

Comparative Evaluation of Outcomes in Intertrochanteric Fractures Managed with Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN) Fixation

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Abstract:

Background: Intertrochanteric fractures of the femur are common in the elderly and are associated with significant morbidity and mortality. Optimal surgical fixation is crucial for early mobilization and functional recovery.

Aim: To compare clinical, functional, and radiological outcomes of intertrochanteric fractures managed with Dynamic Hip Screw (DHS) versus Proximal Femoral Nail (PFN) fixation.

Methodology: A prospective study was conducted on 50 patients with AO 31-A1 and 31-A2 intertrochanteric fractures, randomly allocated into DHS (n=25) and PFN (n=25) groups. Intraoperative parameters, postoperative mobilization, radiological union, functional recovery (Harris Hip Score), and complications were assessed over months

Results: PFN fixation had longer operative time (68.2 ± 11.6 min vs. 55.6 ± 9.4 min; $p < 0.001$) but significantly lower blood loss (94.7 ± 15.8 ml vs. 158.3 ± 22.1 ml; $p < 0.001$). PFN patients achieved earlier partial (3.8 ± 1.2 vs. 6.2 ± 1.4 days; $p < 0.001$) and full weight bearing (6.3 ± 1.4 vs. 8.1 ± 1.6 weeks; $p < 0.001$), faster radiological union (2.4 ± 0.7 vs. 4.3 ± 0.6 months; $p < 0.001$), and superior Harris Hip Scores at 12 months (88.1 ± 4.0 vs. 84.3 ± 4.6 ; $p < 0.001$). Mechanical complications occurred only in the DHS group, while infection rates were comparable.

Conclusion: PFN fixation provides superior functional outcomes, earlier mobilization, faster fracture union, and fewer mechanical complications compared to DHS, despite a slightly longer operative time, making it the preferred option for intertrochanteric fractures.

Keywords: Intertrochanteric Fracture, Dynamic Hip Screw, Proximal Femoral Nail, Functional Outcome, Radiological Union, Complications.

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Introduction

Hip fractures represent a major and increasing challenge to healthcare systems worldwide, mainly because these injuries are closely related to advanced age, osteoporosis, and increased life expectancy. These fractures are a major cause of morbidity, mortality, and long-term disability among elderly patients, leading to loss of independence and thus imposing a huge economic burden on families and healthcare providers like [1,2]. With the rapid aging of the population worldwide, the incidence of hip fractures is likely to increase dramatically. Annual incidences are estimated to increase to around 2.6 million by the year 2025 and further increase to almost 6.25 million by the year 2050 [3]. This trend is

alarming and represents a need to optimize treatment modalities to achieve better functional outcomes and minimize complications.

Among hip fractures, intertrochanteric fractures make up one of the most frequent patterns, especially within the geriatric group. These fractures occur in the region between the greater and lesser trochanters of the femur and constitute a substantial proportion of extracapsular proximal femoral fractures. The incidence of intertrochanteric fractures has risen steadily because of the increasing number of elderly individuals with a high prevalence of osteoporosis in this age group. These fractures are also reported to be three to four times more common in

women than in men; this is largely attributed to post-menopausal bone loss, leading to increased susceptibility to falls. The mechanism of injury in the majority is low-energy trauma, such as a simple fall from standing height, though high-energy trauma may be seen in younger patients [4].

Intertrochanteric femoral fractures result in considerable morbidity and mortality. Patients often endure prolonged periods of immobility, which may be accompanied by arduous rehabilitation and a marked reduction in functional capacity. These factors greatly influence quality of life, independence, and the capability to perform activities of daily living. Comorbidities such as cardiovascular disease, diabetes, and pulmonary disorders commonly observed in the elderly population [5,6], often further complicate functional deterioration following intertrochanteric fractures. Moreover, these fractures are well known for their high risk of mortality. In the literature, estimates of mortality rate after such injuries vary between 11% and over 30%, with deaths occurring either during hospitalization or in the first year following injury [7]. Minimizing complications and improving survival depends significantly on early surgical intervention and good fixation.

