



## A Comparative Study of Proximal Femoral Nail and Dynamic Hip Screw in Treatment of Inter-Trochanteric Fracture in a Tertiary Care Hospital of Eastern India

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### ABSTRACT

**Introduction:** An intertrochanteric fracture is one of the most common hip fractures, especially in elderly adults with osteoporotic bones. The most common cause of these fractures is low-energy trauma, like small falls. The recommended treatment for intertrochanteric femur fractures is internal fixation. There are various kinds of internal fixation devices for intertrochanteric fractures, including the DHS (dynamic hip screw) and PFN (proximal femoral nail).

**Aims/ objective:** To compare the effectiveness of DHS and PFN using Harris Hip Score and compare any potential shortcomings of these methods for management of inter-trochanteric fractures.

**Materials and Method:** Within two weeks of enrollment, 50 patients with close intertrochanteric fractures were added to our research. PFN (proximal femoral nail) was used for internal fixation in 25 patients, while DHS (dynamic hip screw) was used in another 25 patients. Each patient had three months of monitoring, following which their clinical and radiological states were assessed. For a year, this process was carried out every three months. The results at 1, 3, 6 and 12 months were analyzed using the Harris hip scoring methodology.

**Results:** There were 50 patients in our study out of which 28 (26%) were male and 22 (44%) were female. Mean age of the patients was  $59.73 \pm 5.14$ . More patients in PFN group (52%) were stable as compared to DHS group (32%) but the difference was not significant ( $p > 0.05$ ). There was significantly better improvement with respect to Harris hip score in patients receiving PFN internal fixation as compared to DHS at 3 and 6 months of follow-up ( $p < 0.0001$ ) however at 12 months of follow-up, DHS and PFN group were similar with respect to Harris hip score ( $p > 0.05$ ).

**Conclusion:** PFN provides earlier rehabilitation, a quicker union, reduced mechanical failure rates, shorter surgical times, and more rotation stability than DHS. DHS requires less surgical expertise and is cheaper for implants. PFN shows promise as a DHS alternative in some challenging fragmented unstable osteoporotic inter-trochanteric fractures.

**Keywords:** Inter-trochanteric Fracture, Dynamic Hip Screw, Proximal Femoral Nail, Internal Fixation, Harris Hip Score, Functional Outcome.

### INTRODUCTION

Hip fractures can lead to increased mortality, a worse quality of life, and disabilities. They pose a severe risk to the public's health. About 1.5 million people worldwide suffer from hip fractures each year, with Africa having the lowest rate and Europe having the highest.<sup>1, 2</sup> Hip fracture rates are expected to climb in tandem with the aging population. Hip fractures are predicted to affect 2.6 million people worldwide by 2025, and about 6 million by 2050.<sup>1, 3</sup> Hip fractures can be classified as extra-capsular (trochanteric or inter-trochanteric) or intracapsular (cervical). Hip fractures are a diverse group of fractures.

The majority of individuals with trochanteric and intertrochanteric hip fractures are elderly, prone to falls, and at greater risk of life-threatening illness and injury.<sup>4-7</sup>

An intertrochanteric fracture is one of the most common hip fractures, especially in elderly adults with osteoporotic bones. The most common cause of these fractures is low-energy trauma, like minor falls.

Both surgery and non-operative methods of treatment are available for intertrochanteric fractures. When operating technique was not sufficiently advanced to provide stable fixation, the nonoperative approach was the preferred course of treatment in the early 19th century. Only patients who are non-ambulatory or have chronic dementia and whose pain is manageable with analgesics and rest, as well as those with terminal illnesses with a prognosis of less than six weeks, unresolved medical conditions that prohibit surgical therapy, persistent infectious diseases that themselves preclude the placement of a surgical implant, and incomplete pertrochanteric fractures identified by MRI, should be candidates for nonoperative treatment. Within the bounds of pain tolerance, early mobilization and reduction by traction are nonoperative approaches.<sup>8</sup>

The recommended treatment for intertrochanteric femur fractures is internal fixation. There are various kinds of internal fixation methods for trochanteric fractures, including the DHS (Dynamic Hip Screw) and PFN (proximal femoral nail).<sup>9</sup>



The most often used device is the dynamic hip screw (DHS) with sliding plate assembly. The Dynamic Hip Screw (DHS) is still widely regarded as the gold standard for treating intertrochanteric fractures.<sup>9</sup>

Many earlier research papers have carefully analyzed the advantages and disadvantages of the DHS.<sup>10</sup> Because it is a collapsible fixation mechanism, the fragment that is closest to it can collapse or land on it in an attempt to find a secure position. Several studies have shown that using a DHS alone to treat stable fractures can result in very good outcomes. It is most difficult to treat unstable fractures with a DHS alone. Complication rates, including screw cut out, limbs shortening, proximal femoral varus defect, and nonunion, are higher in unstable fractures than in stable fractures.

