OUTCOME OF UNSTABLE INTERTROCHANTERIC FRACTURES MANAGED WITH PROXIMAL FEMORAL NAIL ANTI-ROTATION-II: A STUDY IN ELDERLY NEPALESE POPULATION

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ABSTRACT

Introduction

The ideal implant for treating unstable intertrochanteric fracture has been controversial. Studies have shown good results with various intra-medullary nails. Likewise, Proximal Femoral Anti-rotation-II (PFNA-II) has been designed for the Asian population. But the knowledge about the outcomes of PFNA II in our particular region has been lacking.

Objectives

To evaluate the radiological and functional outcome of unstable intertrochanteric fractures in elderly patients managed with PFNA-II.

Methodology

This is a prospective clinical study conducted at Nobel Medical College between February 2019 and March 2021. Patients above 65 years of age with unilateral unstable intertrochanteric fracture were managed with PFNA-II. Radiological union and complications were recorded. Functional outcome was assessed on the basis of modified Harris Hip Score.

Result

Twenty-nine patients were included in the final evaluation and had at least one year follow-up. Two patients (6.8%) had superficial infection. The average Tip Apex Distance (TAD) was 22.28 mm (range, 18- 28 mm). Mean modified Harris Hip Score at one year was 82.59 with good outcome in 23(79.3%) patients.

Conclusion

This study showed that good clinical outcome can be obtained when radiological parameters are restored. Good intra-operative fracture reduction, and optimal positioning and length of helical blade are crucial. We believe that PFNA-II is an excellent implant to treat unstable intertrochanteric fractures in elderly patients.

KEYWORDS

Proximal Femoral Nail Anti-rotation II, Unstable intertrochanteric fracture, Osteoporosis

INTRODUCTION

Intertrochanteric fractures are relatively common among the elderly population. These fractures typically occur infrail patients with multiple medical comorbidities and often end the patient's functional independence.[1,2] The aim should be to restore function with the lowest possible rate of surgical and medical complications. Achieving acceptable reduction and stable fixation of the fracture that allows early mobilization is the key to these goals. Decision-making in the management of intertrochanteric fractures requires understanding of the fracture geometry and the implants which are available.[3] The ideal implant for treating unstable intertrochanteric fracture has been controversial. Studies have shown good results with cephalomedullary nailing for unstable intertrochanteric fractures.[4,5] There are many implants available in the market to fix this fracture, PFNA-II being one of the recent implant.[6] Proximal femoral nail anti-rotation (PFNA) uses helical blade, which compacts cancellous bone of the femoral head. This increases rotational stability of cervico-cephalic fragments and reduces load on the femoral head. Biomechanical testing has demonstrated that the blade has a significantly higher cut-out resistance than other commonly used screw systems and is effective in cases of osteoporosis.[7] Proximal femoral nail anti-rotation-II (PFNA-II) has been designed to match the Asian proximal femoral morphometry and appears to be better suited in this patient population.[8-9]

The purpose of this study was to evaluate the radiological and functional outcome of unstable intertrochanteric femur fracture managed with PFNA-II in elderly patients.

METHODOLOGY

This is a prospective study done between February 2019 and March 2021on patients who presented to emergency room or outpatient department of Nobel Medical College Teaching Hospital, Biratnagar. The study was approved by ethical committee of this institute. Patients above 65 years of age with unilateral unstable intertrochanteric fracture who were ambulatory prior to fracture were included in the study. Fractures with sub-trochanteric extension, pathological fractures, revision surgery and those with polytrauma were excluded. Fracture classification was according to the AO/OTA classification system in which types 31A2 and 31A3 were considered as unstable fracture patterns.[10]

Radiological confirmation of diagnosis was done by taking antero-posterior and lateral x-rays of the hip. Fractures were classified on the basis of the AO/OTA classification system. All patients were managed pre-operatively with skin traction and adequate analgesia.

Surgery was carried out under spinal anesthesia. A fracture table and an image intensifier were used in all cases (Figure 1). The patient was placed supineon the fracture table. The hip and knee of the uninjured limb were flexed and abducted to facilitate lateral C-armfluoroscopy. To reduce the fracture, traction was applied in the direction of the length of the extremity to distract the fragments and restore length. After that, the limb was internally rotated to achieve fracture reduction.Skin incision was made in line with the femoral shaft axis and about 5 cm proximal to the tip of the greater trochanter.

