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Original Research Article

A Retrospective Comparative Study of Dynamic Hip Screws and Proximal Femoral Nails in Stable Intertrochanteric Femur Fractures

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Abstract:

Introduction: Intertrochanteric femur fractures represent a substantial healthcare challenge in the elderly population. While Dynamic Hip Screw (DHS) has traditionally been the standard treatment for stable fractures, Proximal Femoral Nail (PFN) is increasingly utilized. This study compares their clinical outcomes in stable intertrochanteric fractures.

Materials and Methods: A retrospective comparative analysis was conducted at SVP Hospital, Ahmedabad, reviewing records of 200 patients (100 DHS, 100 PFN) treated between January 2020 and December 2024. Patients aged ≥50 years with stable intertrochanteric fractures (AO/OTA 31-A1) were included. Operative parameters, radiological union, functional outcomes using Harris Hip Score, and complications were analyzed.

Results: Both groups showed comparable baseline characteristics and operative parameters. Mean operative time was similar (DHS: 71.6±10.2 min vs PFN: 69.8±9.6 min, p=0.24). However, DHS demonstrated significantly superior functional outcomes at 6 months (74.3±6.5 vs 70.2±7.1, p=0.002) and 1 year (86.8±5.4 vs 81.7±6.3, p<0.001). Complication rates were comparable (DHS: 7% vs PFN: 10%, p=0.43).

Conclusion: While both implants provide satisfactory outcomes in stable intertrochanteric fractures, DHS offers superior functional recovery despite similar intraoperative metrics. Implant selection should be individualized based on fracture morphology, patient factors, and surgical expertise.

Keywords: Dynamic Hip Screw, Functional Outcome, Harris Hip Score, Intertrochanteric Fractures, Proximal Femoral Nail, Stable Fractures.

Introduction

Intertrochanteric femur fractures form a major share of hip fractures, especially in elderly patients with osteoporosis. They occur between the greater and lesser trochanters and account for about 45–50% of all hip fractures. Their incidence is rising with increasing life expectancy, and by 2050, Asia is projected to contribute over 50% of global hip fractures. The primary aim in treating intertrochanteric fractures is to achieve stable fixation that enables early mobilization and reduces morbidity and mortality. Conservative treatment carries high risks, including pressure ulcers, infections, DVT, and increased mortality [1]. Thus, surgery is the preferred approach for medically fit patients. Intertrochanteric fractures are classified as stable or unstable based on the fracture pattern and posteromedial cortex integrity. Stable fractures (AO/OTA 31-A1) have an intact posteromedial buttress and minimal comminution, offering predictable outcomes with various fixation options. However, the optimal implant choice for these stable fractures remains debated in orthopedic literature [1,2].

The Dynamic Hip Screw (DHS), introduced in the 1960s, has long been considered the gold standard for stable intertrochanteric fractures. It is an extramedullary sliding compression device that allows controlled fracture-site compression, reducing complications such as screw cut-out seen with earlier fixed-angle implants. However, it requires extensive dissection, which may increase blood loss and operative time, posing challenges in elderly patients [1]. The Proximal Femoral Nail

(PFN), introduced by the AO/ASIF group in 1997, is an intramedullary device originally designed for unstable fractures. It provides biomechanical advantages such as a reduced moment arm, lower tensile strain, and load-sharing through the medullary canal. Its use has increasingly expanded to stable fractures as well, owing to smaller incisions, less soft-tissue dissection, and potentially shorter operative times [2].

Indian studies report mixed findings. Jonnes et al. (2016) observed better outcomes with PFN, including less blood loss, shorter operative time, and earlier mobilization [3]. Another Karnataka study also reported reduced blood loss and better early function with PFN (local study). In contrast, a 2024 retrospective analysis found both implants had similar complication rates, with functional outcomes influenced by fracture stability and patient age [4].

