

A Comparative Study of Functional and Radiological Outcomes of Proximal Femoral Nail Antirotation (PFNA) and Dynamic Hip Screw (DHS) Fixation in Patients with Intertrochanteric Femoral Fractures

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ABSTRACT

Background: Intertrochanteric femoral fractures are common orthopaedic injuries, particularly among elderly individuals, and are associated with considerable morbidity and functional disability. Proximal Femoral Nail Antirotation (PFNA) and Dynamic Hip Screw (DHS) are commonly used fixation techniques. This study aimed to compare their functional and radiological outcomes. **Materials and Methods:** This prospective comparative observational study included 90 patients with intertrochanteric femoral fractures, divided into two groups: PFNA (n=45) and DHS (n=45). Operative duration, intraoperative blood loss, postoperative recovery, Harris Hip Score (HHS), radiological union, and complications were assessed over six months. Appropriate statistical tests were used, with $p < 0.05$ considered significant.

Results: Mean operative duration was significantly shorter with PFNA than DHS (62.4 ± 12.6 versus 78.8 ± 15.2 minutes; $p < 0.001$). Intraoperative blood loss was lower in the PFNA group (118.6 ± 42.5 versus 218.4 ± 65.8 mL; $p < 0.001$). Hospital stay and postoperative mobilisation time were also reduced. At six months, mean HHS was significantly higher following PFNA fixation (86.8 ± 7.6 versus 81.2 ± 8.4 ; $p = 0.001$). Radiological union occurred earlier with PFNA (13.8 ± 2.6 versus 15.6 ± 3.1 weeks; $p = 0.004$). Postoperative complications were numerically fewer following PFNA fixation, although differences were statistically nonsignificant. **Conclusion:** The illustrative findings suggest that PFNA may provide better operative efficiency, earlier functional recovery, and faster fracture healing than DHS fixation, particularly in unstable intertrochanteric fractures. Larger randomised studies are warranted.

Keywords: Intertrochanteric femoral fracture; Proximal Femoral Nail Antirotation; Dynamic Hip Screw; Harris Hip Score; Functional outcome; Radiological union.

INTRODUCTION

Intertrochanteric fractures of the femur are among the most common orthopaedic injuries, particularly affecting elderly individuals with osteoporosis. These fractures occur in the extracapsular region between the greater and lesser trochanters and are commonly associated with low-energy falls in older patients and high-energy trauma in younger individuals. With increasing life expectancy and an ageing population, the incidence of intertrochanteric fractures continues to rise, contributing significantly to morbidity, mortality, functional

disability, and healthcare expenditure. These injuries frequently result in prolonged immobilisation, loss of independence, and reduced quality of life, making effective treatment essential [1–3].

The primary goal of managing intertrochanteric fractures is to achieve anatomical reduction and stable fixation, facilitating early mobilisation, fracture union, and restoration of pre-injury functional status. Surgical fixation is generally preferred over conservative management because prolonged immobilisation increases the risk of complications such as deep vein

thrombosis, pressure ulcers, respiratory infections, and muscle wasting. Various fixation devices have been developed, among which the Dynamic Hip Screw (DHS) and Proximal Femoral Nail Antirotation (PFNA) are commonly employed [4-8].

The Dynamic Hip Screw is an extramedullary fixation device consisting of a sliding lag screw connected to a lateral plate. It permits controlled fracture compression and has demonstrated satisfactory outcomes, particularly in stable intertrochanteric fractures. However, its limitations include greater surgical exposure, potential blood loss, excessive fracture collapse, varus deformity, and implant failure in unstable fracture patterns [9-11].

The Proximal Femoral Nail Antirotation is an intramedullary fixation device designed to provide improved biomechanical stability. Its helical blade compacts cancellous bone and enhances rotational stability, particularly in osteoporotic fractures. Its intramedullary position reduces the bending moment and facilitates load sharing, potentially allowing earlier mobilisation and reducing mechanical complications. Nevertheless, technical difficulties and implant-related complications remain important considerations [12-14]. Functional outcomes following fixation are assessed through pain relief, hip mobility, walking ability, and functional scoring systems such as the Harris Hip Score. Radiological outcomes include fracture union, maintenance of alignment, implant position, and complications such as varus collapse, shortening, and fixation failure. Although both implants are widely used, their comparative effectiveness remains debated, particularly across different fracture configurations [9,10].

Therefore, the present study aims to compare the functional and radiological outcomes of PFNA and DHS fixation in patients with intertrochanteric femoral fractures. The findings may provide evidence regarding fracture healing, functional recovery, and implant-related complications, thereby assisting surgeons in selecting an appropriate fixation method to optimise postoperative outcomes.

MATERIALS AND METHODS

Study Design

The present study was designed as a hospital-based, prospective, comparative observational study to evaluate and compare the functional and radiological outcomes of Proximal Femoral Nail Antirotation (PFNA) and Dynamic Hip Screw (DHS) fixation in patients with intertrochanteric femoral fractures.

Study Setting

The study was conducted in the Department of Orthopaedics at a tertiary care teaching hospital. Patients diagnosed with intertrochanteric femoral fractures and undergoing surgical fixation with either PFNA or DHS were included in the study.

Study Duration

The study was conducted over a period of 18 months. During this period, eligible patients were enrolled, surgically treated, and followed up to assess functional recovery, radiological fracture union, and postoperative complications.

Study Population

The study population comprised adult patients diagnosed with intertrochanteric fractures of the femur who underwent surgical fixation using either PFNA or DHS. Patients fulfilling the eligibility criteria and providing informed written consent were included.

Sample Size

A total of 90 patients with intertrochanteric femoral fractures were included in the study. The patients were divided into two groups based on the surgical fixation technique employed.

