



A study to evaluate the functional and radiological outcome of proximal femoral nail Anti rotation 2 in inter trochanteric fractures of femur

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Abstract: *Introduction:* Fractures around the trochanteric area of the femur are among the most frequent fractures encountered in orthopaedics, especially in geriatric population and increasing life expectancy has resulted in increase in these type of fractures. *Aim:* The aim of this study was to analyze the functional and radiological outcome of patients treated with PFN A-II. *Methods:* Patients presenting with unstable intertrochanteric femur fracture (AO classification) and Singh's index ≤ 3 were included. The study included 70 patients (30 males and 40 females), at our institution during the period of July 2019 to December 2020. Clinical outcome was measured in terms of procedure time, clinical function at each follow-up and mortality. Radiographic evaluation was measured by quality of reduction, Cleveland Index, tip-apex distance (TAD), and time for the union. Complications including delayed union, non-union, screw backing out, screw cut through into the joint, infection, osteonecrosis of the femoral head, and implant breakage were also investigated. *Results:* All the 70 patients included in the study were treated with PFN A-2. The average age of the patients included was 74.4 years. The TAD was more than 25mm in 8 patients. 11 patients has sub optimal position of the implant as per cleveland index. Outcome was excellent in 45, good in 15, fair in 7, poor in 3, and this is based on modified Harris hip score with the minimum follow-up period being 6 months. The difference between the neck shaft angle of the operated side when compared with the un-injured side is more than 10° in 11 patients. The average union time was 5.6 weeks, average modified Harris hip score was 86.5. *Conclusion:* The result of our study shows that PFNA2 is an excellent device for osteosynthesis as it can be easily inserted. Moreover, it provides stable fixation in the osteoporotic patients, which allows early full weight bearing mobilization of the patient.

Keywords: Modified Harris hip score, Helical blade, Intertrochanteric fracture, Proximal femoral nail antirotation II.

INTRODUCTION

The incidence of inter-trochanteric fractures has been increasing significantly due to the rising age of modern human populations. [1] The occurrence of proximal femoral fractures among females is 2 to 3 times

higher than the incidence of such fractures amongst males. [2] Also, the possibility of sustaining a these fracture doubles every 10 years after the age of 50 years. [3]

Intertrochanteric femur fractures are commonly seen in elderly people, and surgical fixation is the accepted way for managing these fractures to attain acceptable reduction and early mobilization after surgery, [4] and also helps in reducing the hospital stay, earlier return to preinjury status, and fewer complications such as bed sores, pulmonary thromboembolism, and pneumonia. [5-7]

PFNA2 has been designed to provide better stability in the presence of osteoporotic bone and consist of both short and long versions, with proximal medio-lateral angulation of 5° . Inserting the PFNA2 blade without reaming the head and neck fragment of femur helps to compact the cancellous bone providing extra anchoring in osteoporotic bone. [8] PFNA2 spiral blade helps in compacting the cancellous bone which in turn helps to reduce the cut out and leads to increased stability of the implant in osteoporotic bone. [9]

MATERIALS AND METHODS:

A prospective study was conducted between the period of July 2019 to December 2020 in 70 patients with intertrochanteric fractures that got admitted in Vijaya Institute of Trauma and Orthopaedics, Chennai. Written informed consent was taken and ethics committee approved the study.

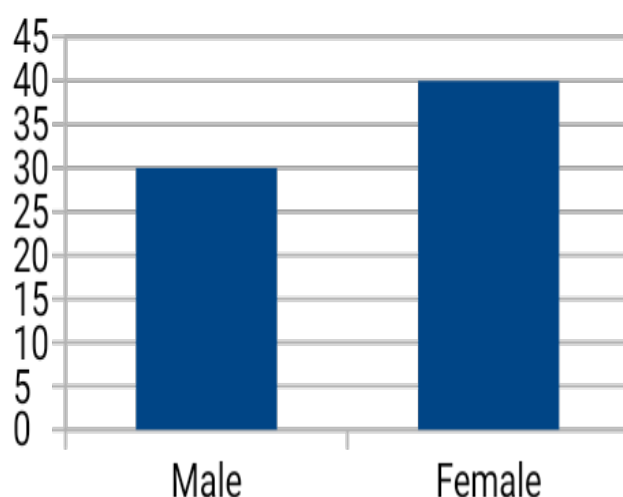
Patients with unstable inter trochanteric fractures, fractures with sub trochanteric extension, aged >40 years and Singh's index ≤ 3 [10] were included in the study. All patients were operated under spinal anaesthesia using a fracture table under fluoroscopy guidance.