Despite available evidence, the optimal implant for stable intertrochanteric fractures remains debated. Although PFN offers some intraoperative advantages, concerns persist about its technical complexity, greater radiation exposure, and implant-related issues such as anterior thigh pain [2]. Whether its biomechanical benefits translate into better long-term outcomes in stable fractures is still uncertain. This retrospective comparative study was conducted to evaluate and compare the clinical, radiological, and functional outcomes of DHS and PFN in the management of stable intertrochanteric femur fractures.

Materials and Methods

Study Design and Setting: A retrospective comparative study was performed at SVP Hospital, Ahmedabad, a tertiary care teaching institution. The study reviewed systematic documentation (medical records, operative notes, imaging, and follow-up) for patients treated between January 1, 2020, and December 31, 2024. Institutional Ethics Committee approval (IEC/SVPIMSR/2024/135) was obtained prior to data collection.

Study Population: Through electronic medical record review, we identified 247 patients who underwent surgical fixation for intertrochanteric femur fractures during the study period. After applying inclusion and exclusion criteria, 200 patients were enrolled and divided into two equal groups based on the surgical fixation method employed:

- Group A (DHS Group): n = 100 patients treated with Dynamic Hip Screw
- Group B (PFN Group): n = 100 patients treated with Proximal Femoral Nail

Inclusion Criteria: Patients included were ≥50 years old with radiologically confirmed stable intertrochanteric femur fractures (AO/OTA type 31-A1) treated surgically with either DHS or PFN within 14 days of injury. A minimum 12-month follow-up with complete clinical and radiological documentation, as well as complete operative records, was mandatory.

Exclusion Criteria: Patients were excluded if they had unstable fractures (AO/OTA 31-A2, 31-A3, reverse oblique, or subtrochanteric extension), pathological fractures, prior ipsilateral hip surgery, polytrauma, or incomplete documentation/follow-up less than 12 months.

Surgical Technique: All surgical procedures were performed by experienced orthopedic surgeons (minimum 5 years post-residency experience) under spinal or epidural anesthesia. Patients were positioned supine on a standard orthopedic fracture table with appropriate padding and positioning aids.

Dynamic Hip Screw Technique: A lateral approach to the proximal femur was utilized with an average incision length of 12-15 cm. Following exposure of the lateral cortex and identification of the vastus ridge, a guide wire was inserted into the femoral head under fluoroscopic guidance, targeting the center-center position on both anteroposterior and lateral views. After reaming, a lag screw of appropriate length was inserted, followed by application of a 4-hole or 5-hole side plate fixed with cortical screws. Fracture compression was achieved through the sliding mechanism.

Proximal Femoral Nail Technique: A proximal lateral incision of approximately 5-7 cm was made, and the entry point was established at the tip of the greater trochanter or slightly medial to it. After guide wire insertion into the medullary canal, reaming was performed, if necessary, followed by nail insertion under fluoroscopic guidance. The cephalic screw was then inserted into the femoral head in the recommended position, followed by distal interlocking with one or two screws depending on nail design and fracture stability.

In both procedures, fracture reduction quality was assessed fluoroscopically in multiple planes before final implant placement. Wound closure was performed in layers after thorough irrigation.

Postoperative Protocol: Standardized postoperative care was provided to all patients including prophylactic antibiotics (first-generation cephalosporin) for 48 hours and low molecular weight heparin for deep vein thrombosis prophylaxis for 10-14 days or until adequate mobilization. Pain was managed with NSAIDs and opioid analgesics as needed. Patients were mobilized with a walker or crutches within 24–48 hours postoperatively, with weight-bearing status dictated by fracture stability. Early physical therapy focused on range of motion, muscle strengthening, and gait training.

