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Orthopaedics

SHORT VS LONG PROXIMAL FEMORAL NAIL IN UNSTABLE INTERTROCHANTERIC FRACTURES OF FEMUR

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ABSTRACT **BACKGROUND;** The current methods of treatment of Inter Trochanteric fractures of femur are either DHS plating for a stable Intertrochanteric fracture or a Proximal Femoral Nail for an unstable IT fracture. There are increased surgical demands and complications associated with Unstable IT fractures. Fracture patterns like –Posteromedial large separate fragment, Basi cervical pattern, Reverse obliquity pattern, Displaced and/or avulsed greater trochanter, Lateral wall fractures pose challenges before operating surgeon. Failure to reduce the fracture before internal fixation and failure to hold the reduction till definitive fixation are the most frequent causes of poor results irrespective of the implant used for fixation. . Present surgeon's usual preference is towards long PFN. There is an added advantage of increased stability due to splinting of the whole length of femur with the use of long PFN. However there are times where short PFN is preferred over long one when there is a mismatch of curvature between the nail and the femur. However, there is no pre-established treatment choice protocol in choosing long nail or short nail for trochanteric fractures, but many surgeons are reluctant to use short proximal femoral nails biased by literature showing more fracture rates with short PFN usage and with a belief that long nails can avoid stress risers in the diaphysis and make peri- prosthetic fracture rates acceptable. Some of the drawbacks of long PFN include increased operative duration, reaming of the medullary canal distally, unavailability of distal locking jig, leading to prolongation of distal locking time and exposing the surgical team to more radiation. Stacking the above facts the study tried to verify these in the practical scenario. The study was conducted at the department of orthopaedics Andhra Medical College Visakhapatnam Andhra Pradesh. Salvage procedures like Dimon osteotomy and Sarmiento osteotomy were not entertained in the present study.This effectively limits the study to cephalomedullary fixation of un stable per trochanteric fractures with short and long Proximal Femoral Nail.

METHODS:

Study design: Hospital Based Comparative study.

Study period: October 2017 to September 2019.

Sample size: 30 (N=30, Short PFN-15, Long PFN-15)

The study population was randomly divided into 2 groups with 15 patients in each group. Group S (odd): The patients who were operated with Short Proximal Femoral Nail. Group L (even): The patients who were operated with Long Proximal Femoral Nail.

RESULTS Thirty cases of unstable inter-trochanteric fractures treated with reduction and internal fixation with long or short proximal femoral nail were studied.

In the present study minimum age was 29 years and maximum age was 75 years.

Majority of the patients were between 51 to 70 years of age. Mean age for long PFN was 52.83 +/- 10.33 SD years, (Range 29-70). Mean age for short PFN was 58.16 +/- 13.94 SD years, (Range 35-75). In the present study males predominate females with a male to female ratio of 3:2.

CONCLUSION We conclude that both short and long nails appear acceptable for use in unstable inter-trochanteric fractures. A reduction in operative duration and reduction in blood loss, which translates into a reduced blood transfusion requirement more importantly significant reduction in image intensifier exposures seen with short PFN makes it a surgeon friendly implant. We prefer long PFN for fixation of unstable trochanteric fractures with osteoporosis so as to splint the whole femur.

KEYWORDS : Hip Fractures C26.404.061.425 Osteoporosis C05.116.198.579 Splints E07.858.442.660.430.750

INTRODUCTION

Per trochanteric fracture is the most common fracture of the hip in elderly. This increase in the incidence of IT fracture is because of the high incidence of osteoporosis in the elderly population. Nearly half of all hip fractures are intertrochanteric fractures. Thirty five to forty per cent of these fractures are unstable. Three part and four part fractures are associated with high post operative morbidity and mortality. This geriatric osteoporotic fracture is three to four times more common in Females. Low energy trauma like a simple fall is usually the cause. The tendency to fall increases with patient's age .Falls in the geriatric age group are influenced by several factors, such as poor vision, , labile blood pressure, decreased muscle power, altered reflexes, vascular disease, and coexisting neurological disease. AO/ASIF group in 1997 introduced an intramedullary device called Proximal Femoral Nail. It works on principal of controlled collapse at fracture site like DHS. Being intramedullary it has shorter lever arm, placed close to the mechanical axis of femur so it acts as a load sharing device.

