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# Evaluation of functional outcome of intertrochanteric fractures of femur treated with proximal femoral nailing antirotation II

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**Conflicts of Interest:** Nil

## Abstract

**Background:** Intertrochanteric fractures of the femur are common injuries, particularly among older adults, and are associated with considerable morbidity, functional impairment, and reduced independence. Osteoporosis, low-energy falls, and age-related changes in bone quality contribute to the increasing incidence of these fractures. Surgical fixation aims to achieve stable fracture reduction, facilitate early mobilization, promote fracture union, and restore pre-injury functional status. Proximal Femoral Nail Antirotation II (PFNA-II) is an intramedullary fixation device designed to provide stable fixation through a helical blade that compacts cancellous bone and improves anchorage in the femoral head.

*Aim:* To evaluate the postoperative functional outcome of intertrochanteric fractures of the femur treated with Proximal Femoral Nail Antirotation II using the Harris Hip Score.

**Materials and Methods:** This prospective observational study was conducted in the Department of Orthopaedics at Katuri Medical College and Hospital, Chinnakondrupadu, Guntur, Andhra Pradesh, from April 2024 to March 2026. Thirty patients aged above 18 years with intertrochanteric fractures of the femur underwent internal fixation using PFNA-II. Patients were followed for six months after surgery. Clinical and radiological assessments were performed to evaluate fracture union, range of motion, postoperative complications, and functional recovery. Functional outcomes were classified according to the

Harris Hip Score as excellent (90–100), good (80–89), fair (70–79), and poor (<70).

**Results:** The study included 30 patients aged 32–92 years, with a mean age of 68.46 years. Females constituted 53% of the study population, and the right femur was involved in 60% of cases. A fall from standing height was the most common mechanism of injury, accounting for 83% of cases. The mean interval between injury and surgery was 3.5 days, and the mean hospital stay was 6.7 days. The mean time to fracture union was 13.63 weeks. At six months, nine patients (30%) had excellent functional outcomes, 16 (53.33%) had good outcomes, four (13.33%) had fair outcomes, and one (3.33%) had a poor outcome. The mean Harris Hip Score was 85.53 ± 7.12. Five patients (16.67%) developed postoperative complications.

Conclusion: PFNA-II fixation was associated with satisfactory functional recovery in most patients with intertrochanteric femoral fractures. Good-to-excellent functional outcomes were observed in 83.33% of patients, although complications and individual patient factors influenced recovery.

**Keywords:** Intertrochanteric Fracture, Femur, PFNA-II, Harris Hip Score, Fracture Union, Functional Outcome.

## Introduction

Intertrochanteric fractures of the femur are extracapsular fractures occurring in the region between the greater and lesser trochanters. They constitute a substantial proportion of hip fractures encountered in orthopaedic practice and are associated with significant morbidity, particularly among elderly individuals. The increasing life expectancy of populations worldwide, together with the rising prevalence of osteoporosis and age-related functional impairment, has contributed to the growing burden of these injuries. Hip fractures frequently result in prolonged hospitalization, loss of independence, reduced mobility, and increased healthcare expenditure.[1,2]

In older adults, intertrochanteric fractures commonly occur following low-energy trauma, particularly a fall from standing height. In younger individuals, these fractures are more frequently associated with high-energy mechanisms, including road traffic accidents and falls from considerable heights. The clinical presentation and prognosis depend on several factors, including age, bone quality, fracture configuration, associated injuries, pre-existing medical conditions, and the patient's functional status before injury. Prolonged immobilization following a hip fracture can lead to pressure injuries, deep vein thrombosis, pulmonary complications, muscle wasting, joint stiffness, and deterioration in general health. These complications emphasize the importance of timely assessment, appropriate surgical treatment, and structured postoperative rehabilitation.

The principal objectives of fracture management are to obtain satisfactory reduction, maintain stable fixation, promote fracture union, minimize complications, and enable early mobilization. The ultimate goal is to restore the patient's ability to perform daily activities and achieve the highest possible level of functional independence.[2,3] Several operative techniques have been developed for treating intertrochanteric fractures. Extramedullary implants, particularly the dynamic hip screw, have traditionally been used because they permit controlled impaction and provide satisfactory results in appropriately selected stable fracture patterns. However, unstable fracture configurations may be associated with medial cortical comminution,



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posteromedial fragment displacement, or disruption of the lateral wall. These features can compromise stability and increase the risk of excessive collapse, limb shortening, varus deformity, and implant failure. Intramedullary fixation devices were developed to improve mechanical stability and facilitate minimally invasive fracture treatment. Because the implant is positioned closer to the mechanical axis of the femur, intramedullary fixation offers a shorter lever arm and may reduce bending forces acting on the implant. These characteristics are particularly relevant in unstable fractures and in patients with compromised bone quality.[3,4] The proximal femoral nail and its subsequent modifications have become important components of modern fracture management. The selection of an implant depends on fracture morphology, bone quality, the adequacy of reduction, and the surgeon's experience.

PFNA-II incorporates modifications intended to accommodate the anatomical characteristics of the Asian proximal femur. These include a modified mediolateral angle, a flattened lateral surface, and a smaller proximal nail diameter compared with the original design. These modifications are intended to facilitate insertion and reduce lateral cortical impingement in appropriately selected patients.[4,5] The potential advantages of PFNA-II include minimally invasive insertion, preservation of soft-tissue structures, reduced fracture-site disturbance, stable fixation, and the possibility of earlier postoperative mobilization.

