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ORIGINAL RESEARCH

Functional Outcomes of Proximal Femoral Nail Anti-Rotation II in Intertrochanteric Femur Fractures: A Single-Arm Interventional Study

Aditya M Gogi[1], Mohammed Ibrahim[2], Mohammed Nazim[3], Anand Kumar[4]

[1]Orthopaedic Resident 3rd Year, [2]HOD and Professor, [3,4]Associate Professor, Department of Orthopaedics, Gulbarga Institute of Medical Sciences Kalaburagi, India

Corresponding Author
Aditya M Gogi
[1]Orthopaedic Resident 3rd Year, Department of Orthopaedics, Gulbarga Institute of Medical Sciences Kalaburagi, India

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ABSTRACT

Background: Intertrochanteric fractures are prevalent among the elderly, often due to osteoporosis, lead-ing to significant morbidity. The Proximal Femoral Nail Anti-rotation II (PFNA-II) has been introduced to improve fixation stability and reduce complications associated with traditional methods. **Methods:** A single-arm interventional study was conducted on 35 patients aged 40–80 years with intertro-chanteric femur fractures treated using PFNA-II at Gulbarga Institute of Medical Sciences, Kalburgi, from August 2022 to January 2024. Patients were followed clinically and radiologically at regular intervals. Functional outcomes were assessed using the Harris Hip Score at 3 and 6 months postoperatively. **Results:** The mean age of patients was 64.17 years, with a slight female predominance (51.42%). Most fractures resulted from trivial trauma (71.42%). The average duration of surgery was 30.37 minutes, and mean blood loss was 117 ml. Fracture union was achieved in an average of 13.74 weeks. Complications included superficial infection in 3 patients and helical blade cut-out in 1 patient. At 6 months, 54% of pa-tients had an excellent outcome, 28% good, and 17% fair, according to the Harris Hip Score. **Conclusion:** PFNA-II is an effective implant for treating intertrochanteric femur fractures, offering re-duced operative time, minimal blood loss, and favourable functional outcomes. It may be considered a biomechanically superior option for unstable intertrochanteric fractures.

Keywords: Intertrochanteric fractures; PFNA-II; Proximal Femoral Nail Anti-rotation II; Harris Hip Score; Functional outcome.

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INTRODUCTION

Intertrochanteric fractures are among the most frequent and debilitating injuries in the elderly, primarily due to osteoporosis-associated bone fragility [1]. These fractures significantly impair mobility, often confining patients to their homes and necessitating assistive devices for daily ac-tivities. Over 50% of intertrochanteric fractures are unstable, characterized by reverse oblique patterns, subtrochanteric extension, or substan-tial comminution of the posteromedial cortex [2,3].

Managing these fractures is challenging due to associated comorbidities like diabetes, hyper-tension, and renal failure. Historically, nonoper-ative treatments such as external splintage, skin traction, and skeletal traction were reserved for patients who were poor surgical candidates or non-ambulant with minimal discomfort [4]. However, operative treatment has become pre-dominant, aiming for anatomical reduction and stable fixation to facilitate early mobilization and reduce risks associated with prolonged re-cumbency [5].

Despite advancements in surgical techniques and implant designs, intertrochanteric fractures continue to present high complication rates and consume substantial healthcare resources [6]. The primary issue is achieving stable fixation, not union or delayed union, due to the cancel-lous nature of the intertrochanteric region [7]. The strength of the fracture-implant assembly depends on factors such as bone quality, frag-ment geometry, reduction quality, implant de-sign, and implant placement [8]. Surgeons can influence the latter three factors to optimize out-comes. The sliding hip screw has been the stand-ard

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implant for over a decade but may not be ideal for all fracture types, especially unstable patterns [9,10]. The Proximal Femoral Nail (PFN) is commonly used but has drawbacks like the "Z-effect" and the need for two screws, which may compromise stability. The Proximal Femoral Nail Anti-rotation II (PFNA-II) address-es these issues by utilizing a single helical blade designed to provide enhanced stability, com-pression, and rotational control [11].

Biomechanical studies have shown that the heli-cal blade compacts cancellous bone into the femoral head, improving rotational stability and reducing stress on the femoral head [12]. The PFNA-II also features a reduced mediolateral angle from 6 degrees to 5 degrees, lowering the risk of implant failure, particularly in osteopo-rotic bones [13]. This study aims to assess the functional outcomes of PFNA-II in treating inter-trochanteric femur fractures.

