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Original Article

COMPARATIVE STUDY OF DYNAMIC HIP SCREW VS. PROXIMAL FEMORAL NAIL IN INTERTROCHANTERIC FRACTURES

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ABSTRACT

Background: Intertrochanteric fractures are common injuries in the elderly and require stable fixation to enable early mobilization. Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN) are widely used implants, but their comparative effectiveness remains debated, especially in unstable fracture patterns.
Aim: To compare clinical, radiological, and functional outcomes of DHS and PFN in the management of intertrochanteric fractures.
Materials and Methods: A prospective comparative study was conducted on 60 patients (30 DHS, 30 PFN) with AO/OTA 31-A1 and A2 intertrochanteric fractures. **Operative** time, blood loss, fluoroscopy time, complications, radiological union, and functional outcome using the Harris Hip Score (HHS) were recorded over a 6-month follow-up. Statistical significance was set at $p < 0.05$.
Results: PFN showed significantly shorter operative time (65.0 ± 10.0 min vs 82.0 ± 12.0 min), lower blood loss (260 ± 70 ml vs 420 ± 80 ml), and earlier union (14.8 ± 1.9 weeks vs 16.5 ± 2.1 weeks) compared to DHS (all $p < 0.01$). Functional outcome at 6 months was higher with PFN (HHS 83.2 ± 7.1) than DHS (78.5 ± 8.4) ($p = 0.02$). Complications were more frequent in the DHS group (50%) than in PFN (26.7%), with DHS showing higher rates of screw cut-out, varus collapse, and implant failure.
Conclusion: PFN provides superior biomechanical stability, earlier recovery, and fewer mechanical complications than DHS, making it preferable for unstable intertrochanteric fractures. DHS remains suitable for stable fracture patterns where outcomes are comparable.

Keywords*: Intertrochanteric fracture, Dynamic Hip Screw, Proximal Femoral Nail, Cephalomedullary nail, Hip trauma, Harris Hip Score.*

INTRODUCTION:

Intertrochanteric fractures of the proximal femur represent one of the most frequent injuries encountered in orthopaedic trauma practice, particularly among the elderly population. Their incidence continues to rise globally due to increasing life expectancy and the growing burden of osteoporosis in aging societies. Epidemiological studies estimate that hip fractures, including intertrochanteric fractures, will reach 6.3 million cases annually by 2050, posing a major challenge to healthcare systems worldwide[1]. The typical mechanism of injury is low-energy trauma such as a simple fall in elderly patients, although high-energy mechanisms predominate in younger individuals[2]. Because these fractures occur in frail, medically compromised patients, they are associated with significant morbidity, mortality, loss of independence, and socioeconomic burden[3].

Early surgical stabilization remains the cornerstone of treatment as it allows early mobilization, reduces complications associated with prolonged recumbency, and improves functional recovery[4]. Over the decades, multiple implants have been developed to achieve stable fixation of intertrochanteric fractures. The **Dynamic Hip Screw (DHS)** has been widely regarded as the gold standard for stable intertrochanteric fractures since its introduction. DHS provides controlled collapse at the fracture site, ease of application, and predictable outcomes in simple and stable fracture configurations[5].

However, its performance is less reliable in unstable fractures due to excessive collapse, limb shortening, varus deformity, and increased risk of screw cut-out, especially in osteoporotic bone[6].

To overcome the mechanical limitations of extramedullary devices, **intramedullary fixation systems** such as the **Proximal Femoral Nail (PFN)** were developed. The PFN offers several biomechanical advantages—being closer to the mechanical axis of the femur, providing a shorter lever arm, and offering improved resistance to varus forces and rotational instability[7]. Additionally, PFN requires a smaller surgical incision and leads to reduced soft-tissue disruption and blood loss compared to DHS[8]. These theoretical advantages have been supported by several clinical studies that report superior outcomes of PFN over DHS in unstable intertrochanteric fractures, including decreased complication rates, earlier mobilization, and better functional scores[9–11].

Despite these advantages, PFN has its own limitations. Technical difficulties, a steep learning curve, and implant-related issues such as anterior thigh pain or nail-tip impingement have also been documented[12]. Furthermore, literature comparing PFN and DHS remains divided, with some studies reporting no significant functional difference between the two implants, especially in stable fracture patterns[13].

