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Research Article

Comparative Evaluation of Proximal Femoral Nail and Dynamic Hip Screw in the Management of Intertrochanteric Femur Fractures

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ABSTRACT

Background: Intertrochanteric fractures of the femur are common in the elderly population and are associated with significant morbidity and mortality. Surgical fixation aims to achieve stable fracture reduction and allow early mobilization. Dynamic Hip Screw (DHS) has traditionally been the standard treatment; however, Proximal Femoral Nail (PFN) has gained popularity due to its biomechanical advantages. This study was conducted to compare the clinical and functional outcomes of PFN and DHS in the management of intertrochanteric femur fractures.
Methods: A hospital-based comparative observational study was conducted in the Department of Orthopedics at JBM Government Medical College, Nandurbar, over a period of six months from January 2025. A total of 60 patients with intertrochanteric femur fractures were included and divided into two groups: PFN (n=30) and DHS (n=30). Patients were evaluated based on operative parameters (operative time, intraoperative blood loss), postoperative recovery (time to mobilization, time to union), functional outcome using Harris Hip Score, and complications. Statistical analysis was performed using Student's t-test and Chi-square test, with $p<0.05$ considered significant.
Results: The PFN group showed significantly shorter operative time (60.5 ± 9.2 min vs 78.4 ± 11.3 min, $p<0.001$) and reduced intraoperative blood loss (140.6 ± 35.2 mL vs 230.8 ± 45.6 mL, $p<0.001$) compared to the DHS group. Early mobilization and weight-bearing were achieved sooner in the PFN group ($p<0.01$). The mean Harris Hip Score at 6 months was significantly higher in the PFN group (82.3 ± 6.5) compared to the DHS group (75.4 ± 7.1, $p<0.01$). The overall complication rate was lower in the PFN group (20%) than in the DHS group (60%).
Conclusion: Proximal Femoral Nail demonstrated superior outcomes compared to Dynamic Hip Screw in terms of operative parameters, early mobilization, functional recovery, and complication rates. PFN appears to be a more effective fixation method for intertrochanteric femur fractures, particularly in elderly patients and unstable fracture patterns.

Keywords*: Intertrochanteric fracture, Proximal femoral nail, Dynamic hip screw, Harris Hip Score, Internal fixation, Femur fracture.*

INTRODUCTION

Intertrochanteric fractures of the femur are among the most common fractures encountered in the elderly population and represent a major cause of morbidity, mortality, and healthcare burden worldwide. The incidence of these fractures is increasing steadily due to rising life expectancy and the growing prevalence of osteoporosis, particularly in developing countries [1,2]. These fractures typically result from low-energy trauma such as trivial falls in elderly individuals, whereas high-energy trauma is more commonly responsible in younger patients.

The primary goal of management of intertrochanteric fractures is to achieve stable fixation that allows early mobilization, thereby reducing complications such as deep vein thrombosis, pulmonary infections, pressure ulcers, and prolonged

immobilization. Early surgical intervention has been shown to significantly improve functional outcomes and reduce mortality in these patients [3].

Dynamic Hip Screw (DHS), an extramedullary implant, has traditionally been considered the gold standard for the treatment of stable intertrochanteric fractures due to its simplicity, cost-effectiveness, and reproducible outcomes [4]. However, its limitations in unstable fracture patterns—including excessive sliding, varus collapse, medialization of the shaft, and implant failure—have been widely reported [5].

In recent years, intramedullary devices such as Proximal Femoral Nail (PFN) have gained increasing popularity owing to their biomechanical advantages. PFN offers a shorter lever arm, improved load-sharing capacity, and better resistance to rotational and bending forces, making it particularly suitable for unstable and comminuted fractures [6]. Additionally, PFN requires a smaller surgical incision, results in less soft tissue dissection, and is associated with reduced intraoperative blood loss [7].

Several recent studies and meta-analyses have compared PFN and DHS in the management of intertrochanteric fractures. Evidence suggests that PFN is associated with shorter operative time, decreased intraoperative blood loss, and earlier mobilization compared to DHS [8,9]. Furthermore, PFN has been shown to provide better early functional outcomes, particularly in elderly patients, although long-term outcomes may be comparable between the two techniques [10].

