Original Research Article

A prospective study on surgical management of trochanteric and subtrochanteric femoral fractures with proximal femoral nail in a tertiary care hospital, Andhra Pradesh

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Abstract

Background: Fractures around the trochanteric region of femur are one of the commonest fractures and the most devastating injuries. Currently, Surgery is the mainstay of treatment for both displaced and undisplaced peri trochanteric fractures. This study consisted of 108 cases of pertrochanteric (intertrochanteric and subtrochanteric) fractures which were fixed with proximal femoral nail and final outcome assessed. **Methods:** A Prospective study of all cases (108) with peritrochanteric fractures admitted in a tertiary care hospital during a period of 36 months. All the patients were surgically managed with proximal femoral nail and the functional outcome assessed at 6 weeks and 12 weeks post-operatively using Modified HARRIS HIP SCORE system. **Results:** Maximum age was 65 years and minimum age was 24 years. Mean age was 48 years. Majority 92 (85.2%) of the patients in this study were males and 16 (14.8%) were females. Right side 64 (59.3%) was predominantly involved, with 44 (40.7%) on left side. About 62 (57.4%) met with accident, 26 (24.1%) had self fall, 14 (12.9%) had fall from height and 6 (5.6%) had other causes resulting in fracture femur. While 72 (66.7%) of the patients had no associated injuries, there were 14 (12.9%) cases with head injury, 12 (11.11%) cases with minor abdominal injuries and pelvic injuries, 5 (4.63%) cases each with ipsilateral tibia and Colles fracture. Sub-trochanteric fractures were 85 (78.7%) while 23 (21.3%) were Intertrochanteric fractures. The mean duration of surgery was 80 minutes and mean duration of screening (x-ray exposure) was 103 Seconds. Mean blood loss was 140 ml. At 12 weeks post-operatively, 72 (66.7%) patients had full range of movement at hip joint (0 to 110) and 84 (77.8%) patients had full range of movement at knee joint (0 to 120). The Harris Hip score showed functional outcome as excellent in 15 (13.9%), good in 57 (52.8%), fair in 22 (20.4%) and poor only in 14 (12.9%). **Conclusions:** The introduction of PFN has broadened the indications for intramedullary fixation of difficult femoral fractures and to include the fractures at the level or below the lesser trochanter. PFN is an effective device in the management of complex femoral fractures.

Key Word: Trochanteric and sub-trochanteric femoral fractures, proximal femoral nail.

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INTRODUCTION

Fractures around the trochanteric region of femur are one of the commonest fractures and the most devastating injuries encountered. The incidence of proximal femoral fractures among females is 2 to 3 times higher than among males.[1] Older patients suffering from a minor fall can sustain such fractures because of osteoporosis or pathological fracture accounting for 90%. In younger patients the fractures usually result from high energy trauma like RTAs and fall from height and accounts for

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only 10 percent.[2] The risk of sustaining a proximal femoral fracture doubles every 10 years after age 50 years[3]. Until 1960's only non-operative treatment was available in the form of traction with prolonged bed rest with fracture healing occurring in ten to twelve weeks (usually) followed by a lengthy programme of ambulation training. These are associated with complications of prolonged recumbence like decubitus ulcer, UTI, joint contractures, pneumonia and thrombo- embolic complications resulting in high mortality rate. Currently, Surgery is the mainstay of treatment for both displaced and undisplaced peri trochanteric fractures. The goal of treatment is fracture reduction so that near anatomic alignment and normal femoral anteversion are obtained.[4] The primary reason for surgery is to allow the early mobilization of the patient, with partial weight-bearing restrictions depending on the stability of the reduction.[5] The ultimate goal of treatment is to limit pain and to help the patient return to the level of activity he or she had prior to sustaining the fracture.[6] The most common internal fixation device used today is the fixed angle extramedullary device, such as a DHS, 95-degree DCS. The advantage of the sliding lag screw, compared with a static screw, is that it allows for impaction of the fragments; this impaction increases the bone-on-bone contact, promoting osseous healing while decreasing implant stress. The disadvantage is common shortening and rotation at the fracture site.[7] And the other is intra medullary fixation with devices like the IMHS (intra medullary hip screw), Gamma nail, Russell - Taylor reconstruction nail, ATN (Ante grade trochanteric nail), TFN (Trochanter fixation nail) and the PFN (Proximal femoral nail). Advantages of intramedullary devices include retained blood supply to the bone fragments, less operative blood loss, reduced operating time and less disruption of the environment. However, the incidence of fixation failure is reported to be as high as 20% in unstable fracture patterns.[8] This study consisted of 108 cases of pertrochanteric (intertrochanteric and subtrochanteric) fractures which were fixed with proximal femoral nail and final outcome assessed.

