International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 14, No. 1, January 2025 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_14.1.2025.150

ORIGINAL RESEARCH

A Retrospective and Prospective Study of Proximal Femoral Nail in Fracture Intertrochanteric Femur

[1]Dr. Sachin Kumar, [2]Dr. Sushil Kumar Singh

[1]Senior Resident, [2]Assistant Professor, Department of Orthopaedics, JNKTMCH Madhepura, India

Corresponding Author
Dr. Sachin Kumar
Senior Resident, Department of Orthopaedics, JNKTMCH Madhepura, India

Received: 21 December, 2024 Accepted: 10 January, 2025 Published: 17 January, 2025

ABSTRACT

Aim: The aim of this study was to evaluate the clinical and radiological outcomes of proximal femoral nailing (PFN) in the management of intertrochanteric femur fractures through both retrospective and prospective analysis. **Material and Methods:** This observational study included 80 adult patients diagnosed with AO/OTA type 31-A1 to A3 intertrochanteric femur fractures over a period of 36 months at a tertiary care teaching hospital. The first 40 patients were evaluated retrospectively using medical records, and the next 40 were enrolled prospectively and followed longitudinally. All patients underwent surgical fixation with PFN. Clinical outcomes were assessed using the Modified Harris Hip Score (mHHS) at 6 months, and radiological healing was evaluated via follow-up X-rays. Complications were documented across the study population. **Results:** The majority of fractures were seen in patients aged 61–70 years (35.00%), with males comprising 65.00% of the study population. AO/OTA fracture type 31-A1 was the most common (42.50%). Functional outcomes at 6 months showed that 22.50% of patients had excellent mHHS scores, 40.00% had good, 27.50% had fair, and only 10.00% had poor results. Complication rates were low, with 7.50% superficial infections, 2.50% deep infections, and 3.75% implant failures. A majority of patients (75.00%) had an uneventful postoperative course. **Conclusion:** PFN proves to be an effective and reliable fixation method for intertrochanteric femur fractures, offering stable fixation, early mobilization, and satisfactory functional recovery with minimal complications. Its role remains crucial in the surgical management of such fractures, particularly in elderly populations.

Keywords: Proximal femoral nail, Intertrochanteric fracture, Modified Harris Hip Score, Functional outcome, Orthopedic fixation.

INTRODUCTION

Intertrochanteric femur fractures, commonly seen in the elderly, represent a significant burden on orthopedic and geriatric healthcare systems worldwide. These fractures occur predominantly in the proximal region of the femur, typically between the greater and lesser trochanters, and are usually the result of low-energy falls in the elderly or high-energy trauma in younger patients. As populations age and life expectancies rise globally, the incidence of such injuries continues to escalate, leading to considerable functional decline, reduced mobility, and increased dependency among older adults.[1]

From a clinical standpoint, intertrochanteric fractures pose a multifaceted challenge. In the elderly, the associated comorbidities, osteoporosis, and reduced physiological reserves often complicate both the surgical and postoperative management. Rapid restoration of mobility is crucial in this age group to prevent complications such as deep vein thrombosis, pulmonary infections, pressure ulcers, and muscle wasting. Therefore, timely surgical intervention with stable internal fixation is considered the cornerstone of effective management.[2]

Over the years, various implants and techniques have been employed to achieve optimal fixation, ranging from dynamic hip screws (DHS) to various intramedullary devices. Among these, the proximal femoral nail (PFN) has gained significant traction as a preferred choice, particularly for unstable fracture configurations. The biomechanical advantages of PFN include its intramedullary position, which offers a shorter lever arm, superior load transfer, and greater stability under axial and rotational stress. Furthermore, it allows for minimally invasive insertion, thereby reducing soft tissue dissection, blood loss, and operative time.[3]

The development of the PFN has evolved in response to the limitations observed with extramedullary devices. While DHS has shown reliable outcomes in

DOI: 10.69605/ijlbpr_14.1.2025.150

stable fracture types, it is associated with a higher rate of implant failure and complications in comminuted or unstable patterns. In contrast, PFN is better suited to address these complex fracture morphologies, thanks to its ability to resist varus collapse and medialization of the femoral shaft. Additionally, it facilitates early mobilization, which is essential for favorable functional outcomes, particularly in elderly patients.[4]

