



ORIGINAL ARTICLE

Functional outcome of intertrochanteric fractures of hip treated with Proximal Femoral Nail Antirotation II (PFNA-2).

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ABSTRACT... Objective: To evaluate the functional outcomes and complication rates in patients with unstable intertrochanteric fractures treated with PFNA-2. **Study Design:** Retrospective study. **Setting:** Department of Orthopedics, Ghurki Trust and Teaching Hospital, Lahore. **Period:** January 2022 and December 2023. **Methods:** 86 patients (46 men and 40 women) with unstable intertrochanteric femur fractures treated with PFNA-2. For a year, the patients were monitored. Twelve months after surgery, the Modified Harris Hip Score (MHHS) was used to evaluate functional results. **Results:** The mean age of patients was 73.53 ± 16.66 years. Post-operatively, the mean MHHS was 80.38 ± 9.28 . Functional outcomes were excellent in 16 patients (18.6%), good in 42 patients (48.8%), fair in 24 patients (27.9%), and poor in 4 patients (4.7%). Postoperative complications were observed in 8 patients (9.3%), including 4 cases of helical screw back-out (4.7%), 2 cases of cellulitis (2.3%), and 2 cases of deep vein thrombosis with cellulitis (2.3%). **Conclusion:** PFNA-2 demonstrates good functional outcomes and a low complication rate in handling unstable intertrochanteric fractures, particularly in the elderly. Its biomechanical advantages and minimally invasive nature make it a favorable option for surgical fixation.

Key words: Elderly Hip Fractures, Functional Outcome, Intertrochanteric Fractures, Modified Harris Hip Score, PFNA-2.

INTRODUCTION

Intertrochanteric proximal femur fractures are one of the most common injuries that occur in patients of elderly age due to osteoporosis as well as their high fall risk. The need for such fractures calls for urgent operation due to patients having significant health risks and surgical intervention for better mobility and low postoperative complications. The chief aim of treatment is to ensure the patient's early mobility, maintain functional independence, and prevent postoperative complications. The Proximal Femoral Nail Antirotation II (PFNA-2) has emerged as the surgery method of choice due to its superior biomechanics in treating unstable osteoporotic fracture patterns based on studies.^{1,2}

The helical blade design of the PFNA-2 implant transmits force through the cancellous bone. It offers better anchorage in osteoporotic femoral heads without enhancing the risk of cut-out

failure or implant migration. The PFNA-2 device is superior to Proximal Femoral Nail (PFN) and Dynamix Hp Screw (DHS) predecessors, with enhanced angular stability, improved rotational stability, shorter operating time, and less tissue trauma while providing better load-sharing benefits.^{3,4} Positive radiological union outcomes and improved functional results have been demonstrated using Harris Hip Score (HHS) and Modified Merle d'Aubigné scoring systems.^{5,6}

Multiple clinical trials show that PFNA-2 makes patients more mobile before surgery while reducing the need for further operations and resulting in better outcomes for stable and unstable intertrochanteric fractures.^{7,8} The study performed by Jeeva et al. showed that PFNA-2 treatment led to successful results in 80% of patients during week 12 after surgery.²

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Khanam and Rao conducted research that showed PFNA-2 patients had reduced blood loss during surgery and faster recovery of full weight-bearing capacity than PFN-experienced patients⁴ PFNA-2 demonstrates enhanced stability during fractures because of its nail shape, which matches Asian femoral structures better.⁹

Research comparing PFNA to PFNA-2 shows that PFNA-2 offers better outcomes for fracture healing times, produces fewer implant complications, and yields superior patient-reported results.^{10,11} The enhanced design of PFNA-2 enables physicians to choose from short or long nails through its adaptable length capability.¹² The clinical usefulness of PFNA-2 has grown because of its ability to treat complex subtrochanteric fractures and reverse obliquity patterns.¹³

The clinical use of PFNA-2 continues to grow, yet functional results diverge between patient demographics, surgical methods, and different fracture types. Research articles about PFNA-2 primarily evaluate radiographic union rates and implant problems while avoiding standardized functional evaluation methods across time points. Little information exists regarding the effectiveness of PFNA-2 in older patients with osteoporosis-related femoral bone changes. A detailed assessment of functional results within a designated group of patients should be conducted to prove the practical value of PFNA-2 beyond its basic mechanical function. The research aims to assess functional outcomes of intertrochanteric femur fractures treated by PFNA-2 through a validated Harris Hip Score evaluation tool. The research aims to enhance current evidence by establishing regional data about PFNA-2's effectiveness for treating intertrochanteric fractures.

