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Original Research Article

COMPARISON OF CLINICAL, RADIOLOGICAL, AND FUNCTIONAL OUTCOMES OF DYNAMIC HIP SCREW AND PROXIMAL FEMORAL NAIL IN INTERTROCHANTERIC FEMUR FRACTURES: A PROSPECTIVE COMPARATIVE STUDY

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ABSTRACT

Background: Intertrochanteric femur fractures are common injuries in the elderly and are associated with substantial morbidity, loss of mobility, and reduced quality of life. This study compared the clinical, radiological, and functional outcomes of DHS and PFN in the management of intertrochanteric femur fractures. **Materials and Methods:** This hospital-based prospective comparative study included 50 patients with intertrochanteric femur fractures treated at a tertiary care centre over 18 months. Twenty-five patients underwent DHS fixation and 25 underwent PFN fixation. Intraoperative parameters, including operative time, blood loss, fluoroscopy time, and incision length, were recorded. Postoperative outcomes assessed included hospital stay, fracture union time, limb shortening, complications, and functional outcome using the Harris Hip Score (HHS) at six months. **Results:** Baseline characteristics were comparable between the two groups. PFN demonstrated significantly shorter operative time (67.2 ± 8.6 vs. 84.1 ± 10.4 minutes), lower blood loss (228 ± 48 vs. 348 ± 56 mL), smaller incision length (6.1 ± 0.8 vs. 10.6 ± 0.9 cm), shorter hospital stay (6.6 ± 1.3 vs. 7.8 ± 1.6 days), less limb shortening (0.63 ± 0.27 vs. 1.08 ± 0.38 cm), and higher HHS at six months (87.1 ± 5.9 vs. 81.4 ± 6.8) than DHS (all $p<0.05$). Fluoroscopy time was significantly longer with PFN (73.8 ± 9.7 vs. 56.3 ± 8.5 seconds; $p<0.001$). Fracture union time and overall postoperative complications were comparable between the groups. **Conclusion:** PFN provided superior operative and functional outcomes compared with DHS, with reduced surgical trauma, shorter hospital stay, and improved hip function, while maintaining comparable fracture union and complication rates.

INTRODUCTION

Intertrochanteric fractures are among the most common fractures involving the proximal femur and constitute nearly half of all hip fractures encountered in orthopaedic practice. Their incidence continues to rise worldwide due to increasing life expectancy, the growing prevalence of osteoporosis, and the expanding elderly population.[1-3] These fractures predominantly occur following low-energy falls in older adults with osteoporotic bone, whereas high-energy trauma is the usual mechanism in younger individuals. Women are affected more frequently because of the higher prevalence of postmenopausal osteoporosis.[4] Beyond the immediate skeletal injury, intertrochanteric fractures are associated with morbidity, mortality, prolonged loss of mobility, reduced independence, and a socioeconomic burden on patients, caregivers, and healthcare systems. Studies have found a continued increase in the incidence of hip fractures over the coming decades.[3-5]

The principal objective in managing intertrochanteric fractures is to achieve stable fracture fixation that permits early mobilisation, minimizes complications related to prolonged immobilisation, promotes fracture union, and restores the patient's pre-injury functional status. Earlier conservative management was associated with complications such as pressure ulcers, pneumonia, urinary tract infections, deep vein thrombosis, malunion, limb deformity, and increased mortality, making operative fixation the current standard of care for the majority of patients.[6,4] Selection of the fixation device depends on several factors, including fracture stability, bone quality, patient characteristics, and surgeon preference.

Despite advances in implant technology, choosing the most appropriate implant remains an area of ongoing debate, particularly for unstable fracture configurations.

