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Comparative Study of the Clinico-Radiological Outcomes of Fixation of Unstable Intertrochanteric Fractures with Standard Proximal Femoral Nail (PFN) and Proximal Femoral Nail Antirotation for Asia (PFNA2)

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Abstract

Introduction: Intertrochanteric fractures are common in elderly individuals with osteoporosis, where surgical fixation is crucial for reducing complications and promoting early mobilization. Proximal femoral nails (PFN) have been widely used for unstable intertrochanteric fractures, but complications such as screw cut-out and rotational instability persist. The PFNA2, featuring a helical blade, has been developed to improve fixation in osteoporotic bone by enhancing stability.

Materials and Methods: A prospective comparative study was conducted on 50 patients with unstable intertrochanteric fractures (AO 31.A2 and 31.A3). Group A (n=25) underwent surgical fixation using PFN, while Group B (n=25) received PFNA2. Patients were followed for six months, with clinical outcomes assessed using the Harris Hip Score and radiological outcomes by bone union time. Both groups had similar demographic and fracture characteristics.

Results: The mean age of patients was 60.75 years in Group A and 64.37 years in Group B. PFNA2 showed a significantly faster mean union time (14.69 weeks) compared to PFN (18.47 weeks). Harris Hip Scores improved significantly in both groups over time, with better results in PFNA2 group. Complications were lower in the PFNA2 group as well.

Conclusion: PFNA2 demonstrated superior clinico-radiological outcomes and fewer complications compared to PFN for unstable intertrochanteric fractures, suggesting it may be a better implant choice, particularly in osteoporotic patients.

Keywords: Proximal Femoral Nail; Asia; Clinico-Radiological; Intertrochanteric fractures; Osteoporosis

Introduction

Intertrochanteric fractures of the femur are very common in elderly individuals with osteoporosis. Prolonged bed rest after a hip fracture is linked to higher mortality rates in this patient group. Surgical intervention has become the standard approach to achieve proper fracture reduction and promote early mobilization in elderly patients with osteoporosis [1]. Achieving successful fixation is crucial in this patient population, as implant failure can lead to severe complications, and revision surgery is highly risky due to their poor overall health. Consequently, identifying the ideal implant for long-lasting fixation in such fractures has been the focus of ongoing research for years.

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The dynamic hip screw, though widely regarded as the gold standard for stable fractures, has been found inadequate for treating unstable intertrochanteric fractures [2]. For these unstable fractures, the preferred method is using an intramedullary nail combined with a dynamic femoral head/neck stabilization implant [3]. Over time, different nail designs, featuring either a single compression screw or a combination of compression and anti-rotation screws (such as the PFN), have gained popularity in managing unstable fractures. Although the PFN has demonstrated superiority over extramedullary devices for unstable intertrochanteric fractures, complications like screw cut-out, back-out, varus collapse, and rotational instability remain significant, with complication rates as high as 31% reported in the literature [4].

The PFNA2 was developed to enhance stabilization of the femoral head and neck by using a single helical blade instead of a screw for fixation. This helical blade is believed to improve the bone-implant interface and compact cancellous bone, resulting in greater fixation stability [5]. The blade can be inserted without removing bone from the head/neck fragment, offering better anchoring, especially in osteoporotic bone. Biomechanical studies have demonstrated that the helical blade, through bone compaction, provides superior resistance to both rotational movement and varus collapse [6].

This prospective study was performed to compare the clinic-radiological outcomes and complications with the use of PFN and PFNA2 in treatment of unstable intertrochanteric fractures.

Materials and Methodology

The study was a prospective comparative study which included 50 patients divided into two groups A and B of 25 patients each with group A being patients with intertrochanteric fracture surgically intervened with PFN and group B being patients which were surgically intervened with PFNA2. All skeletally mature patients with unstable intertrochanteric AO 31.A2 and 31.A3 fractures who meet the pre-defined inclusion criteria were selected and split randomly in both groups. The inclusion criteria included patients aged above 18 years who gave consent for surgical intervention with closed unstable intertrochanteric fractures with no known co-morbidities. The study also took into account the exclusion criteria's which were patients below the age of 18 years, patients not providing consent, patients with compound or stable intertrochanteric fractures and patients with known co-morbidities such as Diabetes mellitus or Hypertension. All the patients of either group were followed up for a minimum of six months and results compared and interpreted.

