



Functional Outcome of Proximal Femoral Nailing for Sub - Trochanteric Fractures

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KEYWORDS

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Proximal Femoral

ABSTRACT:

Introduction: Sub-trochanteric fractures predominantly occur in individuals over the age of 82 years and account for 7% to 34% of all femoral fractures. These fractures result from low-energy impacts in the elderly and high-energy trauma such as motor vehicle collisions or falls from height in the younger population. The preferred treatment for these fractures involves fixation using an intramedullary device, which is favored over extramedullary devices due to lower risks of non-union and complications associated with the shorter devices.

Aim and Objective: The aim of this study is to analyze the functional outcomes of proximal femoral nailing for sub-trochanteric fractures using the Harris Hip Score in patients treated at Sree Balaji Medical College and Hospital. The objectives include assessing functional scoring, radiological evaluation via X-rays, modes of injury, treatment duration, and associated complications.

Methodology: This prospective, observational study includes 39 patients with sub-trochanteric fractures treated with closed reduction and internal fixation using Proximal Femoral Nailing (PFN). The patients' progress was monitored through follow-up visits at 2 weeks, 6 weeks, and radiological outcomes and functional assessments using the Harris Hip Score.

Results: The study sample comprised 39 patients, with a slight female majority (53.8%). The primary mode of injury was road traffic accidents (51.3%). Radiological evaluations showed effective fracture alignment and progress of union in the majority of cases. The functional outcomes assessed by the Harris Hip Score revealed significant improvements over time, with the majority of patients achieving 'Good' to 'Excellent' scores by the 12-week follow-up.

Conclusion: Proximal femoral nailing proves to be a reliable and effective treatment for sub-trochanteric fractures, as evidenced by favorable radiological alignments and functional outcomes in the patient population studied. The study underscores the efficacy of intramedullary nailing in ensuring quick recovery and return to daily activities, with minimal complications and high rates of union and mobility restoration.

Introduction

Subtrochanteric fractures are now recognized as a leading cause of morbidity and mortality among older adults. These fractures occur within a specific zone extending from the lesser trochanter to 5 cm distal to it, often with extension into the intertrochanteric region¹.

Their management poses significant challenges due to the deforming stresses exerted by muscle attachments on the proximal and distal fragments. These stresses, coupled with the high mechanical forces generated during daily activities, render these fractures particularly unstable. Axial loading across the hip joint produces medial compressive and lateral tensile



stresses, while hip muscle activity introduces torsional forces, exacerbating the instability of fracture fragments². Consequently, subtrochanteric fractures are prone to complications such as non-union, malunion, delayed union, and implant failure³.

Surgical intervention is the preferred treatment approach for restoring normal length, alignment, and angulation to provide proper tension to the abductors⁴. Advancements in fixation and implant technology now allow for early mobilization and weight-bearing⁵. Subtrochanteric fractures are commonly treated using either intramedullary or extramedullary fixation. Intramedullary fixation, particularly with the proximal femoral nail, offers biomechanical advantages, including improved stabilization and reduced healing time^{6,7}. However, the unique anatomical and mechanical challenges of subtrochanteric fractures, such as deforming forces and complex fracture patterns, continue to make reduction and fixation challenging.

The Proximal Femoral Nail Antirotation II (PFN-A2) represents a promising innovation in treating trochanteric fractures, particularly in geriatric patients. Its single helical blade design enhances stability, compression, and rotational control at the fracture site while improving anchorage within the femoral neck's cancellous bone. The compressive forces exerted during implantation promote secure fixation and mitigate implant migration or failure. However, the blade's resistance to fracture pressure may be inferior to conventional lag screws, necessitating optimal fracture reduction for successful outcomes⁸. Further clinical evaluations of the PFN-A2 are required to assess its functional outcomes, stability, and complication rates comprehensively.

Functional outcomes of hip surgeries, including subtrochanteric fracture management, are commonly evaluated using the Harris Hip Score (HHS). This validated tool assesses pain, function, range of motion, and deformity absence. In this study, we aim to analyze the functional outcomes of subtrochanteric fractures treated with proximal femoral nailing using the HHS. By assessing both patient-reported and objective measures of hip function, this investigation seeks to contribute to the growing body of knowledge on optimal fracture management strategies, with the ultimate goal of improving clinical decision-making and patient quality of life following subtrochanteric fracture repair.

AIM OF THE STUDY

The study aims to analyze the functional outcomes of proximal femoral nailing for subtrochanteric fractures.

