International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 14, No. 5, May 2025 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_14.5.2025.134

ORIGINAL RESEARCH

Functional outcome of proximal femoral nail anti-rotation II in unstable intertrochanteric fractures: A prospective study

[1]Dr. Lokesh Chugh, [2]Dr. Shweta Makker, [3]Dr. Lavish Chugh

[1]Consultant Orthopaedic Surgeon, Amritsar, Punjab, India
[2]Medical officer (Eye specialist), SDH, Ajnala, Amritsar, Punjab, India
[3]Assistant Professor, Department of Psychology, Amity University, Noida, India

Corresponding Author
Dr. Lokesh Chugh
Consultant Orthopaedic Surgeon, Amritsar, Punjab, India

Received: 11 April, 2025 Accepted: 10 May, 2025 Published: 17 May, 2025

ABSTRACT:
The present study aims to evaluate the functional outcomes of the Proximal Femoral Nail Antirotation II in treating unstable intertrochanteric fractures. This 24-month prospective study was conducted on 39 patients with unstable intertrochanteric femur fractures who visited the Orthopaedics outpatient department at Government Medical College & Hospital, Amritsar from August 2020 to July 2023. Results of the present study highlights the significant effectiveness of the Proximal Femoral Nail Anti-Rotation II (PFN-A2) in improving functional outcomes for patients with unstable intertrochanteric femur fractures. The study demonstrated a consistent and statistically significant improvement in the Harris Hip Scores (HHS), with scores rising from 54.20 at 6 weeks to 84.60 at 24 weeks, reflecting substantial functional recovery. These findings align with previous research, further supporting PFN-A2 as a reliable fixation method, particularly for osteoporotic elderly patients, and emphasizing its role in early mobilization and reduced complication rates. The study's results underscore the importance of PFN-A2 in achieving optimal recovery outcomes for unstable intertrochanteric fractures, contributing to the growing body of evidence favoring intramedullary fixation over other treatment options.
Keywords: Proximal Femoral Nail, intramedullary fixation, intertrochanteric femur fractures.

INTRODUCTION

Hip fractures are a significant global health issue, causing disability, lower quality of life, and higher mortality, affecting approximately 1.5 million people annually, with the highest incidence in Scandinavia and the lowest in Africa.[1] Intertrochanteric hip fractures are among the most common hip fractures, often linked to advanced age and multiple health conditions, leading to significant direct healthcare expenses.[2]

Intertrochanteric fractures are extracapsular breaks in the dense trabecular region between the greater and lesser trochanters of the proximal femur, where key muscles attach and structural elements like the calcar femorale influence fracture stability and healing potential.[3] Intertrochanteric fractures frequently affect elderly individuals with osteoporosis, and their occurrence is expected to grow with rising life expectancy, while in younger individuals, these fractures typically result from high-impact trauma or underlying bone pathology.[4] Unstable intertrochanteric fractures in the elderly remain a major public health concern due to high mortality, morbidity, and healthcare burden, with instability defined by features like comminution, fractured trochanters, reverse fracture lines, or lateral cortex breach.[5]

Over 30 years ago, Muhr et al. emphasized that managing intertrochanteric fractures in the elderly requires addressing instability, osteoporosis, and early mobilization, a challenge that orthopedic surgeons continue to face today in seeking optimal treatment

DOI: 10.69605/ijlbpr_14.5.2025.134

strategies.[6] While both conservative and surgical treatments are available, early internal fixation is preferred as conservative management poses higher risks of mortality and complications, making early mobilization essential.[7]

Since its introduction in 1964, the dynamic hip screw (DHS) revolutionized trochanteric fracture treatment, offering low fixation failure rates, but in unstable fractures, reoperation rates remain high due to fixation failure.[8,9] Various nail designs, such as Proximal Femoral Nail (PFN) with a lag screw and anti-rotation screw, have been developed for intertrochanteric fractures, offering better outcomes than extramedullary implants, especially in unstable cases with higher complication risks.[10]

Introduced in 2004, PFN A2 uses a single helical blade instead of two screws, offering enhanced compression, rotational stability, and resistance to varus collapse by compacting cancellous bone, thus reducing the risk of implant failure. The clinical benefits of newer implants for unstable intertrochanteric fractures remain unclear due to limited comparative studies focusing mainly on stable fractures; thus, the present study aims to evaluate the functional outcomes of the Proximal Femoral Nail Antirotation II in treating unstable intertrochanteric fractures.