Study group	Surgical procedure	Number of patients
Group A	Proximal Femoral Nail Antirotation (PFNA)	45
Group B	Dynamic Hip Screw (DHS)	45
Total		90

The study included 45 patients in each group to facilitate comparison of functional and radiological outcomes. The total sample size of 90 patients was treated as the predetermined study sample. A formal statistical sample-size calculation was not established from the available study details.

Sampling Technique

Patients were enrolled using a consecutive sampling technique. All patients presenting with intertrochanteric femoral fractures during the study period were screened

for eligibility. Those fulfilling the inclusion criteria and providing informed consent were recruited until the required sample size was achieved.

The selection of PFNA or DHS was based on fracture characteristics, bone quality, clinical condition, and the treating surgeon's decision. No random allocation was performed.

Eligibility Criteria

Inclusion Criteria

1. Patients aged 18 years and above.
2. Patients diagnosed with intertrochanteric fractures of the femur.
3. Patients with closed intertrochanteric femoral fractures.
4. Patients who underwent surgical fixation using either PFNA or DHS.
5. Patients who were medically fit to undergo surgery.
6. Patients who provided written informed consent.
7. Patients who were willing to participate in scheduled postoperative follow-up assessments.

Exclusion Criteria

1. Patients with pathological fractures due to malignancy or other underlying bone diseases.
2. Patients with open intertrochanteric femoral fractures.
3. Patients with associated ipsilateral femoral neck or shaft fractures.
4. Patients with previous surgery or implants in the affected proximal femur.
5. Patients presenting with neglected fractures requiring alternative reconstructive procedures.
6. Patients with severe medical comorbidities that contraindicated surgical intervention.
7. Patients who refused consent or were unwilling to participate in postoperative follow-up.

Study Procedure

Patient Recruitment and Initial Evaluation

All patients presenting to the emergency department or orthopaedic outpatient department with suspected intertrochanteric femoral fractures were evaluated clinically and radiologically.

A detailed history was obtained regarding the mechanism of injury, duration since trauma, pain, inability to bear weight, pre-injury functional status, and associated medical illnesses.

Demographic and clinical details were recorded, including age, sex, occupation, affected side, mode of injury, and relevant comorbidities such as diabetes mellitus, hypertension, cardiovascular disease, and osteoporosis.

A general physical examination and detailed orthopaedic assessment of the affected limb were performed. Local examination included assessment of tenderness,

swelling, deformity, shortening, external rotation, skin condition, and distal neurovascular status.

Radiological Evaluation

All patients underwent standard anteroposterior radiographs of the pelvis with both hips and lateral radiographs of the affected hip.

Radiographs were evaluated to determine the fracture location, displacement, comminution, and stability.

Fractures were classified according to the AO/OTA classification system. The presence of posteromedial comminution, lateral wall involvement, and other features of fracture instability was documented. Additional radiological investigations were performed whenever clinically indicated.

Preoperative Assessment

All patients underwent routine preoperative investigations, including complete blood count, renal function tests, serum electrolytes, blood glucose levels, coagulation profile, and other investigations considered necessary according to their clinical condition.

Electrocardiography and chest radiography were performed when indicated.

Anaesthetic assessment was completed before surgery, and patients were optimised for associated medical conditions.

Preoperative pain management, intravenous fluids, and other supportive measures were provided as required.

The affected limb was immobilised appropriately until definitive surgical fixation.

Surgical Intervention

Patients were divided into two groups according to the fixation technique used.

Group A: Proximal Femoral Nail Antirotation (PFNA)

Patients in Group A underwent surgical fixation using a Proximal Femoral Nail Antirotation.

Surgery was performed under spinal or general anaesthesia according to the anaesthesiologist's assessment.

Patients were positioned supine on a fracture table. Closed reduction was attempted using longitudinal traction and appropriate rotational manoeuvres under fluoroscopic guidance.

Following satisfactory fracture reduction, a small incision was made proximal to the greater trochanter. The entry point was identified under image intensifier guidance, and the proximal femoral canal was prepared.

An appropriately sized PFNA was inserted into the femoral medullary canal. A helical blade was introduced into the femoral head and neck after confirming satisfactory guidewire position under fluoroscopy.

Distal locking was performed according to the implant system and fracture configuration.

Final fluoroscopic images were obtained to confirm fracture reduction, implant position, and fixation stability.

The operative wound was irrigated and closed in layers using standard surgical techniques.

Group B: Dynamic Hip Screw (DHS)

Patients in Group B underwent fixation using a Dynamic Hip Screw.

The procedure was performed under spinal or general anaesthesia.

Patients were positioned supine on a fracture table, and fracture reduction was achieved using traction and rotational manoeuvres under fluoroscopic guidance.

A lateral incision was made over the proximal femur, and the lateral femoral cortex was exposed.

A guidewire was inserted into the femoral neck and head under image intensifier guidance. After confirming satisfactory placement, drilling and reaming were performed.

An appropriately sized lag screw was inserted into the femoral head and neck.

A DHS side plate was subsequently applied and secured to the femoral shaft using cortical screws.

Final fluoroscopic images were obtained to assess reduction, implant position, and fixation stability.

The wound was irrigated and closed in layers.

Intraoperative Assessment

The following intraoperative parameters were recorded in both groups:

- Duration of surgery, measured in minutes.
- Intraoperative blood loss, measured in millilitres.
- Quality of fracture reduction.
- Intraoperative complications, including technical difficulties, iatrogenic fractures, and implant-related problems.

Operative duration was measured from skin incision to completion of wound closure.

Intraoperative blood loss was estimated from suction collection and blood-soaked surgical materials, accounting for irrigation fluid wherever applicable.

Postoperative Management

Following surgery, all patients received postoperative care according to the institutional protocol.

Analgesics, antibiotics, and thromboprophylaxis were administered as clinically indicated.

