

## Proximal Femoral Nail Antirotation – II with Antirotation screw - Treatment for stable and unstable Intertrochanteric fractures in Asian patients

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### Abstract

**Background:** Majority of trochanteric fractures occur in older age groups. The best options of internal fixation for unstable intertrochanteric fractures in elderly patients remain controversial. The Asia proximal femoral nail antirotation (PFNA-II) was specifically designed for Asian patients, which could be more effective than the regular proximal femoral nail antirotation (PFNA). Here we aim to report the clinico-radiological and functional outcomes of patients with proximal femoral fractures with PFNA-II With Antirotation screw.

**Materials and methods:** From JAN 2017 to MAY2018, 110 stable and unstable intertrochanteric fractures treated with PFNA-II (Synthes, Solothurn, Switzerland) at Our Institute, were followed prospectively. Clinical and radiographic examinations were conducted in Follow-up at 1, 3 AND 6 months. The quality of the fracture reduction was graded as poor ( $>10^\circ$  deformation), acceptable ( $5^\circ$  to  $10^\circ$  deformation), or good ( $<5^\circ$  deformation). The fracture reduction was evaluated on the first post-operative radiograph using fracture (mm) gap measurement. The fracture gap was classified as good (0-3 mm); acceptable (3-5 mm); or poor ( $>5$  mm). Tip apex distance (TAD) was used to evaluate the placement of helical blade in the femoral head. Augmentation done to PFNA-2 with anti-rotation screw in 72 patients AND only PFNA- 2 used in 38 patients. Statistical analysis was performed to compare the results in both groups. The operative time, intraoperative blood loss, overall time of fluoroscopy, length of hospital stay and postoperative complications were recorded. Functional outcome measured by Harris Hip Score.

**Results:** The average duration of surgery (PFNA-II with antirotation) was 50.01 minutes, Fracture reduction was acceptable in 96.4% cases. Implant position was optimal in 99(90.0%) patients, Tip apex distance  $<20$  in 95(86.36%). Augmentation done to PFNA-2 with anti-rotation screw in 72 patients AND only PFNA- 2 used in 38 patients. Average Harris hip score at 6 months was 86.43. Harris hip score was excellent in 39(35.5%) patients, good in 50(45.5%) patients, fair in 16 (14.5%), poor in 5(4.5%) patients. Good functional outcome by Harris hip score is high in group of patients treated with PFNA-2 with antirotation screw (statistically significant  $p < 0.05$ ) than groups of PFNA-2. Mean union time of fracture is 3.16 months. Union time is less (statistically significant  $p < 0.05$ ) in case of fractures treated with PFNA-2 with antirotation screw than only PFNA-2 groups.

**Conclusions:** All above results suggest that PFNA-Asia is effective and safe and better implant with low complications rate in the treatment of stable and unstable intertrochanteric fractures in elderly Indian patients with osteoporosis. But when used with augmentation with antirotation screw yields excellent results in form of good functional outcome and less union time.

**Keywords:** PFNA-2, Antirotation screw, Harris Hip Score.

### Introduction

Majority of trochanteric fractures occur in older age groups. Trochanteric fractures in old age individuals are the result of a trivial trauma. Early surgical intervention is advocated in the majority of these patients to reduce the complications associated with long-term immobilization(1). The aim of the surgery is to achieve initial stability and early mobilization of the patients to avoid complications. Intramedullary nailing is commonly recommended as the treatment of choice for unstable intertrochanteric fracture of femur(2). The purpose of this study was to evaluate the functional and radiological outcome of proximal femoral nail antirotation –asia (PFNA2) with antirotation screw in treatment of unstable intertrochanteric fracture in Indian people.

