

A PROSPECTIVE COMPARATIVE STUDY EXAMINES THE FUNCTIONAL OUTCOME OF MANAGING INTERTROCHANTERIC FRACTURES OF THE FEMUR USING DYNAMIC HIP SCREW AND PROXIMAL FEMORAL NAIL: A COHORT STUDY.

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ABSTRACT

Overview

Low-energy wounds, such as simple accidents, are usually the cause of intertrochanteric fractures, which are often experienced fractures of the hip, particularly in older individuals with osteoporotic bones. Intertrochanteric fractures have been treated with proximal femur nail (PFN) and dynamic hip screw (DHS). This study aimed to evaluate the efficacy of PFN and DHS therapies in terms of patient compliance and long-term healing.

Materials and Procedures

This current prospective comparative study was carried out. Random treatments were administered for intertrochanteric fractures, utilizing either the PFN or DHS. Each one of the forty instances was included. Twenty patients were categorized into two categories, with twenty PFN in the second category and twenty DHSs in the first. Following therapy, each patient was monitored for nine months.

Results

The PFN group showed better functional outcomes than the DHS group, with higher Harris Hip Scores (HHS) at all follow-ups. At one month, the PFN group had a mean HHS of 33.15 ± 2.50 compared to 21.00 ± 0.75 in the DHS group ($p < 0.0001$), and at nine months, 94.70 ± 2.60 vs. 90.80 ± 0.80 ($p = 0.0001$). The PFN group also had less blood loss (172.31 ± 11.86 mL vs. 279.72 ± 18.62 mL, $p < 0.0001$) and smaller incisions (4.67 ± 0.89 cm vs. 8.52 ± 1.56 cm, $p < 0.0001$), while hospital stay duration was similar between groups.

Conclusion

PFN is a better fixing method for femur intertrochanteric fractures. The requirement will be met to the degree that it will increase the research's reliability and generalizability.

Recommendation

The PFN is recommended for treating intertrochanteric fractures, particularly in elderly osteoporotic people, as per this study. Function, blood loss, and incisions are better with PFN than with the dynamic hip screw.

Keywords: Intertrochanteric Fracture, Dynamic Hip Screw, Proximal Femoral Nail

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INTRODUCTION

Intertrochanteric (IT) femur fractures account for around half of all hip fractures. The most common low-energy mechanism that causes intertrochanteric fractures is a fall from a standing height. Hip fractures are linked to osteoporosis, aging, female gender, falling history, and abnormal gait [1,2]. These femoral fractures have been much more common over the past several decades, and this trend will probably continue as the number of old people and the frequency of osteoporosis rise. Various nations have trochanteric fractures at different rates [2].

As more seniors are receiving osteoporosis diagnoses, intertrochanteric fractures are becoming increasingly frequent.

It is projected that the incidence will have doubled by 2040. The management of intertrochanteric fractures has been the subject of several research projects. Several research approaches have been employed to examine both surgical and nonsurgical treatment options. Numerous research studies have also been done to contrast the results of PFN and DHS in treating intertrochanteric fractures. Stable stabilization is the aim of therapy for these fractures so that the patient can be mobilized more quickly. The morbidity

and fatality rates associated with these fractures are substantial. Co-morbid conditions that worsen the fracture include diabetes, hypertension, heart, lung, and kidney disorders. Elderly people are susceptible to potentially deadly conditions such as decubitus ulcers, hypostatic pneumonia, catheter-associated sepsis, and cardiopulmonary failure [3].

To hasten the patient's recuperation and mobilization, an immediate surgical solution is required in all of the above-mentioned scenarios. This study aimed to evaluate the efficacy of proximal femur nail (PFN) and dynamic hip screw (DHS) therapies in terms of patient compliance and long-term healing.

MATERIALS AND METHODS

Study design

A prospective comparative cohort study.

Study setting

The study took place at Indira Gandhi Institute of Medical Science (IGIMS), Patna, Bihar, India, and was carried out over 12 months, from June 2023 to June 2024. Following a thorough evaluation of medical records and a comprehensive physical assessment, individuals were selected from the Orthopedics Outpatient Department (OPD) or emergency department.

Participants

Inclusion Criteria

1. Patients aged 50 years and above.
2. Patients diagnosed with intertrochanteric fractures of the femur were confirmed by radiographic evaluation.

