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Original Research Article

A Clinical Randomized Study Assessing Long Proximal Femoral Nail versus Short Proximal Femoral Nail in Treatment of Unstable Intertrochanteric Fractures

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Abstract

Aim: The purpose of this study was to study and compare the effectiveness and the disadvantages of intramedullary devices, i.e. short vs long PFN in the management of unstable IT fractures.

Methods: The present study was conducted at Department of Orthopaedics for 12 months and with trochanteric fractures was operated at our hospital. Out of the 200 patients, Group A patients were operated with short Pfn and Group B were operated with long pfn.

Results: The mean age of patients in both groups was 63.47±8.42 years and 65.45 ± 8.32 years respectively and did not differ significantly (p =0.619). Further, the subjects of two groups were also gender matched as the number of females and males 62% and 38% in group A and 59% and 41% in group B respectively. The mean operative time was significantly lower in group B as compared to group A (36.34 ± 6.04 minutes vs. 44.26 ± 8.20 minutes, (p <0.001). Mean blood loss was also significantly lower in group B as compared to group A (58.72±15.75 ml vs. 78.72±16.34 ml, (p<0.001). The mean number of images taken per-op was significantly lower in group B as compared to group A (19.51±3.16 vs 28.52±4.76 (p <0.001). The loss of reduction including shortening (>1 cm) (p =0.678) and varus malalignment (p =0.590) were similar between the two groups though they were relatively lower in group as compared to group A.

Conclusion: Use of Long PFN has advantages over short PFN in terms of the less postoperative complications like peri implant fracture and anterior thigh pain & better functional outcome. The terms of successful outcome include a good understanding of fracture biomechanics, proper patient selection, good preoperative planning and accurate instrumentation.

Keywords: Bone nails; Fracture fixation, Intramedullary; Hip fractures; Unstable it fractures; Short PFN.

Introduction

As the life expectancy has increased worldwide in recent years, a considerable increase has occurred in the incidence of proximal femoral fractures. [1] They are usually complicated with associated co-morbidities like osteoporosis, diabetes, hypertension, renal failure. In such circumstances, non-operative treatment is mainly reserved for poor medical candidates and non-ambulant patients with minimal discomfort after fracture. Today operative treatment has largely replaced conservative measures and the goal of treatment is to achieve accurate or acceptable anatomical and stable reduction with rigid internal fixation in order to achieve early mobilization of patients and prevent complications of prolonged recumbence. Despite marked improvements in implant design, surgical technique and patient care, peritrochanteric fractures continue to consume a substantial proportion of our health care resources and remain a challenge to date. [2] Complications with peri trochanteric fractures arise primarily from fixation rather than union or delayed union because the peri trochanteric area is made up of spongious bones. [3]

The strength of the fracture fragment-implant assembly depends upon various factors including (a) bone quality, (b) fragment geometry, (c) reduction, (d) implant design and (e) implant placement. Of these factors, surgeon can only control the quality of the reduction, choice of implant and its placement. In cases of intertrochanteric fractures, the preferred type of

fixation device is controversial. The sliding hip screw is a widely used extramedullary implant in the treatment for hip fractures. However, studies have reported that this implant is not appropriate for unstable intertrochanteric fractures, and have supported various alternative modalities of fixation. [4,5]

Operative treatment is the best option in trochanteric fractures. [6] Conventional implants like dynamic hip screw, angular blade plates or cephalo medullary nails can be used for the successful treatment of these fractures. [7] The theoretical advantages proposed of the nail include percutaneous insertion and improved fracture fixation biomechanics. [8,9] Biomechanically very large force is required to produce the medial displacement of femoral shaft with intramedullary device which is a common complication of extramedullary devices. [10] The use of intramedullary devices allows a faster restoration of postoperative walking ability, when compared with extramedullary sliding devices. [11]

The purpose of this study was to study and compare the effectiveness and the disadvantages of intramedullary devices, i.e. short vs long pfn in the management of unstable IT fractures.

Materials and Methods

The present study was conducted at department of Orthopaedics, Sri Krishna Medical College and Hospital, Muzaffarpur Bihar, India from March 2022 to February 2023 and with trochanteric fractures was operated at our hospital. Out of the 200 patients, Group A patients were operated with short Pfn and Group B were operated with long pfn.

Patients with pathologic fractures, open fractures, polytrauma, neuromuscular disorders or severe cardio-pulmonary insufficiency were excluded. 100 patients fulfilling inclusion and exclusion criteria were randomized into 2 groups. All patients gave written informed consent before the surgery. Surgical exposures were similar to both implants except for the techniques and instrumentation used in either systems. Background and demographic variables including age, gender associated comorbidities and pre-injury ambulatory status were recorded. Fractures type was assessed and recorded as per AO/ASIF classification system using orthogonal radiographs of the affected hip.