AIMS AND OBJECTIVES

1. To enlist the various fracture patterns of Intertrochanteric and Subtrochanteric region of femur.
2. To evaluate the functional outcome following management of these fractures with proximal femoral nail.

MATERIAL AND METHODS

A Prospective study of all cases with peritrochanteric fractures admitted in a tertiary care hospital, Visakhapatnam, Andhra Pradesh, during a period of 36 months (Jan 2016 to Dec 2018) was conducted. A total of 116 cases were admitted of which 8 patients did not consent for the study and hence the number came to 108. All patients with peritrochanteric fractures including Intertrochanteric and Subtrochanteric region above 20 years of age, who consented for the study were included while those less than 20 years age, Compound fractures, very low Subtrochanteric fractures, previous wound or bone infections, previous operatively treated fractures or retained hardware in the same extremity and those who failed to consent were excluded from the study. A Predesigned and Pretested questionnaire containing questions about the detailed history with special reference to the mode of injury and severity of trauma was used. This was followed by physical examination including a comprehensive orthopaedic examination of the injured limb and other limbs. The involved extremity was examined for swelling, deformity, discoloration, skin integrity, neurological, motor and vascular compromise. Medical and General surgical evaluation was sought expeditiously for all high – energy accident victims to rule out polytrauma. Radiological examination of ipsilateral hip and knee joints both preoperatively and postoperatively were taken for evaluation. X-ray Chest, Routine blood investigations, Urine routine, ECG were all done and also medical and anaesthetist opinion were taken to explore fitness of the patients for surgery. The purpose of the study was explained in local language and a written informed consent was taken from the patients. They were free to withdraw from the study anytime they wished.

MANAGEMENT OF PROXIMAL FEMORAL FRACTURES

Following fixed pattern of management was followed for every patient.

Roentgenographic evaluation and Radiological parameters: After stabilization of vitals, radiographs of affected extremities were taken.

- Pelvis with both hip AP view
- Affected hip lateral vie
- Shaft femur with knee joint AP/lateral views
- Any associated injury x-rays.

The fracture pattern was classified according to Seinshemeir Classification for Subtrochanteric fractures:[9] and Evans Classification for Intertrochantric Fracture. [10]

Operative procedure: All cases were operated under spinal epidural anaesthesia. Prophylactic IV antibiotic usually a third generation cephalsporin was given prior to surgery. Mean time interval between trauma and surgery was eight days. Twelve patients were treated after 2

weeks as they were having associated abdominal injury which was given initial treatment preference, followed by stabilization of systemic condition. Surgery was done in supine position on a fracture table, initially closed manipulation and reduction was attempted after patient is anaesthetized. The entry point in femur is made through the tip of the greater trochanter using an awl. Then, 3.2 mm curved guide wire was inserted using image intensifier. Fracture reduced and guide wire inserted to the distal part under image intensifier.