3. Patients deemed fit for surgical intervention with either Proximal Femoral Nail (PFN) or Dynamic Hip Screw (DHS).

4. Patients or their legal guardians who provided written informed consent to participate in the study.

Exclusion Criteria

1. Patients younger than 50 years.
2. Patients with medical conditions or comorbidities that contraindicate surgical intervention.
3. Patients with subtrochanteric fractures or other types of hip fractures are not classified as intertrochanteric fractures.
4. Patients with a history of previous surgery on the affected hip.
5. Patients are unable to commit to the required follow-up period of nine months.

Procedure

A lateral image of the affected hip and a pelvic radiograph of both hips were taken. The American Orthopedic Association (AO) and Orthopedic Trauma Association (OTA) categorization schemes were used to categorize the fractures. Skin traction was applied in each instance. A proximal femoral nail (PFN) or a dynamic hip screw (DHS) was randomly allocated to each patient with an intertrochanteric fracture. The enrolled cases were informed of the purpose and importance of the study. Those who expressed interest in participating were added to the research upon providing written and informed consent. In total 40 instances were included. The patients were then divided into two categories: 20 underwent therapy with Dynamic Hip Screws, and 20 underwent treatment with Proximal Femoral Nails (Figure 1).



Figure 1: Preoperative radiograph of DHS

Every patient had a follow-up examination every nine months. A doctor evaluated each instance to see if it was surgically appropriate. Prior to surgery, any related medical conditions that were found were treated. Every patient had

a clinic-radiological examination every three, six, and nine months. The implants that were utilized are displayed in the table below:

Table 1: Table 1: D.H.S Barrel angle (degrees)

D.H.S: Barrel angle (in degrees)	130	135
Screw length (in mms.)	85mm	90mm
Screw angle(degrees)	130	135
P.F.N: Nail diameter (in mms.)	9mm	10mm
No. Of holes	4	5

Ethical considerations

The study protocol was approved by the IGIMS Ethics Committee and written informed consent was received from all the participants.

RESULTS

Table 2: Subject distribution based on age

Age category (Years.)	PFN (n=20)	DHS (n=20)	P-value
81- more	1 (5%)	2 (10%)	X= 1.364
71- 80	5 (25%)	4 (20%)	P=0.714
61- 70	8 (40%)	9 (45%)	
50- 60	6 (30%)	5 (25%)	

Table 2 presents the subject distribution based on age for two treatment categories, PFN (n=20) and DHS (n=20). Among participants aged 81 years and older, 5% were treated with PFN, while 10% received DHS, with a chi-square value (X) of 1.364. Within the age range of 71-80 years, 25% of the subjects were treated with PFN, compared to 20% with DHS, yielding a P-value of 0.714.

For the 61-70 years age category, 40% were treated with PFN, and 45% received DHS. Lastly, in the 50-60 years age category, 30% of the participants were given PFN medication, while 25% were treated with DHS. The data indicates a relatively balanced distribution of subjects across different age categories between the two treatment modalities.

Table 3: Subject distribution based on kind of fracture

Radiographic	PFN (n=20)	DHS	P-value
31-A1	1 (5%)	0	X=23.84
31-A2	1 (5%)	14 (70%)	P<0.0001
31-A3	18 (90%)	6 (30%)	

For fracture type 31-A1, 5% of the subjects were handled with PFN, while none were handled with DHS, with a chi-square value (X) of 23.84. Fracture type 31-A2 was observed in 5% of the subjects in the PFN category in contrast to a significant 70% in the DHS category, with a number below 0.0001 as the P-value, indicating a

considerable difference. For fracture type 31-A3, a predominant 90% of the subjects were treated with PFN, whereas only 30% received DHS. This distribution highlights a notable variance in the treatment preference for different fracture types between the two categories.

Table 4: Harris Hip Score comparison among PFN and DHS categories

Harris Hip score	PFN Mean ± SD	DHS Mean ± SD	P-value
At 9 months	94.70 ± 2.60	90.80 ± 0.80	t=7.635 p=0.0001*
At 6 months	82.80 ± 1.0	72.95 ± 3.30	t=15.65 p<0.0001*
At 3 months	57.80 ± 2.15	52.30 ± 1.05	t=12.59 p<0.0001*
At 1 month	33.15 ± 2.50	21.00 ± 0.75	t=25.72 p<0.0001*

Table 4 compares the Harris Hip Scores among the PFN and DHS categories at different follow-up intervals. At 1 month, the PFN category had a significantly higher mean score of 33.16 ± 2.48 compared to 21.02 ± 0.73 in the DHS category, with a t-value of 25.72 and a P-value below 0.0001. At 3 months, the PFN category continued to show higher scores (57.83 ± 2.14) compared to the DHS category (52.35 ± 1.05), with a t-value of 12.59 and a P-value of less than 0.0001. At 6 months, the PFN category

had an average score of 82.83 ± 1.02, while the DHS category had 72.96 ± 3.30, resulting in a t-value of 15.65 and a P-value below 0.0001. By 9 months, the scores were 94.71 ± 2.66 for the PFN category and 90.83 ± 0.82 for the DHS category, with a t-value of 7.635 and a P-value of 0.0001. These outcomes demonstrate that the PFN category consistently achieved higher Harris Hip Scores than the DHS category at each follow-up interval, indicating better hip function recovery over time.