METHODS

This retrospective study was performed at Ghurki Trust and Teaching Hospital, Lahore, using medical records of patients who underwent PFNA2 fixation for proximal femur fractures over two years, from January 2022 to December 2023, after obtaining approval from the Institutional Ethical Committee (Ref.2024/01/R-10, Dated: 01-

01-24). The study included all skeletally mature patients with unstable intertrochanteric fractures classified as AO/OTA 31.A2 and 31.A3, who were independently ambulatory (with or without support) at the presentation time. Patients with open fractures, intracapsular neck of femur fractures, pathological fractures, those medically unfit for anaesthesia, or with prior implants in the fractured hip or femur were excluded. Informed and written consent was taken from all patients or their attendants before enrollment. A detailed clinical examination, baseline investigations, and radiographic evaluation were conducted, including plain X-rays of the affected hip and proximal femur. All patients were planned for surgery under spinal anaesthesia and were positioned supine on a fracture table. Closed reduction of the fracture was performed using traction, with the uninjured leg held in wide abduction. A C-arm image intensifier was positioned between the legs for intraoperative imaging. A total of 43 patients were operated on using PFNA2 fixation.

Patients were encouraged to sit on the first postoperative day, and ankle and knee exercises were started. As tolerated, weight-bearing was promoted with the assistance of a walker and gradually increased according to radiological evaluations on follow-up. Preoperative and postoperative haemoglobin values, blood transfusion count, surgical time, intraoperative loss of blood (estimated from soaked pieces of gauze), hospital stay duration, and postoperative complications were documented on follow-up visits.

The patients were observed for at least 12 months, and postoperative observations and evaluation at 1, 3, 6, and 12 months were taken. The functional status pre-fracture was measured using the Modified Harris Hip Score, and clinical and functional measures were also recorded after 12 months using the Modified Harris Hip Score. All data were analyzed using Microsoft Excel 2016 and SPSS version 27.

RESULTS

Parameter	Category	Number of Patients	Percentage (%)
Age Group	<40	4	4.7
	41–49	2	2.3
	50–59	8	9.3
	60–69	8	9.3
	70–79	22	25.6
	80–89	29	33.7
	90–99	13	15.1
Sex	Male	46	53.5
	Female	40	46.5
Mode of Injury	Trivial	80	93
	High Velocity	6	7
Side of Injury	Right	48	55.8
	Left	38	44.2
MHHS Outcome	Excellent (90–100)	16	18.6
	Good (80–89)	42	48.8
	Fair (70–79)	24	27.9
	Poor (<70)	4	4.7
Complications	Helical Screw Back Out	4	4.7
	Cellulitis of Incision Site	2	2.3
	DVT and Cellulitis	2	2.3

Table-I. Characteristics of patients (n=86)

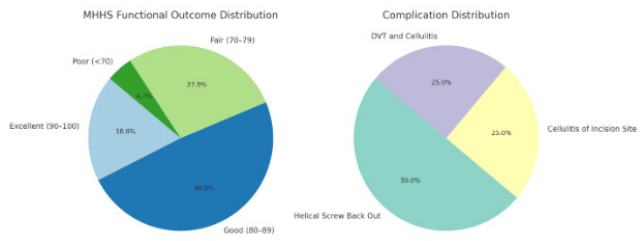


Figure-2. Function outcome & complication distribution

The study analyzed 86 patients with intertrochanteric femur fractures treated using PFNA-2. The majority of patients were elderly, with the highest representation in the 80–89 years age group (33.7%), followed by 70–79 years (25.6%) and 90–99 years (15.1%). Patients aged under 60

comprised a smaller portion of the cohort (25.6%), indicating that these fractures predominantly affect the elderly. Males accounted for a slight majority (53.5%), while females represented 46.5%. The predominant mechanism of injury was trivial trauma (93%), reflecting the typical pattern seen in geriatric osteoporotic populations, with high-velocity trauma accounting for only 7% of cases. The right hip was more commonly affected (55.8%) than the left (44.2%).