MATERIALS AND METHODS

Study Design and Setting

This single-arm interventional study was con-ducted at Gulbarga Institute of Medical Scienc-es, Kalburgi, from August 2022 to January 2024. A total of 35 patients diagnosed with intertro-chanteric femur fractures were enrolled after obtaining informed consent.

Inclusion and Exclusion Criteria

Inclusion Criteria

- Patients aged 40–80 years.
- Intertrochanteric fractures with or without comminution and an intact lateral wall.
- Unstable fractures with reverse obliquity or posteromedial comminution.

Exclusion Criteria

- Patients younger than 40 or older than 80 years.
- Fractures in the ipsilateral limb.
- Head injury or polytrauma.
- Associated neurovascular injury.
- Pathological or open fractures.

Sample Size Calculation

Using a standard normal variate (Z) of 1.645 for 90% confidence, a standard deviation (SD) of 0.36, and a precision (d) of 0.1, the calculated sample size was 35 patients.

Patient Management

Upon admission, patients underwent clinical and radiological evaluations, including AP and lat-eral pelvic radiographs. Relevant laboratory in-vestigations were performed. Preoperative plan-ning included measuring nail diameter, neck-shaft angle, and determining nail length.

Surgical Technique

All patients underwent fixation using the PFNA-II under image intensifier guidance:

1. Positioning: Patients were placed supine on a fracture table with the injured limb ad-ducted 10–15 degrees.
2. Reduction: Closed reduction was achieved using traction and internal rotation.
3. Incision and Entry Point: A 5-cm longitu-dinal incision was made proximal to the tip of the greater trochanter.
4. Guidewire Insertion: A guidewire was in-serted into the medullary canal at the greater trochanter's tip.
5. Reaming and Nail Insertion: The proximal femur was reamed, and an appropriate PFNA-II nail was inserted.
6. Helical Blade Placement: A guidewire for the helical blade was placed, followed by insertion and locking of the blade.
7. Distal Locking: A single cortical screw was used for distal locking.

Postoperative Care

- Limb elevation and monitoring of vital signs.
- Antibiotic therapy for 48 hours.
- Initiation of physiotherapy with static quad-riceps exercises on the third postoperative day.
- Gradual mobilization with non-weight-bearing ambulation, progressing to partial and then full weight-bearing based on radio-logical evidence of union.

Follow-Up and Outcome Measures

Patients were followed at 6 weeks, 3 months, and 6 months postoperatively. Functional outcomes were assessed using the Harris Hip Score. Radio-logical evaluations were performed to assess fracture union and implant position.

RESULTS

Patient Demographics

- Age: The mean age was 64.17 years (range 45–80 years).
- Gender: 18 females (51.42%) and 17 males (48.5%).
- Mode of Injury: 25 cases (71.42%) resulted from trivial trauma, while 10 cases (28.57%) were due to road traffic accidents.
- Side of Injury: Right side affected in 20 patients (57.1%), left side in 15 patients (42.8%).

Fracture Classification

According to Boyd and Griffin:

- Type I: 9 cases (25.7%)
- Type II: 17 cases (48.5%)
- Type III: 5 cases (14.2%)
- Type IV: 4 cases (11.42%)

Intraoperative Details

- Duration of Surgery: Mean time was 30.37 minutes.
- Blood Loss: Average of 117 ml.

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- Fluoroscopic Exposure: Mean of 29.97 images per surgery.
- Complications
- Superficial Infections: Occurred in 3 pa-tients; resolved with antibiotics.
- Helical Blade Cut-Out: Occurred in 1 pa-tient after 14 months due to a fall; managed with implant removal.
- Other Complications: No cases of malu-nion, non-union, or deep vein thrombosis.