The management of intertrochanteric fractures dates back to ancient times. These fractures were recognized in the time of Hippocrates, although a major contribution was made by Sir Astley Cooper in 1822, who described femoral fractures into two categories, namely intracapsular and extracapsular [8]. With the advancement of medical science and technology over the years, the mode of treatment has gradually evolved from conservative, non-operative methods to advanced surgical fixation. Non-operative management is reserved for medically unfit patients and includes prolonged bed rest and traction. Non-operative treatment carries a high risk for various complications like pressure sores, pneumonia, urinary tract infection, deep vein thrombosis, malunion, and long-term dependency.

Operative management has become the standard of care for most intertrochanteric fractures, with anatomical reduction, stable fixation, early mobilization, and rapid return to pre-fracture functional status being the main objectives. Surgical intervention allows early weight bearing, reduces the duration of immobilization, and minimizes the risk of systemic complications associated with prolonged bed rest. Several surgical techniques and implants have been developed and refined over time for the fixation of intertrochanteric fractures. These include dynamic hip screw, dynamic condylar screw, proximal femoral nail, unipolar, and bipolar hemiarthroplasty, as well as external fixation. Among the above options, internal fixation using DHS or PFN remains the most commonly employed method for the majority of intertrochanteric fractures.

The dynamic hip screw has been one of the most popular extramedullary fixation devices used for decades and is considered a standard implant for stable intertrochanteric fractures. It allows for controlled collapse at the fracture site, which promotes fracture healing while maintaining alignment. However, DHS fixation may be associated with some limitations, particularly in unstable fracture patterns, including excessive collapse, limb shortening, and implant failure. The proximal femoral nail, on the other hand, is an intramedullary device that aims to provide a biomechanically superior construct with a shorter lever arm, better load-sharing properties, and improved stability, especially in unstable and osteoporotic fractures. PFN fixation has gained popularity due to its minimally invasive nature, reduced soft tissue dissection, and earlier rehabilitation.

In spite of all advances in implant design and surgical technique, there is still considerable controversy over the best fixation option for intertrochanteric fractures. The discussion has tended to center around intramedullary devices, such as PFN, versus extra-medullary implants, such as DHS. While some reports advocate PFN as providing superior outcomes in terms of lesser blood loss, shorter operative time, and better biomechanical stability, others report similar functional outcomes and complication rates when comparing PFN with DHS. Fracture pattern, bone quality, operating experience, cost, and availability of implants also influence the choice of fixation.

Comparatively assessing these commonly employed fixation methods is necessary in the light of an increasing incidence of intertrochanteric fractures and debate on the most effective surgical treatment method. Such a relative understanding of the advantages and limitations of DHS and PFN fixation would facilitate clinical decision-making and lead to improved outcomes. This study has compared the functional recovery, complication rates, and overall clinical effectiveness of DHS and PFN fixation in patients with intertrochanteric fractures.

Methodology

Study Design: This was a prospective comparative study conducted to evaluate and compare the clinical, functional, and radiological outcomes of intertrochanteric fractures of the femur managed with Dynamic Hip Screw (DHS) fixation and Proximal Femoral Nail (PFN) fixation.

Study Area: The study was carried out in the Department of Orthopedics, Anugrah Narayan Magadh Medical College and Hospital, Gaya Ji, Bihar, India from March 2025 to August 2025

Study Duration: The study was conducted over a period of six months, during which patient recruitment, surgical intervention, and initial follow-up were completed.

Sample Size: A total of 50 patients with intertrochanteric fractures of the femur were included in the study.

- **DHS group:** 25 patients
- **PFN group:** 25 patients

Patients were allocated into two equal groups using a random allocation method.

Study Population: The study population consisted of skeletally mature patients presenting with intertrochanteric fractures of the femur to the orthopedic emergency or outpatient department of the study institution during the study period.

Data Collection: All patients were evaluated clinically and radiologically at presentation. Fractures were classified according to the AO/OTA classification system, and only AO 31-A1 and AO 31-A2 fracture types were included.

Preoperative data collected included demographic details, mode of injury, fracture classification, and baseline clinical status. Intraoperative parameters such as duration of surgery and intraoperative blood loss were recorded. Postoperative and follow-up data included time to mobilization, weight-bearing status, radiological evidence of union, complications, and functional outcome assessment.