Study Objectives:

- To evaluate the functional recovery of patients
- To assess the healing and alignment of the fracture
- To categorize the mechanisms of injury leading to subtrochanteric fractures, distinguishing between high-energy and low-energy impacts.
- To document the duration from the initial surgical intervention to the point of declared recovery or the last follow-up.
- To identify and analyze any complications associated with the use of intramedullary nailing in the treatment of subtrochanteric fractures, including infection, non-union, or implant failure.

SAMPLING METHODOLOGY :

Sample size calculation

Hypothesized %frequency of outcome factor in the population(p):10%

Confidence limits as % of 100 (d): 8%

Design effect :1

Study Design : observation study

Study Population : 39 patients

Study Area: Hospital based (SREE BALAJI MEDICAL COLLEGE AND HOSPITAL, OPD/WARD/CASUALTY).

Study Setting : Hospital based study at SREE BALAJI MEDICAL COLLEGE AND HOSPITAL ,CHROMEPET, CHENNAI

Participants In The Study: 39 Patients with subtrochanteric fracture admitted through OPD or Casualty in Sree Balaji Medical College and hospital

Sampling Methods:

$$n = \frac{DEFF * Np(1-p)}{[(d2/Z21-\alpha/2 * (N-1) + p * (1-p))]}$$

Confidence interval 90%

Minimum sample size & How It Is Calculated - 39 patients.



Inclusion Criteria:

- Diagnosis: Subtrochanteric femoral fractures
- Surgical Intervention: Proximal femoral nailing for treatment
- Age Limitation: 18 years and above
- Follow-up Period: At least 6 months post-PFN
- Consent: Informed consent obtained and Harris Hip Score assessment completed

Exclusion Criteria:

- Fracture Type: Non-subtrochanteric fractures

- Surgical Method: Non-PFN treatments [for instance, plates, external fixators]
- Age: less than 18 years
- Complications: Severe complications affecting the outcomes [for instance, infections, nonunion]
- Cognitive Impairment: Cognitive impairments or severe comorbidities affecting assessment.
- Incomplete data: Either no follow-up data or incomplete Harris Hip Score forms.

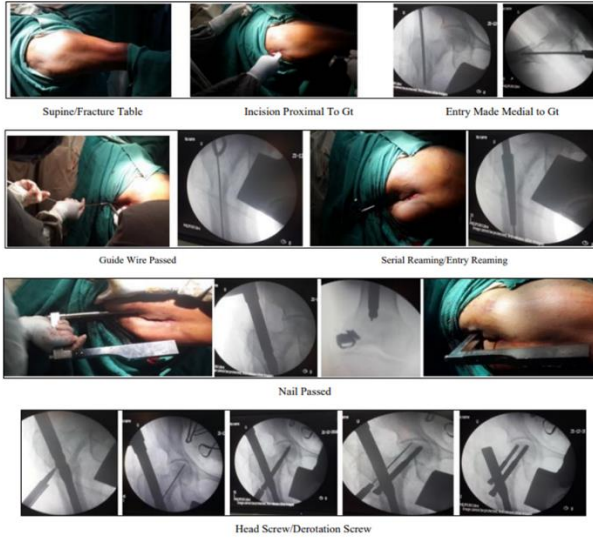
Surgical Steps

Long

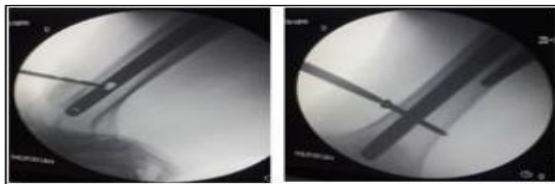




PFN TECHNIQUE



Distal Locking

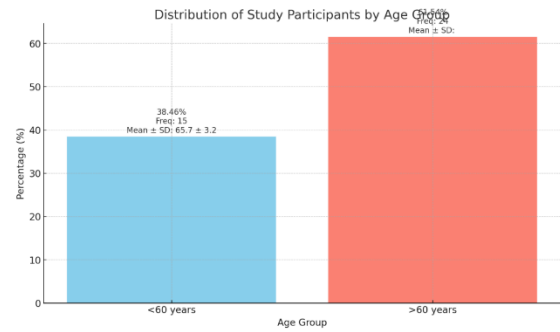


RESULTS

Distribution of study participants by age group

Age Group	Frequency	Percentage (%)	Mean ± SD
<60 years	15	38.46	65.7 ± 3.2
>60 Years	24	61.54	
Total	39	100.0	

Out of the total of 39 participants, 15 fall into the under 60 years category, comprising 38.46% of the study population, with a mean age of 65.7 years and a standard deviation of 3.2. The remaining 24 participants, or 61.54%, are in the over 60 years age group. Collectively, these participants bring the total to 100% of the study sample, reflecting the demographic composition in terms of age distribution among the participants.