Functional Outcomes: At 6 months postopera-tive:

- Excellent (Harris Hip Score 90–100): 19 patients (54%)
- Good (80–89): 10 patients (28%)
- Fair (70–79): 6 patients (17%)
- Poor (<70): 0 patients

Table 1: Patient Demographics

Parameter	Value
Mean Age (years)	64.17
Gender (Male/Female)	17/18
Mode of Injury	Trivial Trauma (71%)
Side of Injury (Right/Left)	20/15

Table 2: Fracture Classification (Boyd and Griffin)

Type	Number of Cases	Percentage (%)
I	9	25.7
II	17	48.5
III	5	14.2
IV	4	11.42

Figure 1: Positioning and Painting

Description: Radiographs showing an intertrochanteric fracture preoperatively and progressive healing at 6 weeks, 3 months, and 6 months postoperatively.

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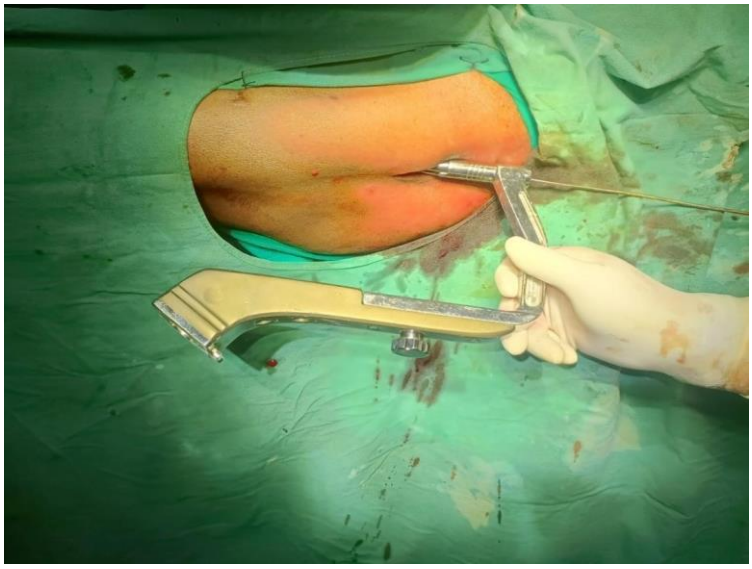


Figure 2: Inserting the Nail

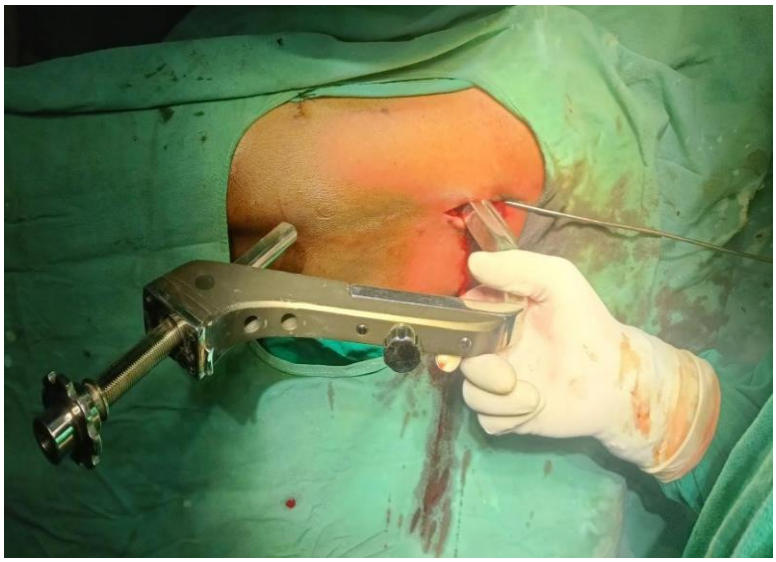
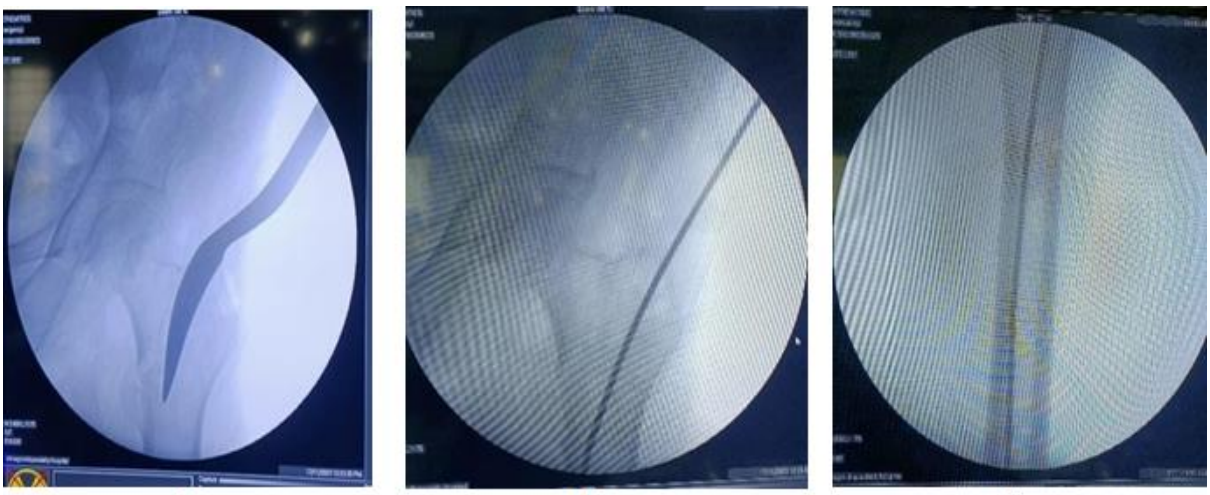