Fracture union is an important measure of successful treatment, but radiological healing does not necessarily indicate complete functional recovery. Patients may continue to experience pain, reduced hip mobility, difficulty walking, and limitations in performing activities of daily living even after satisfactory fracture union. Postoperative rehabilitation is consequently an essential component of treatment. Its objectives include pain control, prevention of immobilization-related complications, restoration of joint mobility, strengthening of the surrounding musculature, and progressive recovery of walking ability. The timing of weight-bearing progression should be individualized according to fracture stability, reduction quality, fixation security, bone quality, and the patient's overall condition. Appropriate follow-up is necessary to identify delayed union, implant-related complications, and functional limitations. Functional outcome assessment provides information about the patient's recovery beyond radiological findings. Relevant parameters include pain, walking ability, gait, range of motion, independence in daily activities, and the requirement for walking aids.

The Harris Hip Score is a widely used clinical instrument for assessing hip function. It incorporates pain, function, deformity, and range of motion into a composite score. It therefore provides a standardized approach to describing postoperative recovery and comparing functional outcomes between patients and studies.[6] In patients treated for intertrochanteric fractures, functional assessment should be interpreted alongside fracture union, complications, rehabilitation progress, and pre-existing medical conditions. A satisfactory functional score may reflect successful fracture stabilization and rehabilitation. Conversely, a poor score may be associated with infection, persistent pain, restricted mobility, implant failure, or other factors that interfere with recovery. Although PFNA-II is widely used in the management of intertrochanteric fractures, postoperative outcomes vary among patients. Age, bone



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quality, fracture stability, associated comorbidities, reduction quality, and postoperative rehabilitation may influence the results. Evaluating patients treated with a standardized fixation technique in a tertiary-care hospital provides an opportunity to document functional recovery, fracture union, and postoperative complications within a defined clinical setting.

The present study was therefore undertaken in the Department of Orthopaedics at Katuri Medical College and Hospital, Guntur, to assess the functional outcome of intertrochanteric fractures treated with PFNA-II. The study evaluated postoperative hip function using the Harris Hip Score and documented the time to fracture union, range of motion, and associated complications.

The findings are intended to contribute to the clinical assessment of PFNA-II fixation and to identify aspects of postoperative recovery that may require additional attention during follow-up and rehabilitation.

## Materials and Methods

### Study design

The study was designed as a prospective observational study to evaluate the postoperative functional outcome of intertrochanteric fractures of the femur treated with PFNA-II.

### Study setting

The study was conducted in the Department of Orthopaedics, Katuri Medical College and Hospital, Chinnakondrupadu, Guntur, Andhra Pradesh.

### Study duration

The study was conducted over 24 months, from April 2024 to March 2026.

### Study population

The study population comprised patients admitted to the Department of Orthopaedics with intertrochanteric fractures of the femur who underwent internal fixation using PFNA-II.

### Sample size

A total of 30 patients with intertrochanteric fractures of the femur were included in the study.

This is the sample size reported in the original dissertation. A separate formal sample-size calculation is not documented in the available study description; therefore, no retrospectively calculated value is presented as the original sample-size determination.

### Inclusion criteria

The following patients were included:

1. Patients with stable or unstable intertrochanteric fractures of the femur.
2. Patients aged above 18 years.
3. Patients of either sex.
4. Patients willing to provide written informed consent.

### Exclusion criteria

The following patients were excluded:

1. Patients with subtrochanteric fractures.
2. Patients with old or malunited intertrochanteric fractures.
3. Patients with periprosthetic fractures.
4. Patients considered medically unfit for surgery.

### Ethical considerations

Written informed consent was obtained from the participants before their inclusion in the study. The dissertation contains an ethics approval certificate in its annexures. The original institutional ethics committee approval and consent documentation should be retained when preparing the final dissertation.

### Clinical assessment

A detailed clinical history was obtained from each patient or the patient's attendant at admission. The history included the mechanism of injury, duration since



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injury, relevant medical conditions, and associated injuries.Initial assessment and resuscitation were performed according to the patient's clinical condition. Vital signs were recorded, and appropriate analgesia, intravenous fluids, and other necessary supportive measures were administered.A comprehensive systemic and musculoskeletal examination was performed to identify associated injuries and assess the overall condition of the patient.

Examination of the affected limb included assessment of:

- Skin and soft-tissue condition.
- Swelling and local tenderness.
- Deformity and limb position.
- Distal circulation and capillary refill.
- Sensory and motor function.
- The condition of the hip and knee joints.
- Associated injuries involving other parts of the body.

The patient's preoperative medical condition was assessed to identify comorbidities that could influence anaesthesia, surgical treatment, or postoperative recovery.

**Radiological assessment**

Standard anteroposterior and lateral radiographs of the affected hip and femur were obtained to confirm the fracture and assess its configuration. Fractures were classified according to the Boyd and Griffin classification. Radiological assessment was used to evaluate fracture displacement, fracture morphology, alignment, and the characteristics relevant to operative planning. Follow-up radiographs were reviewed to assess fracture alignment, evidence of callus formation, progression towards union, and possible implant-related complications.

**Operative procedure**

All patients underwent internal fixation using PFNA-II. Surgery was performed under spinal anaesthesia with the patient positioned supine on a traction table.Closed reduction was attempted under image-intensifier guidance. When satisfactory reduction could not be achieved by closed means, minimally open or percutaneous reduction techniques were used where required. Following preparation and draping of the operative field, an appropriate entry point was established in the proximal femur. A guidewire was introduced, and the proximal femoral canal was prepared according to the implant technique. The PFNA-II nail was inserted, and the helical blade was positioned in the femoral head and neck under image-intensifier guidance. Distal locking was performed as indicated by the operative technique. The final position of the implant and the adequacy of fracture reduction were checked radiologically. Wound closure and postoperative care were performed according to institutional practice.

**Postoperative management**

Postoperative care included monitoring of vital signs, wound assessment, pain management, and prevention of complications associated with immobilization. Patients received postoperative physiotherapy and mobilization according to their clinical condition and the stability of fracture fixation. The progression of weight-bearing was individualized. In the original study, full weight-bearing was generally deferred for approximately 6–10 weeks, depending on the clinical and radiological findings. Patients were advised to attend scheduled follow-up visits for clinical and radiological assessment.