All patients were administered spinal or epidural anaesthesia and positioned supine on a fracture table prior to closed reduction of fracture. Per operatively, the duration of surgery, amount of blood loss, number of images shot on the image intensifier was recorded. All patients received three doses of prophylactic antibiotics including the pre-op dose given within 30 minutes prior to skin incision. Post operatively all patients received thrombo-prophylaxis with low molecular weight heparin for the duration of hospital stay or first 10 post-op days, whichever was shorter, followed by Aspirin for 4 weeks. All patients were allowed touch down weight bearing ambulation using a walking frame starting from the first post op day till 6 weeks, following which progressive weight bearing was allowed depending on the status of fracture union. Clinical and radiological assessment of fracture union/complications for all the patients was done pre-operatively and post-operatively at 06 weeks, 3months, 6months and 1year. Functional evaluation was done at 1year post op using Harris Hip Score.

Statistical Analysis

Statistical analysis was done using SPSS software (IBM Version-20). Statistical difference between continuous variables was assessed using Student t-test. Categorical variables were compared using Chi square test. Statistical significance was set at P value of 0.05 or less.

Results

Table 1: Demography and basic characteristics of the two groups

Basic characteristics	Group A (n=100)	Group B(n=100)	P Value
Age (years)			0.610
Mean ± SD	63.47±8.42	65.45 ± 8.32	
Range (min tomax)	(51 to 82)	(51 to 84)	
Gender			1.000
Females	62 (62%)	59 (59%)	
Males	38 (38%)	41 (41%)	
AO classification			0.412
31A-2.2	69 (69%)	73 (73%)	
31A-2.3	19 (19%)	11 (11%)	
31A-3.1	12 (12%)	10 (10%)	
31A-3.2	0	6 (6%)	

The mean age of patients in both groups was 63.47±8.42 years and 65.45±8.32 years respectively and did not differ significantly (p =0.619). Further, the subjects of two groups were also gender matched as the number of females and males 62% and 38% in group A and 59% and 41% in group B respectively.

Table 2: Operative details of the two groups

Operativedetails	Group A (n=100)	Group B (n=100)	P value
Duration (minutes)			
Mean ± SD	44.26 ± 8.20	36.34 ± 6.04	P<0.001
Range (min to max)	(30 to 60)	(30 to 50)	
Blood loss (ml)			
Mean ± SD	78.72 ± 16.34	58.72 ± 15.75	p<0.001
Range (min to max)	(60 to 120)	(40 to 100)	
Images (no)			
Mean ± SD	28.52 ± 4.76	19.51 ± 3.16	p<0.001
Range (min to max)	(24 to 40)	(15 to 26)	

The mean operative time was significantly lower in group B as compared to group A (36.34±6.04 minutes vs. 44.26±8.20 minutes, (p <0.001). Mean blood loss was also significantly lower in group B as compared to group A (58.72±15.75 ml vs. 78.72±16.34 ml, (p<0.001). The mean number of images taken per-op was significantly lower in group B as compared to group A (19.51 ± 3.16 vs 28.52 ± 4.76 (p <0.001).

Table 3: Loss of reduction

Loss of reduction	Group A (n=100)	Group B(n=100)	P-value
Shortening (>1 cm)			
No	84 (84%)	88 (88%)	0.678
Yes	16 (16%)	12 (12%)	
Varus malalignment			
No	95 (95%)	97 (97%)	0.590
Yes	5 (5%)	3 (3%)	

The loss of reduction including shortening (>1 cm) (p =0.678) and varus malalignment (p =0.590) were similar between the two groups though they were relatively lower in group as compared to group A.

Table 4: Final outcome measures

Final outcome measures	Group A (n=100)	Group B(n=100)	P-value
Mortality	3 (3%)	7 (7%)	0.565
Persistentpain	15 (15%)	10 (10%)	0.732
Use of walking aids	38 (38%)	22 (22%)	0.400
Return to pre fracture status	66 (66%)	78 (78%)	0.364
Harris hip score (1 year post operatively)			
Mean ± SD	87.3± 12.38	89.51±7.43	0.590
Range (min to max)	(50 to 95)	(64 to 95)	

3 patients in group A and 7 in group B died due to causes unrelated to the surgery. Among live patients, 15 patients in group A and 10 in group B had persistent pain in their affected hips at final follow- up, however the difference was not significant (p =0.732). 38 and 22 patients in group A and group B respectively used walking aids at the end of study period, however, the difference between them wasn't significant (p =0.400). 66 patients in group A and 78 patients in group B returned to pre fracture status. The return to pre fracture status also did not differ (p =0.364) between the two groups. The mean Harris hip score of PFNA group was relatively higher as compared to PFN group but the difference was not significant (p =0.590).