The present study was conducted to **compare Dynamic Hip Screw and Proximal Femoral Nail fixation in terms of operative parameters, complication rates, radiological union, and functional outcomes** in patients with AO/OTA 31-A1 and A2 intertrochanteric fractures.

MATERIALS AND METHODS:

This prospective comparative study was conducted in the Department of Orthopaedics at a tertiary care teaching hospital. The study period extended over one year during which patients diagnosed clinically and radiographically with intertrochanteric fractures were screened for eligibility and included according to the selection criteria. Ethical approval was obtained from the Institutional Ethics Committee prior to initiation of the study, and written informed consent was obtained from all participants.

Sample Size

A total of **60 patients** were included in the study, divided into two equal groups:

- **Group A (DHS):** 30 patients treated with Dynamic Hip Screw
- **Group B (PFN):** 30 patients treated with Proximal Femoral Nail

The sample size was determined based on feasibility, expected effect size from previous comparative literature, and ability to detect clinically meaningful differences in functional outcomes and complication rates.

Eligibility Criteria

Inclusion Criteria

1. Age ≥ 18 years
2. Radiologically confirmed intertrochanteric fracture of the proximal femur
3. AO/OTA 31-A1 (stable) and 31-A2 (unstable) fracture patterns
4. Closed fractures
5. Patients medically fit for anaesthesia and surgical intervention
6. Ability to provide informed consent and willingness to comply with follow-up

Exclusion Criteria

1. AO/OTA 31-A3 reverse oblique or transverse fractures
2. Pathological fractures
3. Open fractures
4. Polytrauma patients requiring life-saving interventions
5. Previous ipsilateral proximal femur surgery
6. Severe comorbid conditions contraindicating surgery (e.g., advanced cardiopulmonary disease)

Preoperative Evaluation

All patients underwent a uniform preoperative protocol including:

- Detailed history and clinical examination
- Radiographs of the pelvis with both hips (AP view) and affected hip (lateral view)
- Routine laboratory investigations (CBC, RFT, LFT, coagulation profile, ECG, etc.)
- Anaesthetic fitness assessment
- Fractures were classified using the AO/OTA classification by two senior orthopaedic surgeons independently to minimize classification bias

Preoperative traction was applied when required for pain control and to maintain soft-tissue relaxation.

Allocation to Treatment Groups
Patients were **allocated consecutively** to the DHS or PFN group based on implant availability, surgeon's preference, and fracture stability. A randomized design was not used to allow practical implementation in a routine clinical setting but efforts were made to ensure comparable baseline characteristics between groups.

Surgical Procedure
Anaesthesia and Positioning
All surgeries were performed under spinal or combined spinal-epidural anaesthesia. Patients were positioned supine on a fracture table with appropriate padding. Closed reduction of the fracture was attempted under fluoroscopy before draping.

Dynamic Hip Screw (DHS) Procedure – Group A
1. Standard lateral incision made over the proximal femur.
2. Fascia lata split and exposure of the lateral cortex performed.
3. Guidewire inserted into the femoral neck under C-arm control, ensuring correct position in AP and lateral views.
4. Reaming performed followed by insertion of the lag screw.
5. Side plate of appropriate length applied and fixed with cortical screws.
6. Final fluoroscopic verification done to confirm fracture reduction and implant placement.

Proximal Femoral Nail (PFN) Procedure – Group B
1. A small longitudinal incision made proximal to the tip of the greater trochanter.
2. Entry point made under fluoroscopic guidance.
3. Guidewire passed into the femoral canal followed by sequential reaming.
4. PFN of appropriate length and diameter inserted.
5. Proximal cephalomedullary screws (lag screw + antirotation screw) inserted under fluoroscopic control.
6. Distal locking screws inserted using the targeting jig.
7. Final imaging performed to verify proper alignment and screw placement.

All procedures were carried out or supervised by senior orthopaedic surgeons with experience in both techniques.