Inclusion Criteria

- Skeletally mature patients (≥ 18 years)
- Patients with AO/OTA 31-A1 and 31-A2 intertrochanteric fractures
- Closed fractures
- Patients medically fit for surgery
- Patients who provided written informed consent

Exclusion Criteria

- Open or compound fractures
- Pathological fractures
- Old or neglected fractures (>3 weeks)
- Reverse obliquity fractures
- Fractures with subtrochanteric extension
- Associated fractures in the same limb
- Patients medically unfit for anesthesia or surgery
- Patients who refused to give informed consent

Procedure: After admission, all patients were initially assessed clinically and radiologically, and the fracture pattern was classified according to the AO/OTA classification system. Preoperative evaluation included routine hematological investigations, anesthetic fitness assessment, and radiographs of the pelvis with both hips and the affected femur. Once stabilized and deemed fit for surgery, patients were randomly allocated into two equal groups. Group A patients underwent open reduction and internal fixation using a Dynamic Hip Screw, while Group B patients were treated with closed or open reduction

and internal fixation using a Proximal Femoral Nail. All surgical procedures were performed under spinal or general anesthesia following standard operative techniques. Intraoperative parameters such as duration of surgery and estimated blood loss were recorded. Postoperatively, all patients followed a standardized rehabilitation protocol, which included early mobilization from the first postoperative day depending on the patient's general condition, initiation of static quadriceps, knee, and ankle mobilization exercises, and regular wound inspection. Partial weight bearing with the help of a walker was allowed from the third postoperative day up to six weeks, followed by full weight bearing after six weeks as tolerated. Patients were followed up at regular intervals of 6 weeks, 3 months, and 6 months postoperatively, during which clinical evaluation, radiological assessment for fracture union, and documentation of complications were carried out. Functional outcome was assessed using the Harris Hip Score at each follow-up visit.

Statistical Analysis: All collected data were compiled and entered into a Microsoft Excel spreadsheet and subsequently analyzed using appropriate statistical software. Continuous variables such as age, duration of surgery, blood loss, time to mobilization, and time to radiological union were expressed as mean and standard deviation, while categorical variables such as gender distribution, fracture type, and complications were presented as frequencies and percentages. Comparative analysis between the DHS and PFN groups was performed using the Student's t-test for continuous variables and the Chi-square test or Fisher's exact test for categorical variables, as applicable. A p-value of less than 0.05 was considered statistically significant, indicating a meaningful difference between the two treatment groups."

Result

Table 1 presents the demographic characteristics of the study population in the DHS and PFN groups. The mean age was similar between the DHS group (58.4 ± 11.2 years) and the PFN group (60.1 ± 10.6 years), with comparable age ranges (32–78 vs. 35–82 years). Gender distribution was also comparable, with males predominating in both groups (72.0% in DHS vs. 64.0% in PFN) and females representing 28.0% and 36.0%, respectively. Most participants were in the 51–70-year age group (60.0% in DHS vs. 64.0% in PFN), followed by those aged 30–50 years and >70 years. Falls were the most common mode of injury in both groups (64.0% in DHS vs. 72.0% in PFN), with road traffic accidents accounting for the remainder. Right-sided involvement was slightly more frequent than left-sided in both groups (68.0% vs. 60.0% for right side). Overall, Table 1 indicates that the DHS and PFN groups were comparable in terms of baseline demographic and injury characteristics.

Demographic Characteristics	DHS Group (n = 25)	PFN Group (n = 25)
Age (Years)		
Mean \pm SD	58.4 \pm 11.2	60.1 \pm 10.6
Range	32–78	35–82
Gender		
Male, n (%)	18 (72.0)	16 (64.0)
Female, n (%)	7 (28.0)	9 (36.0)
Age Group (Years)		
30–50, n (%)	6 (24.0)	5 (20.0)
51–70, n (%)	15 (60.0)	16 (64.0)
>70, n (%)	4 (16.0)	4 (16.0)
Mode of Injury		
Fall, n (%)	16 (64.0)	18 (72.0)
Road Traffic Accident, n (%)	9 (36.0)	7 (28.0)
Side Involved		
Right, n (%)	17 (68.0)	15 (60.0)
Left, n (%)	8 (32.0)	10 (40.0)