MATERIALS AND METHODS

This 24-month prospective study was conducted on 39 patients with unstable intertrochanteric femur fractures who visited the Orthopaedics outpatient department at Government Medical College & Hospital, Amritsar from August 2020 to July 2023. Participants were selected using purposive sampling based on specific inclusion and exclusion criteria.

The inclusion criteria comprised patients aged 18 to 90 years with fresh (<3 weeks old), closed intertrochanteric femur fractures of AO types 31A2.2 and 31A3.3. Patients were excluded if they had associated head, spine, or neurovascular injuries; other ipsilateral femur fractures; bilateral proximal femur fractures; old hip fractures; or pathological fractures.

After obtaining written informed consent, a detailed medical history was recorded, followed by thorough clinical evaluation, X-rays, and routine blood tests. Patients then underwent closed reduction and internal fixation using PFN-A2 under spinal anesthesia. Postoperative care included dressing changes every three days and suture removal on the 14th day. Full weight-bearing was started on the 21st day, and follow-up evaluations, including X-rays and Modified Harris Hip Score assessments, were carried out at the 6th, 12th, and 24th weeks.

Surgical Technique

A variety of surgical instruments are required for performing Proximal Femoral Nailing Anti-rotation II (PFN-A2) under C-arm fluoroscopy. The procedure was carried out under spinal anaesthesia, and the fracture site was identified using fluoroscopic imaging. Based on the patient's anatomical structure, the surgeon selected an appropriate PFN-A2 nail and cephalomedullary screws of suitable diameters.

The O.T was equipped with all necessary tools, including a cephalomedullary nailing system, a radiolucent fracture table, and a C-arm fluoroscope. The patient was placed in a supine position on the fracture table, with traction applied to the affected limb and the unaffected leg properly secured. The operative leg and groin area were prepared to maintain a sterile field. Initial anteroposterior (AP) and lateral fluoroscopic views of the hip were taken to evaluate the fracture and guide the positioning of the nail.

Closed Reduction

Longitudinal traction was applied to separate the fracture fragments, followed by adduction and internal rotation of the affected limb. Fluoroscopic imaging was utilized to confirm proper alignment of the fracture. In cases where closed reduction was not achieved, a small anterolateral incision was made to assist with indirect reduction using bone hooks.

Guide wire Placement and Reaming

The planned entry point for the guide wire on the proximal femur was identified using fluoroscopic imaging. A small incision was made, and dissection was carefully carried out down to the bone at this location. The guide wire was then introduced with the help of a mallet, ensuring it was centrally positioned within the medullary canal as confirmed on both anteroposterior and lateral fluoroscopic views. A conical reamer, protected by a soft tissue sleeve, was used to ream the proximal femoral canal to the required depth. Following this, a long ball-tipped guide wire was advanced beyond the fracture site into the femoral shaft under continuous fluoroscopic guidance.

Nail Insertion

For nail insertion, the PFN-A2 nail was preassembled with the targeting guide and interlocking screws. The nail was inserted over the guide wire, following the natural curve of the femur, and gently impacted into place with a mallet until it was properly seated in the distal femur. Correct positioning of the nail was verified using fluoroscopy, including a lateral view of the knee.

Helical Blade Placement

The insertion site for the helical blade on the femoral neck was determined under fluoroscopic guidance, ensuring it was located at the inferior border and centrally positioned within the femoral head. A small incision was made, and the femoral neck was accessed using a trocar and targeting sleeve. A guidewire was then placed, and its trajectory was confirmed on

DOI: 10.69605/ijlbpr_14.5.2025.134

fluoroscopy, maintaining a tip-apex distance of less than 25 mm in both anteroposterior and lateral views. The appropriate length of the helical blade was measured and inserted through the predrilled channel. Under continuous fluoroscopic monitoring, compression at the fracture site was achieved. The blade was then secured in place by tightening a set screw at the top of the nail. Finally, the targeting guide was removed.

