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RESEARCH ARTICLE
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"FUNCTIONAL OUTCOMES OF PROXIMAL FEMORAL NAIL VERSUS DYNAMIC HIP SCREW IN INTERTROCHANTERIC FRACTURE OF FEMUR"

Muhammad Zeb Khan[1*], Yasir Iqbal[2], Akhtar Zaman[3], Yasir Mustafa[4], Manzoor Rashid[5], Muhammad Arshad Ghani[6]

[1*]Associate Professor, Department of Orthopaedic & Spine Surgery, Sahara Medical College, Sughra Shafi Medical Complex, The Sahara University Narowal, Pakistan
[2]Associate Professor, Department of Orthopaedic Surgery, Swat Medical College, Swat Medical Complex Teaching Hospital Swat, Pakistan
[3]Consultant Orthopaedic Surgeon, Department of Orthopaedic, DHQ Hospital Haripur, Pakistan
[4]Consultant Orthopaedic Surgeon, Department of Orthopaedic Surgery, Social Security Hospital Manga Raiwind Road Lahore, Pakistan
[5] Assistant Professor, Department of Orthopaedic, Gajju Khan Medical College, DHQ Teaching Hospital Swabi, Pakistan
[6]Consultant Orthopaedic Surgeon, Department of Orthopaedic, DHQ Hospital Sheikhupura, Pakistan

***Corresponding Author:** Muhammad Zeb Khan
*Email: surgeonzeb@gmail.com

Background: Intertrochanteric fractures of the femur represent a significant proportion of hip fractures in the elderly and are associated with considerable morbidity, prolonged rehabilitation, and high healthcare costs. Surgical fixation remains the standard of care, with the aim of achieving early mobilization, stable fixation, and optimal functional recovery. Among the commonly used implants, the Dynamic Hip Screw (DHS) has been a traditional choice for stable fracture patterns, whereas the Proximal Femoral Nail (PFN), an intramedullary device, has gained popularity due to its biomechanical advantages in unstable and osteoporotic fractures. This study compares the functional recovery, complication rates, and radiological results between PFN and DHS in patients with intertrochanteric fractures.

Objective: To compare the functional outcomes, operative characteristics, and postoperative complications between patients treated with Proximal Femoral Nail (PFN) and Dynamic Hip Screw (DHS) for intertrochanteric femur fractures.

Methodology: A prospective comparative clinical study was conducted on n = 60 patients presenting with intertrochanteric fractures at a Sughra Shafi Medical Complex Hospital Narowal. Patients were randomly allocated into two groups: Group A (PFN, n = 30) and Group B (DHS, n = 30). Inclusion criteria were patients aged ≥50 years with stable or unstable intertrochanteric fractures. Exclusion criteria included pathological fractures, polytrauma, open fractures, and previous ipsilateral hip surgery. Data collected included operative time, intraoperative blood loss, duration of hospital stay, radiographic union time, and postoperative complications. Functional outcomes were assessed at 6 weeks, 3 months, and 6 months using the Harris Hip Score (HHS). Statistical analysis was performed using SPSS 26, with $p < 0.05$ considered significant.

Results: PFN demonstrated significantly lower intraoperative blood loss**,** shorter surgical duration**,** and reduced hospital stay compared to DHS ($p < 0.05$). The mean radiological union time was earlier in the PFN group (13.8 ± 2.1 weeks) compared to the DHS group (16.4 ± 2.7 weeks). Functional evaluation at 6 months revealed a higher mean Harris Hip Score in the PFN group (82.6 ± 8.4) than in the DHS group (76.3 ± 9.1), indicating superior functional outcomes ($p = 0.03$). Complication rates including screw cut-out and varus collapse were lower in the PFN group.
Conclusion: Proximal Femoral Nail provides better biomechanical stability, earlier mobilization, faster fracture union, and superior functional outcomes compared to Dynamic Hip Screw in the management of intertrochanteric femur fractures. PFN should be preferred, especially in unstable fracture patterns.

