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A PROSPECTIVE COMPARATIVE COHORT STUDY: FUNCTIONAL RESULTS OF INTERTROCHANTERIC FEMUR FRACTURES TREATED WITH DYNAMIC HIP SCREW VERSUS PROXIMAL FEMORAL NAIL, BHAGALPUR, INDIA.

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ABSTRACT

Background

Dynamic Hip Screw (DHS) and Proximal Femoral Nail (PFN) are two commonly used devices for managing intertrochanteric femur fractures (ITF), each with its advantages and limitations. Understanding their relative efficacy is essential for informed treatment decisions. The study aims to compare the functional outcomes of intertrochanteric femur fractures managed with DHS versus PFN.

Methods

A prospective comparative cohort study was carried out from July 2021 to July 2023. One hundred participants with ITF were enrolled, with equal distribution between the DHS and PFN treatment groups. Demographic data, fracture classifications, surgical details, functional outcomes, complications, and radiographic assessments were recorded. Statistical analysis was achieved to compare outcomes between the two groups.

Results

The mean age of participants in the DHS group was 72 years, while in the PFN group, it was 69 years, with no significant difference observed. Fracture classifications and surgical durations were comparable between groups. Functional outcomes, assessed using the Harris Hip Score (HHS) at 3, 6, and 9 months post-surgery, showed similar improvement trends with no significant variation between DHS and PFN groups. Complication rates and rates of radiographic union were also similar.

Conclusion

Both DHS and PFN fixation techniques demonstrated comparable efficacy in promoting functional recovery and fracture healing for intertrochanteric femur fractures. The choice between the two methods should be based on individual patient factors, fracture characteristics, and surgeon preference.

Recommendations

Further research should explore long-term outcomes beyond the 9-month follow-up period, including patient-reported quality-of-life measures. Randomized controlled trials with larger sample sizes may provide additional insights into the optimal management of intertrochanteric femur fractures. Surgeons should consider factors such as fracture stability, bone quality, and patient comorbidities when selecting the most appropriate fixation device.

Keywords: *Intertrochanteric Femur Fractures, Dynamic Hip Screw, Proximal Femoral Nail, Functional Outcomes, Radiographic Union.*
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INTRODUCTION

Orthopedic surgeons face a great deal of difficulty when treating femur intertrochanteric fractures (ITF), especially in the geriatric population where these injuries are most common. Selecting the right fixation device for these fractures is essential to maximizing functional results and reducing complications. Proximal femoral nail (PFN) and dynamic hip screws (DHS) are two of the most often used instruments for the surgical treatment of ITF. There are supporters of each device, and orthopedic research continues to be relevant in debating their relative efficacy and results.

For many years, the DHS has been a mainstay in the care of ITF. It works by enabling dynamic compression that is regulated over the fracture site, which is assumed to promote the healing of fractures. Because of its ability to transfer load well and facilitate early mobilization, the DHS is especially preferred for stable fracture patterns [1]. The DHS does have certain drawbacks, though, especially in unstable fracture patterns where there is a greater chance of mechanical failure and fracture varus collapse [2].

Conversely, the PFN—a particular kind of intramedullary fixation device—has become well-known due to its biomechanical benefits in stabilizing ITF which is both

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unstable and stable. The PFN is a minimally invasive approach that preserves soft tissue and blood circulation to the fracture site. It is intended to be put into the femur's medullary canal. Research has demonstrated that, in comparison to DHS, PFN can result in faster-operating durations, less blood loss, and possibly lower incidence of postoperative problems [3]. Additionally, the design of the PFN makes it possible for the fracture to be better stabilized, particularly in cases of osteoporotic bone, which is a prevalent problem in the senior population.

Studies comparing DHS and PFN have produced contradictory findings; some point to no discernible difference in functional outcomes between the two techniques, while others emphasize the benefits of PFN, such as lower rates of complications and improved functional recovery in specific fracture types [4, 5]. Several criteria, like as the particular fracture pattern, the quality of the patient's bone, and the surgeon's experience and preference, often influence the decision between DHS and PFN.

Hence, the study aims to compare the functional outcomes of intertrochanteric femur fractures managed with Dynamic Hip Screw versus Proximal Femoral Nail.

METHODOLOGY

Study Design

Prospective comparative cohort study.

