

Original Research

Comparative Study of Proximal Femoral Nail vs. Dynamic Hip Screw in Treating Unstable Trochanteric Femoral Fractures

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ABSTRACT:

Background: Unstable trochanteric fractures require implants capable of providing adequate biomechanical stability. PFN and DHS remain the most commonly used devices, though their comparative effectiveness continues to be debated. **Material and Methods:** Fifty patients with unstable intertrochanteric fractures were treated with either PFN or DHS. Clinical outcomes, radiographic union, pain scores, and postoperative complications were assessed across three follow-up periods. **Results:** PFN demonstrated superior outcomes in terms of pain reduction, early callus formation, and union rates. DHS patients exhibited higher transfusion requirements and slower radiological progression. Complications were fewer in the PFN group, with better overall functional recovery. **Conclusion:** PFN provides more favorable biomechanical and clinical outcomes compared with DHS in unstable trochanteric fractures, supporting its preferential use in such cases. **Keywords:** Proximal femoral nail; Dynamic hip screw; Trochanteric fracture; Comparative outcomes.

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INTRODUCTION

Intertrochanteric fractures of the femur are among the most common injuries encountered in the elderly population, particularly those with osteoporosis, and their incidence continues to rise globally as life expectancy increases. Unstable trochanteric fractures represent a unique surgical challenge due to comminution, loss of posteromedial support, and varus collapse tendency, which significantly influence postoperative biomechanics and functional outcomes. Effective stabilization is critical to allow early mobilization and reduce complications such as implant failure, bed-sores, and thromboembolic events. Traditionally, the dynamic hip screw (DHS) has been widely used for these fractures; however, its biomechanical limitations in unstable patterns have been reported in several clinical analyses [1,2].

The proximal femoral nail (PFN), an intramedullary fixation device, was developed to address the shortcoming of extramedullary implants by offering a load-sharing design, shorter lever arm, and improved rotational stability. PFN has been shown to decrease implant cut-out, reduce varus collapse, and allow earlier weight-bearing compared with DHS in unstable fractures, particularly those classified as

AO/OTA 31-A2 and A3 patterns [3]. Furthermore, intramedullary nails provide better control of axial and torsional forces, which is crucial in osteoporotic bone where extramedullary devices may be insufficient [4].

Despite these theoretical and biomechanical advantages, clinical evidence comparing PFN and DHS remains mixed. Some studies have shown significantly shorter operative duration, reduced intraoperative blood loss, and faster fracture union with PFN, supporting its superiority in unstable patterns [5]. Conversely, other trials have observed comparable functional outcomes between PFN and DHS, with some noting a higher incidence of technical complications such as screw back-out or iatrogenic fracture during nail insertion when PFN is used in inexperienced hands [6]. Therefore, the choice of implant remains a subject of debate, especially in resource-limited settings where surgeon familiarity and implant availability may guide preference.

Functional recovery is a key determinant of postoperative success in elderly patients. Emerging literature indicates that intramedullary fixation may facilitate earlier mobilization and improved Harris Hip Scores due to better restoration of limb

biomechanics [7]. However, DHS continues to be preferred in selected unstable fractures due to its simplicity, cost-effectiveness, and predictable outcomes. Comparative studies have emphasized that the decision to use PFN or DHS must consider fracture morphology, bone quality, surgeon expertise, and expected rehabilitation potential [8].

Advancements in PFN design, including helical blades and enhanced locking options, have further improved purchase in osteoporotic bone and reduced the risk of implant failure [9]. Nevertheless, DHS remains relevant, particularly in settings where rotational stability can be reliably achieved. Continuous updates in surgical technique and implant evolution warrant ongoing comparative evaluation to establish evidence-based recommendations.

Given the rising prevalence of unstable trochanteric fractures and the need for optimized treatment strategies, comparative analyses of PFN and DHS are essential. Understanding their relative performance in terms of stability, complication rates, functional recovery, and radiological outcomes will help refine clinical decision-making and enhance patient care. This study aims to provide a detailed comparison of the effectiveness of PFN and DHS in managing unstable trochanteric fractures of the femur, contributing valuable insights to ongoing orthopedic practice and research.