Despite these advantages, the choice between PFN and DHS remains controversial, with some studies reporting no significant difference in long-term functional outcomes and complication rates between the two implants when used appropriately [11]. Therefore, the selection of fixation method should be individualized based on fracture pattern, bone quality, patient factors, and surgeon expertise.

In view of these considerations, the present study was undertaken to compare the operative parameters, functional outcomes, and complication rates between Proximal Femoral Nail and Dynamic Hip Screw in the management of intertrochanteric femur fractures.

MATERIALS AND METHODS

The present study was conducted in the Department of Orthopedics at JBM Government Medical College, Nandurbar, over a period of six months from January 2025 onwards. It was designed as a hospital-based comparative observational study aimed at evaluating the outcomes of Proximal Femoral Nail (PFN) and Dynamic Hip Screw (DHS) in the management of intertrochanteric fractures of the femur.

Patients presenting to the orthopaedic department with intertrochanteric fractures of the femur during the study period were assessed for eligibility. All eligible patients who fulfilled the inclusion criteria and provided informed consent were enrolled in the study. A detailed clinical history was obtained, and thorough physical and radiological examinations were performed to confirm the diagnosis and classify the fracture pattern.

The study population comprised adult patients diagnosed with intertrochanteric femur fractures who were considered fit for surgical intervention. Patients with pathological fractures, polytrauma, previous ipsilateral hip surgery, or those who were medically unfit for surgery were excluded from the study. Preoperative evaluation included routine laboratory investigations and radiographic assessment using anteroposterior and lateral views of the hip joint.

Participants were managed surgically using either Proximal Femoral Nail or Dynamic Hip Screw fixation, depending on fracture characteristics, surgeon preference, and intraoperative feasibility. All procedures were performed under spinal or general anesthesia following standard aseptic protocols. In the PFN group, closed reduction was achieved on a fracture table under fluoroscopic guidance, followed by insertion of the intramedullary nail with proximal and distal locking. In the DHS group, fracture reduction was followed by fixation using a sliding hip screw and side plate system.

Postoperatively, all patients received standardized care, including antibiotic prophylaxis, analgesia, and thromboprophylaxis as per institutional protocol. Early mobilization was encouraged, and physiotherapy was initiated as soon as clinically feasible. Weight-bearing status was determined based on fracture stability and radiological progression of healing.

Patients were followed up at regular intervals to assess clinical and radiological outcomes. Outcome parameters included operative time, intraoperative blood loss, time to mobilization, time to fracture union, functional outcome as assessed by the Harris Hip Score, and postoperative complications such as infection, implant failure, and limb shortening.

Data were collected systematically using a predesigned proforma and entered into a database for analysis. Statistical analysis was performed using appropriate statistical software. Continuous variables were expressed as mean and standard deviation, while categorical variables were presented as frequencies and percentages. Comparative analysis between the two groups was carried out using the Student's t-test for continuous variables and the Chi-square test for categorical variables. A p-value of less than 0.05 was considered statistically significant.

Ethical clearance for the study was obtained from the Institutional Ethics Committee prior to commencement. Written informed consent was obtained from all participants, and confidentiality of patient data was maintained throughout the study.

RESULTS

A total of **60 patients** with intertrochanteric fractures of the femur were included in the present study, with **30 patients in the PFN group and 30 patients in the DHS group**. The baseline demographic characteristics of both groups were comparable, with no statistically significant difference in age, gender distribution, or mechanism of injury ($p > 0.05$).

Table 1: Demographic Profile of Study Participants

Parameter	PFN Group (n=30)	DHS Group (n=30)	p-value
Mean Age (years)	71.2 ± 6.8	70.5 ± 7.1	>0.05
Male (%)	16 (53.3%)	14 (46.7%)	>0.05
Female (%)	14 (46.7%)	16 (53.3%)	
Mode of Injury (Fall)	22 (73.3%)	21 (70%)	>0.05

The majority of patients in both groups were elderly, with mean age above 70 years. Trivial fall was the most common mechanism of injury, consistent with osteoporotic fracture patterns reported in literature [1].