A. Reaming and Insertion

- Serial reaming was done over the guide rod in increments of 0.5 mm until the desired diameter was reached. The selected nail usually of 135 degrees was assembled to proximal zig. After assembling the drill guide to the nail, preliminary checking of sleeves with guide pin or drill bit was done to prevent mismatch later was done. Assembled nail is inserted over the guide rod with insertion instrument only and is not hammered.
- The proximal femoral nail is inserted to the appropriate depth to allow proximal screw placement in the femoral head.
- For determining the proper insertion depth for the PFN, the inferior drill sleeve is placed in the drill guide and guide pin is passed through the sleeve, its position superior to the calcar is confirmed with image intensification so that 2 proximal screws can be placed in femoral head.

B. Proximal interlocking

- The 2.4 mm drive pin was inserted through the drill sleeve and advanced it into the femoral head at least 4 mm superior to the calcar to a level 5 mm below the subchondral level of the femoral head.
- The positon of the guide pin within the head was confirmed on c-arm and the same procedure was used for the superior hole.
- The inner sleeve was removed and the cannulated step drill was inserted through the outer sleeve into the femoral head within 5 mm of the subchondral bone.
- The screw length was measured and 6 mm lag screw was inserted through the drill sleeve into the femoral head by means of cannulated hexagonal screw driver. The screw of 8 mm was inserted in a similar manner.

C. Distal locking:

- The distal locking screws of 4.9 mm were inserted by using the distal zig. Haemostasis achieved and wound closed in layers over suction drain.

Post operative management: IV antibiotics in the form of third generation cephalosporins, aminoglycosides were given. Oral antibiotics started from fifth post op day and continued till suture removal. Analgesics /Epidural top up for 2 days. Drain removal after 48 hrs. Static quadriceps exercises were begun from day 2. Early hip and knee assisted Range Of Movement exercises were started from third day. Suture removal done after 10 days. Patient discharged 1 week after operation after giving appropriate physiotherapy instructions. Partial weight bearing was started 2 to 4 weeks post operatively. Full weight bearing was allowed after radiological and clinical signs of union.

Follow up: Regular follow up of every patient was carried out at 4 weeks interval initially and later at 6 weeks interval until union. Clinical and radiological evaluation done. Following points were noted. At each follow up visit, clinically the patients were assessed for gait, pain, deformity, shortening, range of hip and knee motion, ability to sit cross legged, ability to squat, whether returned to pre injury occupation. Radiologically, they were assessed for signs of union, loss of fixation and failure of implant.

Assessment Of Results: The results were assessed by Modified HARRIS HIP SCORE system[11]**.** This system is slightly modified according to needs of the Indian patients. i.e in place of “put on shoes and socks” we have used “squatting” and in place of “sitting” we have used “cross legged sitting”. Based on the total Harris Hip score functional outcome was graded as

- 0 - 69 POOR
- 70 – 79 FAIR
- 80 – 89 GOOD
- 90 – 100 EXCELLENT

Statistical analysis: The data collected were entered in the Microsoft excel 2007 and double checked for errors. Analyzed using Epi info version 3.5.2. Categorical variables are expressed in percentages and proportions while mean and standard deviation are used to express continuous variables. Association between continuous variables are determined using independent samples ‘t’ test and Chi – square test is used to determine the association between categorical variables. A ‘P’ value of < 0.05 is considered statistical significant and < 0.01 highly statistically significant.

Ethical clearance: Obtained from the institutional ethics committee. All the participants were explained about the purpose of the study in vernacular language in understandable manner. Confidentiality of the information was assured and the participants were free to withdraw anytime from the study if there was any breach in ethics during the course of the study.

