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Functional outcome of proximal femoral nail antirotation II in unstable intertrochanteric fractures: A prospective study

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Abstract
Intertrochanteric fractures are a common injury in elderly individuals following falls and can be categorized as stable or unstable based on the displacement of bone fragments. Unstable fractures often require surgical intervention to restore mobility. Traditionally, dynamic hip screws (DHS) were used, but these have shown higher reoperation rates in unstable cases. Proximal femoral nails (PFNs) have gained popularity as a better alternative due to their biomechanical advantages, resulting in fewer implant failures and improved patient outcomes. This study evaluates the effectiveness of the Proximal Femoral Nail Antirotation II (PFN-A2), a newer intramedullary nail with a single helical blade, in treating unstable intertrochanteric fractures in a population from Tumkur, India.
Materials & Methods: The study included 39 participants treated at Sri Siddhartha Medical College Hospital, Tumkur, between June 2022 and June 2024. All had unstable intertrochanteric femur fractures and underwent closed reduction and internal fixation using PFN-A2 under spinal anesthesia. Follow-ups were conducted at 6, 12, and 24 weeks, assessing recovery using X-rays and the Modified Harris Hip Score (mHHS).
Results: There were no significant differences in recovery based on age or gender. The average surgery time was 48 minutes, and mean intraoperative blood loss was 97.8 ml. Significant improvements in mHHS scores were noted over time, from 58.9 at 6 weeks to 82.1 by 24 weeks, indicating consistent functional recovery for all patients.
Complications: Two cases of delayed wound healing were reported, both resolved with additional care.
Conclusion: PFN-A2 demonstrates significant and consistent improvements in hip function after surgery. The study's small sample size and single-center focus limit generalizability, and longer follow-up is needed to explore complications like implant failure.

Keywords: Significant, improvements, generalizability

Introduction
Intertrochanteric fractures are fractures occurring outside the joint capsule, affecting the proximal femur between the greater and lesser trochanters, occasionally extending into the subtrochanteric segment. This metaphyseal area, rich in dense trabecular bone and well-supplied with blood, contributes to a high union rate and lowers the risk of osteonecrosis. The stability of these fractures' hinges on the integrity of the posteromedial aspect of the femoral neck known as the calcar femoral [1, 2].
Osteoporosis contributes significantly to its prevalence among the elderly, where even minor falls can cause these fractures (McLaurin and Lawler, 2008). In younger individuals, intertrochanteric fractures typically result from high-velocity traumas or pathological conditions [3, 4].
Fractures are commonly classified into stable and unstable types. Unstable fractures often show fragmentation in the posteromedial region, basicervical patterns, reverse obliquity patterns, and displaced greater trochanteric fractures with comminution of the lateral wall. Treatment options include both conservative and surgical approaches. However, conservative management carries a higher risk of mortality and morbidity. Therefore, early internal fixation is crucial to promote early mobilization and minimize complications [5].

Proximal femoral fractures (PFFs) represent a significant portion of trauma surgeries and are associated with high mortality rates, with 5% of patients dying within one month and 15% within six months. The frequency of PFFs has been increasing, rising from 50,000 cases in France in 1990 to 75,000 in 2002, with an estimated 145,000 cases by 2050. About 65% of PFFs are extra-capsular. The primary concern with extra-capsular PFFs is instability due to comminution and rupture of the posteromedial cortex. This instability is observed in complex pertrochanteric, intertrochanteric fractures, trochanteric fractures extending into the diaphysis, and subtrochanteric fractures, leading to varus deviation and lateral rotation of the femoral head [6, 7].

Intertrochanteric fractures in elderly patients present a common and challenging issue for orthopedic surgeons. Choosing an implant that supports minimal invasiveness, early weight bearing, and low complication rates is crucial. Since its introduction in 1964, the dynamic hip screw (DHS) has revolutionized the treatment of trochanteric fractures. For many years, DHS has been preferred due to its ability to achieve controlled compression at the fracture site, resulting in low rates of fixation failure and non-union. However, in cases of unstable fractures, DHS has shown higher rates of reoperation due to fixation failure [8, 9].

Several comparative studies have been published in the literature, examining extramedullary and intramedullary implants for fixing intertrochanteric fractures. Most of these studies compare the dynamic hip screw (DHS) with older designs of intramedullary nails such as the Gamma nail, proximal femoral nail (PFN), and proximal femoral nail anti-rotation (PFNA), including both stable and unstable fracture types. Many published studies support and recommend the clinical advantages of PFNA over DHS for the fixation of unstable intertrochanteric fractures [10, 11].

