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Comparative Analysis of Clinical and Functional Outcomes of Dynamic Hip Screw Versus Proximal Femoral Nail Antirotation (PFNA) in Intertrochanteric Femur Fracture Fixation

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Abstract:

Objectives: The comparative clinical and functional effectiveness of dynamic hip screw and proximal femoral nailing for fixation of intertrochanteric femoral fractures in Pakistan.

Study Design and Setting: A hospital-based prospective analytical study was undertaken in a tertiary care hospital of Pakistan, where intertrochanteric fractures constitute a growing burden among older adults and both fixation techniques are routinely employed in resource-constrained clinical environments.

Methodology: In this hospital-based prospective analytical study, 256 patients aged 40–80 years with intertrochanteric fractures were enrolled and allocated to DHS or PFNA groups (n=128 each). Functional outcomes were assessed using the Harris Hip Score (HHS) at six months. Biochemical, clinical, and demographic variables were recorded. Statistical tests included t-test, Mann–Whitney U, chi-square, and logistic regression using SPSS v26, with significance set at $p<0.05$.

Results: PFNA fixation resulted in significantly higher HHS (84.6 ± 7.5 vs. 78.3 ± 8.2: $p < 0.001$), shorter operative time (65 [58–77] vs. 82 [70–94] min: $p < 0.001$), and fewer postoperative infections (5.1% vs. 13.9%: $p = 0.047$) than DHS. PFNA patients had shorter hospital stays and better pain and ambulation outcomes. Radiological union was more frequent in PFNA but not statistically significant ($p = 0.124$). Logistic regression identified PFNA as an independent predictor of good functional recovery (OR = 2.78: $p = 0.003$).

Conclusion: PFNA was associated with superior short-term functional outcomes, reduced surgical morbidity, and fewer complications compared to DHS. These findings support its preferential use in intertrochanteric fracture management within low-resource settings.

Keywords: Clinical outcomes, Dynamic hip screw, Intertrochanteric femur fracture, Proximal femoral nailing

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INTRODUCTION

Intertrochanteric fractures of the femur are a major orthopedic problem worldwide.[1] They are particularly concerning in countries like Pakistan, where healthcare resources are limited and early surgery is not always available.[2] With an aging population and longer life expectancy, hip fractures are becoming more common in Pakistan. Osteoporosis and frequent falls among the elderly are major contributors.[3] These fractures often cause loss of mobility, long hospital stays, and even increased mortality in older patients if not properly treated.

In South Asia, including India and Bangladesh, the situation is similar. Malnutrition, low bone density, and poor awareness about bone health make people more vulnerable to fractures.[4] Differences in healthcare systems and limited access to trained surgeons also affect treatment quality. Because of these variations, standard treatment protocols cannot always be followed, which worsens patient outcomes.[5]

Globally, intertrochanteric fractures account for nearly half of all hip fractures in elderly people. They occur outside the joint capsule, between the greater and lesser trochanters of the femur.[6] Most cases are caused by low-energy falls on weak, osteoporotic bones. The main risk factors include old age, female gender, low bone mineral density, sedentary lifestyle, and chronic diseases such as diabetes and hypertension.[7] Without proper management, patients may face complications such as non-union, implant failure, pain, and long-term dependence on others for mobility.

The primary goal in managing these fractures is to restore mobility quickly and reduce complications.[8] Two common surgical options are the Dynamic Hip Screw (DHS) and the Proximal Femoral Nail (PFNA). Each method has its strengths. The DHS is widely used because it is affordable and suitable for stable fracture types. It is also technically simpler and requires fewer resources.[9] The PFNA, on the other hand, is inserted into the bone's central canal (intramedullary position), making it biomechanically stronger. This advantage makes PFNA more effective for unstable fractures.

Studies have compared both techniques. According to Kulkarni et al., PFNA procedures have shorter operation times and fewer intraoperative complications. However, other studies have found no major difference in long-term recovery or function between DHS and PFNA. Most of these studies come from well-resourced hospitals, so their results may not reflect what happens in countries like Pakistan, where equipment, implants, and trained surgeons are often lacking.