Entry portal was made just medial to the greater trochanter tip. Canal reaming was done over a guide wire. PFNA-II nail, 240mm in length and of appropriate diameter, was mounted on its jig and inserted manually. A guide wire was inserted inside the femoral neck and head in a desired location and the length measured .After the reaming was done, the helical blade was attached to its inserter and introduced over the guide wire with a mallet. The blade was locked and verified intraoperatively. Distal locking was done with the help of the aiming jig. Finally, wound was irrigated with normal saline and closed in layers.

Immediate postoperative radiographs were evaluated for quality of the fracture reduction and measurement of Tip Apex Distance (TAD) as described by Baumgartner et al.[11] Quality of reduction was categorized as good, acceptable or poor. For reduction to be considered as good, there had to be normal or slight valgus neck-shaft alignment on antero-posterior radiograph, less than 20 degrees of angulation on the lateral radiograph and no more than 4 mm of displacement of any fragments. To be considered as an acceptable reduction, criterion for good reduction had to be met in terms of either alignment or displacement. A poor reduction met neither criterion. The position of helical blade was determined by dividing the femoral head into superior, central, and inferior thirds on the antero-posterior radiograph and anterior, central, and posterior thirds on the lateral radiograph as per Cleveland's zones.[12]

Post-operatively patients were encouraged to move the hip, knee and ankle joints on the first post-operative day and partial weight bearing was allowed with the aid of walker on the following day. Patients were discharged from the hospital after 5 to 7 days and followed up at two weeks for suture removal.

Follow-up radiographs at 6 weeks, 3 months, 6 months and 1 year after surgery were evaluated. Radiological union and complications were recorded. Union was defined as bridging callus seen on at least three out of four cortices in two orthogonal views. Functional outcome was assessed on the basis of modified Harris Hip Score (mHHS).[13]

The data was analyzed in SPSS version 26. Frequencies, mean, standard deviation, minimum and maximum values were calculated for continuous data. Comparison between categorical variables was done by Fischer's exact test. Student's T-test was used to compare between continuous and categorical variables.

Figure 1: Intraoperative fluoroscopic images.

RESULTS

Out of 36 cases studied, 6 cases were lost to follow up and 1 patient opted out of the study. So, the data was evaluated in 29 cases who met the inclusion criteria. There were 17 male and 12 female patients with average age of 72.76 years (range, 65 – 82 years). There were 23 AO/OTA type 31A2 fractures and 6 type 31A3 fractures. There was no significant difference in the mean age between the two types of fracture (p =0.7). The quality of reduction was good in 19 cases and acceptable in 10 with no differences between the two fracture types (p = 0.3). About the position of helical blade in anterior-posterior view, 24 had central position and 5 had inferior position. And in lateral view 3 of them were present in anterior position, 22 were present in central position and 4 were present in posterior position. The average Tip Apex Distance (TAD) was 22.28 mm (18- 28 mm) (Table 1). TAD in 26 cases were less than 25 mm and in 3 cases it was more than 25 mm. TAD between the two groups of fracture was statistically insignificant (p= 0.2).

Mean mHHS at 6 weeks, 3 months, 6 months and 1 year were 40.55, 61.07, 80.34 and 82.59 respectively. There was statistical difference in the scores between the types of fracture at 6 weeks (p= 0.02) and 3 months (p= 0.04) but no difference in scores at 6 months (p= 0.25) and 1 year (p= 0.29). At 6 months there were 16 good and 13 fair outcomes, and at 1 year there were 1 excellent, 23 good and 5 fair outcomes. On analysis, there was significant statistical difference between the outcomes at 6 month and 1year (p= 0.011) (Figure 2, Table 2).

Figure 2: Radiographic images and functional outcome of unstable intertrochanteric fracture managed with PFNA-II in a 74 years old lady.

Table 1: Demography and Results of the Study

Variables	Number
Age (years)(Average ±SD)	72.76 ± 4.31
Gender	
Male	17
Female	12
Mode of Injury	
Fall	27
RTA	2
Fracture type (AO/OTA)	
31A2	23
31A3	6
Side of fracture	
Right	15
Left	14
Apex Distance (TAD) (mm)(Range)	22.28 (18 - 28)
Quality of Reduction	
Good	19
Acceptable	10
Blade Position in Head	
Antero-Posterior View	
Centre	24
Inferior	5
Lateral View	
Anterior	3
Central	22
Posterior	4
mHHS scores (mean)	
6 weeks	40.55
3 months	61.07
6 months	80.34
1 year	82.59

Table 2: Functional Outcome

mHHS	3 months	6 months	1 year
Poor	27	-	-
Fair	2	13	5
Good	-	16	23
Excellent	-	-	1
p- value	0.011		