Proximal Femoral Nail is a load sharing device with rotational stability, having short lever arm which provide relative stability (secondary bone healing). .The larger proximal diameter of Proximal Femoral Nail gives extra stiffness to the nail. It has the combined the advantages of, a dynamic hip screw and an intra medullary nail. Closed Intra medullary nailing minimizes blood loss, shortens operative time and allows early weight bearing than hip sliding screw system. When Gamma nail and short PFN were compared, Short PFN achieved either equal or better resultsbiomechanically in the management of unstable intertrochanteric fractures. However both implants have similar incidence of complications like anterior thigh pain, femoral shaft fractures distal to nail tip or around the distal tip of nailand all these lead to higher rates of revision surgery in the form of either exchange nailing or fixation with other device. Such instances required implant removal to achieve union. The afore mentioned reasons led few studies to show minimal or no advantage of intramedullary devices over extra medullary devices. Long intramedullary devices seem to overcome this complication.

AIM AND OBJECTIVES

1. To evaluate the functional outcome between the short proximal femoral nail and long proximal femoral nail in unstable inter-trochanteric fractures femur
2. To compare the effectiveness and the complications of intramedullary devices, i.e. short vs long PFN in the management of unstable Inter Trochanteric fractures.

MATERIAL AND METHODS

All the patients were assessed clinically and stabilized haemodynamically at casualty itself on arrival to the hospital. They were investigated with X- rays of pelvis with both hips antero posterior view with 15 degrees of internal rotation and entire femur antero-posterior and lateral views. Patients were maintained on upper tibial

pin traction till surgery. Required blood investigations, pre anaesthetic checkup and informed consent were obtained. Prophylactic antibiotic was given to all patients 60 minutes prior to surgery. Regional anaesthesia i.e. combined epidural and spinal anaesthesia was given to all patients.

OPERATIVE PROCEDURE

Closed reduction was achieved on a traction table. The unaffected leg was flexed and abducted in semi lithotomy position as far as possible so as to allow the movement of the image intensifier. The tip of greater trochanter was located under, image intensifier and 5 cm skin incision given proximal to the tip of the greater trochanter. Fascia lata and gluteus medius were split in line with the incision. Entry to the medullary canal was made just medial to the greater trochanter and parallel to anterior cortex in the center of the medullary cavity under image intensifier. A 2.8 mm guide wire was passed into the medullary canal and the medullary cavity was reamed serially up to the desired diameter in 0.5 mm increments. Appropriate nail was inserted into medullary canal over the guide wire. This step was done carefully without hammering and by twisting movements of the hand until the hole for 8mm screw is at inferior margin of neck. Insertion of the guide wire for neck screws was done with the help of aiming devices tightly secured to the insertion handle and the 2.8 mm guide wire was put through the inner drill sleeve after a stab incision was made through the skin with its position in the inferior area of the femoral neck. This guide wire is passed 5 mm deeper than the planned screw size. The second 2.8 mm guide wire was passed through the drill sleeve above the first one. Then 8mm screw of measured length was inserted after reaming with the 8 mm reamer without tapping. The de rotation screw of 6.5mm diameter was introduced in a similar fashion. This screw was 1.5 cm shorter than the 8 mm neck screw. Distal locking was performed with two locking bolts. For Short PFN, aiming sleeve was used. In the long PFN group it was done by freehand technique under the guidance of image intensifier. Intravenous Antibiotics were continued in the post-operative period for 5 days and oral antibiotics till suture removal (10th Day). Analgesics were given as per patients compliance. All patients were discharged after suture removal on tenth post-operative day. All patients were taken for post operative X-rays on 2nd post-operative day, at 6 weeks, 3 months, and then between 6 months to 1 year depending upon the fracture union. Healing was assessed both clinically (pain and motion at fracture site) and radiologically. Functional outcome was measured according to modified Harris Hip score at6 months post operatively. Data was statistically analyzed using student t test

INCLUSION CRITERIA

1. Adult patients of age 18-90 years.
2. Patients of either sex
3. Traumatic fractures
4. Pathologic fractures
5. Subjects who have given informed consent

EXCLUSION CRITERIA

1. Age less than 18 years
2. Patients with compound fractures
3. Preexisting deformities of injured hip

RESULTS

Out of 30 study cases (n=30) 18 were males & 12 were females. In all patients 135 degree stainless steel Proximal Femoral Nail was used. We randomized the patients based on odd and even numbers into two groups.

Group 1: Patients treated by short PFN.
Group 2: Patients treated by long PFN.

We hypothesised that short PFN and long PFN have no significant difference in the treatment of unstable IT fractures. We compared various factors in each group to justify the above hypothesis. A P value of < 0.001 was taken as significant.

Thirty cases (n=30) of unstable inter-trochanteric fractures treated with reduction and internal fixation with long or short proximal femoral nail were studied.

In the present study minimum age was 29 years and maximum age was 75 years.