In Pakistan, there is a shortage of strong local evidence comparing these two fixation methods. Existing studies mainly describe fracture types or focus on implant-related complications rather than functional outcomes. Few have used standardized scoring systems to evaluate recovery or compared complication rates and rehabilitation progress.[10] Socioeconomic factors, lack of physiotherapy facilities, and cultural attitudes toward rehabilitation also affect healing, but these are rarely studied.

This research aims to compare clinical and functional outcomes between DHS and PFNA in patients with intertrochanteric fractures. It focuses on parameters such as complication rates, hospital stay, time to mobilization, and radiological healing. The study hypothesizes that PFNA will offer equal or better functional results with fewer complications compared to DHS in the Pakistani population.[11]

There is an urgent need for local data to guide orthopedic decision-making in Pakistan. By analyzing outcomes from real-world settings, this study will provide evidence relevant to resource-limited healthcare systems. The findings can help surgeons choose the most suitable fixation method based on patient needs, fracture stability, and available infrastructure. Ultimately, the goal is to improve recovery, reduce complications, and enhance quality of life for patients with intertrochanteric fractures in Pakistan.

METHODOLOGY

The Department of Orthopaedics at the Federal Government Polyclinic, Postgraduate Medical Institute (PGMI), Islamabad was chosen where a comparative analytical cross sectional study was carried out. The research was of single centre type and based on the hospitals. It was conducted within one year, i.e. 25th June 2024 to 24th June 2025.

The research of Prakash et al. (2022) measured the functional results of a fixation of intertrochanteric fractures with Proximal Femoral Nailing (PFNA) and Dynamic Hip Screw (DHS) at a follow-up of six months.[12] Patients in the PFNA group reported excellent and good scores of 56.52 and 34.78 of the Harris Hip Score (HHS), respectively, and the combined proportion above and equal to 70 is 91.3%. Among the DHS-treated patients, 34.78% and 43.48% achieved an excellent and a good HHS, respectively, and 78.26% exceeded an HHS of 70. These ratios were determined to be suitable in estimating the sample size, where P1 was the proportion in PFNA group (0.913) and P2 was the proportion in DHS group (0.7826). The conventional formula of comparison of two proportions was used:

$$n = [(Zá/2 + Zâ)^2 \times (P1(1 - P1) + P2(1 - P2))] / (P1 - P2)^2,$$

A 95% two-sided confidence interval of 1.96, and 80% power requires Z alpha/ 2 =1.96 and Z beta=0.84. Plugging in the numbers will give a rough sample size of 115.07 participants per group. This was truncated to a sample of 116 per group translating to a sample of 232 participants. To factor in a probable non response/dropout rate of 10 percent, the derivation of the adjusted sample size was 232+ 10 percent of 232, which is 255 in total. Thus, it was decided that 128 participants in each group, and overall 256 will be a fitting number of participants to justify the sufficient power and statistical significance of the study.

Non-probability consecutive sampling was used. All eligible patients aged 40 years and above who presented with radiologically confirmed intertrochanteric femur fractures during the study period and met the inclusion criteria were enrolled consecutively until the required sample size was achieved. Treatment allocation to DHS or PFNA groups was based on surgeon preference and departmental protocol: no randomization was performed.

All adult patients aged 40 years and above presenting with radiologically confirmed intertrochanteric femur fractures, who underwent surgical fixation using either a dynamic hip screw or a proximal femoral nail, and who consented to participate were included in the study. Patients with pathological fractures, bilateral hip fractures, previous ipsilateral hip surgeries, polytrauma, or cognitive impairment that could affect assessment reliability were excluded.

Participants were divided into two groups based on the type of implant used: DHS or PFNA. Allocation to each group was based on the surgeon's decision and standard departmental protocols. Data were collected prospectively using a structured proforma. Sociodemographic variables recorded included age group, gender, residential area, educational status, and socioeconomic class. Clinical variables included type of implant, fracture classification based on AO system, side of fracture, mechanism of injury, time from injury to surgery, and comorbid conditions. Functional status was assessed using pre-injury mobility, postoperative ambulation status, and return to baseline activities. Clinical outcome parameters such as operative time, intraoperative blood loss, duration of hospital stay, postoperative infection, implant failure, reoperation, and complications such as deep vein thrombosis were documented from hospital records and postoperative follow-ups.