The operated limb was examined regularly for wound condition, swelling, pain, and neurovascular status.

Postoperative radiographs were obtained to assess fracture reduction and implant position.

Physiotherapy was initiated as early as the patient's clinical condition permitted. Exercises included ankle movements, quadriceps strengthening, hip and knee mobilisation, and assisted ambulation.

Weight-bearing was initiated and progressively advanced according to fracture stability, fixation quality, postoperative radiological findings, and the treating surgeon's assessment.

Patients were discharged after achieving satisfactory clinical stability and were advised to attend scheduled follow-up visits.

Follow-up Assessment

Patients were evaluated during the postoperative period and subsequently at 6 weeks, 3 months, and 6 months following surgery.

At each follow-up visit, clinical and radiological examinations were performed to assess recovery, fracture healing, and postoperative complications.

Follow-up interval	Assessment performed
Immediate postoperative period	Wound condition, pain, implant position, fracture reduction, and immediate complications
6 weeks	Pain, hip mobility, walking ability, functional recovery, and radiological progression of healing
3 months	Harris Hip Score, weight-bearing status, fracture union, and implant-related complications
6 months	Final functional assessment, radiological union, fracture alignment, and late complications

Outcome Measures

Primary Outcome Measures

A. Functional Outcome

Functional recovery was assessed using the Harris Hip Score (HHS), which evaluated pain, function, deformity, and range of motion of the hip joint.

The total score ranged from 0 to 100, with higher scores indicating better hip function.

Functional outcomes were classified as follows:

Harris Hip Score	Functional outcome
90–100	Excellent
80–89	Good
70–79	Fair
Below 70	Poor

The Harris Hip Score was recorded during scheduled follow-up visits, and the scores obtained in the two groups were compared.

B. Radiological Outcome

Radiological outcomes were assessed using serial anteroposterior and lateral radiographs of the operated hip.

The following parameters were evaluated:

1. Progression of fracture union.
2. Time to radiological union, expressed in weeks.
3. Maintenance of fracture reduction and alignment.
4. Presence of varus collapse.
5. Implant migration or cut-out.
6. Implant breakage or loosening.
7. Delayed union or nonunion.

Radiological union was considered to have occurred when bridging callus or trabecular continuity was observed across the fracture site, accompanied by progressive disappearance of the fracture line and satisfactory clinical evidence of healing.

Secondary Outcome Measures

Secondary outcomes included:

1. Duration of surgery in minutes.
2. Intraoperative blood loss in millilitres.
3. Duration of hospital stay in days.
4. Time to initiation of assisted mobilisation.
5. Time to partial and full weight-bearing.
6. Postoperative pain and complications.
7. Superficial or deep surgical site infection.
8. Implant-related complications.
9. Requirement for revision surgery.

These parameters were compared between the PFNA and DHS groups to evaluate perioperative morbidity and postoperative recovery.

Data Collection

All relevant information was recorded using a predesigned and structured case record proforma.

The proforma included demographic details, clinical history, comorbidities, fracture classification, preoperative investigations, surgical procedure, intraoperative findings, postoperative recovery, functional assessment, radiological findings, and complications.

Data were entered into a Microsoft Excel spreadsheet and checked for completeness and accuracy before statistical analysis.

Statistical Analysis

The collected data were compiled, tabulated, and analysed using SPSS 27 statistical software.

Continuous variables such as age, operative duration, intraoperative blood loss, hospital stay, time to fracture union, and Harris Hip Score were expressed as mean $\pm$ standard deviation for normally distributed data or median with interquartile range for non-normally distributed data.

Categorical variables such as sex, affected side, fracture classification, functional outcome categories, fracture union status, and postoperative complications were presented as frequencies and percentages.

The Shapiro–Wilk test was used to assess normality of continuous variables.

The independent-samples Student's t-test was used to compare normally distributed continuous variables between the two groups. The Mann–Whitney U test was employed for variables that did not follow a normal distribution.

The Chi-square test or Fisher's exact test, as appropriate, was used to compare categorical variables between the groups.

Repeated postoperative Harris Hip Scores were analysed using SPSS27 repeated-measures method, with consideration of the distribution of the data and completeness of follow-up observations.

Potential differences in baseline fracture stability and other clinically relevant characteristics were considered while interpreting comparative outcomes.

A p-value of less than 0.05 was considered statistically significant.

Study Endpoints

The principal study endpoint was the comparison of functional and radiological outcomes between patients treated with PFNA and those treated with DHS at 6 months following surgery.

Functional outcome was primarily assessed using the Harris Hip Score, while radiological outcome was evaluated through fracture union, time to union, maintenance of alignment, and implant-related complications.

The secondary endpoints included operative duration, intraoperative blood loss, duration of hospitalisation, postoperative mobilisation, and the incidence of complications.

RESULTS

The present comparative study included a total of 90 patients with intertrochanteric femoral fractures, equally divided into two groups: 45 patients underwent Proximal Femoral Nail Antirotation (PFNA) fixation, while 45

patients underwent Dynamic Hip Screw (DHS) fixation. Demographic characteristics, fracture patterns, intraoperative parameters, postoperative recovery, functional outcomes, radiological outcomes, and implant-related complications were compared between the two groups.