Table 5: Comparison of the category's hospitalizations, general and clinical parameters

General and clinical parameters	PFN Mean ± SD	DHS Mean ± SD	P-value
Incision size	4.67 ± 0.89	8.52 ± 1.56	t=11.74 p<0.0001*
Hospital stays (Days)	13.43 ± 1.73	12.77 ± 1.21	t=1.712 p=0.0922
Loss of blood	172.31 ± 11.86	279.72 ± 18.62	t=26.67 p<0.0001*

Table 5 compares the PFN and DHS categories based on hospitalization duration, blood loss, and incision size. The average hospital stay for the PFN category was 13.43 ± 1.73 days, slightly longer than the 12.77 ± 1.21 days for the DHS category, with a t-value of 1.712 and a P-value of 0.0922, demonstrating no considerable difference. However, the PFN category experienced significantly less blood loss, averaging 172.31 ± 11.86 mL, compared to 279.72 ± 18.62 mL in the DHS category, with a t-value of

26.67 and a P-value below 0.0001. Additionally, the PFN category had a smaller incision size, averaging 4.67 ± 0.89 cm, compared to 8.52 ± 1.56 cm in the DHS category, with a t-value of 11.74 and a P-value of less than 0.0001. These results show significant advantages of PFN over DHS in terms of reduced blood loss and smaller incision size, though hospitalization duration was similar between the two categories.

Table 6: Comparing the categories' complications

Parameters	PFN(n=20)	DHS(n=20)	P-value
Nonunion	1 (5%)	2 (10%)	X=0.875
Infection	0	2 (10%)	p=0.6456
Screw cut out	0	1 (5%)	

Table 6 compares the complications observed in the PFN and DHS categories, each consisting of 20 subjects. In the PFN category, nonunion occurred in 5% of the subjects, whereas it was observed in 10% of the DHS category, with a chi-square value (X) of 0.875, indicating no significant difference. No infections were reported in the PFN category, while the DHS category had a 10% infection rate,

with a P-value of 0.6456, suggesting no statistically noteworthy difference. Additionally, there were no screw cut-outs in the PFN category, compared to a 5% incidence in the DHS category. These results indicate a relatively low complication rate for both treatment categories, with no statistically considerable differences in nonunion, infection, or screw cut-out between the PFN and DHS categories.



Figure 2: Immediate post-operative radiograph of DHS.

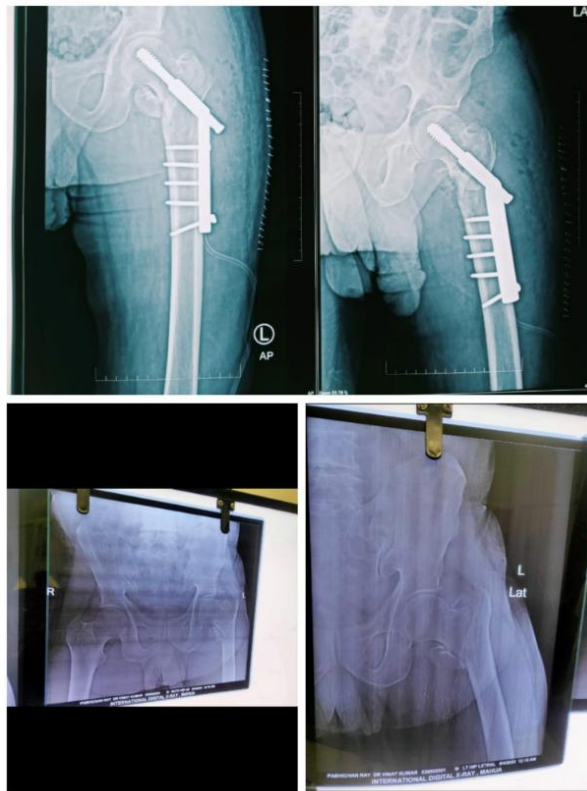


Figure 3: 12-week and 24-week follow-up radiographs of DHS.