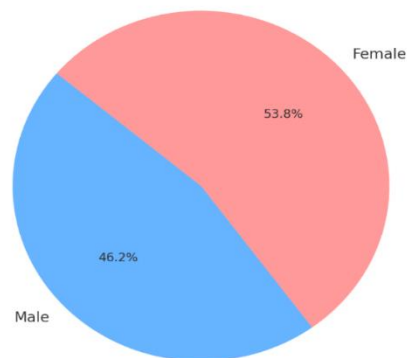
Distribution of study participants by age group

Distribution of study participants by gender.

Gender	Frequency	Percentage (%)
Male	18	46.2
Female	21	53.8
Total	39	100.0

It indicates that out of a total of 39 participants, 18 are male, representing 46.2% of the study population, and 21 are female, making up 53.8%. This distribution highlights a slight female predominance within the study group.

Distribution of Study Participants by Gender



Distribution of study participants by gender

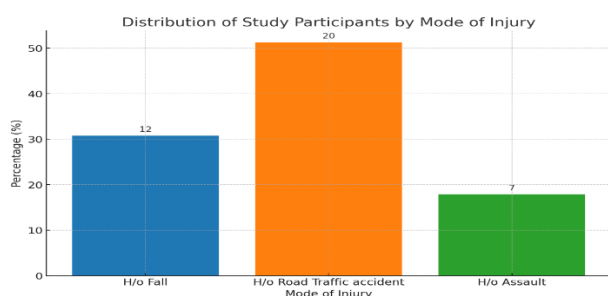
Distribution of study participants by mode of injury

Mode of injury	Frequency	Percentage (%)
H/o Fall	12	30.8



H/o Road Traffic accident	20	51.3
H/o Assault	7	17.9
Total	39	100

The data indicate that the most common cause of injury among the participants was road traffic accidents, accounting for 51.3% (20 individuals) of cases. This was followed by falls, which were responsible for 30.8% (12 individuals) of the injuries. Assaults were the least common cause, contributing to 17.9% (7 individuals) of the total injuries reported. Overall, the table includes data from a total of 39 participants, demonstrating the various ways through which individuals in the study incurred injuries.



Distribution of study participants by mode of injury

Distribution of study participants by Past History

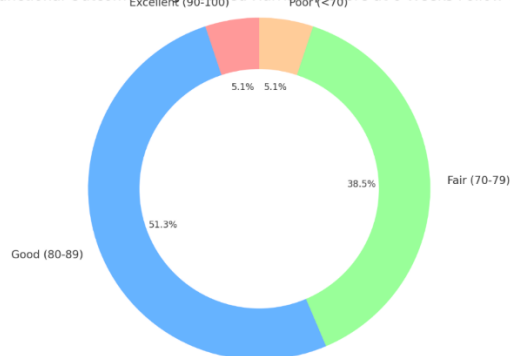
According to the data, 10 participants (25.6%) reported having diabetes, making it a significant condition among the group. Hypertension was reported by 12 participants, accounting for the highest percentage at 30.8%. Osteoporosis and osteoarthritis were less common, with 3 participants (7.7%) having osteoporosis and 2 participants (5.1%) diagnosed with osteoarthritis. This distribution helps in understanding the prevalence of these conditions within the study cohort a 100% success rate in implant stability.

Functional outcome of study participants using Modified Harris Hip Score at 6 weeks follow up (n=62)

Modified Harris Hip Score	Total number of participants	Percentage of participants
Excellent (90-100)	2	5.1
Good (80-89)	20	51.3
Fair (70-79)	15	38.5
Poor (<70)	2	5.1

We evaluated the functional outcome of participants using the Modified Harris Hip Score at six weeks post-operation. Among the participants, 2 (5.1%) achieve an excellent score (90-100), 20 (51.3%) score good (80-89), 15 (38.5%) score fair (70-79), and 2 (5.1%) score poor (<70). This table shows that the majority of participants (56.4%) have good to excellent functional outcomes within six weeks after their procedures.