Upon admission, patients were subjected to preliminary management with skin traction and supportive treatment. Then after attaining anaesthetic clearance, patients were planned for surgery. All patients were taken over operating table after taking informed consent and spinal anaesthesia was administered. Thereafter traction table was applied and reduction was achieved and confirmed under fluoroscopy. The entire surgical procedure was similar in both cases except for the application of the implant and its proper mechanisation.

After proper scrubbing, painting and draping of the parts, an incision of approximately 3cms was made around 2-3cms proximal to the tip of greater trochanter of femur. Thereafter, Tensor Fascia Lata was incised to feel the trochanteric area which was confirmed under fluoroscopy. Then using a curved awl, an entry point was made just medial to the tip of greater trochanter of femur which was followed by insertion of guide wire through it and progressed across the fracture site under fluoroscopic visualisation. Thereafter, proximal reaming was done with a proximal reamer and a PFN or PFNA2 was inserted through it after mounting it onto a jig.

Thereafter another incision of approx. 3cm was made over the proximal locking site and guide wire was placed accordingly in both groups followed by application of protection sleeves. Guide wire was placed centrally in both AP and Lateral views and a Tip Apex Distance of 20mm was kept as reference ending just proximal to subchondral region of femoral head (Figure 1). This was followed by reaming with 8mm and 6.4mm reamers in standard PFN group and Lateral cortex entry was made using lateral cortex opener and reaming done in PFNA2. Lag and de-rotation screws of appropriate sizes were measured and placed in standard PFN group (Figure 2). In case of PFNA2 group, appropriate size helical blade was fixed to the impactor and attached to it by counter-clockwise turns prior to impaction. Then the impactor is advanced by gentle hammering and once impacted, the helical blade was locked with clockwise turns. Thereafter, distal locking was done and final reduction was visualised under fluoroscopy. This was followed by thorough wound wash and closure of wound in layers followed by proper aseptic dressing (Figure 3).

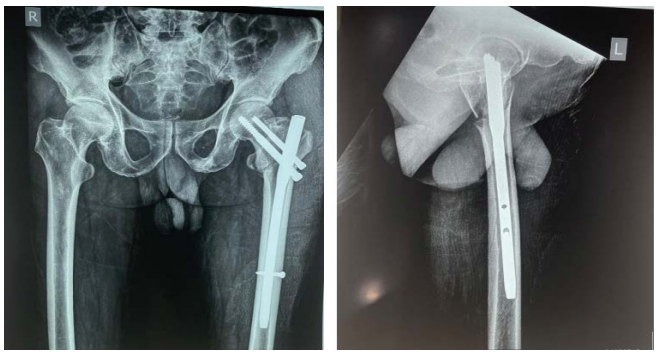

Figure 1: Post-op X-ray film of patient managed with standard PFN.

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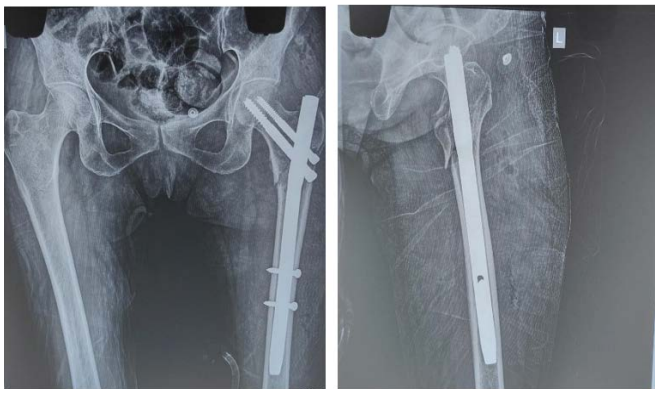

Figure 2: Post-op X-ray film of another patient managed with standard PFN.

Figure 3: Post-op X-ray film of patient managed with PFNA2.

