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Original Research Article

An Institutionalized Randomized Comparative Assessment of Long Proximal Femoral Nail versus Short Proximal Femoral Nail in Treatment of Unstable Intertrochanteric Fractures

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Conflict of interest: Nil

Abstract

Aim: The purpose of this study was to evaluate 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 Jawahar Lal Nehru Medical College & Hospital, Bhagalpur, Bihar, India for one year and with trochanteric fractures were operated at our tertiary care hospital. Out of the 100 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 64.36 ± 8.32 years and 65.36 ± 8.40 years respectively and did not differ significantly (p =0.662). Further, the subjects of two groups were also gender matched as the number of females and males 60% and 20% in group A and 58% and 42% in group B respectively. The mean operative time was significantly lower in group B as compared to group A (35.25 ± 6.03 minutes vs. 43.37 ± 8.12 minutes, (p <0.001). Mean blood loss was also significantly lower in group B as compared to group A (59.81 ± 14.96 ml vs. 77.83 ± 17.33 ml, (p<0.001). The mean number of images taken per-op was significantly lower in group B as compared to group A (18.62 ± 3.17 vs 29.51 ± 4.86 (p <0.001).

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

Proximal femoral fractures are most devastating injury. They commonly affect the elderly. The frequency of these proximal femoral fractures has increased primarily due to the increasing life span and more sedentary life style.

Intertrochanteric fractures constitute about 50% of all proximal femoral fractures. 90% of intertrochanteric fractures occur in elderly as a result of trivial trauma due to associated osteoporosis. IT fractures in younger individuals is a result of high velocity trauma. [1]

Operative treatment is the best option in trochanteric fractures. [2] Conventional implants like dynamic hip screw, angular blade plates or cephalo medullary nails can be used for the successful treatment of these fractures. [3] The theoretical advantages proposed of the nail include percutaneous insertion and improved fracture fixation biomechanics. [4,5] 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. [6] The use of intramedullary devices allows a faster restoration of postoperative walking ability, when compared with extramedullary sliding devices. [7]

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] As compared to extramedullary devices, intramedullary nails can be inserted with less exposure of the fracture, less blood loss, although they may require more fluoroscopic exposure. Biomechanically, nails allow for stable anatomical fixation of more comminuted fractures without shortening the abductor moment arm or changing the proximal femoral anatomy. [8]

As compared to extramedullary devices, intramedullary nails can be inserted with less exposure of the fracture, less blood loss, although they may require more fluoroscopic exposure. Biomechanically, nails allow for stable anatomical fixation of more comminuted fractures without shortening the abductor moment arm or changing the proximal femoral anatomy. [9] The common IM devices used for unstable intertrochanteric fractures today include proximal femoral nail (PFN) and proximal femoral nail antirotation (PFNA). 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. There are different studies available in literature claiming superiority of Gamma nail [10,11] and Short PFN [12-14] individually. Among Short PFN and Gamma nail, Short PFN had shown either equal results [15] or better results16 biomechanically in the management of unstable intertrochanteric fractures. [16]

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 Jawahar Lal Nehru medical College & Hospital, Bhagalpur, Bihar, India for one year and with trochanteric fractures were operated at our tertiary care hospital. Out of the 100 patients, Group A patients were operated with short Pfn and Group B were operated with long pfn.

Institutional ethical clearance was taken. 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=50)**	**Group B (n=50)**	**P Value**
Age (years)			0.662
Mean ± SD	64.36±8.32	65.36 ± 8.40	
Range (min to max)	(51 to 82)	(51 to 84)	
Gender			1.000
Females	30 (60%)	29 (58%)	
Males	20 (40%)	21 (42%)	
AO classification			
31A-2.2	34 (68%)	37 (74%)	0.475
31A-2.3	10 (20%)	6 (12%)	
31A-3.1	6 (12%)	5 (10%)	
31A-3.2	0	2 (4%)	

The mean age of patients in both groups was 64.36 ± 8.32 years and 65.36 ± 8.40 years respectively and did not differ significantly (p =0.662). Further, the subjects of two groups were also gender matched as the number of females and males 60% and 20% in group A and 58% and 42% in group B respectively.

Table 2: Operative details of the two groups

Operativedetails	**Group A (n=50)**	**Group B (n=50)**	**P value**
Duration (minutes)			P<0.001
Mean ± SD	43.37 ± 8.12	35.25 ± 6.04	
Range (min to max)	(30 to 60)	(30 to 50)	

Blood loss (ml)			
Mean ± SD	77.83 ± 17.33	59.81 ± 14.96	p<0.001
Range (min to max)	(60 to 120)	(40 to 100)	
Images (no)			p<0.001
Mean ± SD	29.51 ± 4.86	18.62 ± 3.17	
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 (35.25 ± 6.03 minutes vs. 43.37 ± 8.12 minutes, (p <0.001). Mean blood loss was also significantly lower in group B as compared to group A (59.81 ± 14.96 ml vs. 77.83 ± 17.33 ml, (p<0.001). The mean number of images taken per-op was significantly lower in group B as compared to group A (18.62 ± 3.17 vs 29.51 ± 4.86 (p <0.001).

Table 3: Loss of reduction

Loss of reduction	Group A (n=50)	Group B(n=50)	P value
Shortening (>1 cm)			
No	43 (86%)	45 (90%)	0.650
Yes	7 (14%)	5 (10%)	
Varus malalignment			
No	47 (94%)	48 (96%)	0.550
Yes	3 (6%)	2 (4%)	

The loss of reduction including shortening (>1 cm) (p =0.650) and varus malalignment (p =0.550) 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=50)	Group B(n=50)	P value
Mortality	2 (4%)	4 (8%)	0.550
Persistentpain	8 (16%)	6 (12%)	0.724
Use of walking aids	20 (40%)	12 (24%)	0.400
Return to pre fracture status	34 (68%)	20 (80%)	0.375
Harris hip score (1 year post operatively)			
Mean ± SD	86.8± 11.29	88.48±7.56	0.565
Range (min to max)	(50 to 95)	(64 to 95)	

2 patients in group A and 2 in group B died due to causes unrelated to the surgery. Among live patients, 8 patients in group A and 6 in group B had persistent pain in their affected hips at final follow- up, however the difference was not significant (p =0.724). 20 and 12 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). 34 patients in group A and 20 patients in group B returned to pre fracture status. The return to pre fracture status also did not differ (p =0.375) 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 =0.565).

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. [17,18] Due to difficulty in obtaining anatomical reduction, management of the unstable intertrochanteric fractures in elderly patients is challenging and controversial. [19,20] 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. In India the figures maybe much more.

The mean age of patients in both groups was 64.36 ± 8.32 years and 65.36 ± 8.40 years respectively and did not differ significantly (p =0.662). Further, the subjects of two groups were also gender matched as the number of females and males 60% and 20% in group A and 58% and 42% in group B respectively. 2 patients in group A and 2 in group B died due to causes unrelated to the surgery. Among live patients, 8 patients in group A and 6 in group B had persistent pain in their affected hips at final follow- up, however the difference was not significant (p =0.724). 20 and 12 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). 34 patients in group A and 20 patients in group B returned to pre fracture status. The return to pre fracture status also did not differ (p =0.375) 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 =0.565).

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. [21] 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. [22]

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. [23] 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. [24]

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. [25] 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. [26]

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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