The Proximal Femoral Nail Antirotation II (PFN-A2) features a single helical blade instead of the more commonly used two screws. This helical blade is designed to offer stability, compression, and rotational control of the fracture. Upon insertion into the neck, it compresses cancellous bone, enhancing anchorage and providing greater resistance to cut-out compared to other devices. However, unlike conventional lag screws, the helical blade may not withstand high fracture pressures, underscoring the importance of achieving optimal fracture reduction. Consequently, the PFN-A2 implant represents a potentially more biomechanically favorable option for trochanteric fractures [12-14].

Compared to extramedullary devices like the dynamic hip screw (DHS), proximal femoral nails (PFN) offer a biomechanical advantage due to their closer proximity to the line of force and shorter lever arm. Several studies suggest that intramedullary fixation may be preferable for patients, as it reduces the risk of implant failure and the need for reoperation, while also yielding higher functional scores. PFNs can be implanted using minimally invasive techniques, involving closed reduction to preserve the hematoma and minimize soft-tissue disruption. This approach reduces surgical trauma, blood loss, infection risks, and wound complications. The interfragmentary compression provided by the lag screw in PFNs significantly promotes bone healing [15-16].

Numerous published papers have conducted clinical and radiological evaluations on different types of proximal femoral nails (PFNs). Despite the widespread use of PFNs like A-PFN, PROFIN, and InterTAN in our country, very few studies have directly compared the radiological and clinical outcomes of these three implants.

Fracture implants are broadly classified into extramedullary devices and intramedullary nails, with the choice depending largely on the stability of the fracture. Unstable intertrochanteric fractures typically involve significant disruption of the posteromedial cortex due to comminution, reverse oblique patterns, or extension into the subtrochanteric region. In contrast, stable fractures do not exhibit disruption of the posteromedial cortex or extension into the subtrochanteric region [17, 18].

The effectiveness and clinical advantages of these newer implants in treating unstable intertrochanteric fractures have not been definitively established due to a shortage of sufficient comparative studies that include only stable fractures. Therefore, the purpose of the present study is to assess the functional outcomes of the Proximal Femoral Nail Antirotation II in managing unstable intertrochanteric fractures within the Tumkur population. This study aims to fill the gap in research within our region, aiming to enhance the reliability of existing findings.

Materials and Methods

The data for this 24-month prospective study were obtained from 32 participants with unstable intertrochanteric femur fractures attending the Orthopaedics outpatient department at Sri Siddhartha Medical College Hospital, Tumkur, between June 2022 and June 2024, selected through purposive sampling based on inclusion and exclusion criteria.

Inclusion Criteria

- Inter-trochanteric fracture of femur 31A2.2 and 31A3.3 type (AO Classification)
- Age 18-90 years
- Fresh fractures (< 3 Weeks old)
- Closed fractures

Exclusion Criteria

- Associated head injury, spine injury, neurovascular injuries
- Any other ipsilateral femur fractures
- B/L proximal femur fractures
- Any old fracture around hip
- Other pathological fractures

A comprehensive medical history was obtained, and thorough clinical examinations, along with X-rays and routine hematological investigations, were performed after written informed consent was secured. Closed reduction and internal fixation using PFN-A2 under spinal anesthesia followed, with regular dressing changes every three days and suture removal on the 14th day post-operation. Full weight-bearing was initiated on the 21st day. Follow-up assessments, including X-rays and Modified Harris Hip scores, were conducted at the 6th, 12th, and 24th weeks. Statistical analysis was performed using SPSS (version 24), with quantitative data presented as mean ± standard deviation, and qualitative data as frequencies and percentages. The Chi-square test analyzed categorical variables, while Pearson Correlation compared functional outcomes across intervals. A p-value of <0.05 was considered statistically significant. Pre-operative workup included complete blood tests, viral markers, and imaging studies like X-rays, ECG, and 2D Echo when needed. Patients were fully informed about the injury, treatment options, and potential risks, with consent obtained before the procedure, after discussing the risk-benefit ratio.

Surgical techniques

Several surgical instruments are needed for the Proximal femoral nailing Anti-rotation II, with C- arm fluoroscopy.

Fig 1: Showing Instrument sets used for Proximal Femoral Nail anti-rotation II

Under Spinal Anaesthesia, C-Arm fluoroscopy to note the position of the fracture was done.

