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### Comparative study of PFN A2 vs bipolar hemiarthroplasty in unstable senile intertrochanteric fractures

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#### Abstract

**Introduction:** Successful outcome in the treatment of intertrochanteric fracture in elderly lies in early mobilization of the patient so as to avoid the morbidity, complications and poor recovery. With the associated medical comorbidities and osteoporosis, presents a great challenge in selecting the surgical procedures in these patients. Even though the primary choice of surgery revolves around Osteosynthesis in these type of fractures, there is a conspiracy in the choice of implants for the fractures. Many surgeons have resorted to primary hemiarthroplasty in these fractures to avoid uncertainties and implant failures and able to allow full weight bearing walking after surgery. Off late PFNA2 nail have been preferably used to stabilize these fractures with relatively lesser complications and early mobilization of these patients. The purpose of this study is to compare the outcome of PFNA2 and hemiarthroplasty and to study advantages, disadvantages, complications of both the groups.

**Materials and Methods:** 20 patients each were included in PFNA2 group and hemiarthroplasty group from May 2017 to August 2018 who satisfied the inclusion and exclusion criteria. Patient followed up upto 1 year. Patients were evaluated with multiple variables, complications and Harris hip score.

**Results:** PFNA groups had significantly less blood loss, less surgery time, less hospital stay as compared to hemiarthroplasty group. Both groups had similar medical and Orthopaedic complications. PFNA patients can be mobilised early as with hemiarthroplasty group. Hemiarthroplasty groups have better Harris hip score in initial 3 months but similar score at the end of 1 year.

**Conclusion:** PFNA2 provide less morbidity to patients with early mobilisation and good functional outcome. It can definitely be a better option than replacement in elderly intertrochanteric fracture.

**Keywords:** PFNA2, Bipolar, Intertrochanteric fracture, Hemiarthroplasty, Harris hip score, Replacement

#### Introduction

Hip fractures are among the commonest injuries sustained by the elderly, predominantly over 60 years of age. Among the hip fractures 45% are intertrochanteric fractures and again 35%-40% of these fractures are unstable fractures. [1]

As the life expectancy is increasing, number of patients with postmenopausal or senile osteoporosis are increasing proportionately. So there is increase in demand for better treatment of proximal femoral fractures. [2]

The primary treatment for intertrochanteric fractures is internal fixation or osteosynthesis by dynamic hip screws, intramedullary implants but osteosynthesis is always a challenge in osteoporotic patients due to complications like femoral head perforation, metal failure and varus collapse. [3, 4] In addition to intra-medullary devices for the treatment of intertrochanteric fractures, hemiarthroplasty is considered but not accepted as a primary treatment. [5] Although hemiarthroplasty could shorten weight bearing and decrease implant related complications. [6, 7] Proximal femoral nail antirotation devices have been introduced recently to obtain better fixation in the presence of osteoporosis. These implant consists of intramedullary nail with proximal angulation of 6°. It provides rotational stability by compaction of cancellous bone with the helical blade into the femoral head. It is biomechanically proved that the helical blade has significantly higher cut out resistance than other commonly used screw systems. So PFNA blade appears to be biomechanically suitable implant for unstable trochanteric fractures and trochanteric fractures associated with osteoporotic bones [8].

The purpose of present study is to compare the outcome of PFN antirotation with bipolar hemiarthroplasty in reference to advantages, disadvantages, complications.

### Materials and Methods

20 patients each were included in PFNA2 group and hemiarthroplasty group from May 2017 to August 2018 who fulfil the inclusion criteria.

**Inclusion Criteria:** 1) Age > 70 years, 2) Unstable intertrochanteric fractures 3) Patient mobile before the fracture. 4) Medically fit for surgery.

**Exclusion Criteria:** 1) Age < 70 years, 2) Bedridden patient before fracture 3) Pathological fractures 4) Polytrauma 5) Medically unfit for surgery.

All the patients were admitted in emergency department of our hospital. Preoperative blood test was sent to pathology laboratory. Physician opinion taken regarding fitness for surgery. A written, informed consent taken explaining details of surgery, risk factors, postoperative rehabilitation, medical and surgical complications. Pre anaesthetic check up was done a day prior to surgery. ASA grading recorded.