Management strategies for intertrochanteric fractures are not merely surgical decisions; they must also account for the patient's physiological status, pre-injury mobility, bone quality, and postoperative rehabilitation potential. A multidisciplinary approach involving orthopedic surgeons, anesthetists, geriatricians, and physiotherapists plays a pivotal role in optimizing outcomes. Early surgical fixation using PFN, followed by well-coordinated rehabilitation protocols, is essential for reducing mortality and enhancing the quality of life in this patient population.

In recent years, both retrospective and prospective studies have explored the efficacy of PFN in the treatment of intertrochanteric fractures. Clinical observations suggest that PFN achieves high union rates, satisfactory functional outcomes, and a low incidence of complications when the surgical technique is meticulously followed. The implant's design—with features such as helical blades or lag screws for proximal fixation—helps improve purchase in osteoporotic bone, a common feature in geriatric patients.[5]

There is also increasing interest in comparing standard PFN with augmented fixation techniques such as screw augmentation, particularly in cases with poor bone stock or severely comminuted fractures. Such comparative studies help refine surgical protocols and implant selection based on the fracture pattern and patient characteristics. The importance of tailoring treatment plans to individual patients cannot be overstated, especially given the wide variability in fracture configurations, functional demands, and healing capacities.Although PFN has shown consistent success, its use is not without complications. Technical errors during insertion, such as malpositioning of screws or improper reduction, can lead to issues such as cut-out, implant failure, or malunion. Hence, adequate surgical expertise, precise intraoperative imaging, and a sound understanding of fracture biomechanics are essential components for successful outcomes. Moreover, patient compliance with weight-bearing restrictions and rehabilitation exercises significantly influences postoperative recovery and final function.Another critical factor is the timing of surgery. Early intervention, preferably within 24–48 hours of injury, has been associated with reduced morbidity and mortality in the elderly. Delayed surgeries, whether due to medical optimization or logistical issues, may compromise outcomes by prolonging bed rest and exposing patients to complications of immobility.[6]Given the growing clinical relevance of intertrochanteric femur fractures and the expanding use of PFN, there is a continual need to evaluate treatment outcomes using real-world data. Both prospective and retrospective analyses contribute valuable insights into the functional and radiological results associated with this technique. Parameters such as union time, pain relief, restoration of ambulation, complication rates, and implant-related issues are frequently assessed in these studies to draw conclusions about the efficacy and safety of PFN.

MATERIAL AND METHODS

This retrospective and prospective observational study was conducted in the Department of Orthopedics at a tertiary care teaching hospital, after obtaining ethical clearance from the Institutional Ethics Committee. The study aimed to evaluate the clinical and radiological outcomes of proximal femoral nailing (PFN) in the management of intertrochanteric femur fractures.A total of 80 adult patients diagnosed with intertrochanteric fractures of the femur were included in the study. The study spanned a duration of 36 months, with the first 40 patients evaluated retrospectively based on medical records and follow-up data, and the next 40 patients enrolled prospectively and followed longitudinally.

Inclusion Criteria

- Patients aged ≥ 18 years.
- Radiologically confirmed intertrochanteric fractures of the femur (AO/OTA classification 31-A1 to A3).
- Patients treated surgically with proximal femoral nail (standard or short PFN).
- For retrospective arm: availability of complete treatment and follow-up records.
- For prospective arm: willingness to participate, undergo surgery, and attend regular follow-up.

Exclusion Criteria

- Pathological fractures (excluding osteoporotic fractures).
- Polytrauma patients with multiple skeletal injuries.
- Previous surgery on the same hip.
- Fractures extending into the subtrochanteric region.
- Patients lost to follow-up or with incomplete data in the retrospective arm.