Outcome Measures

Primary Outcomes:

1. **Functional Outcome:** Harris Hip Score (HHS) assessed at 6 and 12 months postoperatively. HHS (0–100) evaluates pain, function, range of motion, and deformity, with scores classified as excellent (90–100), good (80–89), fair (70–79), and poor (<70).
2. **Radiological Union:** Defined by bridging callus in at least three cortices on AP and lateral radiographs, disappearance of fracture line, and painless full weight-bearing. Time to union was recorded in weeks.

Secondary Outcomes:

1. **Operative Time:** Duration from skin incision to wound closure.
2. **Blood Loss:** Estimated from the difference between preoperative and 24-hour postoperative hemoglobin levels.
3. **Complications:** Included implant failure, infection, nonunion, malunion, limb-length discrepancy >1 cm, and mortality.

Data Collection: Data were systematically extracted from hospital medical records, operative notes, anesthesia charts, laboratory reports, and radiographic archives. Two independent reviewers collected data using a standardized pro forma, with discrepancies resolved through consensus or third-party adjudication.

Statistical Analysis: Statistical analysis was performed using trail version of SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables are presented as mean ± standard deviation and were compared using independent samples t-test after confirming normal distribution with the Shapiro-Wilk test. Categorical variables are presented as frequencies and percentages and were compared using chi-square test or Fisher's exact test as appropriate. A p-value <0.05 was considered statistically significant for all analyses.

Results

Demographic and Baseline Characteristics: A total of 200 patients were analyzed, with 100 in each group. Both groups were comparable in demographic and baseline parameters [Table 1]. The mean age did not differ significantly (DHS: 66.4 ± 9.2 years vs PFN: 65.7 ± 8.9 years; p=0.48), and gender distribution was similar, with males comprising 58–60% in both groups. Most fractures resulted from low-energy falls (84–86%), while road traffic accidents accounted for 14–16% of cases. Fracture patterns (AO/OTA 31-A1) were also comparable between groups (p=0.62): simple two-part fractures (A1.1) constituted 35–38%, wedge-type fractures (A1.2) 39–40%, and reverse oblique fractures (A1.3) 23–25% of the cohort.

Table 1: Baseline Demographic and Clinical Characteristics

Variable	DHS Group (n=100)	PFN Group (n=100)	p-value
Age (years)	66.4 ± 9.2	65.7 ± 8.9	0.48
Gender			0.75
- Male	58 (58%)	60 (60%)	
- Female	42 (42%)	40 (40%)	
Fracture Classification (AO/OTA 31-A1)			0.62
- A1.1 (Simple two-part)	35 (35%)	38 (38%)	
- A1.2 (Wedge)	40 (40%)	39 (39%)	
- A1.3 (Reverse oblique)	25 (25%)	23 (23%)	
Mode of Injury			0.68
- Low-energy fall	84 (84%)	86 (86%)	
- Road traffic accident	16 (16%)	14 (14%)	
Comorbidities			
- Hypertension	45 (45%)	47 (47%)	0.78
- Diabetes mellitus	32 (32%)	35 (35%)	0.65
- Cardiac disease	18 (18%)	15 (15%)	0.57

Intraoperative Parameters: Operative parameters were comparable between the two groups [Table 2]. Mean operative time showed no significant difference (DHS: 71.6 ± 10.2 min vs PFN: 69.8 ± 9.6 min; p=0.24), likely reflecting uniform surgical expertise. Blood loss, assessed by postoperative hemoglobin drop, was similar (1.5 ± 0.4 g/dL vs 1.5 ± 0.5 g/dL; p=0.88), and transfusion requirements were low in both groups (8% vs 6%; p=0.58). Fluoroscopy time, however, was significantly higher in the PFN group (48.6 ± 10.2 s vs 42.3 ± 8.7 s; p<0.001), attributable to the additional imaging required for closed reduction and interlocking screw placement.

