

Original Research Article

# A comparative study of PFN vs PFNA2 in intertrochanteric and sub trochanteric fractures

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**Abstract: Background:** Intertrochanteric and subtrochanteric fractures are typically treated with proximal femoral nails. Proximal femoral nails come in two types: regular PFN (which consists of 2 proximal screws) and PFNA2 (which consists of a single proximal screw).

**Aim:** The aim of our study is to compare functional outcomes and implant-related complications in patients treated with regular PFN versus PFNA2 for intertrochanteric and subtrochanteric fractures.

**Material and Methods:** A prospective observational and randomized study was conducted with a total of 40 patients with intertrochanteric and subtrochanteric femoral fractures admitted to Bhaskar Medical College Hospital. After fulfilling the inclusion criteria, the patients were divided into two groups randomly, with 20 cases in each group. They were treated with regular PFN and PFNA2, respectively.

**Conclusion:** Based on the study, we concluded that PFNA2 reduces surgery time, blood loss, and radiation exposure compared to regular PFN. PFNA2 also has a higher union rate with significantly better functional outcomes compared to regular PFN. Patients treated with PFNA2 can bear weight early. Implant-related complications such as screw backing out and cut-through of screws in the femoral head (z-effect and reverse z-effect) are not observed with PFNA2. Therefore, we conclude that PFNA2 is superior to regular PFN.

**Keywords:** Intertrochanteric fractures; Subtrochanteric fractures; Proximal femoral nails; PFNA2; Functional outcomes.

## 1. Introduction

There is increased incidence of Intertrochanteric and subtrochanteric fractures [1]. They can be managed by regular PFN, PFN A2, AND DHS. The basic principle of surgery is to use an implant that is minimally invasive, has less operative time, and one which allows for early mobilization and weight bearing. The choice of surgical treatment (dynamic hip screw or proximal femoral nailing) is determined in part by whether the fracture is stable or unstable. The proposed advantages of intramedullary nailing include a short incision, less operative time, minimal blood loss, and rapid rehabilitation, which is essential to minimize the risk of medical complications [2]. Regular PFN comprises an intramedullary nail with two screws of which one is the lag screw settling the fracture as it collapses and the other is the anti-rotation screw giving the rotational stability. Regular PFN has shown post-operative complication, like screw cut out and back out of screw [3].

PFN A2 comprise of an intramedullary nail with single proximal screw which is helical in shape and is locked to prevent back out of screw and cutting through femoral head. This is the prime advantage of PFNA2 over regular PFN and it allows early weight bearing. Thereby essentially diminishing the possibility of failure of the implant in the osteoporotic bone of old patients [4].

In our study "Comparative study of PFN vs PFNA 2 in intertrochanteric and subtrochanteric fractures: A randomized control trial", We have made an endeavor to analyze both the intramedullary devices as functional outcomes and implant-related complications.

## 2. Materials and Methods

### 2.1. Study Design

This study employed a prospective, randomized, comparative design involving 40 patients.

## 2.2. Study Site

The study was conducted at Bhaskar Medical College and Hospital in Hyderabad.

## 2.3. Study Period and Duration

The study was conducted from 2021 to 2022, spanning a duration of 2 years.

## 2.4. Follow-up

Patients were followed up for a period of 2 years.

## 2.5. Inclusion Criteria

Patients who met the following criteria were included in the study:

1. Skeletally mature patients (>18 years)
2. Patients with intertrochanteric and subtrochanteric fractures
3. Patients with closed fractures

## 2.6. Exclusion Criteria

Patients with pathological fractures were excluded from the study.

All patients in this study presented to the emergency room with complaints of hip pain, either due to a fall or road traffic accident. A complete evaluation and routine investigations were performed. The diagnosis was made based on clinical findings and radiological examinations, specifically X-ray pelvis with anteroposterior and lateral views of the affected hip.

