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ORIGINAL RESEARCH

To compare the Efficacy of Proximal Femoral Nailing (PFN) and Dynamic Hip Screw (DHS) Fixation in the Treatment of Intertrochanteric Fractures: A Hospital Based Prospective Study

Dr. Angwsa Hazowary[1], Dr. Nikesh Kumar[2], Dr. Om Prakash Kumar[3], Dr. Ranjeet Kumar Singh[4]

[1,2]Senior Resident, Department of Orthopaedics, Nalanda Medical College and Hospital, Patna, Bihar, India
[3]Professor, Department of Orthopaedics, Nalanda Medical College and Hospital, Patna, Bihar, India
[4]Professor and Head of Department, Department of Orthopaedics, Nalanda Medical College and Hospital, Patna, Bihar, India

Corresponding Author: Dr. Nikesh Kumar
Senior Resident, Department of Orthopaedics, Nalanda Medical College and Hospital, Patna, Bihar, India
Email: nikesh.10nk@gmail.com

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ABSTRACT

Background: Intertrochanteric fractures, a common occurrence in the elderly population, pose significant challenges in orthopedic surgery due to their association with reduced mobility, prolonged rehabilitation, and increased morbidity and mortality. To compare the efficacy of Proximal Femoral Nailing (PFN) and Dynamic Hip Screw (DHS) fixation in the treatment of intertrochanteric fractures.

Material and Methods: The current prospective, comparative clinical study was conducted at a tertiary care hospital and included 80 patients aged 18–80 years diagnosed with intertrochanteric fractures (AO/OTA types 31-A1 and 31-A2). Patients were randomized into two groups: PFN (n=40) and DHS (n=40). Baseline characteristics, operative variables, postoperative outcomes, and complications were recorded and analyzed using standard statistical methods. The primary outcomes included time to fracture union, operative duration, intraoperative blood loss, and functional outcomes assessed by the Harris Hip Score (HHS) at six months.

Results: Both groups were comparable in terms of baseline characteristics. The PFN group demonstrated significantly shorter operative durations (58.45 ± 7.62 minutes vs. 72.38 ± 8.21 minutes, $p < 0.001$) and lower intraoperative blood loss (118.35 ± 15.42 mL vs. 190.52 ± 20.47 mL, $p < 0.001$) compared to the DHS group. The mean hospital stay was shorter for PFN patients (5.12 ± 1.03 days vs. 6.75 ± 1.28 days, $p < 0.001$). Faster fracture union was observed in the PFN group, with 75.00% achieving union within 12 weeks compared to 50.00% in the DHS group ($p = 0.02$). The mean HHS score at six months was higher in the PFN group (85.42 ± 5.73 vs. 79.62 ± 6.81, $p < 0.001$). The overall complication rate was lower in the PFN group (15.00% vs. 32.50%, $p = 0.04$).

Conclusion: Proximal Femoral Nailing (PFN) demonstrated superior efficacy compared to Dynamic Hip Screw (DHS) fixation in the treatment of intertrochanteric fractures. PFN was associated with shorter surgical times, reduced blood loss, faster fracture union, improved functional outcomes, and fewer complications, making it the preferred choice, especially for unstable fracture patterns.

Keywords: Intertrochanteric fractures, Proximal Femoral Nailing, Dynamic Hip Screw, Fracture fixation,

INTRODUCTION

Intertrochanteric fractures, a common occurrence in the elderly population, pose significant challenges in orthopedic surgery due to their association with reduced mobility, prolonged rehabilitation, and increased morbidity and mortality. These fractures typically occur in the region between the greater and lesser trochanters

