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Original Research Article

A PROSPECTIVE STUDY OF UNSTABLE INTERTROCHANTERIC FRACTURE MANAGEMENT BY PROXIMAL FEMORAL NAILS (PFN)

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ABSTRACT

Background: Unstable intertrochanteric fractures of the femur are common injuries among elderly individuals and are associated with significant morbidity and functional impairment. Proximal Femoral Nailing (PFN) has emerged as an effective treatment option because of its biomechanical advantages and minimally invasive nature. The present study was conducted to evaluate the clinical and radiological outcomes of unstable intertrochanteric fractures managed with PFN.

Materials and Methods: This prospective observational study included 50 patients with unstable intertrochanteric fractures classified as Boyd and Griffin Type III and Type IV fractures. All patients underwent fixation with Proximal Femoral Nail and were followed for a period of 12 months. Clinical and radiological evaluations were performed during follow-up visits. Functional outcomes were assessed using the Harris Hip Score.

Results: The mean age of the patients was 68.8 years, and 66% of patients were older than 60 years. Females constituted 66% of the study population. Boyd and Griffin Type III fractures accounted for 64% of cases. The most common mechanism of injury was a simple fall, observed in 76% of patients. Functional outcome assessment revealed excellent results in 36% of patients, good results in 42%, fair results in 14%, and poor results in 8% of patients. Overall, 78% of patients achieved good to excellent functional outcomes following PFN fixation.

Conclusion: Proximal Femoral Nailing is an effective and reliable treatment modality for unstable intertrochanteric fractures of the femur. The procedure provides stable fixation, facilitates early mobilization, and results in favorable functional outcomes in the majority of patients. PFN should be considered a preferred treatment option for unstable intertrochanteric fractures, particularly in the elderly population.

Keywords: Intertrochanteric Fracture, Proximal Femoral Nail, Harris Hip Score, Functional Outcome

INTRODUCTION

Intertrochanteric fractures of the femur are among the most common injuries encountered in orthopaedic practice, particularly in the elderly population. These fractures occur between the greater and lesser trochanter of the femur and are associated with substantial morbidity, mortality, and socioeconomic burden. The incidence of intertrochanteric fractures has increased significantly over the past few decades due to increasing life expectancy, rising prevalence of osteoporosis, and a growing geriatric population worldwide.[1] These fractures commonly result from low-energy trauma such as a simple fall in elderly individuals, whereas high-energy trauma is usually responsible in younger patients.[2]

Unstable intertrochanteric fractures represent a challenging subset of proximal femoral fractures because of comminution, loss of posteromedial

cortical support, reverse obliquity patterns, and poor bone quality. Such fractures are associated with difficulties in achieving and maintaining stable reduction, leading to increased rates of implant failure, varus collapse, limb shortening, and delayed rehabilitation.[3] The primary goals of treatment include restoration of anatomical alignment, stable fixation, early mobilization, and return to pre-injury functional status while minimizing complications associated with prolonged immobilization.[4]

Historically, conservative treatment of intertrochanteric fractures was associated with prolonged bed rest and a high incidence of complications including pressure sores, deep vein thrombosis, pneumonia, urinary tract infections, and increased mortality. Consequently, operative management has become the standard treatment modality for most patients with intertrochanteric fractures.[5] Various fixation devices have been developed over the years, including dynamic hip screws, fixed-angle devices, intramedullary nails, and arthroplasty procedures. Among these, intramedullary fixation devices have gained increasing popularity because of their biomechanical advantages and minimally invasive nature.[6]

The Proximal Femoral Nail (PFN), introduced by the AO/ASIF group, was specifically designed to address the limitations associated with earlier fixation systems. PFN is an intramedullary load-sharing device that provides improved biomechanical stability by positioning the implant closer to the mechanical axis of the femur. This reduces the bending moment acting on the implant and decreases the risk of fixation failure, especially in unstable fracture patterns.[7] Furthermore, PFN offers advantages such as smaller surgical exposure, reduced blood loss, shorter operative time, preservation of fracture hematoma, and earlier postoperative mobilization.[8]

Several studies have demonstrated favorable outcomes with PFN in the management of unstable intertrochanteric fractures. Functional recovery assessed using Harris Hip Score has consistently shown good to excellent results in a majority of patients treated with PFN. Additionally, PFN has been associated with high union rates, lower rates of implant failure, and improved biomechanical performance compared with extramedullary fixation devices.[9] These advantages have established PFN as one of the preferred treatment modalities for unstable intertrochanteric fractures.