Functional Outcome Using Modified Harris Hip Score at 6 Weeks Follow Up



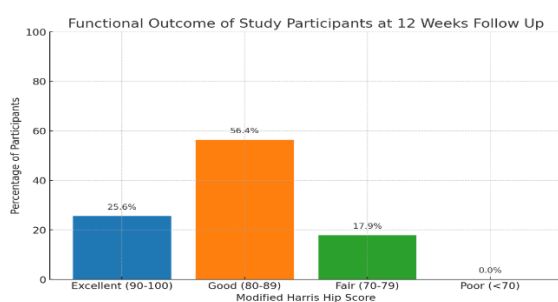
Functional outcome using Modified Harris Hip Score at 6 weeks



Functional outcome of study participants using Modified Harris Hip Score at 12 weeks follow up (n=62)

Modified Harris Hip Score	Total number of participants	Percentage of participants
Excellent (90-100)	10	25.6
Good (80-89)	22	56.4
Fair (70-79)	7	17.9
Poor (<70)	0	0.0

It presents the functional outcomes at twelve weeks using the Modified Harris Hip Score. The results show an improvement compared to the six-week follow-up. Ten participants (25.6%) achieve an excellent score (90-100), 22 participants (56.4%) score good (80-89), 7 participants (17.9%) score fair (70-79), and no participants score poor (<70). This indicates a significant improvement in the functional status of participants over the additional six weeks, with the majority (82%) scoring good to excellent.



Functional outcome using Modified Harris Hip Score at 12 weeks

DISCUSSION

The present study aimed to evaluate the functional outcomes of proximal femoral nailing for subtrochanteric fractures using the Harris Hip Score. Our findings contribute to the growing body of literature supporting PFN as a preferred treatment

method for these complex fractures, particularly in elderly patients and those with osteoporotic bones.^{1,2}

One of the primary objectives was to assess the functional recovery using the Harris Hip Score (HHS). The results demonstrate a significant improvement in functional outcomes post-PFN, with the majority of patients achieving good to excellent scores. These findings align with previous studies that highlight the efficacy of PFN in providing stable fixation, reducing complication rates, and promoting early mobilization.^{2,3,4,6}

Compared to traditional methods such as dynamic hip screw (DHS) fixation, PFN allowed for earlier weight-bearing and quicker rehabilitation, which is crucial in improving the quality of life, particularly in elderly patients.

The application of the Harris Hip Score, though widely used in global studies, presented certain limitations in this study. As noted in, the original HHS questionnaire does not account for culturally relevant activities such as squatting or sitting cross-legged, which are vital for assessing full functional recovery in Indian patients. Thus, our study suggests the need for a modified Harris Hip Score to ensure it accurately reflects the functional abilities relevant to the Indian population. Future research should focus on validating a modified version of the HHS to capture culturally specific functional recovery metrics.

Radiological assessments were crucial in evaluating the fracture healing and implant positioning post-surgery. In our study, radiological union was achieved in most cases by the third follow-up, as evidenced by the disappearance of fracture lines and re-establishment of trabecular continuity. These results are consistent with prior studies demonstrating the biomechanical advantages of PFN, which supports fracture alignment and healing through its intramedullary design. Additionally, minimal complications such as implant failure or malunion were observed, affirming the stability and reliability of PFN in managing subtrochanteric fractures.

Although PFN is generally associated with lower complication rates, a few cases of superficial wound infections were noted in this study. These were



managed with antibiotics, and no further complications such as deep infections or hardware failure were observed. The absence of severe complications like non-union or implant failure in our cohort reinforces the safety profile of PFN, particularly when coupled with meticulous surgical technique and postoperative care.

The majority of subtrochanteric fractures in our study resulted from high-energy trauma such as road traffic accidents, especially in younger patients. In contrast, elderly patients experienced fractures due to low-energy trauma, typically from falls, consistent with epidemiological patterns of fracture causation. The average hospital stay of 12 days and early postoperative mobilization observed in this study highlight the efficiency of PFN in reducing hospital stays and facilitating faster recovery compared to other fixation methods.

Our study's findings are in agreement with other published literature that highlights the superior outcomes of PFN over other fixation techniques. For instance, the ability of PFN to allow early mobilization, its shorter operative time, and reduced intraoperative blood loss are consistent with previous research. Moreover, the reduced incidence of complications, such as implant failure or infection, further supports the argument for PFN as a first-line treatment for subtrochanteric fractures.

This study has certain limitations. The sample size was relatively small, and the follow-up period, although adequate to observe fracture healing and initial recovery, may not fully capture long-term functional outcomes or late complications. Furthermore, as previously mentioned, the Harris Hip Score may not completely reflect the functional recovery of Indian patients due to cultural differences in daily activities. Future studies should explore larger cohorts with longer follow-up durations and include the use of modified functional assessment tools to better capture the outcomes relevant to the Indian demographic.

