Management and Outcome of Unstable Intertrochanteric Fracture by Proximal Femoral Nail Versus Proximal Femoral Nail Anti-Rotation in Elderly Patients: A Prospective Comparative

Kanhei Ram Mahapatro[1], Sravan Kumar Sahukar[2], Sanjay Kumar Das[3], Som Subhankar[4], Rajendra Kumar[5]

ABSTRACT

Introduction: To study the management and outcome of unstable intertrochanteric fracture by proximal femoral nail versus proximal femoral nail anti-rotation in elderly patients.

Material and methods: This was a prospective comparative study conducted in a tertiary care hospital. Patients of unstable intertrochanteric Fracture above 50 years of age treated with Proximal Femoral Nail and Proximal Femoral Nail Anti-rotation, after getting clearance from research and ethical committee were included in the study. A total of 35 patients were included in each group. There were 2 deaths in Proximal femoral nail group and 3 in Proximal Femoral Nail Anti-rotation. One patient was lost to follow-up in Proximal femoral nail group. Hence, 33 patients in Proximal femoral nail group and 31 patients in Proximal Femoral Nail Anti-rotation were analyzed.

Results: The mean age of patients of PFN and PFNA was 71.21±8.30 and 70.35±8.98 years respectively. More than half of patients in both the groups were males. Grade III Singh index was in 42.4% of PFN and in 38.7% of PFNA group. There was no significant ($p>0.05$) difference in Harris Hip score between the groups across the time periods. Complications were present in 12.1% patients of PFN and in 6.5% of PFNA. Excellent outcome among more than one third of patients of PFN (45.5%) and in 64.5% of PFNA, however, the difference was insignificant ($p>0.05$).

Conclusion: This study suggests that both PFN and PFNA perform well, showing equally good functional outcomes following fixation of unstable trochanteric fractures. PFNA offers no significant benefits over PFN in terms of post-operative complications.

Keywords: Proximal femoral, Intertrochanteric fracture, Functional outcomes

INTRODUCTION

Intertrochanteric hip fractures account for approximately half of the hip fractures in the elderly; out of this more than 50% fractures are unstable. Unstable pattern occurs more commonly with increased age and with low bone mineral density (Koval et al, 1996).

The fracture commonly occurs through bone affected by osteoporosis. The presence of osteoporosis in intertrochanteric fractures is important because fixation of the proximal fragment depends entirely on the quality of cancellous bone present, Unstable intertrochanteric fractures are those in which comminution of posteromedial buttress exceeds a simple lesser trochanteric fragment or those with subtrochanteric extension. The results of unstable fractures are less reliable and have a high rate of failure - 8%-25% (Babhulkar, 2006).

With the acceleration of aging society, the incidence of osteoporosis are increasing, leading to intertrochanteric fracture caused by low energy trauma, and this kind of fracture becomes most common in the elderly, with a prevalence ratio between male and female is 1:3 (Petsatodis et al, 2011).

Intramedullary devices such as Proximal Femora Nail (PFN) are biomechanically stronger and more rigid compared to extramedullary devices such as Dynamic Hip Screw (DHS) (Baumgaertner et al, 1998). For fixation of unstable fractures, the use of an intramedullary nail coupled with a dynamic femoral head/neck stabilization implant is the ideal method (Kulkarni et al, 2006).

PFN was introduced by AO/ASIF in 1996 for treatment of trochanteric fractures. It includes an Intramedullary nail through which two screws are inserted into the neck of femur. One is a lag screw that stabilizes the fracture allowing collapse and other is an antirotation screw used to provide rotatory stability to the fracture (Hohendorff et al, 2005).

The proximal femoral nail antirotation (PFNA) was introduced in 2003 and it utilizes a helical blade instead of the conventionally used two screws. The helical blade is believed to provide stability,compression as well as rotational control of the fracture (Hohendorff et al, 2005).

