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ORIGINAL ARTICLE

# Comparison of functional outcomes of Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN) in elderly patients presenting with intertrochanteric femur fracture.

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**ABSTRACT… Objective:** To evaluate and compare the functional outcomes and perioperative metrics of Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN) fixation in elderly individuals with intertrochanteric femoral fractures. **Study Design:** Prospective, Observational Comparative study. **Setting:** Department of Orthopaedic, Ziauddin Hospital, Karachi. **Period:** August 2022 and February 2023. **Methods:** One hundred patients aged 60 years or older with OTA/AO type 31-A1 and 31-A2 intertrochanteric fractures were enrolled and divided equally into DHS and PFN groups. Patients with pathological fractures, high-energy trauma, or severe cognitive impairment were excluded. Surgeries were performed within 72 hours using standardized operative protocols. The primary endpoint was functional recovery at 6 months, assessed using the Harris Hip Score (HHS). Secondary variables included intraoperative parameters, hospital stay duration, time to mobilization, fracture healing time, and postoperative complications. **Results:** The PFN group demonstrated a shorter operative time, reduced blood loss, and earlier mobilization ($p<0.001$). Mean HHS at 6 months was significantly higher in the PFN cohort (85.8 ± 6.6) compared to DHS (80.9 ± 6.9, $p<0.001$). Excellent outcomes were more frequent in PFN (32%) than DHS (12%). Screw cut-out was seen only in the DHS group (10%, $p = 0.022$). **Conclusion:** PFN fixation provides superior early functional results and fewer mechanical complications compared to DHS in elderly patients with intertrochanteric fractures.

**Key words:** Dynamic Hip Screw, Elderly Patients, Harris Hip Score, Intertrochanteric Fracture, Orthopedic Trauma, Proximal Femoral Nail.

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## INTRODUCTION

Hip fractures are a major public health issue in the elderly, causing disability, mortality, and rising costs. Global incidence has climbed in recent decades, driven by aging populations.[1,2] In GBD studies estimate annual hip fractures will approach 2.6 million by 2025 and over 4 million by 2050.[3,4] Older women are disproportionately affected due to osteoporosis, with lifetime hip fracture risks up to 15 after age 50.[1,5,6] By 2050, Asia is expected to account for nearly half of all osteoporotic hip fractures.[4]

Intertrochanteric femur fractures are among the most common injuries in the geriatric population, largely attributed to osteoporosis and low-energy falls. With a globally aging population, the incidence of such fractures is projected to rise substantially, increasing the burden on healthcare systems.[4,5] Surgical stabilization remains the preferred treatment to enable early mobilization, reduce morbidity, and lower mortality.[1]

"Two of the most frequently employed fixation methods are the Dynamic Hip Screw (DHS) and the Proximal Femoral Nail (PFN).[4] The DHS (introduced in the 1970s) is an extramedullary 135° screw-plate device that stabilizes the femur via a sliding lag screw.[7] It provides dynamic compression but can fail (e.g. screw cut-out or plate pull-off), especially in unstable patterns.[4] Intramedullary nails (PFNs) were introduced in the 1990s as a less-invasive alternative. Biomechanically, PFNs have a shorter lever arm and smaller bending moment compared to DHS.[3] The intramedullary position better resists varus collapse and may improve stability, particularly in unstable fractures.[3,4,8]

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Despite these biomechanical differences, clinical studies have reported inconsistent results comparing DHS and PFN. A recent systematic reviews report that PFN often reduces operative time and blood loss but does not significantly change union or complication rates.[4,9] Backman et al. found slightly higher Harris Hip and Parker mobility scores with nails (mean differences<1point)[9], but these small gains may lack clinical significance. Large randomized trials, including the international INSITE trial, have likewise shown equivalent outcomes: INSITE (n=850) found no difference in 1-year HHS or quality-of-life between a gamma nail and sliding hip screw.[10] Registry data are similarly mixed, with some series showing lower reoperation rates or mortality with nails in unstable fractures, while others show no survival advantage.[10,11] Hence, there is no clear consensus on which implant yields better functional recovery.

Given this uncertainty, especially in our local practice environment, we conducted an observational study comparing PFN and DHS fixation in elderly patients with intertrochanteric femur fractures. We hypothesized that PFN would provide at least equivalent, and possibly improved, 6-month Harris Hip Score (HHS) versus DHS, aligning clinical results with its theoretical biomechanical benefits."

