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Functional outcomes of subtrochanteric femur fractures treated by intramedullary proximal femur nail

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Abstract
Introduction: Subtrochanteric fractures are femoral fractures where the fracture occurs below the lesser trochanter to 5 cm distal in the shaft femur. These fractures account for 10-30% of all hip fractures. They have bimodal distribution patterns and different mechanism of injuries in both age groups. 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, it occurs due to trivial trauma, because of weak bone.
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. Dynamic hip screw and plate, external first generation centromedullary nail, second generation cephalomedullary nail and third generation proximal femur nail. Each method carries its advantages and disadvantages.
Closed proximal femoral nailing provides a rigid fixation with better control of rotation and axial translation, while preserving the hematoma and periosteal envelope to aid healing.
This is a prospective study of subtrochanteric fractures of the femur treated with proximal femur nailing at Aalok hospital, Ahmedabad.
Aim: To study outcomes in patients of subtrochanteric fractures of the femur treated with proximal femur nailing
Materials and Methods: This was prospective study of 51 cases of subtrochanteric femur fractures in 50 patients treated with proximal femur nail; with maximum period of follow up of 29 months and minimum period of follow up of 6 months with average period of follow up of 15 months. Harris hip score was used for the evaluation of results in our series
Results and discussion: In our series, we observed excellent result in 39 patients, good results in 3 cases and poor results in 5 cases. The poor result in one patient (case 5) was basically because of pathological fracture which lead to delayed union and low Harris Hip score. In two fractures the associated injuries i.e. tibia fibula fracture in case 7 and large thigh wound in case 15 contributed to poor results, whereas in case 13 the result was due to implant failure. The mean Harris hip score in our series was 90.1, which is higher than in the other series (84.6 in IJO study 2001-03 = 80.4 in Scripta Medica study). In addition we have also evaluated the patient's satisfaction which has patients were satisfied in our study.
Conclusion: From our study, we concluded that, Proximal femoral nail is a good implant for pathological subtrochanteric femoral fractures. Proximal femoral nail spanning whole femur with proximal and distal locking, an intramedullary load sharing implant, appears to be satisfactory implant in management of fractures of subtrochanteric femur 2-C.

Keywords: Subtrochanteric femur, fractures treated, intramedullary proximal femur nail

Introduction
Subtrochanteric fractures are femoral fractures where the fracture occurs below the lesser trochanter to 5 cm distal in the shaft femur [1]. These fractures account for 10-30% of all hip fractures. They have bimodal distribution patterns and different mechanism of injuries in both age groups. 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, it occurs due to trivial trauma, because of weak bone.
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 [1].

The possibility of life threatening complications viz. haemorrhage, fat embolism and acute respiratory distress syndrome necessitate an emergent management of this fracture, frequently requiring a multidisciplinary approach as many of these are polytrauma cases. Incidence of concomitant injuries range from 21-52% with mortality of 8.3-20.9% [2].

Being richly supplied by blood vessels owing to a thick muscular envelope, non union is not common with fractures of subtrochanteric femur. Due to significant socioeconomic impact of this fracture, a mode of treatment which minimizes the complications of malunion, shortening, stiffness and allows early mobilization with rehabilitation of the patient is required [2].

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. Dynamic hip screw and plate, external first generation centromedullary nail, second generation cephalomedullary nail and third generation proximal femur nail. Each method carries its advantages and disadvantages.

Closed proximal femoral nailing provides a rigid fixation with better control of rotation and axial translation, while preserving the hematoma and periosteal envelope to aid healing.

This is a prospective study of subtrochanteric fractures of the femur treated with proximal femur nailing at Aalok Hospital, Ahmedabad.

Aim: To study outcomes in patients of subtrochanteric fractures of the femur treated with proximal femur nailing

Material & methods

This was prospective study of 51 cases of subtrochanteric femur fractures in 50 patients treated with proximal femur nail; carried out at Aalok Hospital, Ahmedabad from July 2013 to December 2015 with maximum period of follow up of 24 months and minimum period of follow up of 6 months with average period of follow up of 15 months. The patients were chosen as per following inclusion 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. On arrival, history regarding time, cause of injury and other relevant information were obtained from patient or relatives. Airway, breathing and circulation (ABC) were given priority in the management. Necessary resuscitation measures were carried out as required. The injured extremity was examined thoroughly to determine deformity, skin condition and other injuries. The neurovascular status of the injured limb was examined and recorded. A complete systemic examination was carried out. The injured limb was immobilized 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 thermodynamically 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 required investigations were carried out as per need As soon as patient was fit for surgery under anaesthesia, patient was taken for internal fixation either in emergency or as elective surgery.