Although PFN proved to be superior to extramedullary devices for unstable intertrochanteric fractures, screw cut-out, back out, varus collapse and rotational instability

[1]Senior Consultant, Department of Orthopaedic, Capital Hospital, Bhubaneswar, Odisha, [2]Consultant, Department of Orthopaedic, Capital Hospital, Bhubaneswar, Odisha, [3]Consultant, Department of Orthopaedic, Capital Hospital, Bhubaneswar, Odisha, [4]Consultant, Department of Orthopaedic, Capital Hospital, Bhubaneswar, Odisha, [5]Professor Community Medicine, Vice Principal & Medical Superintendent, KDMCHRC, Mathura(UP), India

Corresponding author: Dr. Som Subhankar, Consultant (Orthopaedic), Department of Orthopaedic, Capital Hospital, Bhubaneswar, Odisha, India

How to cite this article: Mahapatro KR, Sahukar SK, Das SK, Subhankar S, Kumar R.Management and outcome of unstable intertrochanteric fracture by proximal femoral nail versus proximal femoral nail anti-rotation in elderly patients: a prospective comparative . International Journal of Contemporary Medical Research 2022;9(1):A1-A6.

continued to be significant postoperative complications, with up to 31% complication rates being reported in literature (Kashid et al, 2016).

PFNA was designed to achieve to better stabilization of the femoral head and neck by using a single helical blade rather than a screw system for fixation (Raviraj et al, 2012).

The aim of this study was to study the management and outcome of unstable intertrochanteric fracture by proximal femoral nail versus proximal femoral nail anti-rotation in elderly patients.

MATERIAL AND METHODS

This was a prospective comparative study conducted in a tertiary care hospital. Patients of unstable intertrochanteric Fracture above 50 years of age treated with Proximal Femoral Nail and Proximal Femoral Nail Anti-rotation, after getting clearance from research and ethical committee were included in the study. Patients with pathological fractures, open fracture, any other fracture in same extremity, neuromuscular disorders and life threatening co-morbid conditions were excluded from the study.

Methods

Fracture type was assessed and recorded as per AO classification system after obtaining radiographs – An anteroposterior view of the pelvis with both hips and a lateral view of the affected hip. Singh's index (Singh et al, 1970) was used to grade the radiographs for the degree of osteoporosis. A bolus dose of antibiotic inj. Ceftriaxone 1gm i/v was given pre-operatively, half an hour before surgery.

Proximal Femoral Nail Anti-rotation group

All patients were administered spinal anaesthesia and positioned supine on a fracture table prior to closed reduction of fracture and were monitored under C-Arm X-ray. Then reduction of the fracture was performed. After successful reduction, a lateral incision of 2-3 cm was made 2 cm superior to the apex of greater trochanter, then the apex of greater trochanter was exposed by bluntly dissecting gluteus medius.

With the guidance of C-arm X-ray, a hole was made on the apex of greater trochanter with hollow pointed cone, a guide pin was inserted, and then a hollow intramedullary drill was used to enlarge the medullary cavity along the pin. After enlarging the cavity, the main nail of PFNA was inserted along the pin. The reduction of fracture was confirmed with C-arm X-ray, and then the pin was driven into the neck of femur from the proximal locking hole with matching guider. Posteroanterior film of C-arm X-ray showed that the pin would be 5 - 10 mm beneath the articular surface of femur, and the lateral film showed that it was located at centre of or slightly posterior to the head of femur. Moreover, the distance between the pin tip and the apex of femur head could be visible in posteroanterior and lateral film, namely Tip-Apex Distance (TAD), which was not be over 20 mm. The reamer was used to enlarge the medullary cavity along the pin again. According to the depth measured by guide pin, a helical blade of appropriate length was driven into the bone, and then tightened. Later, distal locking nail and screw cap was installed with the guidance of C-arm X-ray. The reduction of fracture should be satisfactory according to posteroanterior and lateral C-arm X-ray. The wound was washed, sutured and dressed without postoperative drainage.

Proximal femoral nail group

Patient was given spinal anaesthesia and was shifted to a fracture table in supine position. Operative leg was slightly adducted and put on traction. Opposite limb was put in a full abduction as to give space for the C-arm in between the legs. Reduction was achieved by traction and internal rotation primarily mid adduction or abduction as required. Reduction was checked in a C-arm with anterior - posterior and lateral view.