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of the femur and are frequently caused by low-energy trauma, such as a fall from standing height, particularly in individuals with compromised bone quality due to osteoporosis. With the increasing life expectancy and prevalence of osteoporosis, the incidence of intertrochanteric fractures is expected to rise, highlighting the need for effective treatment strategies.[1] Surgical fixation is the standard approach for managing intertrochanteric fractures, aiming to restore early mobility, ensure stable fixation, and minimize complications. Among the surgical options, Proximal Femoral Nailing (PFN) and Dynamic Hip Screw (DHS) fixation are the most commonly employed techniques. Both methods have distinct biomechanical principles and operative techniques, and their selection is often influenced by the fracture type, patient characteristics, and surgeon expertise.[2] The Dynamic Hip Screw (DHS) has been a cornerstone in the treatment of intertrochanteric fractures for decades. It consists of a lag screw inserted into the femoral head and neck, connected to a side plate secured to the lateral femur. The DHS works on the principle of controlled collapse and impaction at the fracture site, which promotes healing. It is particularly effective in treating stable fracture patterns and has the advantages of being relatively simple to use, widely available, and cost-effective. However, the DHS requires extensive soft tissue dissection during its insertion and is associated with a risk of implant failure, particularly in unstable fracture patterns or in osteoporotic bone.[3] Proximal Femoral Nailing (PFN), on the other hand, is an intramedullary device that offers a minimally invasive alternative for the fixation of intertrochanteric fractures. The PFN involves the insertion of a nail into the femoral canal, with proximal locking screws securing the femoral head and neck. This method capitalizes on the principle of load-sharing, allowing for better distribution of forces along the femoral shaft and enhancing biomechanical stability, particularly in unstable fractures. Additionally, the intramedullary location of the implant reduces the lever arm and the associated bending stresses, making PFN particularly suitable for comminuted or reverse oblique fractures. Its minimally invasive nature also reduces soft tissue disruption, minimizes blood loss, and facilitates faster recovery.[4] Despite their widespread use, PFN and DHS have their limitations. DHS, while effective in stable fractures, has shown higher rates of implant failure, excessive sliding, and varus collapse in unstable fractures. PFN, though advantageous in terms of stability and recovery, has been associated with complications such as screw cut-out, femoral shaft fractures, and technical difficulties during insertion. These complications highlight the importance of selecting the appropriate fixation method based on the fracture pattern and patient factors.[5] Several factors influence the choice between PFN and DHS fixation, including the fracture's stability, the patient's age, comorbidities, and bone quality. Stable fractures (AO/OTA type 31-A1) are often well-suited for DHS fixation, while unstable fractures (AO/OTA type 31-A2 and reverse oblique) are more reliably managed with PFN. Additionally, PFN is often preferred in elderly patients or those with multiple comorbidities due to its minimally invasive nature, which reduces surgical stress and postoperative recovery time.[6] The debate over the superiority of PFN versus DHS has been the subject of extensive research. Numerous studies have compared the two techniques in terms of operative duration, blood loss, time to union, functional outcomes, and complication rates. While PFN generally shows advantages in unstable fracture patterns and faster recovery times, DHS remains a reliable and cost-effective option for stable fractures. However, there is no universally accepted consensus, and the choice of fixation technique often depends on the individual clinical scenario. The functional outcomes of surgical fixation are another critical consideration. Early mobilization and restoration of pre-injury functional status are primary goals in the management of intertrochanteric fractures. Both PFN and DHS have demonstrated satisfactory results in improving mobility and reducing pain in most patients. However, PFN has shown better outcomes in terms of early weight-bearing and lower complication rates, particularly in unstable fractures.[7] Postoperative complications, such as infection, implant failure, and mal-union, also influence the selection of fixation methods. The DHS is associated with higher rates of excessive sliding and varus collapse, while PFN complications typically include screw cut-out and difficulty in implant placement. These issues underscore the importance of meticulous surgical technique and appropriate implant selection. With advancements in implant design and surgical techniques, the outcomes of both PFN and DHS fixation have improved significantly over the years. Enhanced imaging modalities,

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improved instrumentation, and better understanding of fracture biomechanics have contributed to reducing complication rates and improving functional recovery.[8,9]

AIM AND OBJECTIVES: To compare the efficacy of Proximal Femoral Nailing (PFN) and Dynamic Hip Screw (DHS) fixation in the treatment of intertrochanteric fractures.

MATERIAL AND METHODS

Study Design

The present study was a hospital based prospective comparative study.

Study Place

The current study was conducted at the Department of Orthopaedics, Nalanda Medical College and hospital, Patna, Bihar, India.

Study Period

The study was carried out from January 2023 to September 2024.

Study Population

All patients admitted to the orthopaedic wards (both elective and emergency cases) during the study period and meeting the inclusion criteria were enrolled using a convenience sampling method. A total of 80 patients diagnosed with intertrochanteric fractures were included in the study. Patients were recruited from the orthopedic department. All gave their written consent to participate in the study after being briefed on the study's purpose and methodology.

