Section: Orthopaedics

Original Research Article

OUTCOME COMPARISON OF TROCHANTERIC FRACTURES TREATED WITH CEPHALOMEDULLARY NAILS

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ABSTRACT

Background: The aim is to assess the outcome of pertrochanteric fractures treated with cephalomedullary nails. To compare the results between two nailing systems: ZNN (Zimmer Natural Nail) and PFNA (Proximal Femoral Nail Antirotation).

Materials and Methods: A total of 43 patients who underwent either ZNN or PFNA between January 2014 to October 2015 were included in the study. Fractures were classified according to the AO system. The parameters assessed were type of reduction, TAD, position of screw in the Cleveland zone, amount of sliding, complication and mortality. Multivariate analysis was done. Functional outcome assessed by Harris Hip score was also compared between the groups.

Results: Out of 43 patients, 5 were lost to follow-up. Of the 38 patients followed up 50% were women. The average age was 67 years (range20-87). The 1-year mortality was 9(24%). There were no significant differences in the use of either nail in terms of TAD, amount of nail sliding and screw penetration into joint. There was a significant difference in the position of screw in Cleveland zone (p = 0.04). Functional outcome was comparable between the groups.

Conclusion: There is predominantly excellent outcome of Pertrochanteric fractures treated with cephalomedullary nails. The ZNN and PFNA have no difference in outcome.

Keywords: TAD, Per trochanteric fractures, Haris Hip score

INTRODUCTION

Hip fractures represent a common type of injuries; its number is increasing rapidly [1]. By 2050, the number of hip fractures is estimated to be around 6.3 million.[1,2] The 1-year mortality for hip fractures range from 14% to 36%.[3] Hip fractures include femoral neck and intertrochanteric factures;[4] 20 to 30 percent of patients die in the first 12 months after an intertrochanteric fracture, especially those elderly with limited activity.[5,6] Surgical treatment represents the optimal strategy for managing intertrochanteric fractures. It should allow early rehabilitation and functional recovery, and reduce the risk of postoperative complications.[7]

Internal fixation is a most common method of treatment for intertrochanteric fractures[3]. Intramedullary (nails) and extramedullary (screws or plates) fixations are two commonly used approaches.[8] The established benefits of internal fixation treatments are immediate pain relief, rapid mobilization, accelerated rehabilitation and maintenance of independent living. Surgical stabilization of these fractures remains a challenge. Dissatisfaction with extra medullary devices especially in unstable fractures, led to the evolution of intramedullary devices. The purpose of this study is to compare the radiological and functional outcomes of patients with pertrochanteric fractures who were treated using PFNA and ZNN.

MATERIALS AND METHODS

The study group comprised 43 patients with pertrochanteric femoral fractures treated using either PFNA or ZNN between January 2014 to October 2015. 5 patients were excluded from the study due to loss of follow up. Therefore, 38 patients were retrospectively evaluated and patient data were collected from electronic files of the patient and picture archiving system. The inclusion criteria were patients with isolated intertrochanteric fractures classified according to The AO system. Patients with pathological fracture were excluded. Surgery was performed at the earliest time after the completion of anesthesia consultation. Procedures were performed on a fracture table. Quality of Reduction and implant positions were confirmed by fluoroscopic images. Prophylaxis for infection was administered for 10 days. TAD was calculated in the immediate postoperative x ray. It was calculated as described by Baumgaerter et al. [9] The tip apex distance is defined as the sum of distance, in millimetres from the tip of the lag screw to the apex of the femoral head, as measured on the anteroposterior radiograph and distance measured on a lateral radiograph, after correction has been made for the magnification TAD=TADAP+TADLAT. The quality of reduction was modified from the system of Baumgaertner et al. based on immediate postoperative AP and lateral radiographs [10]. For both fracture types, reductions were evaluated on the basis of displacement and angulation, and categorized as good, acceptable, or poor. A reduction met the displacement criteria if there was less than 4 mm of displacement on either the AP or lateral X-ray. The angulation criteria were met if the neck shaft angulation was normal or slightly valgus (130–150°) and there was less than 20 degrees of angulation on the lateral X-ray. A reduction was categorized as good if it met both criteria, acceptable if it met one criterion and poor if it met neither criterion. The position of lag screw in the femoral head was charted by method described by parker et al., to measure the influence of lag screw placement on migration. The femoral head was divided into 9 sectors by drawing 2 parallel lines in the antero posterior (AP) radiograph to divide superior and inferior parts and 2 parellel lines lateral radiograph to divide anterior and posterior part. The position of the lag screw tip within the femoral head was then measured and charted upon the nine sectors of the head [Figure 1]. The amount of lateral lag screw slide was measured by comparing the immediate postoperative and final AP radiographs. Functional outcome at follow up was measured using Harris hip score at two years of follow up. Other complications such as screw penetration, implant breakage were also collected from the available data.