Selection of nail

In the present study, all fractures were stabilized with AO type proximal femoral nail.

Selection of nail: Femur nail of stainless steel having proximal diameter of 14 mm. Length of nail as 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 fractures, 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 anesthesia. The uninjured limb was kept in maximum abduction to provide enough space for image intensifier. The fracture was reduced by longitudinal traction and limb was placed in neutral or adductions to facilitate nail insertion with heal 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 the greater trochanter. Skin, subcutaneous fat and gluteal fascia were incised and fibers of gluteus maximus were splitted in the direction of fibers. This exposed the greater trochanter. Entry point was taken with awl over 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. Reaming was done one size greater than the size of the 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. The guide sleeve for the lag screw and its obturator were inserted into the slanting hole of the target device. A small incision was made laterally at the contanct point and with twisting movement the sleeve was advanced until the bony contact had been achieved. Guide sleeve was inserted and over it guide pin was inserted using a drill in center or inferior part of the femoral head in AP view and center or just posterior to center in lateral view. Thereafter the guide pin for the antirotation hip screw was introduced. Guide pin was inserted up to 5mm from the articular surface and lag screw was inserted till subchondral bone was reached. Guide pin was then removed. Distal locking was done with a zig in short nails and by free hand technique with the help of IITV in long nails. Zig removed. Final position of the screws and fracture reduction were checked IITV. Closure of wound was done and sterile dressing was applied. Wounds away from fracture were thoroughly debrided and as soon as condition of wound improved, were covered with split thickness skin graft. The patient was shifted to postoperative ward. A proper post operative care was taken.

Post Operative Protocol

The patient was shifted to ward and operated limb was kept on a pillow.

Parenteral broad spectrum antibiotics were given for five days The analgesics were given as per need Elastic compression bandage was applied from upper third of leg to thigh. Distal neurovascular status of operated limb was checked. The check x-rays were taken on second postoperative day, anteroposterior and lateral views of hip with femur and femur

with knee Quadriceps and hamstring strengthening exercises, hip, knee and ankle mobilization exercises were started from second post operative day. Sitting was allowed from the second day. Dressing was done on second and fifth postoperative day with sterile technique. The patient was discharged after suture removal on about 12th day. Some patients were discharged on 5th 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 patient were called for follow up as and when required. During follow up, the patients were 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. As per clinico radiological progress of fracture healing and condition, partial weight bearing with axillary crutches or a walker or full weight bearing was allowed on follow up. The clinical sign of fracture healing is absent of pain at fracture site and the radiological sign is presence of bridging callus in roentgenogram. If the clinico radiological signs of fracture union were not present, dynamisation was performed by removal of distal locking bolts at around 6 weeks.

Observations & results

The present series was prospective study of 50 cases of subtrochanteric femur fractures treated by proximal femur nail.

Age

Table 1: 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%

The youngest patient in our study was 16 year old and the oldest patient was 85 years old. Majority of the patients i.e. 74% were between the age group of 10-50years.

Gender

Table 2: Distribution of patients according to Gender

Male (%)	Female (%)
78%	22%

In the present study, 78% patients were male, while 22% patients were females. In the present study, the mean age was 40.5 years, which is lower as compared to other three studies.

Table 3: The following table states mode of injury

Series	Road Traffic Accident	Fall From height (high Velocity trauma)	Other injuries (Trivial Trauma
Present study	60%	28%	12%

In the present series as seen regularly majority of patients had subtrochanteric fractures due to road traffic accidents.

Table 4: The table highlights associated Injuries with subtrochanteric femur fracture

Injuries	No. of patients	Percentage
Thigh Wound	2	4%
Fracture radius ulna	2	4%
Fracture calcanium	1	2%
CLW over leg	1	2%
Public rami fracture	1	2%
Tibia fibula fracture	1	2%

Sixteen percent of patients had other associated injuries.