Fig 2: Showing C- Arm guided positioning of the patient on fracture table

Fig 3: Showing patient positioned on fracture table after betadine painting and draping with sterile sheet

The surgeon selected a PFN-A2 nail and cephalomedullary screws with appropriate diameters based on the patient's anatomy.

The operating room was equipped with a cephalomedullary nailing system, radiolucent fracture table, C-arm fluoroscopy, and other necessary surgical instruments.

The patient was positioned supine on the fracture table. Traction was applied to the affected leg, and the unaffected leg was secured. The operative leg and groin were prepped for a sterile surgical field.

Fig 4: Showing appropriate size of PFN A2 nail selection with appropriate diameter under C- Arm guidance

Initial fluoroscopic images (AP and lateral) of the hip were obtained to assess the fracture and plan nail placement.

Closed Reduction

Longitudinal traction was applied to distract the fracture fragments. The leg was then adducted and internally rotated. Fluoroscopy was used to verify alignment.

If closed reduction was unsuccessful, a minimally invasive anterolateral incision was created to facilitate indirect reduction using bone hooks.

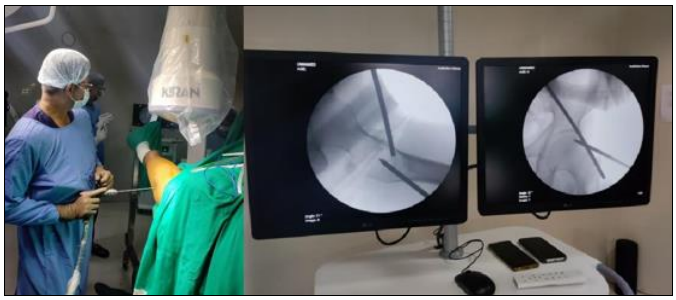


Fig 5: Showing indirect reduction with Steinman Pin

Guidewire Placement and Reaming

The anticipated entry point for the guidewire on the proximal femur was marked based on fluoroscopic visualization.

- A small incision was created, and dissection proceeded down to the bone at the entry point.
- A guidewire was inserted using a mallet, ensuring proper placement in the center of the medullary canal on fluoroscopy (AP and lateral views).

Fig 6: showing guidewire placement

A conical reamer with a soft tissue protector was used to ream the proximal canal until reaching the desired depth. A long ball-tipped guidewire was advanced past the fracture site into the femoral shaft, guided by fluoroscopy.
Nail Insertion: The PFN-A2 nail was assembled with the targeting guide and interlock screws on the back table.
The nail was inserted over the guidewire, following the femoral curvature. It was gently advanced using a mallet until fully seated within the distal femur

Fig 7: Showing assembled PFN A2 nail and inserted over guidewire

Fluoroscopy, particularly a lateral knee radiograph, was used to verify correct nail positioning.

The long guidewire was removed
Helical Blade Placement: The helical blade insertion point on the femoral neck was identified using fluoroscopy (inferior border, centered within the femoral head).
A small incision was created, and the femoral neck was exposed using a trocar and targeting sleeve.

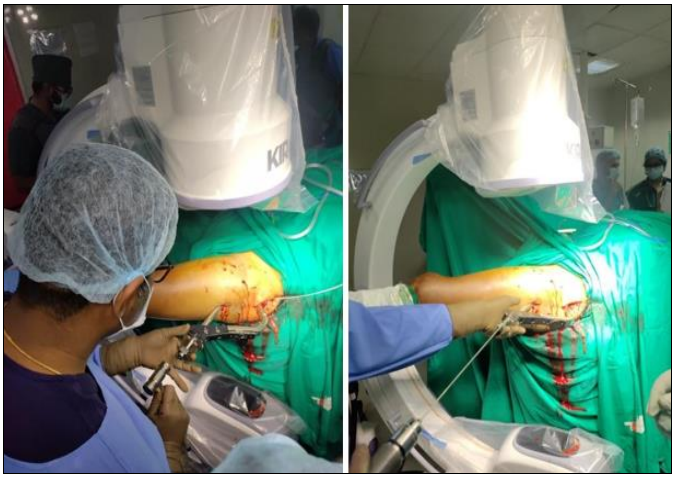


Fig 8: Showing Incision made over femoral helical blade insertion point and drilling over the targeting sleeve

A guidewire was inserted, and proper trajectory was ensured on fluoroscopy (tip-apex distance <25mm on AP/lateral views).

The Helical Blade length was measured and inserted through the drilled hole. Compression across the fracture was achieved under fluoroscopic observation.
The helical blade was tightened and secured with a set screw from the top of the nail.
The targeting guide was removed.