Entry point was taken with awl/guide pin over a protector sleeve, it was on the tip of the Greater Trochanter antero-posterior and lateral position. Guide wire: 2.8mm guide wire was inserted in to the femoral shaft and across the fracture site in 6 degree of valgus: Its position was checked in the C-arm and the entry was widened with the awl.

Reaming of the proximal femur was done up to the proximal part of the nail to be introduced. Nail was fixed on the jig and the alignment was checked. Then the nail was inserted into the femur. The position of the holes for the proximal screws was checked in the C-arm for the depth of the nail.

Follow up

Radiological:

Anteroposterior (AP) and lateral radiograph was taken for all the patients at each follow-up for evaluation of fracture healing and implant position. Clinical and radiological assessment of fracture union/ complications for all the patients was done post-operatively at 6 weeks, 3 months, 6 months and 9 month.

Functional evaluation:

Functional evaluation was done at 6 weeks, 3 months, 6 months and 9 month at each follow up using Harris Hip Score (Harris, 1969).

STATISTICAL ANALYSIS

The results are presented in frequencies, percentages and mean±SD. The Chi-square test was used to analysis categorical variables. The Unpaired t-test was used to compare continuous variables. The p-value<0.05 was considered significant. All the analysis was carried out on SPSS 16.0 version (Chicago, Inc. USA).

RESULTS

A total of 35 patients were included in each group. There were 2 deaths in Proximal femoral nail group and 3 in Proximal Femoral Nail Anti-rotation. One patient was lost to follow-up in Proximal femoral nail group. Hence, 33 patients in Proximal femoral nail group and 31 patients in Proximal Femoral Nail Anti-rotation were analyzed.

The mean age of patients of PFN and PFNA was 71.21±8.30 and 70.35±8.98 years respectively. More than half of patients in both the groups were males. There was no significant (p>0.05) difference in age and gender between the groups showing comparability of the groups in terms of age and

gender. Left side fracture was among more than half of patients in both PFN (54.5%) and PFNA (58.1%) groups. The duration of surgery was significantly (p=0.0001) higher among patients of PFN (84.06±10.31 minutes) than PFNA (62.06±6.01 minutes). 31A2- Unstable fracture was in 48.5% patients of PFN and in 32.3% of PFNA (Table-1).

Grade III Singh index was in 42.4% of PFN and in 38.7% of PFNA group. However, grade II Singh index was in 21.2% patients of PFN and in 29% of PFNA (Table-2).

There was no significant (p>0.05) difference in Harris Hip score between the groups across the time periods (Table-3).

Callus was present in all patients at 6 weeks in both the groups. Union in progress was present in all patients at 3 months and 6 months in both the groups. Union in progress was present in 9.1% patients of PFN and in 3.2% of PFNA at 9 months (Table-4).

Basic characteristics	Proximal femoral nail (PFN) (n=33)	Proximal Femoral Nail Anti-rotation (PFNA) (n=31)	p-value[1]
Age in years, mean±SD	71.21±8.30	70.35±8.98	0.69
Gender, no. (%)			
Male	19 (57.6)	16 (51.6)	0.63
Female	14 (42.4)	15 (48.4)	
Side, no. (%)			
Left	18 (54.5)	18 (58.1)	0.77
Right	15 (45.5)	13 (41.9)	
Operating time in minutes, mean±SD	84.06±10.31	62.06±6.01	0.0001*
Fracture pattern			
31A2- Unstable	16 (48.5)	10 (32.3)	0.18
31A3- Unstable	17 (51.5)	21 (67.7)	
[1]Unpaired t-test/Chi-squire test, *Significant			

Table-1: Basic characteristics of patients between the groups

Grading	Proximal femoral nail (PFN) (n=33)		Proximal Femoral Nail Anti-rotation (PFNA) (n=31)		p-value[1]
II	7	21.2	9	29.0	0.15
III	14	42.4	12	38.7	
IV	8	24.2	2	6.5	
V	4	12.1	8	25.8	
[1]Chi-square test *Significant					