Table 1. Comparison of Demographic and Baseline Clinical Characteristics Between PFNA and DHS Groups (N = 90)

Parameter	PFNA (n = 45)	DHS (n = 45)	p-value
Age (years), Mean $\pm$ SD	67.4 $\pm$ 10.8	66.8 $\pm$ 11.2	0.796
Age group, n (%)			0.922
18–40 years	3 (6.7)	4 (8.9)	
41–60 years	10 (22.2)	9 (20.0)	
61–80 years	26 (57.8)	25 (55.6)	
>80 years	6 (13.3)	7 (15.6)	
Sex, n (%)			0.673
Male	24 (53.3)	22 (48.9)	
Female	21 (46.7)	23 (51.1)	
Affected side, n (%)			0.673
Right	25 (55.6)	23 (51.1)	
Left	20 (44.4)	22 (48.9)	
Mode of injury, n (%)			0.792
Trivial fall	34 (75.6)	33 (73.3)	
Road traffic accident	8 (17.8)	9 (20.0)	
Fall from height	3 (6.7)	3 (6.7)	

As shown in Table 1, the mean age of patients in the PFNA group was 67.4 $\pm$ 10.8 years, compared with 66.8 $\pm$ 11.2 years in the DHS group ($p = 0.796$). Most patients belonged to the 61–80-year age group in both groups (57.8% and 55.6%, respectively). Male patients constituted 53.3% of the PFNA group and 48.9% of the DHS group. Right-sided fractures were slightly more common in both groups. Trivial falls were the predominant mode of injury, accounting for 75.6% and 73.3% of cases, respectively. No statistically significant differences were observed in age, sex, affected side, or mode of injury between the groups ($p > 0.05$), indicating comparable demographic and baseline clinical characteristics.

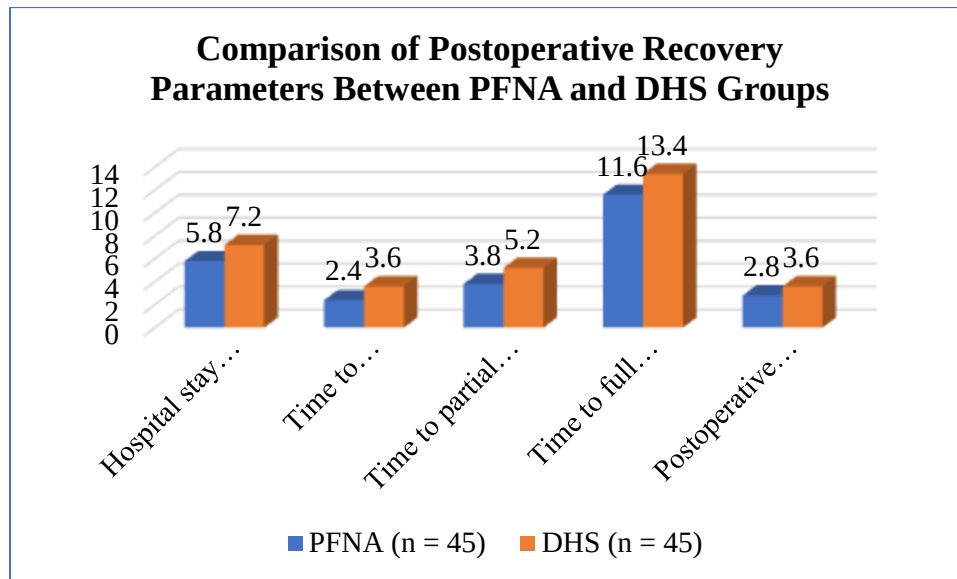
Table 2. Comparison of Fracture Classification and Intraoperative Parameters Between PFNA and DHS Groups

Parameter	PFNA (n = 45)	DHS (n = 45)	p-value
AO/OTA fracture classification, n (%)			0.018
31-A1 (simple)	12 (26.7)	23 (51.1)	
31-A2 (multifragmentary)	24 (53.3)	18 (40.0)	
31-A3 (reverse oblique/transverse)	9 (20.0)	4 (8.9)	
Operative duration (minutes), Mean $\pm$ SD	62.4 $\pm$ 12.6	78.8 $\pm$ 15.2	<0.001
Intraoperative blood loss (mL), Mean $\pm$ SD	118.6 $\pm$ 42.5	218.4 $\pm$ 65.8	<0.001
Quality of reduction, n (%)			0.799
Good	36 (80.0)	35 (77.8)	
Acceptable	7 (15.6)	8 (17.8)	
Poor	2 (4.4)	2 (4.4)	

Table 2 presents the distribution of fracture types and intraoperative parameters. AO/OTA 31-A2 fractures were most common in the PFNA group (53.3%), whereas 31-A1 fractures predominated in the DHS group (51.1%). The distribution of fracture classifications differed significantly between the groups ($p = 0.018$). The mean operative duration was significantly shorter in the PFNA group (62.4 $\pm$ 12.6 minutes) than in the DHS group (78.8 $\pm$ 15.2 minutes; $p < 0.001$). Similarly, mean intraoperative blood loss was significantly lower with PFNA fixation (118.6 $\pm$ 42.5 mL) compared with DHS fixation (218.4 $\pm$ 65.8 mL; $p < 0.001$). Good reduction quality was achieved in 80.0% of PFNA cases and 77.8% of DHS cases, without a statistically significant difference ($p = 0.799$).

Table 3. Comparison of Postoperative Recovery Parameters Between PFNA and DHS Groups

Parameter	PFNA (n = 45)	DHS (n = 45)	p-value
Hospital stay (days), Mean $\pm$ SD	5.8 $\pm$ 1.6	7.2 $\pm$ 2.1	<0.001
Time to assisted mobilisation (days), Mean $\pm$ SD	2.4 $\pm$ 0.8	3.6 $\pm$ 1.2	<0.001
Time to partial weight-bearing (weeks), Mean $\pm$ SD	3.8 $\pm$ 1.2	5.2 $\pm$ 1.6	<0.001
Time to full weight-bearing (weeks), Mean $\pm$ SD	11.6 $\pm$ 2.8	13.4 $\pm$ 3.2	0.006
Postoperative pain at 6 weeks (VAS), Mean $\pm$ SD	2.8 $\pm$ 1.1	3.6 $\pm$ 1.3	0.002

