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Original Research Article

A PROSPECTIVE OBSERVATIONAL STUDY TO ASSESS FUNCTIONAL OUTCOME OF INTERTROCHANTERIC FRACTURES TREATED WITH PROXIMAL FEMUR NAILING ANTI-ROTATION II

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ABSTRACT

Background: Intertrochanteric femur fractures are common in elderly patients and often lead to high morbidity and mortality. This study aimed to assess the functional outcomes and complications of intertrochanteric fractures treated with Proximal Femoral Nailing Anti-rotation II (PFNA-II). **Materials and Methods:** A prospective study was conducted on 33 patients with intertrochanteric femur fractures treated with PFNA-II at the Department of Orthopaedics, Southern Railway Headquarters Hospital, Perambur, Chennai, from February 2022 to August 2023. Functional outcomes were assessed using the Harris Hip Score (HHS), and the results were analysed as mean, frequency, and percentage. **Results:** The mean patient age was 66.7 years, with 18 (54.55%) females and 15 (45.45%) males. Boyd and Griffin type II fractures were the most common 22 (66.67%). Falls were the primary cause of injury in 23 (69.67%) patients. The mean surgical duration was 48.6 min, the mean blood loss was 123 mL, and the average hospital stay was 7.36 days. Radiological union occurred at a mean of 12.78 weeks. The mean Harris Hip Score was 85.2, with outcomes rated excellent in 18.2%, good in 57.6%, fair in 21.2%, and poor in 3%. Complications included varus collapse in 3 (9.09%) patients and superficial wound infection in 2 (6.06%). **Conclusion:** PFNA-II offers stable fixation, early mobilisation, and favourable functional outcomes with low complication rates. Larger multicentre studies with longer follow-up periods are recommended for validation and long-term assessment.

INTRODUCTION

The junction of the trabecular and cortical bones, which experiences the greatest mechanical stress, is where proximal femoral fractures most often occur. These fractures account for roughly 9% to 33% of all hip region fractures.[1] This type of fracture can be fatal for many patients, leading to complications with the heart, lungs, or kidneys that cause death. Ten to thirty per cent of those who suffer an intertrochanteric fracture die within a year.[2]

The average age of patients with trochanteric fractures is reported to be between 66 and 76 years. All fractures in patients over 63 years of age were attributed to a trivial fall.[3]

Fractures were more common in females, supporting the notion that bone stock plays a significant role in the causation of fractures in the elderly following a trivial fall. Intertrochanteric femur fractures and hip fractures are associated with a high rate of morbidity and mortality.[4]

The incidence of limb shortening, medialization of the distal fragment, and implant cut-outs is high with unstable intertrochanteric fractures.[5]

A short limp gait and a high mortality rate from complications of prolonged immobilisation result from conservative treatment, which produces a vicious callus with varus, external rotation, and shortening. Restoring the pre-injury state as soon as possible is the goal of treatment for intertrochanteric fractures.[6]

Because of this, internal fixation has been adopted to improve patient comfort through nursing care facilitation, reduced hospitalisation, early mobilisation, and fewer complications. The treatment of these fractures presents difficulties due to fixation issues and instability. To prevent varus displacement, an internally fixed fracture must be

stable and able to resist the forces of gravity and muscle action.[7]

Contributing factors to fixation failure include intrinsic factors such as fracture reduction quality and osteoporosis, as well as extrinsic factors such as the choice of implant and insertion technique.[8] Proximal Femoral Nailing Anti-rotation (PFNA-II) is designed to enhance rotational and angular stability, allowing early mobilisation and improved functional outcomes in both stable and unstable intertrochanteric fractures. Patients treated with PFNA-II would achieve earlier functional recovery, stable fracture fixation, and satisfactory Harris Hip Scores, with fewer postoperative complications compared to conventional fixation methods.

Aim

This study aimed to evaluate the functional outcomes of PFNA-II in patients with intertrochanteric femoral fractures treated with PFNA-II.

MATERIALS AND METHODS

This prospective study was conducted on 33 patients who had undergone operative fixation of intertrochanteric fracture with PFNA-II at the Department of Orthopaedics, Southern Railway Headquarters Hospital, Perambur, Chennai-23, from February 2022 to August 2023. The Institutional Ethics Committee approved the study, and before inclusion, all patients provided written informed consent.

Inclusion criteria

Patients aged 18-80, with Trochanteric fractures treated with intramedullary fixation, were included.

Exclusion criteria

Patients with major comorbidities, intra-abdominal, intra-thoracic, and major head injury or major fractures in the same limb, and paediatric intertrochanteric fractures were excluded. Patients with intertrochanteric fractures treated with extramedullary fixation or nonoperative methods, and those with intertrochanteric fractures with major subtrochanteric extension or subtrochanteric fractures were also excluded.