Table-2: Comparison of degree of osteoporosis (Singh Index) between the groups

Time periods	Proximal femoral nail (PFN) (n=33)	Proximal Femoral Nail Anti-rotation (PFNA) (n=31)	p-value[1]
6 weeks	25.33±5.08	27.94±5.27	0.06
3 months	46.18±6.43	45.94±7.76	0.89
6 months	71.06±7.49	67.35±8.16	0.06
9 months	90.91±8.71	88.39±11.50	0.32
[1]Unpaired t-test			

Table-3: Comparison of Harris Hip score between the groups across the time periods

Time periods	Proximal femoral nail (PFN) (n=33)		Proximal Femoral Nail Anti-rotation (PFNA) (n=31)		p-value[1]
6 weeks					
Callus present	33	100.0	31	100.00	-
3 months					
Union in progress	33	100.0	31	100.00	-
6 months					
Union in progress	33	100.0	31	100.00	-
9 months					
Union in progress	3	9.1	1	3.2	0.63
Union present	30	90.9	30	96.8	
[1]Chi-square test					

Table-4: Comparison of radiological outcome between the groups across the time periods

Complications	Proximal femoral nail (PFN) (n=33)		Proximal Femoral Nail Anti-rotation (PFNA) (n=31)		p-value[1]
Present	4	12.1	2	6.5	0.72
Absent	29	87.9	29	95.5	
Type of complications					
Screw backout	1	3.0	2	6.5	0.38
Z-effect	3	9.1	0	0.0	
[1]Chi-square test					

Table-5: Comparison of complications between the groups

Results	Proximal femoral nail (PFN) (n=33)		Proximal Femoral Nail Anti-rotation (PFNA) (n=31)		p-value[1]
Excellent	15	45.5	20	64.5	0.29
Good	11	33.3	5	16.1	
Fair	3	9.1	4	12.9	
Poor	4	12.1	2	6.5	
[1]Chi-square test *Significant					

Table-6: Comparison of final outcome between the groups

Complications were present in 12.1% patients of PFN and in 6.5% of PFNA. Screw backout type of complication was in 3% patients of PFN and in 6.5% of PFNA. However, difference was insignificant (p>0.05) (Table-5).

Excellent outcome among more than one third of patients of PFN (45.5%) and in 64.5% of PFNA, however, the difference was insignificant (p>0.05) (Table-6).

DISCUSSION

Closed management of these injuries poses difficulty in obtaining and maintaining a reduction, making operative treatment the ideal treatment. Currently, common modes of fixation devices used are Blade plate systems, Sliding screw systems and Intra-medullary devices. Since its introduction in the 1980s, cephalomedullary fixation for IT fractures in the elderly has gained popularity. Aside from the theoretical advantage of being less invasive and biomechanically superior, these devices have been advocated in cases of unstable fracture patterns such as reverse obliquity, lateral wall incompetence, sub-trochanteric extension, and medial calcar disruption (Matre et al, 2013; Okcu et al, 2013).

The aim of this study was to study the management and outcome of unstable intertrochanteric fracture by proximal femoral nail versus proximal femoral nail anti-rotation in elderly patients.

In this study, the mean age of patients of PFN and PFNA was 71.21±8.30 and 70.35±8.98 years respectively. More than half of patients in both the groups were males. Kashid et al (2016) reported similar results in regard to age in which The mean age of patients in PFN and PFNA groups was 64.36 ± 8.28 years and 65.36 ± 8.66 years respectively and did not differ significantly (p =0.678). However, a significant (p=0.05) difference in the age was reported between patients treated with PFN (60.78 years) and PFNA (74.12 years) (Sharma et al, 2017). In the study by Sharma et al (2017), there were 69.5% males in PFN group and 40% in PFNA group. Kashid et al (2016) reported that the subjects of PFN and PFNA groups were also gender matched as the number of females and males was same in the two groups.

This study found that 31A2- Unstable fracture was in 48.5% patients of PFN and in 32.3% of PFNA. In contrast to this study, Sharma et al (2017) found 31A3 fractures in 30.4% of PFN and in 12% of PFNA. Kashid et al (2016) found that the fracture types as per AO classification also did not differ (p =0.489) between the PFN and PFNA groups. The current study showed that Grade III Singh index was in 42.4% of PFN and in 38.7% of PFNA group. However, grade II Singh index was in 21.2% patients of PFN and in 29% of PFNA. Sharma et al (2017) observed that 8 of 21 patients (38.09%) in PFN group and 13 of 24 patients (54.16%) in PFNA group had a Singh's index of 3 or less.