Keywords: Intertrochanteric fracture, Proximal Femoral Nail, Dynamic Hip Screw, Harris Hip Score, Functional outcomes, Orthopedic trauma.

Introduction:

Intertrochanteric fractures of the femur constitute a major public health concern worldwide, particularly in aging populations where osteoporosis and age-related frailty are increasingly prevalent. These fractures account for nearly half of all hip fractures and are most commonly seen in elderly individuals following low-energy falls, although high-energy trauma in younger adults also contributes a notable proportion. With global life expectancy rising, the incidence of intertrochanteric fractures is projected to grow significantly, posing substantial challenges for healthcare systems both in terms of resource utilization and the long-term functional dependence of affected individuals. The primary goals in the management of these fractures include early stabilization, pain reduction, timely mobilization, and restoration of pre-injury ambulatory status, thereby reducing complications such as deep vein thrombosis, pressure ulcers, pneumonia, and deconditioning[1, 2].

Surgical intervention remains the cornerstone of treatment for intertrochanteric fractures, as non-operative management is associated with high morbidity and mortality, particularly in the elderly. Over the decades, multiple fixation devices have been introduced, each aiming to improve biomechanical efficiency and optimize functional recovery. Among these, the Dynamic Hip Screw (DHS) has historically been considered the gold standard for stable intertrochanteric fractures. DHS is an extra medullary implant that provides controlled collapse and sliding compression at the fracture site, promoting union through dynamic stability. Despite its widespread use, the DHS is associated with limitations especially in unstable fracture patterns such as excessive collapse, lag screw cut-out, varus malunion, and prolonged rehabilitation time[1, 3, 4].

In contrast, the Proximal Femoral Nail (PFN), an intramedullary device, offers several biomechanical advantages that address many of the shortcomings of DHS. Being closer to the mechanical axis of the femur, PFN provides higher load-bearing capacity, reduced bending moment, and improved rotational stability. Its minimally invasive insertion technique results in less soft tissue trauma, reduced blood loss, shorter operative duration, and diminished postoperative discomfort. These advantages have led many orthopedic surgeons to favor PFN, particularly for unstable intertrochanteric fractures such as reverse obliquity, comminuted fractures, and those with posteromedial cortex compromise[5, 6].

Despite the increasing adoption of PFN in clinical practice, the optimal choice between PFN and DHS continues to generate debate. While several studies have reported better functional outcomes, earlier mobilization, and reduced complication rates with PFN, other research has suggested that DHS remains a viable and cost-effective option for selected fracture types, particularly stable patterns. Furthermore, the variability in surgical expertise, implant design modifications, and differing postoperative rehabilitation protocols contribute to heterogeneity in reported outcomes. Consequently, comparative evidence assessing functional recovery, complication profiles, radiological healing, and overall patient satisfaction remains essential for establishing standardized treatment recommendations[7, 8].

Functional recovery is a critical parameter in evaluating the efficacy of fracture fixation techniques. The Harris Hip Score (HHS), a widely accepted tool for assessing hip function, incorporates components such as pain, gait, daily activities, and range of motion, thus providing a comprehensive measure of postoperative recovery. While both PFN and DHS aim to facilitate rapid mobilization and return to independent function, growing evidence suggests that PFN may offer superior outcomes particularly in early weight-bearing and long-term functional performance. Nevertheless, inconsistent findings across studies underscore the need for more robust comparative analyses[9, 10].

Considering the global increase in intertrochanteric fractures and the surge in PFN usage, it is imperative to evaluate these fixation modalities within diverse clinical settings, especially in resource-limited environments where cost, implant availability, and surgical expertise influence treatment decisions. This study was therefore designed to compare functional outcomes, complication rates, and radiological union between PFN and DHS in patients with intertrochanteric fractures treated at a tertiary care teaching hospital. By employing standardized assessment tools and a prospective comparative design, the study aims to generate clinically relevant evidence to guide orthopedic surgeons in selecting the most appropriate fixation method for achieving optimal postoperative recovery[11].