The proximal femoral nail (PFN), a novel medullary device developed by Arbeitsegmenin Schaftfur Osteo Synthes Fragen (AO/ASIF) in 1996, is also more rotationally stable, collapsible, centra-medullary, and biomechanically acceptable. The fact that implant failure can present as nonunion, secondary varus failure proximal screw cutout, or a second surgery in cases of complex unstable intertrochanteric fractures, a fracture of the greater trochanter combined with comminution of the proximal femur lateral wall demonstrates the limitations of PFN and has been the subject of numerous studies.<sup>11</sup>

Our study aims to compare the effectiveness of DHS and PFN using Harris Hip Score and compare any potential shortcomings of these methods for management of intertrochanteric fractures.

## STUDY METHODS

From January to August of 2023, patients with closed intertrochanteric fractures were the subjects of this observational, prospective study at the SKMCH, Muzaffarpur Department of Orthopaedics. The institutional ethics committee gave its approval before the study could begin, and patients with closed intertrochanteric fractures were enrolled only after they had given their written informed consent and been given participant information sheets in their native tongue, in accordance with the Helsinki Declaration and good clinical practice guidelines.

The following criteria were met for inclusion in our study: patients of any sex who had close intertrochanteric fractures within two weeks of enrolment and were older than or equal to eighteen years.

**Exclusion criteria:** Participants were not allowed to participate in the trial if they had a medical condition that would prevent them from receiving general or regional anaesthesia, if they had a compound fracture or multiple injuries, if they had neuropathy, or if they were receiving chemotherapy or radiation therapy.

Each participant had a history taken, which included the kind of injury and how long ago it happened. Each patient received a thorough investigation and a clinical

assessment. The day before surgery, patients had pre-anaesthesia evaluations, surgical sites were prepared. Each patient received a single dosage of antibiotic 30 minutes prior to the induction of anaesthesia. Either a DHS (Dynamic Hip Screw) or PFN (proximal femoral nail) was used for internal fixation. For seven days, each patient got an IV antibiotic. The pain was reduced with an analgesic. Wound dressings were used on the 3rd post-operative day or as required to guarantee appropriate care, following procedure Stitches were removed on days 10 to 12 following surgery.



**Figure 1:** A) PFN; B) DHS Methods of Internal Fixation of Inter-Trochanteric Fracture

Each patient had three months of monitoring, following which their clinical and radiological states were assessed. For a year, this process was carried out every 3 months. At 1, 3, 6 and 12 months, the results were examined using the Harris hip scoring system. The following four criteria are used to determine Harris hip score:

- Pain relief: 44 points
- Function: 47 points
- Range of motion: 5 points
- Absence of deformity: 4 points

A patient's total score is 100; a score of less than 70 is deemed poor, a score of 70–79 is considered fair, a score of 80–89 is considered good, and a score of 90–100 is considered excellent.<sup>12</sup>

**Statistical Analysis:** After being tabulated in Microsoft Excel 365, the data from patients with intertrochanteric fractures were transferred to SPSS version 24 for additional statistical analysis. The statistical significance of differences between different groups with regard to the kind of injury, type of fracture, and type of internal fixation was examined using the chi-square test or Fisher's exact test. With a P-Value of less than 0.05 serving as a threshold for statistical significance, the unpaired t-test was

employed to examine the difference between the DHS and PFN groups in relation to the Harris Hip Score.

**OBSERVATIONS AND RESULTS**

There were 50 patients in our study out of which 28 (26%) were male and 22 (44%) were female. Mean age of the

patients was  $59.73 \pm 5.14$ . There was no significant difference between two groups with respect to age and gender ( $p > 0.05$ ). Mode of injury of the patients and type of internal fixation is summarized in Table 1.