Despite advances in implant design and surgical techniques, complications such as screw cut-out, Z-effect, reverse Z-effect, implant failure, non-union, and malunion continue to be reported. Therefore, continuous evaluation of clinical and radiological outcomes is essential to determine the effectiveness of PFN in different patient populations and fracture configurations [10]. Assessment of union time, functional recovery, weight-bearing status, and complication rates provides valuable information regarding the success of treatment and helps refine management strategies.

In view of the increasing incidence of unstable intertrochanteric fractures and the growing use of proximal femoral nailing, the present study was undertaken to evaluate the clinical and radiological outcomes of unstable intertrochanteric fractures managed with Proximal Femoral Nail fixation. The study also aimed to assess fracture union, functional outcome, mobilization, weight-bearing status, and complications associated with this treatment modality.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Orthopaedics of a tertiary care teaching hospital over a period of 12 months. The study included patients admitted with unstable intertrochanteric fractures of the femur who fulfilled the eligibility criteria and provided informed written consent for participation. The sample size for the study was 50 patients as determined in the original thesis protocol.

Patients aged more than 18 years of either gender presenting with unstable intertrochanteric fractures classified as Boyd and Griffin Type III and Type IV fractures and who were fit and willing for surgery were included in the study. Patients who refused consent, critically ill patients unable to participate, pregnant women, patients with metabolic bone disorders, pathological fractures, associated tumors, or fractures involving the same extremity were excluded from the study.

Fracture Classification

The fractures included in the present study were classified according to Boyd and Griffin classification and Evans classification to assess fracture pattern and stability.

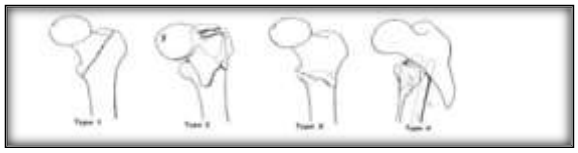

Figure 1: Boyd & Griffin Classification

Boyd & Griffin Classification: Type I – simple intertrochanteric fracture; Type II – comminuted intertrochanteric fracture; Type III – subtrochanteric extension; Type IV – fracture involving trochanteric region and proximal shaft in multiple planes.

Evans Classification: Type I fractures follow the intertrochanteric line and are subdivided by stability after reduction; Type II fractures show reverse obliquity and are considered unstable.

Upon admission, detailed clinical history was obtained and a thorough physical examination was performed. Standard radiographic evaluation including anteroposterior and lateral radiographs of the pelvis with both hips was carried out to assess fracture characteristics. Routine laboratory

investigations including complete blood count, urine analysis, blood grouping, coagulation profile, renal function tests, blood sugar levels, electrocardiography, chest radiography, HIV testing, and hepatitis B screening were performed whenever indicated.

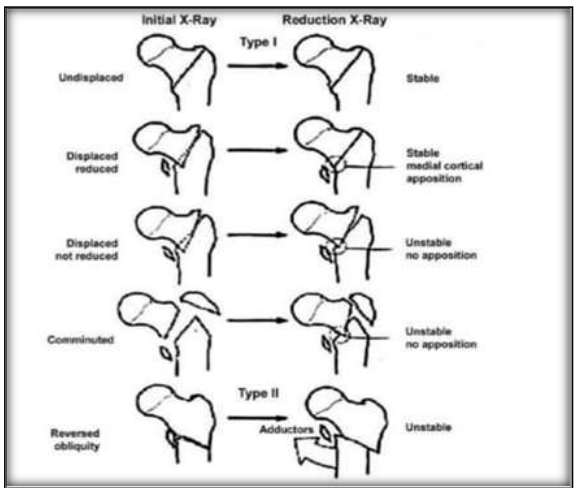

Figure 2: Evans Classification

All patients underwent closed reduction of the fracture on a fracture table under image intensifier guidance. Reduction was achieved using traction and rotational maneuvers aimed at restoring anatomical alignment and correcting varus and rotational deformities. Following satisfactory reduction, fixation was performed using a Proximal Femoral Nail according to standard surgical principles. Perioperative antibiotic prophylaxis was administered to all patients, and thromboprophylaxis was provided to high-risk individuals as deemed necessary.

