Original Research Article

A study of management of subtrochanteric fractures of femur with reconstruction nail

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Abstract

Background: Injuries to the femur the longest bone in the body present challenging situation to the Orthopaedic Surgeon. These fractures account for 10% to 34% of all hip fractures. Advantages of intramedullary devices included retained blood supply to bone fragments, less operative blood loss and less disruption of the environment. **Aims And objectives:** The aim of this study is to study the various fracture problems of proximal femur, the management of these fracture with reconstruction nail, the management of these fracture on the basis of Russell Taylor classification, **Materials and methods:** Intramedullary Nailing with closed reduction was chosen. This study was performed in MGM Medical College and Hospital, Aurangabad. Patients Having simple subtrochanteric, subtrochanteric with intertrochanteric extension and communited subtrochanteric fracture were included in study. **Result and conclusions:** were drawn after assessing immediate and late complications, and difficulty while performing surgeries. complications like knee stiffness, shortening, rotational deformity, and Non union were faced.

Key Word: subtrochanteric fractures of femur.

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INTRODUCTION

Subtrochanteric fractures is the term limited to fractures between the lesser trochanter and the isthmus of diaphysis. Injuries to the femur the longest bone in the body present challenging situation to the Orthopaedic Surgeon. The subtrochanteric fracture has long been recognized as the most difficult of these injuries to treat. Femur fractures are commonly seen in polytrauma patients, mechanisms of injury include automobile, crashes, vehicle versus pedestrian injuries, motor cycle injuries, gunshot wounds, fall from height and industrial accidents. These fractures account for 10% to 34% of all hip fractures. They have bimodal age distribution and very different mechanisms of injury. The older patient typically sustains low velocity trauma, where as in younger patients these fractures commonly results from high energy trauma and often are associated with other fractures and associated fractures usually are, fracture tibia, fracture patella and pathological fracture associated with metastatic bone diseases. Reported incidences of concomitant injuries requiring surgical treatment from 21% to 52% and reported mortality ranges from 8.3% to 20.9%. Prior to the turn of the 20th century these injuries were less common but more devastating to the patient. The treatment option were few and less effective then the treatment now available, this clearly was a life threatening situation that had grave associated consequences. Now the subtrochanteric fracture is best treated surgically in most cases as restoration of femoral length and rotation and correction of femoral head and neck angulation can be done. There are two ways to treat fracture subtrochanteric femur by internal fixation, i.e. sliding compression hip screw with side plate assembly and intramedullary fixation devices. Advantages of intramedullary devices included retained blood supply to bone fragments, less operative blood loss and less disruption of the environment. So here is study of 30 cases of subtrochanteric fracture. The goal is to find most suitable treatment for given fracture pattern in available setup.

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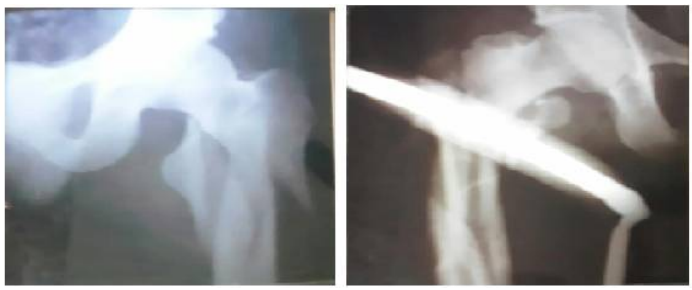

AIM AND OBJECTIVES

The aim of this study is to study the various fracture problems of proximal femur, the management of these fracture with reconstruction nail, the management of these fracture on the basis of Russell Taylor classification, Studying the various complications, and to set guidelines for the management of these fracture.

MATERIALS AND METHODS

In this prospective study of 30 patients of subtrochanteric fractures admitted in our institute were studied during the period of Oct.2005 to Sept. 2007.

Criteria to include the patients in this series were,

1. Subtrochanteric fracture of the femur (simple)
2. Subtrochanteric fracture with intratrochanteric extension.
3. Complex comminuted fracture of subtrochanteric region.