Nearly half of the patients (48.8%) achieved a ‘good’ outcome (scores 80–89), while 18.6% had ‘excellent’ results (90–100). A fair outcome (70–79) was recorded in 27.9% of patients, and only 4.7% demonstrated poor functional recovery (<70). Postoperative complications were infrequent: 4.7% experienced helical screw back-out, while 2.3% developed cellulitis at the incision site, and another 2.3% had both deep vein thrombosis (DVT) and cellulitis. (Table-I, Figure-2)

DISCUSSION

As the elderly population is increasing worldwide, the incidence of intertrochanteric fractures of the hip has increased in recent years. The main objective of treatment in these fractures is to obtain a stable fixation to allow rapid rehabilitation and early mobilization. A Cochrane meta-analysis¹⁵ studied the comparison between extramedullary implants and old-generation implants. It showed that even though there were short-term benefits of intramedullary fixation, it was associated with a higher number of operative morbidities. PFNA2, a relatively newer intramedullary implant, is biomechanically suitable for treating unstable intertrochanteric fractures.¹⁶

In our study, the mean age was 73.53 years, with the highest rate of fractures observed in the 80–89 age group (33.7%). About 83% of the patients were above 60 years of age. In other studies, most of the patients were above 60 years old.¹⁷⁻¹⁹ Poor bone quality, neglected old-aged patients, and senile decreased vision could be the probable reasons for the high incidence of intertrochanteric fractures above 60 years of age.

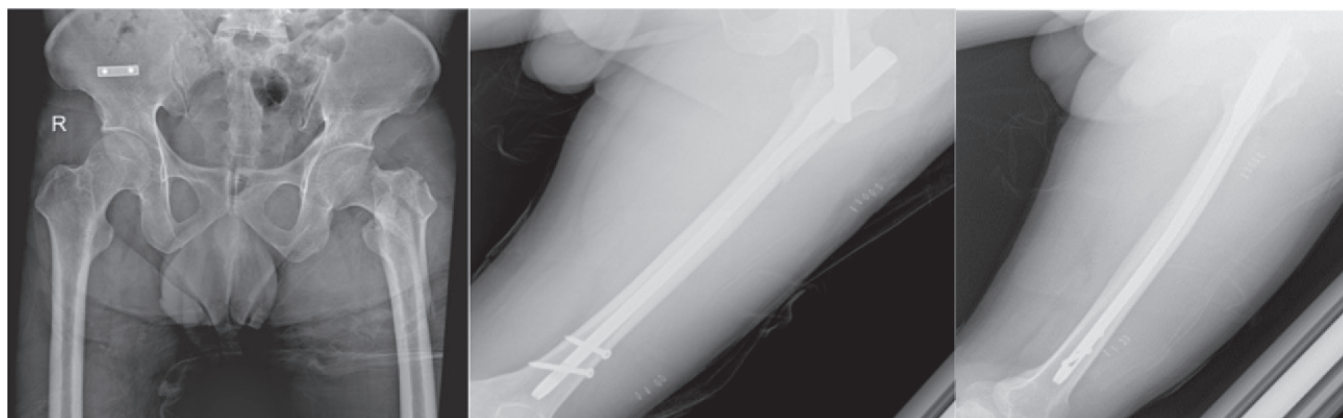
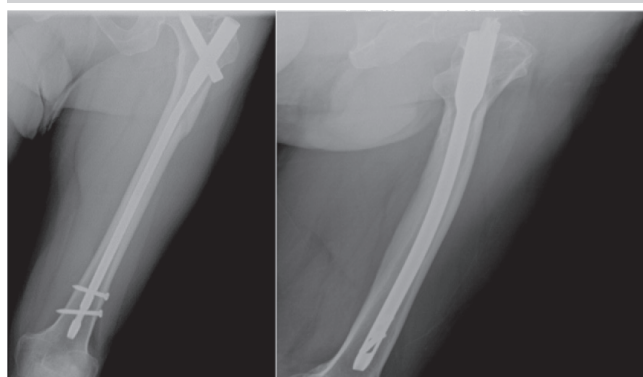


Figure-3. Sequential radiographic images demonstrating intertrochanteric femur fracture and postoperative fixation using PFNA-2 — (a) preoperative X-ray (AP view), (b) immediate postoperative X-ray (AP view), and (c) immediate postoperative X-ray (lateral view).