Most of the patients were between 51 to 70 years of age. Mean age for long PFN was 52.83 +/- 10.33 SD years, (Range 29-70). Mean age for short PFN was 58.16 +/- 13.94 SD years, (Range 35-75). In the present study male preponderance was noted with a male to female ratio of 3:2. The incidence of fractures was more in elderly patients in both males and females. The mean duration of surgery in the long PFN group was a mean 118 minutes+/-22.71 minutes. In the short PFN group it was a mean63.8 minutes +/-10.67 minutes. The average blood loss was 192.67ml whereas it was 100.67ml in the short PFN group. The time taken for distal locking (both static and dynamic) was longer in the long PFN group with a mean 53.33+/-16.94 minutes when compared to the mean of 18.33+/-5.22 minutes for short PFN group. The mean image intensifier exposures with the long PFN group was306+/-77.71when compared to a mean of 86+/-10.66with the short PFN group.

Functional outcome was estimated by Harris Hip Score at 6 months for each individual showed 33.33% excellent, 20%good, 33.33%fairand13.34%poor results.

Among them short PFN group showed better excellent and good results when compared to long PFN group (Table-1).

Table-1 Functional Outcome by Harris Hip score at 6 months

Group	Excellent(HHS 90-100)	Good(HHS 80-89)	Fair(HHS 70-79)	Poor(HHS <70)	Total
Long PFN	04	02	07	02	15
Short PFN	06	04	03	02	15
Total	10(33.33%)	06	10	04	30

Associated injuries:

In the present study, 3 patients of which 2 were operated with short PFN and one operated with long PFN, had distal radius fractures. One patient operated with long PFN 29 years of age had blunt injury abdomen.

Intra-operative complications: Breakage of guide wire occurred for 6.4mm screw in one patient. Complications that occurred were anterior thigh pain which occurred in five patients in each group. Re fracture occurred in one each patient in each group. Screw migration, reverse Z effect, implant failure and avascular necrosis of femoral head occurred in one each only in short PFN group. (Table -2).

Table -2 : complications

Complication	Long PFN group no of pts	Short PFN group no of pts
Fractures	1	1
Anterior thigh pain	5	5
Screw migration	0	1
Implant failure	0	1
Reverse Z effect	0	1
Avascular necrosis	0	1

DISCUSSION

In the present study the mean age of study group for PFN was found to be younger i.e. 58.16 years for short PFN and 52.83 years for long PFN group respectively when compared with two other studies. Lindvall et al showed a mean age of71.9 years in the short PFN group and a mean age of 73 years in the long PFN group[1]. Parmar et al. showed a mean age of60.75 years for short PFN group and62.4years for long PFN group[2] (Table-3).

Table no. 3: Age distribution in various studies

Series	Short PFN. age in years	Long PFN. age in years
Lindvall et al	71.9	73
Parmar et al	60.75	62.4
Present study	58.16	52.83

In the present study there was a male preponderance in both groups compared to Boone et al .and Parmar et al. studies in which there was female preponderance [3,2] (Table-4).

Table no. 4: Sex distribution in various studies

Series	Short PFN.		Long PFN.	
	M	F	M	F
Boone et al.	25	57	57	126
Parmar et al.	23	29	32	40

Present study	10	05	08	07

The average blood loss in present study in the long PFN group was 192.7ml and in short PFN group it was 100.67ml. The difference was statistically significant with p value less than 0.001. Other studies show no significant difference in blood loss between the two groups but an increased incidence of transfusions in long PFN group was observed with this study.

Lindvall et al. showed a mean blood loss of188.7 ml and166.2 ml in long and short PFN groups respectively[1]. Hou et al. reported an average loss of135 and 100 ml of blood in long and short PFN groups respectively[4]. Guo et al reported the least amount of blood loss with a mean blood loss of 127.8 and 90.8ml with long and short PFN groups with a p value of 0.0004[5]. The average time to operate an IT fracture with long PFN was 118+/- 22 minutes. The duration for a short PFN was 63.8+/-10.67. Short PFN took shorter time and the difference was clinically significant ($p<0.0001$). Most of studies like Hou et al[4],

Kleweno et al statistically signify that short PFN is quicker than long PFN[6]. However some studies like Lindvall et al. found the short PFN to be quicker but not statistically significant and Parmar et al. actually found the long PFN to be quicker by one minute, but this was not highlighted as statistically significant[1,2] (Table-5).