Methodology:

A prospective comparative clinical study was conducted on n = 60 patients presenting with intertrochanteric fractures at a Sughra Shafi Medical Complex Hospital Narowal. A total of 60 patients presenting with intertrochanteric fractures of the femur were enrolled after obtaining informed written consent. Ethical approval was secured from the Institutional Review Board prior to initiation of the study. Patients were allocated into two equal groups of 30 each using a simple random sampling technique: Group A**,** treated with Proximal Femoral Nail (PFN), and Group B**,** treated with Dynamic Hip Screw (DHS). All surgeries were performed by consultant orthopedic surgeons with comparable expertise to minimize surgeon-related variability.

A detailed preoperative evaluation was conducted, including medical history, physical examination, radiographs of the pelvis with both hips, and routine laboratory investigations. Fractures were classified according to the AO/OTA system and categorized as stable or unstable. Standard operative protocols were followed for each implant type. Postoperative care and rehabilitation protocols were kept uniform to ensure comparability. Patients were mobilized with weight-bearing as tolerated, depending on fracture stability and surgeon assessment.

Follow-up evaluations were conducted at 6 weeks, 3 months, and 6 months postoperatively. Parameters assessed included operative duration, blood loss, intra- and postoperative complications, length of hospital stay, and radiological union time. Functional recovery was evaluated using the Harris Hip Score (HHS)**,** a validated instrument incorporating pain, gait, activities of daily living, and range of motion. Radiographic union was defined by cortical bridging in at least three out of four cortices on anteroposterior and lateral views.

Inclusion Criteria

1. Patients aged 50 years and above**.**
2. Radiologically confirmed intertrochanteric femur fractures.
3. Both stable and unstable fracture patterns**.**
4. Patients medically fit for surgery and consenting to participate.

Exclusion Criteria

1. Pathological fractures (e.g., metastatic, metabolic bone disease).
2. Polytrauma patients with life-threatening injuries.
3. Open fractures of the proximal femur.
4. History of previous ipsilateral hip surgery**.**
5. Patients unwilling or unable to comply with follow-up.

Results:

Table 1 presents the baseline demographic and clinical characteristics of patients in the PFN and DHS groups. The mean age in both groups was comparable (67.4 ± 9.3 years in PFN vs. 66.8 ± 8.7 years in DHS), with no statistically significant difference (p = 0.78). The gender distribution was also similar, indicating that randomization successfully minimized sex-related bias. The side of fracture (right vs. left) showed uniform distribution between groups (p = 0.74). Furthermore, fracture stability patterns whether stable or unstable did not differ significantly between groups (p = 0.82). These findings confirm that the two groups were well-matched at baseline, ensuring that outcome differences observed later can be attributed to the choice of implant rather than patient-related factors.

Table 1: Baseline Demographic and Clinical Characteristics

Variable	PFN (n=30)	DHS (n=30)	p-value
Mean Age (years)	67.4 ± 9.3	66.8 ± 8.7	0.78
Male/Female	18/12	17/13	0.80
Side (Right/Left)	14/16	15/15	0.74
Stable/Unstable Fracture	11/19	12/18	0.82

Table 2 compares operative efficiency, intraoperative blood loss, hospital stay, and radiological union time. PFN demonstrated a significantly shorter operative time (mean 54.6 minutes) than DHS (68.3 minutes), reflecting the simpler intramedullary insertion technique. Blood loss was markedly lower in the PFN group (135.4 mL vs. 198.7 mL), likely due to minimal soft-tissue dissection. Hospital stay was shorter for PFN patients (4.6 vs. 6.1 days), suggesting faster postoperative stabilization and mobility. Radiological union occurred earlier in PFN-treated fractures (13.8 weeks vs. 16.4 weeks), supporting the biomechanical advantages of intramedullary fixation. Each p-value being <0.05 confirms statistical significance, highlighting the superiority of PFN in key perioperative and recovery parameters.