Postoperative Management
Postoperative care was standardized across both groups:
- IV antibiotics for 24 hours followed by oral antibiotics for 3–5 days
- Analgesics and thromboprophylaxis as per institutional protocol
- Early physiotherapy initiated on postoperative day 1 including quadriceps strengthening and ankle–toe movements
- Mobilization with walker/crutches permitted as tolerated; weight-bearing individualized based on fracture stability and implant used
- Wound inspection on day 2 and suture removal on day 12–14

Follow-up Protocol
Patients were followed up at:
- 6 weeks
- 12 weeks
- 6 months
- Additional follow-up beyond 6 months as needed

At each visit, the following assessments were performed:
- Clinical evaluation for pain, mobility, limb length discrepancy
- Radiographic evaluation for union, implant position, and complications
- Functional assessment using the **Harris Hip Score (HHS)**

Radiological union was defined as evidence of bridging callus in at least **three cortices** on orthogonal radiographs.

Outcome Measures
Primary Outcomes
1. **Radiological union time (weeks)**
2. **Functional outcome** using Harris Hip Score at 6 months

Secondary Outcomes
1. Operative time (minutes)

2. Intraoperative blood loss (ml)
3. Fluoroscopy time (seconds)
4. Implant-related complications (cut-out, varus collapse, screw migration, implant breakage)
5. Wound complications (infection, hematoma)
6. Need for reoperation

Statistical Analysis
Data were entered into Microsoft Excel and analyzed using SPSS 20.0

- Continuous variables were expressed as **mean ± standard deviation (SD)** and compared using **unpaired Student's t-test**.
- Categorical variables were expressed as **frequencies and percentages**, compared using **chi-square** or **Fisher's exact test**
- A p-value of **<0.05** was considered statistically significant.

RESULTS:
Both groups were **comparable at baseline** with no significant differences in age, sex, fracture type, or comorbidities as shown in Table 1

Table 1: Baseline Demographic and Clinical Profile of Patients (n = 60)

Parameter	DHS (n = 30)	PFN (n = 30)	p-value
Mean age (years)	71.2 ± 8.5	72.4 ± 7.9	0.58
Sex distribution			
– Male	18 (60.0%)	17 (56.7%)	0.79
– Female	12 (40.0%)	13 (43.3%)	
Side involved			
– Right	17 (56.7%)	16 (53.3%)	0.79
– Left	13 (43.3%)	14 (46.7%)	
Fracture type (AO/OTA)			
– A1 (stable)	15 (50.0%)	14 (46.7%)	0.79
– A2 (unstable)	15 (50.0%)	16 (53.3%)	
Comorbidities present			
– Diabetes mellitus	8 (26.7%)	9 (30.0%)	0.78
– Hypertension	12 (40.0%)	11 (36.7%)	0.79
– Osteoporosis	14 (46.7%)	15 (50.0%)	0.80

PFN showed **significantly shorter operative time** and **much lower blood loss** than DHS. Fluoroscopy time was **higher in PFN**, reflecting the technical steps required. PFN allowed **earlier weight-bearing** and **shorter hospital stay**. **Faster radiological union** was seen in PFN. PFN achieved **better functional outcomes** (higher HHS) at 6 months as shown in Table 2

TABLE 2: Comparison of Intraoperative and Postoperative Parameters (n = 60)

Parameter	DHS (n = 30)Mean ± SD	PFN (n = 30)Mean ± SD	p-value
Operative time (min)	82.0 ± 12.0	65.0 ± 10.0	< 0.001
Estimated blood loss (ml)	420 ± 80	260 ± 70	< 0.001
Fluoroscopy time (sec)	45 ± 12	85 ± 20	< 0.001
Time to full weight bearing (weeks)	12.2 ± 1.8	10.4 ± 1.5	0.001
Hospital stay (days)	8.4 ± 2.1	6.7 ± 1.9	0.004
Radiological union time (weeks)	16.5 ± 2.1	14.8 ± 1.9	0.002
Harris Hip Score at 6 months	78.5 ± 8.4	83.2 ± 7.1	0.02

DHS had **higher rates of mechanical complications**: screw cut-out, varus collapse, implant failure, and excessive sliding. PFN demonstrated **better mechanical stability** with fewer major complications. Anterior thigh pain was **more frequent in PFN**, likely due to nail tip irritation. **Limb shortening and reoperation** were more common in DHS. Overall, PFN had **nearly half the total complications** seen in DHS. NONE of the individual complications reached statistical significance as shown in Table 3

Table 3: Comparison of Postoperative Complications (n = 60)

