pm 12$  minutes, whereas the DHS group required a mean duration of  $92 \pm 15$  minutes. Intraoperative blood loss was also significantly lower in patients treated with PFN ( $120 \pm 35$  mL) compared to those treated with DHS ( $240 \pm 50$  mL). The comparative analysis of operative time and blood loss between the two groups is depicted in **Figure 2** and detailed in **Table 3**. The PFN group additionally demonstrated shorter incision length and reduced soft tissue dissection when compared with DHS fixation.

### Radiological Outcome

Radiological union was achieved in the majority of patients within the expected postoperative period. The mean fracture union time in the PFN group was  $14.2 \pm 2.1$  weeks, while the DHS group demonstrated a mean union time of  $16.8 \pm 2.6$  weeks. Earlier fracture union observed in the PFN group was statistically significant.

The comparison of mean fracture union time between the two treatment groups is illustrated in **Figure 3** and summarized in **Table 4**. Delayed union was observed in 3 patients (5%) in the PFN group and 8 patients (13.3%) in the DHS group. Varus collapse and implant-related complications were more frequently encountered among patients treated with DHS fixation.

### Functional Outcome

Functional outcome assessment was performed using the Harris Hip Score (HHS) at the final follow-up visit. Patients treated with PFN demonstrated superior functional recovery compared to those treated with DHS fixation. In the PFN group, excellent functional outcome was achieved in 28 patients (46.7%), good outcome in 18 patients (30%), fair outcome in 10 patients (16.7%), and poor outcome in 4 patients (6.6%). In contrast, the DHS group showed excellent outcome in 20 patients (33.3%), good outcome in 17 patients (28.3%), fair outcome in 15 patients (25%), and poor outcome in 8 patients (13.3%). The comparative distribution of Harris Hip Score outcomes between the two groups

is represented in **Figure 4** and detailed in **Table 5**. Patients managed with PFN achieved earlier mobilization, reduced postoperative pain, and improved range of hip movements compared to patients treated with DHS fixation.

#### **Postoperative Complications**

Postoperative complications were comparatively fewer in the PFN group. Delayed union, implant failure, and varus collapse were more commonly observed following DHS fixation. Superficial wound infection occurred in one patient in the PFN group and two patients in the DHS group. The comparison of postoperative complications between the two groups is illustrated in **Figure 5** and summarized in **Table 6**. No cases of deep infection, implant breakage, neurovascular injury, or mortality were encountered during the study period.

#### **DISCUSSION**

Intertrochanteric fractures of the femur continue to represent a major orthopedic challenge due to their increasing incidence, association with osteoporosis, and the need for early postoperative mobilization to minimize morbidity and mortality. The ideal fixation device should provide stable fracture fixation, permit early ambulation, minimize surgical trauma, and reduce implant-related complications. The present prospective observational study compared the functional and radiological outcomes of Proximal Femoral Nailing (PFN) and Dynamic Hip Screw (DHS) fixation in patients with intertrochanteric femur fractures.

In the present study, patients treated with PFN demonstrated superior operative and postoperative outcomes when compared to DHS fixation. The mean duration of surgery was significantly shorter in the PFN group, which may be attributed to the minimally invasive nature of the procedure and reduced soft tissue dissection. In contrast, DHS fixation requires a larger surgical exposure and more extensive periosteal stripping, thereby increasing operative time and intraoperative blood loss. Similar findings were reported by Saudan et al., who observed reduced operative duration and lower blood loss in patients managed with PFN compared to DHS fixation (13).

The present study also demonstrated significantly lower intraoperative blood loss in the PFN group. The intramedullary location of the implant and smaller incision size contribute to reduced tissue trauma and preservation of fracture hematoma. Reduced blood loss is particularly advantageous in elderly patients with limited physiological reserve and multiple comorbidities. Pajarinen et al. similarly reported that intramedullary fixation techniques were associated with less blood loss and facilitated earlier postoperative rehabilitation compared with extramedullary implants (14).

Radiological evaluation in the current study showed earlier fracture union in patients treated with PFN. The mean union time in the PFN group was 14.2 weeks compared to 16.8 weeks in the DHS group. The biomechanical advantages of PFN, including shorter lever arm and improved load-sharing capacity, may account for enhanced fracture stability and accelerated healing. Furthermore, intramedullary fixation reduces bending stresses across the implant and maintains alignment more effectively in unstable fracture patterns. These observations are consistent with the findings of Boldin et al., who demonstrated improved fracture stability and satisfactory union rates with PFN fixation (15).