**Figure-4a. Follow-up X-ray showing fracture healing
Fig 4b: Further follow-up X-ray showing the union of fracture.**

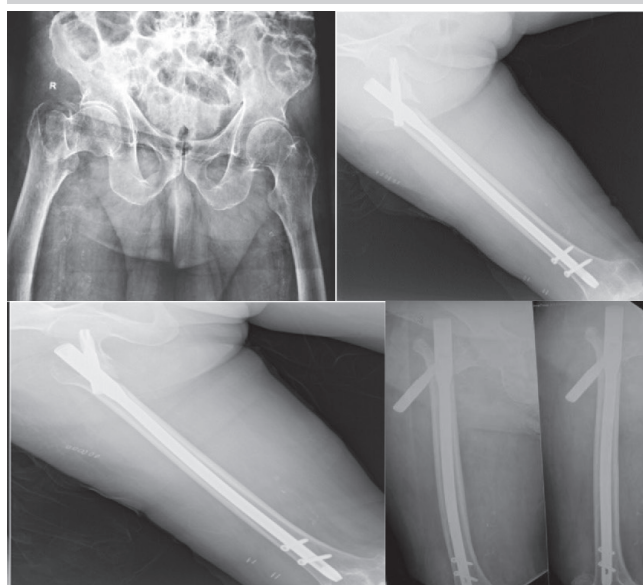


Figure-5. Preoperative and Immediate Postoperative Radiographs Showing Bilateral Intertrochanteric Fractures Treated with PFNA-II (a: Pre-op, b: Immediate Post-op AP View, c: Immediate Post-op Lateral View)

Our research's mean operating time was 48.02 minutes, between 31–70 minutes. Mean per-operative blood loss and decrease in post-operative hemoglobin from basal values were 81.62 mL and 2.4 gm/dL, respectively. The mean time taken to perform PFNA2 in another study²⁰ was 43.1 minutes. The mean blood loss was 109.1 mL. Zeng et al.²¹ have reported a mean operation time of 36.5 minutes and blood loss of 220 mL, as compared to Takigami et al.²²

Functional status was excellent in 18.6%, good in 48.83%, fair in 27.9%, and poor in 4.65% of patients in this study. The mean MHHS after one year was 80.38 ± 9.28 . As per Harshwardhan et al.²⁰, MHHS functional status was excellent in 30%, good in 40%, fair in 20% of patients, and poor in 10%, with a mean score of 82.86. Sahin et al.²³ stated the mean Harris Hip Score to be 77.8. Liu et al.²⁴ had a mean score of 84.0, and Kashid et al. had 88.48.²⁵

In our study, there were 2 cases of screw cut-out (4.65%) and 2 cases of deep vein thrombosis with cellulitis (4.65%). Takigami et al.²¹ and Sahin et al.²³ found 2% and 4.7% cut-out rates, respectively. Harshwardhan et al.²⁰, in a sample size of 30 patients, reported 2 cases of implant cut-out (6.66%) and 1 case of implant pull-out (3.33%). Mora et al.²⁶ and Aguado-Maestro et al.²⁷, in their studies of intertrochanteric fractures treated with PFNA2, reported a lower incidence of a cut-out of the helical blade screw.

The study faced limitations due to its retrospective approach combined with the single-center collection of data and its small patient sample size, which could reduce the research findings' reliability. The study lacks comparison data from alternative fixation methods because no control group was included. A short follow-up period of twelve months restricts researchers from properly assessing implant survivorship and long-term complications. Additional research must be conducted in multicenter randomized controlled trials with increased patient numbers and extended follow-up times to assess better PFNA-2 and other fixation device outcomes across patient demographics.

CONCLUSION

Our study showed that using PFNAII in treating unstable intertrochanteric fractures had good functional outcomes, especially in the elderly population with fewer complications. However, the study's limitations were a single-center trial with a smaller clinical sample size and a short postoperative follow-up duration, making long-term outcomes and complications remain unclear and non-comparative study. Therefore, a large-sample, multicenter randomized trial comparing the outcomes of PFNA with other devices in elderly patients will probably be required for definitive assessment.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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2	Muneeb ur Rehman Niazi: Statistical analysis.
3	Uzair Rashid: Literature review, manuscript writing.
4	Muhammad Ismail: Manuscript design, proof read.
5	Haseeb Elahi: Data collection.
6	Qudrat Ullah: Study design.
7	Sabir Khan Khattak: Manuscript design.