



# International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958

P-ISSN: 2706-6630

Impact Factor (RJIF): 6.72

IJOS 2025; 11(4): 103-108

© 2025 IJOS

[www.orthopaper.com](http://www.orthopaper.com)

Received: 17-08-2025

Accepted: 23-09-2025

**Dr. Mahantesh Magadum**

Associate Professor, Department  
of Orthopedics, Trichy SRM  
Medical College and Hospital,  
Trichy, Tamil Nadu, India

**Dr. Deepak Chitragar**

Associate Professor, Department  
of Orthopedics, Trichy SRM  
Medical College and Hospital,  
Trichy, Tamil Nadu, India

**Dr. Shreyas Zalariya**

Consultant Orthopedic Surgeon,  
Rajpriya Hospital, Raigarh,  
Chhattisgarh, India

**Dr. Manjunath KL**

Senior Consultant,  
Orthopedics Surgeon, Fortis  
Hospital Nagarbhavi, Bangalore,  
Karnataka, India

## Functional outcome of short proximal femoral nail in the management of intertrochanteric fractures

**Mahantesh Magadum, Deepak Chitragar, Shreyas Zalariya and  
Manjunath KL**

DOI: <https://www.doi.org/10.22271/ortho.2025.v11.i4b.3835>

### Abstract

**Background:** Intertrochanteric fractures of the femur are common in the elderly and are associated with significant morbidity and functional impairment. Surgical fixation using proximal femoral nails aims to restore stability and enable early mobilization, improving functional outcomes.

**Aim of the study:** To evaluate the functional outcomes of short proximal femoral nail (PFN) fixation in the management of intertrochanteric fractures.

**Methods:** A prospective study was conducted on 50 patients with intertrochanteric fractures treated with short PFN at our institution, between April 2018 and December 2019. Functional outcomes were assessed using the Harris Hip Score (HHS) at 6, 12, and 24 weeks postoperatively. Operative details, time to union, and complications were recorded.

**Results:** The mean operative time was  $66.83 \pm 8.76$  minutes, with average blood loss of  $90.23 \pm 56.45$  ml. Most patients (82%) had a hospital stay of 3-5 days. The mean HHS improved from  $34.23 \pm 1.52$  at 6 weeks to  $87.37 \pm 2.14$  at 24 weeks, with 82% achieving excellent-to-good outcomes. Complications were minimal, including revision surgery and superficial infection (4% each).

**Conclusion:** Short PFN fixation is a safe and effective option for intertrochanteric fractures. It provides stable fixation, early mobilization, excellent functional recovery, and low complication rates.

**Keywords:** Intertrochanteric fracture, short proximal femoral nail, harris hip score, functional outcome, elderly, orthopedic surgery

### Introduction

Hip fractures are an increasingly significant global health challenge, particularly among the elderly population, and are associated with substantial morbidity, mortality, and functional impairment [1]. Intertrochanteric fractures, which occur between the greater and lesser trochanters of the femur, account for a considerable proportion of hip fractures. These fractures are predominantly the result of low-energy trauma in osteoporotic bones, making older adults particularly susceptible [2]. Globally, the incidence of hip fractures was estimated at 1.26 million in 1990, with projections suggesting an increase to 2.6 million by 2025 and as high as 4.5 million by 2050 due to the growing elderly population and increased life expectancy [3]. This rising incidence represents not only a clinical challenge but also a significant socioeconomic burden, as these injuries often lead to prolonged hospitalization, loss of independence, and increased healthcare costs [4, 5]. Management of intertrochanteric fractures has evolved significantly, with surgical fixation now standard due to high complication rates with non-operative care, including thrombosis, pulmonary issues, and functional decline [6]. Surgical treatment focuses on achieving stable reduction, enabling early mobilization, restoring functional status, and minimizing complications, with intramedullary implants increasingly favored for certain fracture patterns [7]. The Proximal Femoral Nail (PFN) is an intramedullary device that provides biomechanical stability by reducing bending stress and enabling load sharing across the proximal femur. It manages both stable and unstable intertrochanteric fractures and permits early weight-bearing, aiding functional recovery in elderly patients [8]. Compared with extra-medullary devices, PFNs may better maintain fracture alignment, reduce varus collapse, minimize soft tissue disruption, and