This study revealed that there was no significant (p>0.05) difference in Harris Hip score between the groups across the time periods. Sharma et al (2017) also reported similar finding in which the average Harris Hip Score obtained at final follow up was identical in the two groups of patients – 75.37 for the PFN group and 78.85 for the PFNA group. Kashid et al (2016) found that the mean Harris hip score of PFNA group was relatively higher as compared to PFN group but the difference was not significant (p =0.562) as in the present study.

The duration of surgery was significantly (p=0.0001) higher among patients of PFN (84.06±10.31 minutes) than PFNA (62.06±6.01 minutes) in this study. Kashid et al (2016) also reported similar finding with this study in context to operation time in which the mean operative time was significantly lower in PFNA group as compared to PFN group (35.20 ± 6.03 minutes vs. 43.32 ± 8.20 minutes, (p <0.001). Bajpai et al (2015) found that the two groups were similar in operation time (screw PFN, 85.91 min; helical blade PFN group 83.91 min; p =0.43). Zeng et al (2012) found that PFNA use was associated with a significant reduction in duration of surgery, overall complication rate, post-operative fixation failure rate, and intraoperative blood loss as compared to PFN. Takigami et al (2008) also found that the surgical time and operative

blood loss were lower with the use of PFNA as compared to PFN.

This study found that complications were present in 12.1% patients of PFN and in 6.5% of PFNA. Screw backout type of complication was in 3% patients of PFN and in 6.5% of PFNA. Sharma et al (2017) reported higher complications in both PFN (34.7%) and PFNA (12%) than the present study. Bajpai et al (2015) reported that complication rate in both PFN and PFNA groups were not serious: 2 patients in screw proximal group had superficial wound infection which was managed with antibiotics; 1 patient in screw proximal nail group had persistent hip pain and was managed with analgesics and 1 patient in screw proximal nail group had shortening >1 cm but < 2 cm (1 cme1.8 cm); 1 patient in helical PFN group had superficial wound infection which was managed with antibiotics after culture and sensitivity. Sharma et al (2017) reported that screw back-out and Z-effect was in 28.4% and 14.2% patients of PFN respectively and both were nil in PFNA group. Kashid et al (2016) found that the incidence of cut out/z-effect and re-operation didn't differ significantly between PFN and PFNA groups (p =0.552).

In the present study, excellent outcome among more than one third of patients of PFN (45.5%) and in 64.5% of PFNA, however, the difference was insignificant (p>0.05). In the study by Mohan et al (2016), in PFNA group, 45 cases (90%) showed excellent results, 5 cases(10%) showed good results, whereas in PFN group, 37cases (75%) showed excellent results, 8 cases (20%) showed good results and 3 cases (5%) showed poor results. Mora et al (2011) recommend PFNA for the treatment of trochanteric femoral fractures in the elderly as PFNA's blade demonstrated a lower incidence of cut out in their study. They argued that the blade improved fixation stability decreasing bone loss of the remaining bone stock, increased the contact area between implant and the femoral head and compacted the cancellous bone.

The prospective nature of the study and randomization of patients strengthened the study. However, the smaller sample size and shorter duration of follow-up are limiting factors.

CONCLUSION

This study suggests that both PFN and PFNA perform well, showing equally good functional outcomes following fixation of unstable trochanteric fractures. PFNA offers no significant benefits over PFN in terms of post-operative complications.