Study Setting

The study was carried out at Jawahar Lal Nehru Medical College and Hospital (JLNMCH) Bhagalpur, India, spanning from July 2021 to July 2023.

Participants

A total of 100 participants were randomly assigned to the study.

Inclusion Criteria

- Aged above 50 years
- Those with ITF of femur.

Exclusion Criteria

- Those with pathological fractures due to metastases or tumors.
- with compound fractures or polytrauma.

Bias

To minimize bias, random assignment of patients to receive either DHS or PFN treatment was conducted. Additionally, a thorough review of each case was performed before surgery to ensure consistency and accuracy in data collection.

Variables

Variables included treatment type (DHA vs. PFN), functional outcomes, complications, and radiographic assessments.

Data Collection

- Before surgery, each case underwent a detailed history review and pelvic radiograph assessment using both hips and a lateral view of the affected hip.
- The American Orthopaedic Association (AO) and Orthopaedic Trauma Association (OTA) classification systems were used to categorize fractures.
- The functional outcomes were assessed using the Harris Hip Score (HHS).
- Skin traction was applied in all cases.
- Patients with intertrochanteric fractures were randomly assigned to receive either DHS or PFN.
- Follow-up examinations were conducted at 1-, 3-, 6-, and 9-months post-surgery.
- Physicians examined patients for surgical suitability and corrected any associated medical issues identified before surgery.
- Clinic-radiological examinations were performed at each follow-up interval.

Table 1: Implants Used

Treatment	Implant Details
DHS	Barrel angle: 130° or 135°
	Number of holes: 4 or 5
	Screw length: 85mm or 90mm
PFN	Nail diameter: 9mm or 10mm
	Screw angle: 130° or 135°

Statistical Analysis

Statistical analysis was carried out using SPSS version 21.0 software. Data from the study were analyzed using appropriate statistical methods to compare functional outcomes between the DHS and PFN groups. The significance level was set at $p< 0.05$.

RESULT

The study enrolled 100 participants, evenly divided between those receiving treatment with DHS and PFN for intertrochanteric femur fractures. The mean age of participants in the DHS group was 72 years, ranging from 60 to 85 years, while in the PFN group, it was 69 years, ranging from 62 to 80 years, with no significant difference observed between the groups ($p = 0.12$). Surgical duration did not significantly differ between the groups, with DHS

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procedures averaging 75 minutes and PFN procedures averaging 80 minutes (p = 0.08).

Table 2: Clinical features

Feature	DHS Group	PFN Group
Surgical Duration	75 minutes	80 minutes
Fracture Type		
- Stable (OTA 31-A1, AO A1)	20	18
- Unstable (OTA 31-A2, AO A2)	15	17
- Unstable (OTA 31-A3, AO A3)	15	15

Functional outcomes, assessed using the Harris Hip Score (HHS) at 3, 6, and 9 months post-surgery, demonstrated similar trends in both treatment arms. At 3 months, the mean HHS was 70 for the DHS group and 72 for the PFN group (p = 0.32). At 6 months, the mean HHS improved to 82 for DHS and 84 for PFN (p = 0.18). By 9 months, the mean HHS further increased to 90 for DHS and 92 for PFN (p = 0.21). However, no significant variation in functional outcomes was noted among the groups at any time point.

Table 3: Functional Outcomes Using Harris Hip Score (HHS)

Time post-surgery	Mean HHS - DHS Group	Mean HHS - PFN Group	p-value
3 months	70	72	0.32
6 months	82	84	0.18
9 months	90	92	0.21

Complications were monitored throughout the follow-up period. In the DHS group, 10 participants experienced complications, including screw cut-out (n=4), superficial wound infection (n=3), and implant failure (n=3). In the PFN group, 8 participants experienced complications, such as nail migration (n=3), deep vein thrombosis (n=2), and non-union (n=3).

Table 4: Complications in DHS and PFN Groups

Complication	Number of patients
DHS Group	
- Screw cut-out	4
- Superficial wound infection	3
- Implant failure	3
PFN Group	
- Nail migration	3
- Deep vein thrombosis	2
- Non-union	3

There was no discernible difference in the overall complication rates between the groups ($t(98) = 0.55$, $p = 0.58$). Radiographic assessments at 9 months post-surgery revealed evidence of radiographic union in 92% of DHS fractures compared to 88% of PFN fractures, with no significant variation in the rate of union observed among the groups ($\chi^2(1, N = 100) = 0.82$, $p = 0.42$). Confidence intervals for radiographic union rates were (85%, and 99%) for DHS and (81%, and 95%) for PFN, further indicating the lack of significant difference.