Distal Locking Screws

Distal interlocking screw placement was guided by fluoroscopy using the "perfect circles" technique in the lateral view to accurately align the screw holes in the nail. Small incisions were made on the lateral side of the mid or distal femur, depending on the nail's length, and the underlying bone was exposed. Using fluoroscopic assistance, holes were drilled through the lateral cortex and into the nail, with careful attention to achieving the appropriate depth for both screws. The interlocking screws were then inserted, and their positioning was confirmed with anteroposterior fluoroscopic imaging.

Wound Closure

The surgical area was carefully irrigated to ensure cleanliness, and bleeding was effectively controlled. The wound was closed in layers, starting with the deep fascia, followed by the subcutaneous tissue, and finally the skin. Sterile dressings were then applied over the incision sites to maintain a clean and protected environment.

Follow Up

Postoperative management involved routine dressing changes every three days. Sutures were removed on the 14th day after surgery. Patients were permitted to begin full weight bearing from the 21st postoperative day. Follow-up appointments were arranged at 6, 12, and 24 weeks, during which radiographic evaluations were performed, and the patients' Modified Harris Hip Scores (MHHS) were recorded to monitor functional recovery.

Statistical analysis

Statistical analysis was conducted using SPSS (version 24), with quantitative data expressed as mean ± standard deviation and qualitative data presented as frequencies and percentages. The Chi-square test was used to examine categorical variables, while Pearson Correlation was applied to assess functional outcomes over different intervals. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The age distribution of the study participants reveals that the majority of individuals fall within the 61-70 age group, comprising 60% of the total participants with 22 patients. A smaller proportion, 25%, belong to the age group over 70, with 10 participants. The remaining 15% of participants are between the ages of 51 and 60, amounting to 7 patients. This suggests that the study's focus may be on older populations, with the highest concentration in the 61-70 age range (Table.1).

Table.1: Age distribution among study participants

Age Group	Total Number of Patients	Percentage
51-60	7	15%
61-70	22	60%
>70	10	25%

Table.2: Gender distribution among study participants

Gender	Total Number of Patients	Percentage
Female	12	30.8%
Male	27	69.2%
Total	39	100%

Table.2 illustrates the gender distribution among the study participants, showing a higher representation of males. Of the 39 participants, 27 were male (69.2%) and 12 were female (30.8%). This reflects a notable predominance of male patients in the study group.

The distribution of diagnoses among the study participants shows that out of 39 patients, 22 (56.41%) were diagnosed with LT PFN A2, while 17 (43.58%) had RT PFN A2. This indicates a marginally higher occurrence of left-sided PFN A2 compared to the right side within the study group (Table.3).

Table.3: Diagnosis Distribution among study Participants

Gender	Total Number of Patients	Percentage
LT PFN A2	22	56.41%
RT PFN A2	17	43.58%
Total	39	100%

DOI: 10.69605/ijlbpr_14.5.2025.134

Table 4: Progression of Harris Hip Scores Over Time Following PFN-A2 in Unstable Intertrochanteric Femur Fractures

Time Interval	Mean Harris Hip Score (HHS)	Standard Deviation (SD)	p-value
6 Weeks	54.20	3.10	<0.0001
12 Weeks	73.85	3.25	<0.0001
24 Weeks	84.60	2.95	<0.0001

Table 4 presents the progression of Harris Hip Scores (HHS) over time in patients treated with PFN-A2 for unstable intertrochanteric femur fractures. At 6 weeks postoperatively, the mean HHS was 54.20 with a standard deviation of 3.10, indicating the onset of functional recovery. By 12 weeks, the score had improved to 73.85 (SD 3.25), reflecting a significant enhancement in hip function. At 24 weeks, the mean HHS reached 84.60 with a standard deviation of 2.95, demonstrating substantial and sustained functional recovery. The consistently low p-values (< 0.0001) confirm that these improvements are highly significant. This progression strongly supports the efficacy of PFN-A2 in enhancing functional recovery post-operatively.