**Table 1:** Comparison of mode of injury between two groups

Type of Internal Fixation	Total	Mode of Injury		P-Value (Fisher’s Exact Test)
		Road Traffic Accident (RTA)	Domestic Fall	
PFN	25	8	17	0.77
DHS	25	10	15	
Total (%)	50 (100.00)	18 (36.00)	32 (64.00)	

PFN: Proximal Femoral Nail; DHS: Dynamic Hip Screw

There was no significant difference between PFN and DHS groups with respect to mode of injury ( $p > 0.05$ ). Mode of injury of most of the patients was domestic fall (64.00%) followed by RTA (36.00%).

**Table 2:** Stability of fracture with respect to AO classification in PFN and DHS group

Type of Internal Fixation	Stable		Unstable	P-Value (Chi-Square Test)
	A1	A2	A3	
PFN	4	9	12	0.34
DHS	2	6	17	
Total (%)	6 (12.00)	15 (30.00)	29 (58.00)	

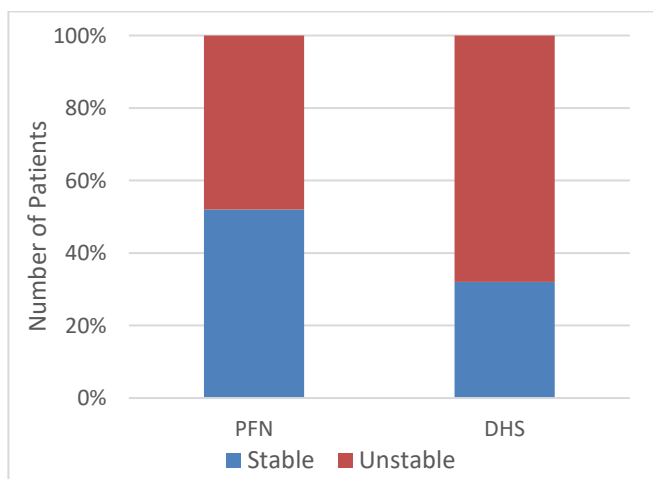
PFN: Proximal Femoral Nail; DHS: Dynamic Hip Screw

According to AO classification, 21 patients (42.00%) patients were stable and 29 patients (58.00%) were unstable. More patients in PFN group (52%) were stable as compared to DHS group (32%) but the difference was not significant ( $p > 0.05$ ).

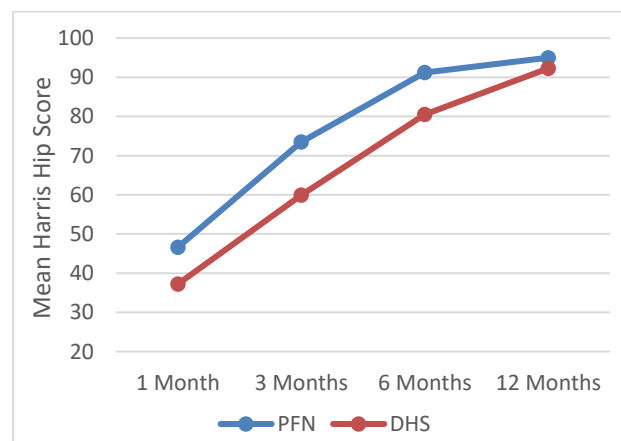
**Table 3:** Comparison of Harris Hip Score between PFN and DHS Group

Time	PFN	DHS	P-Value (Unpaired t test)
1 Month	$46.63 \pm 6.75$	$37.24 \pm 5.34$	$< 0.0001$
3 Months	$73.48 \pm 9.37$	$59.96 \pm 8.39$	$< 0.0001$
6 Months	$91.23 \pm 4.29$	$80.48 \pm 5.35$	$< 0.0001$
12 Months	$94.99 \pm 6.89$	$92.26 \pm 5.16$	0.07
P-Value (Repeated Measure ANOVA)	$< 0.0001$	$< 0.0001$	

PFN: Proximal Femoral Nail; DHS: Dynamic Hip Screw; PFLCP: Proximal Femoral Locking Compression Plate



**Figure 2:** Comparison of Stability between DHS and PFN Group



**Figure 3:** Harris Hip Score between different type of internal fixation Harris Hip Score between different type of internal fixation

There was significantly better improvement with respect to Harris hip score in patients receiving PFN internal fixation as compared to DHS at 3 and 6 months of follow-up ( $p < 0.0001$ ) however at 12 months of follow-up, DHS and PFN group were similar with respect to Harris hip score ( $p > 0.05$ ).