Table 2: Intraoperative Parameters and Blood Loss

Parameter	DHS Group (n=100)	PFN Group (n=100)	p-value
Mean Operative Time (minutes)	71.6 ± 10.2	69.8 ± 9.6	0.24
Preoperative Hemoglobin (g/dL)	12.4 ± 1.3	12.5 ± 1.2	0.66
Postoperative Hemoglobin (g/dL)	10.9 ± 1.4	11.0 ± 1.3	0.52
Hemoglobin Drop (g/dL)	1.5 ± 0.4	1.5 ± 0.5	0.88
Blood Transfusion Required	8 (8%)	6 (6%)	0.58
Fluoroscopy Time (seconds)	42.3 ± 8.7	48.6 ± 10.2	<0.001

Radiological Union: Serial radiographs at 6 and 12 weeks, followed by monthly assessments, demonstrated similar union times in both groups (DHS: 14.1 ± 2.2 weeks vs PFN: 13.8 ± 2.5 weeks; p=0.37). Union rates at 6 months were comparable (96% vs 95%; p=0.74). Delayed union (>20 weeks) occurred in 3–4% of patients, and one case of nonunion in each group required revision surgery [Table 3].

Table 3: Radiological Union

Parameter	DHS Group (n=100)	PFN Group (n=100)	p-value
Time to Radiological Union (weeks)	14.1 ± 2.2	13.8 ± 2.5	0.37
Union Rate at 6 months	96%	95%	0.74
Delayed Union (>20 weeks)	3%	4%	0.7
Nonunion	1%	1%	1

Functional Outcomes: Functional recovery, assessed by the Harris Hip Score, was significantly better in the DHS group [Table 4]. At 6 months, the DHS group had a higher mean score (74.3 ± 6.5) than the PFN group (70.2 ± 7.1; p=0.002). This difference widened at 12 months (86.8 ± 5.4 vs 81.7 ± 6.3; p<0.001). At one-year, excellent outcomes (HHS ≥90) were achieved in 42% of DHS patients compared with 28% in the PFN group. Poor outcomes (<70) were uncommon in both groups but slightly more frequent with PFN (3% vs 2%).

Table 4: Functional Outcomes - Harris Hip Score

Time Point	DHS Group (n=100)	PFN Group (n=100)	p-value
6 Months Follow-up	74.3 ± 6.5	70.2 ± 7.1	0.002
Score Distribution:			
- Excellent (90-100)	8%	3%	
- Good (80-89)	38%	29%	
- Fair (70-79)	42%	48%	
- Poor (<70)	12%	20%	
12 Months Follow-up	86.8 ± 5.4	81.7 ± 6.3	<0.001
Score Distribution:			
- Excellent (90-100)	42%	28%	
- Good (80-89)	48%	54%	
- Fair (70-79)	8%	15%	
- Poor (<70)	2%	3%	