Ethical Consideration

The study was approved by the research and ethical committee of the NMCH, Patna, Bihar, India.

The inclusion and exclusion criteria were as follows:

Inclusion Criteria:

- Patients aged 18–65 years with unilateral intertrochanteric fractures (AO/OTA types 31-A1, 31-A2).
- Both genders included.
- Fractures occurring due to low-energy trauma, such as falls from standing height.
- Patients fit for surgery under spinal or general anesthesia.
- Informed consent provided by the patient or a legal guardian.
- Available for follow-up.

Exclusion Criteria:

- Pathological fractures (other than osteoporosis-related).
- Open fractures.
- Polytrauma patients or those with associated injuries that may affect mobility.
- Patients with pre-existing hip pathologies or deformities.
- Patients unfit for surgery due to severe comorbidities or unstable medical conditions.
- Uncooperative patients or patients who did not give consent and unable to attend follow-up.

Patients were randomly allocated into two groups to ensure balanced comparison and minimize selection bias:

- **Group A (PFN group):** 40 patients treated with Proximal Femoral Nailing.
- **Group B (DHS group):** 40 patients treated with Dynamic Hip Screw fixation.

A computer-generated random number table was used for randomization. The allocation process was blinded to the surgeons to maintain objectivity in the treatment protocol.

Surgical Technique

All surgeries were performed by experienced orthopedic surgeons under strict aseptic conditions in the operating theatre. Anesthesia, either spinal or general, was administered based on individual patient characteristics and in consultation with the anaesthetist.

Proximal Femoral Nailing (PFN)

The PFN procedure was performed using a standard PFN system. A minimally invasive lateral incision was made, and the fracture was reduced under fluoroscopic guidance. A guide wire was inserted to mark the path for the nail, followed by reaming and insertion of the proximal femoral nail. Locking screws were placed proximally and distally to stabilize the construct and ensure adequate fixation of the fracture.

Dynamic Hip Screw (DHS) Fixation

The DHS fixation involved a standard lateral incision followed by open reduction of the fracture. Under fluoroscopic guidance, a guide wire was inserted centrally into the femoral head to establish the correct trajectory. The femoral neck was then drilled, and a screw-plate construct was secured to the proximal femur using cortical screws for fracture stabilization.

Postoperative Care and Follow-Up

Postoperatively, all patients received antibiotics for 48 hours to prevent infection. Thrombo-prophylaxis was provided using low molecular weight heparin for 7–10 days to minimize the risk of deep vein thrombosis. Patients were encouraged to mobilize early, with weight-bearing as tolerated based on the fracture stability and the type of fixation used. Follow-up

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visits were conducted at 6 weeks, 12 weeks, and 6 months postoperatively. During these visits, clinical and radiological assessments were performed to evaluate fracture healing, functional outcomes, and potential complications.

Outcome Measures

The primary outcomes assessed were the time to fracture union (measured in weeks), functional outcomes using the Harris Hip Score (HHS) at 6 months, operative duration (in minutes), and intraoperative blood loss (in milliliters). Secondary outcomes included postoperative complications such as infection, implant failure, or mal-union, as well as the length of hospital stay (in days).