Figure 4: Pre-operative radiograph of PFN



Figure 5: Immediate post-operative radiograph of PFN

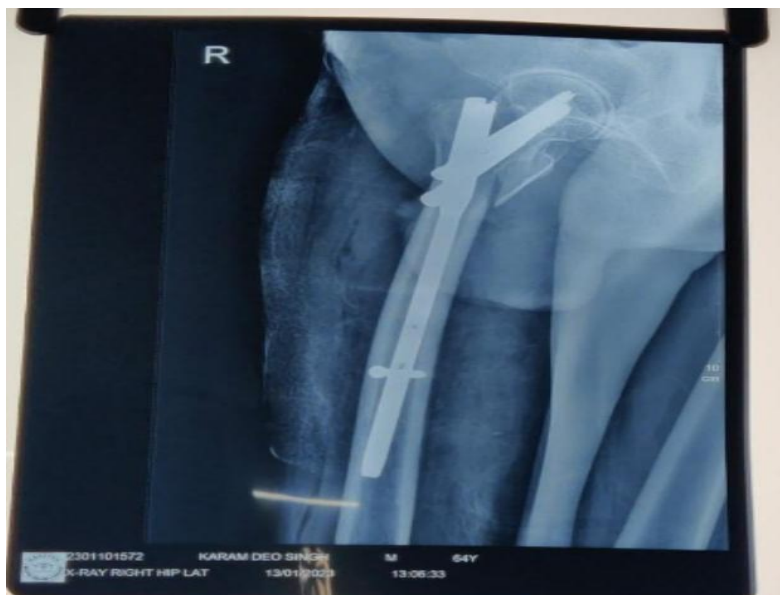


Figure 6: Follow-up radiograph of PFN

DISCUSSION

The study comparing the effectiveness of Proximal Femoral Nail (PFN) and Dynamic Hip Screw (DHS) in managing intertrochanteric fractures demonstrated that PFN offered superior functional outcomes. Patients treated with PFN consistently achieved higher Harris Hip Scores (HHS) at every follow-up interval, indicating better recovery of hip function. Specifically, at the one-month mark, the PFN group had a significantly higher mean HHS than the DHS group, which persisted through the nine-month follow-up period. These results suggest that PFN enables faster and more effective functional recovery in patients with intertrochanteric fractures.

In addition to functional outcomes, the study also found that patients in the PFN group experienced significantly less blood loss during surgery compared to those in the DHS group. The smaller surgical incision required for PFN may have contributed to this reduction in blood loss, potentially lowering the risk of complications and promoting quicker postoperative recovery. Despite these advantages, the duration of hospital stays was similar between the two groups, indicating that while PFN may improve surgical outcomes, it does not necessarily reduce the overall length of hospitalization.

Overall, the findings strongly support the use of PFN over DHS for treating intertrochanteric fractures, particularly in cases where minimizing blood loss and optimizing functional recovery are key considerations. These results are consistent with previous research, which has also highlighted the biomechanical advantages of PFN in managing such fractures.

The results of Shakeel et al. [2], Ranjeetesh et al. [6], and Kumar et al. [8] were comparable to this. Research by Cyril et al. [9], evaluates the efficacy of using a proximal femoral nail (PFN) in combination with a dynamic hip screw (DHS) for treating Intertrochanteric injuries of type II. The outcomes assessed include both functional and radiological results, revealing a similar conclusion. Using PFN or DHS, thirty different instances of Intertrochanteric injuries of type II were investigated. The average age of the fractures seen was almost sixty years old in many studies [10-14]. In both categories, many individuals in the current study were male as in these studies Hall et al. [15], Saudan et al. [16], Tyllianakis et al. [17], Zickel et al. [18], and Cuthbert et al. [19]. This was in line with what Shakeel et al. [2] and Jones et al. [5] found.

Mundla et al. (20) discovered, in contrast, that of 60 individuals, 27 (45%) were men and 33 (55%) were women. The impact is disproportionately felt by women. Kumar et al. [7] reported similar results. Johnson and Harrington [10], There was further evidence of a female sex predominance from Kuderna et al. [12], Poigenfurst and Schnabel [13], and Laskin et al. [14]. The study's preponderance of male participants is consistent with the notion that men are more vulnerable to automobile accidents.

Similar to Shakeel et al., this one indicated a 50% frequency of both unstable and stable fractures, but Kuderna et al. [12] observed a greater proportion of stable fractures [2]. In the current study, 31–A3 fractures were seen in 18 (90%) patients in the PFN category, followed by 31–A2 fractures in 1 (5%) and 31–A1 fractures in 1 (5%) patient. Of the patients in the DHS category, 14 patients (70.0%) had 31–A3 fractures, while the remaining 6 patients (30.0%) had 31–A2 fractures. In the DHS category, none of the participants had fracture type 31–A1. The kind of fracture varied significantly across the two treatment categories.