### Material & Method

From Jan 2017 to Jan 2018, 110 stable and unstable

intertrochanteric fractures treated with PFNA-II (Synthes, Solothurn, Switzerland) at Our Institute, were followed prospectively. This study was approved by the ethics committee of our hospital, and informed consents were obtained from patients or their authorized persons. Clinical and radiographic examinations were conducted on admission to the hospital, at 1 and 3 months post discharge and thereafter at 3-month intervals. A minimum follow-up of 6 months was required for inclusion in this study. Fractures were classified according to New AO classification criteria. The fracture reduction was evaluated on the first post-operative radiograph using fracture (mm) gap measurement. The fracture gap was classified as good (0-3 mm); acceptable (3-5 mm); or poor ( $>5$  mm). Tip apex distance (TAD) was used to evaluate the placement of helical blade in the femoral head. No patients died within 16 months of study duration. Operative time, intraoperative and postoperative complications, and postsurgical ambulatory status were analysed with Harris hip score. Surgery was carried out under general or spinal anaesthesia. All cases were either performed or supervised by an orthopaedic surgeon. All cases and x-rays were analysed by a team of orthopaedic surgeons. Postoperative physiotherapy was given by physiotherapist and discharged with advice of partial weight bearing walking and quadriceps drill and quadriceps strengthening exercise.

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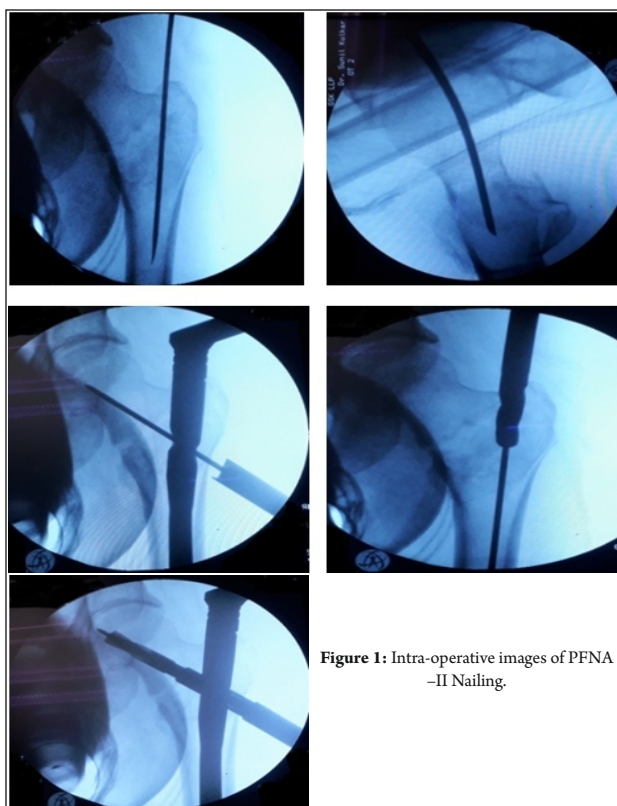


Figure 1: Intra-operative images of PFNA-II Nailing.



Figure 2: Intra-operative images of PFNA-II Nailing



Figure 3: Post operative Images PFNA-2 With Antirotation screw. (AP and Lateral View) Of another case.

## Results

The age of the patients ranged from 36 to 96 years with the mean age of 65.76 years. 67 (60.9 %) patients were in the age group of above 60 years. 60 (54.5%) patients were male and 50(45.5%) patients were female. left side (52.7%) slightly more common as compared to right side (47.3%). Right hip was involved in 52 patients and left in 58 patients. 42(38.2%) patients had history of low energy trauma resulting from slip over the ground OR floor and 14(12.7%) patients had history of fall from standing OR from height. 49(44.5%) had history of high energy trauma resulting from road traffic accident. New AO classification was used to classify these fractures(3). 67 fractures were classified as 31.A2 and 23 fractures as 31.A3 based on pre-operative

radiograph and ct scan. Average singh index of patient is 3.46 . 70(63.6%) patients were operated within 3 days of injury and all except 1 patient operated within 1 week, Average Injury-surgery duration in my study was 3 days (range 1-6 days). All surgeries were done over fracture table in supine position. Closed reduction of the fracture under fluoroscopic guidance was possible in 101 cases. Rest were reduced with minimal opening of the fracture site using various reduction manoeuvres and reduction clamps. The average duration of surgery(PFNAIL with antirotation screw) was 50.01 minutes, ranging from 30 minutes to 95 minutes. All patients received prophylactic antibiotic (cefoperazone sulbactam and amikacin) within half an hour of skin incision. Most commonly used nail length size was the smaller version (170 mm length) and diameter 10 and commonly used blades were between 85-100 mm.. Good fracture reduction in 86 (78.2%) patients and acceptable in 20(18.2%) patients so in total 96.4% cases reduction was acceptable. Implant position was optimal in 99(90.0%) patients and suboptimal in 11 patients, Tip apex distance <10mm in 22(20.0%) patients and <20 in 95(86.36%) and more than 20mm in 15 patients. Augmentation done to PFNA-2 with anti-rotation screw in 72 patients and PFNA-2 alone was used in 38 patients Intra operative fracture of greater trochanter was noted in 2 patients and there were no femoral shaft fractures. The active range of motion exercises and partial weight bearing mobilisation was started on the first post-operative day as tolerated in supervision of physiotherapist. The mean hospital stay was 3 days (range, 1 - 6). Suture removal was done on 14th post-operative day. All patients were evaluated clinically using Harris hip score