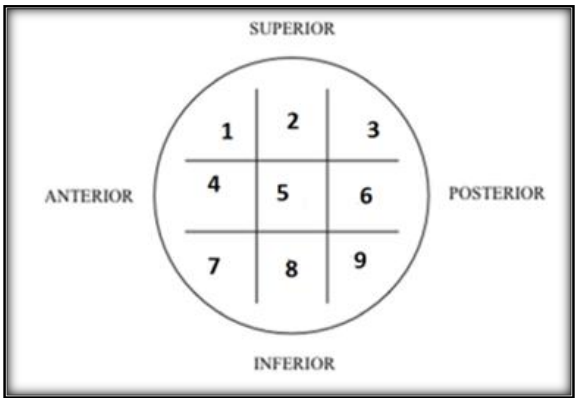

Figure 1: Cleveland zones

RESULTS

The demographic data are shown in [Table 1]. The patients in both groups had similar mean ages. Twenty patient (11males and 11 females) were treated with PFNA and the mean age of these patients was 68.8±6.4years. Sixteen patients (8 males and 8 females) were treated with ZNN, and the mean age of these patients was 65.25±5.6 years. In both groups AO type A2 PFNA 14(64%), ZNN 12(75%) were common. The most common mode of injury in both groups was trivial fall PFNA 17(77%), ZNN 14(88%). In PFNA the quality of reduction was as follows:10patients (45%) were classified as had good reduction quality,11(50%) was classified as had acceptable reduction quality, and 1(5%) were classified as had poor reduction quality. In ZNN the quality of reduction was as follows: 8 patients (50%) were classified as had good reduction quality, 7(44%) were classified as had acceptable reduction quality, and 1(6%) were classified as had poor reduction quality. In our study Tip Apex Distance was comparable between two groups the mean TAD in PFNA 16.54±4.2mm and ZNN 15.68±5.10mm [Table 2].

Table 1: Demographic Data

	PFNA (n=22)	**ZNN(n=16)**
Sex(M/F)	11/11	8/8
Average age (YEARS)	68.8±6.4years	65.25±5.6years
Fracture classification (AO)		
A1	7(32%)	1(6%)
A2	14(64%)	12(75%)
A3	1(4%)	3(19%)
Side (Right/Left)	7/15	8/8
Mode of injury		
RTA	5(23%)	2(12%)
Trivial fall	17(77%)	14(88%)
Average follow up months	24	24
PFNA:Proximal femoral nail anteversion, ZNN:Zimmer natural nail: M: male F: female		

In our study the location of the blade with in the head was recorded as per the Cleveland method, The Cleveland zone 5 centre-centre [Figure 1] was the most common placement of the tip of the blade on the post operative radiographs in both group accounting for 14(64%) in PFNA group and 10(63%) in ZNN. The location of the blade in various zone described in [Figure 2] for both groups. There was statistical significance of centre-centre zone 5 screw placement in the Cleveland zone with p=0.040 using chi square test. The various location of blade/lag screw for both groups described in [Figure 2-3].