**Corresponding Author:**

**Dr. Mahantesh Magadum**

Associate Professor, Department  
of Orthopedics, Trichy SRM  
Medical College and Hospital,  
Trichy, Tamil Nadu, India

preserve periosteal blood supply, potentially promoting faster healing [9]. Among PFNs, the short proximal femoral nail has been developed to provide sufficient fixation while minimizing surgical exposure. Its design aims to reduce operative time, blood loss, and soft tissue disruption while maintaining fracture stability [10]. Biomechanically, short nails offer comparable axial and rotational stability for most stable and some unstable fracture patterns, making them a suitable option in routine clinical practice [11]. The use of short PFNs is also associated with theoretical advantages in reducing perioperative complications, facilitating postoperative rehabilitation, and promoting earlier mobilization compared with longer nails, although careful patient selection is necessary for highly unstable fracture types [12]. Functional outcomes after intertrochanteric fracture fixation are critically important, as they directly affect the patient's mobility, independence, and quality of life [13]. Early mobilization is a key determinant of functional recovery, as prolonged bed rest can result in muscle atrophy, joint stiffness, and increased risk of secondary complications [14]. Factors influencing functional outcome include fracture stability, bone quality, surgical technique, and the patient's general health and comorbid conditions [15]. Achieving an anatomical reduction with stable fixation is central to optimizing early weight-bearing, preventing implant-related complications such as screw cut-out, malunion, or implant failure, and improving long-term functional performance [16]. Given the global burden of intertrochanteric fractures, evaluating surgical strategies to optimize functional recovery is essential. This study aims to evaluate the functional outcomes of short proximal femoral nails in the management of intertrochanteric fractures.

### Methodology & Materials

This prospective study was conducted on 40 patients who underwent short proximal femoral nail (PFN) fixation for intertrochanteric fractures of the femur. The study was carried out in the Department of Orthopedics at the teaching institution from April 2018 to December 2019.

### Inclusion Criteria

- Skeletally mature patients with intertrochanteric fractures of the femur.
- Fractures confirmed by appropriate radiographs.
- Fresh fractures (<3 weeks from injury).

### Exclusion Criteria

- Intertrochanteric fractures with reverse obliquity patterns or subtrochanteric extension.
- Compound (open) fractures.
- Pathological fractures.
- Patients admitted for revision surgery.

### Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrollment. Patient confidentiality was strictly maintained throughout the study.

### Proximal Femoral Nail - Implant Details

A short PFN (commonly called TFN) of 180 mm length was used. Distal diameters were 9, 10, or 11 mm, while the proximal diameter was 14 mm. The implant included a 6.5 mm proximal derotation screw, an 8 mm hip screw, and 4.9 mm bolts for distal locking. The nail was universal, with a 6° mediolateral angulation and varying neck-shaft angles.

### Surgical Technique

All patients were operated on under spinal anesthesia. After induction, the patient was placed supine on a fracture table with 10-15° adduction of the affected limb, followed by closed reduction of the fracture using traction and rotation. In some cases, 10-15° flexion of the limb was required to align the distal and proximal fragments. The unaffected limb was abducted to accommodate the image intensifier. The C-arm was positioned to allow simultaneous anteroposterior and lateral imaging. The operative field was scrubbed, painted, and draped in a sterile manner, and prophylactic antibiotics were administered preoperatively.

### Postoperative Care

Patients' vitals were monitored, and foot-end elevation was given overnight. Drains were observed, and antibiotics were administered according to hospital protocol. Analgesics were provided based on patient needs, and blood transfusions were given when required due to preoperative condition or intraoperative blood loss. Patients were encouraged to sit on the bed by the third postoperative day and were taught quadriceps and knee mobilization exercises. The time from surgery to mobilization was recorded. Sutures were removed between the 12th and 15th postoperative day. Functional weight-bearing was initiated after 6 weeks, and radiographic union was assessed at follow-up.