**Follow-up schedule**

Patients were followed for six months after surgery.



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Follow-up assessments were conducted at approximately:

- Six weeks.
- Twelve weeks.
- Six months.

Clinical and radiological findings were documented during follow-up. Additional assessment was undertaken when complications or concerns regarding fracture healing arose.

**Assessment of fracture union**

Fracture union was assessed using clinical and radiological findings. Clinical assessment included pain and tenderness at the fracture site and the patient's ability to progress with weight-bearing. Radiological assessment included evidence of bridging callus, maintenance of alignment, and progression of fracture healing. In the original dissertation, union was considered when bridging callus was visible across at least three cortices on anteroposterior and lateral radiographs, together with an absence of pain during weight-bearing. The time to union was recorded in weeks.

**Functional outcome assessment**

Functional outcome was assessed using the Harris Hip Score at follow-up, with the six-month assessment used for the principal functional outcome analysis. The assessment considered pain, walking ability, daily activities, deformity, and range of motion. Functional outcomes were classified as follows:

| Harris Hip Score | Functional outcome |
|---|---|
| 90–100 | Excellent |
| 80–89 | Good |
| 70–79 | Fair |
| Below 70 | Poor |

The mean Harris Hip Score and its standard deviation were recorded.

**Assessment of complications**

Patients were monitored for postoperative complications, including:

- Superficial wound infection.
- Deep wound infection.
- Helical blade or screw back-out.
- Implant failure.
- Delayed union or non-union.
- Varus malunion.
- Anterior thigh pain.
- Joint stiffness.
- Neurovascular complications.
- Peri-implant fracture.

The nature of each complication and the treatment provided were documented.

Fig. 1: Instruments Used During PFN A2 Fixation

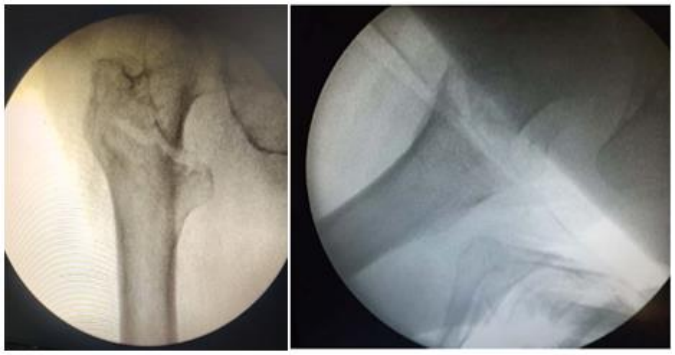

Fig. 2: Closed Reduction Under Image Intensifier



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**Skin Incision:** The tip of the greater trochanter was located. A 5cm longitudinal incision was made proximal to the tip of the greater trochanter. The fascia lata is incised, and the Gluteus Medius is split along the direction of its fibers. The tip of the greater trochanter is palpated.

Fig. 3: Skin Incision

**Determining the entry point:** Entry point is on the tip of greater trochanter or slightly medial to it. It is made with bone awl (straight, curved or cannulated). The awl is driven just proximal to the lesser trochanter, under the guidance of c-arm in both AP and lateral views.

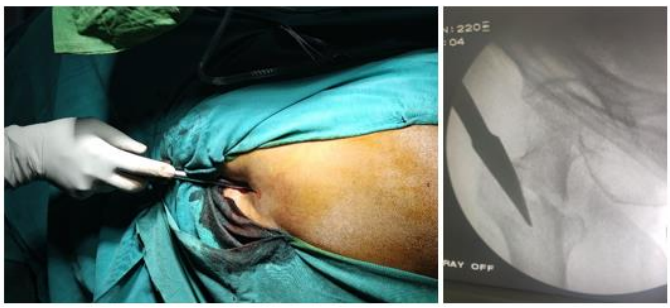

Fig. 4: Entry with AWL

**Insertion of guide wire:** The guide wire is inserted in this direction along the medullary canal.

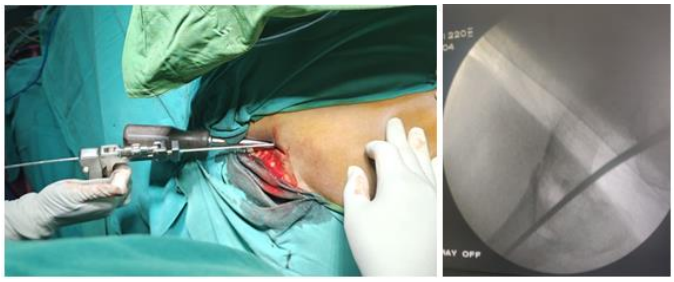

Fig. 5: Insertion of Guide Wire

**Proximal reaming of the femur:** Through the guide wire a cannulated proximal reamer is inserted and manual reaming was done.

Fig.6: Proximal Reaming of Femur

**Insertion of the nail:** After fracture reduction an appropriate size nail is mounted on the jig and inserted. The nail is inserted slowly inside the canal until the slot for the helical blade is at the level of the neck.

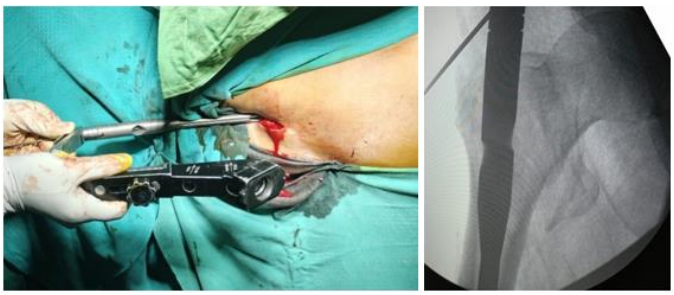

Fig. 7: Insertion of Nail Fixed with A Jig

**Insertion of the guide pin:** Inner and outer drill sleeves are fixed to the jig so that the outer sleeve is hitching the lateral cortex. A 2.5 mm guide wire was inserted through the drill sleeve using a stab incision. This guide wire is inserted up to 5 mm from the subchondral bone. The position of this guide wire should be in the lower half of the neck in AP view and in the center of the neck in



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lateral view. Positioning of the guide wire is important for a stable fixation.