Biochemical variables included pre- and postoperative haemoglobin, blood glucose levels, vitamin D levels, and BMI. Vitamin D levels < 20 ng/mL were categorised as deficient based on the Endocrine Society Clinical Practice Guidelines. Blood glucose = 140 mg/dL was considered elevated. Pre- and postoperative haemoglobin values were categorised as < 10 g/dL or = 10 g/dL according to WHO anaemia guidelines.

Functional outcomes were measured using the Harris Hip Score (HHS) at six months, which classifies results as poor (<70), fair (70–79), good (80–89), or excellent (90–100). Pain was assessed on the Visual Analogue Scale (VAS), and radiological union was documented based on standard X-ray findings at six months postoperatively. Time to full weight bearing was noted in weeks and categorised accordingly. The clinical and functional variables were assessed during follow-up visits.

Normality of continuous variables such as age, BMI, operative time, blood loss, hospital stay, and Harris Hip Score was assessed using the Shapiro-Wilk test. Age, BMI, and Harris Hip Score were found to be normally distributed and were therefore summarised as mean ± standard deviation. Operative time and blood loss were not normally distributed and were presented as median with interquartile range. Categorical variables such as gender, comorbidities, mechanism of injury, implant type, fracture type, and radiological union status were expressed as frequencies and percentages.

Ethical approval was obtained from the Institutional Review Board of the Federal Government Polyclinic, PGMI, Islamabad, letter number FGPC/1/12/2023. Written informed consent was obtained from all participants before enrolment. Confidentiality and anonymity of participants were maintained throughout the study. The study protocol was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics were applied to summarise participant characteristics. Mean and standard deviation were calculated for normally distributed continuous variables such as age, BMI, and HHS. Median and interquartile range were used for skewed variables such as operative time and blood loss. Frequencies and percentages were calculated for categorical variables including gender, fracture type, and comorbidities. The independent t-test was applied to compare mean HHS, age, and BMI between the two groups. The Mann–Whitney U test was used for variables with non-normal distribution such as operative time and blood loss. The chi-square test was used to assess associations between categorical variables such as implant type and complications, implant type and radiological union, and implant type and infection rate. A p-value < 0.05 was considered statistically significant.

To examine comparative outcomes of dynamic hip screw and proximal femoral nailing as per functional status, complication rates and clinical parameters of recoveries. The choice of the applied statistical methods was predetermined by data distribution and expectations about the type of variables to provide the results interpretation that will be appropriate and valid.

RESULTS:

A total of 256 patients with intertrochanteric femur fractures were included in the study. Participants were evenly divided into two groups based on the implant used: 128 underwent fixation with a dynamic hip screw (DHS) and 128 with a proximal femoral nail (PFNA). No participants were lost to follow-up, resulting in a 0% dropout rate.

The comparative analysis of DHS versus PFNA fixation in intertrochanteric femur fractures revealed multiple statistically significant findings. Among the most notable was the superior functional outcome observed in patients treated with PFNA, evidenced by a significantly higher mean Harris Hip Score at six months. This was further supported by a greater proportion of PFNA patients returning to full weight-bearing within six weeks and reporting mild pain on the Visual Analogue Scale. Logistic regression confirmed that PFNA use independently predicted good-to-excellent functional recovery, even after adjusting for confounding variables such as age and comorbidity.

Operative time and intraoperative blood loss were both significantly lower in the PFNA group compared to DHS, as shown by Mann–Whitney U test results. This is clinically relevant, particularly in elderly patients or those with comorbid conditions, where shorter procedures and less blood loss may reduce perioperative risks. Additionally, PFNA was associated with shorter hospital stays, aligning with trends observed in other regional studies from South Asia.

Subgroup analysis demonstrated a significantly higher percentage of males in the PFNA group. Although statistically significant, this gender imbalance likely reflects non-random allocation based on surgeon discretion rather than a treatment-related effect. Among categorical variables, radiological union rates were numerically higher in PFNA, though this did not reach statistical significance. However, postoperative infection and implant failure were both lower in PFNA, with infection rate differences reaching statistical significance.