## 3. Pre-Operative Evaluation

Patients with suspected trochanteric fractures who met the inclusion and exclusion criteria were included in the study. Ethical committee approval was obtained, and written informed consent was obtained from the patients. The patients were randomly assigned to two groups: group A for regular PFN and group B for PFNA2. Pre-anesthetic check-up was performed, and once the patients were deemed fit, they underwent surgery using either regular PFN or PFNA2 as appropriate.

## 4. Intraoperative and post operative Evaluation

Evaluation for intraoperative blood loss, number of image intensifier shots, and surgery time (skin to skin) was done. A medial cortical buttressing was used to assess the quality of reduction in all patients.

All the patients underwent clinical and radiological judgment of fracture morphology and union rate, on first post-operative day which is repeated at 6 weeks, 3 months, and 6 months. Functional assessment was done on every follow up at 6 weeks, 3 months and final assessment at 6 months was done by using Modified Harris Hip Score (MHHS).

## 5. Result

There were 14 males and 6 females in the PFNA2 group whereas there were 13 males and 7 females in the regular PFN group. The mean age in PFNA 2 group was 64.23 years and 65.6 years in the regular PFN group. Most of the patients in both groups were injured due to trivial fall. In the regular PFN group patients with fall were 14 and with RTA was 6, and in PFNA2 group patients with fall was 15 and with RTA was 5. Right hip involved predominantly in both groups. In regular PFN group right hip involvement was 12 and left was 8, and in PFNA2 group right was 13 and left was 7. Fracture pattern in each group was same. In both group A1 was 6, A2 was 9, and A3 was 5. Mean time interval between injury and surgery was 7.4 days in regular PFN group and 6.5 days in PFNA2 group. Mean operative time was 49.53 min in PFNA2 group and was 94.07 min in regular PFN group. Post operative hospital stay was 6.98 days in PFNA2 group and 9.27 days in regular PFN group. The mean image intensifier shots number was 33.54 in PFNA2 group and 58.33 in regular PFN group. Mean blood loss was 73.33 ml in PFNA2 group and 82.67ml in regular PFN group. Post operative partial weight bearing was started after 3 weeks in regular PFN group and on 2nd day in PFNA2

group. Modified Harris hip score was 78.53 (72-84) in PFNA2 group and 70 (70-84) in regular PFN group at 6 months follow up. Late complications as 1) Residual thigh pain was 3 in regular PFN group and 0 in PFNA2 group. 2) 2 Malunion was in regular PFN group and 0 in PFNA2 group. 3) Z- effect was 4 in regular PFN group. 4) Screw cut out was 3 in regular PFN group [Table 7].

**Table 1.** Sex Distribution

Sex	PFN	PFNA2
Male	13	14
Female	7	6

**Table 2.** Mean Age

Mean age	
PFN	65.6 Years
PFNA2	64.23 Years

**Table 3.** Mode Of Injury

Mode of injury	Road traffic accident	Trivial fall
PFN	6	14
PFNA2	5	15

**Table 4.** Side Affected

Side	Right	Left
PFN	12	8
PFNA2	13	7

**Table 5.** AO Classification

Fracture pattern(AO)	A1	A2	A3
PFN	6	9	5
PFNA2	6	9	5

**Table 6.** Operative Details

	PFN	PFNA2
Mean operative time	94.07	49.53
Mean blood loss	82.67ml	73.33ml
Mean image intensifier shot	58.33	33.54
Post op partial weight bearing	3 weeks	2 day

**Table 7.** Complications

Complications	PFN	PFNA2
Residual thigh pain	3	0
Malunion	2	0
Z effect	4	0
Screw cut out	3	0