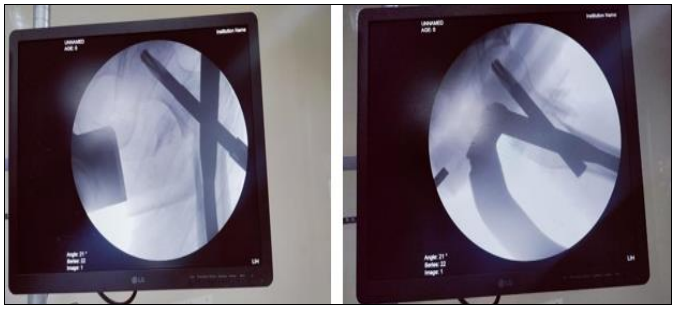


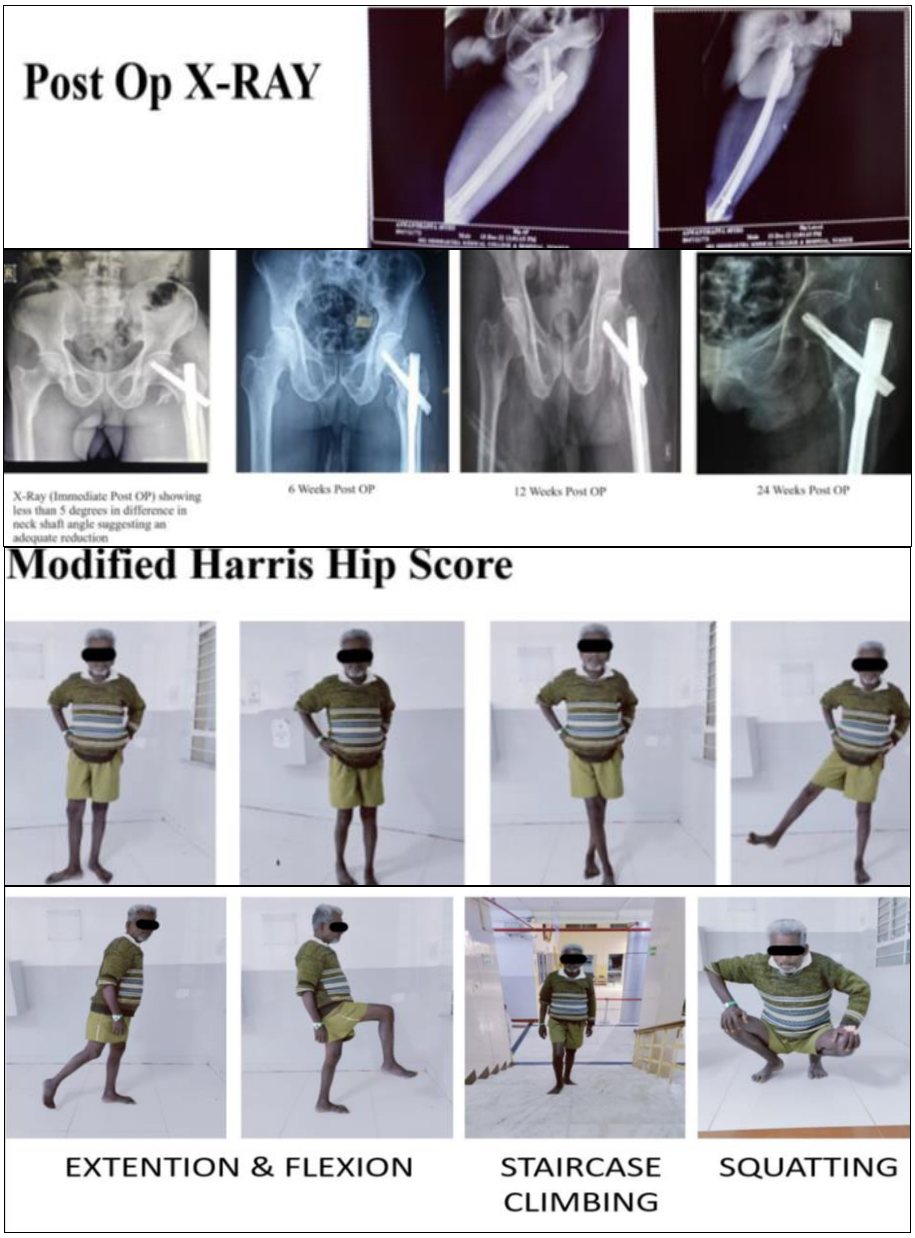
Fig 9: Showing AP and Lateral View of the helical blade under C-Arm

Distal Locking Screws: Fluoroscopy (lateral view) was used to achieve the "perfect circles" technique for inserting the distal interlocking screws.
Small incisions were made on the lateral aspect of the mid/distal femur (depending on nail length), and the bone was exposed.