Fig.8: Insertion of Guide Pin

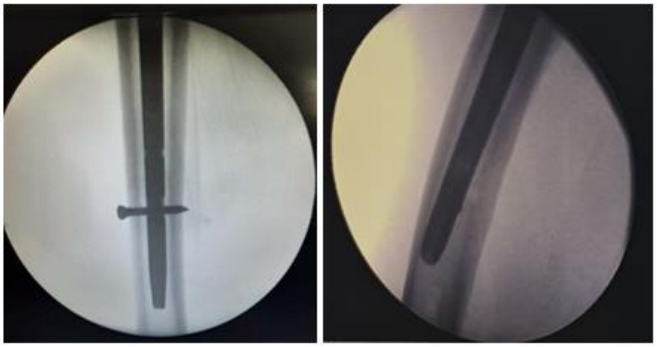


Fig. 9: Distal Locking Under Image Intensifier

Fig. 10: Wound Closure

**Radiological Assessment Criteria Included**

- Evidence of bone union
- Presence of varus collapse
- Amount of lateral displacement, Risk of screw cut-out
- Evaluation for implant failure and loss of fixation.

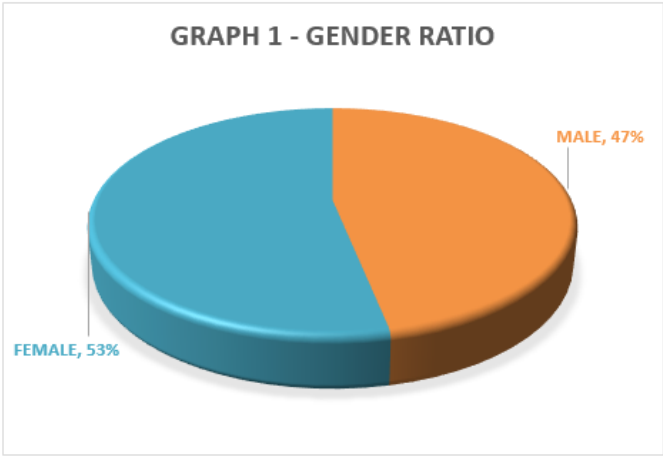
Patients were categorized based on their score on the Harris Hip Score evaluation at the 6th month follow up visit post-surgery as follows:

**Results**

In our study, 30 cases of intertrochanteric femur fractures were treated with proximal femoral nail antirotation 2. The duration of the study was from April 2024 to March 2026 with a mean follow-up period of 6 months. Out of the 30 cases, 14 patients were male and 16 patients were female. The age of the patient ranges from 32 years to 92 years. The results were analyzed both clinically and radiologically.

Table 1: Gender Incidence

| Gender | No. of Patients | Percentage |
|---|---|---|
| Male | 14 | 46.66% |
| Female | 16 | 53.33% |
| Total | 30 | 100% |



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Out of 30 patients in our study, there were 14 male and 16 female, which is indicating a high female incidence of intertrochanteric femur fracture with 1:1.14 ratio.

Table 2: Age Incidence

The patient's age ranged from 32 years to 92 years with a mean of 68.46.

| Age [in years] | No. of patients | Percentage |
|---|---|---|
| 18 – 30 | 0 | 0% |
| 31 – 40 | 1 | 3.33% |
| 41 – 50 | 1 | 3.33% |
| 51 – 60 | 4 | 13.33% |
| 61 – 70 | 11 | 36.66% |
| 71 – 80 | 10 | 33.33% |
| 81 - 90 | 2 | 6.66% |
| 91 - 100 | 1 | 3.33% |
| Total | 30 | 100% |

Table 3: Mode of Injury

| Mode of Injury | No. of Patients | Percentage |
|---|---|---|
| Road Traffic Accident | 5 | 16.66% |
| Self Fall | 25 | 83.33% |
| Total | 30 | 100% |

We grouped the patients based on their mode of injury under two categories including Road traffic accidents (RTA) and self-fall. Above observation shows that self-fall was a more common mode of injury compared to RTA. In our study, RTA was the mode of injury in most of the patients under age 30 - 60 years whereas self-fall was the common mode of injury in patients of elder age groups.

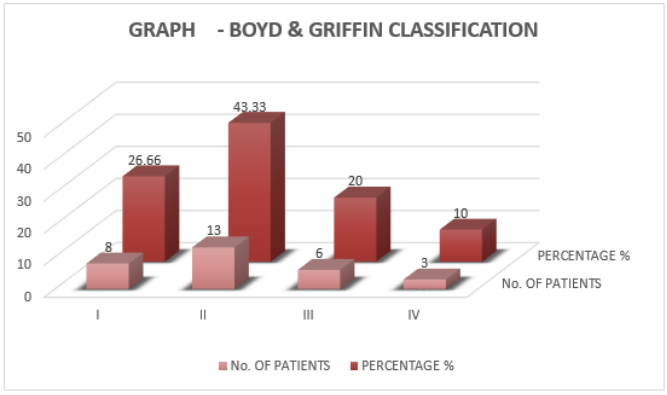
Table 4: Laterality

| Side | No. of Patients | Percentage |
|---|---|---|
| Right | 18 | 60% |
| Left | 12 | 40% |
| Total | 30 | 100% |

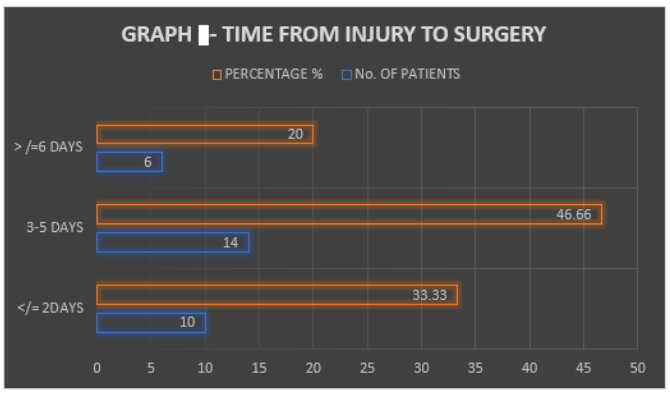
Out of 30 patients, 12 had left femur fracture, and 18 had right femur fracture, which indicates that right side is more common in our study.