Dynamic Hip Screw (DHS) has long been considered as the standard extramedullary implant for the fixation of stable intertrochanteric fractures. It functions as a sliding hip screw system that allows controlled fracture impaction, enabling compression across the fracture site and promoting union. DHS has demonstrated satisfactory clinical and functional outcomes in stable fracture patterns and continues to serve as the benchmark.[7,6,4] However, because it requires a larger surgical exposure and greater soft-tissue dissection, it is often associated with increased intraoperative blood loss and longer operative duration. In unstable or osteoporotic fractures, excessive fracture collapse, limb shortening, varus deformity, screw cut-out, and implant failure have been reported more frequently.[3,4,8]

To overcome the biomechanical limitations of extramedullary fixation, intramedullary devices such as the Proximal Femoral Nail (PFN) were developed. PFN provides a shorter lever arm, superior load-sharing characteristics, greater resistance to bending and rotational forces, and improved stability, particularly in unstable fracture patterns. The minimally invasive nature of PFN also allows a smaller incision, reduced soft-tissue disruption, lower blood loss, and earlier postoperative mobilisation. PFN is technically more demanding, requires greater fluoroscopic guidance during surgery, has a steeper learning curve, and may be associated with implant-specific complications, including technical insertion errors and hardware-related problems.[7,4,3,6]

Several comparative studies have evaluated DHS and PFN, but their conclusions remain inconsistent. Most studies have reported that PFN is associated with shorter operative time, reduced blood loss, smaller incision length, earlier fracture union, less limb shortening, and lower complication rates than DHS, particularly in unstable intertrochanteric fractures.[6,3,5] Better functional recovery and higher Harris Hip Scores (HHS) have also been found with PFN. Increased fluoroscopy exposure and technical complexity have been identified as disadvantages of PFN. Several studies have also demonstrated that DHS and PFN produce comparable outcomes in stable fracture patterns, indicating that the superiority of one implant over the other may depend largely on fracture configuration rather than the implant itself.[6-8]

Although considerable evidence comparing DHS and PFN is available, differences in patient populations, fracture types, surgical expertise, and outcome assessment have resulted in difference conclusions. A comprehensive evaluation of intraoperative parameters, postoperative recovery, radiological healing, implant-related complications, and functional outcomes is essential. The present study was undertaken to compare the clinical, radiological, and functional outcomes of DHS and PFN in the management of intertrochanteric femur fractures.

Aim

To compare the clinical, radiological, and functional outcomes of DHS and PFN in the management of intertrochanteric femur fractures.

Objectives

To compare the intraoperative parameters (operative time, blood loss, fluoroscopy time, and incision length), postoperative clinical outcomes (hospital stay and complications), radiological outcomes (fracture union, limb shortening, malunion, varus collapse, and implant-related complications), and functional outcomes using the HHS at six months between DHS and PFN. To determine the overall effectiveness and safety of both implants in the surgical management of intertrochanteric femur fractures.

MATERIALS AND METHODS

This hospital-based prospective comparative study was conducted in the Department of Orthopaedics, Government Tiruvannamalai Medical College and Hospital, Tiruvannamalai, Tamil Nadu, India, over a period of 18 months. The study was undertaken after obtaining approval from the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to enrolment.

Study Population and Sampling

A total of 50 patients with radiologically confirmed intertrochanteric fractures of the femur who fulfilled the eligibility criteria were included in the study. Patients were allocated into two treatment groups, with 25 patients undergoing DHS fixation and 25 patients undergoing PFN fixation. Participants were recruited consecutively during the study period using a convenience sampling method.

Inclusion Criteria

Patients aged 18 years and above with radiologically confirmed intertrochanteric fractures of the femur (stable or unstable) who were medically fit for surgery and provided written informed consent.

Exclusion Criteria

Patients with pathological fractures, subtrochanteric fractures extending beyond the defined intertrochanteric region, polytrauma with associated fractures of the ipsilateral lower limb, previous surgery on the affected hip, bilateral intertrochanteric fractures, active local infection around the hip, patients who were medically unfit for surgery, and those unwilling to participate.

Methods

After obtaining informed consent, all eligible patients underwent detailed clinical evaluation, including history taking, physical examination, and routine preoperative investigations. Demographic details, side involved, and fracture characteristics were recorded using a structured case record proforma.

Standard anteroposterior and lateral radiographs of the affected hip were obtained for diagnosis and fracture classification. Fractures were classified as stable or unstable based on standard radiographic criteria. Patients underwent surgical fixation with either DHS or PFN according to the treating surgeon's decision and implant availability.

All procedures were performed under spinal or general anaesthesia on a fracture table using standard operative techniques. In the DHS group, fracture fixation was performed using a 135° DHS with an appropriate side plate following satisfactory reduction. In the PFN group, closed reduction was followed by insertion of a standard PFN under fluoroscopic guidance. Intravenous prophylactic antibiotics were administered before surgery according to institutional protocol.

