



Comparative Analysis of Proximal Femoral Nail and Dynamic Hip Screw Fixation in Intertrochanteric Fractures: Impact on Stability and Functional Outcomes

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ABSTRACT

Background: Intertrochanteric fractures are prevalent injuries, particularly among individuals over sixty, and are often associated with osteoporotic women. The goal of modern surgical management is to expedite patient recovery while minimizing complications. This study aims to evaluate and compare functional outcomes following treatment of peritrochanteric femur fractures using Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN) techniques.

Methods: A prospective comparative study was conducted at Index Medical College Hospital and Research Centre, Indore, involving 80 adult patients with hip fractures. Patients were randomly assigned to receive either DHS or PFN treatment. Clinical data were collected, including surgical time, blood loss, and complications, and functional outcomes were assessed using the Harris Hip Score (HHS) over six months.

Results: The study included 49 males (61.3%) and 31 females (38.8%), with the majority aged 61-70 years. Surgical times were significantly longer for DHS (140.43 minutes) compared to PFN (94.93 minutes) ($p < 0.001$). Additionally, intraoperative blood loss was higher in the DHS group (223.88 ml) compared to the PFN group (114.28 ml) ($p < 0.001$). The PFN group exhibited superior improvements in HHS at multiple time points ($p < 0.001$). Complication rates were higher in the DHS group, particularly regarding pain in the lateral thigh region ($p = 0.042$).

Conclusion: Both DHS and PFN techniques yield comparable outcomes for stable intertrochanteric fractures, but PFN shows advantages in unstable fractures by promoting faster recovery and reducing complications. Overall, PFN is recommended as a superior fixation device for intertrochanteric fractures.

Keywords: Intertrochanteric fractures, Proximal Femoral Nail, Dynamic Hip Screw, Harris Hip Score, surgical outcomes, complications.

INTRODUCTION

Intertrochanteric fractures are among the most common injuries, particularly in individuals over sixty, occurring three to four times more frequently in osteoporotic women, usually resulting from minor falls. Historically, these fractures were often left untreated due to their location in the cancellous bone, which has a good blood supply, allowing natural healing without medical intervention. However, the goal of modern surgical management is to restore patients to their pre-injury state as quickly as possible.¹

Internal fixation of these fractures has been shown to improve patient comfort, facilitate nursing care, reduce hospital stays, and decrease long-term complications. For orthopedic surgeons, a major challenge in treating these fractures is achieving stability, as instability and issues with fixation often complicate recovery.²

Stability here refers to the fracture's capacity to withstand the stresses exerted by gravity and surrounding hip muscles, which can cause the fracture to shift into a varus position. The choice of implant is crucial, as it significantly influences fixation success. Sliding devices, such as the dynamic hip screw, are commonly used; however,

intramedullary implants like the proximal femoral nail are thought to offer advantages because of their placement, which reduces the lever arm and mechanical strain on the implant.³

This study seeks to validate the theoretical benefits of the proximal femoral nail over the dynamic hip screw and to evaluate its impact on patient functional outcomes. This study aimed to evaluate and compare patient outcomes following treatment for peritrochanteric femur fractures using Dynamic Hip Screw Fixation and Proximal Femoral Nail techniques. The key objectives were to (1) assess the relative healing speeds for fractures managed by each method, (2) determine the time required for radiographic union in both treatment groups, (3) examine and compare complication rates, including infection, non-union, implant cut-out, and other implant-related issues, and (4) evaluate functional recovery, focusing on mobility restoration and patient-reported outcomes following each surgical approach.

MATERIALS AND METHODS

After receiving approval from the Institutional Ethical Committee, this prospective comparative study was conducted in the Department of Orthopaedics at Index



Medical College Hospital and Research Centre in Indore. The study included 80 adult patients with hip fractures who presented to the outpatient department during the study period from September 2022 to June 2024 and met the inclusion criteria. Written informed consent was obtained from all enrolled patients after the study protocol was explained to them in their native language.

Inclusion criteria

- Age > 18 years;
- Displaced fracture;
- Peri-trochanteric femur fractures including Intertrochanteric Fracture and Subtrochanteric Fracture; and
- Dynamic hip screw is used for patients with 31A1 & 31A2

Exclusion criteria

- Age less than 18 years.
- Un-displaced fractures.
- All open fractures.
- Neglected fractures more than 4 weeks.

Methodology

The patients were randomly assigned to two study groups based on the treatment received, comprising 80 cases in total: 40 cases treated with Proximal Femoral Nail and 40 cases treated with Dynamic Hip Screw.

Clinical histories and examination data were prospectively recorded in a predesigned case record form. The outcomes of patients treated with Proximal Femoral Nail (PFN) and Dynamic Hip Screw (DHS) were evaluated using the Harris Hip Score.