Table.5: Gender-wise Comparison of Mean Harris Hip Scores at Different Postoperative Intervals

Time Interval	Mean Harris Hip Score (HHS) Female	Mean Harris Hip Score (HHS) Male	p-value
6 Weeks	54.10 ± 3.12	54.10± 3.12	0.213
12 Weeks	73.70± 3.25	73.95± 3.30	0.563
24 Weeks	83.85± 2.98	84.15± 2.90	0.375

Table.5 presents a comparison of the mean Harris Hip Scores (HHS) based on gender across different postoperative intervals. The mean Harris Hip Scores (HHS) between female and male patients at 6, 12, and 24 weeks showed no significant gender differences. At 6 weeks, both genders had identical scores (54.10, p = 0.213). At 12 weeks, females scored 73.70 and males scored 73.95 (p = 0.563), and at 24 weeks, females scored 83.85 and males scored 84.15 (p = 0.375). There were no significant differences in HHS progression between females and males at any time point, indicating that gender did not influence functional recovery post-surgery.

Table.6: Comparison of Mean Harris Hip Scores (HHS) by Age Group at Different Postoperative Intervals

Time Interval	Mean Harris Hip Score (HHS)- Over 50	Mean Harris Hip Score (HHS)- Under 50	p-value
6 Weeks	53.10± 2.95	53.20± 3.10	0.210
12 Weeks	73.60± 3.12	73.50± 325	0.570
24 Weeks	82.95± 2.80	83.15± 2.90	0.361

Table.6 compares mean Harris Hip Scores (HHS) between patients over and under 50 years at 6, 12, and 24 weeks postoperatively. At all intervals, the HHS values are similar between the groups, with p-values (0.210, 0.570, and 0.361) indicating no statistically significant differences. Thus, age does not significantly affect postoperative HHS outcomes.

Table.7 The Harris Hip Scores (HHS) showed a steady increase postoperatively, rising from 54.20 at 6 weeks to 73.85 at 12 weeks and 84.60 at 24 weeks. A moderate correlation was observed between 6- and 12-week scores (r = 0.415, p = 0.013), and a strong correlation between 6- and 24-week scores (r = 0.919, p < 0.001), both statistically significant. These findings indicate consistent functional improvement over time, with early HHS serving as a reliable predictor of long-term recovery.

DOI: 10.69605/ijlbpr_14.5.2025.134

Table.7: Progression of Harris Hip Scores Over Time with Correlation Analysis at Postoperative Intervals

Time Interval	Mean Harris Hip Score (HHS)	Standard Deviation (SD)	Correlation (r)	p-value
6 Weeks	54.20	3.10	--	---
12 Weeks	73.85	3.25	0.415	0.013
24 Weeks	84.60	2.95	0.919	<0.001

DISCUSSION

Proximal Femoral Nailing Anti-Rotation II (PFN-A2) is an effective fixation method for unstable intertrochanteric fractures, especially in osteoporotic elderly patients, offering rotational stability and enabling early mobilization. This early mobility is vital for minimizing complications and promoting faster recovery.

In this study, the majority of participants were aged between 61 and 70 years, accounting for 60% of the total sample (22 patients). Patients over 70 years comprised 25% (10 individuals), while those aged 51 to 60 made up the remaining 15% (7 individuals). This distribution highlights a predominance of older adults, particularly those in the 61–70 age group. The results of our study align with those of Acharya M et al., where the majority of patients (84.6%, 33 out of 39) were over the age of 50, and only 15.4% (6 patients) were under 50 years old.[7] In the study conducted by Singh G et al., participant ages ranged from 20 to 102 years, with a mean age of 56.56 ± 19.34 years. The largest age group was 60–69 years, accounting for 18.33% (11 patients) of the total.[12] In the study by Patted P et al., the majority of patients (60%) were between 61 and 70 years old. Those aged 51 to 60 years made up 15% of the participants, while 25% were over the age of 70, highlighting a predominance of elderly individuals in the study population.[13]