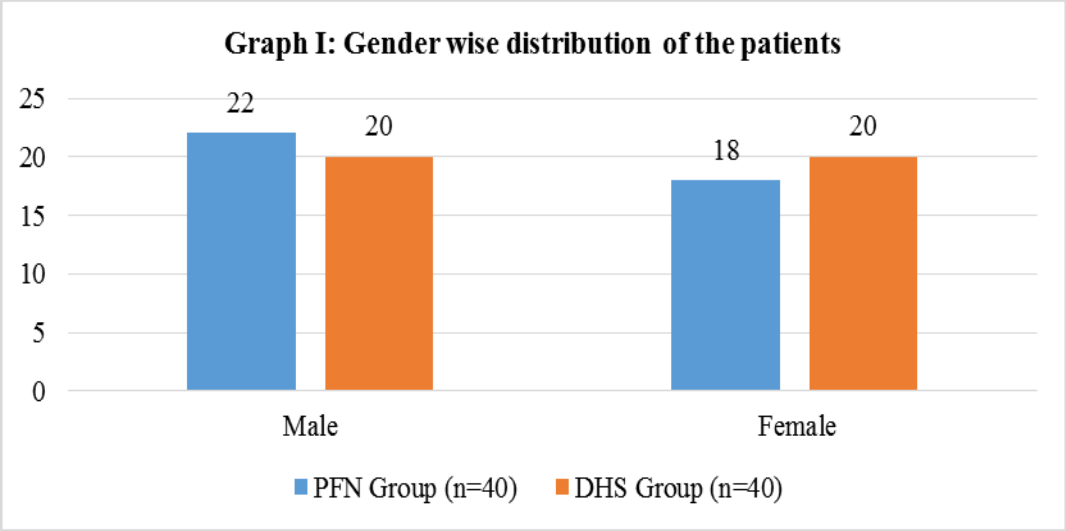
Statistical Analysis

Data were analyzed using SPSS software version 25.0. Continuous variables were expressed as mean ± standard deviation and compared using an independent t-test. Categorical variables were expressed as frequencies and percentages, and comparisons were made using the chi-square test. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1: Baseline Characteristics of Patients

Characteristic	PFN Group (n=40)	DHS Group (n=40)	p-value
Mean Age (years)	65.42 ± 8.15	64.75 ± 7.92	0.67
Gender			
Male	22 (55.00%)	20 (50.00%)	0.66
Female	18 (45.00%)	20 (50.00%)	
Type of fracture			
Fracture Type (31-A1)	25 (62.50%)	27 (67.50%)	0.63
Fracture Type (31-A2)	15 (37.50%)	13 (32.50%)	0.63



The baseline characteristics of patients in both groups were comparable, with no statistically significant differences observed. The mean age of patients in the PFN group was 65.42 ± 8.15 years, while in the DHS group, it was 64.75 ± 7.92 years (p = 0.67). The gender distribution was nearly similar, with males comprising 55.00% of the PFN group and 50.00% of the DHS group, and females accounting for 45.00% and 50.00%, respectively (p = 0.66) [Graph I]. Regarding fracture types, 62.50% of patients in the PFN group and 67.50% in the DHS group had type 31-A1 fractures (p = 0.63). The remaining patients in each group presented with type 31-A2 fractures, comprising 37.50% of the PFN group and 32.50% of the DHS group (p = 0.63). These findings indicate that the groups were well-matched in terms of age, gender, and fracture type, reducing potential confounding factors and ensuring a balanced comparison between the two treatment methods [Table 1,Graph I].

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Table 2: Operative and Postoperative Variables

Variable	PFN Group (n=40)	DHS Group (n=40)	p-value
Operative Duration (min)	58.45 ± 7.62	72.38 ± 8.21	<0.001
Intraoperative Blood Loss (mL)	118.35 ± 15.42	190.52 ± 20.47	<0.001
Length of Hospital Stay (days)	5.12 ± 1.03	6.75 ± 1.28	<0.001

Table 2 show that significant differences were noted between the groups regarding operative and postoperative variables. The mean operative duration for the PFN group was 58.45 ± 7.62 minutes, significantly shorter than the DHS group, which required 72.38 ± 8.21 minutes ($p < 0.001$). Similarly, intraoperative blood loss was substantially lower in the PFN group (118.35 ± 15.42 mL) compared to the DHS group (190.52 ± 20.47 mL, $p < 0.001$). The length of hospital stay also favoured the PFN group, with a mean duration of 5.12 ± 1.03 days compared to 6.75 ± 1.28 days in the DHS group ($p < 0.001$). These results suggest that PFN is associated with shorter surgical times, reduced blood loss, and faster postoperative recovery.

Table 3: Time to Fracture Union

Time to Fracture Union (weeks)	PFN Group (n=40)	DHS Group (n=40)	p-value
<12 weeks	30 (75.00%)	20 (50.00%)	0.02
≥12 weeks	10 (25.00%)	20 (50.00%)	0.02
Mean Time to Union (weeks)	11.28 ± 1.75	12.85 ± 2.04	0.01

Table 3, show that the time to fracture union showed a statistically significant difference between the two groups. In the PFN group, 75.00% of patients achieved fracture union within 12 weeks, compared to 50.00% in the DHS group ($p = 0.02$). Conversely, 25.00% of PFN patients and 50.00% of DHS patients required 12 or more weeks for union ($p = 0.02$). The mean time to union was significantly shorter in the PFN group (11.28 ± 1.75 weeks) compared to the DHS group (12.85 ± 2.04 weeks, $p = 0.01$). These findings highlight the faster healing associated with PFN fixation.