### Data Collection

Baseline demographic details, mode of injury, and fracture classification (AO/OTA) were recorded. Operative details, including duration from injury to surgery, operative time, blood loss, and hospital stay, were noted. Functional outcome was assessed using the Harris Hip Score (HHS) at 6, 12, and 24 weeks. Radiological evaluation was performed at each follow-up to assess fracture healing. Postoperative complications were documented.

### Statistical Analysis

Collected data were tabulated and analyzed using descriptive statistics. Data were entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS) version 24.0. Continuous variables such as operative time, blood loss, and time to union were expressed as mean  $\pm$  Standard deviation (SD). Categorical variables such as gender, side involvement, type of fracture, and complications were presented as frequencies and percentages.

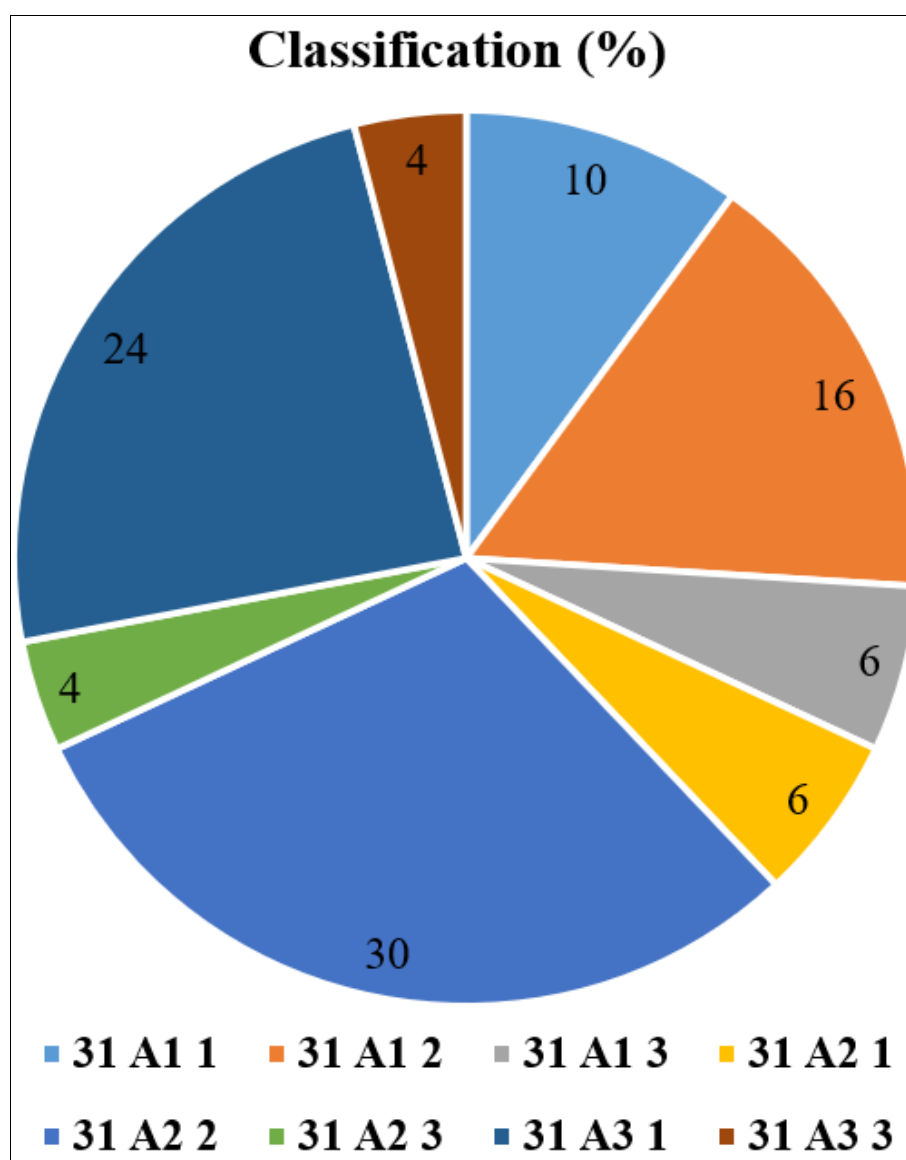
### Results

The majority of patients were aged 70-79 years (30%), followed by 60-69 years (20%), while only 10% were above 80 years. Females (60%) were more commonly affected than males (40%). Left-sided involvement (54%) was slightly more frequent than right-sided (46%). Slip and fall was the most common mode of injury (64%), followed by road traffic accidents (20%) and fall from height (16%) (Table 1). The most frequent type was 31 A1.1 (30%), followed by 31 A2.2 (24%) and 31 A1.2 (16%). Other subtypes were less