Figure 3: Insertion of sleeve for the helical blade



A **B** **C**

C ARM IMAGES

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CASE ILLUSTRATION

Case1- 38-Year-old Male, Trochanteric Fracture PRE-OPXRAY

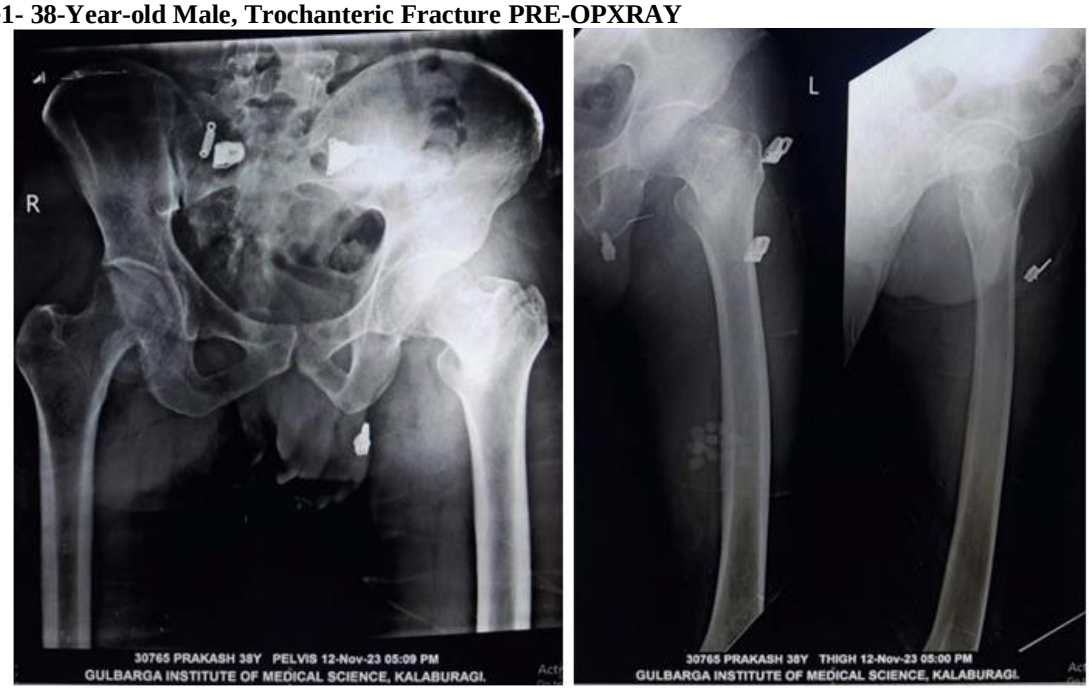

Fig. 4. Left Side Intertrochanteric fracture(Case1)