RESULTS AND DISCUSSION

About 36 (33.33%) of the patients were between 51 to 60 years, followed by 28 (25.92%) in 31 to 40 years, 20 (18.5%) in 1 to 30 years and 12 (11.11%) each in 41 to 50 years and above 61 years. Maximum age was 65 years and minimum age was 24 years. The mean age was 69 years in a study conducted by Pavelka T *et al*[12], while in the present study, mean age was 48 years which is comparable to the mean age of 46 years reported by B Kanthimathi *et al*.[13] Majority 92 (85.2%) of the patients in this study were males and 16 (14.8%) were females indicating that males are highly exposed to the risk factor, due to highly demanding physical work and vehicular accidents, similar to study by B Kanthimathi *et al*[13], in which males were 64% and females 36% as compared to 40.1% male patients and 59.86% of female patients in a study conducted by Pavelka T *et al* [12]. Right side 64 (59.3%) was predominantly involved, with 44 (40.7%) on left side comparable to findings of B Kanthimathi *et al*[13] (right side was affected in 60% and left side in 40%). RTA was the main cause of trauma. About 62 (57.4%) met with accident while 26 (24.1%) had self fall, 14 (12.9%) had fall from height and 6 (5.6%) had other causes resulting in fracture femur. While 72 (66.7%) of the patients had no associated injuries, there were 14 (12.9%) cases with head injury, 12 (11.11%) cases with minor abdominal injuries and pelvic injuries, 5 (4.63%) cases each with ipsilateral tibia and Colles fracture. Regarding fracture types, 85 (78.7%) were Sub-trochanteric fractures while 23 (21.3%) were Intertrochanteric fractures. In this study, Sub-trochanteric fractures were classified based on Seinsheimer's classification and intertrochanteric fractures based on Evan's classification. Of the 85 (78.7%) subtrochanteric fractures 36 (33.3%) were type III fractures followed by type V fractures 27 (25%) and 11 (10.2%) each of type IIc fractures and type IV fractures. Of the 23 (21.3%) Intertrochanteric fractures 7 (6.5%) were Stable while 16 (14.8%) were Unstable. (Table 2)

Table 2: Classification of Subtrochanteric and Intertrochanteric fractures

	Type	No. of cases	Percentage
Subtrochanteric fractures (Seinsheimer's classification)	IIC	11	10.2%
	III	36	33.3%
	IV	11	10.2%
	V	27	25.0%
Intertrochanteric fractures (Evans classification)	Stable	7	06.5%
	Unstable	16	14.8%

Intraoperative Details: In the present study 83 (77%) patients underwent closed nailing and 25 (23%) patients underwent open nailing due to delay for surgery and failure to achieve anatomical reduction due to deforming forces. The mean duration of surgery was 80 minutes and mean duration of screening (x-ray exposure) was 103 Seconds. Mean blood loss was 140 ml (measured by fully soaked (50 ml) mop count). In the study conducted by B Kanthimathi *et al*[13] closed nailing was performed in 78% and open nailing in 22% and mean operative time was 71.5 minutes. In the study conducted by I. B. Schipper *et al*[14] the mean operating time was 60 minutes and open reduction was required in 8.1% with mean blood loss of 220 ml.

Intraoperative complications: In the present study, 12 cases (14%) had intra operative complications. We experienced failure to put derotation screw in 6 (7%) cases, jamming of the drill sleeve in 3 (3.5%) cases and guide wire breakage in 3 (3.5%) cases. Other complications such as Fracture of lateral cortex, Fracture displacement by nail insertion, Failure to get anatomical reduction, Failure of distal locking, Breakage of drill bit and varus angulation did not occur. No complications were reported in the immediate post operative period**.**

Delayed Complications: In the present study, 38 (35.2%) cases showed delayed complications.

Table 3: Delayed complications following surgery

Complication	Number of cases	Percentage
Hip joint stiffness	12	11.11
Knee joint stiffness	7	06.48
Delayed union	6	05.55
Nonunion	3	02.78
Malunion(Varus)	3	02.78
Shortening of >1cms	2	01.85
Implant failure	2	01.85
Secondary infection	3	02.78

In the study conducted by Pavelka T *et al*[12] the average operative time was 56 min and X-ray exposure lasted on average 1 min. There were 14 intra-operative complications in nine patients, which included incomplete reduction in four cases, fixation in distraction in two, incorrect length of screws in one, fracture at the site of distal locking in two and incorrect insertion of femoral neck screws in five cases. Early post-operative complication involved seven cases and late complications occurred in two patients. In the study conducted by Christophe sadowski et. al[15], 20 patients of proximal femoral fractures were treated by PFN. In the series conducted by Boldin C et. al[16], 34 patients of unstable proximal femoral fractures were treated by PFN. In the series conducted by Schipper[14], 210 patients of proximal femoral fractures were treated by PFN, and they could in all assess 144 patients. The comparison of union rates in various series with the present series is as follows.