Fig 10: Showing distal Locking screw placement

Holes were drilled through the lateral cortex and nail using fluoroscopic guidance, ensuring proper depth for both screws.
The interlocking screws were inserted, and their position was verified with fluoroscopy in the AP view.
Wound Closure: The surgical site was thoroughly irrigated, and hemostasis was achieved. The deep fascia, subcutaneous tissue, and skin were closed in layers. Sterile dressings were applied to the incisions.

Follow Up
Postoperative care included regular dressing changes every 3 days. Sutures were removed on postoperative day 14. Full weight bearing was allowed starting on postoperative day 21.
Follow-up visits were scheduled at 6 weeks, 12 weeks, and 24 weeks. During each visit, patients received X-rays and their Modified Harris Hip Scores (MHHS) were assessed.



Results

The study on Proximal Femoral Nailing Anti-Rotation II (PFN-A2) for unstable intertrochanteric femur fractures showed progressive improvement in Harris Hip Scores (HHS) over time. At 6 weeks, the mean HHS was 53.95 (SD 3.145), improving to 74.13 (SD 3.113) by 12 weeks and reaching 84.05 (SD 3.043) at 24 weeks, indicating significant functional recovery among the 39 patients studied.

- **Age Distribution:** Most patients were over 50 (33 out of 39; 84.6%), while 6 patients (15.4%) were younger than 50.
- **Gender Distribution:** The study involved 27 males (69.2%) and 12 females (30.8%), with similar recovery outcomes for both genders.
- **Diagnosis Distribution:** The fractures were nearly evenly distributed between left (46.2%) and right (53.8%) sides.
- **T-Test Results:** At 6, 12, and 24 weeks, there were no significant differences in HHS between left and right fractures, confirming comparable recovery.
- **HHS by Gender:** Minimal differences were observed between males and females at 6, 12, and 24 weeks. At 24 weeks, the mean HHS was 84.00 for females and 84.07 for males, with no statistically significant variations.
- **HHS by Age:** Both age groups (over and under 50) showed similar recovery. At 24 weeks, the mean HHS was 84.03 for those over 50 and 84.17 for younger patients, with no significant differences.
- **Correlation Analysis:** Strong positive correlations were found between HHS at different time points, showing consistent recovery with PFN-A2. There was a moderate positive correlation between HHS at 6 and 12 weeks ($r = 0.388$, $p = 0.015$), and a strong correlation between 6 and 24 weeks ($r = 0.921$, $p < 0.001$), indicating steady improvement. Overall, PFN-A2 proved effective for all age groups and genders in treating unstable intertrochanteric femur fractures.

Table 1: Age distribution among study participants

AGE					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Greater than 50	33	84.6	84.6	84.6
	Less than 50	6	15.4	15.4	100.0
	Total	39	100.0	100.0	

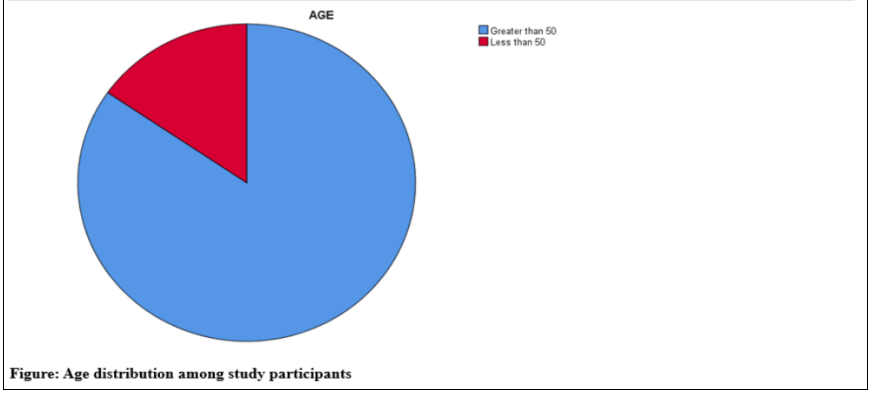


Figure: Age distribution among study participants

Table 2: Gender Distribution among study participants

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	12	30.8	30.8	30.8
	Male	27	69.2	69.2	100.0
	Total	39	100.0	100.0	