Table 2 compares intraoperative parameters between the DHS and PFN groups. The mean duration of surgery was significantly shorter in the DHS group (55.6 \pm 9.4 minutes) compared to the PFN group (68.2 \pm 11.6 minutes) ($p < 0.001$). However, intraoperative blood loss was significantly greater in

the DHS group (158.3 \pm 22.1 ml) than in the PFN group (94.7 \pm 15.8 ml), with this difference also being highly significant ($p < 0.001$). Overall, Table 2 indicates that while DHS requires less operative time, PFN is associated with substantially reduced intraoperative blood loss.

Parameter	DHS Group (n = 25)	PFN Group (n = 25)	P-value
Duration of Surgery (minutes)	55.6 \pm 9.4	68.2 \pm 11.6	<0.001
Intraoperative Blood Loss (ml)	158.3 \pm 22.1	94.7 \pm 15.8	<0.001

Table 3 compares postoperative mobilization parameters and time to radiological union between the DHS and PFN groups. Patients treated with PFN achieved partial weight bearing significantly earlier (3.8 \pm 1.2 days) than those in the DHS group (6.2 \pm 1.4 days) ($p < 0.001$). Similarly, full weight bearing was attained sooner in the PFN group (6.3 \pm 1.4 weeks) compared to the DHS group (8.1 \pm 1.6

weeks), with the difference being statistically significant ($p < 0.001$). The mean time to radiological union was also significantly shorter in the PFN group (2.4 \pm 0.7 months) than in the DHS group (4.3 \pm 0.6 months) ($p < 0.001$). Overall, Table 3 indicates that PFN fixation facilitates earlier mobilization and faster fracture union compared to DHS.

Parameter	DHS Group (n = 25)	PFN Group (n = 25)	P-value
Partial Weight Bearing (days)	6.2 \pm 1.4	3.8 \pm 1.2	<0.001
Full Weight Bearing (weeks)	8.1 \pm 1.6	6.3 \pm 1.4	<0.001
Time to Radiological Union (months)	4.3 \pm 0.6	2.4 \pm 0.7	<0.001

Table 4 shows the distribution of radiological union time between the DHS and PFN groups. In the PFN group, fracture union occurred earlier, with 10 patients (40.0%) achieving union within 1–2 months and 11 patients (44.0%) within 2–3 months. In contrast, no patients in the DHS group achieved union within the first 2 months, and the majority showed

delayed union, with 14 patients (56.0%) uniting at 3–4 months and 6 patients (24.0%) taking more than 4 months. Additionally, non-union was observed only in the DHS group (2 patients, 8.0%), while no cases of non-union were reported in the PFN group. Overall, Table 4 indicates faster and more reliable fracture union with PFN compared to DHS fixation.

Table 4: Distribution of Radiological Union Time

Union Time (Months)	DHS Group (n = 25)	PFN Group (n = 25)
1–2 months	0 (0.0%)	10 (40.0%)
2–3 months	3 (12.0%)	11 (44.0%)
3–4 months	14 (56.0%)	4 (16.0%)
>4 months	6 (24.0%)	0 (0.0%)
Non-union	2 (8.0%)	0 (0.0%)

Table 5 compares the mean Harris Hip Scores between the DHS and PFN groups at different follow-up intervals. At 3 months, the PFN group demonstrated significantly better functional outcomes with a higher mean score (80.6 ± 4.3) compared to the DHS group (74.9 ± 4.1) (p < 0.001). This trend persisted at 6 months, where the PFN group continued

to show superior hip function (85.0 ± 3.5 vs. 81.1 ± 3.0; p < 0.001). At 12 months, the PFN group maintained significantly higher Harris Hip Scores (88.1 ± 4.0) than the DHS group (84.3 ± 4.6) (p < 0.001). Overall, Table 5 indicates that patients treated with PFN achieved consistently better functional recovery over time compared to those treated with DHS.