common, including 31 A1.3 (6%), 31 A2.1 (6%), 31 A2.3 (4%), 31 A3.1 (4%), and 31 A3.3 (10%) (Figure 1). Among all patients, nearly half (46%) underwent surgery within 5-10 days of injury and 26% had the procedure after 11-15 days (Figure 2). Most patients (82%) had a hospital stay of 3-5 days, and only 2% required more than 7 days (Figure 3). The

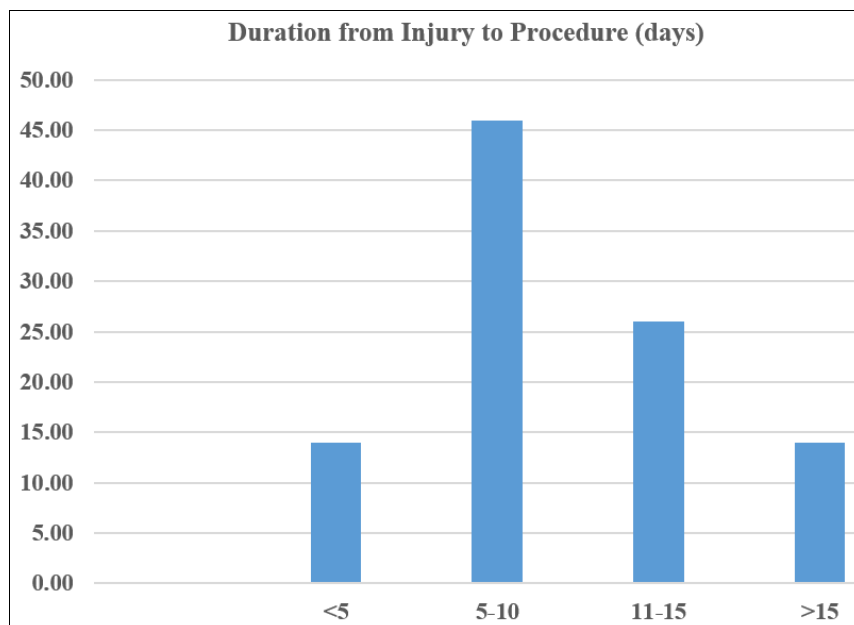
mean operative time was  $66.83 \pm 8.76$  minutes with an average blood loss of  $90.23 \pm 56.45$  ml. The average time to fracture union was  $16.54 \pm 1.87$  weeks (Table 2). The mean pre-injury HHS was  $86.23 \pm 1.52$ , with most patients categorized as excellent (40%) or good (36%). At 6 weeks postoperatively, the mean score dropped to  $34.23 \pm 1.52$ , with only 10% achieving excellent outcomes, while the majority fell into fair (34%) and poor (26%) categories. By 12 weeks, the mean HHS improved to  $57.75 \pm 1.92$ , with 70% of patients in the excellent-to-good range. At 24 weeks, functional recovery was near pre-injury status, with a mean score of  $87.37 \pm 2.14$ , where 82% of patients achieved excellent or good outcomes (Table 3). Revision surgery and superficial infection were the most common, each occurring in 4% of cases. Other complications, including Z-effect, inadequate reduction, distal locking issues, and varus deformity, were noted in 2% of patients each (Table 4). Preoperative, Intraoperative and Postoperative X-rays image show in (Figure 4).

