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## Study of proximal femoral nail in subtrochanteric femur fracture

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### Abstract

**Background:** Subtrochanteric fractures constitute 10 to 30 percent of all hip fractures. Significant force is required to fracture this bone in adult like motor vehicle accident or fall from significant height while trivial trauma can cause fracture in old people. Various modalities of treatment available for fracture of subtrochanteric fracture femur. The purpose of this study is to assess the outcome of proximal femoral nailing in subtrochanteric fracture femur.

**Material & Method:** 50 cases of subtrochanteric femur fracture underwent surgery with proximal femoral nail carried out at department of orthopaedics, NCH, Surat. The clinical outcome was evaluated by using Harris Hip Score and patient's satisfaction.

**Results:** In our study majority of the patients i.e. 74% were between the age group of 10-50 years, and from it 78% patients were male, the mean age was 40.5 years and majority of the patients had subtrochanteric fractures due to road traffic accidents. The fracture healing time 16.54 weeks.

**Conclusion:** Closed proximal femoral nail is a safe method and can be performed with minimal complication.

**Keywords:** Subtrochanteric femur fracture, proximal femoral nail, intramedullary implant

### Introduction

Subtrochanteric fractures are femoral fracture where fractures occur below lesser trochanter to 5 cm distal in the shaft of femur. These fractures account for 10-30 % of all hip fractures [1]. A significant force is required to fracture this bone in adult individuals, which mainly happens with high energy injury like motor vehicle accident or fall from significant height, whereas in old people occurs because of trivial trauma, because of weak bone [2].

Because of complex anatomy, strong muscle pull and highly stressed region in the body, the reduction of subtrochanteric femur fracture is one of the biggest challenges in traumatology.

Various modalities of treatment for fractures of subtrochanteric femur are available i.e. traction, casting, bracing, pin and plaster, plate osteosynthesis, dynamic compression plate and screw [3].

With the thought that closed proximal femoral nail provides a rigid fixation with better control of rotation and axial translation, while preserving the hematoma and periosteal envelope to aid healing.

### Material and methods

A prospective study of 50 cases of subtrochanteric femur fractures treated with proximal femur nail was carried out at Department of Orthopaedics, New Civil Hospital, Surat with maximum period of follow up 29 months and minimum period of follow up 6 months with average period of follow up 15 months. The patients were chosen as per following criteria:

1. Fracture extending from lesser trochanter to isthmus.
2. Fracture extending from lesser trochanter to isthmus with extension up to greater trochanter

### Initial management

All patients were treated as indoor patients. Airway, Breathing, Circulation were given priority in the management. Necessary resuscitation measures were carried out as required.

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The neurovascular status of the injured limb was examined and recorded. A complete systemic examination was carried out. The injured limb was immobilised with Thomas's splint or below knee skin traction. All the patients were given tetanus prophylaxis, analgesics and broad spectrum antibiotics. Open wounds were managed with debridement and aseptic dressing. A hemodynamically stable patient was sent to radiology department. Anteroposterior roentgenogram of hip with femur, pelvis with both hips and anteroposterior and lateral roentgenogram of femur with knee of affected limb were taken. Other investigations were carried out as per need.

In present study, all fractures were stabilized with AO type of proximal femoral nail of stainless steel having proximal diameter of 14 mm. Length of nail was decided preoperatively by measuring the length of femur from the tip of greater trochanter to adductor tubercle of normal limb. In case of bilateral fracture subtrochanteric femur, the length of nail was measured intraoperatively with two guide wires of identical length.

**Surgical technique**

Patient was operated in supine position on fracture table with perineal support under spinal, general, or epidural anaesthesia. The fracture was reduced by longitudinal traction and limb was placed in neutral or adduction to facilitate nail insertion with heel toe position of feet. Reduction was confirmed under image intensifier in AP and Lateral views. After confirming reduction, the operative part was prepared and draped.

Greater trochanter was palpated between thumb and index finger. Incision was extended 5 cm proximally from the tip of greater trochanter.