Intraoperative parameters, including operative time, intraoperative blood loss, fluoroscopy time, and incision length, were recorded. Postoperatively, all patients received standardised analgesia, antibiotic prophylaxis, thromboprophylaxis when indicated, and physiotherapy. Quadriceps strengthening exercises and ankle pump exercises were initiated on the first postoperative day. Mobilisation with walker assistance and progression to weight bearing were guided by fracture stability, implant fixation, and radiological evidence of healing.

Patients were followed up at 6 months after surgery. At each follow-up visit, clinical examination and radiographic assessment were performed to evaluate fracture union and detect complications. Radiological union was defined by the presence of bridging callus across at least three cortices with the absence of fracture site tenderness. Limb shortening, malunion, implant failure, screw cut-out, varus collapse, superficial wound infection, and requirement for reoperation were documented.

Functional outcome was assessed at the six-month follow-up using the HHS. Based on the HHS, outcomes were categorised as excellent (90–100), good (80–89), fair (70–79), and poor (<70).

Statistical Analysis

Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequency and percentage. Comparisons of continuous variables between the groups were performed using the independent samples t-test, whereas categorical variables were compared using the Chi-square test or Fisher's exact test, as appropriate. A two-tailed p-value <0.05 was considered statistically significant.

RESULTS

The mean age of the participants was comparable between the DHS and PFN groups (64.2 ± 7.8 vs. 63.8 ± 8.1 years; p=0.858). Females constituted the majority in both groups (56.0% vs. 60.0%; p=0.774), and the distribution of fracture side was similar. Stable fractures comprised 56.0% of cases in both groups, while unstable fractures for 44.0% (p=1.000). [Table 1]

Table 1: Baseline Characteristics

Variable		DHS (n=25)	PFN (n=25)	P value
Age (years), Mean ± SD		64.2 ± 7.8	63.8 ± 8.1	0.858
Sex	Male	11 (44.0%)	10 (40.0%)	0.774
	Female	14 (56.0%)	15 (60.0%)	
Side	Right side	13 (52.0%)	14 (56.0%)	0.777
	Left side	12 (48.0%)	11 (44.0%)	
Fracture type	Stable fractures	14 (56.0%)	14 (56.0%)	1.000
	Unstable fractures	11 (44.0%)	11 (44.0%)	

The mean operative time was significantly shorter in the PFN group than in the DHS group (67.2 ± 8.6 vs. 84.1 ± 10.4 minutes; p<0.001). The mean intraoperative blood loss was also lower in the PFN group (228 ± 48 vs. 348 ± 56 mL; p<0.001), while the mean fluoroscopy time was higher (73.8 ± 9.7 vs. 56.3 ± 8.5 seconds; p<0.001). The mean incision length was significantly shorter in the PFN group than in the DHS group (6.1 ± 0.8 vs. 10.6 ± 0.9 cm; p<0.001). [Table 2]

Table 2: Operative Parameters

Variable	DHS	PFN	P value
Operative time (min)	84.1 ± 10.4	67.2 ± 8.6	<0.001
Blood loss (mL)	348 ± 56	228 ± 48	<0.001
Fluoroscopy time (sec)	56.3 ± 8.5	73.8 ± 9.7	<0.001
Incision length (cm)	10.6 ± 0.9	6.1 ± 0.8	<0.001

The mean hospital stay was significantly shorter in the PFN group than in the DHS group (6.6 ± 1.3 vs. 7.8 ± 1.6 days; p=0.006). The mean fracture union time was comparable between the two groups (15.0 ± 1.7 vs. 15.5 ± 1.8 weeks; p=0.321). The mean limb shortening was significantly lower in the PFN group (0.63 ± 0.27 vs. 1.08 ± 0.38 cm; p<0.001), while the mean HHS at six months was significantly higher in the PFN group than in the DHS group (87.1 ± 5.9 vs. 81.4 ± 6.8; p=0.003). [Table 3]

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Table 3: Postoperative Outcomes

Variable	DHS	PFN	P value
Hospital stay (days)	7.8 ± 1.6	6.6 ± 1.3	0.006
Fracture union (weeks)	15.5 ± 1.8	15.0 ± 1.7	0.321
Limb shortening (cm)	1.08 ± 0.38	0.63 ± 0.27	<0.001
HHS (6 months)	81.4 ± 6.8	87.1 ± 5.9	0.003

