Original Research Article

Comparative study of Unstable intertrochanteric fractures treated with long proximal femoral nailing and short proximal femoral nailing

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Abstract

Background: Unstable intertrochanteric fractures mainly comprise of Posteromedial comminution, Lesser Trochanteric fracture contains portion of the calcar,Comminution of greater trochanter and adjacent posterolateral shaft predispose to medial shaft migration andReverse obliquity.Trochanteric fractures are common in the elderly people. The incidence of trochanteric fractures is more in the female population compared to the male due to osteoporosis. surgery by internal fixation of the fracture is ideal choice. **Material and methods:**The present study consists of 30 adult patients of unstable intertrochanteric factures of femur satisfying the inclusion criteria, who are treated with proximal femoral nail in Osmania Medical College and General Hospital, Afzalgunj, Hyderabad. The study is carried out from July 2017 to July 2020.prospective study. A standard length PFN nail (250 mm) was used for short proximal femoral nailing cases. For long proximal femoral nailing cases, length of the nail was measured individually. **Results:** Functional results were assessed taking 30 cases (15 long PFN + 15 short PFN) into consideration using Harris Hip Scoring System (Modified). In our study, according to Harris Hip Score (modified), good results were seen in 66.66% cases of intertrochanteric fractures using long PFN. In our study, according to Harris Hip Score (modified), good results were seen in 33.33% cases of intertrochanteric fractures using short PFN.**Conclusion:** In our results, it was evident that the use of long PFN has advantages over short PFN in terms of the less postoperative complications,less mean time of union and better lower extremity functional scores.

Key Words: Intertrochanteric Fracture of Femur, Internal Fixation, Proximal Femoral Nail, Short PFN, Long PFN.

Introduction

Intertrochanteric fractures are injuries that most commonly affect the elderly and also in young, have tremendous impact on both the health care system and society in general, Unstable intertrochanteric fractures mainly comprise of Posteriomedial comminution, Lesser Trochanteric fracture contains portion of the calcar, Comminution of greater trochanter and adjacent posteriolateral shaft predispose to medial shaft migration, Reverse obliquity Despite marked improvements in implant design, surgical technique and patient care, peritrochanteric fractures continues to consume a substantial proportion of our health care resources. [1]

Trochanteric fractures are common in the elderly people. The frequency of these fractures has increased primarily due to the increasing life span and more sedentary life style brought on by urbanization. Trochanteric fractures occur in the younger population due to high velocity trauma, whereas in the elderly population it is most often due to trivial trauma. [2]

The incidence of trochanteric fractures is more in the female population compared to the male due to osteoporosis. The trochanteric fractures can be managed by conservative methods and there is usually union of the fracture. If suitable precautions are not taken the fracture undergoes malunion, leading to varus and external rotation deformity at the fracture site and shortening and limitation of hip movements. [3]

It is also associated with complications of prolonged immobilization like bedsores, deep vein thrombosis and respiratory infections. Since this fracture is more common in the elderly patients, the aim of treatment should be prevention of malunion, and early mobilization. Taking all the factors into consideration surgery by internal fixation of the fracture is ideal choice. [4]

There are various forms of internal fixation devices used for Trochanteric Fractures; of them the most commonly used device is the Dynamic Hip Screw with `Side Plate assemblies. This is a collapsible fixation device, which permits the proximal fragment to collapse or settle on the fixation device, seeking its own position of stability.The latest implant for management of trochanteric fractures is proximal femoral nail, which is also a collapsible device with added rotational stability. This implant is a Centro medullary device and biomechanically more sound. It also has other advantages like small incision, minimal blood loss. [5]

Pertrochanteric and Subtrochanteric that distinguish them from intracapsular fractures. Subtrochanteric fractures comprises about 10 to 34% of hip fractures. [6]

Subtrochanteric fractures are complicated by malunion and delayed or nonunion. The factors responsible for these complications in sub trochanteric fractures are high stress concentration, predominance of cortical bone and difficulties in getting biomechanically sound reduction because of comminution and intense concentration of deforming forces. [7]

Aims and objectives of the study

1. To assess the stable fixation and early mobilization of patients.
2. To compare the anatomical and functional outcome of treatment of unstable intertrochanteric fractures using long proximal femoral nail and short proximal femoral nail.