Clinical outcome was measured in terms of operation time, postoperative function at each patient's visit to the hospital. The minimum follow up period for the study was 6 months. The operation time was calculated from skin incision to closure. Radiographic evaluation included the reduction state after the operation, which was categorized into three groups using modified Baumgartner's criteria, [11] the Cleveland Index, [12] tip-apex distance (TAD), [13] union rate, time to union. Complications like delayed union, non-union, screw cut-out, screw cut through into the joint, infection, osteonecrosis of the femoral head, and implant breakage were investigated. The functional assessment was done using modified Harris hip score. [14] Both AP and lateral X-ray views were taken to assess the radiological outcome. Radiological union was described as bridging callus at the fracture site in both views.

RESULTS:

Seventy patients with unstable intertrochanteric femur fracture and osteoporosis (Singh's index ≤ 3) were followed up for 6 months, all of them are treated with PFN A2.

Figure 1: Sex Distribution



In our study the maximum age was 99 years and minimum age was 41 years. 7% of the patients were in the age group of 41 to 60 years, 59% were in the age group of 61 to 80 years and other 34% were above 80 years and mean age group was 74.4 years. There were 43% males (30 patients) and 57% (40) females, which indicate females are greatly exposed to the risk factor, due to osteoporotic bones. In our series majority of the cases were due to self-fall and minority of the cases were due to other causes. In our study 38 patients were injured on right side and 32 on left side.

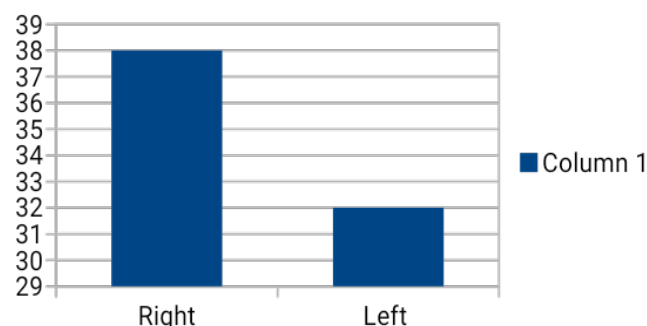


Figure 2: Side Involved

In table 1 as per Singh's index 42 (60%) had grade 3, 18 (26%) had grade 2, and 10 (14%) had grade 1 osteoporosis.

Table 1: Demographic Statistics :

Age (Average)	74.4 years
Sex	
Male	30(43%)
Female	40(57%)
Singh's Index	
Grade III	42(60%)
Grade II	18(26%)
Grade I	10(14%)

Table 2: Operative Details

Operative Details	
Duration (minutes)	45 mins
Blood loss (ml)	<200 ml
Fluoroscopy Time	100 secs
Length of hospital stay (both pre and post-operative days included)	<10 days

In table 2, the mean duration of surgery was 45 minutes. The mean value of fluoroscopic time was 100 seconds. The mean value of length of hospital stay was less than 10 days.

Modified Baumgartner's criteria: 52 showed good, 15 acceptable and 3 poor reduction. Tip apex distance (TAD): 8/70 patients had a TAD >25mm, out of which only 3 had poor outcome, the other 5 had good outcome. The average TAD in the study was 14.2 mm.

Cleveland index: 59/70 had optimal position of implant in the head of femur as per Cleveland index (centre–centre, inferior–centre). 11 had sub optimal position of implant, out of which only 1 had implant back out, 1 had screw going into the joint and 1 had implant failure.

Table 3: Summary Details

Summary Details	
Modified Harris Hip Score (Final Average)	86.5
Tip Apex Distance (>25mm)	8
Cleveland Index (sub Optimal Position)	11
Radiological Union	5.6 weeks
Baumgartners Index (Poor)	3
Overall Complications	4
Implant Failure	1

In table 3, Functional outcome by Modified Harris Hip score: The average Modified Harris hip score was 86.5. 45 (64%) patients had excellent results, 15 (21.5%) had good results, 7 (10%) had fair, and 3 (4.5%) had poor results. The average score in patients with complications was 62.86.