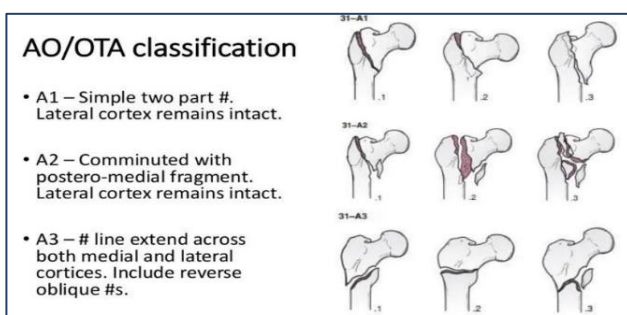


Figure 1: AO/OTA Classification of per-trochanteric fracture.

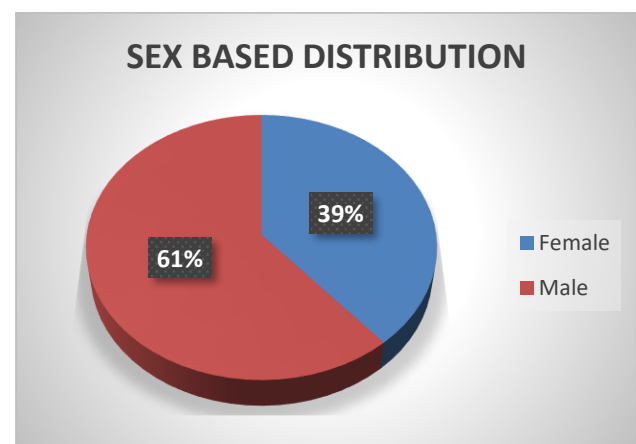
Pre-operative digital X-rays of the lower limb were taken to capture the complete length of the femur in both anteroposterior and lateral views. Surgical interventions were performed using either PFN or DHS based on the pre-operative assessment. Post-operative radiographs of the treated femur were obtained, again capturing the entire length of the bone. Patients were followed up for six months, with functional outcomes assessed at four intervals: 15 days, 1.5 months, 3 months, and 6 months.

Statistical Analysis

The data was coded and entered into Microsoft Excel 2010, and analyzed using both Excel 2010 and SPSS 20.0 for Windows. Descriptive analysis was conducted on the population, with categorical or dichotomous variables expressed as absolute values and percentages. These were compared using Pearson's chi-square test. Continuous variables with normal distribution were presented as mean (\pm SD) and compared using the Student's T-test or ANOVA test. A chi-square test was used to assess associations between variables, with a p-value of less than 0.05 considered statistically significant.

RESULTS

In the study, a total of 80 participants were included, with a gender distribution of 31 females (38.8%) and 49 males (61.3%). This indicates a higher prevalence of male patients compared to female patients among those undergoing treatment for hip fractures. (Graph 1)



Graph 1: Distribution of study participants based on Sex

The clinicodemographic distribution of the study participants showed that the majority were aged 61-70 years, and there were no significant differences in age between the groups ($P = 0.481$). The mode of injury primarily involved self-falls (64 patients), with only 16 patients injured in road traffic accidents, and again, no significant difference was noted between the groups ($P = 0.264$). Regarding AO classification, 33 patients were classified as 3-1A1 and 47 as 3-1A2, with similar distributions across both interventions. Overall, the demographic characteristics indicated comparability between the two treatment groups. ($p > 0.05$) (Table 1)

The mean surgical times for Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN) interventions, revealed a statistically significant difference ($p < 0.001$) with DHS requiring a longer mean surgical time (140.43 minutes) compared to PFN (94.93 minutes).

The comparison of intraoperative blood loss between the two surgical interventions reveals that the Dynamic Hip Screw (DHS) procedure had a statistically significant higher mean blood loss of 223.88 ml (SD = 13.228) compared to the Proximal Femoral Nail (PFN) procedure, which

exhibited a mean blood loss of 114.28 ml (SD = 11.277), with a p-value of less than 0.001. This indicates a marked difference in blood loss favoring the PFN technique. (Table 2).