Postoperatively, patients were encouraged to begin sitting in bed from the second postoperative day. Static quadriceps exercise and physiotherapy were initiated early. Mobilization without weight bearing was started as tolerated, and progression to partial or full weight bearing was determined based on fracture stability, radiological findings, and adequacy of fixation. Patients were followed up at 2 weeks, 6 weeks, 3 months, 6 months, and 12 months after surgery.

During follow-up visits, clinical and radiological assessment was performed to evaluate fracture union, alignment, complications, weight-bearing status, and functional recovery. Functional outcome was assessed using the Harris Hip Score. Outcome measures included mode of injury, duration of surgery, blood loss, duration of hospital stay, fracture union time, postoperative complications, and functional outcome.

The collected data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 26.0. Qualitative variables were expressed as frequencies and percentages, while quantitative variables were presented as mean ± standard deviation. Associations between categorical variables were analyzed using the Chi-square test. Comparisons of continuous variables were performed using the unpaired t-test for normally distributed data and the Mann–Whitney U test for non-normally distributed data. A p-value of less than 0.05 was considered statistically significant.

Prior to commencement of the study, approval was obtained from the Institutional Ethics Committee. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Confidentiality of patient information was strictly maintained throughout the study, and participation was entirely voluntary. Written informed consent was obtained from all participants before enrollment.

RESULTS

[Table 1] shows the age-wise distribution of the study participants. The mean age of the patients was 68.8 years. A majority of the patients, 33 (66%), were above 60 years of age, followed by 12 (24%) patients in the age group of 51–60 years. Only 3 (6%) patients belonged to the age group of 41–50 years, while 2 (4%) patients were aged 40 years or below. These findings indicate that unstable intertrochanteric fractures predominantly occurred in the elderly population.

[Table 2] presents the gender distribution of the study population. Out of the total 50 patients included in the study, 33 (66%) were females and 17 (34%) were males. Female patients constituted nearly two-thirds of the study population, suggesting a higher occurrence of unstable intertrochanteric fractures among women, likely due to osteoporosis and age-related bone loss.

[Table 3] depicts the distribution of patients according to Boyd and Griffin fracture classification. Type III fractures were observed in 32 (64%) patients, whereas Type IV fractures were seen in 18 (36%) patients. Type III fractures were therefore the most common unstable intertrochanteric fracture pattern encountered in the present study.

[Table 4] demonstrates the distribution of patients according to the mode of injury. The majority of patients, 38 (76%), sustained fractures following a simple fall, while 12 (24%) patients sustained injuries due to road traffic accidents. The findings indicate that low-energy trauma was the predominant mechanism of injury among the study participants.

[Table 5] shows the functional outcome of patients at final follow-up as assessed by the Harris Hip Score. Excellent outcomes were observed in 18 (36%) patients, good outcomes in 21 (42%) patients, fair outcomes in 7 (14%) patients, and poor outcomes in 4 (8%) patients. Thus, 39 (78%) patients achieved excellent to good functional outcomes following management with Proximal

Femoral Nailing, indicating satisfactory clinical results.