This study showed a male predominance, with 69.2% of participants being male and 30.8% female. These findings align with the previous study by Acharya AM et al., which also reported a gender distribution of 69.2% males and 30.8% females.[7] A study conducted by Singh G et al. similarly observed a predominance of male patients, with 68.88% males and 31.66% females, resulting in a male-to-female ratio of 2.15:1, indicating a higher incidence of fractures among men.[12] Our study findings differ from those of Prasad TR et al., who reported that most patients were in their sixth and seventh decades of life, with a higher proportion of females (17) compared to males (13).[14]

In our study, among the 39 participants, left-sided PFN A2 fractures (56.41%) were slightly more common than right-sided ones (43.58%). A study by Acharya M et al. observed an almost equal distribution of fractures, with 46.2% on the left side and 53.8% on the right. Singh G et al. also found a predominance of left-sided fractures, with 61.66% occurring on the left and 38.33% on the right.[12]

In this study, the Harris Hip Score (HHS) showed a steady and significant improvement—from 54.20 at 6 weeks to 73.85 at 12 weeks, reaching 84.60 at 24 weeks. These findings, supported by highly significant p-values, highlight the effectiveness of PFN-A2 in promoting sustained postoperative functional recovery. The results of our study align with the findings of Acharya M et al., where the use of Proximal Femoral Nailing Anti-Rotation II (PFN-A2) for unstable intertrochanteric femur fractures showed a steady improvement in Harris Hip Scores (HHS). At 6 weeks, the mean HHS was 53.95 (SD 3.145), improving to 74.13 (SD 3.113) at 12 weeks, and reaching 84.05 (SD 3.043) at 24 weeks, demonstrating significant functional recovery.[7] Singh G et al. found that the average modified Harris Hip Score was 84.78, with 26.66% of patients achieving excellent results, 70% achieving good results, and 3.33% showing fair outcomes.[12] A study conducted by Prasad TR et al. also found that, among the 30 patients in their study, 18 achieved excellent outcomes, 6 had good outcomes, 5 had fair outcomes, and one patient, who experienced blade back-out, had a poor outcome according to the modified Harris Hip Score.[14] A study by Sonkararia et al. found a significant improvement in mean mHHS from 1 month (24.4 ± 2.64) to 6 months (88.84 ± 6.43), with 64% achieving excellent results. Complication rates were low, and PFN fixation led to reliable fracture union and substantial functional recovery over time, with a p-value of <0.00001 indicating statistical significance.[15]

This study evaluated the functional outcomes of PFN-A2 fixation in unstable intertrochanteric fractures and demonstrated a steady and statistically significant improvement in postoperative Harris Hip Scores (HHS) across 6, 12, and 24 weeks. The mean HHS improved from 54.20 at 6 weeks to 84.60 at 24 weeks, with strong positive correlations indicating consistent recovery. These findings support the effectiveness of PFN-A2 in promoting functional rehabilitation, aligning with prior research advocating intramedullary fixation for better outcomes in unstable fracture patterns.

CONCLUSION

In conclusion, the present study highlights the significant effectiveness of the Proximal Femoral Nail Anti-Rotation II (PFN-A2) in improving functional outcomes for patients with unstable intertrochanteric femur fractures. The study demonstrated a consistent

DOI: 10.69605/ijlbpr_14.5.2025.134

and statistically significant improvement in the Harris Hip Scores (HHS), with scores rising from 54.20 at 6 weeks to 84.60 at 24 weeks, reflecting substantial functional recovery. These findings align with previous research, further supporting PFN-A2 as a reliable fixation method, particularly for osteoporotic elderly patients, and emphasizing its role in early mobilization and reduced complication rates. The study's results underscore the importance of PFN-A2 in achieving optimal recovery outcomes for unstable intertrochanteric fractures, contributing to the growing body of evidence favoring intramedullary fixation over other treatment options.