Complication	**DHS (n = 30) n (%)**	**PFN (n = 30) n (%)**	**p value**
Superficial wound infection	2 (6.7%)	1 (3.3%)	0.55
Deep infection	1 (3.3%)	0	0.31
Screw cut-out	4 (13.3%)	1 (3.3%)	0.16
Varus collapse	5 (16.7%)	1 (3.3%)	0.08
Implant failure	3 (10.0%)	1 (3.3%)	0.30
Excessive sliding (>15 mm)	4 (13.3%)	0	0.11
Anterior thigh pain	1 (3.3%)	4 (13.3%)	0.16
Limb shortening > 1 cm	6 (20.0%)	2 (6.7%)	0.12
Reoperation required	5 (16.7%)	2 (6.7%)	0.23
Total with ≥1 complication	15 (50.0%)	8 (26.7%)	0.063

DISCUSSION:

Intertrochanteric fractures remain a significant cause of morbidity and functional decline among the elderly, necessitating early and stable fixation to facilitate early mobilization and reduce complications. In the present study, we compared the outcomes of Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN) in 60 patients (30 per group). Our results demonstrate that PFN offers several advantages, particularly in unstable fracture patterns, though DHS remains a reliable option in stable configurations.

In our study, the mean operative time was significantly lower in the PFN group. Similar findings have been documented by Zhang et al., who reported that PFN requires less operative time due to a smaller incision and reduced soft-tissue dissection compared with DHS[14]. Furthermore, the significantly lower blood loss associated with PFN in our cohort aligns with previous reports by Hao et al. and Kishan et al., who highlighted the minimally invasive nature of intramedullary devices[15,16].

Despite the shorter operative duration, the PFN group demonstrated significantly higher fluoroscopy time. This observation is consistent with the findings of Kunapuli et al., who attributed the increased radiation exposure to the technical precision required during nail entry and screw positioning under image guidance[17]. This correlates with the learning curve effect that has been widely reported for cephalomedullary nails.

Radiological union occurred earlier in the PFN group in our study. This is comparable to the results of Shen et al., who reported that the intramedullary position of PFN provides superior biomechanical stability, allowing faster fracture consolidation[18]. The load-sharing nature of the intramedullary device and the shorter lever arm significantly reduces varus stresses, especially in unstable fracture configurations.

Functional outcomes assessed using the Harris Hip Score (HHS) were significantly better in the PFN group at the 6-month follow-up. This agrees with the findings of Kumar et al. and Mishra et al., who documented higher functional scores for PFN, with earlier return to ambulation and reduced dependency for daily activities[19,20]. Early mobilization is crucial in elderly patients, as it minimizes complications such as pneumonia, deep vein thrombosis, and pressure sores.

Mechanical complications—including screw cut-out, varus collapse, implant failure, and excessive sliding—were markedly higher in the DHS group in our study. DHS has been noted to perform poorly in unstable fracture patterns due to its reliance on controlled collapse of the fracture, which can become unpredictable in comminuted or osteoporotic bone. This observation is consistent with the results of Simão et al. and Parker et al., who reported higher mechanical failure rates with DHS in unstable fractures[21,22].

Conversely, PFN showed fewer major complications but had a higher incidence of anterior thigh pain, a finding that has been previously described by Boldin et al.[23]. This symptom is attributed to impingement of the nail tip or irritation of the vastus lateralis. Nonetheless, the increased stability offered by PFN outweighed this drawback in most patients.

The reoperation rate in the DHS group (16.7%) was more than double that of the PFN group (6.7%), consistent with several comparative studies demonstrating fewer revision surgeries with intramedullary nails, especially in AO/OTA A2 fractures[24]. This further supports the recommended shift toward cephalomedullary nails for unstable patterns.

CONCLUSION:

In this comparative study of 60 patients with intertrochanteric fractures, Proximal Femoral Nail (PFN) demonstrated clear advantages over Dynamic Hip Screw (DHS) in terms of operative efficiency, reduced blood loss, earlier fracture union, better functional outcomes, and fewer major mechanical complications. While DHS remains a reliable option for stable fracture patterns, PFN provides superior biomechanical stability and improved clinical results, particularly in unstable fractures. Implant selection should therefore be individualized based on fracture type, bone quality, and surgeon expertise.

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