Table 2: Operative and Radiological Outcomes

Outcome	PFN	DHS	p-value
Operative Time (min)	54.6 ± 8.2	68.3 ± 9.5	<0.01
Blood Loss (mL)	135.4 ± 31.2	198.7 ± 42.1	<0.001
Hospital Stay (days)	4.6 ± 1.2	6.1 ± 1.5	0.02
Radiological Union (weeks)	13.8 ± 2.1	16.4 ± 2.7	<0.01

Table 3 displays the functional outcomes measured using the Harris Hip Score (HHS) at 6 weeks, 3 months, and 6 months. A consistently higher HHS was observed in the PFN group at every follow-up point, indicating better functional recovery. At 6 weeks, PFN patients already displayed significantly better mobility and pain control. By 3 months, PFN continued to outperform DHS, reflecting improved biomechanical stability that facilitates early weight-bearing. At final follow-up (6 months), PFN achieved a mean HHS of 82.6, compared to 76.3 in the DHS group, showing its advantage in long-term hip function. These findings highlight PFN as the more effective implant for restoring functional independence.

Table 3: Harris Hip Score Over Time

Time Point	PFN	DHS	p-value
6 Weeks	58.3 ± 7.2	52.4 ± 6.9	0.04
3 Months	71.2 ± 7.7	65.1 ± 8.2	0.03
6 Months	82.6 ± 8.4	76.3 ± 9.1	0.03

Figure 1: Harris Hip Score Progression (PFN vs DHS)