**Table 1:** Baseline characteristics of the study population (n=50)

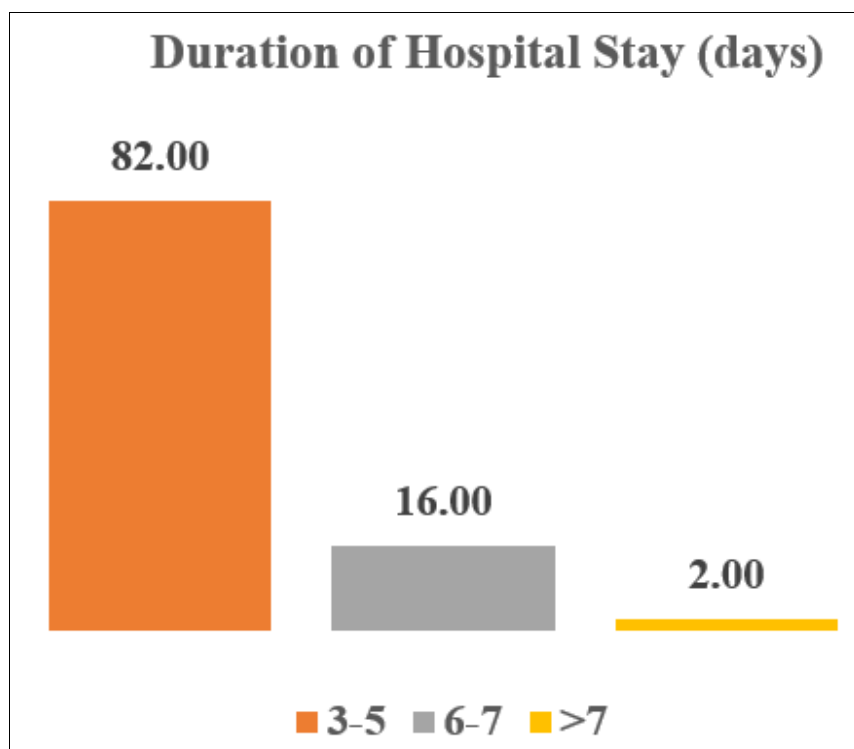
Variables	Frequency (n)	Percentage (%)
<b>Age (years)</b>		
30-39	7	14.00
40-49	7	14.00
50-59	6	12.00
60-69	10	20.00
70-79	15	30.00
$\geq 80$	5	10.00
<b>Gender</b>		
Male	20	40.00
Female	30	60.00
<b>Side involvement</b>		
Left	27	54.00
Right	23	46.00
<b>Mode of injury</b>		
Slip and fall	32	64.00
Road traffic accidents	10	20.00
Fall from height	8	16.00



**Fig 1:** Fracture classification among participants (n=50)



**Fig 2:** Duration from injury to procedure (days) (n=50)



**Fig 3:** Duration of hospital stay (days) (n=50).

**Table 2:** Operative details of the study subject (n=50).

Variables	Frequency (n)	Percentage (%)
Duration of procedure (minutes)		
Mean ± SD	66.83±8.76	
Estimated blood loss (ml)		
Mean ± SD	90.23±56.45	
Time to union (weeks)		
Mean ± SD	16.54±1.87	

**Table 3:** Functional outcome - Harris Hip Score (HHS) (n=50).

Time point	Mean HHS $\pm$ SD	Excellent (90-100)	Good (80-89)	Fair (70-79)	Poor (<70)
Pre-injury (retrospective)	86.23 $\pm$ 1.52	20 (40.0)	18 (36.0)	8 (16.0)	4 (8.0)
6 weeks	34.23 $\pm$ 1.52	5 (10.0)	15 (30.0)	17 (34.0)	13 (26.0)
12 weeks	57.75 $\pm$ 1.92	17 (34.0)	18 (36.0)	10 (20.0)	5 (10.0)
24 weeks	87.37 $\pm$ 2.14	23 (46.0)	18 (36.0)	5 (10.0)	4 (8.0)

