Assessment of clinical & radiological outcome of fixation of intertrochanteric femoral fractures with PFNA2 (Proximal femoral antirotation augmentation nail): A case series

Dr. Dinesh Raj S, Dr. A Senthilnathan, Dr. R Prabhakar, Dr. Vijaya Shankar K and Dr. Raghul Raj

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Abstract

Aim and Objective: Intertrochanteric femoral fractures are associated with trivial trauma. Although many treatment methods have been developed, controversy exists regarding the optimal management of these fractures. This study evaluated the clinical outcome of intertrochanteric femoral fractures fixed with proximal femoral anti-rotation augmentation nail (PFNA2). Materials and Methods: In this study between JUNE 2018 and OCTOBER 2019, 25 patients with traumatic intertrochanteric fractures of the femur were treated with PFNA2. Closed reduction and internal fixation were performed in 24 cases and open reduction internal fixation done in 1 patient. Results were assessed by modified Harris hip scoring system. Results: The average follow-up time was 6 months. All intertrochanteric femoral fractures healed. The mean union time was 12 weeks. No implant failure was observed. Conclusion: PFNA2 is effective in treatment of intertrochanteric femoral fractures, with a high rate of bone union, minor soft tissue damage, early return to function and few implant-related complications.

Keywords: Intertrochanteric fracture, PFNA2, modified harris hip score

Introduction

With improved medical facilities and prolonged life expectancy, the incidence of intertrochanteric fractures has increased drastically. Surgery is the preferred treatment of choice in view of early mobilization. The basic principle of surgery is to use an implant that is minimally invasive, that has a less operative time and one which allows for early mobilization and weight bearing. The implants used are of two types, extramedullary and intramedullary. The implant to be used is decided on the basis of the type of fracture(stable or unstable). A fracture is said to be unstable if it has comminution of the posteromedial cortex, reverse oblique type of fractures and fractures of subtrochanteric extension. This study evaluated the clinical outcome of intertrochanteric femoral fractures both stable and unstable fixed with proximal femoral anti-rotation augmentation nail (PFNA2) in local population around Chidambaram.

Materials and Methods

From June 2018 to October 2019, 25 cases of both stable and unstable intertrochanteric fractures were managed with the PFNA2 and were followed prospectively. There were men and women with mean age of 65.7 years (range, 35-90). Right hip was involved in 13 patients and left in 12 patients. The most common mechanism of injury was a trivial fall followed by RTA. The fractures were classified based on Boyd and Griffin classification for intertrochanteric fractures. The patients were operated within one week from date of injury. 24 cases underwent closed reduction internal fixation and in 1 case with lateral wall comminution open reduction internal fixation done. Average operative time (skin to skin) was 67 minutes (range 35 - 90 minutes). Prophylactic antibiotics were administered on the day of surgery one hour prior to skin incision. The sizes of PFNA 2 nail used are depicted in Table 1. Commonly
used nail diameter was 10 mm, which was used in 18 patients. In remaining patients, 9 mm nail was used. Most commonly used nail size was the smaller version (200 mm length) and commonly used blades were between 90-105 mm. Tip apex distance (TAD) was used to assess the position of helical blade in the femoral head. Garden’s alignment index and fracture gap were used to estimate the reduction in post-operative X-rays. The results were classified using GAI as very good (anteroposterior 160°); good (anteroposterior 180°-160°); acceptable (anteroposterior 160°-150°); or poor (anteroposterior <150°) lateral not 180°. The fracture gap was classified as good (0-3 mm); acceptable (3-5 mm); or poor (>5 mm) (Table 2). The patient was allowed to weight bear partially on the first post-operative day. The position of helical blade was found to be in the centre or postero-inferior in both AP and lateral views. There were no intra-operative complications like greater trochanter and shaft of femur fractures. The average duration of stay in the hospital was 13 days (range, 8 - 20). Suture removal was done on 13th post-operative day.

**Fig 1:** Intra operative images showing fracture reduction using strategically placed hohmann retractors.

The patients were followed for a period of 6 months. Clinically, the patients were assessed using the Harris hip score and radiological photographs were taken at first, second and sixth months. Average time for full weight bearing was 6 weeks. At each visit, the X rays were assessed for TAD, fracture healing and screw pull out.

**Fig 2:** 70 year old male patient, who sustained unstable intertrochanteric fracture after a trivial fall and post-operative radiographs showing good fracture reduction.

**Fig 3:** Showing immediate post op mobilization (a), follow up at 1 month (b) and follow up at 6 months showing full range of movements (c)

**Results**

All fractures achieved complete union by 6 months. 84% of cases showed fracture gap of less than 3 mm and remaining 16% showed acceptable reduction. Garden Alignment Index (GAI) was graded as very good to good in 84% of cases (Table 2). A TAD of less than 20 mm was achieved in almost 95% of cases.

Intra and post-operative complications are depicted in Table 3. There were no cases of cut through or breakage of the implant.