Table 5: Classification of Fracture

| Boyd & Griffin Type | No. of Patients | Percentage |
|---|---|---|
| I | 08 | 26.66% |
| II | 13 | 43.33% |
| III | 06 | 20% |
| IV | 03 | 10% |
| Total | 30 | 100% |




In the present study we followed Boyd & Griffin[11] classification for intertrochanteric femur fractures and excluded all open or compound fractures in accordance with our exclusion criteria. Our observation shows majority of the intertrochanteric femur fractures are of type II compared other types owing to the osteoporotic nature of the metaphyseal bone in elderly patients leading to comminuted and unstable fractures.



Out of 30 patients prepared for surgery,10 required less than or equal to 2 days, 14 required a duration of 3-5 days, and 6 patients required more than or equal to 6 days from time of injury. The mean duration from injury to surgery was 3.53 days with a minimum being 1 day and a maximum of 7 days and standard deviation was 1.6069. Majority of study population being elder patients with prolonged comorbidities alongside delayed presentation requiring optimization of the patient's general condition suitable for anaesthesia lead to delayed fitness for the surgery.

Table 7: Associated injuries

| Injury | No. of patients | Percentage |
|---|---|---|
| Colle's fracture | 01 | 3.33% |
| Distal fibula fracture | 01 | 3.33% |
| Pubic rami fracture | 01 | 3.33% |
| Metatarsal fracture | 01 | 3.33% |
| No associated injuries | 26 | 86.66% |

Table 8: Comorbidities

Out of 30 patients included in our study, 13 patients presented with long standing comorbidities where hypertension and type 2 Diabetes mellitus were seen in 04 and 03 patients respectively, and 4 other patients presented with both hypertension and diabetes. COPD and anemia were observed in 1 patient each. All patients were optimized to normal limits to obtain fitness for surgery.

| Comorbidity | No. of patients | Percentage |
|---|---|---|
| Hypertension | 04 | 13.33% |
| Type 2 dm | 03 | 10% |
| HTN + Type 2 DM | 04 | 13.33% |
| COPD | 01 | 3.33% |
| Anemia | 01 | 3.33% |
| Total | 13(30) | 43.33% |

Table 9: Implant Size

PFN A2 of same length i.e. 180 mm was used for all the patients in our study. Our observation shows that 11 mm diameter nails were used in majority of patients pertaining to 43.33% of sample whereas 10 mm nails were used in 10 patients and 09 mm nails were used in 7 patients. Hence Dorr type C52 proximal femoral medullary canal was seen commonly in present study.

| PFN A2 Size | No. of Patients | Percentage |
|---|---|---|
| 09 X 180 | 7 | 23.33% |
| 10 X 180 | 10 | 33.33% |
| 11 X 180 | 13 | 43.33% |
| Total | 30 | 100% |

Table 10: Length of Hospital Stay

| Duration | No. Of Patients | Percentage |
|---|---|---|
| </= 7 Days | 16 | 76.20% |
| > 7 Days | 05 | 23.80% |
| Total | 21 | 100% |

Out of 30 patients, 21 patients stayed in the hospital for less or equal to 7 days where as 09 patients stayed for more than 7 days. The minimum stay was 5 days while the maximum stay was 10 days. The mean duration of hospital stay was 6.7 days with a standard deviation of 1.7049.

Table 11: Time taken for union

| Duration | No. of Patients | Percentage |
|---|---|---|
| < 12 Weeks | 05 | 16.66% |
| 12 – 16 Weeks | 21 | 70% |
| 17 – 20 Weeks | 04 | 13.33% |
| Total | 30 | 100% |

Out of 30 patients in our study, the time for union of fracture was found to be < 12 weeks in 5 patients, 12 -



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16 weeks in 21 patients and 17 - 20 weeks in 04 patients. The mean time for union was 13.63 weeks, with a minimum being 10 weeks and a maximum of 20 weeks, and the standard deviation is 2.6518.

Table 12: Complications

| Complications | No. of patients | Percentage |
|---|---|---|
| Screw Backout | 02 | 6.66% |
| Superficial Infection | 01 | 3.33% |
| Deep Infection | 01 | 3.33% |
| Anterior Thigh Pain | 01 | 3.33% |
| Total | 05 (30) | 16.66% |

Out of 30 patients, Screw backout was the complication seen in 2 patients, anterior thigh pain, deep and superficial infection were seen in 1 patient each. A total of 5 patients in our study experienced complication. There is no vascular or neurological complication, non-union, and implant loosening or failure observed in our study.