**Figure 1 Comparison of Postoperative Recovery Parameters Between PFNA and DHS Groups**

As demonstrated in Table 3 and Figure 1, patients undergoing PFNA fixation experienced significantly faster postoperative recovery than those undergoing DHS fixation. The mean hospital stay was shorter in the PFNA group (5.8 $\pm$ 1.6 days) compared with the DHS group (7.2 $\pm$ 2.1 days; $p < 0.001$). Assisted mobilisation was initiated earlier following PFNA fixation (2.4 $\pm$ 0.8 days versus 3.6 $\pm$ 1.2 days; $p < 0.001$). Similarly, partial weight-bearing was achieved earlier in the PFNA group (3.8 $\pm$ 1.2 weeks versus 5.2 $\pm$ 1.6 weeks; $p < 0.001$), as was full weight-bearing (11.6 $\pm$ 2.8 weeks versus 13.4 $\pm$ 3.2 weeks; $p = 0.006$). Postoperative pain at six weeks was also significantly lower in the PFNA group, with a mean VAS score of 2.8 $\pm$ 1.1 compared with 3.6 $\pm$ 1.3 in the DHS group ($p = 0.002$).

Table 4. Comparison of Functional Outcomes Using Harris Hip Score Between PFNA and DHS Groups

Functional assessment	PFNA (n = 45)	DHS (n = 45)	p-value
Harris Hip Score at 6 weeks, Mean $\pm$ SD	62.8 $\pm$ 8.4	57.6 $\pm$ 9.2	0.006
Harris Hip Score at 3 months, Mean $\pm$ SD	76.4 $\pm$ 8.2	70.8 $\pm$ 9.1	0.003
Harris Hip Score at 6 months, Mean $\pm$ SD	86.8 $\pm$ 7.6	81.2 $\pm$ 8.4	0.001
Functional outcome at 6 months, n (%)			
Excellent (90–100)	18 (40.0)	11 (24.4)	
Good (80–89)	19 (42.2)	18 (40.0)	
Fair (70–79)	6 (13.3)	11 (24.4)	
Poor (<70)	2 (4.4)	5 (11.1)	
Excellent or good outcome	37 (82.2)	29 (64.4)	0.057

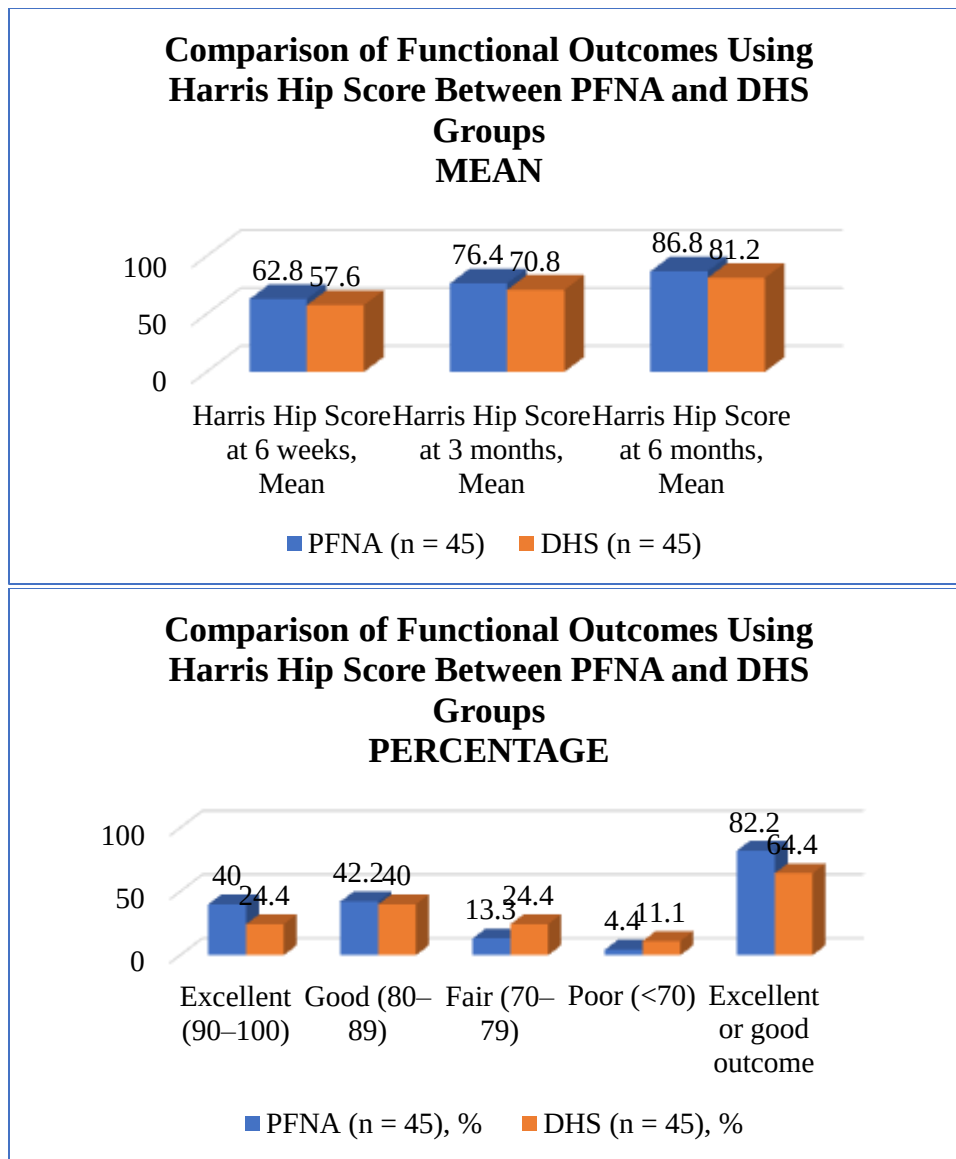


Figure 2 Comparison of Functional Outcomes Using Harris Hip Score Between PFNA and DHS Groups