## METHODS

A prospective observational study was conducted at the Department of Orthopaedic Surgery, Ziauddin Hospital, Karachi, over a six-month period from August 2022 to February 2023. The study protocol received approval from the institutional ethics committee (06-07-25), and informed consent was obtained from all participants or their legal representatives.

"We performed an a priori sample size calculation to ensure sufficient power to detect a clinically meaningful difference in the primary outcome i.e. the HHS at 6 months. A minimally clinically important difference of 10 points on the HHS was selected based on prior literature demonstrating that such a difference reflects meaningful functional improvement in hip fracture patients.[12] Assuming a two-sided $\alpha$=0.05 and power (1 –$\beta$)=0.80, with a standard deviation (SD) of approximately 7 derived from previously published scores in elderly hip fracture cohorts[12], the required sample size per group was estimated as 40. Allowing for a 20% rate of potential attrition or incomplete follow-up, the final sample size target was increased to 50 patients per group (total n=100).

Patients aged 60 years or older presenting with low-energy intertrochanteric femoral fractures, classified as OTA/AO types 31-A1 and 31-A2, were eligible for inclusion. Exclusion criteria were pathological fractures, polytrauma, prior surgery on the affected limb, cognitive disorders (e.g., dementia) affecting consent or compliance, and any contraindication to follow-up.

Eligible patients were allocated into two equal groups (1:1) to undergo either DHS or PFN fixation. Group assignment was based on the attending surgeon's routine practice pattern rather than randomization, maintaining an observational design with prospective follow-up. All procedures were performed by experienced orthopedic consultants within 72 hours of admission using standardized surgical techniques. The DHS group had a standard 135° sliding hip screw and side plate; the PFN group had a cephalomedullary nail (AO/ASIF type) with lag screw/antirotation screw. Both procedures followed standard surgical techniques, aiming for anatomic fracture reduction. All patients received similar perioperative antibiotics and thromboprophylaxis, and were encouraged to bear weight as tolerated postoperatively.

Patients were clinically and radiographically assessed at 6 months postoperatively. The primary outcome was functional recovery at 6 months, assessed using the HHS, a validated instrument ranging from 0 to 100, with higher scores indicating better function. included: Secondary outcomes: time to full weight bearing, time to radiological union (defined as bridging callus on three cortices on standard ap and lateral radiographs), duration of surgery, estimated intraoperative blood loss, length of hospital stay, and complications such as surgical site infection, screw cut-out, need for revision surgery, and thromboembolic events (DVT/PE).

Data were analyzed using SPSS version 25.

Continuous variables were expressed as mean±standard deviation and compared using independent samples t-tests. Categorical variables were presented as frequencies and percentages and compared using chi-square or Fisher's exact tests as appropriate. A p-value <0.05 was considered statistically significant."

## RESULTS

A total of 100 elderly patients with intertrochanteric femur fractures were enrolled, with 50 patients randomized to the DHS group and 50 to the PFN group. The mean age in the PFN group was significantly higher than in the DHS group (p=0.003). The gender distribution was comparable between the groups, with females constituting 50% of the DHS group and 58% of the PFN group (p=0.422). Notably, diabetes mellitus was significantly more prevalent in the DHS group (48%) than in the PFN group (26%; p=0.023). There were no statistically significant differences in hypertension status (p=0.159) or ASA classification (p=0.500). (Table-I)

The PFN group demonstrated statistically significant advantages in all perioperative metrics (Table-II). Mean duration of surgery was shorter in the PFN group (59.75 ± 11.03 minutes) compared to the DHS group (p=0.001). PFN fixation was also associated with significantly less intraoperative blood loss (p=0.001). Postoperatively, the PFN group had shorter hospital stays (p=0.001) and achieved earlier weight bearing (p=0.001). Additionally, the mean union time was significantly faster in the PFN group (p=0.008), respectively.

At 6-month follow-up, functional outcomes assessed via HHS favored the PFN group (Table-III). The mean HHS was significantly higher in patients treated with PFN compared to DHS (p=0.001). Categorically, a greater proportion of patients in the PFN group achieved excellent functional scores (p=0.045). While good outcomes were nearly equivalent between groups, the DHS group had more patients in the fair and poor categories.

