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# UNSTABLE INTERTROCHANTERIC FRACTURES TREATED WITH PROXIMAL FEMORAL NAIL ANTIROTATION- II: AN EVALUATION OF FUNCTIONAL OUTCOME IN THE ELDERLY

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**Abstract:**

**Background:** The incidence of unstable intertrochanteric fractures is increasing due to increased life span. These fractures require stable fixation and early mobilisation to reduce the morbidity and mortality. Extra-medullary implants are biomechanically inferior in these cases. The Proximal Femoral Nail Antirotation-II (PFNA-II) is an intra-medullary nail system designed for such fractures in the Asian population.

**Materials and methods:** 63 patients with Boyd and Griffin type 2, 3 and 4 unstable intertrochanteric fractures who presented to us between January 2016 and March 2017 were treated with PFNA-II. The functional outcome of these patients was assessed using the Harris Hip Score at 1 year follow up. The ambulatory status of these patients was also assessed at the end of 1 year.

**Results:** At the end of 1 year follow up, 55 (87.3%) patients had excellent to good outcomes as assessed by the Harris Hip Score. 61 (96.8%) patients were ambulatory with or without walker aid. 1 (1.6%) patient had cut out of the helical blade and hence, had a poor outcome.

**Conclusion:** We conclude that the treatment of unstable intertrochanteric fractures with PFNA-II nail system leads to excellent functional outcome and regaining the pre-fall ambulatory status with minimal complications.

**Keywords:** Intertrochanteric fractures, intra-medullary nailing, proximal femoral nail antirotation II (PFNA-II)

## Introduction

Unstable, comminuted intertrochanteric fractures continue to pose a challenge to the orthopedic surgeon. The incidence of these fractures is increasing due to increasing life expectancy<sup>1</sup>. Stable fixation is essential to allow early mobilization, to return to pre-fall ambulatory status and to decrease the morbidity and mortality<sup>2</sup>. Despite the availability of a myriad implants, the optimal treatment of these fractures have remained a controversy.

Traditionally these unstable fractures have been treated by extra medullary implants like the dynamic hip screw. However, the chances of complications like implant cut out and varusmalunion are high with them<sup>3</sup>. Intra-medullary implants offer many advantages like preservation of biology with decreased periosteal stripping, decreased lever arm of the implant and act as a buttress against excessive shaft medialisation<sup>1</sup>.

The proximal femoral nail antirotation (PFNA), with a helical blade, is an intramedullary device developed by AO/ASIF IN 2004<sup>4</sup>. However, many complications like lateral wall impingement, prominence of the proximal end of the nail and abutment of the distal nail tip to the anterior femur cortex were reported during its clinical use in Asian patients<sup>5</sup>. To overcome these problems, the PFNA-II was introduced in 2008<sup>6</sup>.

The aim of this study is to evaluate the functional and radiological outcome of unstable intertrochanteric fractures in the elderly, treated with proximal femoral nail- antirotation (PFNA-II) in our population.

## Materials And Methods

From January 2016 to March 2017, 67 patients with unstable

intertrochanteric fractures, satisfying our inclusion criteria, were treated with PFNA-II. 4 patients died within 9 months of follow up and were not considered. Of the remaining 63 patients, 22 patients were males and 41 were females (Table 1).

**Table no. 1:  
Sex distribution**

| Sex    | No. Of Patients |
|--------|-----------------|
| Male   | 22 (35%)        |
| Female | 41 (65%)        |

The inclusion criteria were

- 1) Patients aged > 60 years.
- 2) Patients with isolated Boyd and Griffin type 2, 3 and 4 fractures (unstable fractures with large posteromedial fragment, reverse obliquity and subtrochanteric extension).

Patients with stable fractures, undisplaced fractures, fractures > 1month duration, associated other fractures and medically unfit patients were excluded from the study.