## 6. Discussion

Treatment of intertrochanteric and subtrochanteric fractures with osteoporosis is a challenge to an orthopaedic surgeon. Screw pull out in a dual screw design due to osteoporosis in old age is the most common cause of implant failure [5]. Clinical studies have also shown that osteoporosis is associated with inferior outcomes in intertrochanteric and subtrochanteric fractures [6]. Various nail designs and augmentation techniques introduced in market to enhance the fixation in both stable and unstable intertrochanteric and subtrochanteric fracture. Selecting an ideal implant for these patients with osteoporosis is a challenge for showing functional outcomes. In view of this helical blade device introduced in PFNA2 for osteoporotic bones [7]. While introducing the helical blade inside the proximal femur the cancellous bone is retained thus the bone stock is preserved. This is the main reason behind prevention of complications such as varus collapse, rotational stress and screw cut out [8]. This cancellous bone stock within the proximal femur offers significant resistance to the implant and increases the purchase in the bone and also augments bone healing and better union rate [9].

In our study [Table 1] Mean age of subjects in regular PFN was 65.6 years and in PFNA 2 was 64.23 years. Kunderna *et al.*, in their study had 70% of the patients over 60 years of age with average age of 68 years ranging from 21 years to 94 years. This is comparable to my study. In our study [Table 2] regular PFN group 45% had A2 fracture and 25% had A3 fracture (Figures 5-7). In PFNA2 [Table 3] 2, 45% had A2 fracture and 25% had A3 fracture (Figures 1-3). Ming hui Li *et al.*, [10]. In their study [Table 4] of 163 patients with intertrochanteric fractures, according to AO, 53 (32.52%) fractures were classified as 31A1, 83 (50.92%) as 31A2, and 27 (16.56%) as 31A3 [Table 5]. Mean duration of surgery in regular PFN was 94.07 and in PFNA 2 was 49.53 min Mohan N.S *et al.*, had similar finding in their study with 50 minutes the average duration of surgery for PFNA2 and 80 min for PFN [Table 6]. Average blood loss in PFN group was 82.67ml and in PFNA2 group was 73.33ml. Levent karapinar *et al.*, in their study average blood loss was 127ml. Number of IIT shots in PFN group was 58.33 and in PFNA2 group 34.67 Comparable with Harshwardhna *et al.*, [11]. Radiological union at 6 months in PFN group was 93.3% with average union time 16weeks (Figures 6-8) and in PFNA2 group was 100% (Figures 2-4) with average union time was 14 weeks [Table 7]. In PFN 15% had residual thigh pain, 20% had Z effect, 15% had screw cut out, 10% had malunion as complications and in PFNA 2, 0% had residual thigh pain, 0% had screw cut out 0% had malunion and 5%. This is comparable to study done by Kashid MR *et al.*, [12]. In PFN 50% had excellent, 20% had Very good, 10% had good and 20% had poor outcome, in PFNA 2, 80% had had excellent, 20% had Very good and 0% had poor outcome in the patients with 1 year follow up. GN Kiran Kumar *et al.*, [13] and Yu.W.Zhang *et al.*, [14]. In their study, Harris hip score was excellent in 15(35.7%), good in 18(42.8%), fair in 6(14.2%), poor in 3(7.1%). This is comparable to our study.



Figure 1. Pre OP X Ray



**Figure 2.** Post OP X Ray (PFNA2)



**Figure 3.** Pre OP X Ray



**Figure 4.** Post OP X Ray (PFNA2)



Figure 5. Pre OP X Ray



Figure 6. Post OP X Ray(Regular PFN)



Figure 7. Pre OP X Ray



Figure 8. Post OP X Ray(Regular PFN)

## 7. Conclusion

From the study, we concluded that PFNA2 brings down the surgery time, blood loss, and radiation exposure compared to regular PFN. PFNA2 has more union rate with significantly better functional outcomes in comparison to regular PFN. Patients can bear weight early with PFNA2. Implant-related complications like backing out of screws (z effect and reverse z effect), and screws cut through the femoral head are not seen with PFNA2. So we conclude that PFNA2 is superior to regular PFN.

**Author Contributions:** All authors contributed equally to the writing of this paper. All authors read and approved the final manuscript.

**Conflicts of Interest:** "The authors declare no conflict of interests."

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