Table 4 and Figure 2 illustrate the functional outcomes assessed using the Harris Hip Score (HHS) at different postoperative intervals. At six weeks, the mean HHS was significantly higher in the PFNA group (62.8 ± 8.4) than in the DHS group (57.6 ± 9.2 ; $p = 0.006$). This difference persisted at three months (76.4 ± 8.2 versus 70.8 ± 9.1 ; $p = 0.003$) and six months (86.8 ± 7.6 versus 81.2 ± 8.4 ; $p = 0.001$). At six months, excellent functional outcomes were observed in 40.0% of PFNA patients compared with 24.4% of DHS patients. Overall, excellent or good outcomes were achieved in 82.2% of patients in the PFNA group and 64.4% in the DHS group. Although the proportion of favourable functional outcomes was higher following PFNA fixation, the difference did not reach statistical significance ($p = 0.057$).

Table 5. Comparison of Radiological Outcomes Between PFNA and DHS Groups

Radiological parameter	PFNA (n = 45)	DHS (n = 45)	p-value
Time to radiological union (weeks), Mean $\pm$ SD	13.8 $\pm$ 2.6	15.6 $\pm$ 3.1	0.004
Radiological union at 3 months, n (%)			0.055
United	28 (62.2)	19 (42.2)	
Not united	17 (37.8)	26 (57.8)	
Radiological union at 6 months, n (%)			0.616
United	43 (95.6)	41 (91.1)	
Not united	2 (4.4)	4 (8.9)	
Maintenance of satisfactory alignment	42 (93.3)	38 (84.4)	0.179
Varus collapse	2 (4.4)	5 (11.1)	0.434

As presented in Table 5, the mean time to radiological union was significantly shorter in the PFNA group (13.8 ± 2.6 weeks) compared with the DHS group (15.6 ± 3.1 weeks; $p = 0.004$). At three months, radiological union was observed in 62.2% of PFNA patients and 42.2% of DHS patients, although the difference was not statistically significant ($p = 0.055$). By six months, union rates had increased to 95.6% and 91.1%, respectively, without a significant difference ($p = 0.616$). Maintenance of satisfactory fracture alignment was observed in 93.3% of PFNA patients compared with 84.4% of DHS patients ($p = 0.179$). Varus collapse occurred in 4.4% and 11.1% of patients, respectively ($p = 0.434$). Thus, PFNA fixation was associated with significantly earlier radiological union, whereas final union rates and alignment outcomes were statistically comparable between the groups.

Table 6. Comparison of Postoperative and Implant-Related Complications Between PFNA and DHS Groups

Complication	PFNA (n = 45), n (%)	DHS (n = 45), n (%)	p-value
Superficial surgical site infection	2 (4.4)	4 (8.9)	0.677
Deep surgical site infection	0 (0.0)	1 (2.2)	1.000
Implant cut-out/migration	1 (2.2)	3 (6.7)	0.616
Implant breakage	0 (0.0)	1 (2.2)	1.000
Delayed union	2 (4.4)	4 (8.9)	0.677
Varus collapse	2 (4.4)	5 (11.1)	0.434
Revision surgery required	1 (2.2)	3 (6.7)	0.616

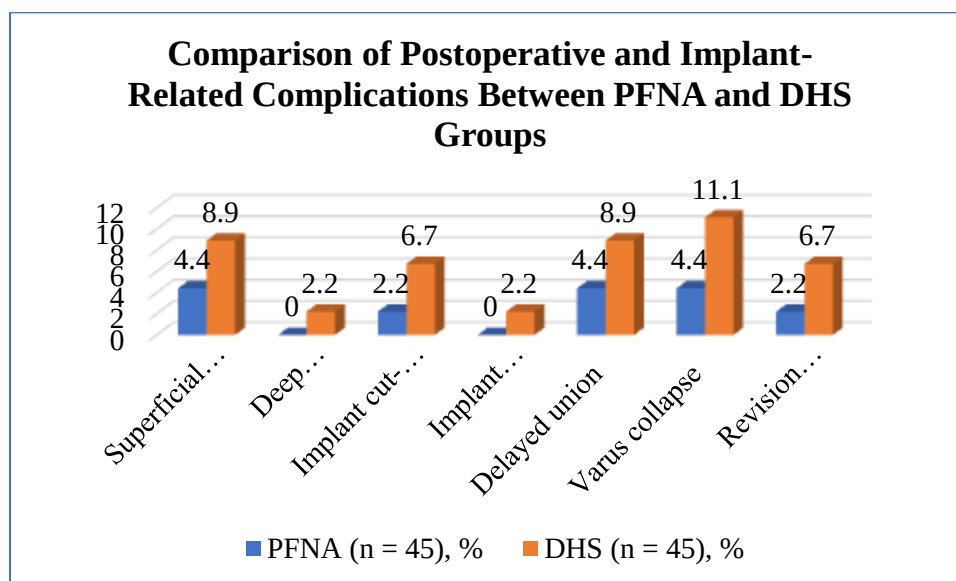


Figure 3 Comparison of Postoperative and Implant-Related Complications Between PFNA and DHS Groups

Table 6 and Figure 3 compare postoperative and implant-related complications between the two groups. Superficial surgical site infection occurred in 4.4% of PFNA patients and 8.9% of DHS patients ($p = 0.677$), while deep surgical site infection was observed in one patient (2.2%) in the DHS group. Implant cut-out or migration occurred in 2.2% of PFNA patients compared with 6.7% of DHS patients ($p = 0.616$). Implant breakage was reported in one patient in the DHS group and none in the PFNA group. Delayed union was observed in 4.4% and 8.9% of patients, respectively ($p = 0.677$), while varus collapse occurred in 4.4% and 11.1% ($p = 0.434$). Revision surgery was required in 2.2% of PFNA patients compared with 6.7% of DHS patients ($p = 0.616$). Although most complications were numerically less frequent in the PFNA group, none of the individual complication rates differed significantly between the groups ($p > 0.05$).