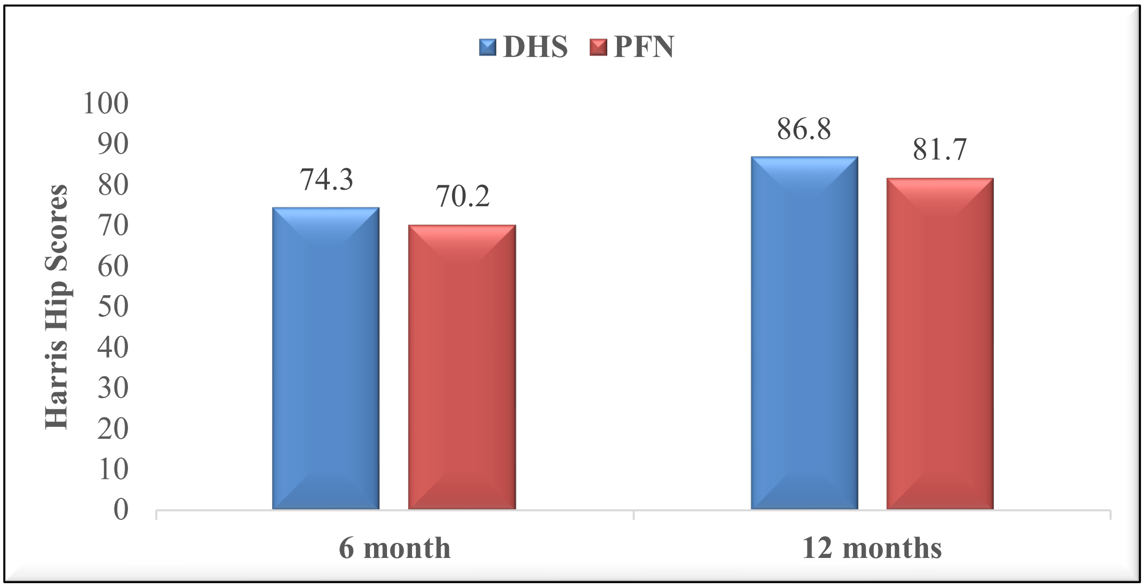

Figure 1: Comparison of Harris Hip Scores at 6 and 12 Months

Table 5: Postoperative Complications

Complication	DHS Group (n=100)	PFN Group (n=100)	p-value
Wound-related			
- Superficial infection	3 (3%)	2 (2%)	0.65
- Deep infection	1 (1%)	1 (1%)	1
Implant-related			
- Screw/Nail cut-out	1 (1%)	3 (3%)	0.31
- Screw back-out/migration	0 (0%)	2 (2%)	0.15
- Implant breakage	0 (0%)	0 (0%)	-
Fracture-related			
- Peri-implant fracture	0 (0%)	1 (1%)	0.32
- Nonunion	1 (1%)	1 (1%)	1
- Malunion (varus >10°)	0 (0%)	1 (1%)	0.32
Other			
- Limb length discrepancy >1cm	2 (2%)	3 (3%)	0.65
- Thigh pain (chronic)	1 (1%)	4 (4%)	0.18
Total Complications	7 (7%)	10 (10%)	0.43
Revision Surgery Required	2 (2%)	4 (4%)	0.41

Postoperative Complications: Overall complication rates were low and comparable between groups (DHS: 7% vs PFN: 10%; p=0.43) [Table 5]. Superficial wound infections were slightly more frequent with DHS (3% vs 2%), while deep infections occurred in one patient in each group and were successfully treated with debridement and antibiotics. Implant-related complications were more common in the PFN group. Screw cut-out occurred in 1% of DHS cases and 3% of PFN cases, and screw back-out (2%) was observed only with PFN. Chronic anterior thigh pain affected 4% of PFN patients versus 1% in the DHS group. One peri-implant fracture occurred in the PFN group, requiring revision surgery. Revision procedures were required in 2% of DHS patients and 4% of PFN patients, with no significant difference between groups.

Discussion

This retrospective study evaluated clinical, radiological, and functional outcomes in 200 patients with stable intertrochanteric fractures treated with either DHS or PFN, offering insights into the comparative effectiveness of these two commonly used fixation methods.

Operative Parameters: In our study, there is no any significant differences in operative time and blood loss between DHS and PFN groups, which contrasts with several earlier reports in the literature. Traditional teaching suggests that PFN offers advantages of shorter operative time and reduced blood loss due to its minimally invasive, closed technique. A meta-analysis by Yu et al. [5] (2018) reported markedly shorter operative time (weighted mean difference: -21.15 minutes) and lower blood loss (weighted mean difference: -139.81 mL) with

PFN compared to DHS, and Jonnes et al. [3] (2016) showed similar advantages (53 min vs 75 min; 80 mL vs 159 mL). Iman S et al. [4] (2023) further reported operative times of 53.24±8.67 minutes for PFN versus 69.62±12.82 minutes for DHS. However, our findings contradict these; operative time and blood loss were similar between groups. This suggests surgical expertise and standardized protocols may reduce differences. Our results suggest that the traditional operative advantages of PFN may lessen with greater surgical experience, indicating that implant choice should focus on fracture pattern, bone quality, and functional goals rather than presumed time savings. Our study did reveal PFN did show significantly longer fluoroscopy time (48.6±10.2 sec vs 42.3±8.7 sec, $p<0.001$), reflecting the need for multiple imaging steps. Although modest, this increased radiation exposure should be factored into decision-making, especially for younger patients and operating-room staff.