**Table 4:** Postoperative complications among patients (n=50).

Adverse Events	Frequency (n)	Percentage (%)
Revision surgery	2	4.00
Superficial infection	2	4.00
Z effect	1	2.00
Inadequate reduction	1	2.00
Distal locking	1	2.00
Varus	1	2.00

**Fig 4:** Preoperative, Intraoperative and Postoperative X-rays image.

## Discussion

The management of intertrochanteric fractures has evolved with various fixation strategies, among which short proximal femoral nails have gained prominence for their potential to enhance functional recovery [17]. This study was designed to evaluate the functional outcomes of patients with intertrochanteric fractures treated using the Short Proximal Femoral Nail (SPFN). Analysis of the baseline characteristics of our study population revealed a predominance of elderly patients, with 60% aged 60 years or older, reflecting the higher susceptibility of this age group to proximal femoral fractures due to age-related bone fragility and osteoporosis. Additionally, there was a slightly higher proportion of female patients, accounting for 60% of the study population, which is consistent with the known gender distribution of osteoporotic fractures, where postmenopausal women are at greater risk. Regarding the mechanism of injury, slip-and-fall incidents emerged as the most frequent cause, accounting for 64% of cases. This finding is consistent with global epidemiological trends, which indicate that low-energy falls represent the leading cause of intertrochanteric fractures among the elderly population, highlighting the importance of preventive strategies and fall-risk mitigation in this vulnerable group [18]. The distribution of fracture types in our study showed a predominance of 31-A2.2 fractures, accounting for 30% of cases. This finding reflects the frequent occurrence of unstable intertrochanteric fracture patterns in the elderly population, which can be attributed to age-related bone fragility and diminished bone density. The higher incidence of such unstable fracture types underscores the clinical importance of selecting fixation methods, such as the Short Proximal Femoral Nail, that provide adequate biomechanical stability and allow for early mobilization in this vulnerable age group [19]. Our mean operative duration was  $66.83 \pm 8.76$  minutes, with a mean estimated blood loss of  $90.23 \pm 56.45$  ml, reflecting the minimally invasive nature of SPFN fixation [20]. Most patients underwent surgery within 5-10 days of injury (46%), and the mean time to union was  $16.54 \pm 1.87$  weeks. The majority of patients had a short hospital stay of 3-5 days (82%), emphasizing the advantage of early mobilization and reduced hospitalization, as also highlighted in studies by Wang *et al.* [21]. Functional recovery assessed by the Harris Hip Score (HHS) showed gradual improvement from 6 weeks (mean HHS  $34.23 \pm 1.52$ ) to 24 weeks (mean HHS  $87.37 \pm 2.14$ ), with 82% achieving excellent or good outcomes at the final follow-up. These results are comparable to previous studies using SPFN or PFNA, which reported mean

HHS in the range of 85-90 at 6 months postoperatively [18]. The early postoperative decline in HHS at 6 weeks reflects expected limitations in mobility and muscle strength, highlighting the importance of physiotherapy and weight-bearing protocols [22, 23]. In our study, the overall complication rate included revision surgery (4%), superficial infection (4%), and minor technical complications-such as Z-effect, varus malalignment, inadequate reduction, and distal locking failures-each occurring in 2% of cases. This complication profile is similar to other reports in the literature, where PFN and SPFN are associated with low rates of mechanical failure and infection [24]. The low incidence of major complications in our study further supports the safety and reliability of SPFN fixation in intertrochanteric fractures.