Functional outcome assessment using the Harris Hip Score revealed superior postoperative recovery in the PFN group. A greater proportion of patients achieved excellent-to-good functional outcomes following PFN fixation compared to DHS fixation. Earlier mobilization, reduced postoperative pain, and improved restoration of hip biomechanics likely contributed to better functional recovery. Patients treated with PFN were also able to regain independent ambulation earlier than those treated with DHS. Similar functional advantages of PFN have been documented in comparative studies evaluating intramedullary and extramedullary fixation methods for intertrochanteric fractures (16). Postoperative complications were more frequently encountered in the DHS group in the present study. Delayed union, varus collapse, and implant failure were comparatively higher following DHS fixation, particularly in unstable fracture configurations. Extramedullary implants are subjected to greater bending forces due to their lateral placement, predisposing them to mechanical failure in osteoporotic bone. In contrast, PFN provides a more biomechanically favorable construct by placing the implant closer to the mechanical axis of the femur. Menezes et al. also reported lower complication rates and improved mechanical stability with PFN fixation in unstable intertrochanteric fractures (17). Despite the favorable outcomes observed with PFN, certain technical challenges were encountered during surgery, including increased fluoroscopic exposure and the need for precise implant positioning. The learning curve associated with intramedullary fixation techniques may influence operative efficiency and complication rates. However, with adequate surgical expertise and proper patient selection, PFN offers significant advantages over DHS fixation.

The present study has certain limitations. The follow-up duration was relatively short, and long-term functional outcomes could not be assessed. Additionally, the study was conducted at a single tertiary care center with a limited sample size.

Future multicentric studies with larger populations and longer follow-up periods would provide stronger evidence regarding the comparative efficacy of these fixation modalities.

Overall, the findings of the present study suggest that PFN provides better radiological and functional outcomes, reduced operative morbidity, earlier mobilization, and fewer postoperative complications when compared to DHS fixation in intertrochanteric femur fractures.

## CONCLUSION

The present prospective observational study demonstrated that Proximal Femoral Nailing (PFN) provides superior functional and radiological outcomes when compared with Dynamic Hip Screw (DHS) fixation in the management of intertrochanteric femur fractures. Patients treated with PFN showed reduced operative duration, lower intraoperative blood loss, earlier fracture union, shorter hospital stay, and improved postoperative mobilization. Functional assessment using the Harris Hip Score also revealed better recovery and higher rates of excellent-to-good outcomes in the PFN group.

The biomechanical advantages of intramedullary fixation, particularly in unstable fracture configurations, contribute to improved fracture stability and reduced implant-related complications. In contrast, DHS fixation was associated with comparatively higher rates of delayed union, varus collapse, and implant failure, especially in osteoporotic bone and unstable fracture patterns.

Although PFN requires greater surgical expertise and increased fluoroscopic guidance, its minimally invasive nature and favorable biomechanical characteristics make it a reliable and effective treatment modality for intertrochanteric femur fractures. Based on the findings of the present study, PFN may be considered the preferred implant for achieving early rehabilitation, stable fixation, and improved functional recovery in patients with intertrochanteric femur fractures.

Further multicentric studies with larger sample sizes and longer follow-up durations are recommended to validate these findings and assess long-term functional outcomes and implant survivorship.

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Table 1. Demographic Characteristics of Study Population

Variable	PFN Group (n=60)	DHS Group (n=60)	p-value
Mean Age (years)	56.2 ± 4.1	55.8 ± 3.9	>0.05
Male	34 (56.7%)	32 (53.3%)	>0.05
Female	26 (43.3%)	28 (46.7%)	>0.05

Table 2. Distribution of Fracture Types According to Boyd and Griffin Classification

Fracture Type	PFN Group (n=60)	DHS Group (n=60)
Type I	12 (20%)	18 (30%)
Type II	24 (40%)	22 (36.7%)
Type III	16 (26.7%)	12 (20%)
Type IV	8 (13.3%)	8 (13.3%)

Table 3. Comparison of Operative Parameters between PFN and DHS

Parameter	PFN Group	DHS Group	p-value
Mean Operative Time (minutes)	68 ± 12	92 ± 15	0.0003
Mean Blood Loss (mL)	120 ± 35	240 ± 50	0.0001
Mean Hospital Stay (days)	6.2 ± 1.5	8.4 ± 2.1	0.011
Mean Fluoroscopy Exposure Time (minutes)	2.8 ± 0.6	1.6 ± 0.4	0.018

Table 4. Radiological Outcome and Fracture Union

Radiological Parameter	PFN Group	DHS Group	p-value
Mean Union Time (weeks)	14.2 ± 2.1	16.8 ± 2.6	0.021
Delayed Union	3 (5%)	8 (13.3%)	0.042
Varus Collapse	1 (1.7%)	5 (8.3%)	0.061
Implant Failure	2 (3.3%)	6 (10%)	0.068

Table 5. Functional Outcome Based on Harris Hip Score

Functional Outcome	PFN Group (n=60)	DHS Group (n=60)
Excellent (90–100)	28 (46.7%)	20 (33.3%)
Good (80–89)	18 (30%)	17 (28.3%)
Fair (70–79)	10 (16.7%)	15 (25%)
Poor (<70)	4 (6.6%)	8 (13.3%)
Mean Harris Hip Score	86.4 ± 7.2	78.1 ± 8.5