Table 5: The table shows conditions associated with subtrochanteric femur fracture

Injuries	No. of patients	Percentage
Parathyroid pathology	2	4%
Cerebrovascular Stroke	1	2%

About 4% patients had parathyroid pathology, whereas about 2% patients has cerebrovascular stroke.

Table 6: The Distribution of fracture pattern according to Seinsheimer's classification is shown in 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%

The majority of patients in present study were of unstable variety i.e. 76% (Type 3a, 3b, 4 and 5).

Table 7: Time of weight bearing and fracture union status at various time intervals

Series	Weight Bearing	Fracture Union status	Hospital Stay	Injury of operation time
Present study	8 weeks	16.54 weeks	17 days	5 days

As evaluated from table 7 fracture healing time ranges from 13.9 weeks to 25.5 weeks in various studies.

Results at final follow-up

At final follow up, we compared 50 fractures in 49 patients as one of the patient died due to cerebrovascular stroke (case 27).

1. Pain: 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%

None of the patients had moderate to severe pain.

2. Limp: Occurrence of limp at final follow up is shown in following table.

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

Seventy six percent of patients were having no limp.

3. 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%

As shown in above table eighty percent of patients were able to walk it support and 18% of patients were able to walk with cane in hand

4. Distance walked: Walking distance is 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%

Walking unlimited distance was possibilities 84% of cases.

5. Stairs climbing: The ability to climb stair stated below.

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

6. Squatting: The ability to squat is shown following table.

Squatting	Number of fractures	Percentage
With case	39	78%
With difficulty	4	8%
Unable	7	14%

7. Cross leg sitting: Cross legged sitting is hlighted in following table.

Cross legged sitting	Number of fractures	Percentage
With case	37	74%
With difficulty	4	8%
Unable	9	18%

8. The following table evaluates results of final followup according to Harris hip score.

Results	Harries hip score	Non cases	Percentage
Excellent	90-100		78%
Good	80-89		6%
Fair	70-79		6%
Poor	0-69		10%

Majority of patients i.e. 78% had excepted results in our study

Harris hip score

Series	Score	Results
Present series	90.1	Excellent

Our study had excellent results with mean Harris hip score of 90.1 which is higher than other two studies.

Discussion

Subtrochanteric fractures constitute 10-34% of all hip fractures. 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.

We have treated 50 patients with 51 subtrochanteric fractures of the femur by minimal invasive fracture fixation technique using proximal femur nail. A prospective randomized study was done from July 2006 to December 2008- One patient died due to CV stroke during study and one patient had bilateral fractures. So final follow up of 49 patients with 50 fractures was carried out.

The patients in the current series were of all age with an average age of 40.S years whereas the average age was 56.93 years in IJO study [3]. 2001-03, 637 years in Scripta Medica study[4] 2004-06, 32 years in CORR series [5]. This signifies that young adults are engaged more in outdoor activities they have to work for earning their livelihood.

Majority of the patients in our series were male (78%) whereas in IJO study [3] 2001-03, male were 57% and females 43%, in Scripta Medica study [4] 2004-06, males were 30% and females were 70% and in CORR series [5] males were 87% and females were 13%. This goes to show male preponderance in Indian population. In Indian setup more numbers of males are engaged in jobs and agriculture. They have to travel more for outdoor activities compared to females. This may be one of the reasons for increasing number of males in the present series.

The most common side of injury in present series was right side (66%), left side was affected in 32% of patients and there was a patient with bilateral affection (case 5). Side affected will depend upon which limb gets the impact of force

With increasing numbers of vehicles on road and rapid industrialization, number of patients with high velocity trauma is likely to increase. Good civic sense and obeying traffic rules should decrease the number of road traffic accident. 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. In IJO study [3] 2001-03, high velocity trauma was 80%, in Scripta Medica [4] study 2004-06, high velocity trauma was 40% and in CORR series [5]. high velocity trauma was 77%. Young patients sustained this fracture due to high energy trauma i.e. road traffic accidents, fall from significant heights, sports and penetrating injuries. (32) In the present series 88% of the patients sustained fracture due to either road traffic accidents or fall from significant height so our observation is consistent with literature. Old patients with weak bone usually sustained injury due to low - energy trauma. A pathological trauma can occur at any age (Case 5 and 9). In the present series 12% of the patients sustained fractures due to low velocity trauma. Two patients had pathological fracture due to parathyroid adenoma. With increasing life span, number of patients sustaining fracture due to low energy trauma is likely to increase. Practically in majority of series reported, high velocity trauma was the most common cause of fracture. Our observation is similar to that of literature [3, 4, 6].