Methodology

Preoperative evaluation included detailed clinical history, physical examination, routine hematological investigations, and radiological assessment using anteroposterior and lateral X-rays of the pelvis and involved femur. Patients were classified according to the AO/OTA classification for intertrochanteric fractures.All patients underwent surgical fixation with a proximal femoral nail under spinal or general

DOI: 10.69605/ijlbpr_14.1.2025.150

anesthesia, as deemed appropriate. Closed reduction was attempted in all cases under fluoroscopic guidance, with open reduction reserved for irreducible fractures. The standard operative technique for PFN was followed in all cases.Postoperative care included early mobilization based on patient tolerance and stability of fixation. Patients were encouraged for partial weight bearing as per intraoperative assessment and progressed to full weight bearing over 6 to 12 weeks. Clinical and radiological follow-ups were scheduled at 6 weeks, 3 months, 6 months, and 12 months.Functional outcomes were evaluated using the Modified Harris Hip Score (mHHS), while radiological union was assessed based on callus formation and cortical continuity in follow-up X-rays.

RESULTS

Age-wise Distribution of Patients (Table 1)

The age distribution of the patients revealed that the majority of intertrochanteric fractures occurred in the elderly population. The highest number of patients (35.00%) were in the 61–70 years age group, followed by 27.50% in the 41–60 years group. Notably, 25.00% of patients were older than 70 years, highlighting the increased susceptibility of the geriatric population to such fractures due to age-related osteoporosis and falls. A smaller portion (12.50%) of patients were between 18–40 years, likely due to high-energy trauma rather than degenerative bone conditions. This trend underscores the predominance of intertrochanteric fractures among older individuals.

Sex Distribution of Patients (Table 2)

Out of the total 80 patients, 52 were males (65.00%) and 28 were females (35.00%). The higher proportion of male patients may be attributed to increased outdoor activity and risk exposure among males in this demographic. However, despite being numerically fewer, female patients—particularly postmenopausal—are biologically at greater risk due to osteoporosis. The male predominance in this study might reflect regional or lifestyle-specific risk patterns.

AO/OTA Fracture Type Distribution (Table 3)

According to the AO/OTA classification system, 42.50% of the patients sustained 31-A1 type fractures, which are simple two-part fractures. These are generally considered stable and easier to manage. A significant number (37.50%) had 31-A2 multi-fragmentary fractures, representing more complex and unstable patterns requiring precise reduction and fixation. The remaining 20.00% presented with 31-A3 reverse oblique fractures, known for their inherent instability and technical challenges in fixation. The distribution reflects a diverse case mix, allowing the assessment of PFN outcomes across various fracture severities.

Functional Outcome Based on Modified Harris Hip Score at 6 Months (Table 4)

Functional outcomes, as assessed by the Modified Harris Hip Score (mHHS) at the 6-month follow-up, demonstrated favorable results. A total of 18 patients (22.50%) achieved excellent scores (>90), while the majority—32 patients (40.00%)—had good functional outcomes (mHHS 80–89). Another 22 patients (27.50%) recorded fair outcomes (70–79), and only 8 patients (10.00%) had poor outcomes with scores below 70. These results indicate that PFN provides satisfactory to excellent functional restoration in a majority of patients within the first six months postoperatively, especially when rehabilitation protocols are adequately followed.

Complications Observed During Follow-Up (Table 5)

Complication rates were relatively low in this cohort. The most frequent complication was superficial infection, observed in 6 patients (7.50%), which was successfully managed with local wound care and antibiotics. Deep infections, which required more intensive management, were reported in only 2 cases (2.50%). Implant failure was noted in 3 patients (3.75%), which necessitated revision surgery in some cases. Delayed union occurred in 5 patients (6.25%), often associated with severe comminution or poor bone quality. Malunion was observed in 4 cases (5.00%), typically due to suboptimal reduction. Importantly, 60 patients (75.00%) had an uneventful postoperative course with no reported complications, indicating the relative safety and effectiveness of PFN in the studied population.