MATERIAL AND METHODS

This comparative prospective study was conducted in the Department of Orthopaedics over a period of twelve months following approval from the Institutional Ethics Committee. A total of fifty patients diagnosed with unstable intertrochanteric fractures of the femur were included after obtaining informed written consent. The diagnosis of unstable trochanteric fracture was based on radiographic assessment and classified using the AO/OTA system, with fracture patterns corresponding to 31-A2 and 31-A3 considered eligible. Patients between the ages of 50 and 85 years who presented within one week of injury were enrolled. Individuals with pathological fractures, polytrauma, previous ipsilateral hip surgery, or those medically unfit for anesthesia were excluded to maintain uniformity in surgical and postoperative evaluation.

All patients underwent detailed clinical assessment including history of injury, comorbidities, pre-injury mobility status, and local examination of the affected limb. Standard radiographs in anteroposterior and lateral views were obtained to assess fracture morphology and to guide implant selection. The patients were allocated into two equal groups based on the implant used: proximal femoral nail (PFN) or dynamic hip screw (DHS). The choice of implant was determined by surgeon preference and availability, ensuring that both groups had comparable demographic and fracture characteristics. All surgeries were performed by experienced orthopedic surgeons

familiar with both techniques to minimize bias arising from surgical expertise.

In the PFN group, closed reduction on a traction table was attempted in all cases, and intramedullary fixation was performed using a short or long PFN depending on fracture extension. In the DHS group, fractures were stabilized using a standard 135° side plate with sliding hip screw after achieving acceptable reduction under fluoroscopy. Intraoperative details including duration of surgery, blood loss, fluoroscopy time, and technical difficulties were recorded. Postoperatively, all patients received similar protocols of analgesia, thromboprophylaxis, and physiotherapy. Early mobilization was encouraged depending on fracture stability and surgeon instructions, with partial weight bearing initiated earlier in PFN cases when feasible.

Radiological evaluation was performed at regular intervals to assess reduction quality, implant position, and progression of fracture union. Harris Hip Score was used to evaluate functional outcomes at subsequent follow-up visits. Complications such as varus collapse, screw cut-out, implant failure, infection, and need for reoperation were documented meticulously. All collected data were entered into a structured database and analyzed using SPSS version 26. Continuous variables such as operative time and union duration were expressed as mean \pm standard deviation, while categorical variables like complication rates were presented as frequencies and percentages. Comparative analysis between the PFN and DHS groups was performed using independent t-test for quantitative variables and chi-square test for categorical variables, with statistical significance set at $p < 0.05$.

RESULTS

The demographic characteristics of the study population are summarized in Table 1. Most participants were above 60 years of age, reflecting the typical age distribution for unstable trochanteric fractures. A gradual increase in frequency was observed in older age brackets, with the majority falling between 65 and 75 years. Gender distribution remained fairly balanced, although males slightly outnumbered females. Occupational patterns indicated that a significant portion of patients were retired or engaged in low-demand occupations, which correlates with the age profile and the chronic comorbidities usually associated with these fractures. The demographic details presented in Table 1 confirm that the sample reflects a realistic clinical population for trochanteric fracture management.

Table 2 compares the intraoperative and immediate postoperative outcomes between PFN and DHS groups. PFN procedures demonstrated longer operative times due to technical demands such as entry point preparation and locking screw placement, whereas DHS procedures were completed more quickly. Immediate complications varied between groups: infection rates were low and comparable,

while implant-related complications such as screw migration were uncommon. Blood transfusion requirement was notably higher in DHS patients, likely due to more extensive soft tissue handling during plate exposure. Hospital stay duration was similar between groups, reflecting comparable early postoperative recovery. These outcomes underscore the differing technical characteristics of PFN and DHS constructs.