Entry point was taken with owl tip of greater trochanter in AP view and midpoint of greater trochanter in lateral view. Guide wire was inserted from entry point and advanced up to lower end of femur. Remaining was done one size greater than the size of nail to be inserted. Proximal part was reamed with 14 mm reamer. After mounting appropriate sized nail in the insertion device, the nail was introduced manually until sufficient depth of insertion was reached, confirmed under IITV.

Drilling and tapping for lag screw was done up to 5 mm from articular surface and lag screw was inserted till subchondral bone was reached. Distal locking was done with a zig in short nails and by free hand technique with the help of IITV in long nails. Zig was removed. Closure of wounds was done and sterile dressing was applied.



**Fig 1:** Instruments Required For Surgery



**Fig 2:** Clinical picture of Entry point



**Fig 3:** IITV image of entry point

**Postoperative Protocol**

Quadriceps and hamstring strengthening exercises, hip, knee, and ankle mobilization exercises were started from second postoperative day. Sitting was allowed from second day. Dressing was done on second and fifth postoperative day with sterile technique. The patient was discharged after suture removal on about 12<sup>th</sup> day. Some patients were discharged on 5<sup>th</sup> day. Patients were advised non weight bearing or walking with the help of crutches or walker if, other injuries did not preclude it.

**Follow up**

All patients were called for first follow up after 6 weeks, second follow up at 10-12 weeks and after that patients were called for follow up as and when required. During follow up, the patient was examined for pain, swelling, wound condition, tenderness at fracture site, limb length discrepancy and implant impingement or any other complaint, range of movements of hip and knee. The radiological assessment was done, anteroposterior and lateral view of affected limb for callus formation, position of fracture, position of nail and screws Results were assessed on the bases of Harris Hip Score.

**Harris Hip Score**

<b>Results</b>	
0-69	: Poor
70-79	: Fair
80-89	: Good
90-100	: Excellent

## Observations & Results

**Table 1:** The table states distribution of age in present study.

Age group	No. of patients	Percentage
10-30 years	18	36%
31-50 years	19	38%
>50 years	13	26%

**Table 2:** Comparison of percentage of Sex with other studies is shown in the following table.

Series	Male (%)	Female (%)
Scripta Medica Study 2006 <sup>[4]</sup>	30%	70%
CORR Study 1992 <sup>[5]</sup>	87%	13%
Present Study	78%	22%

**Table 3:** Comparison of mean age with other studies is shown in the following table.

Series	Age range (years)	Mean age (years)
Scripta Medica Study 2006	46-97	63.70
CORR Study 1992	17-81	32.00
Present Study	16-85	40.50

**Table 4:** The following table states comparison of mode of injury in various series.

Series	Road Traffic Accident	Fall from height (High velocity trauma)	Other injuries (Trivial Trauma)
Scripta Medica Study	30%	10%	60%
CORR Study	70%	07%	23%
Present Study	60%	28%	12%

**Table 5:** The distribution of fracture pattern according to Seinsheimer's classification is shown in the following table.

Seinsheimer's classification	No of cases	Percentage
Type 1	--	--
Type 2a	2	4%
Type 2b	9	18%
Type 2c	1	2%
Type 3a	16	31%
Type 3b	20	39%
Type 4	1	2%
Type 5	2	4%

**Table 6:** The comparison of complications with other studies is shown in following table.

Series	Cut through	Infection	Impingement	Others
Scripta Medica Study 2006	8%	4%	6%	3.6%
CORR Study 1992	0%	0%	9%	5%
Present Study	2%	2%	2%	2%

## Results at Final Follow Up

**Table 7:** The following table highlights distribution of pain in our study.

Degree of pain	Number of fractures	Percentage
No pain	26	52%
Slight pain	19	38%
Mild pain	5	10%
Moderate pain	0	0%
Total disability	0	0%