Discussion

5% of all hip fractures are intertrochanteric fractures and 35–40% of these fractures are unstable three- or four-part fractures and associated with high rates of morbidity and mortality. [12,13] Due to difficulty in obtaining anatomical reduction, management of the unstable intertrochanteric fractures in elderly patients is challenging and controversial. [14,15] In elderly, the IT fracture is one of the most common fractures of the hip. The rise In the IT fracture is because of the increase in number of elderly population with osteoporosis. These fractures are three to four times more common in women. The low energy trauma like a simple fall is usually the cause. By the year 2040 the incidence is estimate to be doubled.

The mean age of patients in both groups was 63.47±8.42 years and 65.45±8.32 years respectively and did not differ significantly (p =0.619). Further, the subjects of two groups were also gender matched as the number of females and males 62% and 38% in group A and 59% and 41% in group B respectively. The mean operative time was significantly lower in group B as compared to group A (36.34 ± 6.04 minutes vs. 44.26 ± 8.20 minutes, (p <0.001). Mean blood loss was also significantly lower in group B as compared to group A (58.72 ± 15.75 ml vs. 78.72 ± 16.34 ml,

(p<0.001). The mean number of images taken per-op was significantly lower in group B as compared to group A (19.51 ± 3.16 vs 28.52 ± 4.76 (p <0.001). The loss of reduction including shortening (>1 cm) (p =0.678) and varus malalignment (p =0.590) were similar between the two groups though they were relatively lower in group as compared to group A. 3 patients in group A and 7 in group B died due to causes unrelated to the surgery. Among live patients, 15 patients in group A and 10 in group B had persistent pain in their affected hips at final follow- up, however the difference was not significant (p =0.732). 38 and 22 patients in group A and group B respectively used walking aids at the end of study period, however, the difference between them wasn't significant (p =0.400). 66 patients in group A and 78 patients in group B returned to pre fracture status. The return to pre fracture status also did not differ (p =0.364) between the two groups. The mean Harris hip score of PFNA group was relatively higher as compared to PFN group but the difference was not significant (p =0.590). Our results are consistent with a study by Hou Z et al. who concluded that there were no significant difference between the two treatment modalities, complication and reoperation rates for the 2 groups. Treatment with a long nail showed increase in procedure time and blood loss. [16] A retrospective study by Boone et al. conducted in 2014 concluded that, statistically significant lower operative time, Blood loss, and transfusion rate were found in this study for short intramedullary nails. There were no differences seen in length of stay or peri implant fracture. The incidence of peri implant fracture and implant failures were very low in both cohorts which is similar to our results. [17]

However, a retrospective study conducted by Zhi Li et al. concluded that the long nail group had significantly lesser failure rate and hip pain rate than those with short nail. But the operative time was significantly longer in the former than the latter intra-medullary device. This was comparable to our study where mean operative time for long PFN group was longer than that of short. [18] A study conducted by Nicholas B Frisch et al. came up with the result that short nails had the advantage of a faster surgery and lesser blood loss but had a higher rate of peri-implant fractures as compared to longer intramedullary nails. We had one patient in short PFN group with peri implant fracture. [19]

A study conducted by Xue-Feng Guo et al. concluded that both the intramedullary long and short nail fixation has a good clinical effect in treating intertrochanteric femur fractures in the elderly. They showed no significant difference in terms of therapeutic effect, hospital stay and postoperative complications. The incidence of peri implant fractures treated by either length of nails was low. The same results were found in our study. [20] AO foundation recommends that a multi fragmentary intertrochanteric fracture without distal extension or without another fracture distally can be treated with a short intramedullary nail. Preoperatively the anterior bow of the femur of the uninjured extremity needs to be checked. If the tip of the nail comes to lie at the apex of the anterior bow, a long nail or a plate should be used instead.

Conclusion

Operating with PFN has distinct advantages. Early mobilization and weight bearing is allowed in patients treated with both short and long PFN thereby decreasing the incidence of bedsores, lung infections, deep vein thrombosis. Thorough preoperative planning and correct surgical technique, adequate reaming of the femoral canal, insertion of implant and meticulous placement of distal locking screws and early post-operative rehabilitation is essential for successful outcome. Hence we conclude, long PFN is effective treatment modality for stable intertrochanteric fractures, providing excellent functional outcome and regaining the pre-fall ambulatory status and avoids complications like periprosthetic fracture and anterior thigh pain which is found in short PFN group. However, proper operative technique is important for achieving fracture stability and to avoid major complications.

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