Table 6. Postoperative Complications in PFN and DHS Groups

Complication	PFN Group	DHS Group
Superficial Wound Infection	1 (1.7%)	2 (3.3%)
Delayed Union	3 (5%)	8 (13.3%)
Implant Failure	2 (3.3%)	6 (10%)
Varus Collapse	1 (1.7%)	5 (8.3%)
Limb Shortening	2 (3.3%)	7 (11.7%)
Deep Infection	0	0
Mortality	0	0

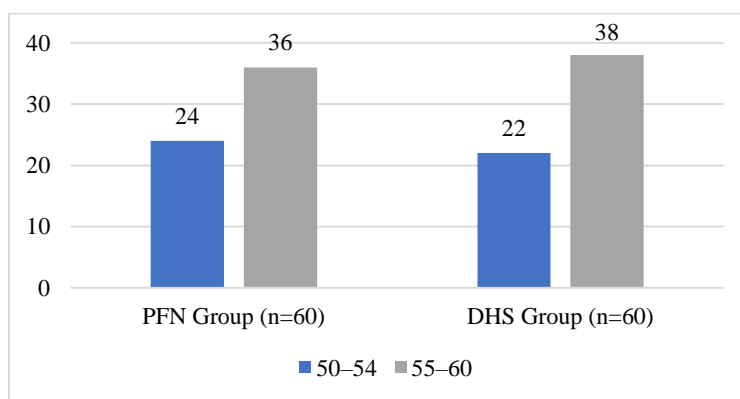


Figure 1. Age-wise Distribution of Patients in PFN and DHS Groups



Figure 2. Comparison of Mean Operative Time and Intraoperative Blood Loss between PFN and DHS Groups

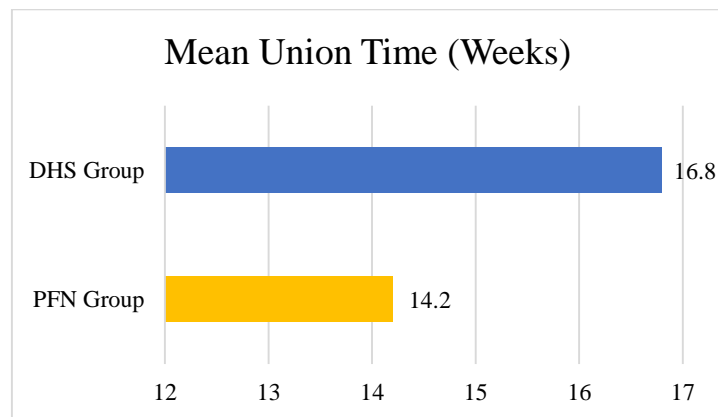


Figure 3. Comparison of Mean Radiological Fracture Union Time Between PFN and DHS Groups

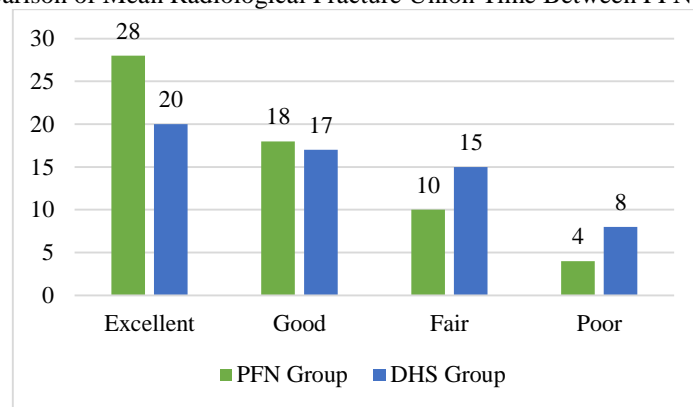


Figure 4. Functional Outcome Assessment Based on Harris Hip Score in PFN and DHS Groups

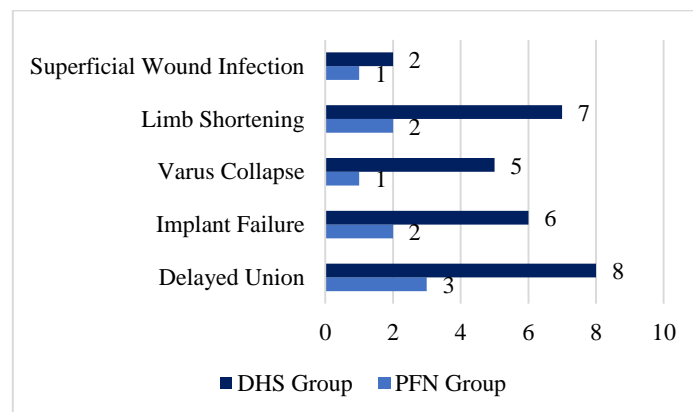


Figure 5. Comparison of Postoperative Complications between PFN and DHS Groups