These all fracture were classified according Russell Taylor classification

Preoperative Evaluation: Patient after coming to hospital the treatment was started right from casualty. Emergency management of all life threatening conditions was carried out in casualty department with respect to airway, breathing circulation, Emergency treatment in casualty, IV fluids, IV antibiotics, Immobilization of the affected extremity in Thomas split. Monitoring of vital Parameters, Management of associated injuries to vital organs like, chest injury, abdominal injury and head injury were carried out initially, After stabilization of vital parameters, radiographs of the affected extremities were carried out. Fracture pattern was grouped according to Russell Taylor classification.

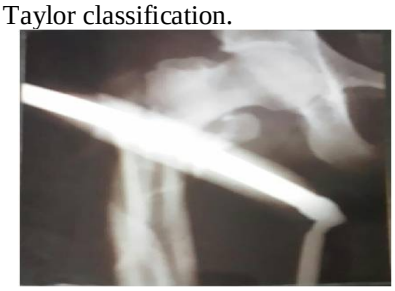

Figure 1: Pre op Xray of right subtrochanteric Femur Fracture

Preoperatively all routine investigations and specific investigations of the associated medical illness were carried out. All routine investigation were done as hemogram (HB, TLC, DLC). Urine-routine and microscopy, Blood sugar level, Serum electrolytes, Blood urea level, Electrocardiogram, X-ray chest, Blood group cross matching, Pre operatively anesthetic fitness was taken, adequate blood was kept ready in the blood bank and informed and written consents were taken ,Shaving of the affected extremity, informed and written consent of the patients for internal fixation of fracture were taken. All the patients were kept fasting overnight and were given Tablet Dulcolax 2 at bedtime. Study of the fracture anatomy was done according to the Russell Taylor classification. Clinical and radiological measurements of proper nail size and screw size were carried out. Essential implants instruments were kept ready. Reconstruction nails of all sizes were kept ready along with interlocking bolts of all sizes and reconstruction nail assembly was kept ready. X-ray machine, Image intensifier and all necessary equipments were kept ready. We have operated all the patients under spinal and epidural anaesthesia in supine position on fracture table.

Steps Of Operation: After inducing the patient, we have give supine position was given to all patients on fracture table. Painting draping was done after scrubbing the extremity with 10% betadine solution and savlon from iliac crest to ankle joint was done. We used close reduction and internal fixation initially and in cases where close reduction was not possible we did open reduction and internal fixation with reconstruction nail. All patients who had undergone open reduction were primarily bone grafted.

Positioning of patients: Patient was given supine position. The unaffected extremity was abducted and flexed and fixed to the post of fracture table. Trunk and affected extremity adducted so the position was like inverted 'V' shape. Flexion of the affected hip of 15 degrees. Maintenance of 'heel to toe' relationship. Traction applied to the affected limbs by foot holder. Foot of the affected extremity was rotated to obtains correct rotational alignment with respect to anteversion of the hip as determined with image intensification Prepare and

drape the patient and the image intensifier in the standard manner.

Procedure: Oblique skin incision was taken just proximal to the greater trochanter and dissection continued proximally and medically for 9 to 10cm. Fascia of gluteus maximus was incised in line with its fibers. Subfacial plane of the gluteus maximus was identified and trochanteric fossa was palpated.

Femoral Preparation: Determining the proper entry portal is crucial as entry portal to far laterally can create varus reduction. The entry site was identified by using Steinman pin and it was inserted at the trochanteric fossa in the midplane of the femur in the both AP and lateral plane. The entry portal was made directly with curved awl at the trochanteric fossa in the mid plane of the femur and confirmed with image intensification in both AP and lateral view.