CONCLUSION

- The majority of study participants are aged over 60 years, accounting for 61.54% of the total, suggesting a higher prevalence of the condition being studied in the older population.

- A slight female predominance is noted in the study's demographic composition, with females making up 53.8% of the participants.
- Road traffic accidents are the most common cause of injury among the participants, representing over half of the cases (51.3%).
- Hypertension is the most prevalent past medical condition among participants, affecting 30.8% of the group, indicating its significance as a comorbid condition in the study population.
- Six weeks post-operation, the majority of participants report no pain at the fracture site (61.5%) and no fever or constitutional symptoms (74.4%).
- Twelve weeks after surgery, significant improvements are noted with 87.2% of participants reporting no pain at the fracture site and 92.3% showing no fever or constitutional symptoms.
- Functionally, using the Modified Harris Hip Score, 56.4% of participants rate as good or excellent at six weeks post-operation, improving to 82% rating good or excellent by twelve weeks.
- Overall, the study indicates effective treatment and management of the condition, with significant improvements in clinical and functional outcomes over time, demonstrating the efficacy of the treatment protocols used.

Limitations

- The small sample size of 39 patients limits the generalizability of findings.
- Single-center focus introduces selection bias, reducing population diversity.
- Reliance on the Harris Hip Score may not capture psychosocial or long-term recovery outcomes.



- Fracture classification and injury mode are based on patient history and X-rays, possibly overlooking subtler variations.
- Follow-up at 2 and 6 weeks may not fully assess long-term healing or complications.
- Self-funding limits access to advanced diagnostic tools and follow-up resources.
- Inclusion criteria exclude certain demographics, such as patients with medial femoral neck fractures.
- Observational design limits causative conclusions compared to randomized trials.
- Patient-reported outcomes may introduce subjective bias in functional scoring.
- Complication assessment relies on clinical observations, possibly missing subclinical issues.

CASE ILLUSTRATIONS

CASE 1



PRE OP X-RAY



POST OP X -RAY



6 WEEKS



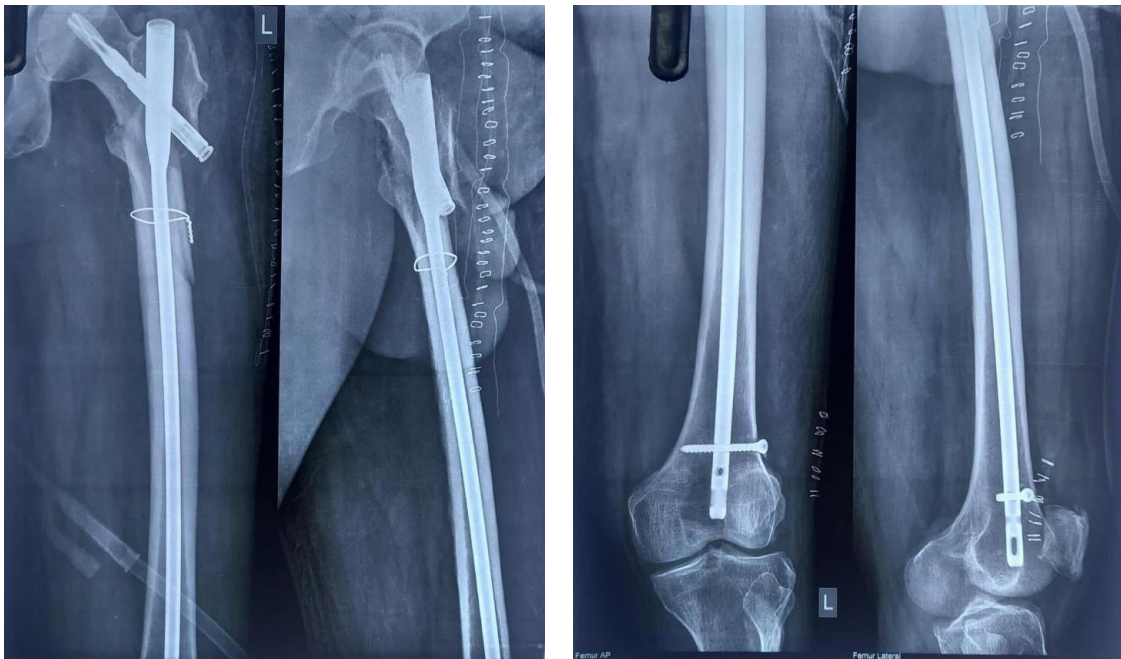
12 WEEKS



CASE 2



PRE OP



POST OP



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