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Material and methods

The present study consists of 30 adult patients of unstable intertrochanteric factures of femur satisfying the inclusion criteria, who are treated with proximal femoral nail in Osmania Medical College and General Hospital, Afzalgunj, Hyderabad,after taking informed consent. The study is carried out from July 2017 to July 2020.

Inclusion Criteria

- Age between 50 to 70 years.
- Unstable intertrochanteric fractures.
- Acute fractures.

Exclusion criteria

- Inter trochanteric fractures involving piriformis fossa.
- Open hip fractures
- Pathological fractures.
- Periprosthetic fractures.
- Paediatric fractures (before physeal closure).
- Age below 50 years and above 70 years.
- Patients not fit for surgery.

Data collection

After the patient with sub trochanteric or trochanteric fracture was admitted to hospital, all the necessary clinical details were recorded in proforma prepared for this study. After the completion of the hospital treatment, patients were discharged and called for follow up at outpatient level at regular intervals for serial clinical and radiological evaluation.

The patients were followed up till fracture union and function recovery after surgery at regular intervals and if necessary subsequent follow up was done.

Management of patients

As soon as the patient with suspected sub trochanteric or trochanteric fracture was seen, necessary clinical and radiological evaluation done and admitted to the ward after necessary resuscitation and splintage using skin traction.

The following investigations were done routinely on all the patients preoperatively.

Blood

Hb%, total leucocyte count with differential count, blood grouping, cross matching, fasting blood sugar, blood urea, serum creatinine, serum electrolytes. **Urine:** Albumin, sugar and microscopic examination.

X-Rays

- Pelvis with both hips-AP view.
- Involved side hip with femur full length-AP and Lateral view in all patients.
- Chest-PA view in necessary patients.

All the patients were evaluated for associated medical problems and were referred to respective departments and necessary treatment was given. Associated injuries were evaluated and treated simultaneously. All the patients were operated on elective basis after overcoming the avoidable anesthetic risks.

Pre-op planning

- Determination of nail diameter: Nail diameter was determined by measuring diameter of the femur at the level of isthmus on an AP x ray.
- Determination of neck shaft angle: Neck shaft angle was measured on the unaffected side on an AP x-ray using goniometer.
- Length of the nail: A standard length PFN nail (250 mm) was used for short proximal femoral nailing cases. For long proximal femoral nailing cases, length of the nail was measured individually.

Proximal Femoral Nail implant details

- The implant consists of a proximal femoral nail, self-tapping 6.5mm hip pin, self-tapping 8 mm femoral neck screw, 4.9 mm distal locking screws, and an end cap.
- Proximal femoral nail is made up of either 316L stainless steel or titanium alloy which comes in following sizes.
- Length: standard PFN – 250 mm, Long PFN – 340, 380, 420mm.
- Diameter: 9, 10, 11, 12 mm.
- Neck shaft angle range: 120^0, 130^0, 135^0.

The nail is having 14mm proximal diameter. This increases the stability of the implant.

There are 6^0 mediolateral valgus angles, which prevents varus collapse of the fracture even when there is medial comminution.

The distal diameter is tapered to 9 to 12 mm which also has grooves to prevent stress concentration at the end of the nail and avoids fracture of the shaft distal to the nail. Proximally it has 2 holes the distal one is for the insertion of 8 mm neck screw which acts as a sliding screw, the proximal one is for 6.5 mm hip pin which helps to prevent the rotation. Distally nail has two holes for insertion of 4.9 mm locking screws, of which one is static and the other one is dynamic which allows dynamization of 5 mm.

In our study, we used a standard length PFN of 250 mm with distal diameter of 10, 11,12mm, the proximal diameter of nail is 14mm for short PFN cases. The proximal derotation screw of 6.5 mm and distal lag screw of 8mm. Distal locking is done with self-tapping 4.9mm cortical screws one in static mode and the other in dynamic mode allowing 5 mm dynamisation. The nail is universal with 6 degrees mediolateral angulation and with a neck shaft angle of 135 degrees, we did not use end cap. For long PFN cases, the length of the nail measured individually and the diameter of the nail was 10, 11, 12 mm.