Comparison of improvement in Harris Hip Score (HHS) between Dynamic Hip Screw (DHS) and Proximal Femoral Nail interventions indicates significant differences. For HHS1.5, HHS3, and HHS6, PFN demonstrates superior improvement ($p < 0.001$), with mean scores of 74.55 ± 2.218 , 84.25 ± 2.817 , and 92.83 ± 4.935 , respectively, compared to DHS. However, for HHS15, although the p-value is 0.052, suggesting a trend towards significance, no

definitive conclusion can be drawn regarding the difference in improvement between the two interventions. (Table 3)

For post-operative complications, patients in the DHS group experienced a statistically significant incidence of pain in the lateral thigh region ($p = 0.042$) compared to the PFN group. Other complications, such as decreased hip range of motion, implant failure, and surgical site infections, were also documented, with the DHS group showing a higher overall complication rate. In contrast, a greater number of patients in the PFN group reported no complications. (Table 4)

Table 1: Clinicodemographic distribution of study participants depending with Intervention given

	Intervention		Total	P value
	DHS (N=40)	PFN (N=40)		
Age of patients				
≤40	5	5	10	0.481 (NS)
41-50	2	7	9	
51-60	10	12	22	
61-70	18	12	30	
71-80	3	3	6	
>80	2	1	3	
Mode of Injury				
RTA	6	10	16	0.264 (NS)
Self-fall	34	30	64	
AO Classification				
3-1A1	17	16	33	0.820 (NS)
3-1A2	23	24	47	

PFN: Proximal Femoral Nail, DHS: Dynamic Hip Screw, NS: Non-significant

Table 2: Comparison of Mean Surgical Time and Blood Loss with Intervention given

	Intervention		P value
	DHS (N=40)	PFN (N=40)	
Surgical time (in min.)			
Mean ± SD	140.43 ± 13.195	94.93 ± 21.231	<0.001 * (Sig)
Blood loss			
Mean ± SD	223.88 ± 13.228	114.28 ± 11.277	<0.001 * (Sig)

Table 3: Comparison of improvement in Harris Hip Score with Intervention given

		Intervention			P value (between group)
		DHS	PFN	Total	
HHS15	Mean	65.45	64.30	64.88	0.052 (NS)
	Std. Deviation	3.080	2.015	2.650	
HHS1.5	Mean	72.55	74.55	73.55	<0.001* (Sig)
	Std. Deviation	1.825	2.218	2.255	
HHS3	Mean	78.95	84.25	81.60	<0.001* (Sig)
	Std. Deviation	4.701	2.817	4.684	
HHS6	Mean	81.65	92.83	87.24	<0.001* (Sig)
	Std. Deviation	7.934	4.935	8.644	



Table 4: Comparison of post-operative complications with Intervention given

	Intervention		Total	P value
	DHS	PFN		
Post-Operative Complication				
Pain in thigh region lateral aspect	1	0	1	0.042 * (Sig)
Decreased hip ROM	1	0	1	
Implant failure	3	0	3	
None	28	37	65	
Pain in hip and thigh while climbing up the stairs	1	0	1	
Pain in hip flexion	0	1	1	
Pain in hip region while walking	0	1	1	
Pain while weight bearing	0	1	1	
Painful hip rom	4	0	4	
Surgical site infection	2	0	2	

DISCUSSION

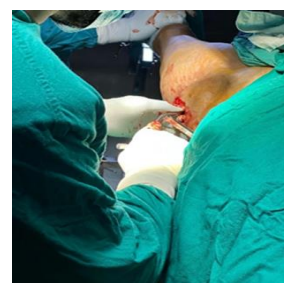
The present study revealed a slight predominance of male patients (61.3%) compared to female patients (38.8%) (Graph 1), consistent with demographic trends observed in prior research. This finding aligns with studies conducted by Sharma H et al.⁴ and Kumar P et al.⁵, which similarly indicated a higher incidence of intertrochanteric femur fractures among males.

Our study revealed a diverse distribution of patients across all age groups, with the highest percentage (37.5%) in the 61-70 age range. The majority of fractures resulted from falls from a height (Table 1). These findings are consistent with previous research by Taneja D et al.⁶ and Nadeem U et al.⁷, who similarly reported a higher incidence of intertrochanteric femur fractures among older adults, attributing the primary mode of injury to falls from height.

Comparison of AO classification between Dynamic Hip Screw (DHS) and Proximal Femoral Nail interventions shows no significant difference ($p = 0.820$) with 33 patients classified as 3-1A1 and 47 patients as 3-1A2 across the total sample of 80 patients (Table 1)

Our study reveals a significant difference in the average surgical duration between the Dynamic Hip Screw (DHS) and Proximal Femoral Nail Antirotation (PFN) procedures, with DHS requiring a longer time to complete than PFN (Table 2). This finding aligns with research conducted by Sharma H et al.⁴ and Klinger H et al.⁸, who attributed the shorter surgery time in the PFN group to its less invasive technique, which necessitates less tissue dissection compared to DHS fixation. Furthermore, a meta-analysis by Shen H et al.⁹ indicated that the operation time for PFNA was slightly shorter than that for DHS. However, Mohan H et al.⁵ and Giraud B et al.¹⁰ found no statistically significant differences in surgical duration between the two procedures. Similarly, Huang X et al.'s meta-analysis corroborated that there was no notable discrepancy in operating time between DHS and PFN surgeries.¹¹

Additionally, our investigation demonstrated that the Dynamic Hip Screw (DHS) procedure was associated with a significantly greater average blood loss compared to the Proximal Femoral Nail (PFN) procedure (Table 2). This finding aligns with research conducted by Kumar A et al.¹¹ and Sharma H et al.⁴, which also reported a reduction in blood loss associated with the use of PFN.