Table 2: Operative Parameters Comparison

Parameter	PFN Group	DHS Group	p-value
Operative Time (min)	60.5 ± 9.2	78.4 ± 11.3	<0.001
Blood Loss (ml)	140.6 ± 35.2	230.8 ± 45.6	<0.001
Length of Incision (cm)	6.5 ± 1.2	13.8 ± 2.1	<0.001

The mean operative time was significantly shorter in the PFN group compared to the DHS group. Similarly, intraoperative blood loss was significantly lower in the PFN group. These findings are consistent with previous meta-analyses and clinical studies demonstrating reduced operative duration and blood loss with PFN due to its minimally invasive nature .

Table 3: Postoperative Mobilization and Union

Parameter	PFN Group	DHS Group	p-value
Operative Time (min)	60.5 ± 9.2	78.4 ± 11.3	<0.001
Blood Loss (ml)	140.6 ± 35.2	230.8 ± 45.6	<0.001
Length of Incision (cm)	6.5 ± 1.2	13.8 ± 2.1	<0.001

Patients treated with PFN achieved earlier mobilization and weight-bearing compared to those treated with DHS. Time to fracture union was also shorter in the PFN group. These findings correlate with previously reported studies indicating earlier rehabilitation and faster recovery with PFN fixation .

Table 4: Functional Outcome (Harris Hip Score)

Follow-up	PFN Group	DHS Group	p-value
3 months	68.5 ± 7.2	60.2 ± 6.8	<0.01
6 months	82.3 ± 6.5	75.4 ± 7.1	<0.01

The functional outcome assessed by Harris Hip Score was significantly better in the PFN group at both 3 and 6 months follow-up. Early functional superiority of PFN has also been reported in previous comparative studies, although long-term outcomes may become comparable over time .

Table 5: Postoperative Complications

Complication	PFN Group (n=30)	DHS Group (n=30)
Infection	1 (3.3%)	3 (10%)
Implant Failure	2 (6.7%)	4 (13.3%)
Varus Collapse	1 (3.3%)	5 (16.7%)
Limb Shortening	2 (6.7%)	6 (20%)
Total Complications	6 (20%)	18 (60%)

The overall complication rate was lower in the PFN group compared to the DHS group. Varus collapse and limb shortening were more frequently observed in the DHS group. These findings are consistent with literature suggesting better biomechanical stability and fewer complications with PFN, particularly in unstable fractures .

In the present study, PFN demonstrated significant advantages over DHS in terms of operative parameters, including shorter operative time and reduced intraoperative blood loss (Table 2). Postoperative recovery was faster in the PFN group, with earlier mobilization and shorter time to full weight-bearing (Table 3). Functional outcomes, as measured by Harris Hip Score, were significantly better in the PFN group at early follow-up intervals (Table 4). Furthermore, the PFN group showed a lower rate of postoperative complications compared to the DHS group (Table 5). These findings suggest that PFN may provide superior short-term outcomes and improved biomechanical stability in the management of intertrochanteric femur fractures.

DISCUSSION

Intertrochanteric fractures of the femur remain a significant clinical problem, particularly in the geriatric population, where osteoporosis and comorbid conditions adversely influence outcomes. The primary objective of management is to achieve stable fixation that permits early mobilization and minimizes complications associated with prolonged immobilization. In the present study, PFN demonstrated clear advantages over DHS in several intraoperative and early postoperative parameters, which is consistent with contemporary literature.

The demographic profile of the present study showed that the majority of patients were elderly and sustained fractures following trivial falls. This observation is in agreement with recent epidemiological studies. Veronese et al. reported that hip fractures are predominantly seen in elderly individuals and are closely associated with osteoporosis and low-energy trauma [1]. Similarly, Dyer et al. emphasized the increasing burden of hip fractures and their long-term functional consequences in aging populations [2]. These findings validate the demographic pattern observed in our study.

In the present study, operative time was significantly shorter in the PFN group compared to the DHS group (Table 2). This finding is consistent with recent meta-analyses. Zou et al. in their systematic review observed that intramedullary fixation techniques such as PFN significantly reduce operative duration compared to DHS due to minimally invasive techniques and reduced surgical exposure [3]. Similarly, recent comparative analyses have also demonstrated shorter operative times with PFN, particularly in experienced hands [4].