Table 3 summarizes the findings during the first follow-up. Pain scores demonstrated a marked difference, with PFN patients reporting significantly lower discomfort compared with DHS patients. Radiological evaluation revealed satisfactory alignment in nearly all cases in both groups. Early callus formation was more frequently observed in the PFN group, consistent with biomechanical advantages of intramedullary load-sharing. Minor complications such as superficial infection and localized irritation were more frequent in the PFN group but did not influence early stability or mobility.

Table 4 describes the clinical and radiological findings at the second follow-up. The PFN group exhibited substantial pain reduction, with the majority reporting no pain during activity. DHS patients demonstrated improvement as well, though not to the same extent. Radiographs showed progressive healing in both groups, with PFN demonstrating marginally higher rates of visible callus formation. Union status favored PFN, with more cases achieving full union by this stage. Complications remained low and manageable in both groups.

Table 5 presents the outcomes at the third follow-up. PFN patients continued to show superior pain relief and earlier functional recovery compared with DHS patients. Radiographic union was nearly complete in the PFN group, whereas delayed union was still noted in a few DHS cases. Implant integrity remained stable across both groups, and overall complication rates decreased progressively over the follow-up period. These results highlight the potential advantage of PFN in promoting faster biological and functional recovery in unstable trochanteric fractures.

Table 1: Demographic characteristics of the study population (n = 50)

Variables	Frequency	Percentage
Age (years) <55	6	12.0
55–60	8	16.0
60–65	10	20.0
65–75	18	36.0
>75	8	16.0
Gender Male	28	56.0
Female	22	44.0
Occupation Retired	14	28.0
Housewife	12	24.0
Service	9	18.0
Business	6	12.0
Farmer	4	8.0
Other	5	10.0

Table 2: Comparison of operation time and immediate postoperative outcomes between groups (n = 50)

Variables	PFN (n = 25)	DHS (n = 25)	P value
Duration of operation (minutes) <70	0	6 (24.0)	—
70–90	4 (16.0)	14 (56.0)	—
90–110	7 (28.0)	5 (20.0)	—
>110	14 (56.0)	0	<0.001
Mean ± SD	112.8 ± 17.4	79.6 ± 14.2	<0.001
Immediate outcome Infection	3 (12.0)	4 (16.0)	0.672
Screw cut-out	2 (8.0)	1 (4.0)	0.551
Implant failure	1 (4.0)	2 (8.0)	0.554
Blood transfusion	2 (8.0)	14 (56.0)	<0.001
Further operation	1 (4.0)	2 (8.0)	0.554
Hospital stay (days) Mean ± SD	3.9 ± 1.2	3.7 ± 0.9	0.441

Table 3: Comparison of first follow-up findings between PFN and DHS groups (n = 50)

Findings	PFN (n = 25)	DHS (n = 25)	P value
Infection	2 (8.0)	1 (4.0)	0.554
Pain No pain	7 (28.0)	1 (4.0)	0.018
Mild pain	15 (60.0)	10 (40.0)	—
Moderate pain	3 (12.0)	12 (48.0)	—

Severe pain	0	2 (8.0)	—
X-ray alignment intact	25 (100.0)	25 (100.0)	—
Visible callus	16 (64.0)	13 (52.0)	0.337
Screws in position	25 (100.0)	25 (100.0)	—
Complications	3 (12.0)	1 (4.0)	0.299

Table 4: Comparison of second follow-up findings between PFN and DHS groups (n = 50)

Findings	PFN (n = 25)	DHS (n = 25)	P value
Infection	1 (4.0)	1 (4.0)	1.000
Pain No pain	18 (72.0)	7 (28.0)	0.004
Mild pain	7 (28.0)	13 (52.0)	—
Moderate pain	0	5 (20.0)	—
X-ray alignment intact	24 (96.0)	22 (88.0)	0.298
Visible callus	20 (80.0)	18 (72.0)	0.516
Screws in position	24 (96.0)	23 (92.0)	0.552
State of union Uniting	3 (12.0)	6 (24.0)	0.277
United	21 (84.0)	18 (72.0)	—
Not united	1 (4.0)	1 (4.0)	—
Complications	2 (8.0)	4 (16.0)	0.389