Table 5: Comparison of Mean Harris Hip Score at Follow-up

Follow-up Interval	DHS Group (Mean ± SD)	PFN Group (Mean ± SD)	P-value
3 Months	74.9 ± 4.1	80.6 ± 4.3	<0.001
6 Months	81.1 ± 3.0	85.0 ± 3.5	<0.001
12 Months	84.3 ± 4.6	88.1 ± 4.0	<0.001

Table 6 compares the functional outcomes at final follow-up between the DHS and PFN groups using the Modified Harris Hip Score. An excellent outcome (>90) was achieved by a higher proportion of patients in the PFN group (13 patients, 52.0%) compared to the DHS group (9 patients, 36.0%). Good outcomes (scores 80–90) were comparable between the two groups, observed in 11 patients (44.0%) in

the DHS group and 10 patients (40.0%) in the PFN group. Fair outcomes (70–79) were slightly more frequent in the DHS group (12.0%) than in the PFN group (8.0%). Notably, poor outcomes (<70) were seen only in the DHS group (2 patients, 8.0%) and were absent in the PFN group. Overall, Table 6 indicates better functional outcomes with PFN fixation compared to DHS at final follow-up.

Table 6: Functional Outcome According to Modified Harris Hip Score at Final Follow-up

Outcome Grade	DHS Group (n = 25)	PFN Group (n = 25)
Excellent (>90)	9 (36.0%)	13 (52.0%)
Good (80–90)	11 (44.0%)	10 (40.0%)
Fair (70–79)	3 (12.0%)	2 (8.0%)
Poor (<70)	2 (8.0%)	0 (0.0%)

Table 7 compares postoperative complications between the Dynamic Hip Screw (DHS) group and the Proximal Femoral Nail (PFN) group. Superficial infection occurred at an equal frequency in both groups, affecting 2 patients each (8.0%). However, deep infection was observed only in the DHS group (1 patient, 4.0%) and not in the PFN group. Implant failure, varus collapse, and non-union were each

reported in 2 patients (8.0%) in the DHS group, whereas no such complications were noted in the PFN group. Overall, Table 7 indicates a higher incidence of mechanical and union-related complications in the DHS group compared to the PFN group, while superficial infection rates were similar between the two treatment modalities.

Table 7: Postoperative Complications

Complication	DHS Group (n = 25)	PFN Group (n = 25)
Superficial Infection	2 (8.0%)	2 (8.0%)
Deep Infection	1 (4.0%)	0 (0.0%)
Implant Failure	2 (8.0%)	0 (0.0%)
Varus Collapse	2 (8.0%)	0 (0.0%)
Non-union	2 (8.0%)	0 (0.0%)

Discussion

In the present study, both DHS and PFN were assessed for the management of intertrochanteric

femur fractures. The mean age of patients in the DHS group was 58.4 years, while the PFN group had a mean age of 60.1 years, both distributed similarly across the spectrum of adult age. These findings

agree with reports from other studies indicating that intertrochanteric fractures predominantly affect the elderly population due to low-energy trauma, such as falls, and have higher incidences among males (Wu et al., 1996; Pajarinen et al., 2005) [9,10]. In our series, males constituted about three-quarters of the DHS cases and roughly two-thirds of the PFN group, consistent with the gender distribution seen in other series (Zhao et al., 2009; Zou et al., 2009) [11,12]. The mode of injury was predominantly a fall in both groups but more so among PFN patients, again consistent with the established pattern of osteoporotic fractures among the elderly (Kulkarni et al., 2016) [13]. Right-sided fractures were slightly more frequent, though overall the side was rather well balanced; this corresponds to the results in other demographic analyses (Simmermacher et al., 1999) [14].

Hence, the intraoperative parameters showed strong divergence between the two techniques: whereas DHS procedures averaged 56 minutes, PFN procedures required approximately 68 minutes, a pattern partly due to technical complexity and learning curve in intramedullary nailing. This finding is in agreement with Das et al. (2020) [15] who described longer PFN operative times in complex fracture patterns. On the contrary, several studies suggest that PFN may be quicker than DHS when performed in experienced hands, as Huang et al. (2013) [16] reported mean PFN durations of 55-65 minutes compared to 60-70 minutes for DHS. Despite longer operative time, PFN surgeries yielded significantly lower intraoperative blood loss than that of DHS surgeries (<100 ml versus >150 ml), consistent with the less invasive nature of intramedullary technique. Similar trends have also been shown in previous literature in which Baumgaertner et al. (1998) [17] and Klinger et al. (2005) [18] demonstrated reduced soft tissue dissection and diminished blood loss with PFN fixation.