Functional outcomes differed significantly between the two groups (p=0.041). Excellent outcomes were achieved in 12 (48%) patients in the PFN group compared with 5 (20%) in the DHS group, while good outcomes were observed in 10 (40%) patients in both groups. Fair outcomes were more frequent in the DHS group (28% vs. 12%), and poor outcomes occurred only in the DHS group (12% vs. 0%). [Table 4]

Table 4: Functional Outcome (HHS)

Outcome	DHS (n=25)	PFN (n=25)	P value
Excellent	5 (20%)	12 (48%)	0.041
Good	10 (40%)	10 (40%)	
Fair	7 (28%)	3 (12%)	
Poor	3 (12%)	0 (0%)	

Malunion occurred in 2 (8%) patients in the PFN group and 5 (20%) in the DHS group (p=0.221). Superficial infection was observed in 1 (4%) patient in the PFN group and 3 (12%) in the DHS group (p=0.297). Implant failure/screw cut-out occurred only in the DHS group (8%; p=0.149), while varus collapse was noted in 1 (4%) patient in the PFN group and 2 (8%) in the DHS group (p=0.551). Reoperation was required in 1 (4%) patient in the DHS group and none in the PFN group (p=0.312). Overall complications occurred in 4 (16%) patients in the PFN group compared with 9 (36%) in the DHS group (p=0.102). [Table 5]

Table 5: Postoperative Complications

Complication	DHS	PFN	P value
Malunion	5 (20%)	2 (8%)	0.221
Superficial infection	3 (12%)	1 (4%)	0.297
Implant failure/Screw cut-out	2 (8%)	0 (0%)	0.149
Varus collapse	2 (8%)	1 (4%)	0.551
Reoperation	1 (4%)	0 (0%)	0.312
Overall complications	9 (36%)	4 (16%)	0.102

DISCUSSION

The baseline characteristics were comparable between the DHS and PFN groups with respect to age, sex distribution, side of injury, and fracture stability, indicating that the two groups were well matched before intervention. The mean age was 64.2 ± 7.8 years in the DHS group and 63.8 ± 8.1 years in the PFN group, with females being slightly more than half of the study population. Similar baseline characteristics have been reported in previous comparative studies. Herode et al. reported comparable demographic characteristics between the two groups, with the majority of patients belonging to the 50–70-year age group and nearly equal gender distribution.[9] Jose et al. reported a mean age of 67 years in the DHS group and 66 years in the PFN group, while Patel et al. observed mean ages of 71.5 ± 7.1 years and 72.1 ± 6.4 years in the DHS and PFN groups, respectively, without significant baseline differences.[10,11] These findings indicate that age and sex distribution were comparable across treatment groups and might not influence the postoperative outcomes.

In the present study, PFN demonstrated significantly superior operative parameters compared with DHS. Operative time was significantly shorter (67.2 ± 8.6 vs. 84.1 ± 10.4 minutes), intraoperative blood loss was lower (228 ± 48 vs. 348 ± 56 mL), and incision length was smaller (6.1 ± 0.8 vs. 10.6 ± 0.9 cm), whereas fluoroscopy time was longer with PFN (73.8 ± 9.7 vs. 56.3 ± 8.5 seconds). Similar observations were reported by Shivakumar et al., who found that PFN required a smaller incision, shorter operative duration, less blood loss, and facilitated faster recovery, although fluoroscopy exposure was greater because of the technically demanding intramedullary procedure.[12] Patel et al. also demonstrated significantly shorter operative time (58.2 ± 8.4 vs. 72.5 ± 10.1 minutes) and lower blood loss (145.6 ± 30.5 vs. 210.4 ± 42.3 mL) with PFN.11 Ansari et al. similarly reported significantly reduced intraoperative blood loss in the PFN group (80 mL vs. 220 mL; p=0.01).[13] These findings support the minimally invasive nature of PFN, although the technique requires increased fluoroscopic guidance.