### Surgery steps

#### 1) PFNA2

After induction of anaesthesia patient put on fracture table

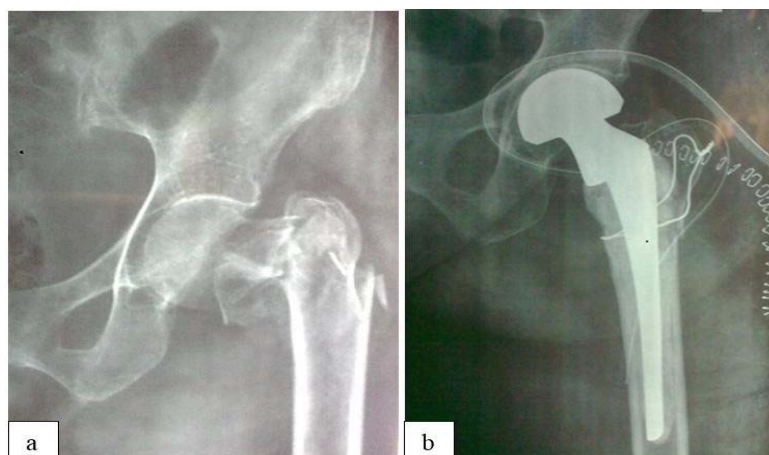
closed reduction by traction internal rotation. Fracture reduction confirmed under image intensifier in AP view and lateral view (20 degree oblique to avoid overlap with other hip). After closed reduction, an about 5 cm longitudinal incision was made approaching the greater trochanter. Entry taken with awl through tip of GT. Guide pin passed through the tip into the medullary canal. Nail passed over the guide pin without reaming. Helical blade put centrally/inferiorly in anteroposterior view and centrally in lateral view. Distal static bolt put. (Fig. 1) wound closed in layers without drain.

#### 2) Bipolar hemiarthroplasty

After induction of anaesthesia patient put on lateral decubitus position. Moore's approach for all the cases. 10 cm curved incision centering over GT. Short external rotators ligated and cut. Removal of head in intertrochanteric fracture is difficult. Head extractor is put and capsule is released all around. Other option is to cut it subcapitally with saw as in neck femur fracture and then remove remaining neck with piecemeal. Fracture pattern is assessed. Usually LT is reconstructed first to get a anatomical landmark using SS wire. Then Canal is reamed and serially broached. Trial stem put. Final stem is put with/without cement. Final head put after trial reduction. Greater trochanter then fixed with k wires/encirclage/tension band wiring depending on fracture pattern. (Fig. 2) Wound closed over negative suction drain.



**Fig. 1:** A) Pre op x-ray unstable intertrochanteric fracture, B) immediate post op x-ray -helical blade put centro-inferiorly, C) union at 4 month post op



**Fig. 2:** a: Pre op X-Ray – comminuted intertrochanteric fracture, b: Post op x-ray – GT, LT fixed with encirclage wire

Post operatively abduction pillow kept for hemiarthroplasty patient. Haemoglobin checked next morning and accordingly blood transfused if required. Most of hemiarthroplasty patients started full weight bearing walking with walker support from post op day one.

PFNA2 patients also started full weight bearing walking with walker from post op day one. All patients were given DVT prophylaxis like factor Xa inhibitor/ direct thrombin inhibitor/ clopidogrel/aspirin etc. till 3 weeks.

All patient planned to discharge usually post op day 2-3. Criteria to discharge 1) Minimum 4 dose of iv antibiotics, 2) Dry wound 3) Drain should be removed in case of replacement 3) should have commode training 4) General condition should be satisfactory.

Patient called for follow up at 1 month, 3 month, 6 month, 1 year. X-rays taken at each follow up and Harris hip score calculated.

Patients of PFNA2 group were gradually mobilised from walker support to stick support to walking without support. Hemiarthroplasty group mobilised with walker for one week and then to stick support /without support depending upon general condition of patient.

Data statistically analysed using fisher's exact test for categorical variables and student's T test for continuous variables.

## Results

In both groups 20 patients were included and their data analysed. Baseline characteristics like age, sex, side, type of fracture, ASA grading, comorbid conditions were recorded. There were no significant difference in above characteristics ( $P>0.05$ ) (Table 1)

In hemiarthroplasty group 15 patients underwent cemented bipolar replacement, 5 patients underwent uncemented bipolar replacement.

PFNA2 group scored significantly better with respect to intraoperative blood loss, surgical time, hospital stay compared to hemiarthroplasty group. ( $P<0.05$ ) (Table 2)

There was less intraoperative complications in PFNA2 group as compared to hemiarthroplasty. ( $P=0.047$ ). (Table 2). In hemiarthroplasty group three patients had hypotension with bradycardia following cementing. Two patients had

symptomatic fat embolism with hypotension, desaturation and tachypnea. All patients were immediately resuscitated and shifted to ICU for further management. In PFNA2 group none of the patients had intraoperative complications.