Functional Outcomes: DHS demonstrated superior functional outcomes at both 6 and 12 months, as reflected in significantly higher Harris Hip Scores. At 6 months, the DHS group scored 74.3±6.5 versus 70.2±7.1 in the PFN group (p=0.002) in the present study. By 12 months, this difference increased to 86.8±5.4 versus 81.7±6.3 ($p<0.001$). Although the early 4-point gap was modest, it influenced functional categorization, and by one year, 42% of DHS patients achieved excellent results (HHS ≥90) compared with 28% in the PFN group. This aligns with Sarma et al.[6] (2016), who reported better gait parameters and range of motion with DHS in stable fractures. A systematic review also suggested DHS may offer better functional outcomes in stable patterns [1]. The biomechanical basis for superior DHS outcomes in stable fractures is threefold. DHS enables controlled sliding compression, promoting primary bone healing when an intact posteromedial cortex provides a strong medial buttress. Its open reduction approach allows precise anatomical alignment and optimal fracture contact. Additionally, as an extramedullary implant, DHS preserves the medullary canal and endosteal blood supply, which may contribute to reduced long-term pain. In contrast, the biomechanical advantages of PFN—particularly its role as an internal buttress in unstable fractures with posteromedial comminution—are less impactful in stable patterns. The closed nailing technique may also limit reduction accuracy, and the mismatch between the nail and the femoral anterior bow can cause cortical irritation, contributing to persistent thigh pain, which occurred in 4% of PFN patients in our study.

Radiological Union: Our study found no significant difference in time to radiological union between groups (DHS: 14.1±2.2 weeks vs PFN: 13.8±2.5 weeks, p=0.37), with excellent union rates in both (95-96%). This is consistent with Das et al. [7] (2020), who found similar union rates between DHS and PFN, and with Zhang et al. [8] (2014) who reported no differences in complication or reoperation rates. The similar healing times observed likely reflect the intrinsic stability of 31-A1 fractures rather than implant choice. With an intact posteromedial cortex, both DHS and PFN provide sufficient stability for union, making quality of reduction and accurate implant placement the primary determinants of healing.

Complications: In the present study, although overall complication rates were comparable (7% vs 10%, p=0.43), the pattern differed between groups. DHS had slightly more superficial wound infections (3% vs 2%) due to its larger exposure, whereas PFN showed higher implant-related issues, including screw cut-out (3% vs 1%), screw migration (2% vs 0%), and chronic thigh pain (4% vs 1%). Our cut-out rates (DHS: 1%, PFN: 3%) were lower than those reported by Parker et al. [9] (2012), who noted rates of 1.7% for DHS and 3.5% for cephalomedullary nails. These low rates likely reflect stable fracture selection, meticulous technique, and structured postoperative rehabilitation. Chronic anterior thigh pain, a recognized PFN complication with reported incidence from 1.7% to 17.4%, may stem from iliopsoas irritation, trochanteric bursitis, or distal nail impingement as described by Hou et al. [10] (2013). In our study, 4% of PFN patients reported persistent pain at one year, with only one case affecting function. Iman et al. [5] (2024) similarly found more superficial infections with DHS (10% vs 3.3%) and more implant-related complications with PFN in stable fractures, though their overall complication rates (DHS: 23.3%, PFN: 16.7%) were higher than ours, likely due to differing patient characteristics and follow-up practices.