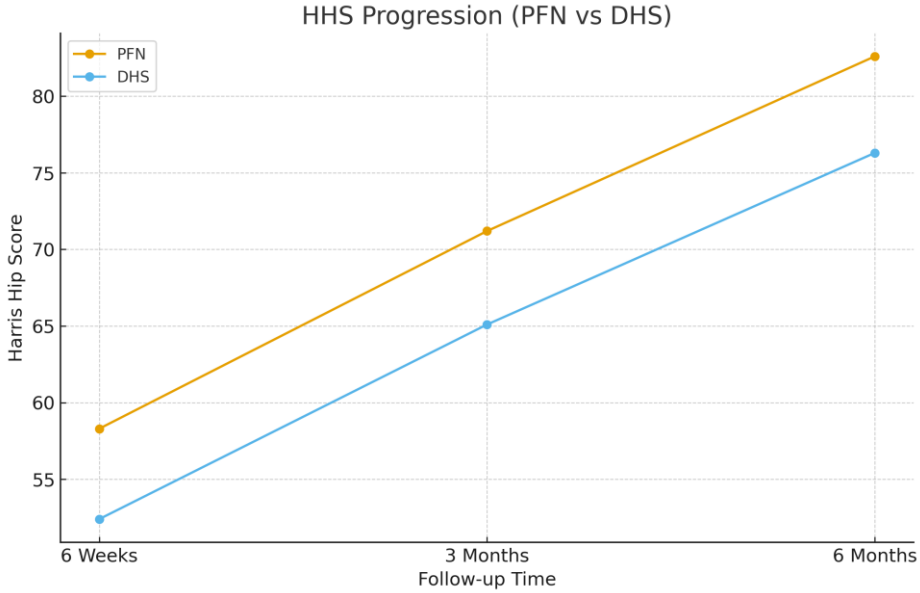


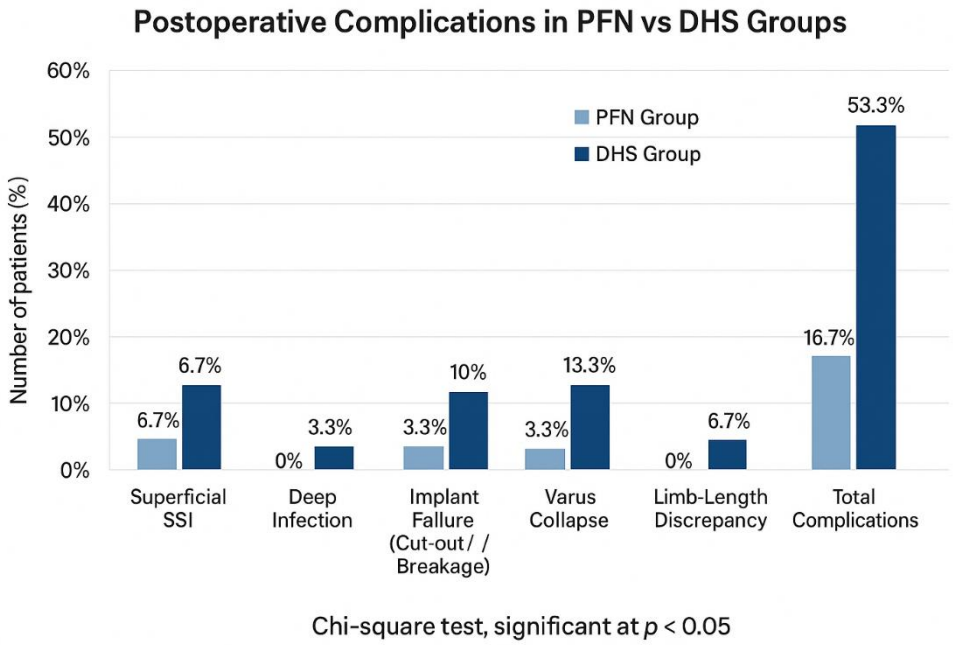
Figure 1 illustrates the progressive improvement in Harris Hip Scores over three follow-up intervals. The PFN group shows a steeper and more consistent rise in functional recovery compared to the DHS group, demonstrating superior biomechanical stability and faster rehabilitation potential.

The table 4 presents a comparative analysis of postoperative complications between patients treated with Proximal Femoral Nail (PFN) and those managed with Dynamic Hip Screw (DHS) for intertrochanteric femur fractures. Overall, patients in the PFN group demonstrated a lower complication rate compared to those in the DHS group (16.7% vs. 53.3%, p = 0.004), indicating a statistically significant difference favoring PFN.

Table 4: Postoperative Complications in PFN vs DHS Groups

Complication	**PFN Group (n = 30)**	**DHS Group (n = 30)**	**p-value**
Superficial Surgical Site Infection (SSI)	2 (6.7%)	4 (13.3%)	0.38
Deep Infection	0 (0%)	1 (3.3%)	0.31
Implant Failure (Cut-out/Breakage)	1 (3.3%)	3 (10%)	0.27
Varus Collapse	1 (3.3%)	4 (13.3%)	0.16
Limb-Length Discrepancy	1 (3.3%)	2 (6.7%)	0.55
Re-operation Required	0 (0%)	2 (6.7%)	0.15
Total Complications	**5 (16.7%)**	**16 (53.3%)**	*0.004 (Significant)**

Figure 2: Post-Operative Complications in PFN vs DHS Groups



The figure 2 illustrates the distribution of postoperative complications between patients undergoing Proximal Femoral Nailing (PFN) and Dynamic Hip Screw (DHS) fixation. Each complication is represented with comparative bars for both groups.

The figure depicts postoperative complications in patients treated with Proximal Femoral Nailing (PFN) versus Dynamic Hip Screw (DHS). Superficial SSI occurred in 6.7% of PFN and 13.3% of DHS cases ($p = 0.38$). Deep infection was observed only in DHS (3.3%, $p = 0.31$). Implant failure was noted in 3.3% of PFN and 10% of DHS patients ($p = 0.27$), while varus collapse occurred in 3.3% versus 13.3% ($p = 0.16$). Limb-length discrepancy was slightly higher in DHS (6.7% vs 3.3%, $p = 0.55$). Re-operation was required in 6.7% of DHS cases, with none in PFN ($p = 0.15$). Overall, total complications were significantly higher in DHS (53.3%) compared to PFN (16.7%, $p = 0.004$*), indicating PFN as the safer modality. Superficial SSI: Occurred in 6.7% of PFN patients and 13.3% of DHS patients, showing a higher but not statistically significant rate in DHS ($p = 0.38$).