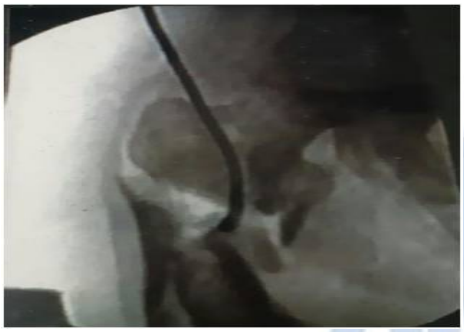

Figure 2: Determination of proper Entry Portal

Guide Rod Insertion: 3.2 mm curved tip guide rod was used so that displaced fracture can be reduced. Reamed nailing was used. So guide rod was introduced in proximal fragment and its containment within the femur on AP and lateral views was confirmed with image intensification. Using cannulated reamer proximal fragment was reamed upto 13mm in diameter in 1mm increments. Proximal fragment reduced to the distal fragment and confirmed on AP and lateral views with image intensification. The guide rod was advanced into the center of the distal fragment until the tip reaches the physeal scar and containment of the guide rod within the femur was confirmed with image intensification.

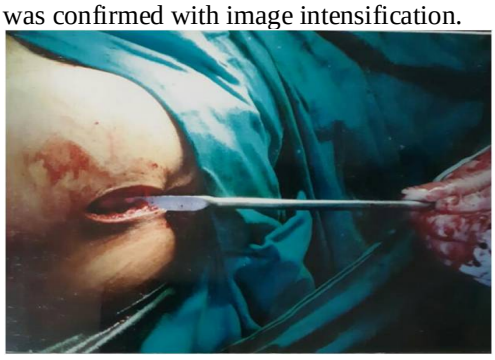

Figure 3: Guide Rod Insertion through entry portal

Determination Of Correct Nail Length: The correct nail length was verified by following method. The distal end of guide rod between proximal pole of patella and distal femoral physeal scar, and the second equal length guide road was overlap and extended from the femoral entry portal. The length of overlapped guide rod was subtracted (in millimeters) from 900mm to determine nail length.

Reaming and Insertion: Reaming was done over the 3.2 mm guide rod in 0.5mm increments until the desired diameter was reached. The final reamer diameter was verified with the reamer template. The femur was over reamed 1.5mm over the selected nail diameter. Proximal fragment upto 8cm was reamed upto 13mm for the expensed proximal portion of the reconstruction nail. The selected nail was assembled to proximal stainless steel drill guide with hexagonal bolt, so that the nail will have an anterior bow and the keyed post of the proximal drill guide will point laterally. The supine driver is attached to offset driver at 15 degrees. The guide preassembled to the nail and a guide pin passed through the sleeves into the locking screw holes in the nail for assuring the accurate placement of the screws. The nail is inserted over the guide rod, the keyed post is used for controlling rotation and insertion of the nail. Nail is inserted with insertion instrument only. The reconstruction nail is inserted to the proper depth to allow proximal screw placement in the femoral head. For determining the proper insertion depth for the reconstruction nail, the inferior drill sleeve is placed in the proximal drill guide and guide pin is passed through the sleeve, its position superior to the calcar is confirmed with image intensification so that two 6.4 mm screw can be placed in the femoral head.

Proximal Interlocking: Two screws were inserted into the femoral head to have stronger mechanical construct. No. 15 knife was used to incise the skin and fascia through inferior hole in the proximal drill guide. The stacked drill sleeves were inserted with all three sheaths. The 8mm green and 2.4mm purple sheaths were used. The drill sleeves pushed to the bone and 2.4mm guide pin inserted through the purple drill sleeve and advanced into the femoral head at least 4mm superior to the calcar to a level of approximately 5mm below the subchondral bone of the femoral head. The position of the guide pin within femoral head and neck was confirmed with AP and oblique lateral views. After confirming the position of inferior guide pine, skin and fascia was incised through the superior hole of proximal drill guide. The stacked drill sleeves through the superior hole were pushed to the bone. The 2.4 mm guide pin was inserted through the purple drill sleeve and advanced in the femoral head. The position was confirmed with image intensifier.