Table-5: Duration of surgery comparison in various studies

Study group	long PFN(min)	short PFN(min)	p value
Lindvall et al.	53.7	49.4	0.71
Kleweno et al.	70	51	0.002
Hou et al.	61	41	0.001
Parmar et al.	69	70	Un specified
Present Study	118	63.8	<0.0001

Time taken for distal locking in the present study was 53.33 minutes on average for long PFN group and 18.33 for short PFN group. The difference is significant with a p value<0.0001. Other studies also showed that a short PFN is quicker to perform but Lindvall et al. study showed no significant difference [1]. In the present study, we noticed a significant increase in the image intensifier exposure in long PFN group when compared to short PFN. The average number of exposures in long PFN was 306 but in a short PFN it was 86. The p value was 0.0001 which was significant. Rashid et al in their study reported a median exposure value of 109 exposures for short PFN and 243 exposures for long PFN[7] (Table-6) .

Table -6: Comparison of C-ARM exposures with other study

Number of exposures	Short PFN group	Long PFN group
Rashid et al	109(Median)	243(Median)
Present study	86(Mean)	306(Mean)

They also stated that least number of exposures were with DHS plating. They claimed that experienced consultant surgeons required fewer exposures than junior surgeons. Xue-FengGuo et.al. in their retrospective analysis of 178 cases of intertrochanteric fractures of the femur compared the clinical effects of long vs. short intramedullary nails and found no significant difference in terms of therapeutic effect, hospital stay and postoperative complications[8] Zhi Li et.al compared failure rates between short and long intramedullary nails used for the treatment of inter-trochanteric hip fractures in patients of age over 65 years.(long nail (n=59) and short nail (n=97)). And found no statistically significant difference between these groups in time to fracture union, intraoperative blood loss, and Harris Hip Score at 1 year.[9]. Mahesh Kumar NB compared the effectiveness & drawbacks of short PFN vs long PFN in the management of Intertrochanteric fractures (n=40). The post operativecomplication rate in the short PFN group was significantly less in their study. The mean time of union in the short PFN group was 10.05 weeks and the long PFN group was 21.10 weeks. They reported a higher rate of shortening with short PFN when compared to the patients in whom long PFN was used.[10].

Uzun M, et al studied the complications of unstable pertrochanteric hip fractures treated with the Proximal Femoral Nail (PFN) radiologically in 35 patients (n=35) . The mean Harris hip score they reported was 82.1[11]. Wasudeo M Gadegone, Yogesh S Salphale in their study opined that short proximal femoral nail was a better implant for pertrochanteric fractures in terms of operating time, blood loss, surgical exposure, and complications[12]. R.N. Singh, B.N. Singh compared the outcome of intertrochanteric fractures (n-50) treated with Dynamic Hip Screw and Proximal Femoral nail. They confirmed that DHS was tolerated well by young patients with stable fracture patterns while PFN had a better outcome with osteoporotic patients and weak bone mass and reverse oblique fractures [13]. M.A.Sohatee ,J.Bennet in their systematic review of 90 papers comparing short and long PFN advocated that both short and long PFN were safe to use. They opined that short nails may be advantageous in view of short operative time less blood transfusion requirement and cost benefit [14]. John Dunn et al in their systematic review article concluded in favour of short PFN due to a decreased operative time blood loss and a decreased re- operation rate along with cost benefit [15].

D Andrew Hulet, et al compared failure s and complications of short vs long PFN in stable and un stable trochanteric fractures .they opined that unstable fractures were more likely to be fixed with long PFN. They also found an increasing mortality trend in patients treated with short PFN for unstable trochanteric fractures [16]. In a retrospective study at Japan Tomohiro Matsumura et al estimated the clinical outcome of patients who were treated with mid length PFN for trochanteric fractures. They concluded despite the extreme bowing and short femoral length of Japanese femora short PFN yielded comparable outcome to modern cephalo medullary nails[17]. Josh Vaughn et al studied the complications of short and long femoral nail fixations for trochanteric fractures over a period of one year. They found no difference in catastrophic failures between the two groups but found an increased risk of secondary femur fracture in the short PFN group [18]. Emily N et al in a survey at USA found that there was a trend to words treating the trochanteric fractures with cephalomedullary nails among orthopaedic surgeons. But the survey compared between sliding hip screw and cephalomedullary nailing for inter trochanteric fractures [19]. This survey reflected the current trend to words treating the trochanteric fractures with PFN and also justifies the dilemma of short vs long PFN of the current study concept. Yan-Xiao Cheng and Xia Sheng in a meta- analysis compared eight surgical modalities of treating trochanteric fractures and concluded that Proximal Femoral Nail Anti rotation was the treatment of choice in these fractures [20].

CONCLUSION

We conclude that both short and long nails appear acceptable for use in unstable inter-trochanteric fractures. A reduction in operative duration and reduction in blood loss, which translates into a reduced blood transfusion requirement; more importantly significant reduction in image intensifier exposures seen with short PFN makes it a surgeon friendly implant. We prefer long PFN for fixation of unstable trochanteric fractures with osteoporosis so as to splint the whole femur.

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