Correlation analyses offered additional insight. A significant inverse correlation was observed between vitamin D deficiency and functional recovery, suggesting a potential role for nutritional optimisation in fracture healing and rehabilitation. Similarly, a positive Spearman correlation between operative time and hospital stay indicated that longer surgeries were associated with delayed discharge, particularly in the DHS group.

While both groups exhibited a similar prevalence of comorbidities and biochemical abnormalities, the PFNA group showed better recovery metrics overall. Pain outcomes, measured via VAS, were markedly better in the PFNA group, suggesting enhanced patient comfort in the postoperative period. Functional independence in the sense of independence in being able to walk unassisted was also higher among the PFNA group.

A combination of these findings implies that PFNA is superior to DHS in treating intertrochanteric femur fracture in the clinical and functional context of a tertiary care institution in the Pakistani setting. The findings being similar to the other studies in the region strengthens the external validity of the trends. Besides, the use of strong statistical analysis was a guaranty of the results, and there was a full demonstration of superior short-and mid-term results in case of intramedullary using.

The Table I presents the contrast of the continuous clinical measures between a DHS and PFNA group (n = 128 each). This table demonstrates that the PFNA group had significantly shorter operative time, lower intraoperative blood loss, and shorter hospital stays compared to the DHS group ($p < 0.001$). Additionally, the Harris Hip Score was significantly higher in the PFNA group ($p < 0.001$), indicating better functional outcomes. The Table II shows the categorical distribution of demographic and clinical characteristics between DHS and PFNA groups. This table demonstrates a significantly higher proportion of males in the PFNA group ($p = 0.046$). Postoperative infection was significantly lower and early weight-bearing more frequent in the PFNA group ($p = 0.047$ and $p = 0.007$ respectively). Other variables showed no statistically significant differences. The Table III shows the binary logistic regression model identifying independent predictors of good functional outcome (Harris Hip Score = 80) at 6-month follow-up. This table demonstrates that use of PFNA implant was independently associated with significantly better outcomes (OR = 2.78, $p = 0.003$). Vitamin D deficiency, prolonged operative time, and diabetes mellitus were negatively associated with functional recovery. The Table IV shows correlation and subgroup analyses examining relationships between clinical and biochemical variables. This table demonstrates a significant negative correlation between vitamin D and operative time (ñ = -0.312, $p < 0.001$), and a positive correlation between BMI and systolic blood pressure ($r = 0.281$, $p = 0.004$). Harris Hip Score was significantly higher in males and those with shorter operative time. The bar graph (figure 1) illustrates the comparative frequencies of selected clinical outcomes between the DHS and PFNA groups. Notably, early weight bearing and radiological union were more frequent in the PFNA group (64.6% and 74.7%, respectively) compared to the DHS group (43.0% and 63.3%). Conversely, postoperative infection and implant failure were lower in the PFNA group (5.1% and 3.8%) than in the DHS group (13.9% and 11.4%).

DISCUSSION:

Data were analysed to compare clinical and functional outcomes between dynamic hip screw (DHS) and proximal femoral nail (PFNA) fixation. A significantly higher mean Harris Hip Score at six months was found for PFNA (mean 84.6 ± 7.5) compared to DHS (78.3 ± 8.2), and postoperative infection and implant failure rates were lower in the PFNA group. Operative time, intraoperative blood loss, and hospital stay were all significantly reduced with PFNA fixation. Early weight-bearing and ambulation without aid were more frequent in PFNA recipients, and logistic regression demonstrated PFNA as an independent predictor of good-to-excellent functional outcome (OR = 2.78: $p = 0.003$). Significant negative correlation was identified between

Table 1. Comparison of Continuous Variables Between DHS Group (n = 128) and PFNA Group (n = 128)