**Fig 4:** (a) Mismatch between proximal end of nail and greater trochanter noted (b) Case with heterotopic ossification and infection

| Nail Size       | Number (n) | Percentage (%) |
|-----------------|------------|----------------|
| Small (200 mm)  | 23         | 92             |
| Very small (170 mm) | 2    | 8              |

**Table 2:** Assessment of fracture gap

| Fracture gap | Number (n) | Percentage (%) |
|--------------|------------|----------------|
| Good (0-3 mm) | 21        | 84             |
| Acceptable (3-5 mm) | 4        | 16             |
| Poor (>5 mm)  | 0          | 0              |

**Table 1:** Nail sizes used in our series

The patients were followed for a period of 6 months. Clinically, the patients were assessed using the Harris hip score and radiological photographs were taken at first, second and sixth months. Average time for full weight bearing was 6 weeks. At each visit, the X rays were assessed for TAD, fracture healing and screw pull out.
There were no documented cases of any femoral shaft fractures. One patient complained of pain in the lateral aspect of thigh because of the helical blade impinging on the fascia lata. There was a case of secondary varus that was detected at the final follow up.

Clinical evaluation was done using Harris hip score (Table 4). The results were classified to be excellent in about 32% of cases and good in 60% of cases.

**Table 3: Intra-and post-operative frequencies of complications**

| Complications                  | Number (n) | Percentage (%) |
|-------------------------------|------------|----------------|
| Fracture of greater trochanter| 0          | 0              |
| Femoral shaft fracture        | 0          | 0              |
| Nail mismatch at the proximal end | 2      | 8              |
| Anterior thigh pain           | 0          | 0              |
| Fascia lata pain              | 1          | 4              |
| Secondary varus development   | 1          | 4              |
| Persistent limp               | 2          | 8              |
| Heterotopic ossification      | 1          | 4              |
| Infection                     | 1          | 4              |

Table 4: Functional assessment using Harris hip score.

| Harris Hip Score | Number (n) | Percentage (%) |
|------------------|------------|----------------|
| Excellent        | 8          | 32             |
| Good             | 15         | 60             |
| Fair             | 2          | 8              |
| Poor             | 0          | 0              |

At the final visit, 23 patients (92%) were able to walk independently, 2 (8%) needed walker or crutches. Walking to pre-operative levels was achieved in almost all the patients.

**Discussion**

With the increasing incidence of osteoporosis, the occurrence of unstable intertrochanteric fractures has been on the rise and is likely to remain very high for a few decades atleast\(^1\)\(^-\)\(^3\). The choice of implants ranges from extra-medullary implants like femoral head collapse at the fracture site\(^20\). Nikoloski et al. concluded that the helical blade was fundamentally different to the lag screw being used in PFN and suggested to maintain a TAD of less than 25 mm\(^21\).

Jin et al\(^20\) suggested the use of a longer nail than the shorter one to encounter excessive femoral shaft curvature. In our case series, we found impingement of nail tip (170mm length) to the anterior cortex in about 2 cases due to increased anterior bowing and short femoral length in Indian population\(^14\). In these 2 cases we used longer nail of size 200mm It is better to use longer nail to bypass the curvature or relatively shorter nail to prevent this complication especially inpatients with excessive anterior bowing of femur.

We did not encounter any femoral shaft fractures in our case series. Yaozeng et al\(^22\), documente at least 6 (5.6%) intra operative shaft of femur fractures in their case series. While using a longer nail, adequate reaming of the medullary cavity seemed to prevent this complication.

Boopalan et al\(^23\), documented an 21% incidence of intraoperative fracture in the lateral walls especially in 31 A1 and A2 pertrochanteric fracture fixation, however this did not seem to affect the fracture union. Gottfried documented 24 cases of lateral wall fractures in his case series\(^24\). On radiographic examinations, there was a common finding, a varus malalignment of the femoral head which was found to the reason for the lateral wall fractures. This was because of the use of a lateral cortex drill of 16mm in diameter for the helical blade. We documented 1 case of infection and heterotopic ossification post operatively as patient suffered secondary trauma\(^26\).

We reported no cases of fracture distraction in our case series which was attributed to the narrow portion of the nail when it is crossing the fracture site\(^25\). The mechanism is thought to be due to the translation of the proximal fragment along the line of fracture and the lower part of the nail pushing the distal fragment laterally leading to distraction, usually leading to a varus malalignment. We didn’t face this kind of complication intraoperatively\(^27\).

In the past 5 years, multiple case series have documented more success rates and reduced complication rates with PFNA2 in the treatment of both stable and unstable intertrochanteric fractures. Our case series supports this result, validating the fact that PFNA2 is a very good and feasible option in treatment unstable trochanteric fractures\(^28\). Our sample size was small with wide variability in the age. However there is a need for further studies validating the use of different implants in treatment of inter-trochanteric fractures\(^29\).
Conclusion

- To conclude, we infer that once fracture union occurs, functional outcomes are similar irrespective of the type of implant used.
- The number of implant related complications however, is less when a helical blade device is used, indicating its biomechanical superiority over a dual screw design.
- PFNA2 has a superior performance over PFN in the setting of osteoporosis, which is attributed to compaction of cancellous bone by the helical blade.
- Nevertheless, it must be remembered that no implant design can compensate for poor reduction or poor implant placement in these fractures.

We would like to conclude by recommending the PFNA2 for the treatment of both stable and unstable intertrochanteric fractures because of its stable fixation, decreased operating time, minimal complications and early mobilization.

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