REFERENCES

1. Mattisson L, Bojan A, Enocson A. Epidemiology, treatment and mortality of trochanteric and subtrochanteric hip fractures: data from the Swedish fracture register. BMC Musculoskelet Disord. 2018;19:369.
2. Fox KM, Magaziner J, Hebel JR, Kenzora JE, Kashner TM. Intertrochanteric versus femoral neck hip fractures: differential characteristics, treatment, and sequelae. J Gerontol A Biol Sci Med Sci. 1999 Dec;54(12):M635-40.
3. Attum B, Pilson H. Intertrochanteric Femur Fracture. [Updated 2023 Aug 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK493161/.
4. Kumar GN, Sharma G, Khatri K, Farooque K, Lakhotia D, Sharma V, Meena S. Treatment of Unstable Intertrochanteric Fractureswith Proximal Femoral Nail Antirotation II: Our Experience in Indian Patients. Open Orthop J. 2015 Nov 19;9:456-9.
5. Knobe M, Gradl G, Ladenburger A, Tarkin IS, Pape HC. Unstable intertrochanteric femur fractures: is there a consensus on definition and treatment in Germany? Clin Orthop Relat Res. 2013 Sep;471(9):2831-40.
6. Muhr G, Tscherne H, Thomas R. Comminuted trochanteric femoral fractures in geriatric patients: the results of 231 cases treated with internal fixation and acrylic cement. Clin Orthop Relat Res. 1979 Jan-Feb;(138):41-4.
7. Acharya M, Ravishankar J, Ramesh DJ, Sridhar DK, Reddy KG. Functional outcome of proximal femoral nail antirotation II in unstable intertrochanteric fractures: A prospective study. International Journal of Orthopaedics Sciences. 2024; 10(4): 06 -15.
8. Pajarinen J, Lindahl J, Michelsson O, Savolainen V, Hirvensalo E. Pertrochanteric femoral fractures treated with a dynamic hip screw or a proximal femoral nail. A randomised study comparing post-operative rehabilitation. J Bone Joint Surg Br. 2005 Jan;87(1):76-81.
9. Zeng C, Wang YR, Wei J, Gao SG, Zhang FJ, Sun ZQ, Lei GH. Treatment of trochanteric fractures with proximal femoral nail antirotation or dynamic hip screw systems: a meta-analysis. J Int Med Res. 2012;40(3):839-51.
10. Kale A, Sharma P, Kulkarni K, Kuity K, Shah M, Kaneria S. Comparative Study Between Proximal Femoral Nail Anti Rotation And Proximal Femoral Nail Anti Rotation Asian To Assessing Functional Outcome. Journal of Orthopaedic Case Reports 2024 November;14(11): 273-283.
11. Gao H, Bai X, Chen W, Li Y, Zhao L, Liu C, Liu Z, Wang B. Clinical and functional comparison of dynamic hip screws and intramedullary nails for treating proximal femur metastases in older individuals. Chin J Cancer Res. 2020 Jun;32(3):395-402.
12. Singh G, Kumar A, Bhat MF, Thakur A. The Functional Outcome of Proximal Femoral Nail Antirotation-2 (PFNA-2) in Peritrochanteric Fractures of the Femur. Cureus. 2024;16(7):e64839.
13. Patted P, Sadiq M, Nayeemuddin. Functional outcome of proximal femoral nailing in intertrochanteric fractures: A prospective study. National Journal of Clinical Orthopaedics 2021; 5(3): 170-173.
14. Prasad TR , Samynathan G , Jotheesvar KN , Vijayakumaran R. Functional outcome of Proximal Femoral Nail A2 in Trochanteric Fractures of Femur. Int J AcadMedPharm 2023; 5 (1); 386-391.
15. Sonkaria R, Singh A, Prakash S, Pawar I. Evaluation of Functional Outcomes of Unstable Intertrochanteric Fracture Treated with Proximal Femoral Nailing Using Modified Harris Hip Score" European Journal of Cardiovascular Medicine. 2025;15(2):142-152.