Table 13: Range of Motion Scale

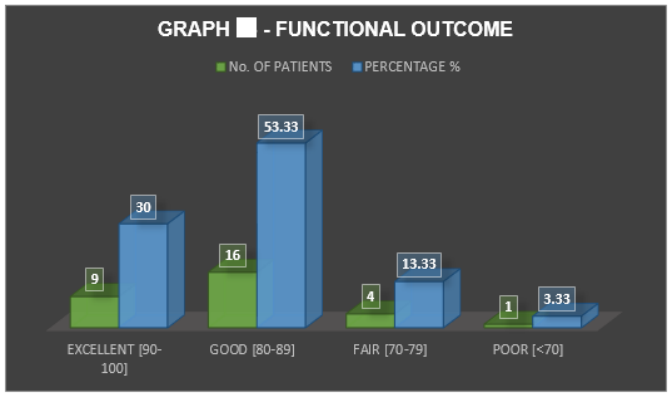
| Range of motion scale | No. of patients | Percentage |
|---|---|---|
| 3 | 05 | 16.66% |
| 4 | 06 | 20% |
| 5 | 19 | 63.33% |
| Total | 30 | 100% |

Out of 30 patients in our study, the range of motion scale was 3 in 5 patients, 4 in 6 patients and 5 in 19 patients, with a mean of 4.4666 and a standard deviation of 0.76303.

Table 14: Results [Functional Outcome]

| Functional outcome | No. of patients | Percentage |
|---|---|---|
| Excellent [90 - 100] | 9 | 30% |
| Good [80 - 89] | 16 | 53.33% |
| Fair [70 - 79] | 04 | 13.33% |
| Poor [<70] | 01 | 3.33% |
| Total | 30 | 100% |

Out of 30 patients included in our study, 9 patients got excellent results, 16 patients got good results, 04 patients got fair results and 01 patient got poor result at the end of 6 months follow up with a mean Harris Hip score [65] being 85.53 and standard deviation of 7.1168, with a minimum score being 66 and a maximum score of 96.




**Case 1**

A 64-year-old female patient presented with a history of slip and fall and was diagnosed to have comminuted intertrochanteric fracture of left femur [Boyd & Griffin Classification type 2] and was treated on day 3 of injury with closed reduction and internal fixation with Proximal Femoral Nail A2. She does not have any comorbidities and she stayed in the hospital for 6 days. She showed excellent functional outcome, without any complications, with Harris Hip score being 90 at 6 months follow up, Range of motion scale 5 and attained complete radiological fracture union at 12 weeks.

Fig.1: Pre-operative x ray in AP & lateral views showing comminuted left intertrochanteric femur fracture

Fig.2: Immediate post-operative x-ray in AP & lateral views showing fracture fixed with PFN A 2

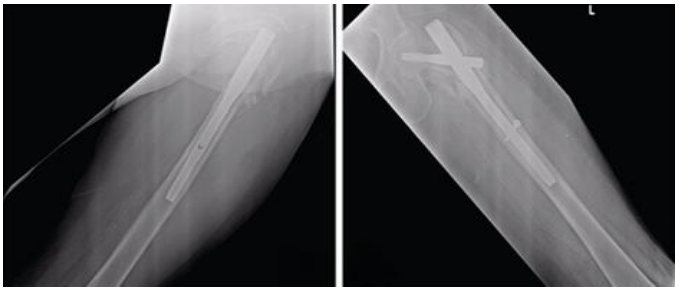


Fig. 3: X rays at 6 weeks follow up showing well maintained reduction and callus formation at fracture site

Fig.4: X rays at 3 months follow up showing signs of fracture union

Fig. 5

**Case 2**

A 56-year-old female patient presented with a history of road traffic accident and was diagnosed to have simple intertrochanteric fracture of left femur [Boyd & Griffin Classification type 1] and was treated on day 2 of injury with closed reduction and internal fixation with Proximal Femoral Nail

A2. She does not have any comorbidities and she stayed in the hospital for 5 days. She showed excellent functional outcome, without any complications, with Harris Hip score being 94 at 6 months follow up, Range of motion scale 5 and attained complete radiological fracture union at 12 weeks.

Fig.1: Pre-operative X ray in AP & lateral views showing left intertrochanteric femur fracture

Fig. 2: Immediate post-operative X-ray in AP & lateral views showing fracture fixed with PFN A 2.

**Case 3**

A 52-year-old male patient presented with a history of road traffic accident and was diagnosed to have comminuted intertrochanteric fracture of left femur [Boyd & Griffin Classification type 2] and was treated on day 2 of injury with closed reduction and internal fixation with Proximal Femoral Nail A2. He presented with associated 3$^{rd}$ and 4$^{th}$ Metatarsal fractures and stayed in the hospital for 5 days. He showed excellent functional outcome, without any complications, with



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Harris Hip score being 92 at 6 months follow up, Range of motion scale 5 and attained complete radiological fracture union at 10 weeks.

Fig.1: X- rays showing left intertrochanteric femur fracture and it's follow up after PFN A 2 fixation depicting good radiological union.

**Discussion**

The present prospective observational study evaluated the functional outcome of 30 patients with intertrochanteric fractures of the femur treated using PFNA-II. The mean age of the patients was 68.46 years, and the age range was 32–92 years. Females constituted approximately 53% of the study population. The right femur was involved in 60% of patients, while a fall from standing height was the most common mechanism of injury, accounting for 83% of cases.The mean time from injury to surgery was 3.5 days. The mean hospital stay was 6.7 days, and the mean time to fracture union was 13.63 weeks.At six months, the mean Harris Hip Score was 85.53 ± 7.12. Nine patients (30%) achieved excellent results, 16 (53.33%) achieved good results, four (13.33%) had fair results, and one (3.33%) had a poor result.Overall, **25 of 30 patients (83.33%) achieved good-to-excellent functional outcomes**. Five patients (16.67%) experienced complications.These findings suggest that PFNA-II fixation was associated with satisfactory functional recovery in most patients in this study. However, the small sample size, absence of a comparison group, and six-month follow-up period limit the conclusions that can be drawn about its comparative effectiveness. The mean age of 68.46 years reflects the predominance of older adults among patients with intertrochanteric fractures. Age-related reductions in bone mineral density, impaired balance, muscle weakness, and an increased risk of falls contribute to the occurrence of these injuries. Older patients may also have medical comorbidities that affect their ability to tolerate surgery and participate in rehabilitation. The importance of early mobilization and effective fracture stabilization in older adults has been emphasized in clinical guidelines and reviews of hip-fracture management.[7,8] The present study included patients across a relatively broad age range. Nevertheless, the relatively small number of participants prevents reliable subgroup analysis of outcomes according to age.