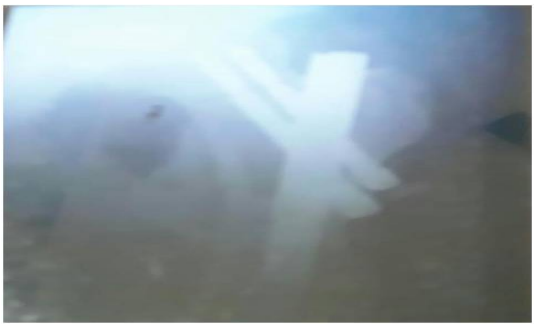

Figure 4: Proximal Locking Screws

Inferior Screw Placement: Inferior purple drill sleeve removed and the large cannulated step drill was inserted through the green drill sleeve into the femoral head to within 5mm of subchondral bone. The screw length was measured at this point using the drill calibrations and reading the depth against the top of the green drill sleeve, this was followed by tapping. The appropriate length of 6.4mm screw was inserted with 6.4mm hex driver. The above mentioned procedure was repeated for superior screw placement.

Distal Locking: The freehand technique described by Hall was used for distal locking. By placing the image intensifier in the lateral position and distal area was scanned. True lateral image were obtained so that screw holes were circular. When the holes were circular and ring forcep was centered over proximal screw hole on the lateral side of the leg and then 15 No blade was introduced within the confines of the ring forcep. Longitudinal incision was made along the midline axis of the leg, incision carried down to the bone, repeat the procedure at the distal screw hole.3mm K wire was angled at 45 degree over proximal screw hole, using the image intensifier K wire was adjusted until the point was centered in the screw hole. The image intensifier is then turned to AP view and maintain constant pressure on the K wire to prevent skidding and the K wire is swinged perpendicular to the axis of the bone, the angle of K wire was adjusted in AP image so that K wire can be driven toward the hole in the nail. K wire was lined in Both AP and Lateral image. K wire was pointed directly to the center of the hole within the rod and once proper alignment was obtained K wire was hammered and hole was made. K wire was removed and drill was placed in the hole and drilled through the rod and opposite cortex. The length was determined with depth gauge. The screw is placed in proper position. The same procedure is repeated at the other screw hole. The final image was obtained with image intensifier to confirm satisfactory placement of the screw. Proper hemostasis was achieved, wound closed in layers over suction drain. Post operative check x-ray were taken of the operated extremities.

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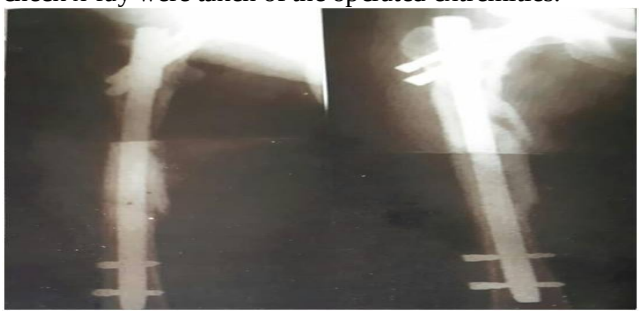

Post Operative Management: Limb elevation was given on Bohler's frame, IV Fluids, IV Antibiotics in the form

of III generation cephalosporin, aminoglycosides, metronidazole were administered, Analgesics were given ,isometric quadriceps exercise from Day 2 were started, Suction drain removal done after 48-72 hrs., Early hip and knee assisted ROM were started from third day. Suture removal after 10 days was done .Patient discharged one week after operation after giving proper physiotherapy instruction.

Follow Up:-Regular follow up of every patient was carried out at every 4 week interval. Following points were noted after clinical and radiological examinatinon 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 x-ray were taken for-Signs of union, Failure of the fixation, Failure of the implant. Partial weight bearing was started 2 to 4 weeks post operatively. Full weight bearing was allowed after radiological and clinical signs of union. Grading of the patients was done as per D Aubigne / Post scale.

Very good = P + W =11 or 12
Good = P + W =10
Medium= P + W =9
Fair = P + W =8
Poor = P + W =7 or less

Table 1: D' Aubigne and postal scale for function as grading

(P)Pain	Ability to (W) walk	Mobility (N) or nearly Normal	Grade
		Very Good	
6	6	Walking without cane, with no pain and no limp	P + W = 11 or 12
6	5	Walking without cane, with no pain but slight limp	
5	6	Walking without cane, with no limp but slight pain when starting	
		Good	
5	5	Walk without cane, with slight pain and slight limp	P + W = 10
4	6	Walk without cane, with pain but no limp	
6	4	Walk without cane, without pain, a cane used to go outdoors.	
		Medium	
5	4	Slight pain, a cane is used outdoors	P + W = 10
4	5	Pain after walking some minute, no cane, but there is slight limp	
6	3+	No pain, a cane used all time	
		Fair	
5	3	Slight pain, a cane is used all the time	P + W = 10
4	4	Pain after walking, a cane is used outdoor	
≤3	≤3	Poor	P+ W = 7 or less