Methods

Preoperative evaluation: Patient demographics, injury mechanism, and comorbidities were recorded. Pain was managed with NSAIDs. Standard radiographs of the pelvis, hip, and chest were obtained, and preoperative planning included measurement of nail size and neck–shaft angle.

Surgical technique: Patients were positioned supine on a fracture table, and closed reduction was achieved under C-arm guidance. A 5 cm incision was made over the greater trochanter. The guide wire was inserted, reaming performed, and the PFNA-II nail introduced. The helical blade was placed into the femoral head and distal locking done under fluoroscopy. The wound was irrigated and closed in layers.

Instrumentation: Standard proximal femoral nailing instruments were used, including an aiming arm, conical bolt, drill sleeves, trocar, drill bits, depth gauge, and screwdriver or impactor.

Postoperative management and follow-up: Parenteral antibiotics and NSAIDs were given postoperatively. Quadriceps exercises and non-weight-bearing ambulation began on the first postoperative day, and assisted hip and knee mobilisation on the second day. Sutures were removed on day 14. Partial weight-bearing was allowed as tolerated, and full weight-bearing was permitted after radiological and clinical union.

Patients were reviewed every four weeks initially and every six weeks thereafter until union. Functional outcomes were assessed using the Modified Harris Hip Score (HHS) at 4, 8, and 12 weeks, and at six months and one year.

Statistical analysis

Only descriptive analysis was performed. Quantitative data were expressed as mean and standard deviation, and categorical data as frequency and percentage. Data were analysed using IBM SPSS Statistics version 27.

Sample size: The sample size was calculated assuming a 75% expected outcome, 5% precision, and 95% confidence level, based on Goriya B et al. With an estimated population of 34, finite population correction was applied as per Daniel WW et al.9,10 Including a 5% loss to follow-up, the final sample size was 33, $n = [N \times Z^2 \times P \times (1 - P)] / [d^2 \times (N - 1) + Z^2 \times P \times (1 - P)]$.

RESULTS

The majority were in the 60–69 years age group, 15 (45.45%), with a slightly higher proportion of females, 18 (54.55%) than males, 15 (45.45%). Boyd and Griffin type II fractures were the most common (66.66%), predominantly affecting the right side 20 (60.61%). A significant number of patients had comorbidities, most commonly systemic hypertension 22 (66.67%) and diabetes mellitus 20 (60.61%). Falls were the leading mechanism of injury 23 (69.67%). Functional outcomes assessed using the HHS were predominantly good 19 (57.58%) or excellent 6 (18.18%). Complications were relatively low, with varus collapse 3 (9.09%) and surgical site infections 2 (6.06%) being the most notable. No cases of implant migration, screw back-out, or non-union were observed. [Table 1]

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Table 1: Patient demographics, clinical characteristics, and outcomes

Parameter	Category	N (%)
Age groups (years)	40–49	0
	50–59	6 (18.18%)
	60–69	15 (45.45%)
	70–80	12 (36.36%)
Gender	Male	15 (45.45%)
	Female	18 (54.55%)
Fracture classification	Type I	5 (15.15%)
	Type II	22 (66.67%)
	Type III	6 (18.18%)
	Type IV	0
Side of fracture	Right	20 (60.61%)
	Left	13 (39.39%)
Associated comorbidities	Diabetes mellitus	20 (60.61%)
	Systemic hypertension	22 (66.67%)
	Coronary artery disease	13 (39.39%)
	Chronic kidney disease	4 (12.12%)
	Chronic obstructive pulmonary disease	3 (9.09%)
	Cerebral vascular disease	0
Mechanism of injury	Fall	23 (69.67%)
	Other	10 (30.30%)
Harris hip score	Excellent (90–100)	6 (18.18%)
	Good (80–89)	19 (57.58%)
	Fair (70–79)	7 (21.21%)
	Poor (60–69)	1 (3.03%)
Complications	Intra-operative varus reduction	1 (3.03%)
	Surgical site infection	2 (6.06%)
	Varus collapse	3 (9.09%)
	Blade migration into the acetabulum	0
	Screw back-out	0
	Peri-implant fractures	0
	Shortening <2 cm	3 (9.09%)

The mean age of the patients was 66.7 years. The average surgical duration was 48.6 min, and the mean blood loss was 123 mL. The average hospital stay was 7.36 days, radiological union was achieved at a mean of 12.78 weeks, and the mean hip score was 85.2. [Table 2]

Table 2: Mean values of key parameters

Parameter	Mean
Age (years)	66.7
Duration of surgery (minutes)	48.6
Blood loss (ml)	123
Hospital stays (days)	7.36
Radiological bone union (weeks)	12.78
Hip score	85.2

DISCUSSION

This study focused on evaluating the functional outcomes of intertrochanteric femur fractures treated with PFNA-II by analysing patient recovery and functional scores. This study showed that the treatment of intertrochanteric femur fractures with PFNA-II resulted in good functional outcomes. Most patients regained satisfactory hip function with few complications. The procedure provides stable fixation, early mobility, and consistent fracture healing with minimal postoperative complications.