The patients from both the groups were then discharged after suture removal on 12th post op day and were followed up after 3 weeks, 3 months and 6 months. Upon each visit, the patients were subjected to clinical examination and radiological investigations which were then compiled and compared. The clinical outcome of the patient was measured and compared using Harris Hip score whereas the radiological outcome was assessed by determining the duration required to achieve union in weeks. The study also took into consideration any complications that developed in any cases from either group.

Result

The mean age of the patients in group A was 60.75 ± 8.40 years and 64.37 ± 4.58 years in group B. There was no significant difference in mean age between the two groups (p=0.059). In group A, 65% patients had a simple fall whereas 35% had a road traffic accident. In group B, 70% of the patients had a simple fall whereas 30% had experienced a road traffic accident. In group A, 70% had A2 fracture and 30% had A3 fractures whereas in group B, 65% had A2 fracture and 35% had A3 fracture. There was no difference in fracture pattern between both groups (p=0.736) or in terms of duration of surgery (p=0.117). Harris Hip Score was measured and compared in both groups which showed insignificant value at 3 weeks follow up but showed significant values at 3 and 6 months follow up as demonstrated in Table 1.

Table 1: Harris Hip Score comparison between both groups.

	Group A		Group B		Total		P value
	Mean	SD	Mean	SD	Mean	SD	
3 Weeks	62.41	2.14	68.74	1.67	65.57	1.81	0.493
3 Months	66.82	2.66	78.9	3.01	72.86	2.92	0.038
6 Months	76.23	3.18	88.57	2.24	82.4	2.63	0.014

Furthermore, the mean duration of union of bone in group A was found to be at 18.47 ± 2.52 weeks whereas that for group B was found to be 14.69 ± 3.27 weeks. In addition to these data's, a total of 4 patients suffered from superficial infection (group A- 3 and group B- 1) which was managed with an extended course of antibiotics. No cases reported Z-effect or reverse Z-effect. No cases were reported to have suffered from implant breakage or screw back-out or screw/ blade cut out.

Discussion

At present it is generally believed that all Intertrochanteric fractures should be internally fixed to reduce the morbidity and the mortality of the patient. But the appropriate method and the ideal implant of choice to fix the Intertrochanteric fracture is still a debate, as each method has its own pros & cons. Proximal femoral nail was noted to be more useful in unstable and reverse oblique patterns due to the fact that it has better axial telescoping and rotational stability as it is a load sharing device [7,8]. 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 [9]. The Asia proximal femoral nail anti-rotation (PFNA2) was specifically designed for Asian patients to avoid these problems, which was designed to have a mediolateral angle of 5° 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 [10].

Biomechanical studies have proven that osteoporosis is an important determinant of screw migration in the proximal femur, thereby predisposing to implant failure [11]. Clinical studies have also shown that osteoporosis is associated with inferior outcomes in intertrochanteric fractures [12]. Therefore, various methods are being used in attempt to improve fixation in osteoporotic intertrochanteric fractures, including cement augmentation and improvements in implant design [13].

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Mora A et al. [14], compared the PFNA2 (helical blade) with PFN and found a lower incidence of cut-out with the PFNA. Choo SK et al. [15], found less postoperative sliding of the PFNA2 compared to PFN. Park JH et al. [16], found significantly better social function scores, mobility scores and complication rates with helical blade nails. Gardenbroek et al. [17], in their study found that the risk of a secondary late complication and re-surgery is much higher with a PFN than the helical blade device. Our study also found better clinic-radiological outcomes in unstable intertrochanteric fractures managed with PFNA2 as compared to standard PFN.

Conclusion

This study has shed significant light over the choice of implant impacting the management and outcome of intertrochanteric fractures. On the basis of the study, it can be concluded that PFNA2 acts as a better implant as compared to standard PFN for unstable intertrochanteric fractures. It allows better clinic-radiological outcomes than the other implants and allows patients an early return to their normal life. It also has an advantage in terms of complication rates as well as in difficult settings of severely osteoporotic bones. Nevertheless, it must be remembered that no implant design can compensate for poor reduction or poor implant placement in these fractures and further study is warranted in a larger population size to come to a final result.

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