Hemiarthroplasty group definitely had better functional outcome using Harris hip score till first three months ( $P<0.05$ ) as compared to PFNA2 group. But both groups had similar score at 6 month and 1 year ( $P>0.05$ ) (Table 3)

There was significant difference in the incidence of wound complications in both groups (0% vs 25%,  $P= 0.047$ ) (Table 4). In PFNA2 group none of the patients had wound infection or post-operative wound drainage following DVT Prophylaxis. In Hemiarthroplasty group two patients have superficial wound infection. Wound debridement and through lavage done in both cases and antibiotics was given as per culture and sensitivity for 6 weeks. Both patients recovered following the treatment. Three patients had postoperative wound drainage following oral anticoagulants. Regular dressing was done and anticoagulants were stopped. There was no significant difference in implant related orthopaedic complications (10% vs 15%,  $P>0.999$ ) in both the groups. IN PFNA2 group one patient had screw cut out superiorly and varus collapse for which he was advised reoperation but patient was not willing for second surgery. Another patient had periprosthetic fracture (Vancouver type B1) following history of fall from bed. She was operated again and ORIF with DCP and screws done. In hemiarthroplasty group one patient had dislocation with breakage of tension band wire over GT. This patient was re-operated with open reduction and revision of TBW. One patient had breakage of tension band wiring over GT following history of fall. She was managed conservatively and advised non weight bearing walking with walker till GT union. One patient had migration of k wire medially noticed in one year follow up x-ray. As this patient didn't have any complaints she was counselled and monitored. There was no significant difference in reoperation rate in both groups ( $P= 0.605$ ) (Table 4).

Patient treated with Hemiarthroplasty had a trend of higher medical complications as compared to PFNA2 group. However results are not significant (5% vs 20%  $P = 0.342$ ) (Table 4). Common causes includes pneumonia, hyponatremia.

**Table 1:** Preop comparison between two groups

Characteristics	PFN antirotation	Hemiarthroplasty	P value
Age(years)	82.4 + 3.9	80.8+4.3	0.230
Sex(M:F)	10:10	9:11	0.999
Side (R:L)	11:9	6:14	0.200
Boyd and griffin classification			0.758
type II	14(70%)	12(60%)	
type III	2(10%)	2(10%)	
type IV	4(20%)	6(30%)	
ASA Grade			0.584
I	2(10%)	2(10%)	
II	9(45%)	5(25%)	
III	8(40%)	12(60%)	
IV	1(5%)	1(5%)	
Comorbidities			
DM	7(35%)	5(25%)	0.731
Hypertension	6(30%)	9(45%)	0.515
Cardiac illness	4(20%)	6(30%)	0.716
Asthma/COPD	3(15%)	3(15%)	0.999

M - male, F - female, R - right, L - left, DM - diabetes mellitus, COPD - chronic obstructive pulmonary disease

**Table 2:** intraop and postop comparison between two groups

Variable	PFN antirotation	Hemiarthroplasty	P values
Surgical time (mins)	40 + 6.09	55 +9.50	<0.001
intraoperative blood loss(ml)	120 + 29.4	300 + 49.4	<0.001
Intraoperative complications	0 (0%)	5(25%)	0.047
ICU requirement post op	3(15%)	8(40%)	0.155
Hospital stay (days)	4+ 1.19	6+2.13	<0.001
Time to complete weight bearing	Immediate	Immediate	

**Table 3:** Harris hip score comparison between two groups

Variable	PFN antirotation	Hemiarthroplasty	P value
Harris hip score at 1 month	52.1+2.05	61.4+3.75	<0.001
Harris hip score at 3 month	64.05+2.61	70.20+2.14	<0.001
Harris hip score at 6 month	79.65+1.5	79.95+1.82	0.573
Harris hip score at 1 year	84.35+2.58	85.9+2.31	0.053

**Table 4:** Complications among two groups

Variables	PFN antirotation	Hemiarthroplasty	P value
Minor orthopaedic complications (wound infection/excessive bleeding)	0(0%)	5(25%)	0.047
Major orthopaedic complications (implant failure, dislocations, periprosthetic fracture)	2(10%)	3(15%)	>0.999
Medical complications	1(5%)	4(20%)	0.342
Reoperation rate	1(5%)	3(15%)	0.605