The average age of the patients was 72.3 years (range 61-97 years). The right hip was involved in 27 cases and the left in 36 cases. Domestic fall was seen in 46 cases and the rest were due to road traffic accidents (Table 2). 51 patients were community ambulators before the fall and 12 were household ambulators. Standard Anteroposterior view of the pelvis with both hips in 15° internal rotation and lateral view of the affected hip were taken. 53 patients had type 2 Boyd and Griffin fracture, 7 patients had type 3 fractures (reverse oblique pattern) and 3 patients had type 4 fractures (intertrochanteric fracture with subtrochanteric extension) (Table 3).

**Table No.2:  
Mode of injury**

| Mode Of Injury        | No. Of Patients |
|-----------------------|-----------------|
| Domestic fall         | 46 (73%)        |
| Road traffic accident | 17 (27%)        |

**Table no. 3:  
Classification of fractures**

| Boyd & Griffin Type | No. Of Patients |
|---------------------|-----------------|
| TYPE 2              | 53 (84%)        |
| TYPE 3              | 7 (11%)         |
| TYPE 4              | 3 (5%)          |

All patients underwent thorough pre-operative evaluation and the co-existing medical co-morbidities were optimised. The mean delay in performing the surgery was 72 hours. All patients were operated within 7 days of admission. All patients were given low molecular weight heparin (Enoxaparin Sodium 40mg/0.4ml once a day) for DVT prophylaxis.

## Operative Technique

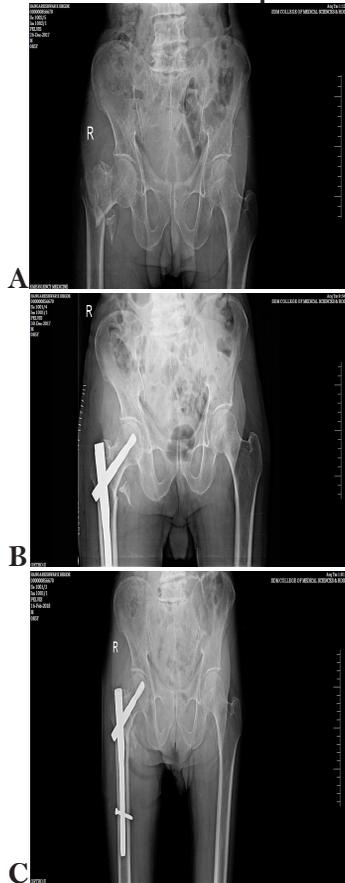
Written informed consent was taken from all patients. After anesthesia, the patients were positioned on the fracture table. The normal lower limb was flexed and abducted and placed over a support so as to facilitate lateral C-arm imaging. Intra-venous injection of Cefuroxime 1.5 grams was given about 30 minutes prior to the incision. Closed reduction was attempted by longitudinal traction, adduction and internal rotation of the lower limb till the patella faces the ceiling. Closed reduction could be achieved in 58 patients. In 5 patients, open reduction was performed by minimal opening of the fracture site and the fracture was held reduced with Hohmann spike or bone holding clamps.

5cm longitudinal skin incision was taken starting from the tip of the greater trochanter and extending proximally. The subcutaneous tissue, fascia lata and the gluteus medius were divided in line with the skin incision to reach the tip of the greater trochanter. Entry point was taken with a cannulated awl under C-arm guidance. The proximal femur was reamed with a proximal

reamer following which the nail was passed. The guide wire for helical blade was inserted with the help of the aiming device and under C-arm guidance. The PFNA-II blade length was measured. The helical blade of appropriate size was assembled and impacted over the guide wire with a mallet. Distal locking was performed with an aiming device. The operative time was calculated from the time of incision to the time of starting wound closure. In our series, 9mm nail diameter was used in 19 cases and 10mm nail diameter was used in 44 cases.

In the post-operative period, the patients were initially mobilised bed side from day 1. Non weight bearing with walker was initiated from the 2<sup>nd</sup> day. All patients received injection Enoxaparin Sodium (40 mg/0.4 ml) subcutaneous for DVT prophylaxis. Most patients were discharged on 5<sup>th</sup> post-operative day and asked to follow up on 14<sup>th</sup> post-operative day for suture removal. Subsequently, they were called for follow up at 6weeks, 3 months, 18 weeks, 6 months and 1 year follow up. At each follow up, anteroposterior and lateral radiographs were obtained to see for fracture union, tip apex distance and cut-out of the helical blade. Partial weight bearing was initiated at the first radiological sign of fracture healing, usually at 6 weeks follow up. The Harris hip score was calculated at 1 year follow up.