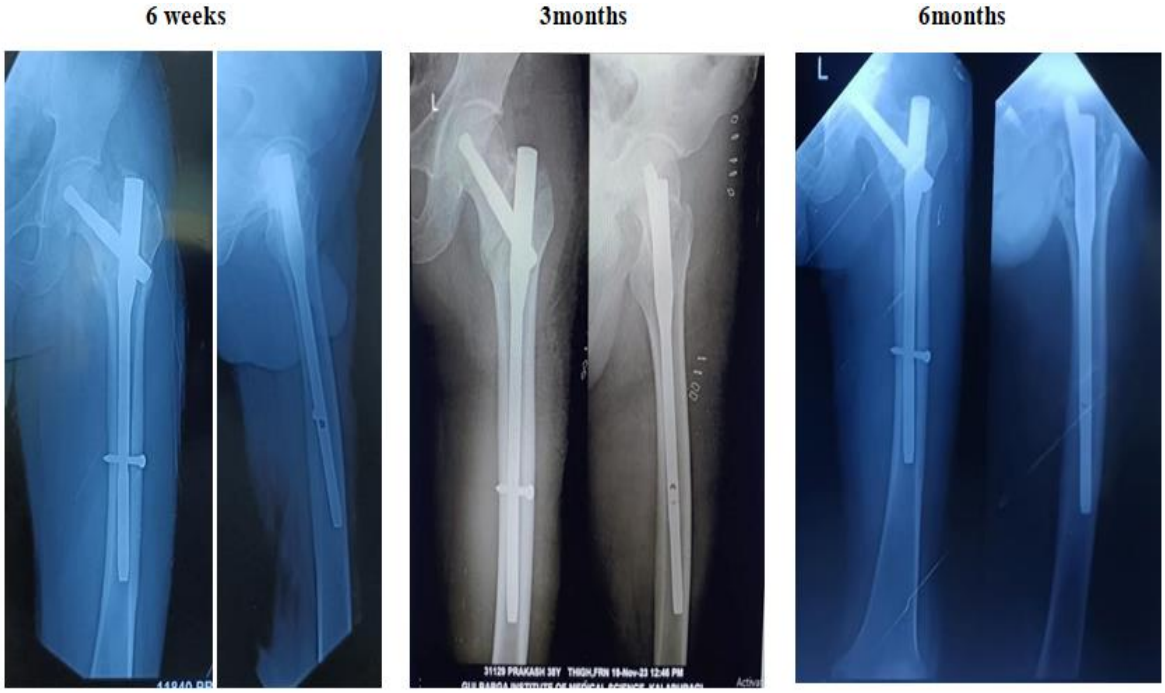

Fig.5. Showing 6weeks, 3months and 6months followup x-ray

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CASE 1

Case 2-6 Year old female, Trochanteric Fracture PRE-OP X RAY

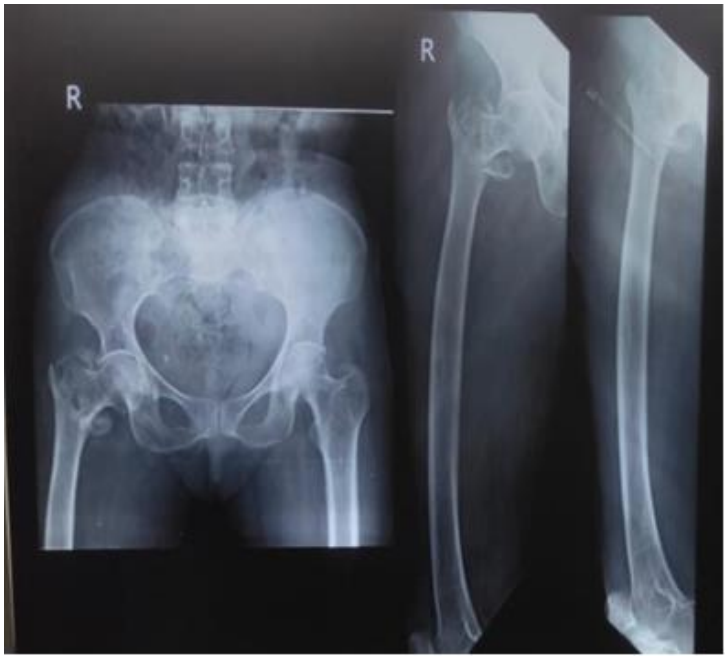

Fig.7. Right Side Intertrochanteric fracture(Case1)