## Discussion

Treating a senile intertrochanteric fracture poses a great challenge to orthopaedic surgeon especially when multiple options are available from conservative to internal fixation to replacement surgeries. Internal fixation with PFN has advantage of small incision, less invasive, less tissue handling, less hospital stay, less operative time.<sup>[9-11]</sup> Our study well supported the above advantages where PFNA2 group showed significant less blood loss (100 ml vs 300 ml,  $P < 0.001$ ), less operative time (40 mins vs 55 mins,  $P < 0.001$ ), less hospital time (4 days vs 6 days,  $P < 0.001$ ). Hemi arthroplasty group had more wound complications (25%) including wound complications secondary to DVT prophylaxis as compared to PFNA2 group (0%). This results are comparable with study by Görmeli<sup>[12]</sup> *et al.*

Anticoagulants need to be stopped in those patients till wound heals which lead to cardiac risk in elderly patients.

Studies showed that internal fixation have disadvantage of screw cut out, periprosthetic fracture, head fracture, higher reoperation rate<sup>[13,14]</sup> but our study contradicts and showed no significant difference in implant related and major orthopaedic complications ( $P > 0.999$ ). Possible explanation can be 1) Helical blade results in increased surface contact between devices and femoral head cancellous bone, compressing rather than removing the limited amount of bone. 2) The tip of PFNA2 nail is especially designed to reduce the concentration of stress.<sup>[8]</sup> In another study by R.K. simmermacker *et al*<sup>[15]</sup> concluded PFNA2 to be effective method in treating unstable senile intertrochanteric fracture with low rate of internal fixation failure and related reoperation. E. soucanye *et al*<sup>[16]</sup> showed similar results. Although there are many studies which showed lesser orthopaedic complications with hemiarthroplasty as compared to PFN6,<sup>[17-20]</sup> but the complications associated with replacement like dislocations, cement related complications, fat embolism mainly depends on skill and experience of operating surgeon. Hemiarthroplasty in senile comminuted intertrochanteric fracture is far more difficult compared to hemiarthroplasty in neck femur fracture which require longer learning curve and surgeons expertise to identify and reconstruct anatomical landmark correctly.<sup>[21]</sup> In our study

even after taking all the precautions 15% of patient had cement related complication like hypotension, bradycardia and immediate intervention was required to resuscitate the patients. This complication can easily be avoided with PFN. In hemiarthroplasty broaching and reaming of medullary canal is necessary irrespective of cementation with leads to fat embolism in many patients as seen in 10% of our patients in hemiarthroplasty group. As unreamed PFNA2 was done in all of our cases, no incidence of fat embolism was noticed in PFNA2 group.

One unbiased advantage of hemiarthroplasty is early mobilisation which reduces the chances of medical complications like pulmonary complications, bed sores, DVT.<sup>[22]</sup> In our study we mobilised PFNA2 patients on post operative day 1 or 2 because of 1) added advantage associated with PFNA helical blade as described earlier 2) PFNA is minimal invasive surgery with minimal tissue handling, minimal blood loss which lead to less disturbance to normal physiology of body and early recovery to normal physiology 3) Operating surgeon took additional precaution to put helical blade centrally or inferiorly in AP view and centrally in lateral view. We documented less medical complications in PFNA2 group although insignificant ( $P = 0.342$ ).

R. Siwach *et al.*,<sup>[23]</sup> N. Ozkayn *et al.*<sup>[24]</sup> showed better functional outcome of hemiarthroplasty group as compared to PFN group. Though our study showed hemiarthroplasty patients outscoring PFNA2 patients significantly in first 3 months Harris hip scores ( $P < 0.001$ ) but both groups showed similar Harris hip score at 6 month and 1 year ( $P > 0.05$ ). As the fracture unites in PFNA2 group, pain reduces and activity level increases which usually takes 4-5 months. PFNA2 preserve the natural hip, patients have no restriction in activities especially in Indian population where squatting and sitting cross leg is required for daily living and for religious activities.

## Conclusion

PFNA2 definitely provide advantage for senile intertrochanteric fracture being less invasive, quick surgery, and less disruptive to normal physiology. It allows early weight bearing similar to hemiarthroplasty which has more

risk of cementation, hypotension, wound related complications. PFNA2 being osteosynthesis procedure provide normal hip with no restriction of activities and similar functional outcome at the end of 1 year.

### Limitation

Small sample size can alter the study results. Prefecture activity level not included in study which can affect the post-operative functional outcome. Also to study orthopaedic complications long term follow up is required.

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