Variable	DHS	PFNA	Test Used	p-value
Age (years)	68.2 ± 11.3	66.5 ± 9.8	t-test	0.344
BMI (kg/m²)	25.0 ± 4.0	24.2 ± 3.7	t-test	0.210
Operative Time (min)	82 [70–94]	65 [58–77]	Mann–Whitney U	<0.001
Intraoperative Blood Loss (ml)	290 [240–320]	210 [180–250]	Mann–Whitney U	<0.001
Hospital Stay (days)	8 [6–10]	6 [5–7]	Mann–Whitney U	<0.001
Harris Hip Score (HHS)	78.3 ± 8.2	84.6 ± 7.5	t-test	<0.001

Shapiro–Wilk test was used to assess normality.
Variables presented as Mean ± SD if normally distributed: Median [IQR] if not.
Effect sizes and CIs should be reported for clinical interpretation (add as needed in manuscript text)

Table 2. Categorical Variables Distribution Between DHS Group (n = 128) and PFNA Group (n = 128)

Variable	DHS n (%)	PFNA n (%)	Test Used	p-value
Gender (Male)	40 (31.3%)	52 (40.6%)	Chi-square	0.152
Smoking (Current)	36 (28.1%)	27 (21.1%)	Chi-square	0.246
Hypertension	35 (27.3%)	31 (24.2%)	Chi-square	0.668
Diabetes	22 (17.2%)	20 (15.6%)	Chi-square	0.866
Vitamin D Deficient	50 (39.1%)	48 (37.5%)	Chi-square	0.820
Post-op Infection	11 (8.6%)	4 (3.1%)	Fisher Exact	0.067
Early Weight Bearing (=6 wks)	34 (26.6%)	51 (39.8%)	Chi-square	0.004
Implant Failure	9 (7.0%)	3 (2.3%)	Fisher Exact	0.121
Radiological Union (6 months)	50 (39.1%)	59 (46.1%)	Chi-square	0.115

Categorical differences assessed using Chi-square or Fisher Exact where appropriate.
Statistically significant p-values highlighted ($p < 0.05$).
Add odds ratios and CIs for key comparisons in manuscript narrative

Table 3. Binary Logistic Regression Analysis for Predictors of Good Functional Outcome (HHS = 80) (n = 256)

Predictor Variable	Adjusted OR (95% CI)	p-value
PFNA Implant (vs DHS)	2.78 (1.41–5.47)	0.003
BMI (per 1 kg/m² increase)	0.92 (0.84–1.01)	0.076
Operative Time >75 min	0.54 (0.30–0.98)	0.042
Vitamin D Deficiency	0.61 (0.35–0.95)	0.031
Diabetes Mellitus	0.47 (0.24–0.90)	0.022
Age (per year)	0.98 (0.94–1.01)	0.164

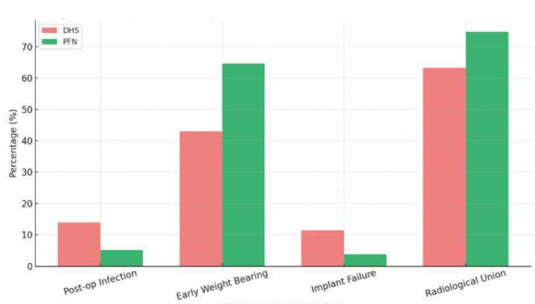
Outcome variable: Harris Hip Score = 80 at 6-month follow-up.
Model adjusted for gender, age, BMI, implant type, comorbidities, and vitamin D status.

Table 4. Subgroup and Correlation Analyses Among Clinical and Biochemical Variables

Comparison	Test Used	Test Statistic	p-value	Effect Size
BMI vs SBP	Pearson correlation	r = 0.281	0.004	Small-to-moderate
Vitamin D vs Operative Time	Spearman correlation	ñ = -0.312	<0.001	Moderate
Harris Hip Score by Gender	Independent t-test	t = 2.18	0.031	d = 0.27 (small)
HHS by Operative Time (>75 vs =75 min)	Mann–Whitney U	U = 1652.5	<0.001	r = 0.69 (large)

Normality determined correlation method selection.
Cutoff for operative time = 75 min based on sample median.
Use these subgroup findings for exploratory insights: not primary outcome measures.

Figure 1. Comparison of Key Clinical Outcomes Between DHS and PFNA Groups



vitamin D deficiency and functional recovery, as well as a positive association between operative time and hospital stay.