Table 1. Distribution of Study Participants According to Age Group

Age Group (Years)	Number of Patients (N)	Percentage (%)
≤40	2	4
41–50	3	6
51–60	12	24
>60	33	66
Total	50	100

Table 2. Distribution of Study Participants According to Gender

Gender	Number of Patients (N)	Percentage (%)
Male	17	34
Female	33	66
Total	50	100

Table 3: Distribution According to Boyd and Griffin Classification

Fracture Type	Number of Patients (N)	Percentage (%)
Type III	32	64
Type IV	18	36
Total	50	100

Table 4: Distribution According to Mode of Injury

Mode of Injury	Number of Patients (N)	Percentage (%)
Fall	38	76
Road Traffic Accident	12	24
Total	50	100

Table 5: Functional Outcome According to Harris Hip Score

Functional Outcome	Number of Patients (N)	Percentage (%)
Excellent	18	36
Good	21	42
Fair	7	14
Poor	4	8
Total	50	100

DISCUSSION

The present study was conducted to evaluate the clinical and radiological outcomes of unstable intertrochanteric fractures managed with Proximal Femoral Nailing (PFN). A total of 50 patients were included in the study, and the results demonstrated satisfactory functional outcomes with acceptable complication rates. The majority of patients belonged to the elderly age group, with a mean age of 68.8 years and 66% of patients being older than 60 years. This finding is comparable to the study conducted by Gadegone and Salphale,[11] who reported a mean age of 67 years among patients treated with PFN. The increased incidence of unstable intertrochanteric fractures in elderly individuals can be attributed to age-related osteoporosis, decreased bone mineral density, and increased susceptibility to falls.

Female predominance was observed in the present study, with females accounting for 66% of cases. Similar observations were reported by Gadegone and Salphale,[11] where female patients constituted a substantial proportion of the study population. The higher prevalence among females may be explained by postmenopausal osteoporosis and reduced bone strength, which significantly increase the risk of fragility fractures involving the proximal femur.

In the present study, Boyd and Griffin Type III fractures were more common than Type IV fractures. These findings indicate that unstable fracture configurations constitute a significant challenge in orthopaedic trauma management. Boldin et al,[12] evaluated unstable proximal femoral fractures treated with PFN and concluded that the implant provides reliable stabilization even in complex fracture patterns. Their study highlighted the biomechanical advantages of intramedullary fixation, particularly in unstable fractures where maintenance of reduction is often difficult.

The majority of fractures in the present study occurred following a simple fall, accounting for 76% of cases. This observation is consistent with the findings of Simmermacher et al,[13] who reported that low-energy trauma is the predominant mechanism of injury among elderly patients with intertrochanteric fractures. The increasing prevalence of osteoporosis and reduced protective reflexes among elderly individuals contribute significantly to the occurrence of such injuries.

Functional outcome assessment using the Harris Hip Score demonstrated excellent results in 36% of patients and good results in 42% of patients, indicating that 78% of patients achieved good to excellent outcomes. These findings are comparable to those reported by Schipper et al,[14] who observed favorable functional outcomes following PFN

fixation in unstable trochanteric fractures. The authors emphasized that intramedullary fixation offers improved biomechanical stability, facilitates early mobilization, and promotes satisfactory fracture healing.

The high rate of satisfactory functional outcomes observed in the present study also supports the findings of Saudan et al,[15] who compared PFN with Dynamic Hip Screw fixation and demonstrated that intramedullary fixation provides excellent stability and functional recovery in unstable fracture patterns. The shorter lever arm of PFN, reduced bending forces, and load-sharing characteristics contribute to improved fracture union and early rehabilitation.

Overall, the findings of the present study support the use of Proximal Femoral Nailing as an effective treatment modality for unstable intertrochanteric fractures. The procedure provides stable fixation, facilitates early mobilization, and yields favorable functional outcomes in the majority of patients. The results are consistent with contemporary literature and reinforce the role of PFN as a preferred implant for managing unstable proximal femoral fractures.

CONCLUSION

The present study demonstrated that unstable intertrochanteric fractures occur predominantly in elderly individuals, particularly females. Low-energy trauma in the form of simple falls was the most common mechanism of injury. Proximal Femoral Nailing provided stable fixation and resulted in satisfactory clinical outcomes, with 78% of patients achieving good to excellent functional results according to the Harris Hip Score. The procedure facilitated early mobilization and effective fracture stabilization with acceptable complication rates. Based on the findings of the present study, Proximal Femoral Nailing can be considered a reliable and effective treatment option for unstable intertrochanteric fractures of the femur.

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