Indian Context and Healthcare System Considerations: India's rapidly aging population is driving a rising burden of geriatric hip fractures, with estimates suggesting the country may account for 25–30% of global cases by 2050. Recent Indian literature reflects mixed findings. Iman et al. [4] reported less blood loss and shorter operative times with PFN, though final functional outcomes were similar. Jonnes et al. [2] (2016) observed better mobility and earlier return to activity with PFN in Type II fractures, whereas Gupta et al. [11] (2017) reported higher satisfaction with DHS in stable patterns. These differences likely arise from variations in fracture stability, surgical expertise, and assessment methods. Our study—larger in sample size (200 patients), with uniform follow-up and a focus on stable fractures—adds clarity by showing DHS offers superior functional outcomes despite similar operative parameters. Cost is an important factor in India, where PFN implants are generally more expensive than DHS. In resource-constrained settings, the combination of lower cost, similar safety, and better functional recovery may make DHS the preferred option for stable fractures, though longer operative times in less experienced centers may influence overall decision-making.[1] Our findings support a tailored approach to implant selection in intertrochanteric fractures. For stable AO/OTA 31-A1 patterns, DHS should be the preferred option, particularly when the posteromedial cortex is intact, functional recovery is the primary goal, and cost is a significant consideration. PFN may still be appropriate in selected stable fractures—such as in patients with major comorbidities requiring minimal operative time, cases with questionable lateral wall integrity, or fractures extending toward the subtrochanteric region—especially when surgeon expertise favors intramedullary techniques. For unstable fractures (outside the scope of this study), PFN generally remains the implant of choice. Overall, the evidence supports DHS for stable fractures, but implant selection should remain individualized, reflecting patient factors, fracture morphology, and surgical experience rather than a uniform “one-size-fits-all” approach.

Comparison with International Literature: Our findings show partial agreement with international literature while highlighting ongoing debate. A Cochrane review (2022) [12] comparing cephalomedullary nails and extramedullary implants reported no significant differences in mortality or functional outcomes, though inclusion of both stable and unstable fractures may have obscured fracture-specific effects. In contrast, a Chinese meta-analysis by Xu et al. [13] (2023) favored PFN for shorter operative time, reduced blood loss, and fewer complications, though substantial heterogeneity was noted. Differences from our results may stem from variations in surgeon expertise, fracture classification accuracy, and outcome assessment methods. Overall, the literature underscores the need for high-quality randomized trials focused specifically on stable intertrochanteric fractures with long-term functional follow-up to clarify true implant-related differences.

Limitations: This retrospective, single-center study is subject to selection and information bias, and the choice of implant by treating surgeons introduces potential allocation bias. Hemoglobin drop was used as an indirect measure of blood loss and may have been affected by perioperative factors. The one-year follow-up may not capture late complications or long-term functional decline. Radiological assessments were performed by operating surgeons rather than independent reviewers, introducing the possibility of interpretation bias. Variations in surgical technique, although performed by experienced surgeons, could not be fully accounted for. Finally, as a single-center study from a tertiary care hospital, the findings may have limited generalizability to other populations and practice settings.

Conclusion

This retrospective comparative study of 200 patients with stable intertrochanteric femur fractures highlights key differences between Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN) fixation. Despite common assumptions, PFN did not demonstrate intraoperative advantages over DHS, as operative time and blood loss were comparable when performed by experienced surgeons. In contrast, DHS showed significantly better functional outcomes at both 6 and 12 months, with a higher proportion of patients achieving excellent Harris Hip Scores. Radiological union rates and overall complication profiles were similar between groups, indicating that DHS may offer functional benefits without compromising healing or safety. These findings suggest that for stable fracture patterns (AO/OTA 31-A1), DHS remains a reliable and effective first-line option. Implant selection should still consider fracture stability, patient factors, surgeon expertise, and resource availability. Although PFN retains an important role—particularly for unstable fractures—its routine use in stable patterns may not be warranted based on the functional outcomes observed in this study.

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