Table 1: Age-wise Distribution of Patients (n = 80)

Age Group (Years)	Number of Patients	Percentage (%)
18–40	10	12.50
41–60	22	27.50
61–70	28	35.00
>70	20	25.00
Total	**80**	**100.00**

Table 2: Sex Distribution of Patients

Sex	Number of Patients	Percentage (%)
Male	52	65.00
Female	28	35.00

DOI: 10.69605/ijlbpr_14.1.2025.150

Total	**80**	**100.00**

Table 3: AO/OTA Fracture Type Distribution

Fracture Type (AO/OTA)	Number of Patients	Percentage (%)
31-A1 (Simple 2-part)	34	42.50
31-A2 (Multi-fragmentary)	30	37.50
31-A3 (Reverse oblique)	16	20.00
Total	**80**	**100.00**

Table 4: Functional Outcome Based on Modified Harris Hip Score (mHHS) at 6 Months

Outcome Category	mHHS Range	Number of Patients	Percentage (%)
Excellent	>90	18	22.50
Good	80–89	32	40.00
Fair	70–79	22	27.50
Poor	<70	8	10.00
Total	—	**80**	**100.00**

Table 5: Complications Observed During Follow-Up

Complication	Number of Patients	Percentage (%)
Superficial infection	6	7.50
Deep infection	2	2.50
Implant failure	3	3.75
Delayed union (>6 months)	5	6.25
Malunion	4	5.00
No complications	60	75.00
Total	**80**	**100.00**

DISCUSSION

The age-wise distribution in this study clearly demonstrated a higher incidence of intertrochanteric fractures among the elderly, with 35.00% of patients falling in the 61–70 years age group and 25.00% above 70 years. This trend mirrors the findings of Korkmaz et al. (2014) and Endigeri et al. (2015), who reported that advancing age significantly predisposes individuals to intertrochanteric fractures due to senile osteoporosis and an increased risk of falls. The smaller proportion of younger patients (12.50%) in the 18–40 years group was primarily associated with high-energy trauma, consistent with the demographic trends observed in prior orthopedic studies.[6,7]

In terms of sex distribution, males represented 65.00% of the study population, a finding consistent with the observations made by Khairnar and Patil (2018) and Kumar et al. (2016), who noted male predominance in intertrochanteric fracture cases. While postmenopausal osteoporosis is a known risk factor in females, particularly over 60 years, the greater number of male cases in this study could be attributed to increased outdoor exposure, occupational hazards, and higher incidences of road traffic accidents in the male population.[8,9]

The classification of fractures using the AO/OTA system revealed that 42.50% of patients sustained type 31-A1 (simple two-part fractures), while 37.50% had 31-A2 (multi-fragmentary) and 20.00% had 31-A3 (reverse oblique) fractures. These results align with the observations by Aithala and Rao (2013) and Reska et al. (2006), who reported similar patterns of fracture distribution and emphasized the technical challenges associated with treating unstable 31-A2 and 31-A3 fractures. The presence of a significant proportion of complex fracture types in this study supports the use of PFN, as it offers biomechanical advantages in maintaining stability and promoting early mobilization.[10,11]

The Modified Harris Hip Score (mHHS) outcomes at 6 months in this study showed that 62.50% of patients had excellent to good results, which is in agreement with the outcomes reported by Ghilzai et al. (2018) and Dordevic et al. (2016). Their studies demonstrated high functional recovery rates in patients treated with PFN, particularly when early weight-bearing and physiotherapy were initiated.[12,13] The fair outcomes in 27.50% of cases and poor outcomes in 10.00% could be associated with factors like delayed surgery, inadequate rehabilitation, or higher fracture complexity—issues also acknowledged by Mandalia et al. (2020) in their retrospective series.[14]

Regarding postoperative complications, the present study recorded relatively low rates, with superficial infections occurring in 7.50% of cases and deep infections in only 2.50%. Implant failure (3.75%), delayed union (6.25%), and malunion (5.00%) were also infrequent. These findings are comparable to those of Chidanand et al. (2015), who documented minimal complications when strict operative technique and aseptic precautions were observed.[15] Furthermore, the 75.00% of patients without any complications reinforce the procedural safety and clinical reliability of PFN in both stable and unstable

DOI: 10.69605/ijlbpr_14.1.2025.150

intertrochanteric fractures, as previously supported by Korkmaz et al. (2014) and Endigeri et al. (2015) in larger prospective cohorts.[6,7]

CONCLUSION

The use of the proximal femoral nail (PFN) in the management of intertrochanteric femur fractures has demonstrated favorable outcomes in terms of fracture stability, early mobilization, and functional recovery, particularly in elderly patients. Across multiple studies, PFN has shown to be effective in treating both stable and unstable fracture patterns with relatively low complication rates. The minimally invasive nature of the procedure allows for reduced soft tissue damage, shorter hospital stays, and faster rehabilitation. Despite some technical challenges, PFN remains a reliable and preferred method of fixation. Continued evaluation through larger multicentric studies is recommended to further validate long-term outcomes.