Complication rates were generally low across both groups (Table-IV). The incidence of superficial infection was slightly higher in the DHS group compared to the PFN group, but this was not statistically significant (p=0.695). Notably, screw cut-out occurred exclusively in the DHS group (p=0.022). Revision surgery was required for one patient in the DHS group and none in the PFN group (p=0.315). Conversely, two cases of deep vein thrombosis or pulmonary embolism were observed in the PFN group, while none occurred in the DHS group (p=0.153), though this difference was not statistically significant.

**TABLE-I**

**Baseline characteristics of study participants (n=100)**

| Variable | DHS Group (n=50) | PFN Group (n=50) | P-Value |
|---|---|---|---|
| Age (years) | 72.53±6.06 | 75.90±5.16 | 0.003* |
| Gender (Female) | 25 (50) | 29 (58) | 0.422 |
| Diabetes (Yes) | 24 (48) | 13 (26) | 0.023* |
| Hypertension (Yes) | 19 (38) | 26 (52) | 0.159 |
| ASA Class I | 10 (20) | 5 (10) | 0.500 |
| ASA Class II | 11 (22) | 10 (20) | |
| ASA Class III | 16 (32) | 18 (36) | |
| ASA Class IV | 13 (26) | 17 (34) | |

Data presented as mean±SD or n (%) , *p-value<0.05

**TABLE-II**

**Operative and postoperative parameters (n=100)**

| Variable | DHS Group (n=50) | PFN Group (n=50) | P-Value |
|---|---|---|---|
| Duration of Surgery (min) | 75.15±12.63 | 59.75±11.03 | 0.001* |
| Blood Loss (ml) | 304.17±41.57 | 211.04±37.80 | 0.001* |
| Hospital Stay (days) | 7.30 ± 1.27 | 6.47 ± 0.99 | 0.001* |
| Time to Weight Bearing (days) | 5.68 ± 1.44 | 3.70 ± 0.96 | 0.001* |
| Union Time (weeks) | 11.11 ± 1.11 | 10.56 ± 0.93 | 0.008* |

Data presented as mean±SD , *p-value<0.05

| TABLE-III | | | |
|---|---|---|---|
| **Functional outcome (Harris Hip Score) at 6 Months (n=100)** | | | |
| **HHS Category** | **DHS Group (n=50)** | **PFN Group (n=50)** | **P-Value** |
| Excellent (90–100) | 6 (12.0) | 16 (32.0) | 0.045* |
| Good (80–89) | 26 (52.0) | 25 (50.0) | |
| Fair (70–79) | 17 (34.0) | 9 (18.0) | |
| Poor (<70) | 1 (2.0) | 0 (0.0) | |
| Mean HHS ± SD | 80.89 ± 6.93 | 85.83±6.56 | 0.001* |
| Data presented as n (%) , *p-value<0.05 | | | |

| TABLE-IV | | | |
|---|---|---|---|
| **Postoperative complications by treatment group (n=100)** | | | |
| **Complication** | **DHS Group (n=50)** | **PFN Group (n=50)** | **P-Value** |
| Infection | 4 (8.0%) | 3 (6.0%) | 0.695 |
| Screw Cut-out | 5 (10.0%) | 0 (0.0%) | 0.022* |
| Revision Surgery | 1 (2.0%) | 0 (0.0%) | 0.315 |
| DVT/PE | 0 (0.0%) | 2 (4.0%) | 0.153 |
| Data presented as n (%) , *p-value<0.05 | | | |

## DISCUSSION

In this prospective comparative study of elderly patients with intertrochanteric femur fractures, proximal femoral nail (PFN) fixation yielded notable advantages in perioperative outcomes, early functional recovery, and mechanical failure rates compared to dynamic hip screw (DHS) fixation over a six-month period. At 6 months, the PFN group demonstrated superior functional outcomes with a mean Harris Hip Score (HHS) of 85.8 versus 80.9 in the DHS group ($p < 0.001$), and a significantly higher proportion of "excellent" outcomes (32% vs 12%; $p = 0.045$). These results align with findings from Prakash et al., who reported significantly higher 6-month HHS values (89.3 vs 84.3) favoring PFN in an elderly cohort of 46 patients ($p = 0.023$).[13] Moreover, a comparative Indian study involving 60 patients also found higher HHS at 6 months in the PFN group, though differences ceased by 12 months. Given that clinically significant differences in HHS are defined in the 4–8 point range[14], our 5-point advantage likely represents a meaningful improvement for patients, especially during early recovery.