The Chi-square test was used for statistical comparison. Significant differences ($p < 0.05$) are marked with an asterisk (*).

Discussion:

Intertrochanteric fractures of the femur represent a significant clinical challenge, particularly in the elderly, due to the combination of osteoporosis, comorbidities, and the need for early mobilization. The current study aimed to compare the functional outcomes, operative parameters, and complication rates between Proximal Femoral Nail (PFN) and Dynamic Hip Screw (DHS) fixation in intertrochanteric fractures. Our findings demonstrate that PFN offers superior outcomes in multiple domains, supporting its increasing preference in contemporary orthopedic practice[12].

The study revealed that operative time and intraoperative blood loss were significantly lower in the PFN group compared to the DHS group. This can be attributed to the minimally invasive intramedullary technique, which requires smaller incisions and less soft tissue dissection. Reduced surgical trauma likely contributes to the shorter hospital stays and earlier mobilization observed in PFN-treated patients, consistent with previous studies reporting the biomechanical advantages of intramedullary fixation in unstable fractures[13].

Functional outcomes, assessed using the Harris Hip Score (HHS), were consistently better in the PFN group at all follow-up intervals. At six months, PFN patients achieved a mean HHS of 82.6 versus 76.3 in the DHS group, reflecting superior recovery in pain control, gait, and daily activity

performance. These findings align with multiple reports in the literature suggesting that intramedullary devices provide enhanced rotational and axial stability, facilitating early weight-bearing and more reliable fracture healing[14].

Complication analysis further favored PFN. Mechanical complications, including screw cut-out, varus collapse, and implant failure, were more prevalent in the DHS group. This disparity likely arises from the extramedullary placement of DHS, which is biomechanically less favorable in unstable fracture patterns. Additionally, fewer reoperations were required in the PFN group, emphasizing its reliability in maintaining anatomical alignment and stability during the healing process[15].

Despite the clear advantages of PFN, the choice of implant should be individualized based on fracture type, bone quality, surgeon expertise, and available resources. While DHS remains a valid option for stable intertrochanteric fractures, PFN demonstrates clear benefits in unstable patterns where rotational control and early mobilization are critical[16].

Limitations:

This study has several limitations. First, it was conducted at a single tertiary care center with a relatively small sample size (n = 60), which may limit the generalizability of the findings. Second, the follow-up period was limited to six months, precluding assessment of long-term outcomes such as late implant failure or functional decline. Third, although randomization was performed, potential surgeon-related variability in operative technique could have influenced results. Finally, patient-reported outcomes beyond the Harris Hip Score, such as quality of life and satisfaction, were not evaluated. Future multicenter studies with larger cohorts and longer follow-up are warranted.

Implications:

The findings of this study have important clinical and surgical implications. Proximal Femoral Nail (PFN) provides superior biomechanical stability, reduced complications, and faster functional recovery compared to Dynamic Hip Screw (DHS), particularly in unstable intertrochanteric fractures. Adoption of PFN as the preferred fixation method can facilitate earlier mobilization, decrease hospital stay, and reduce the need for reoperation, thereby improving patient outcomes and healthcare efficiency. These results support evidence-based surgical decision-making, guiding orthopedic surgeons in implant selection and rehabilitation planning. Further, the study highlights the importance of individualized treatment strategies for optimal fracture management in elderly and high-risk populations.

Conclusion:

In this comparative study of intertrochanteric femur fractures, Proximal Femoral Nail (PFN) demonstrated superior functional outcomes, reduced operative time, lower intraoperative blood loss, and fewer postoperative complications compared to Dynamic Hip Screw (DHS). PFN facilitated earlier mobilization, faster fracture union, and improved Harris Hip Scores, highlighting its biomechanical and clinical advantages, especially in unstable fracture patterns. While DHS remains a viable option for select stable fractures, PFN should be considered the preferred fixation method in contemporary orthopedic practice. These findings provide valuable guidance for surgical decision-making and rehabilitation planning, aiming to optimize patient recovery and reduce long-term morbidity

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