**Table 8:** Occurrence of limp at final follow up is shown in the following table.

Degree of limp	No of fractures	Percentage
No limp	38	76%
Slight limp	11	22%
Moderate limp	1	2%
Severe limp	0	0%

**Table 9:** Walking ability: The walking ability at final follow up is mentioned below.

Walking ability	Number of fractures	Percentage
Walking without support	40	80%
Cane for long walk	9	18%
Cane for more time	0	0%
Crutches	1	2%
Not able to walk	0	0%

**Table 10:** Distance walked: Walking distance is highlighted below.

Distance walked	Number of fractures	Percentage
Unlimited	42	84%
6 Blocks(3 km)	7	14%
2-3 Blocks(1-1.5 km)	0	0%
Indoors only	1	2%
Bedridden	0	0%

**Table 11:** Stairs climbing: The ability to climb stairs is stated below.

Stairs climbing	Number of fractures	Percentage
Without using railing	41	82%
Normally with using railing	9	18%
In any manner	0	0%
Unable	0	0%

**Table 12:** Squatting: The ability to squat is shown in table.

Squatting	Number of fractures	Percentage
With ease	37	74%
With difficulty	4	8%
Unable	9	18%

**Table 13:** The following table evaluates results of final follow up according to Harris Hip Score.

Results	Harris Hip Score	No of cases	Percentage
Excellent	90-100	39	78%
Good	80-89	3	6%
Fair	70-79	3	6%
Poor	0-69	5	10%

**Table 14:** The comparison of results of various studies according to Harris Hip Score.

Series	Score	Result
Present series	90.1	Excellent
IJO study 2003	84.6	Good
Scripta Medica Study 2006	80.4	Good

**Table 15:** The following table expresses satisfaction amongst the patients.

	No of patients	Percentage
Fully satisfied	45	90%
Partially satisfied	3	6%
Not satisfied	2	4%



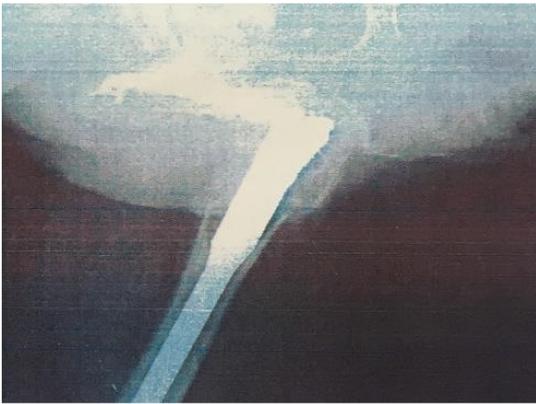
**Fig 4:** Preoperative



**Fig 5:** Immediate Post Operative



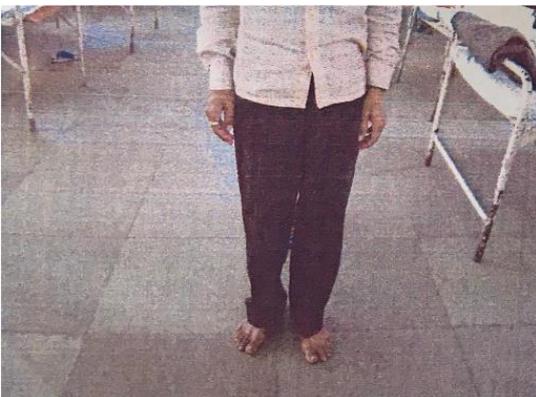
**Fig 6:** Final follow up AP view



**Fig 7:** Final Follow up LATERAL View



**Fig 8:** Final Follow up Clinical Picture 1



**Fig 9:** Final Follow up Clinical Picture 2

### Discussion

Subtrochanteric fractures constitute 10-34% of all hip fractures [1]. It has bimodal age distribution. Young patients

sustain fractures due to high velocity trauma. Older patients sustain these fractures due to low velocity trauma i.e. house hold fall [2]. The high incidence of delayed union, malunion and non-union of fractures has left conservative treatment, as advocated by DeLee *et al*, abolished in modern trauma care. [6].