OBSERVATION AND RESULTS

In this study, we have treated 30 cases of subtrochanteric fracture femur. Assessment done is as follows

Sr. No.	Age group in year	No of case	Percentage
1	20 to 30	5	16.6
2	30 to 40	17	56.6
3	40 to 50	4	13
4	50 to 60	2	6.6
5	>60	2	6.6
	Total	**30**	**100**

Table 2: Age Incidence

Majority of the patient in the series were 20 - 40 age group.

1	Male	25	83.3
2	Female	5	16

Table 3: Sex Incidence

Most of the patients were males as they participate is active physical out door work and traveling.

Sr. No.	Mechanism of Injury	No of case	Percentage
1	Accidental fall	2	6.6
2	Fall from height	5	16.6
3	RTA	22	77.3
4	Pathological Fracture	1	3

Table 4: Mechanism Of Injury

Thus majority of patients had a history of road traffic accident.

Sr. No.	Type of Injury	No of case	Percentage
1	Ipsilateral fracture patella	2	6.6
2	Ipsilateral fracture tibia	3	10
3	Contralateral fracture shaft femur	1	3
4	Head injury	5	16
5	No associated injury	15	50
6	Pelvic injury	2	6.6
7	Abdominal injury	2	6.6
	Total	**30**	**100**

Table 5: Associated Injury

Sr. No.	Side	No of case	Percentage
1	Right	165	53
2	Left	14	46.6

Table 6: Side Of Injury

Sr. No.	Type of fracture according to Russell Taylor Classification	No of case	Percentage
1	Type IA - Piriformis fossa and Lesser Trochanter intact	5	16.6
2	Type IB - Piriformis fossa intact and Lesser Trochanter fractured	20	66.6
3	Type IIA - Piriformis fossa fractured and Lesser Trochanter intact	4	13.3
4	Type IIB - Piriformis fossa and Lesser Trochanter both fractured	2	6.6

Table7: Classification Of Fractures

Majority patient in our series belonged to type IB category.

Sr. No.	Type of Surgery	No of case	Percentage
1	Close Reduction	27	90
2	Open Reduction	3	10

Table 8: Type of surgery

Sr. No.	Duration of Surgery in hours	No of case	Percentage
1	1.50 - 2.00	20	66.6
2	2.00 - 2.30	8	26.6
3	2.30 - 3.00	2	6.6

Table 9: Duration of surgery

Sr. No	Type of Fracture	No	Union	Delayed Union	Non Union
1	Type IA - Piriformis fossa and Lesser Trochanter intact	5	5	-	0
2	Type IB - Piriformis fossa intact and Lesser Trochanter fractured	20	20	2	0
3	Type IIA - Piriformis fossa fractured and Lesser Trochanter intact	4	3	1	0
4	Type IIB - Piriformis fossa and Lesser Trochanter both fractured	2	1	1	1

Table 10: Type of Union

Sr. No.	Type of fracture	No	Union Month
1	Type IA - Piriformis fossa and Lesser Trochanter intact	5	5
2	Type IB - Piriformis fossa intact and Lesser Trochanter fractured	20	4
3	Type IIA - Piriformis fossa fractured and Lesser Trochanter intact	4	4.5
4	Type IIB - Piriformis fossa and Lesser Trochanter both fractured	2	5

Table 11: Duration in months for union

Sr. No.	Grading	No of case	Percentage
1	Very Good	7	23.3
2	Good	16	53.3
3	Medium	4	13.3
4	Fair	2	6.6
5	Poor	1	3

Table 12: Grading of Operated cases

A) Intra Operative Complications

Sr. No	Complications	No of Patients
1	Flaring of trip of nail	2
2	Difficulty in distal locking	8
3	Difficulty in proximal locking	4
4	Difficulty in entry point	8
5	Difficulty in achieving close reduction	7