Table 1. Demographic characteristics of the patients	
CHARACTERISTICS	
AGE	65.76
SEX	M>F
SIDE	L>R
AO Classification	No. of pt
31A1.1	0
31A1.2	7
31A1.3	13
31A2.2	37
31A2.3	30
31A3.1	9
31A3.2	6
31A3.3	8
Stable fracture	20
Unstable fracture	90

Table 2. Mode of injury		
Mode of Injury	N	percentage
Fall from height	14	12.70%
RTA	49	44.50%
Slip on Floor	42	38.20%
Others	5	4.50%
Total	110	100.00%

and radiologically at 1 month, 3 months, 6 months and thereafter every 3 months. Mean time for full weight bearing was 6 weeks. Anteroposterior and lateral plain radiographs were obtained at each visit to look for the fracture union, tip apex distance, cut-out or lateral migration of helical blade. Clinical evaluation was done using Harris hip score, average Harris hip score at 6 months was 86.43. Harris hip score was excellent in 39 (35.5%) patients, good in 50 (45.5%) patients, fair in 16 (14.5%), poor in 5 (4.5%) patients. Harris hip score is significantly higher in group of patients treated with antirotation screw with PFNA-2 ( $P < 0.05$ ) than groups of PFNA-2. Out of 110 patients post operatively 2 (1.8%) patients had wound infection (superficial or deep) which was treated by dressing and antibiotics, 2 (Deep venous thrombosis), 1 (myocardial infarction), 1 (hypoproteinemia), 6 (haematoma) and 5 (4.5%) patients developed thigh pain post-operatively. Mean union time of fracture is 3.16 months. Union time is significantly less in case of fractures treated with PFNA-2 with antirotation screw than only PFNA-2.

### Discussion

Trochanteric fractures occur mostly in elderly patients. Treatment of Proximal femoral fractures is challenging (4). Intramedullary nailing is commonly recommended as the treatment of choice for unstable intertrochanteric fracture of femur. The AO/ASIF group further modified PFN to the

PFNA to ameliorate the angular and rotational stability with one single element. It is an intramedullary device with a helical blade rather than a screw for better purchase in the femoral head and was tested in a clinical study (5). The standard PFNA nail has a mediolateral angle of  $6^\circ$  and a proximal diameter of 17 mm. To insert the nail, a much larger femoral canal needs to be prepared to accommodate the nail of the given diameter (6). The study shows that the necessary over reaming of the shaft weakens the entire shaft, and that reaming of the medulla can result in increased blood loss (7)(8). Geometric mismatch between the proximal end of the nail and proximal femur is the most probable cause of the intraoperative complications of jamming and fracturing of the lateral cortex. (9) The PFNA was introduced to obtain high stability to prevent rotation and collapse due to its helical neck blade. (10)(11). The PFNA is one of the most effective methods in the treatment of intertrochanteric femur fractures. (12)(13). However, PFNA was designed in accordance with the anatomical data of Westerners. The anatomy of Asians is different, resulting in some complications due to mismatch. (10). An Asian version of the existing PFNA was developed and introduced into the market in 2009. (14) Few published studies in the literature systematically assessed PFNA-Asia in the treatment of intertrochanteric femoral fractures in elderly Chinese patients. (14), (15) In theory, PFNA-Asia should be suitable for Chinese with satisfactory effect. The Asia proximal femoral nail antirotation (PFNA-II) was specifically designed for Asian patients to avoid these problems, which was designed to have a mediolateral angle of  $5^\circ$  and a proximal diameter of 16.5 mm. The modified nail has a considerably better anatomic fit. This effectively decreases the hoop stress inside the femoral shaft and may have led to a significant decrease in intraoperative and postoperative diaphyseal fractures (16). We present a technique of trochanteric reconstruction using antirotation screw in the trochanter in addition to PFNA-2 AND Radiological and functional outcome of this technique of this technique of