Our study found substantial perioperative benefits with PFN: shorter operative time (59.8 vs 75.2 minutes), reduced blood loss (211 vs 304 mL), shorter hospital stay, and earlier weight-bearing; all significant at $p=0.001$. These findings echo those of Xu et al. in a meta-analysis, confirming operative time and blood loss reductions with PFN, although they found no significant difference in long-term complications.[3] Another RCT meta-analysis of 12 studies reaffirmed shorter surgical duration and reduced intraoperative blood loss in PFN-treated patients, although DHS required less fluoroscopy.[4] These efficiencies may translate into shorter hospitalizations and reduced perioperative morbidity in elderly populations.

Notably, screw cut-out occurred in 10% of DHS patients but none in the PFN group ($p = 0.022$). This aligns with Zhang C et al. findings favoring PFN in cut-out rates and implant stability in unstable fractures.[15] While overall complication rates did not significantly differ, the significant mechanical failure disparity underscores the structural advantage of intramedullary support, particularly in osteoporotic bone where PFN better resists Varus collapse and rotational forces.

Contrary to our early functional advantages, large-scale RCTs and meta-analyses report no significant differences in 12-month HHS between PFN and DHS.[15,16] A 2024 meta-analysis examining multiple RCTs found comparable 6-month HHS outcomes (MD −3.28; 95% CI, −7.66 to 1.09; $p = 0.14$), suggesting that while PFN may enable faster early recovery, long-term results converge.[16] These findings support the notion that PFN primarily accelerates early functional recovery, but that DHS can achieve equivalent outcomes by 12 months; particularly in less frail patients or stable fracture patterns.

From a clinical standpoint, PFN offers clear benefits in early mobilization, reduced blood loss, and mechanical reliability, critical factors in elderly patients at high risk for immobility-related complications.[17] However, PFN implants come with higher costs, greater demands for surgical expertise, and increased radiation exposure during fluoroscopy.[16,18,19] In resource-limited settings where surgical infrastructure is constrained, DHS may still represent an acceptable, cost-effective option, especially for stable fractures.[20,21]

Strengths of this study include prospective design, consistent implant use, and six-month follow-up with no patient attrition. However, several limitations merit attention. This single-center, observational design lacks randomization, which may introduce selection bias. Although baseline demographics were similar, the PFN group was slightly older, which could have attenuated the observed functional benefits. Fracture stability was not stratified, limiting applicability to unstable versus stable patterns. Also, the follow-up period captures early outcomes but cannot address longer-term concerns such as implant longevity, post-traumatic arthritis, or mortality. Future research should include larger, randomized multicenter trials with stratification based on fracture stability, incorporation of quality-of-life instruments, cost-effectiveness analyses, and follow-up beyond one year.

## CONCLUSION

Proximal femoral nailing offers a statistically significant early functional advantage, reduced operative morbidity, and improved mechanical reliability over dynamic hip screw fixation for elderly patients with intertrochanteric femur fractures. These benefits, while most evident within the first six months, must be weighed against implant cost and surgical resource demands. Long-term outcomes appear similar between the two methods, suggesting implant selection should be driven by individual patient factors, fracture stability, and resource availability. High-quality RCTs with longer follow-up are necessary to refine practice guidelines and optimize outcomes across diverse settings.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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| 1 | **Asim Aziz:** Principal investigator; Study conception and design, patient recruitment, surgical procedures, data supervision, and manuscript final review. |
| 2 | **Naseem Munshi:** Study conception, surgical supervision, critical analysis of data, literature review, and manuscript editing |
| 3 | **Arham Azizi:** Data collection, operative data management, statistical analysis, and drafting of results section. |
| 4 | **Uzma Azmatullah:** Radiological evaluation, interpretation of imaging data, and contribution to discussion on union outcomes. |
| 5 | **Muhammad Hassam:** Follow-up coordination, clinical examination at follow-up visits, data entry, and formatting of tables. |
| 6 | **Muhammad Ahmad:** Literature search, referencing, figures preparation, and preparation of initial manuscript draft. |