Table 4: Functional Outcomes (Harris Hip Score)

Harris Hip Score at 6 months	PFN Group (n=40)	DHS Group (n=40)	p-value
Excellent (90–100)	18 (45.00%)	10 (25.00%)	0.04
Good (80–89)	15 (37.50%)	12 (30.00%)	0.48
Fair (70–79)	6 (15.00%)	12 (30.00%)	0.14
Poor (<70)	1 (2.50%)	6 (15.00%)	0.05
Mean HHS Score	85.42 ± 5.73	79.62 ± 6.81	<0.001

Table 4 shows the functional outcomes at 6 months, as assessed by the Harris Hip Score (HHS), showed better results in the PFN group. The proportion of patients with an "Excellent" outcome (HHS 90–100) was significantly higher in the PFN group (45.00%) compared to the DHS group (25.00%, $p = 0.04$). Similarly, a higher percentage of DHS patients had "Poor" outcomes (HHS <70) at 15.00%, compared to only 2.50% in the PFN group ($p = 0.05$). The mean HHS score was significantly higher in the PFN group (85.42 ± 5.73) than in the DHS group (79.62 ± 6.81, $p < 0.001$), indicating superior functional recovery with PFN fixation.

Table 5: Postoperative Complications

Complication	PFN Group (n=40)	DHS Group (n=40)	p-value
Infection	2 (5.00%)	3 (7.50%)	0.64
Implant Failure	1 (2.50%)	4 (10.00%)	0.18
Malunion	3 (7.50%)	6 (15.00%)	0.29
Total Complications	6 (15.00%)	13 (32.50%)	0.04

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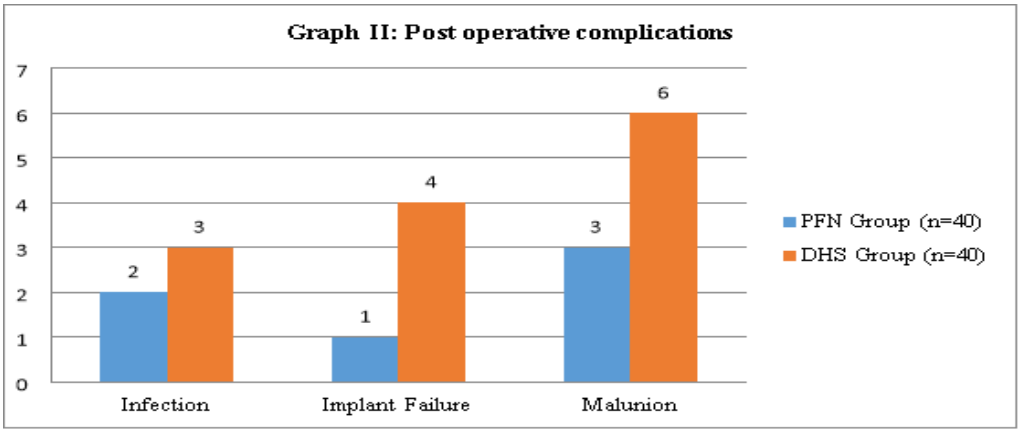

Table 5 and Graph II shows the overall incidence of postoperative complications was significantly lower in the PFN group (15%) compared to the DHS group (32.50%, p = 0.04). Infection rates were slightly lower in the PFN group (5.00%) than in the DHS group (7.50%, p = 0.64), although this difference was not statistically significant. Implant failure occurred in 2.50% of PFN cases versus 10 % in the DHS group (p = 0.18), while mal-union rates were 7.50% for PFN and 15 % for DHS (p = 0.29).

Figure 1: Pre-operative radiograph of a 54-year-old male with a left-sided type-II intertrochanteric fracture (antero-posterior view).

Figure 2: Post-operative radiographs of a 54-year-old male with a left-sided type-II intertrochanteric fracture operated on with PFN after close reduction and internal fixation (antero-posterior and lateral view).

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Figure 3: Pre-operative radiographs of a 58-year-old female with right-sided type-II intertrochanteric fracture (anteroposterior and lateral view).	Figure 4: Post-operative radiographs of a 58-year-old female with right sided type-II intertrochanteric fracture fixed with DHS after close reduction and internal fixation (Antero-posterior and lateral view).