A lot of fractures in the current research were caused by floor slides [41 (68.3%)], followed by RTA [19 (31.7%)]. According to Sakeel et al. [2], the percentage of fracture cases was strikingly similar. There was no appreciable distinction in the traumatization style between the two treatment categories. IT fractures are more common in younger people after high-velocity trauma [23].

Furthermore, Mundla et al. [24] discovered that slip and fall injuries accounted for 70% of IT injuries, with road traffic collisions coming in second with 20%. 23.3%. Patients who had an RTA were younger than those who received an injury from a slip and fall. The results of the study supported those of Jonnes et al., who found that road traffic accidents (23%) and trivial trauma (77%) were the most prevalent modes of intertrochanteric fractures in terms of damage [5].

In the current experiment, the PFN category exhibited a superior HHS score, and on a subsequent evaluation, a comparison among the PFN and DHS categories revealed notable disparities in the Harris Hip score.

A similar conclusion was reached by Ranjeetesh et al. [6] in their investigation. They evaluated the results of 50 individuals diagnosed with treated intertrochanteric fractures. The findings showed that because the PFN patients had higher Harris Hip Scores in the early stages (at 1 and 3 months), they started walking earlier. Research by Chaitanya et al. [23] (2015) that evaluated the outcomes of DHS vs PFN treatment for intertrochanteric fractures found a similar conclusion. In neither category did the Harris hip score significantly alter in a month and a year? The Harris scores at the six-month and one-year follow-ups were the same for DHS and PFN.

Research by Chaitanya et al. [23], which looked at the outcomes for fractures in the intertrochanteric region of DHS with PFN, revealed a similar finding. Thirty patients received an intramedullary hip screw, and sixty patients received a sliding hip screw and plate for their intertrochanteric fractures. The average blood loss in the PFN category was 96 milliliters, but in the DHS category, it was 233 milliliters.

The PFN category experienced nonunion in one (5%) case, whereas the DHS category had nonunion in two (10%) cases, according to a category comparison of complications between the two categories in the current study. Infection

was identified in two (10.0%) cases in the DHS category but not in any cases in the PFN category. In the DHS category, the screw cutout was found in one (5%) instance, but not in any of the PFN category's cases. Furthermore, there was just one issue that the PFN category had to deal with: non-union. The DHS category experiences conditions such as bedsores, profound infection, decreasing, and surface infection were additional problems. Similar results were seen in research by Chaitanya et al. [23] comparing the outcomes of PFN to DHS treatment for fractures of the intertrochanteric. Twenty patients had treatment with a hip screw and sixty patients with sliding hip screws and plates. While related to implants and medical matters issues were among the PFN category's difficulties, infection and nonunion were among the DHS categories.

Generalizability

The generalizability of this study is somewhat limited due to its single-center design and small sample size. However, the findings provide valuable insights into the comparative effectiveness of PFN and DHS in managing intertrochanteric fractures, particularly in similar clinical settings with comparable patient populations. Further multicentric studies with larger sample sizes are recommended to enhance the applicability of these results to broader populations.

CONCLUSION

When considering functional results (fracture healing, ability to resume normal activities, complications, and implantation failure), surgical parameters, and failed implants (surgery duration, blood loss during surgery, and surgical complications), the PFN is a superior option compared to fixation for patients with intertrochanteric femur fractures. To get more accurate study results, nevertheless, further research is required.

LIMITATIONS

The present investigation was restricted by its single-center study design and small sample size.

Recommendation

Based on the findings of this study, it is recommended that the proximal femoral nail (PFN) be considered as the preferred method for managing intertrochanteric fractures, particularly in elderly patients with osteoporotic bones. PFN offers superior functional outcomes, reduced surgical blood loss, and smaller incisions compared to the dynamic hip screw (DHS). Future research should focus on multicentric studies with larger sample sizes to further validate these findings and assess the long-term benefits and potential complications associated with each treatment method.

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List of abbreviations

PFN: Proximal Femoral Nail
DHS: Dynamic Hip Screw
HHS: Harris Hip Score
IGIMS: Indira Gandhi Institute of Medical Sciences
OPD: Outpatient Department
AO: American Orthopedic Association
OTA: Orthopedic Trauma Association
RTA: Road Traffic Accident

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Conflict of interest

The authors have no competing interests to declare.

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