In our study, PFNA-II provided biomechanical benefits over earlier fixation devices through its helical blade, which compacts the cancellous bone to improve stability in osteoporotic fractures. Therefore, Simmermacher et al. observed that it prevents femoral head penetration.[11] Garg et al. reported superior stability and fewer complications, while Liu et al. found it safe but technically demanding.[12,13] Yaozeng et al. highlighted its advantages in unstable fractures.[14] Egol et al. emphasised anatomical differences across populations, indicating the need for region-specific implant designs.[15]

In this present study, the average age of the 33 patients was 66.7 years, similar to the mean age of 43.5 years in the study by Kulkarni et al,[16] Our 6:5 male-to-female ratios were comparable to Agarwala et al.'s 7:4 ratios, indicating a significant female predominance in intertrochanteric fractures due to age-related bone loss.[17]

Our study showed that the mean hospital stay was 7.36 days (range: 5-10 days), reflecting improved perioperative management and care of comorbidities. Similarly, Kang et al. reported that in patients undergoing intramedullary fixation, including PFNA -II, the mean hospital stay decreased from 8.21 ± 0.83 days with conventional care to 5.82 ± 0.64 days with the Enhanced

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Recovery After Surgery (ERAS) protocol, whereas a more recent study, such as those by Kesemenli et al., shows reduced lengths of stay consistent with our findings.[18,19]

In this study, the mean Harris Hip Score was 85.2, showing that most patients achieved a good to excellent functional outcome after fixation with PFNA-II. This result is comparable with that reported by Chhabra et al., who found a mean HHS of 84.6 at one year, and Goriya et al., who reported an average score of 86.1 in a similar population. The close similarity across studies supports the consistent performance of PFNA-II in restoring hip function after intertrochanteric fractures.[9]

Similarly, Chhabra et al. found that in a study on the functional outcome of intertrochanteric femur fractures treated with PFNA-II, at six months, 16.67% of patients had excellent and 60.42% had good HHS. At one year, 29.73% achieved excellent, 51.35% good, 10.81% fair, and 8.11% poor outcomes.20 Pancham et al. reported that at three months, 10% of patients had excellent, 50% good, 30% fair, and 10% poor HHS. At six months, 50% achieved excellent, 35% good, 10% fair, and 5% poor outcomes, showing progressive functional improvement.[21]

In our study, complications were minimal, including superficial wound infections in two patients, varus collapse in three, and limb shortening of < 2 cm in three, all achieving satisfactory union and recovery within 12–18 weeks, aligning with findings from Kashid et al., where shortening > 1 cm occurred in 3 patients.[22] No cases of blade migration, screw back-out, peri-implant fractures, or non-union were noted. These outcomes are consistent with reports by Park et al., which demonstrated improved functional outcomes, better mobility scores, and low complication rates with helical blade nails.[23]

For intertrochanteric femur fractures, PFNA-II was found to be a reliable and efficient fixation technique that provided excellent functional recovery with few complications, early mobilisation, and stable fixation. These results are consistent with earlier research, indicating that this method is suitable for older patients with osteoporotic bone. PFNA-II simplifies postoperative management. Patients regain mobility sooner, reducing complications related to prolonged bed rest such as pulmonary infection and thromboembolism. Early weight-bearing also facilitates muscle preservation and enhances confidence during rehabilitation. For surgeons, the system allows shorter operative time, less intraoperative blood loss, and minimal soft-tissue handling, making it suitable even for elderly patients with multiple comorbidities.

Limitations

This study was limited by its single-centre design and small sample size, which restrict wider generalisation. Only descriptive analysis was performed, and no correlation testing was done between patient factors and outcomes. The 12-month follow-up was adequate for assessing early recovery but insufficient for evaluating late complications or implant longevity. Larger, multicentre studies with longer follow-up are needed to validate these findings.

CONCLUSION

For the treatment of intertrochanteric femur fractures, PFNA-II is a safe and effective technique that offers early mobilization, stable fixation, and functional recovery with few side effects. The implant is suitable for older patients because its biomechanical design improves stability, especially in osteoporotic bones. PFNA-II may be recommended as the preferred fixation method in elderly osteoporotic patients due to superior biomechanical stability. To assess long-term results and implant longevity, larger multicentre studies with longer follow-up are recommended. Future research should focus on developing region-specific implant modifications and enhancing surgical techniques to further improve clinical outcomes.

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