Table 2: Comparison of radiographic evaluation results between the two groups

	PFNA (n=22)	ZNN(n=16)
Fracture quality reduction		
Good	10(45%)	8(50%)
Acceptable	11(50%)	7(44%)
Poor	1(5%)	1 (6%)
Tip apex distance (mm)(mean±SD)	16.54±4.2mm	15.68±5.10
PFNA: Proximal femoral nail antirotation, ZNN: Zimmer natural nail mm:millimeter		

Table 3: Outcomes and complication between two groups

	PFNA (n=22)	ZNN (n=16)
Radiological union	15(68%)	11(69%)
Screw cutout	Nil	Nil
Screw penetration	2(9%)	1(6%)
Implant failure	1(5%)	1 (6%)
Mortality	4(22%)	3(18%)
Harris hip score (mean)	90	92
PFNA:Proximal femoral nail antirotation ,ZNN:Zimmer natural nail: M: male F: female		

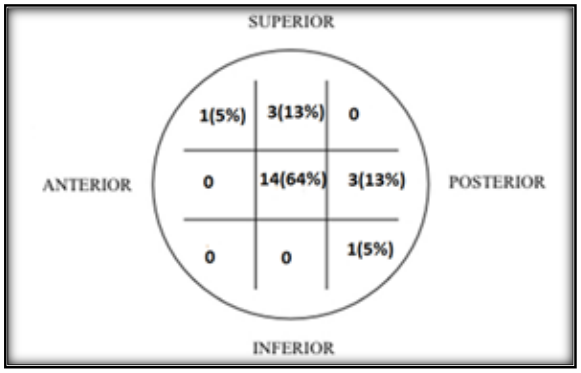

Figure 2: Cleveland index distribution PFNA

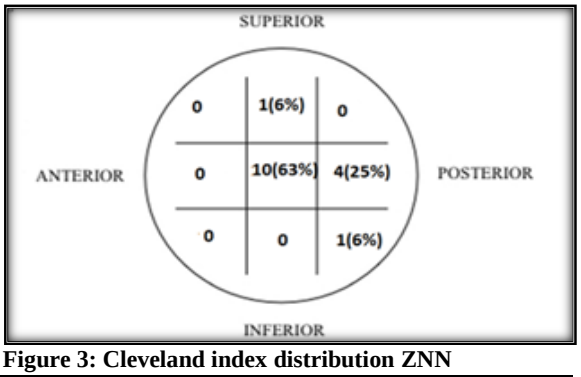

Figure 3: Cleveland index distribution ZNN

In our study we also found the lateral slide of the lag screw as more in the PFNA 7.25mm(n=18) when compared to the ZNN group, which was 4.85mm(n=13). The functional outcome score calculated using harris hip score was comparable between two groups with mean score of 90 in PFNA group and 92 in ZNN group. In PFNA group (n=22),15(68%) patient had radiological union with excellent functional outcome,2(9%) patients had screw penetration and 1(5%) had a implant breakage which was revised,4(22%) patients were dead during follow up in PFNA group. In ZNN group (n=16),11(69%) patient had radiological union with excellent functional outcome,1(6%) patients had screw penetration and 1(6%) had a implant breakage which was revised,3(18%) patients were dead during follow up in ZNN group [Table 3]. There was no screw cutout in both groups.

DISCUSSION

The incidence of intertrochanteric hip fractures increases as the population ages. Elderly patients have a high risk of developing postoperative complications such as wound infections, pneumonia, urinary tract infections, and cardiovascular disease. Due to poor bone quality, fracture fixation remains a challenging task in the elderly. Despite the various implants suitable for fixation, the most popular implant in the treatment of per trochanteric fractures is not yet clear. [11,12] Our study revealed that both ZNN and PFNA are reliable devices for the surgical management of intertrochanteric fractures in elderly patients with high union rate, fewer postoperative complication rates. However the choice of the unstable intertrochanteric fracture is still debatable. PFNA2 are now favoured in the west and there are multiple studies to support this. [13-15] The change in the helical blade was aimed to decrease the risk of cut out. However, the cut out of helical blade still remains the common cause of failure. The various studies that have reported the wide range of cut out rates varying from 2-25%.[16-18] The design of helical blade was quoted as a possible reason for cut out and medial perforation of subchondral bone.[16] There was no screw cut out in our study in PFNA group. Baumgaertner et al,[10] have documented that the optimal placement of the lag screw was in the