## DISCUSSION

These days, close or open reduction and internal fixation are the recommended treatment options for intertrochanteric fractures. These days, conservative ways of managing these fractures are out of date and ought to be reserved for the worst-case scenarios of morbidity. Despite a great deal of research, there is still debate regarding the best internal fixation mechanism for intertrochanteric fractures, especially when it comes to unstable complicated comminuted type fractures.

Most of the patients in our study were between the ages of five and seven. Cleveland et al. reported that a higher incidence of intertrochanteric fractures in the elderly is associated with senile osteoporosis, reduced the amount of muscle for soaking trauma energy, and poor vision.<sup>13</sup> According to Ahrengart L, Tornkvist H, Fornander P, et al., the average age of men was 80 years, whilst the average age of women was 78 years.<sup>14</sup> The average age, as recorded by Tyllionksi M et al., was 71.3 years.<sup>15</sup> The participants in our study had an average age of 59.73 years, which is younger than the mean age in the previously mentioned studies. This is probably because Asians, especially those living in underdeveloped countries like India, have lower life expectancies, early osteoporosis, and generally worse quality of life.

Compared to most of the published literature, the male to female ratio in our research was 1.27:1. Girls in this age group in this part of India are mostly confined to their families.<sup>16-19</sup>

It is quite difficult to classify the kind of injury accurately. We divided the various types of injury into two main groups: RTA and home fall. According to this categorization, domestic fall had the greatest number of cases. According to Cummings and Nevit, aged patients have weaker muscles, less localized shock absorbers, and fewer protective reflexes to absorb the force of falls.<sup>20</sup> Ninety percent of hip fractures in the elderly are caused by simple falls, as reported by Keneth J. Koval and Joseph D. Zuckerman.<sup>21</sup>

The AO classification system was used to categorize the pattern of fractures in the current experiment. In 13 out of 25 cases in the PFN group and 8 out of 35 cases in the DHS, stable fracture framework was seen. Of the 50 patients in the current study, 29 (58.00%) had unstable fractures, while 42.00% of the participants overall had stable fractures. While Wolfgang et al. observed 79% stable and 21% unstable type fracture, Larsson S., Friberg S. et al. documented a series of 35% stable and 65% unstable intertrochanteric fracture; Neilson, B.P. et al. reported 28% stable and 72% unstable inter-trochanteric fracture.<sup>22-24</sup>

Our study indicates that the PFN group's average operating time was 61 minutes, whereas the DHS group's average operating time was 47 minutes. This aligns with previous studies. According to Wie Ting Lee et al., the mean duration of surgery for stable fractures was 116 minutes, while the mean surgical duration for 13 cases of multi-fragmentary unstable inter-trochanteric fractures was 151.3 minutes.<sup>25</sup> According to Nayer asif et al., 27 patients had operations that lasted an average of about 75 minutes.<sup>26</sup>

In the present investigation, the Harris Hip Score was utilized as a means of comparison. In comparison to the DHS group, the PFN group's average score at 3 and 6 months shows a significant improvement. The Harris Hip Score among participants from the PFN and DHS groups, however, shows minimal variations in their functional state at a year of follow-up.

Domingo L J, et al. performed a prospective analysis on 295 patients who underwent PFN treatment for intertrochanteric fractures. Clinical and radiological assessments were done at 1, 3, and 6 months. They showed that 71% of the previous walking capacity had returned.<sup>27</sup>

Because the proximal femoral nail is a load-shearing device with superior axial telescopic and rotational stability, we discovered that it is more beneficial in unstable and reverse oblique patterns.<sup>28, 29</sup> Because they can tolerate higher static and several times higher cycle stress than dynamic hip screws, they have demonstrated to be better biomechanically stronger. As a result, the fracture repairs without the medial support's initial restoration. The medial column's function is made up for by the implant.

The proximal femoral nail's hip screw and anti-rotation cervical screw sufficiently compress the fracture, allowing enough bone block in between for future revision if necessary.

## CONCLUSION

PFN management produced good to exceptional performance. PFN provides better rotation stability, compression at the fracture site, a reduced lever arm, a reduced likelihood of mechanical failure, quicker mobilization, less blood loss, shorter surgical periods, early rehabilitation, and a quicker union than DHS. It also requires less hospital stays. DHS needs less surgical skill, is cheaper for implants, and puts patients to lower radiation than PFN. The quality of the bone and the fracture geometry will determine which fixation is appropriate. The most favourable outcome following surgery is mostly dependent on the excellence of the reduction and the precise placement of the implant.

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