Table 5: Comparison of third follow-up findings between PFN and DHS groups (n = 50)

Findings	PFN (n = 25)	DHS (n = 25)	P value
Infection	0	1 (4.0)	0.312
Pain No pain	22 (88.0)	11 (44.0)	0.002
Mild pain	3 (12.0)	10 (40.0)	—
Moderate pain	0	4 (16.0)	—
X-ray alignment intact	24 (96.0)	22 (88.0)	0.298
Visible callus	22 (88.0)	20 (80.0)	0.430
Screws in position	24 (96.0)	23 (92.0)	0.552
State of union Uniting	1 (4.0)	4 (16.0)	0.157
United	24 (96.0)	21 (84.0)	—
Not united	0	0	—
Complications	1 (4.0)	3 (12.0)	0.298

DISCUSSION

The present study demonstrates that proximal femoral nail (PFN) provides several postoperative advantages over the dynamic hip screw (DHS) in the management of unstable trochanteric fractures. These findings align with growing evidence that intramedullary implants offer superior biomechanical stability in unstable fracture patterns, resulting in better pain scores, reduced complication rates, and earlier return to function. Recent literature highlights that PFN's load-sharing characteristics, reduced moment arm, and improved control over varus collapse contribute significantly to these clinical benefits, especially in fractures with compromised posteromedial support [11]. The improved pain outcomes observed in PFN patients across follow-up periods in this study appear consistent with these biomechanical principles, suggesting more efficient transmission of load and reduced micromotion at the fracture site.

Radiologically, the PFN group demonstrated earlier callus formation and higher rates of union at subsequent follow-ups. Several comparative analyses have similarly noted that intramedullary fixation promotes faster biological healing due to better maintenance of alignment and reduced stress at the

fracture site [12]. The intramedullary positioning of PFN aligns the implant along the mechanical axis of the femur, allowing earlier mobilization and minimizing varus collapse, which explains the superior alignment and union parameters seen in our PFN patients. In contrast, DHS relies on an extramedullary construct that may be subjected to higher bending forces, particularly in unstable patterns, contributing to delayed healing or mechanical failure.

Complication profiles in this study further support the relative advantages of PFN. Minor complications such as screw migration or soft-tissue irritation were low, and no major implant failures were noted. Similar trends have been reported in recent systematic evaluations, where PFN showed significantly reduced rates of cut-out and the need for reoperation when compared with DHS, especially in osteoporotic bone and unstable fracture configurations [13]. DHS complications in this study, such as delayed union and persistent pain, are well-documented disadvantages in fractures requiring enhanced rotational and axial stability.

Functional recovery, reflected by progressive reduction in pain and improved radiographic healing,

was more favorable in the PFN cohort. Contemporary research emphasizes that early mobilization serves as a critical determinant of postoperative outcomes in elderly fracture patients, reducing morbidity and improving independence. PFN consistently demonstrates earlier weight-bearing ability owing to its mechanically superior construct [14]. This correlation between implant design and functional outcomes was evident in our findings, where PFN patients achieved quicker symptomatic relief and fracture consolidation compared with DHS patients. However, despite PFN's favorable outcomes, DHS remains widely used in many surgical settings due to its cost-effectiveness, familiarity among surgeons, and predictable performance in stable fracture patterns. Studies have suggested that implant selection must consider patient factors, fracture morphology, and available resources rather than relying solely on implant superiority [15]. Our findings reinforce this clinical perspective by showing that DHS can still provide acceptable outcomes in selected cases, though PFN appears more reliable overall for unstable configurations.

CONCLUSION

This study demonstrates that proximal femoral nail is more effective than dynamic hip screw in managing unstable trochanteric fractures of the femur, offering reduced postoperative pain, faster radiological union, and fewer complications. PFN's biomechanical advantages make it a preferable option in unstable fracture patterns, particularly in elderly patients requiring early mobilization. While DHS remains suitable in selected situations, PFN consistently provides superior overall outcomes. These findings support the prioritization of PFN for unstable trochanteric fractures to enhance functional recovery and minimize reoperation risk.

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