**Limitations of the study:** This study has several limitations. First, the sample size was relatively small and drawn from a single center, which may limit generalizability. Second, the follow-up period of 24 weeks, although sufficient for early functional assessment, does not capture long-term outcomes such as late implant-related complications or functional decline. Third, fracture patterns with reverse obliquity or subtrochanteric extension were excluded, restricting applicability to all intertrochanteric fractures. Finally, functional assessment relied solely on the Harris Hip Score without incorporating patient-reported quality-of-life measures.

## Conclusion

The present study demonstrates that short proximal femoral nail fixation provides satisfactory functional outcomes in patients with intertrochanteric fractures, with the majority achieving excellent-to-good Harris Hip Scores by 24 weeks postoperatively. Early mobilization, minimal operative time, and low intraoperative blood loss contributed to a favorable recovery and reduced hospital stay. Complication rates were low and comparable to those reported in contemporary literature, indicating the procedure's safety and reliability. Short PFNs offer adequate biomechanical stability for most stable and select unstable fracture patterns, supporting their role as an effective surgical option. Careful patient selection and meticulous surgical technique remain crucial for optimizing functional recovery.

**Funding:** No funding sources.

**Conflict of interest:** None declared.

**Ethical approval:** The study was approved by the Institutional Ethics Committee.

## References

- Andaloro S, Cacciatore S, Risoli A, Comodo RM, Brancaccio V, Calvani R, *et al.* Hip fracture as a systemic disease in older adults: a narrative review on multisystem implications and management. *Medical Sciences*. 2025 Jul 11;13(3):89.
- Attum B, Pilson H. Intertrochanteric femur fracture.
- Gullberg B, Johnell O, Kanis J. World-wide projections for hip fracture. *Osteoporosis International*. 1997 Sep;7(5):407-413.
- Johnell O. The socioeconomic burden of fractures: today and in the 21st century. *American Journal of Medicine*. 1997 Aug 18;103(2):S20-S26.
- Sanderson-Jerome C, Hariharan S, Sanderson C.