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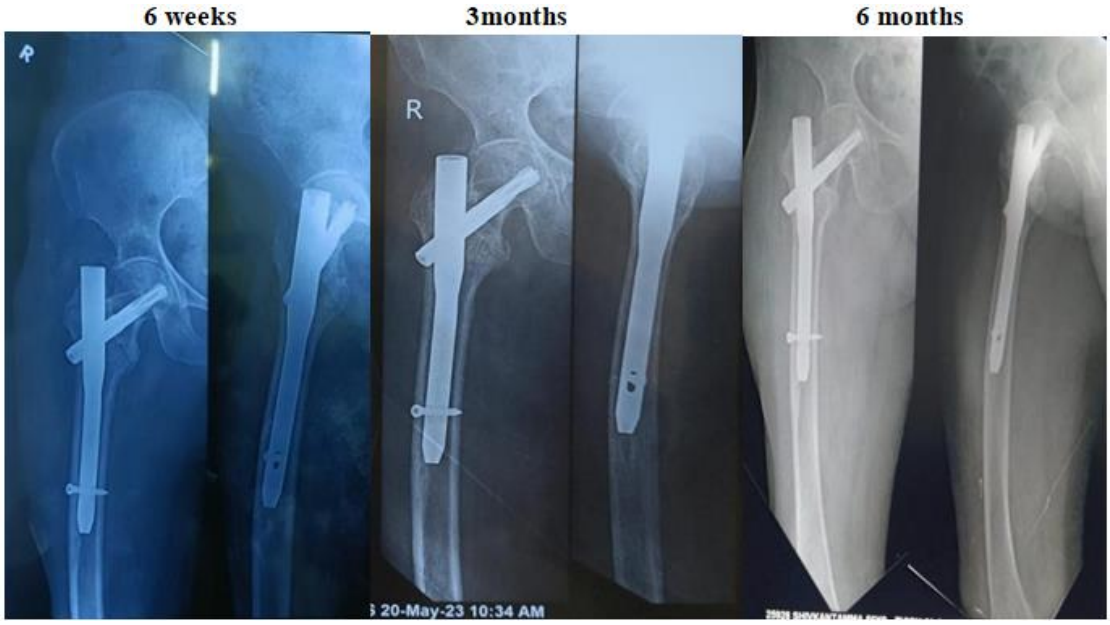

Fig.25. Showing 6weeks, 3months and 6months followup x-ray

CASE 2

Description: Similar series demonstrating successful fracture union in another patient.

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DISCUSSION

Intertrochanteric fractures significantly impact the elderly due to reduced bone mineral density and associated comorbidities [13]. The primary goal is stable fixation allowing early mobiliza-tion to minimize complications from prolonged immobilization [14].

The PFNA-II nail offers advantages over tradi-tional implants. Its helical blade design com-pacts cancellous bone, enhancing rotational sta-bility and reducing cut-out risk [15]. The re-duced mediolateral angle from 6 to 5 degrees in PFNA-II decreases implant failure rates, particu-larly in osteoporotic bones [16].

In this study, the mean operative time was short (30.37 minutes), beneficial for elderly patients who may not tolerate lengthy surgeries [17]. Minimal blood loss (117 ml) aligns with the min-imally invasive approach of PFNA-II [18]. Func-tional outcomes were favourable, with 82% of patients achieving excellent or good Harris Hip Scores at 6 months. This concurs with other studies demonstrating improved outcomes with PFNA-II [19]. Early weight-bearing was facilitat-ed by stable fixation, promoting better rehabili-tation [20].

Complications were minimal. The helical blade cut-out in one patient underscores the need for careful patient education on postoperative pre-cautions [21]. Superficial infections were effec-tively managed, indicating good surgical and postoperative care.

Limitations of this study include a small sample size and lack of a control group using alternative fixation methods. Larger randomized controlled trials are necessary to validate these findings [22].

CONCLUSION

PFNA-II is an effective implant for managing intertrochanteric femur fractures in elderly pa-tients. It offers reduced operative time, minimal blood loss, and improved functional outcomes. The helical blade design enhances fixation sta-bility, allowing early mobilization and reducing complication rates. Further large-scale studies are recommended to establish PFNA-II as a standard treatment option for unstable intertro-chanteric fractures.

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