Table 4: Comparative studies for union following Proximal Femoral Nailing

Sl. No.	Series	No. of patient	Union	Non union	Delayed union
1	Schipper's[14]	144	83.3%	1.3%	6.25%
2	Christophe's [15]	20	90%	5%	5%
3	Boldin's[16]	55	88%	5.4%	5.4%
5	Present	108	91.67%	2.78%	5.55%

The mean hospital stay was 17.54 days while in a study by I. B. Schipper *et al*[14] the mean duration of hospital stay was 21.7 days. All patients were followed at 6 weeks, 12 weeks, 6 months and some patient's upto 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 and implant failure and screw cut out.

Assessment Of Results: In the present study the average duration of hospital stay was 17.54 days. The mean time for full weight bearing was 12.25 weeks. All patients enjoyed good range of motion at hip and knee joints except twelve patients had hip joint stiffness and seven patients had knee joint stiffness for some period of time. Post operative mobility was aided in immediate post operative period but later all patients were ambulatory independently with or without walking aid after 6weeks, except two patients. At 12 weeks post-operatively, 72 (66.7%) patients had full range of movement at hip joint (0 to 110) and 84 (77.8%) patients had full range of movement at knee joint (0 to 120).

Different fractures took different periods of time for union. Mean period of union was as follows:

- Type IIc- was about 3 months
- Type III- was about 3 months
- Type IV- was about 4 months
- Type V - was about 4 months
- Intertrochantric stable fracture – was about 2 months
- IT unstable fracture – was about 3 months

The mean period of union in our study was 12.9 weeks comparable to findings of B Kanthimathi *et al*[12] (12.6 weeks)

Anatomical Results: Anatomical results were assessed by presence or absence of deformities, shortening, and hip and knee range of motions. In the present study, the union rates were 91.67% and three (2.78%) patients had shortening of >1 cms, seven patients (6.48%) had knee joint stiffness and twelve patients (11.11%) had hip joint stiffness.

Functional Outcome: In this study of 88 operated cases, no deaths were reported during the study period.

The results of the treatment of intertrochanteric and subtrochanteric fractures using Proximal Femoral Nail were assessed by HARRIS HIP SCORE system (Modified).

Table 5: Functional Outcome using Harris Hip Score

Harris hip score	No. Of cases	Percentage
Poor (0 - 69)	14	12.9 %
Fair (70 - 79)	22	20.4 %
Good (80 - 89)	57	52.8%
Excellent (90 - 100)	15	13.9%

In the present study the mean Hip Harris Score at final follow up was 83.2 comparable to the series conducted by I. B. Schipper, E. *et al*[14] (77.6).

CONCLUSION AND RECOMMENDATIONS

The introduction of PFN has broadened the indications for intramedullary fixation of difficult femoral fractures and to include the fractures at the level or below the lesser trochanter. PFN is an effective device in the management of complex femoral fractures. Use of PFN in such fractures provides various advantages:

- Closed procedure

- Minimal soft tissue damage
- No stress risers in bone
- Closer to weight bearing axis.

It offers superior stabilization than other currently used methods of internal fixation. The use of PFN is technically demanding and needs expertise. Complications can be avoided by proper operative technique. Early post operative mobilization and physiotherapy improves the results of PFN.

LIMITATIONS

This study is conducted in a single centre. Multi-centric studies might provide further supportive evidence.

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