Patients were operated on fracture table with supine position and as per standard approaches and strict aseptic protocols during pre,intra op and postoperatively after insertion of nail and distal,and proximal locking screws applied,wound closed in layers over drain.

Discharge

Patients were discharged from the hospital when independent walking was possible with or without walking aids.

Follow up

All patients were followed up at an interval of 6 weeks till the fracture union is noted and then after once in 3 months till 1 year.

At every visit patient was assessed clinically regarding hip and knee function, walking ability, fracture union, deformity and shortening.

Modified Harris Hip scoring system was used for evaluation.

X-ray of the involved hip with femur was done to assess fracture union and implant bone interaction.

Result

In our series, total number of long PFN cases n= 15, mean age for men was 65.5 and mean age for women was 62. Mean age for long PFN in our study was 63.7 years.

Total number of short PFN case n = 15, mean age for men was 67.8 and mean age for women was 62.8. Mean age for short PFN in our study was 65.3 years.

Table 1: Sex Distribution Long PFN (N=15)

Sr. No.	Sex	Number of cases	Percentage
1	Male	9	60%
2	Female	6	40%

Table 2: Sex Distribution Short PFN (n=15)

Sr. No.	Sex	No. of Patients	Percentage
1	Male	10	66.66%
2	Female	5	33.33%

Table 3: Time Taken for Radiological Union (N = 15) Long PFN

Radiological Union

Union in Weeks	12 Weeks	14 Weeks	16 Weeks	20 and Above Weeks	Nonunion
Number of Cases	8	4	3	-	-
Percentage	53.33%	26.66%	20%	-	-

Mean Weeks for Radiological Union in Long PFN Is 13.3 Weeks

Table 4: Time Taken for Radiological Union (N = 15) short PFN

Radiological Union:

Union in Weeks	12 Weeks	14 Weeks	16 Weeks	20 and Above Weeks	Nonunion
Number of Cases	5	7	3	-	-
Percentage	33.33%	46.66%	20%	-	-

Mean Weeks for Radiological Union in Short PFN is 14.4 Weeks

Sex Distribution

In the present study, men were more commonly involved. Majority of the patients were males – 9 cases (60%) and 6(40%) were females for long PFN, 10 males (66.66%) and 5 (33.33%) female cases for short PFN.

Long PFN Follow up

All patients were followed at 6 weeks, 12 weeks, 6 months and some patients up to one year and further if necessary.At each follow up, radiograph of operated hip with upper half femur was taken and assessed for fracture union, implant failure and screw cut out.

Functional results were assessed taking 30 cases (15 long PFN + 15 short PFN) into consideration using Harris Hip Scoring System (Modified)**:**

Table 5: Harris Hip Scoreinlong PFN (N =15)

Grade	Score	No. of Cases (N =15)	Percentage
Excellent	90 to100	-	-
Good	80 to 89	10	66.66%
Fair	70 to 79	5	33.33%
Poor	<70	-	-

66% cases of intertrochanteric fractures using long PFN. In our study, according to Harris Hip Score (modified), good results were seen in 66.

LONG PFN CASES

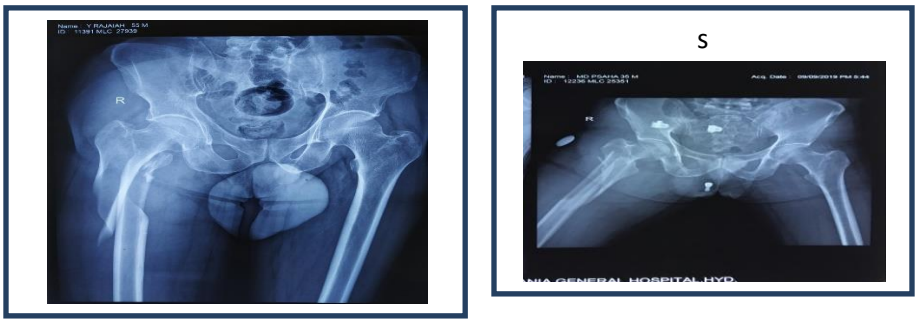

Fig 1:Long PFN Cases

SHORT PFN CASES

Fig 2:Short PFN Cases

Table 6: Harris Hip Scoreinshort PFN (N =15)