Implant characteristics indicated that the majority of participants received implants with barrel angles of 135° and screw lengths of 90mm, with slight variations between the DHS and PFN groups. While DHS and PFN fixation techniques demonstrated comparable outcomes in terms of functional recovery, complication rates, and radiographic union, the choice between the two may hinge on surgeon preference, fracture characteristics, and patient factors. The lack of statistically significant differences, as demonstrated by t-tests and chi-square tests, supports the conclusion that both DHS and PFN are viable options for the treatment of intertrochanteric femur fractures, with decision-making likely influenced by individual case specifics rather than the inherent superiority of one technique over the other.

DISCUSSION

The study examined the effectiveness of DHS and PFN treatments for femur ITF in 100 participants, and the results revealed no discernible differences between the two groups' age distribution or fracture classification. The lengths of the surgeries were also similar. At three, six, and nine months after surgery, functional outcomes measured by the HHS showed comparable improvement patterns in both groups; no statistically significant difference was seen. Fractures were classified, revealing a

comparable distribution between the two groups (p = 0.45).

A range of problems were observed in both groups, but overall, there was no discernible difference in complication rates. Radiographic evaluations conducted after nine months revealed comparable union rates across DHS and PFN fractures. The majority of implant features were the same in each group.

The results indicate that the DHS and PFN fixation techniques provide similar results in terms of radiographic union, complication rates, and functional recovery. This emphasizes the significance of taking into account the patient's needs, fracture characteristics, and surgeon preference when selecting between the two techniques.

Comparative studies on the treatment of ITF of femur with DHS and PFN have yielded insightful results. A prospective study highlighted significant differences in outcomes such as blood loss, surgery time, and Harris-hip score favoring the choice of fixation device [6]. Research comparing PFN and DHS in the elderly population found PFN to result in better outcomes regarding blood loss, surgery duration, and early weight-bearing capabilities [7].

Another study concluded that PFN offered superior functional outcomes compared to DHS, with a higher percentage of patients achieving excellent to good recovery [8]. A retrospective analysis showed no significant difference in long-term functional outcomes between the two methods, though DHS was associated with more complications like peri-implant fracture and varus deformity [9]. A comparative study suggested that PFN is preferable for unstable intertrochanteric fractures, offering advantages over DHS even in stable fractures [10]. These findings collectively underscore the nuanced considerations in choosing the appropriate surgical intervention for intertrochanteric femur fractures.

Generalizability

While the study provides valuable insights into the comparative efficacy of DHS and PFN for treating intertrochanteric femur fractures, applying these results to a larger, more diverse population requires careful consideration of various factors, including demographic similarities, healthcare settings, surgeon expertise, and patient-specific circumstances.

CONCLUSION

The study comparing DHS and PFN treatments for intertrochanteric femur fractures demonstrated no significant differences in functional outcomes, complication rates, or radiographic union between the two groups. Both techniques showed comparable efficacy in promoting functional recovery and fracture healing. Therefore, the choice between DHS and PFN fixation should be based on surgeon preference, fracture characteristics, and patient factors. Further research may provide additional insights into optimizing treatment strategies for intertrochanteric femur fractures.

Limitations

The limitations of this study include a small sample population who were included in this study. Furthermore, the lack of a comparison group also poses a limitation for this study's findings.

Recommendation

Further research should explore long-term outcomes beyond the 9-month follow-up period, including patient-reported quality-of-life measures. Randomized controlled trials with larger sample sizes may provide additional insights into the optimal management of intertrochanteric femur fractures. Surgeons should consider factors such as fracture stability, bone quality, and patient comorbidities when selecting the most appropriate fixation device.

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List of abbreviations

DHS - Dynamic Hip Screw
PFN - Proximal Femoral Nail
ITF - Intertrochanteric Femur Fractures
HHS - Harris Hip Score
AO - American Orthopaedic Association
OTA - Orthopaedic Trauma Association

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Conflict of interest

The authors have no competing interests to declare.

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