Intraoperative blood loss was also significantly lower in the PFN group in our study (Table 2). This finding is supported by multiple recent studies. Ma et al. reported that PFN is associated with significantly less intraoperative blood loss compared to DHS due to minimal soft tissue dissection and closed reduction technique [4]. Likewise, Shen et al. found reduced blood loss in PFN-treated patients, further supporting the minimally invasive advantage of intramedullary fixation [5].

Early mobilization is a crucial determinant of functional recovery in intertrochanteric fractures. In our study, patients treated with PFN achieved earlier partial and full weight-bearing compared to those treated with DHS (Table 3). These findings are consistent with recent literature. Liu et al. demonstrated that intramedullary fixation allows earlier mobilization due to better biomechanical stability and load-sharing characteristics [6]. Similarly, Rasul et al. in a recent meta-analysis reported significantly earlier rehabilitation and weight-bearing in PFN-treated patients compared to DHS [10].

The time to radiological union was shorter in the PFN group in the present study, although the difference was modest (Table 3). Similar observations have been reported in recent studies. Yu et al. found slightly earlier fracture union in PFN-treated patients, although both PFN and DHS ultimately achieved satisfactory union rates [7]. This suggests that while PFN may facilitate faster healing, both implants are effective when adequate reduction is achieved.

Functional outcome, as assessed by the Harris Hip Score, was significantly better in the PFN group at early follow-up in our study (Table 4). This finding is supported by recent studies. Sharma et al. reported higher Harris Hip Scores in PFN patients at early follow-up, indicating faster functional recovery [8]. Similarly, contemporary cohort studies have shown improved early functional outcomes with PFN, although long-term outcomes may become comparable [13].

The incidence of postoperative complications was lower in the PFN group in the present study (Table 5). Complications such as varus collapse, limb shortening, and implant failure were more frequent in the DHS group. These findings are consistent with recent evidence. Zhang et al. demonstrated lower complication rates with PFN, especially in unstable fractures, due to its intramedullary position and superior biomechanical stability [9]. Additionally, Musa et al. reported reduced rates of implant failure and mechanical complications with PFN compared to DHS [11].

Despite these advantages, PFN is not devoid of complications. Issues such as screw cut-out, Z-effect, and increased radiation exposure have been reported in recent studies [9,11]. In our study, although PFN demonstrated better overall outcomes, a small number of implant-related complications were observed. These findings emphasize that surgical expertise, proper implant positioning, and patient selection are critical determinants of successful outcomes.

Overall, the findings of the present study are in concordance with the growing body of recent literature favoring intramedullary fixation techniques. PFN offers significant advantages in terms of operative efficiency, reduced blood loss, early mobilization, improved early functional outcomes, and lower complication rates. However, DHS remains a reliable and cost-effective option, particularly in stable fracture patterns and in resource-limited settings.

In summary, the present study supports the increasing preference for PFN in the management of intertrochanteric fractures, especially in elderly patients and unstable fracture configurations, while emphasizing the importance of individualized treatment planning.

CONCLUSION

The present study demonstrates that both Proximal Femoral Nail (PFN) and Dynamic Hip Screw (DHS) are effective modalities for the surgical management of intertrochanteric fractures of the femur. However, PFN showed significant advantages over DHS in terms of shorter operative time, reduced intraoperative blood loss, smaller surgical incision, and earlier mobilization. Functional outcomes, as assessed by the Harris Hip Score, were superior in the PFN group during early follow-up, and the overall complication rate was lower compared to DHS.

The intramedullary biomechanics of PFN, with its shorter lever arm and load-sharing properties, likely contribute to improved stability and reduced mechanical complications, particularly in unstable fracture patterns. Although long-term outcomes may become comparable between the two techniques, PFN provides clear benefits in the early postoperative period, which is crucial in elderly patients to reduce morbidity associated with prolonged immobilization.

In conclusion, PFN can be considered a preferable fixation method for intertrochanteric femur fractures, especially in elderly patients and in cases of unstable fracture configurations. Nevertheless, appropriate implant selection should be individualized based on fracture characteristics, patient factors, and surgeon expertise to achieve optimal clinical outcomes.

Conflict Of Interest: None To Declare

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