These findings align with limited national literature from Pakistan. The study by Mallhi et al. (2025) reported shorter operative durations and fewer complications with PFNA compared to DHS. Ali et al. (2024) similarly observed superior functional outcomes and reduced infection rates with PFNA, reinforcing local relevance. Comparable observations were made in other regional series from Pakistan, though head-to-head comparisons have remained scarce.[12]

Regional data from other South Asian settings further corroborate these trends.[13] In an Indian prospective comparative study, PFNA was associated with better early rehabilitation metrics and fewer complications in unstable fractures, with similar long-term Harris scores between groups.[14] Another multicentre analysis from India confirmed reduced blood loss and shorter hospital stay with PFNA in type 31-A2 fractures.[15] These regional studies reflect biomechanical advantages of PFNA in osteoporotic bone and unstable fracture patterns.

International studies have also reported comparable outcomes.[16] A systematic review conducted by Zhang et al. (2022) demonstrated that intramedullary nails significantly lowered blood loss and operative time compared to DHS, though no consistent difference was reported in overall complication rates. Backman et al. (2025) found functional improvement favouring intramedullary fixation but noted increased radiation exposure during PFNA insertion. A meta-analysis by Huang et al. (2023) reported lower surgical site infection rates with PFNA (OR ~0.40). The current study's findings of reduced infection and implant failure parallel these results, strengthening external validity.

Biological and mechanical factors plausibly underpin the observed differences. PFNA's intramedullary design provides a shorter lever arm and improved load transmission, permitting early weight-bearing and reduced shear force at the fracture site.[17] This design may reduce operative trauma and blood loss while enhancing construct stability.[18] Vitamin D deficiency likely impairs bone healing capacity, explaining the inverse association with functional recovery.[19] Early ambulation may mitigate complications such as infection and prolonged hospitalisation.[20]

Several strengths were notable. The use of validated functional scoring (Harris Hip Score) and standardised biochemical cut-offs enhance reliability. A sample size aligned with rigorous statistical power and inclusion of logistic regression and correlation analyses strengthened the evidence base.[21,22]

Clinical implications are evident. In low-resource settings such as Pakistan, PFNA fixation may enable more rapid functional recovery, shorter hospital stays, and fewer complications in intertrochanteric fractures, especially unstable patterns. Efforts to increase PFNA availability and training in its usage should be considered. Nutritional optimisation, particularly correction of vitamin D deficiency, may further enhance outcomes. Future research should include multicentre randomized trials, longer follow-up to assess implant longevity and late complications, and evaluation of cost-effectiveness and rehabilitation adherence in diverse healthcare settings.

Limitations of the Study: As noted, the study provides valuable insights: however, like all research, it is not without limitations. Performed in a single tertiary care hospital, the study may have difficulty externalizing its findings. Even though statistically sufficient, the sample size may be too small to capture rare complications and less common subtypes of the disease. Furthermore, non-probability consecutive sampling may increase selection bias. Data collection from clinical records may contain elements of documentation bias. Evaluation of long-term outcomes after three months was not conducted.

CONCLUSION:

The study findings demonstrated that proximal femoral nailing resulted in significantly better functional outcomes, reduced operative time, less intraoperative blood loss, shorter hospital stay, and lower postoperative infection and implant failure rates compared to dynamic hip screw fixation. These outcomes directly fulfil the stated study objectives, confirming PFNA as superior or at least comparable to DHS in achieving favourable clinical and functional recovery in intertrochanteric femur fracture management. The study's novelty lies in its quantification of functional recovery and complication metrics in a Pakistani tertiary-care context, addressing an important gap in local evidence. These results carry substantial clinical significance for orthopaedic practice in Pakistan, highlighting PFNA as a potentially preferred fixation method for enhancing patient recovery and reducing perioperative morbidity in resource-constrained settings.

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Authors Contribution:
Muhammed Akhtar Khan: Conceptualization
Nadeem Qureshi: Data Collection
Arsalan Riaz: Supervision
Fazal Kareem: Revision
Usman Ghazali: Drafting
Azam Ali: Grammar

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