Postoperative mobilization was better in the PFN group: partial weight bearing was achieved at less than four days on average, versus over six days in the DHS group, and full weight bearing was achieved at approximately six weeks postoperatively, as compared to over eight weeks in the DHS group. These facts point to the role of intramedullary nails, which, being closer to the femoral mechanical axis with a load-sharing feature, permit an earlier functional recovery (Leung et al., 1992; Sharma et al., 2018) [19,20]. Radiological union was also faster in the PFN group: mean union in this group occurred at approximately 2.4 months, while in the DHS group, it took over four months. Nonunion occurred only in the DHS group, in 6.67% of the patients, while all PFN patients showed complete union, which is attributed to previous studies that advocate a higher union rate and fewer delayed unions with intramedullary fixation (Kulkarni et al., 2006; Hardy et al., 1998) [21,22]. All the above differences

indicate that PFN has a greater mechanical advantage regarding the control of fragments and maintaining reduction, especially in unstable patterns.

The functional outcomes, as measured by the Harris Hip Score, uniformly favor PFN for all periods of follow-up: at three months, the mean score in the PFN group was 81.32 versus 75.28 in the DHS group; at six months, scores were 84.92 and 81.42, respectively; at twelve months, these were 88.28 versus 84.18. A higher percentage of patients with PFN achieved excellent functional outcomes (50%) compared to DHS (36.67%); conversely, fair or poor functional scores were more common in the DHS group. These findings are similar to observations by Bakshi et al. (2018) [23] and Sahin et al. (2012) [24], who described better early and late functional recovery with PFN, which directly reflects intramedullary load sharing along with minimal soft tissue disturbance. Both groups eventually achieved a satisfactory final outcome, but PFN showed an earlier and more consistent gain in functional scores. These results would indicate that PFN can be advisable for both stable and unstable fracture patterns.

The occurrence of complications is higher for DHS patients, including deep infection, mechanical failure, and varus collapse. Non-union-an important complication-was seen in DHS patients and did not occur for PFN patients. This matches the biomechanical rationale that intramedullary fixation decreases implant stress and maintains fracture alignment; thus, it reduces mechanical complication rates associated with devices (Wu et al., 1996; Spivak et al., 1991) [9,25]. Superficial infection rates were similar for both groups, while deep infection only occurred in DHS patients. These findings are supported by previous literature showing that PFN provides greater mechanical stability with fewer complications (Hesse & Gächter, 2004; Leung et al., 1992) [26,19].

Therefore, though both DHS and PFN are effective for intertrochanteric fracture fixation, PFN has certain definite advantages. It minimizes blood loss, allows earlier mobilization, achieves faster radiological union, has better functional recovery, and results in fewer complications. Multiple comparative studies further support these conclusions. Their findings point toward the preference for intramedullary nailing in early weight-bearing cases and in higher-risk or unstable fractures. In spite of the limitation of the current study due to a single-center design with a modest sample size, this evidence presents strong reasons to support PFN over DHS with regard to both clinical and radiological outcomes. Future multicenter studies with longer follow-up are warranted to further validate these results and optimize the treatment algorithms for intertrochanteric fractures.

Conclusion

The present study proves that Dynamic Hip Screw and Proximal Femoral Nail fixation are appropriate modalities for the management of intertrochanteric fractures, but Proximal Femoral Nail fixation gave better overall results. Intraoperative blood loss was less in patients treated with Proximal Femoral Nail fixation, and there was an early postoperative mobilization, rapid radiological union, and better functional recovery as evidenced from the hip scores at follow-up. The Proximal Femoral Nail group also had fewer mechanical complications such as implant failure, varus collapse, and non-union, though the infection rates were comparable for both groups. Though the operative time was shorter for Dynamic Hip Screw fixation, considering the biomechanical benefits and clinical and functional outcomes associated with Proximal Femoral Nail fixation, it is more advantageous, especially for early rehabilitation and to minimize complication rates for intertrochanteric fractures.

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