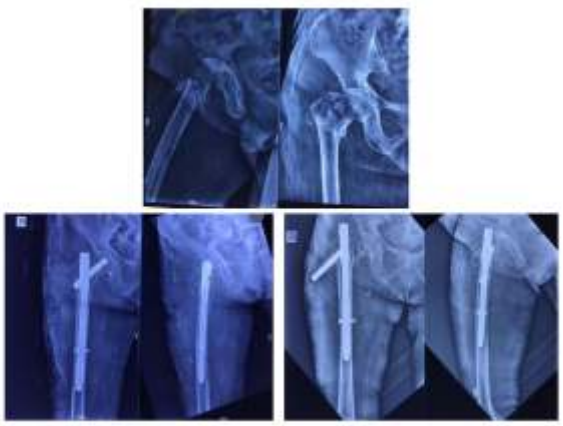

Figure 3: AO type 31A2.3 fracture with screw cut-out at 2 months post-operatively.

Three patients had complications in this series. One had implant failure. It occurred at second month post-operatively. There was screw back out (Figure 3). He opted to be transferred to another institution for further treatment. Other two patients had superficial infection that healed with local wound care and oral antibiotics. None of the latter two

cases needed further surgery. There was no incidence of femoral shaft fracture intra-operatively or during the follow-up period.

DISCUSSION

In our study, we evaluated the outcome of PFNA-II in the management of unstable intertrochanteric fracture in elderly patients. Because of the shorter average height of Asian population, the femoral length and femoral neck diameter are relatively shorter as compared to Europeans.[14] The standard PFNA has medio-lateral anglulation of 6 degrees and proximal diameter of 17 mm, whereas PFNA-II has medio-lateral angle of 5 degrees and proximal diameter of 16.5 mm. Studies have shown that over-reaming of the canal weakens the entire shaft and can result in increased blood loss.[15,16] Moreover, the mismatch in geometry between the nail and proximal femur is the most probable cause of fracturing of the lateral cortex. The PFNA-II has a considerably better anatomic fit in Asian population. So, it effectively decreases the hoop stress inside the femoral canal which may have led to a significant decrease in intra operative and postoperative complications.

In our study, among 36 initial cases, 6 were lost to follow up. 1 patient who had implant failure opted out of the study and went to another institution for further management. The patient had AO/OTA type 31A2.3 fracture and had good reduction postoperatively. The position of the helical blade was not in centre-centre position as per Cleveland index. The blade was centre in antero-posterior view and anterior in lateral view. The TAD was less than 25 mm. However he presented with implant failure in the second month. So only remaining 29 patients were included in the study and those all patients had satisfactory outcome according to mHHS. Study conducted by Kumar et al in 2015 had 92.9% satisfactory outcome with PFNA-II in 45 patients.[17] Similarly, study by Li et al had mHHS score of 86.19 (range, 58 – 93) among PFNA-II group. In the same study he found that PFNA-II is superior to PFNA in terms of surgical time, intraoperative blood loss, and postoperative complications.[15]

Baumgaertner et al. described a lower complication rate for implant tips placed close to the subchondral bone of the femoral head and recommended TAD of 25mm or less.[11] In a study by Mallya et al, there were more patients with poor functional outcome when TAD was more than 25 mm.[18] However, in case of PFNA, Nikoloski et al proposed that helical blade behaved differently to a screw in the femoral head and recommended the TAD to be kept between 20-30 mm. They observed higher rate of cut out or cut through when TAD was either more than 30 mm or less than 20mm.[19] Brunner et al. reported three cases of postoperative perforation of the helical blade through the femoral head into the hip joint, and in cases of severe osteoporosis they recommended that pre-reaming of the blade 5 mm below the joint should not be performed.[20] In our series, range of TAD was 18–28 mm. There were 5 patients with TAD less than 20 mm in our study but all of them had TAD of 18 mm or more. Three of them had fair and two had good functional outcomes at one year. In addition, two patients in this series who had TAD more than 25 mm had good outcome.

CONCLUSION

This study showed that good clinical outcome can be obtained when acceptable radiological parameters are restored. Good intra-operative fracture reduction, and optimal positioning and length of helical blade are crucial. A good clinical outcome was obtained in our cohort of patients with unstable intertrochanteric fracture in whom PFNA-II was used.

LIMITATION OF THE STUDY

This study has number of limitations. The sample size was insufficient to generalize the results. Although the follow up of the study is short, the study population was followed up to fracture union or need for revision in one patient. This pooled patient cohort involved all Orthopaedic surgeons working in the institution, thus introducing the bias of variations in technique.

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CONFLICT OF INTEREST

None

FINANCIAL DISCLOSURE

No benefits in any form have been received from commercial party related to the subject of this article

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