DISCUSSION

The results of this study highlight the advantages of Proximal Femoral Nailing (PFN) over Dynamic Hip Screw (DHS) fixation in treating intertrochanteric fractures, corroborating findings from similar studies. The demographic and fracture characteristics of patients in our study were comparable between the PFN and DHS groups, ensuring a balanced comparison. The mean ages of 65.42 ± 8.15 years (PFN) and 64.75 ± 7.92 years (DHS) align with studies such as Kumar et al. (2020), which reported mean ages of 66.1 and 65.8 years for PFN and DHS groups, respectively.[10] Gender distribution was also consistent with the literature, including the study by Gupta et al. (2019), where male patients slightly outnumbered females in both groups.[9] This demographic similarity ensures that differences in outcomes are likely attributable to the fixation technique rather than patient factors. Our study found significantly shorter operative durations for PFN (58.45 ± 7.62 minutes) compared to DHS (72.38 ± 8.21 minutes, $p < 0.001$). This result is supported by the findings of Wang et al. (2019), who reported mean operative times of 57 and 73 minutes for PFN and DHS, respectively. The reduced intraoperative time with PFN can be attributed to its minimally invasive nature, avoiding the need for open reduction and extensive soft tissue dissection.[11] Intraoperative blood loss was also significantly lower in the PFN group (118.35 ± 15.42 mL) compared to the DHS group (190.52 ± 20.47 mL, $p < 0.001$). Similar results were observed in the study by Sharma et al. (2018), which reported mean blood losses of 120 mL for PFN and 190 mL for DHS. The smaller incision and less invasive approach in PFN contribute to this difference.[12] Hospital stays were shorter for PFN patients (5.12 ± 1.03 days) than for DHS patients (6.75 ± 1.28 days, $p < 0.001$). Shorter hospitalizations with PFN are consistent with studies by Sharma et al. (2018), which demonstrated faster recovery and earlier mobilization in PFN-treated patients.[12]

The PFN group demonstrated faster fracture union, with 75.00% achieving union within 12 weeks compared to 50.00% in the DHS group ($p = 0.02$). The mean union time was also shorter for PFN (11.28 ± 1.75 weeks) compared to DHS (12.85 ± 2.04 weeks, $p = 0.01$). These findings align with the results of Zeng et al. (2019), who reported union times of 11.5 weeks for PFN and 13.2 weeks for DHS. The biomechanical stability of intramedullary fixation with PFN likely facilitates earlier healing.[13]

At six months postoperatively, functional outcomes, as measured by the Harris Hip Score (HHS), were significantly better in the PFN group. The proportion of patients with "Excellent" outcomes (HHS 90–100) was higher in the PFN group (45.00%) than in the DHS group (25.00%, $p = 0.04$). The mean HHS score was also significantly higher for PFN (85.42 ± 5.73) compared to DHS (79.62 ± 6.81, $p < 0.001$). These results are consistent with the study by Mishra et al. (2021), where PFN-treated patients had a mean HHS of 86.0, compared to 78.5 for DHS. The superior functional recovery with PFN may be attributed to its ability to provide stable fixation with minimal soft tissue disruption.[14] The overall complication rate was significantly lower in the PFN group (15.00%) compared to the DHS group (32.50%, $p = 0.04$). While infection rates and mal-union were slightly higher in the DHS group, these differences were not statistically significant. However, implant failure was more common in the DHS group (10.00% vs. 2.50% in PFN). A meta-analysis by Parker et al. (2020) similarly reported lower complication rates with PFN (14%) than DHS (30%).[15]

LIMITATIONS OF THE STUDY: The shortcomings of the study are the small sample size and the study was conducted at a single centre. The study may not account for differences in postsurgical rehabilitation or pre-existing medical conditions.

CONCLUSION

In conclusion, this study demonstrated that Proximal Femoral Nailing (PFN) offers significant advantages over Dynamic Hip Screw (DHS) fixation in the treatment of intertrochanteric fractures, particularly in terms of shorter operative duration, reduced blood loss, faster fracture union, and superior functional

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outcomes. PFN also showed a lower overall complication rate compared to DHS. While both techniques are effective, PFN appears to be the preferred choice, especially for unstable fracture patterns and patients requiring faster recovery.

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