REFERENCES

1. Fischer H, Maleitzke T, Eder C, Ahmad S, Stöckle U, Braun KF. Management of proximal femur fractures in the elderly: current concepts and treatment options. Eur J Med Res. 2021;26:86. PMID: 34348796.
2. Greenstein AS, Gorczyca JT. Orthopedic surgery and the geriatric patient. Clin Geriatr Med. 2019;35:65–92. PMID: 30390985.
3. Malik AA, Patidar S, Siddiqui S. A retrospective and prospective study of proximal femoral nail in fracture intertrochanteric femur. Int J Health Clin Res. 2021;4(7):248–51.
4. Kumar M, Equbal MR, Kumar R. Proximal femoral nail in intertrochanteric femur fracture patients. Int J Life Sci Biotechnol Pharm Res. 2023;12(2):April-June.
5. Rajput AK, Gupta PK, Gill SPS, Singh SK, Raj M, Singh J, et al. Prospective comparative study between proximal femoral nail vs. screw augmented proximal femoral nail in unstable intertrochanteric fractures of femur. Cureus. 2022 Dec 21;14(12):e32791. doi: 10.7759/cureus.32791. PMID: 36578861; PMCID: PMC9788788.
6. Korkmaz MF, Erdem MN, Disli Z, Selcuk EB, Karakaplan M, Gogus A. Outcomes of trochanteric femoral fractures treated with proximal femoral nail: an analysis of 100 consecutive cases. Clin Interv Aging. 2014;9:569–74.
7. Endigeri P, Pattanashetty OB, Banapatti DB, Pillai A, Ullas T. Outcome of intertrochanteric fractures treated with proximal femoral nail: a prospective study. J OrthopTraumatolRehabil. 2015;8(1):25–9.
8. Khairnar A, Patil L. A study of functional outcome in intertrochanteric femur fractures treated by proximal femoral nailing. Int J Med Res Rev [Internet]. 2018 Aug 31 [cited 2025 Apr 21];6(6):335–40. Available from: https://ijmrr.medresearch.in/index.php/ijmrr/article/view/1000
9. Kumar A, Somashekareappa T, Singh A, Narula RK. Proximal femoral nail still of implant of choice in trochanteric fracture. Int J Contemp Med Res. 2016;3(7):1967–9.
10. Aithala JP, Rao S. Proximal femoral nailing: technical difficulties and results in trochanteric fractures. Open J Orthop. 2013;3:234–42.
11. Reska M, Veverkova L, Divis P, Konecny J. Proximal femoral nail (PFN) – a new stage in the therapy of extracapsular femoral fractures. Scripta Medica (Brno). 2006;79(2):115–22.
12. Ghilzai AK, Shah SKA, Khan MA, Ghazi MA, Najjad MKR. Role of proximal femoral nail in the treatment of unstable intertrochanteric fractures. Biomed J Sci Tech Res. 2018;2(1):1.
13. Dordevic N, Stanojilovic M, Milenkovic S, Stojilikovic P, Kocic M, Golubovic I. Perioperative and early postoperative outcome of proximal femoral nailing for stable and unstable trochanteric fractures. Acta Fac Med Naiss. 2016;33(1):43–7.
14. Mandalia MH, Kubavat HL, Trivedi N. Retrospective study for the results of proximal femoral nailing in subtrochanteric fractures. Int J Res Orthop. 2020;6:699–703.
15. Chidanand KJC, Avinash P, Sridhar DR, Rafeeq MD, Babu S. Prospective analysis of extracapsular fractures of the proximal femur treated with proximal femoral nail. Int J Sci Stud. 2015;3(8):97–100.