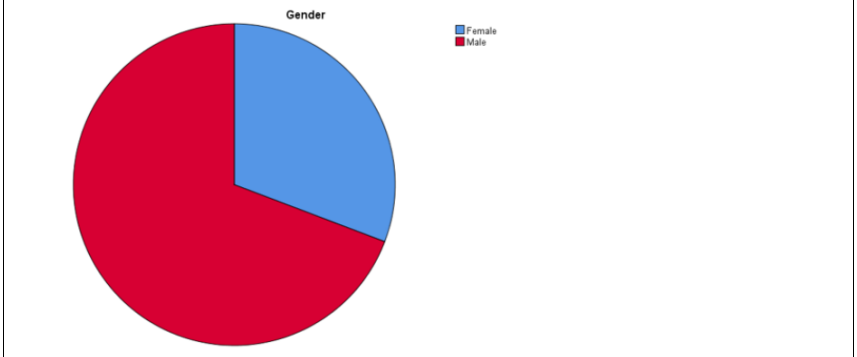


Figure: Gender distribution among study participants

Table 3: Diagnosis Distribution among study Participants

DIAGNOSIS					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	LT PFN A2	18	46.2	46.2	46.2
	RT PFN A2	21	53.8	53.8	100.0
	Total	39	100.0	100.0	

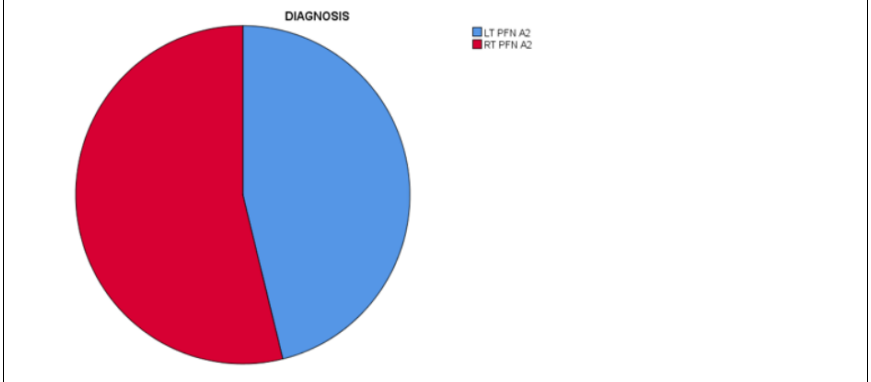


Figure: Diagnosis distribution among study participants

Discussion

Proximal Femoral Nailing Anti-Rotation II (PFN-A2) is a widely used surgical technique for the management of unstable intertrochanteric femur fractures, particularly in elderly patients who often present with osteoporosis. These fractures pose significant challenges due to their unstable nature, and they require a fixation method that provides both stability and allows for early mobilization. PFN-A2 is designed to offer rotational stability, which is essential for maintaining alignment during the healing process. Moreover, the technique promotes early weight-bearing and mobilization, a key aspect of reducing complications such as deep vein thrombosis, pulmonary embolism, and pressure ulcers—complications that are particularly common among the elderly population. Early mobility plays a crucial role in expediting recovery and reducing the adverse effects associated with prolonged immobilization.

This study aims to assess the functional outcomes of PFN-A2 using the Harris Hip Score (HHS), a reliable and widely accepted tool for measuring hip function after surgery. By using the HHS, we can objectively evaluate the recovery progress in terms of mobility, pain management, and the ability to resume daily activities. Besides functional recovery, anatomical restoration and radiological union of the fractures are also analyzed, providing a more comprehensive view of the technique's effectiveness. Comparing these results with prior studies, this research seeks to establish PFN-A2 as a superior option for treating unstable intertrochanteric fractures, highlighting its benefits over other available techniques.

In this study, there was a significant improvement in Harris Hip Scores after PFN-A2 was used for treating unstable intertrochanteric fractures. The average HHS improved from 53.95 at six weeks post-surgery to 74.13 at 12 weeks and further to 84.05 at 24 weeks. These results align with those of Verma *et al*. (2022), who found an average HHS of 87 at the conclusion of their study, with 73% of patients achieving excellent or good outcomes. Similarly, Singh and Bhartiya (2021) reported an average HHS of 84 in their PFN-A2 group, with most patients showing good to excellent results. Kunwar *et al*. (2022) observed an average HHS of 82.59 one year after surgery, with 79.3% of their patients showing positive functional outcomes. This consistent improvement across multiple studies underscores the reliability of PFN-A2 in facilitating significant functional recovery for patients with unstable intertrochanteric fractures.