Females constituted approximately 53% of the study population. The slightly higher representation of females is consistent with the importance of osteoporosis and age-related bone fragility in the development of hip fractures.A fall from standing height was the predominant mechanism of injury, accounting for 83% of patients. This observation highlights the importance of falls prevention and the assessment of bone health in older individuals.However, the sex distribution and mechanism of injury in a single-centre sample of 30 patients should not be interpreted as precise estimates of the population-level incidence of intertrochanteric fractures.

The mechanical properties of an implant are important in the management of intertrochanteric fractures because the fracture configuration and quality of the surrounding bone influence the stability of fixation.

PFNA-II is an intramedullary device incorporating a helical blade that compacts cancellous bone during insertion. This design is intended to improve anchorage in the femoral head, particularly in osteoporotic bone.

Intramedullary fixation also places the implant closer to the mechanical axis of the femur, reducing the lever arm compared with many extramedullary constructs. These characteristics make cephalomedullary fixation particularly relevant to unstable fracture patterns.[3,4,9] However, the clinical outcome depends on the quality of reduction and the accuracy of implant placement. A well-designed implant cannot fully compensate for inadequate reduction, poor blade positioning, or failure to restore mechanical stability. In the present study, all 30 patients underwent PFNA-II fixation. The study design did not include a control group treated with a dynamic hip screw or conventional proximal femoral nail. Consequently, the results describe outcomes following PFNA-II treatment but cannot establish superiority over alternative implants.

The mean time from injury to surgery was 3.5 days.Early surgery, when clinically appropriate, can facilitate mobilization and reduce the period of immobilization. Nevertheless, medical stabilization and adequate preoperative preparation remain essential.National and international clinical guidance emphasizes timely operative treatment of hip fractures while recognizing the need to correct potentially reversible medical problems before surgery.[7,8] The present study did not establish a statistical relationship between the interval from injury to surgery and functional outcome. Therefore, the observed mean interval should be interpreted descriptively rather than as evidence of a specific optimal surgical timeframe.

The mean hospital stay was 6.7 days. Twenty-one patients (70%) stayed in hospital for less than seven days, while nine patients (30%) stayed for more than seven days. Hospital stay following intertrochanteric fracture fixation depends on several factors, including the patient's general health, pain control, wound condition, mobility, availability of rehabilitation, and the occurrence of postoperative complications. The minimally invasive nature of intramedullary fixation may facilitate postoperative recovery in appropriately selected patients. However, the duration of hospital stay cannot be attributed solely to implant design. The study did not include a comparative treatment group or a formal analysis of factors associated with prolonged hospitalization. Therefore, the results demonstrate the observed length of stay in this cohort rather than a proven reduction attributable to PFNA-II. The mean time to fracture union in the present study was 13.63 weeks, with the reported range extending from 10 to 20 weeks. Fracture union depends on fracture morphology, bone quality, reduction, fixation stability, biological factors, and postoperative loading. Adequate mechanical stability allows the fracture to progress towards union while reducing the risk of excessive displacement. Intramedullary devices provide a load-sharing construct that can be advantageous in unstable intertrochanteric fractures. Nevertheless, implant position and fracture reduction remain important determinants of healing.[9,10] The observed mean union time suggests that most fractures in this cohort progressed towards healing within the reported follow-up period. However, a comparison with other studies should account for differences in fracture classification, definitions of union, patient characteristics, and follow-up protocols. The absence of a comparison group also



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means that the present study cannot determine whether PFNA-II shortened union time relative to other fixation methods.

The mean Harris Hip Score was 85.53 ± 7.12. Nine patients (30%) achieved excellent results, 16 (53.33%) achieved good results, four (13.33%) had fair results, and one (3.33%) had a poor result. The combined good-to-excellent outcome rate was 83.33%. The Harris Hip Score is useful because it incorporates several clinically relevant dimensions of recovery, including pain, walking ability, daily activities, deformity, and range of motion.[6] The results indicate that most patients in this study achieved satisfactory hip function at six months. Nevertheless, the distribution of scores suggests that a proportion of patients continued to experience functional limitations. Functional recovery following hip-fracture surgery is influenced by more than fracture union. Older age, pre-existing disability, comorbidities, muscle weakness, postoperative pain, and limitations in rehabilitation can all affect the final score. The present study did not include a preoperative functional score or a control group. Consequently, the magnitude of improvement attributable to surgery cannot be calculated independently from the reported postoperative scores.

The findings can be considered alongside previous investigations of cephalomedullary fixation and PFNA-II. Thiyageswaran and colleagues reported functional outcomes following PFNA-II fixation of intertrochanteric fractures. Their findings support the importance of assessing hip function in addition to radiological union when evaluating postoperative recovery.[11] Manjunath and colleagues also reported clinical outcomes following PFNA-II fixation in unstable intertrochanteric fractures and documented complications that included pain, non-union, varus angulation, and blade-related failure.[12] In the present study, the mean Harris Hip Score of 85.53 was within the range of good functional recovery reported in the original dissertation's comparative discussion. However, differences in patient selection, fracture stability, rehabilitation, and follow-up mean that numerical comparisons should be interpreted cautiously. Aloy and colleagues reported a mean Harris Hip Score of 83.20 in the comparative table presented in the original dissertation. The present study's mean score was slightly higher, at 85.53. This difference alone does not demonstrate better treatment efficacy because the studies were not designed as a direct comparative trial.

The key interpretation is that PFNA-II can provide satisfactory functional outcomes when appropriate surgical and postoperative management are achieved, but results remain dependent on patient characteristics and technical factors.