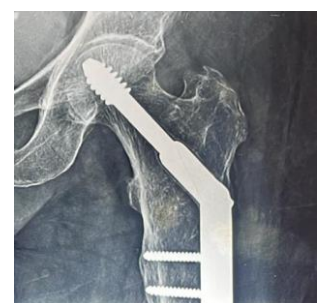
Intra op DHS



Pre op DHS



Post op C-arm



Follow up



Reasonable Rom and full weight bearing

Figure 2: Case 1 treated with Dynamic Hip Screw (DHS)

In a study conducted by Taneja D et al.⁶, the lasting functional outcomes of Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN) treatments for intertrochanteric femur fractures were examined.

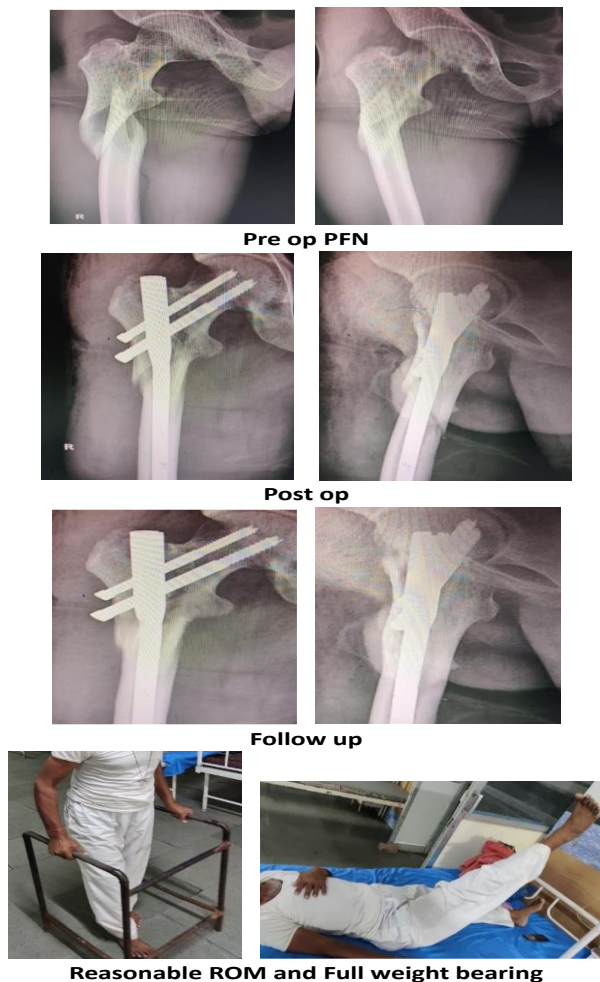


Figure 3: Case 2 treated with Proximal Femoral Nail

Although both groups showed comparable functional results during long-term follow-up, patients treated with PFN demonstrated superior Harris Hip Scores (HHS) during the initial three-month follow-up period (Table 3). This finding aligns with study done by Nadeem U et al.⁷ research, which reported that the PFN group had significantly higher average HHS at six weeks compared to the DHS group, suggesting that PFN led to improved early functional outcomes. Our observations corroborate this, indicating a significant enhancement in HHS with PFN at various time intervals. Moreover, postoperative complications, such as pain in the lateral thigh region, implant failure, and painful range of motion, were more common in the DHS group compared to the PFN group, consistent with the findings of studies by Yu et al.¹⁴ and Xu Y et al.¹⁵

CONCLUSION

In stable intertrochanteric fractures, both the Proximal Femoral Nail (PFN) and Dynamic Hip Screw (DHS) techniques yield comparable outcomes. However, in cases of unstable intertrochanteric fractures, PFN treatment facilitates a quicker restoration of walking ability. The PFN

device is associated with fewer iatrogenic tissue injuries and lower reoperation rates; however, it does involve increased x-ray exposure compared to DHS. Overall, PFN demonstrates advantages over DHS in stable intertrochanteric fractures, including shorter surgical time, reduced blood loss, smaller incision size, and less postoperative pain. Therefore, we propose that PFN may be a superior fixation device for managing intertrochanteric fractures.

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