We have treated 50 patients with subtrochanteric fractures of the femur by minimal invasive fracture fixation technique using proximal femur nail.

With increasing number of vehicles on road and rapid industrialization number of patients with high velocity trauma is likely to increase. As in our study the most common mode of injury was road traffic accidents (60%) and 28% were due to fall from height (High velocity injury). It was also observed that 88% of patients sustained injury because of high velocity trauma and 12% had low velocity trauma.

Short nails are associated with fracture distal to the implant. [7].

Though 3 of our patients did not have any complications with short nails. These small numbers of patients are inadequate to draw definite conclusions. Literatures are in favour of using long nail to avoid this complication.

We have followed the Seinsheimer's Classification [8] according to which 31% of patients were of type 3a, 39% of patients were of type 3b, 2% of patients were of type 4, 4% of the patients were of type 5.

Neurological and vascular deficits are unusual with these fractures, unless they are result of penetrating injuries. In the present series none of the patients had neurovascular deficit.

Average size of nail in present series was of 38 cm long and 10 mm thick with minimum size of 34 cm and maximum size of 44 cm. Proximal screw, superior screw (6.4 mm) has average size of 80 mm with minimum size of 70 mm and maximum size of 85 mm. Proximal screw, inferior screw 8 mm has average size of 85 mm with minimum size of 75 mm and maximum size of 90 mm.

Average duration of surgery in our study was 79.41 minutes with minimum number of 60 minutes and maximum number of 90 minutes. Blood transfusion was needed only in 4 patients. This is very much suggestive of advantage of less blood loss due to close technique and speedy procedure.

Jiang LS *et al* did a study on 49 patients with subtrochanteric fractures treated with the long proximal femoral nail [9]. They achieved union in all their cases but one case had delayed union. They had no complications like cut out or breakage of the implant. They concluded that long proximal femoral nail is a reliable implant in treatment of subtrochanteric fractures and leads to a high rate of bone union with minimal soft tissue damage.

Daniel FA Menzes *et al* and Axel Gamulin (2005) in a clinical study of 155 consecutive patients treated with proximal femoral nail, reported failure of fixation in 2%, femoral shaft in 0.7%, fixation failures included one cut out, one delayed fracture healing and one lateral displacement of the antirotation screw [10]. We also had similar results in our study. One patient had impingement of the screw heads following controlled collapse and was treated with removal of implant at fracture union and he was symptom free. In the present series 8 % complications were present.

Alvarez *et al*. [11] reported two out of 42 cases that developed infection [12]. In our study, superficial infection was present in 1 patient, which respond to wound care and antibiotics with no sign of osteomyelitis at final Follow up.

In our series, average time to full weight bearing was 8 weeks which is late as compared to the series by Smith *et al* who

started full weight bearing by 6.7 weeks.

Average time of fracture union in our study was 16.54 weeks, with minimum of 12 weeks and maximum of 24 weeks as compared to Domingo *et al* series who reported union in 12 weeks.

Harris Hip Score for the evaluation of results in our series which shows excellent result in 39 patients, good results in 3 cases, fair results in 3 cases and poor results in 5 cases. The poor result in one patient was basically because of pathological fracture which led to delayed union and low Harris Hip Score. In other fractures, the associated injuries i.e. tibia fibula fracture, large thigh wound & implant failure contributed to poor results.

In addition we have also evaluated the patient's satisfaction which has shown that 90% of patients were satisfied in our study.

We had some limitations in our prospective study. First, we had no control group such as patients treated with dynamic condylar screw or other types of internal fixation methods to serve as a comparison to the surgical technique, secondly the number of patients were less.

### Conclusions

The series is relative small and period of follow up is short, it is difficult to draw authentic conclusions, however it appears that, Proximal femoral nail is spanning whole femur with proximal and distal locking, an inter medullary load sharing implant, appears to be satisfactory implant in management of fractures of subtrochanteric femur.

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