**Figure 1: Case 1- A) Anteroposterior view of the pelvis showing Boyd and Griffin type 2 intertrochanteric fracture on right side. B) Immediate Post-op x-ray (PFNA-II 200mm). C) X-ray showing union at 3 months follow up.**



**Results**

Of the total 63 patients, closed reduction could be achieved in 58 cases. In 5 patients, limited open reduction was performed. The mean operative time was 53 minutes (range 41-77 minutes). The average intra-operative blood loss was 95 ml (range 60- 210 ml) (Table 4). The nail diameter used was 9mm in 19 patients and 10 mm in 44 patients. The nail length used was 200mm in 48 patients and 240mm in 15 patients (Table 5).

**Table no. 4:**

**Intra-operative clinical data**

| Reduction Manouver                 |                                  |
|------------------------------------|----------------------------------|
| Closed reduction                   | 58 patients (92%)                |
| Limited open reduction             | 5 patients (8%)                  |
| Mean Operative Time                | 53 minutes (range 41-77 minutes) |
| Average Intra-Operative Blood Loss | 95 ml (range 60-210 ml)          |

**Table no. 5: Nail dimensions**

| Nail Diameter | No. Of Patients |
|---------------|-----------------|
| 9 mm          | 19 (30%)        |
| 10 mm         | 44 (70%)        |
| Nail Length   |                 |
| 200 mm        | 48 (76%)        |
| 240 mm        | 15 (24%)        |

**Figure 2: Case 2- A) Anteroposterior view of the pelvis showing Boyd and Griffin type 4 intertrochanteric fracture on right side. B) Immediate Post-op x-ray (PFNA-II 240mm). C) X-ray showing union at 3 months follow up.**



The average time for fracture union was 12-18 weeks. There were no cases of non-union or infection. 9 patients had anterolateral thigh pain. The 240mm nail was used in majority of these patients (6 patients). 1 patient

had implant cut out for which implant removal was done. The fracture united in varus in this patient. 2 patients had edge necrosis of the surgical wound (entry point wound). They were treated with debridement and secondary suturing under local anesthesia, after which, they healed uneventfully (Table 6).

**Table no. 6:  
Complications**

| Complications            | No. Of Patients |
|--------------------------|-----------------|
| Anterolateral thigh pain | 9 (14%)         |
| Cut out                  | 1 (1.5%)        |
| Edge necrosis of wound   | 2 (3%)          |

Clinical outcome of these patients were assessed using the Harris Hip Score. A score of > 90 was considered excellent, 80-89 was considered good, 70-79 was considered fair and < 69 was considered poor. The average Harris Hip Score in our study was 84.3 (range 60-95). The score was excellent in 31 cases, good in 24 patients, fair in 7 patients and poor in 1 patient. The patient with poor outcome had cut out of the implant at 6 weeks follow up (Table 7).

At 1 year follow up, 37 patients were walking independently without any support. 15 patients still used a walker and 9 patients still required an elbow crutch/ stick. 2 patients were bed ridden and did not regain their pre-fall ambulatory status. These were the patients with advanced age (89 years and 97 years) and had multiple medical co-morbidities (Table 8).