REFERENCES

1. Koval KJ, Aharonoff GB, Rokito AS, Lyon T, Zuckerman JD. Patients with femoral neck and intertrochanteric fractures: Are they the same? Clin Orthop.1996; 330:166-172
2. Babhulkar SS. Management of trochanteric Fractures. Indian J Orthop 2006; 40:210-8.
3. Petsatodis G, Maliogas G, Karikis J. External fixation for stable and unstable intertrochanteric fractures in patients older than 75 years of age: a prospective comparative study. J Orthop Trauma 2011; 25: 218-223.
4. Baumgaertner MR, Curtin SL, Lindskog DM. Intramedullary versus extramedullary fixation for the treatment of intertrochanteric hip fractures.Clin Orthop. 1998; 348:87-94
5. Kulkarni GS, Limaye R, Kulkarni M, Kulkarni S. Intertrochanteric fractures. Indian J Orthop. 2006; 40:16–23.
6. Hohendorff B, Meyer P, Menezes D, Meier L, Elke R. [Treatment results and complications after PFN osteosynthesis] Unfallchirurg. 2005; 108:938. 940, 941-46.
7. Kashid MR, Gogia T, Prabhakara A, Jafri MA, Shaktawat DS, Shinde G. Comparative study between proximal femoral nail and proximal femoral nail antirotation in management of unstable trochanteric fractures. Int J Res Orthop 2016; 2:354-8.
8. Raviraj A, Anand A, Chakravarthy M, Pai S. Proximal femoral nail antirotation (PFNA) for treatment of osteoporotic proximal femoral fractures. Eur J Orthop Surg Traumatol. 2012; 22:301–05.
9. Harris WH. Traumatic arthritis of hip after dislocation and acetabular fractures: Treatment by mold arthroplasty. An end-result study using a new method of result evaluation. J Bone Joint Surg Am. 1969;51-A: 737-755.
10. Singh M, Nagrath AR, Maini PS. Changes in trabecular pattern in the upper end of the femur as an index of osteoporosis. J Bone Joint Surg Am. 1970; 52:457–67.
11. Matre K, Vinje T, Havelin LI, Gjertsen JE, Furnes O, Espehaug B, Kjellevold SH, Fevang JM. TRIGEN INTERTAN intramedullary nail versus sliding hip screw: a prospective, randomized multicenter study on pain, function, and complications in 684 patients with an intertrochanteric or sub-trochanteric fracture and one year of follow-up. JBJS. 2013;95:200-8.
12. Okcu G, Ozkayin N, Okta C, Topcu I, Aktuglu K. Which implant is better for treating reverse obliquity fractures of the proximal femur: a standard or long nail? Clinical Orthopaedics and Related Research. 2013;471:2768-75.
13. Kashid MR, Gogia T, Prabhakara A, Jafri MA, Shaktawat DS, Shinde G. Comparative study between proximal femoral nail and proximal femoral nail antirotation in management of unstable trochanteric fractures. Int J Res Orthop 2016;2:354-8.
14. Sharma A, Mahajan A, John B. A Comparison of the Clinico-Radiological Outcomes with Proximal Femoral Nail (PFN) and Proximal Femoral Nail Antirotation (PFNA) in Fixation of Unstable Intertrochanteric Fractures. Journal of Clinical and Diagnostic Research. 2017; 11(7).
15. Bajpai J, Maheshwari R, Bajpai A, Saini S. Treatment options for unstable trochanteric fractures: Screw or helical proximal femoral nail. Chinese Journal of Traumatology 2015; 18: 342-346.
16. Zeng C, Wang YR, Wei J, Gao SG, Zhang FJ, Sun ZQ, et al. Treatment of trochanteric fractures with proximal femoral nail antirotation or dynamic hip screw systems: a meta-analysis. J Int Med Res. 2012;40:839-51.
17. Takigami I, Matsumoto K, Ohara A, Yamanaka K, Naganawa T, Ohashi M, et al. Treatment of trochanteric fractures with the proximal femoral nail antirotation (PFNA) nail system – report of early result. Bull NYU

Hosp Jt Dis. 2008:66:276-9
18. Mohan NS, Chandrashekhar, Reddy R, Santoshbabu M. Comparative Study Between PFN Vs PFNA in The Treatment of Unstable Intertrochanteric Fracture. IJAR 2016; 6 (6).
19. Mora A, Marimon I, Rius M, Brill W, Corral A, Gaya S. PFN versus PFNA in treatment of trochanteric femoral fractures: A prospective study. Bone and joint journal Orthopaedic proceedings. 2011;93:136.

Source of Support: Nil; **Conflict of Interest:** None

Submitted: 27-11-2021; **Accepted:** 29-12-2021; **Published:** 31-01-2022