Hospital stay was significantly shorter in patients treated with PFN (6.6 ± 1.3 days) than those treated with DHS (7.8 ± 1.6 days). Fracture union time was comparable between both groups (15.0 ± 1.7 vs. 15.5 ± 1.8 weeks), while limb shortening was significantly less in the PFN group (0.63 ± 0.27 vs. 1.08 ± 0.38 cm). Patel et al. similarly reported earlier full weight-bearing in patients treated with PFN and observed rapid postoperative recovery.[11] Jose et al. also observed lower rates of limb shortening and varus collapse in the PFN group than in the DHS group.[10] These findings suggest that although fracture healing occurs within a similar time period for both implants, PFN provides better maintenance of fracture alignment and facilitates earlier rehabilitation.

The present study demonstrated significantly better functional outcomes following PFN fixation. The mean HHS at six months was significantly higher in the PFN group (87.1 ± 5.9) than in the DHS group (81.4 ± 6.8). Excellent functional outcomes were achieved in 48% of patients treated with PFN compared with only 20% of patients treated with DHS, while no patient in the PFN group had a poor functional outcome. Jose et al. reported a higher mean HHS in the PFN group (75.17 ± 31.51) than in the DHS group (70.28 ± 30.51), with 40% of PFN patients achieving excellent functional outcomes compared with 14.29% in the DHS group.10 Shivakumar et al. observed excellent results in 66.7% of patients treated with PFN compared with 60% following DHS fixation at 24 weeks.[12] Ansari et al. similarly reported excellent outcomes in 56.52% of PFN patients compared with 34.78% in the DHS group, although functional differences became less pronounced at one year.[13] Yadav et al. also demonstrated significantly higher HHSs in the PFN group at each follow-up assessment.[14] These findings indicate that PFN provides superior early functional recovery compared with DHS.

In our study, postoperative complications were lower in the PFN group (16%) than in the DHS group (36%), it was not significant. Malunion, superficial infection, implant failure, varus collapse, and reoperation were all less frequent following PFN fixation. Jose et al. observed overall complication rates of 20% with PFN compared with 40% with DHS, with fewer superficial infections, screw cut-outs, varus collapse, and limb shortening in the PFN group.[10] Patel et al. reported complication rates of 12.5% following PFN and 25% after DHS fixation.[11] Herode et al. also found lower incidences of limb shortening and varus deformity in the PFN group, although the overall clinical outcomes between implants were comparable.[9] These observations suggest that PFN may reduce mechanical complications through its biomechanical advantages, even though differences in smaller studies may not always achieve statistical significance.

The superior clinical performance of PFN can be due to its intramedullary biomechanical design. Being positioned closer to the mechanical axis of the femur, PFN provides a shorter lever arm, improved load sharing, greater rotational stability, and reduced bending stresses across the implant. These biomechanical advantages contribute to less collapse at the fracture site, reduced limb shortening, earlier mobilisation, and improved functional recovery, particularly in unstable intertrochanteric fractures. In contrast, DHS, although technically simpler and well established, functions as an extramedullary load-bearing device and is more susceptible to excessive sliding, varus collapse, and implant-related mechanical failure in unstable fracture patterns.[10-14]

The findings of the present study are consistent with most comparative studies demonstrating that PFN offers several advantages over DHS, including shorter operative time, reduced blood loss, smaller surgical incision, shorter hospital stay, better functional outcome, and fewer postoperative complications, while achieving similar fracture union.

Limitations

The study was conducted at a single tertiary care centre, which may limit the generalizability of the findings to other healthcare settings. The sample size was relatively small, which may have reduced the statistical power to detect differences in less frequent complications. The follow-up period was limited to six months, preventing assessment of long-term functional outcomes, implant survival, and late complications. Functional assessment was based only on the HHS, patient-reported quality of life and return to pre-injury activity levels were not evaluated. The study was not randomized, which may have introduced selection bias despite comparable baseline characteristics between the two groups.

CONCLUSION

PFN demonstrated superior clinical and functional outcomes compared with DHS in the treatment of intertrochanteric femur fractures. PFN was associated with shorter operative time, reduced blood loss, smaller incision, shorter hospital stay, less limb shortening, and significantly better HHSs, while fracture union rates were comparable between the two groups. These findings suggest that PFN is a safe and effective fixation method and may be preferred, particularly in patients requiring early mobilisation and improved functional recovery.

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