Pre op X-ray



Immediate post op X-ray

In our study all patients underwent closed fixation after application of traction and adduction of the injured limb and few cases we used homhans retractor/Kocher's to reduce the fracture to achieve anatomical reduction in either open or neutral position of the proximal fragment.

Table 4: Complications

Complications	
Screw cut through	1
Screw backout	1
Superficial Infection	1
Implant Failure	1
Total	4

In table 4, In our study, we had no cases of intra operative complications. We had one case of implant backout, four cases of delayed union and no cases of non-union. There was superficial secondary infection in one patient, which healed with regular dressing. one case of screw going into the joint, for which the screw was replaced with a shorter one. one case had implant failure, which was re-operated with hemi arthroplasty with solution stem. There were no cases of femoral head necrosis and implant breakage.

In our study, suture removal was done on 10th post-operative day. Then patient was made to follow up with rehabilitation program such as toe touch walking, partial weight bearing, crutch walking and the average hospital stay was less than 10 days in most of the cases. All patients were followed at 6 weeks, 3 months and 6 months. In our study the mean duration of hospital stay was less than 10 days, the average time to achieve full weight bearing was 5.6 weeks. Toe touch Mobilization was started in immediate post-operative period as tolerated by the patient but later all patients were ambulatory independently with or without walking aid after 6 weeks.



3 month follow up X-ray

The results of the treatment of intertrochanteric and sub-trochanteric fractures using Proximal Femoral Nail anti rotation 2 were assessed by Harris Hip Score system (Modified). 14 cases (37%) has good score, 10 cases (33%) has fair score, 4 cases (13%) has poor score while 2 cases (7%) has excellent score.

DISCUSSION:

Intertrochanteric femur fractures accounts for majority of fractures in the age group of >60 years, with increase in the life expectancy the incidence is only increasing. The goal of treatment is to provide a stable fixation, following which the patient can be mobilized which reduces the morbidity and mortality associated with being bed ridden, particularly in the elderly patients. This intramedullary device has many advantages in terms of small surgical wound, easy insertion and stable fixation [15] Zeng et al. [16] and Takigami et al. [17] found that operative time and blood loss were lower with PFNA2. The results of our study are comparable with these studies.

The duration of surgery and number of fluoroscopic images were significantly lower in PFNA2. The mean blood loss was lower due to decreased procedure time and a smaller incision for PFNA2 blade. Nikoloski et al. [18] recommended a tip apex distance of 20–30 mm in case of PFNA-2. They observed a higher incidence of cut out/cut through, when TAD was more than 30 mm or less than 20 mm, which is comparable to our study. As per the Cleveland index, maintaining an optimal position (centre–centre, inferior–centre) of the screw is necessary for good outcome. [19] Complications were more when the screw position was not in optimal position. When the index was centre–centre no complications were seen and had better outcome. Only 2 cases in our study with sub optimal position showed complication of screw back out and one had implant failure. No patients with optimal implant position had any complications.

Hu et al. [20] suggested from their study that there was a morphological mismatch in Asian population between proximal fragment of PFNA 2 and greater trochanter leading to post-operative lateral trochanter pain. In our study we did not find any mismatch and few patients had surgical site pain which resolved eventually.

Kumar et al. [21] from their prospective study suggested that PFNA 2 as effective implant in treating intertrochanteric fractures with proper operative techniques.

Results of our study considering average age, duration of surgery, amount of blood loss, flouroscopy time, average hospital stay and modified harris hip score are comparable to other studies like sahin S et al [22], sadic et al [23] and kumar et al. [21]

The implant-related complications seen had either poor neck shaft angle reduction, tip apex distance more than 25 mm or Cleveland index in sub-optimal position. Hence, we recommend to restore TAD < 25 mm, Cleveland index in centre–centre, inferior–centre position and neck shaft angle difference of < 5°.

CONCLUSION:

Good functional outcome can be achieved, when the radiological parameters are anatomically restored, i.e. TAD < 25 mm, Cleveland index in optimal position and a good score with Baumgartner index.

Fixation of trochanteric fracture with PFN A2 have the following benefits of Smaller Incision, Less Blood Loss & Shorter procedure time Due To Usage Of A Single Helical Blade, Significant Cut Out Resistance Due To Impacted Helical Blade. Shorter Individuals With Short Neck Can accommodate a single screw rather than two In other devices. Rapid rehabilitation and decreased medical complications.

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