centre/centre position. The correct placement of the lag screw and helical blade at the centre of the femoral head and neck is important in both the antero-posterior and axial views. TAD is one of the most important predictive factors for the occurrence of a cut out.[19,20] Geller et al. reported 44% of cut outs in intertrochanteric fractures fixation with TAD of > 25 mm and did not cut out with TAD of < 25 mm 21.Nikoloski et al. hypothesized that the helical blade behaved in different way to a screw in the femoral head and recommended the TAD to be kept between 20-30 mm.[22] In our study the mean the tip apex distance in both the groups were less than 25mm with mean of (15-25mm) and the most common screw placement in the head is centre-centre zone in Cleveland zone. In ZNN group one patient(6%) had type A3.1 fracture, screw penetrated into the joint at 6 months follow up whose tip apex distance is 15mm, lag screw was in centre-centre and reduction was acceptable, this patient was revised to shorter lag screw functionally doing well at two years of follow up. [Figure 4]

Figure 4: A. Patient with type A 3.1 fracture. Immediate post op C. At 6 weeks follow up D. At 3months follow up screw penetrated into the joint E.Revised to shorter lag screw.

In our study the mortality of inter trochanteric fracture between two groups PFNA 4(22%) and ZNN 3(18%) was comparable with various other studies. The 1-year mortality for hip fractures range from 14% to 36%3. Jee-Hoon Kim, stated ZNN showed a shorter sliding distance of cervical screw, but they were not statistically different23. In our study we observed that the amount of lateral lag screw slide was more in the PFNA group compared to ZNN group similar to the above mentioned study.

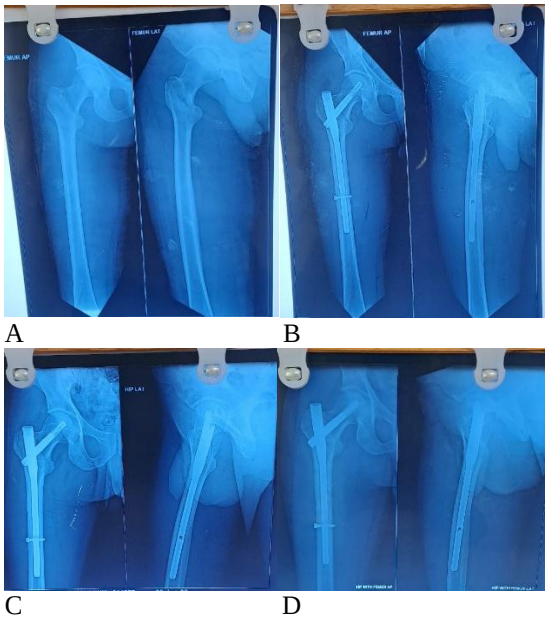

Figure 5: A. Preoperative x-ray B. Immediate post op surgical fixation with PFN A C. At 3 months follow up D. At 2 years follow up.

There are several studies which states successful outcome with low complication rates with cephalomedullary nails for intertrochanteric fracture similar to our study. Hence we conclude there is predominantly excellent outcome of per trochanteric fractures treated with cephalomedullary nails. The ideal position of lag screw placement in the femoral head is Cleveland zone 5 i.e centre and anteroposterior and centre in lateral with good reduction necessary for excellent functional and radiological outcome [Figure 5]. The recommended tip apex distance is 25mm with mean of (15-25mm). The ZNN and PFNA have no difference in the outcome.

Limitations: This study is attributed to all the retrospective design relying on the available data. The sample size is small with wide variability of age.

CONCLUSION

Both PFNA and ZNN are reliable device for the treatment of pertrochanteric fracture. They have high union rate with lower rates of postoperative complication. An important point in achieving good results and avoiding cut out complications in trochanteric fracture is to avoid varus reduction and anterior-superior blade or screw position.

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