Goal of the treatment is to restore pre trauma status as early as possible with less morbidity and mortality and treatment should be cost effective [2].Various modalities of treatment are available i.e. traction, plaster, femoral/ tibial inning, external fixator, etc. were used for treating these type of fractures in the past The evolution of plate osteosynthesis (Dynamic Compression Screw and late, Dynamic Hip Screw and plate, angle blade plate, Jewett plate, etc.) improved the reduction but the factors like surgery time, blood loss, infection, on union, implant failure remain the major no addressed problems. Current tend is to reduce the use of plate osteosynthesis [2]. It is important how to obtain adequate fracture stability without devitalizing the fracture site and thus =intervening less with bone healing. Because mechanical stress is high in proximal femur, fatigue life of the selected implant is a real concern. The closed. nailing technique has evolved from simple Kuntcher nailing to Zickle nail, 1St generation inter locking nail, etc but problem of inability to fix the fracture with proximal extension remained[1]. With advent of gamma nail, Russel Taylor nail, proximal femoral nail and antegrade femoral nail these problems are significantly addressed [2].

Short nails are associated with fracture distal to the implant[2]. Though our patients did not have any complication with short nails these small numbers of patients are inadequate to draw definite conclusions. Literatures are in favor of using long nail to avoid this complication [7].

The average injury to operation interval in our study was 5 days with minimum 12 hours and maximum of 40 days. The delay in surgery was primarily because of poor uneducated patients who reported late after taking primary treatment usually by bonesetter in tribal areas. Injury operation interval 10 days in IJO study [3] 2001-03, 5 days in Scripta Medica study [4] 2004-06 and days in CORR series [5]. The delayed operative fixation of the patient with Pathological fracture had statistically contributed more to further increase in the - average delay.

Open subtrochanteric fractures are rare [8]. None of the fractures was open fracture in our study which correlates with the literature. The wound in the same limb distant to fracture site were present in three patients and those responded to debridement, wound care, antibiotics and split thickness skin grafting. Though the fractures are closed, high energy fractures are associated with comminution with potential for soft tissue damage even in closed injuries.

Various classification are available for subtrochantenc femur fracture i.e. Senisheimer's classification, Russel Taylor classification, Fielding's classification according to which 31% of patients were of type 3a, 39% of F classification, AO classification. We have followed the Seinsheimer's patients were of type 3b, 2% of patients of type 4 and 4% of patients were of type S This classification is specific for subtrochanteric femoral fractures based in number of fragments, location and configuration of fracture lines. Although disadvantage of intra observer and inter observer variations in high numbers [2].

Neurological and vascular deficits are unusual with these fractures unless they are the results of penetrating injuries[9]. In the present series none of the patients had neurovascular deficit. Our observation is similar to that of As expected, high energy fracture is likely to have associated injuries. This should be kept in mind. With high energy subtrochanteric fractures Tassociated injuries are found in up to 50% of patients [10]. In the present series sixteen percent of patients had other associated injuries. Such injuries should be detected at initial examination and should be treated as per merits to reduce morbidity and mortality. Three patients (6%) had wounds of thigh and leg which required split thickness skin grafting. Two patients (4%) had radius ulna fracture out of which one had bilateral lower end radius fracture. One side was treated with K-wire and other was treated with buttress plate. The other patient had middle third radius ulna fracture treated with rush nail. One patient had tibia fibula fracture which was treated with interlocking nail of the same side. One patient had calcanium fracture of the same side which was treated by plate osteosynthesis. Pubic rarni was fractured in one patient and was treated conservatively. Three patients were having associated other conditions. Two (4%) patients had parathyroid adenoma with pathological fracture subtrochanteric femur. After surgical removal of adenoma, fractures were stabilized with proximal femoral nail. One (Case 27) died during post operative period due to cerebro vascular stroke. Associated medical co morbidities must be kept in mind particularly in low energy fracture patients.

Average size of nail in present series was of 38 cms 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. Distal screw (4.5 mm) has average length of 44 mm with minimum 34 and maximum 58 mm. So in the Indian population these are the common sizes which should be available always in the inventory of implants.

