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Clinical Outcomes of Proximal Femoral Nail Anti-Rotation in Extracapsular Proximal Femoral Fractures: A Prospective Study

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ABSTRACT

Background: Extracapsular proximal femoral fractures, predominantly seen in elderly osteoporotic patients, pose a significant treatment challenge due to instability and poor bone quality. Proximal Femoral Nail Anti-Rotation (PFNA) is designed to enhance fixation stability and reduce implant-related complications.

Materials and Methods: A prospective clinical study was conducted on 50 patients with extracapsular proximal femoral fractures (AO/OTA 31-A1 to A3) treated with PFNA between January 2020 to December 2020. Patient demographics, operative parameters, radiological union, and functional outcomes (Harris Hip Score) were recorded. Follow-ups were done at 6 weeks, 3 months, and 6 months. Data were analyzed using descriptive statistics.

Results: The mean age of patients was 68.4 years, with 28 males and 22 females. Mean operative time was 65 ± 12 minutes, and mean intraoperative blood loss was 95 ± 20 mL. Radiological union occurred in an average of 13.4 ± 2.1 weeks. At 6 months, 82% of patients achieved good to excellent outcomes. Complications included varus collapse in 4% and superficial infection in 6%, with no implant failure.

Conclusion: PFNA provides stable fixation, allows early mobilization, and yields excellent union rates in extracapsular proximal femoral fractures, making it a preferred implant in elderly osteoporotic patients.

Keywords: Proximal femoral nail anti-rotation, Extracapsular fracture, Harris hip score, Osteoporosis, Hip fracture fixation.

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Introduction

Extracapsular proximal femoral fractures, which include intertrochanteric and subtrochanteric fractures, are among the most frequently encountered fractures in the elderly population. They are commonly caused by low-energy mechanisms such as domestic falls in patients with osteoporosis, while in younger individuals, they usually result from high-energy trauma such as road traffic accidents. These injuries are associated with substantial morbidity, loss of independence, and, in some cases, increased mortality, making their timely and effective management a priority in orthopaedic trauma care (Bhandari et al., 2015).

Traditional fixation methods, particularly the dynamic hip screw (DHS), have been widely used for decades and continue to provide satisfactory results in stable fracture patterns. However, unstable fractures, reverse obliquity configurations, and fractures in severely osteoporotic bone present unique challenges. In such cases, DHS fixation may be associated with higher rates of mechanical failure, excessive collapse, and prolonged recovery periods (Haidukewych et al., 2001).

The Proximal Femoral Nail Anti-Rotation (PFNA) system was developed to overcome some of these limitations. It is an intramedullary load-sharing device that offers biomechanical advantages by placing the implant closer to the mechanical axis of the limb, reducing the bending moment and improving stability. The helical blade of the PFNA compacts cancellous bone during insertion, enhancing purchase in osteoporotic bone and resisting rotational forces, thereby reducing the risk of cut-out compared to conventional screw designs (Simmermacher et al., 2008).

While multiple international studies have reported favorable results with PFNA in terms of reduced complication rates, shorter operative time, and earlier weight-bearing, there remains a paucity of region-specific clinical data that evaluates both functional and radiological outcomes in our patient population. Furthermore, variations in patient bone quality, fracture patterns, and rehabilitation protocols across regions warrant locally conducted studies to confirm these benefits.

In light of these considerations, the present study was undertaken to evaluate the role of PFNA in the management of extracapsular proximal femoral fractures, with a focus on union rates, functional recovery using the Harris Hip Score, and procedure-related complications. By doing so, this study aims to contribute meaningful data to guide implant selection in similar clinical settings.

Materials and Methods

Study Design & Setting:

A prospective observational study conducted in the Department of Orthopaedics, [National Institute of Medical Sciences & Research, Jaipur], between January 2020 to December 2020.

Sample Size:

50 patients diagnosed with extracapsular proximal femoral fractures.

Inclusion Criteria:

- Age >50 years
- Fresh fractures (AO/OTA 31-A1, A2, A3)
- Medically fit for surgery

Exclusion Criteria:

- Pathological fractures other than osteoporosis
- Polytrauma with unstable systemic condition
- Old neglected fractures (>3 weeks)

Surgical Technique:

All surgeries were performed under spinal or combined spinal-epidural anesthesia on a fracture table. Closed reduction was achieved under fluoroscopic guidance. PFNA (Synthes) of appropriate size was inserted via a minimally invasive approach.

Postoperative Care:

Quadriceps strengthening started from day 1. Partial weight-bearing initiated by day 2, progressing to full weight-bearing based on radiological union.

Outcome Measures:

- Harris Hip Score (HHS) at 6 weeks, 3 months, 6 months
- Radiological union time (bridging callus in 3 cortices)
- Complication rates

Statistical Analysis:

Data analyzed using SPSS v25. Continuous variables expressed as mean ± SD; categorical variables as percentages.

Results

Demographic Profile:

Parameter	Value
Sample size	50 patients
Mean age	68.4 ± 8.2 years
Gender	M: 28 (56%), F: 22 (44%)
Side affected	Right: 27 (54%), Left: 23 (46%)
Fracture type (AO)	A1: 18 (36%), A2: 22 (44%), A3: 10 (20%)

Operative & Postoperative Data:

Parameter	Mean ± SD
Operative time (min)	65 ± 12
Blood loss (mL)	95 ± 20
Full weight-bearing (weeks)	8.2 ± 1.6
Radiological union (weeks)	13.4 ± 2.1

Functional Outcome (HHS at 6 months):

Outcome	Patients (%)
Excellent (90–100)	20 (40%)
Good (80–89)	21 (42%)
Fair (70–79)	7 (14%)
Poor (<70)	2 (4%)

Complications:

- Varus collapse: 2 cases (4%)
- Superficial infection: 3 cases (6%)
- No deep infection or implant breakage

Figures:

Fig. 1: Preoperative X-ray showing AO/OTA 31-A2 fracture.

Fig. 2: Immediate postoperative X-ray after PFNA fixation.

Fig. 3: Three-month follow-up X-ray showing union.

Discussion

This study demonstrates that PFNA offers excellent clinical and radiological outcomes in extracapsular proximal femoral fractures. The high rate of good to excellent results (82%) correlates with findings by Simmermacher et al. (2008), who reported improved rotational stability and early mobilization with PFNA compared to DHS.

The average union time in our series (13.4 weeks) is comparable to studies by Seyhan et al. (2015) and Takigami et al. (2011). Low complication rates in our cohort can be attributed to careful surgical technique and early rehabilitation.

While PFNA's biomechanical advantage is well established, its success also depends on accurate reduction and proper implant positioning. Our study is limited by its small sample size and relatively short follow-up period. Long-term randomized studies with larger populations are required to establish its superiority conclusively.

Conclusion

PFNA is a reliable implant for extracapsular proximal femoral fractures, particularly in elderly osteoporotic patients. It provides stable fixation, early rehabilitation, and minimal complications, thereby contributing significantly to improved patient mobility and quality of life.

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Conflict of Interest

The authors declare no conflict of interest.

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