**Table No. 7:**

**Harris Hip Score at 1 year follow up**

| Harris Hip Score | No. Of Patients |
|------------------|-----------------|
| Excellent (> 90) | 31 (49%)        |
| Good (80-89)     | 24 (38%)        |
| Fair (70-79)     | 7 (11.5%)       |
| Poor (<69)       | 1 (1.5%)        |

**Table no. 8:  
Ambulatory status at 1 year follow up**

| Ambulatory Status         | No. Of Patients |
|---------------------------|-----------------|
| Independent ambulators    | 37 (58.7%)      |
| Needs walker              | 15 (23.8%)      |
| Needs elbow crutch/ stick | 9 (14.5%)       |
| Bed ridden                | 2 (3%)          |

### Discussion

Intra-medullary nail systems offer many biomechanical advantages over extra-medullary systems in the treatment of unstable intertrochanteric fractures in elderly patients with osteoporosis<sup>7</sup>. The mechanical axis of the intra-medullary system is close to the centre of the body, decreasing the lever arm of the implant and hence offering better mechanical properties<sup>8</sup>. The implant also acts as a buttress against medialisation of the shaft. They also offer biological advantages like decreased periosteal stripping and decreased blood loss as compared to extra medullary implants<sup>1</sup>.

The use of intra-medullary nails for intertrochanteric fractures gained popularity in the 1980s. The earliest nails used were the Gamma nails<sup>1</sup> and the Russell-Taylor Reconstruction nail<sup>9</sup>. However, they were associated with complications like cut out and medial penetration of the hip screw<sup>1</sup>. To overcome these problems, the AO/ASIF group introduced the Proximal Femoral Nail (PFN) in 1998<sup>10</sup>. Despite having advantages over the previous versions, the PFN was associated with complications like proximal screw cutting, Z effect and iliotibial tract irritation<sup>11,12</sup>. The design of the PFN was improved and the Proximal Femoral Nail Antirotation (PFNA) was introduced in 2003. The main change made was the replacement of the lag screws with a helical blade, which has a gradually increasing

diameter, to allow for compression of the bone around the femoral head, thereby allowing antirotation<sup>13</sup>.

The use of PFNA in Asian patients, with relatively shorter stature than western population, was found to have complications like nail tip impingement over anterior femoral cortex, femoral fractures at the nail tip and soft tissue irritation at the proximal part<sup>5</sup>. To overcome these problems, the PFNA was further modified to suit the Asian population and the PFNA-II was introduced in 2008<sup>14</sup>. The proximal nail diameter was reduced from 17mm to 16.5 mm, the medio-lateral angle was reduced from 6° to 5° and the proximal lateral surface was made more flat<sup>14</sup>.

Xie H et al performed a comparative study of results of Dynamic Hip Locking Plates (DHLP) and PFNA-II for unstable intertrochanteric fractures. They recommend the use of PFNA-II for such fractures because of its shorter operation time, faster full weight bearing, faster recovery and lower failure rate. They also had excellent to good results, as assessed by the Harris Hip Score, in 80% of their patients at 6 months follow up<sup>15</sup>.

Macheras et al performed a retrospective comparative study of unstable peritrochanteric fractures treated by PFNA and PFNA-II. They concluded that the PFNA-II avoids lateral cortex impingement and provides fast and stable fixation for such fractures. The mean Harris Hip Score of their patients at 12 month follow up was 81.42<sup>16</sup>. Several other authors have reported excellent to good functional outcomes with the use of PFNA-II for unstable intertrochanteric fractures<sup>17, 18, 19, 20</sup>.

We began using the PFNA-II for unstable intertrochanteric fractures in October 2015. The initial few

cases done were excluded from our study in order to eliminate the effects of learning curve. In our study, the functional outcome was evaluated by the Harris Hip Score at 1 year follow up. Excellent to good results were seen in 55 (87.3%) patients. 61 (96.8%) patients were ambulatory, with or without support at 1 year follow up. The 2 patients who remained bed ridden were so because of advanced age and multiple medical co-morbid conditions. 1(1.6%) patient had a cut out of the helical blade and was treated with implant removal and skeletal traction. 2 (3.2%) patients had edge necrosis of the proximal (nail entry site) wound which was treated with debridement and secondary suturing under local anesthesia. There were no cases of non-union or infection requiring implant removal in our study.

The limitations of our study are that our sample size is relatively small and it is a retrospective study. We conclude that the PFNA-II is an effective treatment modality for unstable intertrochanteric fractures, especially in the elderly with osteoporosis, with good functional outcome.

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