- Outcome and cost evaluation of hip fractures in elderly patients at a tertiary care hospital in the Caribbean. *Cureus*. 2024 Nov 27;16(11).
6. Kim JH, Kim HS, Yoo JJ. What is the reason for the trend shift from dynamic hip screw to cephalomedullary nailing for the treatment of intertrochanteric fractures? A comprehensive retrospective study in a single tertiary referral hospital. *Clinics in Orthopedic Surgery*. 2024 Apr 18;17(3):381.
  7. Zhou X, Du G, Jia J, Xuan Y. Effect of different internal fixation devices on intertrochanteric fractures. *American Journal of Translational Research*. 2024 Nov 15;16(11):6779.
  8. Das PB, Singh A, Lenka BS, Pani S. Osteosynthesis of intertrochanteric fractures by PFN and DHS - a prospective randomized comparative study. *Journal of Orthopaedics, Trauma and Rehabilitation*. 2020;2210491720971832.
  9. AM YM, Salih M, Abdulgadir M, Abbas AE. Comparative efficacy of proximal femoral nail vs dynamic condylar screw in treating unstable intertrochanteric fractures. *World Journal of Orthopedics*. 2024 Aug 18;15(8):796-806.
  10. Das C, Phukan K, Kushwaha U. Functional outcome of long proximal femoral nail versus short proximal femoral nail in peri-trochanteric fractures in elderly patients. *International Journal of Orthopaedic Surgery*. 2022 Jul 1;30(2):49-52.
  11. Linhart C, Kistler M, Kussmaul AC, Woiczinski M, Böcker W, Ehrnthaller C. Biomechanical stability of short versus long proximal femoral nails in osteoporotic subtrochanteric A3 reverse-oblique femoral fractures: a cadaveric study. *Archives of Orthopaedic and Trauma Surgery*. 2023 Jan;143(1):389-397.
  12. Acharya D, Neupane G, Dawadi TP, Rijal S, Bhandari PB. Short versus long proximal femur nail for treatment of intertrochanteric femur fractures. *Journal of Chitwan Medical College*. 2023 Sep 29;13(3):9-12.
  13. Mianehsaz E, Aghaei F, Tabatabaee SM, Haghpanah B, Azadchehr MJ, Kalanfarmanfarma K. Functional outcomes and quality of life in elderly patients following intertrochanteric femur fracture: a one-year follow-up study. *Bulletin of Emergency & Trauma*. 2025;13(1):25.
  14. Agarwal N, Feng T, Maclulich A, Duckworth A, Clement N. Early mobilisation after hip fracture surgery is associated with improved patient outcomes: a systematic review and meta-analysis. *Musculoskeletal Care*. 2024 Mar;22(1):e1863.
  15. Yu X, Li YZ, Lu HJ, Ao RG, Liu BL. Analysis of factors affecting the surgical efficacy for elderly intertrochanteric fracture. *Frontiers in Surgery*. 2025 Apr 15;12:1589181.
  16. Kyriakopoulos G, Panagopoulos A, Pasiou E, Kourkoulis SK, Diamantakos I, Anastopoulos G, *et al*. Optimizing fixation methods for stable and unstable intertrochanteric hip fractures treated with sliding hip screw or cephalomedullary nailing: a comparative biomechanical and finite element analysis study. *Injury*. 2022 Dec 1;53(12):4072-4085.
  17. Raagul TS, Kumar KP, Seetharaman K, Bharath V, Ranganathan T, Murugesan V. Fixation in intertrochanteric fractures using short proximal femoral nail anti-rotation-2: a functional and radiological prospective study. *Journal of Orthopaedic Case Reports*. 2025 May;15(5):261.
  18. Rajulapati BA, Payidi N, Kumar PK, Nandyala VK. A prospective observational study on functional outcomes of intertrochanteric fractures treated with proximal femoral nail antirotation (PFNA) in elderly patients. *Journal of Contemporary Clinical Practice*. 2024 Aug 28;10:487-492.
  19. Jegathesan T, Kwek EB. Are intertrochanteric fractures evolving? Trends in the elderly population over a 10-year period. *Clinics in Orthopedic Surgery*. 2022 Feb 15;14(1):13.
  20. Guo XF, Zhang KM, Fu HB, Cao W, Dong Q. A comparative study of the therapeutic effect between long and short intramedullary nails in the treatment of intertrochanteric femur fractures in the elderly. *Chinese Journal of Traumatology*. 2015 Dec 1;18(6):332-335.
  21. Wang WY, Yang TF, Liu L, Pei FX, Xie LM. A comparative study of ipsilateral intertrochanteric and femoral shaft fractures treated with long proximal femoral nail antirotation or plate combinations. *Orthopaedic Surgery*. 2012 Feb;4(1):41-46.
  22. McDonough CM, Harris-Hayes M, Kristensen MT, Overgaard JA, Herring TB, Kenny AM, *et al*. Physical therapy management of older adults with hip fracture: clinical practice guidelines linked to the International Classification of Functioning, Disability and Health from the Academy of Orthopaedic Physical Therapy and the Academy of Geriatric Physical Therapy of the American Physical Therapy Association. *Journal of Orthopaedic & Sports Physical Therapy*. 2021 Feb;51(2):CPG1-81.
  23. Jia X, Qiang M, Zhang K, Han Q, Wu Y, Chen Y. Influence of timing of postoperative weight-bearing on implant failure rate among older patients with intertrochanteric hip fractures: a propensity score matching cohort study. *Frontiers in Medicine*. 2021 Dec 20;8:795595.
  24. Koyuncu Ş, Altay T, Kayalı C, Ozan F, Yamak K. Mechanical failures after fixation with proximal femoral nail and risk factors. *Clinical Interventions in Aging*. 2015 Dec 17:1959-1965.

#### How to Cite This Article

Magadam M, Chitragar D, Zalariya S, Manjunath KL. Functional outcome of short proximal femoral nail in the management of intertrochanteric fractures. *International Journal of Orthopaedics Sciences*. 2025;11(4):103-108.

#### Creative Commons (CC) License

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 International (CC BY-NC-SA 4.0) License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.