The helical blade is a defining feature of PFNA-II. Its insertion mechanism is intended to compact cancellous bone and provide anchorage within the femoral head. However, implant-related complications may occur if fixation is compromised. Relevant factors include poor reduction, inappropriate blade position, inadequate fixation, severe osteoporosis, and excessive collapse at the fracture site. Windolf and colleagues examined the biomechanical properties of helical blades compared with conventional lag screws. Their work contributes to understanding the mechanical principles underlying blade-based fixation, although biomechanical findings should not be equated directly with clinical superiority.[13] More recent systematic reviews have also emphasized that the mechanical performance of



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cephalomedullary implants depends on the device design, fracture configuration, reduction quality, and position of the proximal fixation element.[14,15]

In the present study, five patients (16.67%) developed complications. These included one deep wound infection, two cases of screw or blade back-out, one superficial wound infection, and one case of anterior thigh pain. These complications demonstrate that implant-related and postoperative problems remain clinically relevant even when intramedullary fixation is used. One patient developed a deep wound infection and subsequently required implant removal and conversion to a salvage procedure, as documented in the original dissertation. Deep infection is a serious complication because it may compromise fracture healing, necessitate further surgery, delay weight-bearing, and impair functional recovery. The patient with deep infection had the poorest functional result at the six-month assessment. This observation is clinically plausible because infection and repeat surgery can substantially interfere with rehabilitation.

However, a single case cannot establish the magnitude of the effect of infection on functional outcomes.

The findings reinforce the importance of appropriate perioperative antibiotic prophylaxis, surgical-site preparation, aseptic technique, wound surveillance, and prompt management of suspected infection. One patient developed a superficial wound infection, which was managed with intravenous antibiotics and regular dressings, according to the original dissertation. Another patient experienced anterior thigh pain that gradually subsided with physiotherapy by the final follow-up.

Postoperative pain may arise from soft-tissue irritation, implant-related factors, altered biomechanics, muscle weakness, or the rehabilitation process. Persistent or worsening pain should prompt clinical and radiological assessment to exclude implant-related problems or delayed healing.

The improvement in thigh pain in the affected patient suggests a favourable course in that individual. Nevertheless, further investigation would be needed to establish the specific cause of pain and the factors associated with its resolution.

Recent literature has continued to evaluate the comparative performance of PFNA-II and other cephalomedullary fixation systems. A 2024 systematic review and meta-analysis comparing PFNA with the InterTAN nail examined clinical outcomes and complications in intertrochanteric fractures. It highlighted that differences between implants should be assessed using multiple endpoints, including operative parameters, fracture healing, functional recovery, and complications.[16]

A 2025 systematic review addressing fracture stability and PFNA treatment emphasized the importance of reduction quality, implant positioning, and fracture morphology in minimizing fixation failure.[17] A 2026 systematic review and meta-analysis comparing conventional PFN with PFNA-II reported fewer implant-related mechanical complications with PFNA-II, while fracture union and functional outcomes were broadly comparable between the two devices. These findings support the relevance of implant design but also show why conclusions should be based on direct comparative evidence rather than on an uncontrolled case series.[18] The present study adds a single-centre clinical description of 30 patients treated with PFNA-II. Its findings are consistent with the general observation that satisfactory functional recovery is achievable, but



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its design cannot independently confirm the comparative advantages reported in larger studies.

Poor reduction may produce residual varus alignment, inadequate cortical support, and unfavorable loading conditions. These problems can increase the risk of excessive collapse, blade migration, and mechanical failure. Accurate placement of the proximal fixation element is also important. The surgeon must assess the position of the helical blade, the adequacy of its purchase in the femoral head, and the overall alignment of the proximal femur. Recent reviews of PFNA-related complications emphasize the need for careful preoperative planning and adherence to sound surgical principles.[17,19] Although the present study documented postoperative complications, it did not provide sufficient patient-level data to establish statistically significant associations between reduction quality, blade position, and the occurrence of complications. The present study incorporated postoperative physiotherapy and individualized weight-bearing progression. Nevertheless, it did not include a standardized measure of rehabilitation intensity or adherence. These factors may have influenced the observed functional outcomes. First, most patients achieved good-to-excellent functional outcomes following PFNA-II fixation. Second, the mean time to union was 13.63 weeks, indicating that fracture healing could be documented within the study's follow-up period. Third, postoperative complications occurred in 16.67% of patients and included infection, blade or screw back-out, and thigh pain. These observations support the importance of combining appropriate implant selection with sound surgical technique, careful postoperative monitoring, and structured rehabilitation. The results should not be interpreted as evidence that PFNA-II is superior to all other fixation devices. Such a conclusion would require direct comparative studies with adequate sample sizes and appropriate statistical analysis.

**Conclusion**

In this prospective observational study of 30 patients, PFNA-II fixation for intertrochanteric fractures of the femur was associated with good-to-excellent functional outcomes in 83.33% of patients, with a mean Harris Hip Score of 85.53 ± 7.12 and a mean time to fracture union of 13.63 weeks. PFNA-II represents a useful fixation option for intertrochanteric fractures; however, careful fracture reduction, accurate implant placement, postoperative monitoring, and appropriate rehabilitation remain essential for achieving satisfactory outcomes and minimizing complications.

**Limitations**

1. The study included only 30 patients from a single tertiary-care centre, limiting the generalizability of the findings.
2. The absence of a comparison group prevented direct assessment of PFNA-II against alternative fixation methods.
3. The six-month follow-up period was insufficient to assess long-term functional outcomes and late implant-related complications.
4. The study did not establish statistical associations between fracture characteristics, patient comorbidities, operative variables, complications, and functional outcomes.
5. The available study description did not document a separate formal sample-size calculation.

**Declarations**

**Consent to participate:** There is consent to participate.

**Consent for publication:** There is consent for the



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publication of this Article.

**Authors' contributions:** Author equally contributed the work.

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