Radiological outcomes in this study were also consistent with existing literature, demonstrating successful anatomical restoration and fracture union in most cases. Hegde *et al*. (2023) pointed out that PFN-A2 offers several advantages, including reduced blood loss, shorter operative times, and improved post-surgery range of motion. Li *et al*. (2018) similarly found that PFN-A2 promotes faster clinical and bone healing, with fewer complications compared to alternative methods. Collectively, these studies indicate that PFN-A2 is not only effective in achieving bone healing but also reduces the likelihood of surgical complications, which is particularly beneficial for elderly patients who are often at higher risk for perioperative challenges.

The demographic data from this study align with previous research on intertrochanteric femur fractures, where the majority of patients are above 50 years of age. In this study, 85.6% of participants were older than 50, a figure comparable to Hegde *et al*. (2023), who reported an average patient age of 67 years. Dinkar *et al*. (2021) found a similar trend, with a significant portion of their patients aged 60 and above, reflecting the higher incidence of these fractures among older adults due to factors like osteoporosis. Kunwar *et al*. (2022) reported an average patient age of 68.72 years, further emphasizing that these fractures predominantly affect the elderly population. Given this age distribution, the PFN-A2 technique is invaluable for providing stable fixation and facilitating early mobilization, key to reducing postoperative complications in older patients.

A male predominance was noted in this study, with 69.2% of the patients being male. This observation is supported by other studies, including Hegde *et al*. (2023) and Dinkar *et al*. (2021), who also reported a higher proportion of male patients. Kandel *et al*. (2019) found that 61% of their PFN-A2-treated cohort were male. This gender discrepancy may be attributed to differences in physical activity, bone density, and the likelihood of experiencing high-impact trauma, which tends to be higher in males. The consistency of these findings across studies suggests that the PFN-A2 technique is frequently applied to male patients, highlighting the need for targeted strategies that address the specific risks and challenges faced by this demographic.

In terms of fracture laterality, this study observed that 54% of fractures occurred on the right side, with 46% on the left, a pattern that is consistent with the findings of Hegde *et al*. (2023) and Dinkar *et al*. (2021). Kandel *et al*. (2019) also noted a slight predominance of right-sided fractures in their study, with 56% of cases involving the right femur. The reasons for this right-side preference may be multifactorial, involving dominant hand use, fall biomechanics, or uneven loading during motion. Regardless of the side of the fracture, functional outcomes were similar. At 24 weeks, the average HHS for left-sided fractures was 84.17, while for right-sided fractures it was 83.95. These results echo the findings of Hegde *et al*. (2023) and Kandel *et al*. (2019), demonstrating that PFN-A2 provides equally effective results for both left- and right-sided fractures.

When comparing functional outcomes between genders, there was little variation. At six weeks, females had an average HHS of 54.00, compared to 53.93 for males. By 12 weeks, the average HHS for females was 74.00, while males had an HHS of 74.19. At 24 weeks, the scores were nearly identical, with females scoring 84.00 and males 84.07. These findings are in line with the studies by Hegde *et al*. (2023) and Verma *et al*. (2022), both of which found no significant gender-based differences in HHS. These consistent recovery patterns suggest that PFN-A2 is equally effective for both male and female patients in restoring hip function after surgery.

Age-related differences in recovery were also minimal. Patients aged 50 and above had an average HHS of 53.97 at six weeks, compared to 53.83 for patients younger than 50. By 12 weeks, younger patients showed slightly better outcomes with an HHS of 75.67, compared to 73.85 for older patients. However, at 24 weeks, the scores were almost identical, with HHS values of 84.03 for older patients and 84.17 for younger ones. These results are in agreement with those of Hegde *et al*. (2023) and Verma *et al*. (2022), who also found no significant differences in functional recovery based on age, further confirming the broad applicability of PFN-A2 for patients of all ages.

In conclusion, this study, supported by findings from previous research, demonstrates that PFN-A2 is an effective surgical technique for treating unstable intertrochanteric femur fractures. It promotes early mobilization, enhances functional recovery, and ensures reliable fracture healing, regardless of

patient age, gender, or fracture laterality. The consistent improvements in Harris Hip Scores and positive radiological outcomes affirm PFN-A2 as a reliable, superior option for managing these complex fractures, offering significant advantages over alternative surgical techniques.