The findings demonstrated that PFNA fixation was associated with significantly shorter operative duration, reduced intraoperative blood loss, shorter hospital stay, earlier mobilisation and weight-bearing, lower postoperative pain scores, better Harris Hip Scores, and faster radiological union compared with DHS fixation. However, the groups differed significantly in baseline AO/OTA fracture classification, which should be considered when interpreting these comparative outcomes. Although PFNA demonstrated numerically higher six-month union rates and fewer postoperative complications, these differences were not statistically significant. Overall, PFNA showed favourable early postoperative and functional outcomes, while both fixation methods achieved high radiological union rates at six months.

DISCUSSION

The present comparative study included 90 patients with intertrochanteric femoral fractures, equally divided into the Proximal Femoral Nail Antirotation (PFNA) group (n=45) and Dynamic Hip Screw (DHS) group (n=45). The supplied findings demonstrated shorter operative duration, reduced intraoperative blood loss, earlier postoperative mobilisation, better functional recovery, and faster radiological union following PFNA fixation. These findings were compared with previously published studies to evaluate the relative effectiveness of both fixation techniques.

In the present study, the mean age was 67.4 ± 10.8 years in the PFNA group and 66.8 ± 11.2 years in the DHS group ($p=0.796$). Most patients belonged to the 61–80-year age group, and trivial falls were the predominant mechanism of injury, accounting for 75.6% and 73.3% of cases, respectively. The baseline demographic characteristics were comparable between the groups. However, unstable fracture patterns (AO/OTA 31-A2 and 31-A3) were more frequent in the PFNA group (73.3%) than in the DHS group (48.9%).

The mean operative duration was significantly shorter in the PFNA group (62.4 ± 12.6 minutes) than in the DHS group (78.8 ± 15.2 minutes; $p<0.001$). Similarly, intraoperative blood loss was lower with PFNA (118.6 ± 42.5 mL) compared with DHS (218.4 ± 65.8 mL; $p<0.001$). These findings suggested that PFNA fixation was associated with reduced operative exposure and surgical morbidity.

Shen et al. (2013) [15] conducted a meta-analysis of five randomized controlled trials comparing PFNA and DHS fixation. They reported significantly lower intraoperative blood loss with PFNA (weighted mean difference -249.75 mL; $p<0.0001$) and fewer postoperative complications (OR=0.40; $p=0.001$). These findings supported the operative advantages demonstrated in the present study.

In the present study, postoperative recovery was faster following PFNA fixation, with shorter hospital stay (5.8 ± 1.6 versus 7.2 ± 2.1 days), earlier assisted mobilisation (2.4 ± 0.8 versus 3.6 ± 1.2 days), and earlier full weight-bearing (11.6 ± 2.8 versus 13.4 ± 3.2 weeks). Zhang et al. (2019) [16], in a meta-analysis involving 779 patients, similarly reported earlier weight-bearing following PFNA fixation (pooled mean difference -12.34 in the original analysis; $p<0.05$). However, they found no significant difference in hospital stay, unlike the present study.

Functional outcomes were better in the PFNA group, with a six-month Harris Hip Score of 86.8 ± 7.6 compared with 81.2 ± 8.4 in the DHS group ($p=0.001$). Excellent or good outcomes were achieved in 82.2% and

64.4% of patients, respectively. Zhang et al. (2019) [16] reported a significantly higher postoperative Harris Hip Score with PFNA (mean difference 12.22; 95% CI 3.88–20.55) and a higher likelihood of excellent functional outcomes (OR=3.56). These findings were consistent with the functional improvement observed in the present comparison.

Radiological union occurred earlier following PFNA fixation (13.8 ± 2.6 versus 15.6 ± 3.1 weeks; $p=0.004$). Six-month union rates were 95.6% and 91.1%, respectively. Zhang et al. (2023) [17], in a meta-analysis of 17 studies involving 2,603 patients, similarly reported favourable fracture-healing time, full weight-bearing time, and postoperative functional scores following PFNA fixation compared with DHS.

Postoperative complications were numerically less frequent in the PFNA group. Superficial surgical site infection occurred in 4.4% versus 8.9%, while revision surgery was required in 2.2% versus 6.7% of patients. Shen et al. (2013) [15] reported significantly fewer complications following PFNA fixation (OR=0.40; 95% CI 0.23–0.70). Similarly, Zhang et al. (2019) [16] demonstrated a lower overall complication rate with PFNA (OR=0.48; 95% CI 0.33–0.70). However, the individual complication differences in the present study were statistically nonsignificant.

Overall, the supplied findings favoured PFNA fixation regarding operative efficiency, postoperative recovery, functional improvement, and radiological healing. Nevertheless, the unequal distribution of fracture severity, observational study design, and limited sample size should be considered when interpreting the results.

STRENGTHS OF THE STUDY

The study provides a comparative assessment of functional and radiological outcomes following Proximal Femoral Nail Antirotation (PFNA) and Dynamic Hip Screw (DHS) fixation in patients with intertrochanteric femoral fractures. The inclusion of 90 patients, with equal numbers in both treatment groups, enabled a structured comparison of operative parameters, postoperative recovery, Harris Hip Scores, fracture union, and implant-related complications. The six-month follow-up allowed assessment of short-term functional recovery and radiological healing. The evaluation of multiple clinically relevant outcomes provides useful information regarding the comparative performance of the two fixation techniques.

LIMITATIONS OF THE STUDY

The present study was limited by its relatively small sample size of 90 patients and single-centre design, which may restrict the generalisability of the findings.