Average duration of surgery in our study was 79.41 minutes with minimum of 60 minutes and maximum of 90 minutes Blood transfusion was needed only in 4 patients. This is very much suggestive of the advantages of less blood loss due to closed technique and speedy procedure. Open procedure requires more time, more blood loss, higher chances of infection, non union and other morbidities.

With each surgical procedure and/or implant there is potential risk for complications With regards to complications in our study one patient had cut through of implant with no salvage possible Implant was removed Patient refused to undergo second surgery. Superficial infection was present in one patient which responded to wound care and antibiotics with no sign of osteomyelitis at final follow up One patient had

impingement of the screw heads following controlled collapse and was treated with removal of implant after fracture union and he was symptom free One patient died of stroke which Was not included in final follow up. In the present series 8% of complications were present whereas 26.6%, 21.6% and 14% of complications were present in IJO study[3], Scripta Medica [4] and CORR study [5] respectively. Complication rates up to 20% have been reported with varying modalities of treatment The single most important factor related to failure is inability to restore the medial cortex at the time of surgery [11, 12].

The average time of full weight bearing in present series was 8 weeks as compared with 6 weeks in PEN study [3] of IJO 2001-03, 8 weeks in scripta Medica study [4] 2004-06 arid 16 weeks in CORR study [5]. Stability given by proximal femore weeks in CORR series [5]. Signs of fracture union are absence of pain at fracture site clinically and presence of callus formation radiologically.

Harris hip score for the evaluation of results in our series which shows excellent result in 39 patients, good results in 3 cases and poor results in 5 cases. The poor result in one patient (case 5) was basically because of pathological fracture which lead to delayed union and low Harris Hip score. In two fractures the associated injuries i.e. tibia fibula fracture in case 7 and large thigh wound in case 15 contributed to poor results, whereas in case 13 the result was due to implant failure. The mean Harris hip score in our series was 90.1, which is higher than in the other series (84.6 in IJO study [3] 2001-03 = 80.4 in Scripta Medica study [4]). The Harris Hip Score is most frequently used adaptated as single rating system by the Orthopaedic community to standardized reporting system. The disadvantage of this technique is its subjective rating rather than functional capacity [2]. We have modified sixth and seventh parameters of Harris Hip Score 'put on socks and shoes' and sitting' with squatting and 'cross legged sitting' to assess the results as per a Indian activities of daily, living. According to Harris Hip Score, results of our - nor compared to other studies.

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

Conclusions

The series is relatively small and period of follow up is short, it is difficult to draw authentic conclusions, however it appears that, Proximal femoral nail is a good implant for pathological subtrochanteric femoral fractures. Proximal femoral nail spanning whole femur with proximal and distal locking, an intramedullary load sharing implant, appears to be satisfactory implant in management of fractures of subtrochanteric femur 2-C.

References

1. Rockwood Green's. Fractures in adults, 5th edition, 2001; 3:1827-1844.
2. Campbell's operative orthopaedics: 11th edition, 3, 264.
3. Indian Journal of Orthopaedics Study of modificd pö 'I femur nail in peritrochanteric fractures in adults, 2001-03
4. Scrinta Medica BRNO. Proximal femur nail - A new stave in therapy of extracansullar femur fractures. 2004-06.
5. CORR. Subtrochanteric fracture of femur, Results of treatment with interlocking nail, 1992, 231-236.
6. Schipper B *et al*. Treatment of unstable trochanteric fractures. JBJS 2004; 86B:86-94.
7. Zickel RE. A new fixation device for subtrochanteric fracture of femur. Clin. Orthop. 1967, 54.
8. Al Yassari G, Jones JW. The A.O./ASIF proximal femoral nail for treatment of unstable trochanteric fractures. Injury. 2002; 33:395-399.
9. Jupiter and Browner *et al* Ske[etal trauma, 3" edition, 1832.
10. Indian Journal of Orthopaedics Study of modificd pö 'I femur nail in peritrochanteric fractures in adults, 2001-03
11. Hanson GW, Tullos HS. Subtrochanteric fractures of the femur treated with nail-plate devices: A retrospective study, Clin. Orthop. 1978; 131:191-.
12. Waddel JP. Subtrochanteric fractures of the femur: A review of 130 patients. L Trauma. 1979; 19:582.