**Table 3. Mode of injury**

Nail Length Size	Short PFNA-II(170)	81
	Long PFNA-II(250)	29
Reduction Technique	Closed	101
	Open	9
Implant position	Optimal	99
	Suboptimal	11
Fracture gap reduction	Good	86
	Acceptable	20
	Poor	4
Tip apex distance	<10 mm	22
	10-20 mm	73
	>20 mm	15
Augmentation	Antirrotation screw used	72
	Only PFNA2	38

**Table. 4: Harris Hip score**

Grade	No. of pts	Percentage
EXCELLENT	39	35.45%
GOOD	50	45.45%
FAIR	16	14.54%
POOR	5	4.54%

**Table 5: Harris hip score comparison in 2 groups.**

	PFNA-2 WITH antirotation screw	Only PFNA- 2
Observations	72	38
Mean Harris hip scores	89.30556	81
SD	$\pm 5.95$	$\pm 9.02$
P Value	$P < 0.05$	

**Table. 6 : Intra and post operative complications:**

Parameters	COMPLICATIONS	No
Intra-operative complications	Greater trochanter fracture	2
	Femoral shaft fractures	0
Post-operative complications	• varus deformity	8
	• valgus deformity	2
	• Thigh pain	5
	• heamatoma	6
	• deep infection	1
	• superficial infection	1
	• DVT	2
	• myocardial infarction	1

**Table 7: Union time comparison in 2 groups.**

Union time	PFNA-2 with Antirrotation screw	Only PFNA- 2
Observations	72	38
Mean Union time (months)	3.05	3.37
SD	$\pm 0.64$	$\pm 0.68$
	$P < 0.05$	



augmentation measured. Procedure PFNA-2 with antirotation screw Required less time as compared to other studies. Mohan N.S et al(17) had similar finding in their study with 50 minutes the average duration of surgery for PFNA and 80 min for PFN, Jun li,zhong et al(18) Studied anatomical, or acceptable reduction in 96% patients and implant position was optimal in 88% patients Tip Apex Distance in 82% patients was less than 20 mm. This is comparable to our study In our 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%). Harris hip score at 6 months is high(statistically significant ( $P<0.05$ )) in group of patients treated with PFNA-2 with antirotation screw compare to group of patients treated with only PFNA-2. Kulkarni SG et al(19) in their prospective study of 154 patients, The mean union was 3.6 months in group A(PFNA-2 With augmentation) and 4.1 months in group B(only PFNA-2), with No statistically significant difference found. this is comparable to my study .But in this study good functional outcome was greater in the augmented group which was statistically significant. In our study, varus deformity seen in 8(7.3%) and valgus deformity seen in 2(1.8%) patients .G.N.Kiran kumar et al(20) They noted 6 cases of intra operative lateral wall fractures, out of which 2 cases developed secondary varus collapse of 5 degrees. Mean union time is 3.16 months. Union time is less(statistically

significant ( $P<0.05$ )) in fracture treated with implant PFNA-2 with antirotation screw compare to only PFNA-2 groups. Ming Hui Li et al(21) the fracture healing time was  $14.0 \pm 2.5$  weeks (range, 11–19 weeks). Lv C,Fang et al(14) in their study The mean time to bone healing was 14 weeks. This is comparable to our study. Complications comparable to previous studies June li et al(18) , G.N.Kiran Kumar et al(20) In their study of total 42 patients with unstable intertrochanteric fracture treated with PFNA-2 there were no cases of infection, cut out or breakage of the implant. No femoral shaft fractures were noted in the follow up period.

### Conclusions

• All above results suggest that PFNA-Asia is effective and safe and better implant with low complications rate in the treatment of stable and unstable intertrochanteric fractures in elderly indian patients with osteoporosis. But when used with augmentation with antirotation screw yields excellent results in form of good functional outcome and less union time.

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