Grade	Score	No. of Cases (N =15)	Percentage
Excellent	90 to100	-	-
Good	80 to 89	5	33.33%
Fair	70 to 79	10	66.66%
Poor	<70	-	-

In our study, according to Harris Hip Score (modified), good results were seen in 33.33% cases of intertrochanteric fractures using short PFN.

Table 7: Comparative Study Results of Long PFN Vs Short PFN in Our Study

	Long PFN	**Short PFN**
Sample Size	15	15
Mean Age in Years	63.7	65.3
Gender M/F	9/6	10/5
Side R/L	7/8	10/5
Mean Time for Radiological Union	13.3WK	14.5WK
Mean Harris Hip Score At 6 Months	79.33	77.3
Hip Pain	6.66%	20%
Failure Percentage	None	6.66%

Discussion

Many fixation devices have been developed to overcome the difficulties encountered in the treatment of inter trochanteric fractures.

Until recently, most of these fractures were treated by sliding hip screw. Since these devices performed less well in unstable trochanteric fractures with high rates of failure, intramedullary devices have become increasingly popular.

The proximal femoral nail is an effective load bearing device that incorporates the principles and theoretical advantages of all the intra medullary devices and considered to be the second-generation nail. [8]

Biomechanically the PFN is more stiff, it has a shorter movement arm (i.e. from the tip of the lag screw to the centre of the femoral canal) whereas the DHS has a longer movement arm.The larger proximal diameter of PFN imparts additional stiffness to the nail. It also combines the advantages of closed intramedullary nailing, a dynamic femoral neck screw, minimal blood loss, shorter operative time and early weight bearing than DHS. [9]

PFN was developed to improve the rotational stability of the proximal fracture fragment and the tip of the nail was re-designed with reduction of the distal diameter of the nail to decrease the risk of intra and post operative fractures of the femoral shaft by a significant reduction in bone stress. [10]

This prospective series demonstrates there is a clinically significant difference in failure rate and hip pain rate when treated unstable inter trochanteric fracture by long PFN and short PFN, the long PFN had significantlyless failure rate and hip pain ratethan those with short PFN. Similarly, short nails were modified in length and incorporated a tapered end and smaller locking screws. All the above changes could achieve the goal of decreasingthe incidence of fracture in the diaphyseal region. In our study, we noted that short PFN is not suitable for a 3 fractures because its distal nail tip is too short to provide effective stabilization. In contrast, long PFN is suitable for almost all intertrochanteric fractures because it provides stability which has advantages especially in elderly inter trochanteric fractures with severe osteoporosis.

In our study, one case using long nail had hip pain whereas three cases with hip pain were induced by short PFN. This may be due to the end of long nail is located at distal femur with relatively large medullary cavity thus reduces the pressure on the femoral cortex and reduces the postoperative hip and knee pain.

Conclusion

In the present study of 30 patients with intertrochanteric fractures of femur- 15 cases were surgically managed with long Proximal Femoral Nail and 15 cases with short Proximal Femoral Nail.

In our results, it was evident that the use of long PFN has advantages over short PFN in terms of the less postoperative complications,less mean time of union and better lower extremity functional scores.Most of the complications of proximal femoral nailing are surgeon and instruments related which can be cut down by proper patient selection, good preoperative planning and preoperative good reduction before entry and correct length of the screws.Our sample size reflects the routine patient inflow in our hospital.A study with a larger sample size would have made a better assessment of this surgical intervention.As our study was time bound the patients were followed up for a minimum of 6 months and a maximum of 1 year. Therefore, the long term effects of this intervention remains unknown in our study. A longer follow up would have made a complete assessment of this surgical intervention.

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