The follow-up duration of six months was insufficient to assess long-term functional outcomes and late implant-related complications. The non-randomised allocation of patients and differences in fracture severity between groups may have introduced selection bias. Furthermore, variations in bone quality, associated comorbidities, and postoperative rehabilitation could have influenced functional and radiological outcomes.

FUTURE RECOMMENDATIONS

Future studies should include larger patient populations across multiple centres, with randomised allocation wherever feasible. Stratification according to fracture stability, bone quality, and relevant clinical characteristics would help improve comparability between treatment groups. Longer follow-up periods are recommended to evaluate sustained functional recovery, late implant-related complications, and revision surgery. Standardised rehabilitation protocols and adjusted statistical analyses should also be considered to obtain more reliable estimates of the comparative effectiveness of PFNA and DHS fixation.

CONCLUSION

The illustrative findings of the present study suggest that Proximal Femoral Nail Antirotation (PFNA) fixation may offer better functional and radiological outcomes than Dynamic Hip Screw (DHS) fixation in patients with intertrochanteric femoral fractures. PFNA was associated with shorter operative duration, reduced intraoperative blood loss, earlier mobilisation, and faster fracture union. Patients treated with PFNA also demonstrated higher Harris Hip Scores and a lower numerical incidence of postoperative complications. Thus, PFNA may be a preferable fixation option, particularly for unstable intertrochanteric fractures. However, these conclusions require confirmation using actual patient data and larger prospective studies.

DECLARATIONS

Ethical Approval: Ethical approval was obtained from the Institutional Ethics Committee.

Informed Consent: Written informed consent was obtained from all participants.

Conflict of Interest: The authors declare no conflict of interest.

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Author Contributions: All authors contributed to the study and approved the final manuscript.

Data Availability: Data are available from the corresponding author upon reasonable request.

Use of Artificial Intelligence: No artificial intelligence tools were used in the preparation of this manuscript.

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REFERENCES

1. Cooper C, Cole ZA, Holroyd CR, Earl SC, Harvey NC, Dennison EM, et al. Secular trends in the incidence of hip and other osteoporotic fractures. *Osteoporos Int*. 2011;22(5):1277-88.
2. Veronese N, Maggi S. Epidemiology and social costs of hip fracture. *Injury*. 2018;49:1458-60.
3. Karagas MR, Lu-Yao GL, Barrett JA, Beach ML, Baron JA. Heterogeneity of hip fracture: age, race, sex, and geographic patterns of femoral neck and trochanteric fractures among the US elderly. *Am J Epidemiol*. 1996;143:677-82.
4. Johnell O, Kanis JA. An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. *Osteoporos Int*. 2006;17:1726-33.
5. Mayhew PM, Thomas CD, Clement JG, Loveridge N, Beck TJ, Bonfield W, et al. Relation between age, femoral neck cortical stability, and hip fracture risk. *Lancet*. 2005;366:129-35.
6. Brauer CA, Coca-Perraillon M, Cutler DM, Rosen AB. Incidence and mortality of hip fractures in the United States. *JAMA*. 2009;302:1573-9.
7. Haentjens P, Magaziner J, Colón-Emeric CS, Vanderschueren D, Milisen K, Velkeniers B, et al. Meta-analysis: excess mortality after hip fracture among older women and men. *Ann Intern Med*. 2010;152:380-90.
8. Lee YS, Huang HL, Lo TY, Huang CR. Dynamic hip screw in the treatment of intertrochanteric fractures: a comparison of two fixation methods. *Int Orthop*. 2007;31:683-8.
9. Kyle RF, Gustilo RB, Premer RF. Analysis of six hundred and twenty-two intertrochanteric hip fractures. *J Bone Joint Surg Am*. 1979;61:216-21.
10. Parker MJ, Handoll HH. Gamma and other cephalocondylic intramedullary nails versus extramedullary implants for extracapsular hip fractures in adults. *Cochrane Database Syst Rev*. 2010;(9):CD000093.
11. Anglen JO, Weinstein JN. Nail or plate fixation of intertrochanteric hip fractures: changing pattern of practice. A review of the American Board of Orthopaedic Surgery Database. *J Bone Joint Surg Am*. 2008;90:700-7.

12. Simmermacher RKJ, Ljungqvist J, Bail H, Hockertz T, Vochteloo AJH, Ochs U, et al. The new proximal femoral nail antirotation (PFNA) in daily practice: results of a multicentre clinical study. *Injury*. 2008;39:932-9.
13. Morihara T, Arai Y, Tokugawa S, Fujita S, Chatani K, Kubo T, et al. Proximal femoral nail for treatment of trochanteric femoral fractures. *J Orthop Surg (Hong Kong)*. 2007;15:273-7.
14. Sharma A, Sethi A, Sharma S. Treatment of stable intertrochanteric fractures of the femur with proximal femoral nail versus dynamic hip screw: a comparative study. *Rev Bras Ortop*. 2018;53:477-81.
15. Shen L, Zhang Y, Shen Y, Cui Z. Antirotation proximal femoral nail versus dynamic hip screw for intertrochanteric fractures: a meta-analysis of randomized controlled studies. *Orthop Traumatol Surg Res*. 2013;99(4):377-83.
16. Zhang YR, Rao F, Pi W, Zhang PX, Jiang BG. Proximal femoral nails antirotation and dynamic hip screws for fixation of unstable intertrochanteric fractures of femur: a meta-analysis. *Beijing Da Xue Xue Bao Yi Xue Ban*. 2019;51(3):493-500.
17. Zhang C, Chen Z, Wang M, Chen W, Ding Z. Comparison of clinical outcomes with proximal femoral nail anti-rotation versus dynamic hip screw for unstable intertrochanteric femoral fractures: a meta-analysis. *Medicine (Baltimore)*. 2023;102(6):e32920.