Variables	Reference Name	Reference Value	Observed Value
Age	Navin Kumar Singh *et al.*	(52%) were in the age group 61-80 years with 19% patients above 80 years and 29% below 61 years	6 (15.4%) were <50 Years and 33 (84.6%) were >50 years
Gender	Harshwardhan H *et al.* J Thiyageswaran *et al.*	Around 40% of the patients were female and around 60% of the patients were male. Male: Female: 1.9:1	Around 39% were Female and 61% were male Participants Male: female: 2.25:1
Mean Blood Loss	Harshwardhan H *et al.*	The mean amount of blood loss in surgery was 110.8 ml	Mean Blood loss was 97.8 ml
Time Required	E. Soucanye de Landevoisin *et al.*	Mean operating time was 47 min (11—127 min).	Mean Operating time was 48 min
Modified Harris Hip Score	J Thiyageswaran *et al.* Harshwardhan H *et al.*	At 12 weeks: Modified Harris Hip Score be Excellent: 17(57.33%) good:8(25.33%)	6 Weeks (HHS): Poor (Less than 70): 8 patients Fair (70 80): 22 patients (56.4%)
		Fair: 3(10.3%)	
		Poor: 2(7%) patients	Good (80-90): 9
		At 24 weeks:	patients (23.1%)
		Excellent: 30%,	Excellent (90-100):
			0
		Good: 40%,	
			12 Weeks (HHS):
		Fair:20% cases	
			Poor (Less than 70):
		Poor: 10% cases.	
			2 (5.1%)
		Mean score is 82.86	
			Fair (70-80): 20
			patients (51.3%)
			Good (80-90): 15
			patients (38.5%)
			Excellent (90-100):
			2 (5.1%)
			24 Weeks (HHS):
			Poor (Less than 70):
			0
			Fair (70-80): 8
			(20.5%)
			Good (80-90): 22
			(56.4%)
			Excellent (90-100):
			9 (23.1%)
			Mean score at 24
			weeks: 84.05
Complication	E. Soucanye de Landevoisin *et al.*	Surgical Site Infection: 1.02%	Surgical site infection: 5%

Recommendations

Based on the findings, it is suggested that Proximal Femoral Nailing, anti-rotation-II (PFN- A2) should be regarded as a standard treatment for managing unstable inter-trochanteric femur fractures due to its consistent and significant improvements in functional outcomes over time. It is crucial for surgeons to prioritise achieving the best possible intraoperative fracture reduction and ensuring the accurate positioning of the helical blade. These factors greatly enhance the likelihood of successful outcomes. PFN-A2 can be effectively utilised across diverse patient demographics, as minimal differences were observed across age and gender.

Future Aspects

Future research should focus on improving the study by involving a wider range of participants and extending the duration of follow-up. This will provide a more comprehensive understanding of the long-term effects and possible complications related to PFN-A2. Further research comparing PFN-A2 with other advanced fixation techniques could offer a more comprehensive understanding of the pros and cons associated with each approach. In addition, studying how certain patient factors, like bone density and other health conditions, affect the effectiveness of PFN-A2 could assist in customising treatment strategies to meet the unique needs of each patient, leading to better results.

Conclusion

The study on Proximal Femoral Nailing Anti-Rotation II (PFN-A2) for unstable intertrochanteric femur fractures demonstrates its effectiveness in improving hip function. Using Harris Hip Scores (HHS), the study showed a steady rise in patient recovery: from an average score of 53.95 at six weeks, to 74.13 at 12 weeks, and 84.05 at 24 weeks. The results indicate consistent improvement across different ages and genders, with no significant differences in recovery—both males and females achieved similar outcomes, and age showed minimal impact on functional recovery.

Correlation analysis confirmed that improvements at earlier stages predicted continued progress, emphasizing PFN-A2's reliability. Statistical tests validated that the surgery offers consistent benefits regardless of demographic factors. Overall, PFN-A2 proved to be an effective and reliable treatment for unstable intertrochanteric fractures, offering significant functional improvements across diverse patient groups. Future research should focus on larger studies to further validate these findings.

Limitations of the Study

This study considered 39 participants and thus the relatively small sample size and a single center-based study could affect its findings.

A longer follow-up beyond 12 months would also give us a better understanding regarding other complications like, Implant cut-outs, implant breaks etc. could be better assessed.

Use of DEXA scan could also help the study in analyzing the osteoporotic status of the participants as majority were elderly. The presence of a control group would also strengthen the findings.

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Conflict of Interest

Not available

Financial Support

Not available

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