B) Early

Sr. No	Complications	No of Patients
1	Shortening	8
2	External rotation deformity	4
3	Superficial Infection	6
4	Deep infection	2
5	Bed Sores	0
6	Mortality	0

Sr. No	Complications	No of Patients
1	Mal union (Coxa Varus)	2
2	Non union and implant failur	1
3	Delayed union	1
4	Knee stifness	6

DISCUSSIONS

Age Incidence: In our series 16.6% of patients were in 20 - 30 age group and 56.6% of patients were in 30 - 40 age group so overall 73% were in active working age group and mean age group was 35yrs.In the series of Dr.Dipak Raj England (1998) there were 13 patients of high energy comminuted subtrochanteric fracture and the mean age was 38yrs. All the patients were treated by reconstruction nail. The age incidence in our series and this series all mentioned were almost same and comparable.

Sex Incidence: In our studies there were 83.3% of male and 16% were female, which indicate that male are more exposed to occurrence of these facture, because they are highly exposed to the risk factor, due to highly demanding physical work. Risk factor like vehicular accident to which male are more exposed.

Associated Systemic Injuries And Complication:- Shock: This complication was observed in the 2 patient due to severe blood loss in thigh as well as associated abdominal injury in the form of splenic rupture. Both patients were resuscitated with blood transfusion and later on both patient underwent splenetomy.

Other Injuries:-Subtrochanteric fracture femur was associated with other injuries in our series, following were associated injury.16% patient were having head injury with GCS 9/10 on admission. 6.6% patient was having pelvic injuries in the form of disruption of pubic symphysis for which conservative treatment was given one patient was having urtheral injury following which patient had distention with blood at meatus for which he has to undergo suprapubic cystotomy.

Associated Fractures:-Many other associated factures were observed especially those involved in high vehicular accident. Ipsilateral fracture patella in 6.6% of patient, Ipsilateral fracture tibia in 10% of patient contralateral fracture shaft femur in 3% of patient. Associated fractures w ere treated in same setting, as it was must for immediate mobilization.

Distribution Of Fractures:-Russell Taylor classification was applied in this series because this classification was based on two variables and it determined the treatment modality, There were 16% type IA subtrochanteric, factures 66% of fractures were type I B, 13% of factures were type II A, 6.6% of fracture were type IIB. In our series majority of fractures were type IB and in our series

all were treated with cephalomedullary interlocking nail, as it allowed length and rotational control even when the lesser trochanter is not intact. In our series 6 patients with subtrochanteric fracture displayed extension into piriformis forsa, with careful attention to proper guide wire positioning it allowed successful nail placement in 4 patient and 2 patient with this fracture pattern went in varus malunion. Determination of the proper entry portal is more difficult, improper positioning of the nail can occur if the guide wire slips posteriorly in the comminution around the piriformis fossa, stabilizations of posterior fragment may be inadequate and nail placement lateral to correct portal predisposes to varus deformity at the fracture site.

Interval Between Trauma And Surgery: In our series mean time interval was one week. Two patients were treated after 2week as they were having associated abdominal injury which was given initial treatment preference, followed by stabilization of systemic condition.

Closed Versus Open Nailing: In our series 27 patient were undergone closed nailing and 3 patients were required open reduction because there was delay for surgery due to associated problems. Open reduction versus close reduction : In case of close reduction in our series we had initial difficulty with operation time and it took time, but as we were acquainted with the procedure, we gradually reduced the operative time. In close reduction, it was carried out with the knowledge of the deforming forces acting on the proximal fragment, i.e. the proximal fragment is externally rotated and flexed due to insertion of iliopsoas, and it is also abducted due to short abductors of the hip muscles on the greater trochanter. The distal fragment was always displaced medially due to the unopposed pull from the adductor magnus. So to achieve the reduction, the distal fragment was aligned with the proximal fragment by external rotation, abduction and elevation and pressure on the lateral side of the proximal femur was applied to correct the marked abduction of the proximal segment. We were able to reduce most of the subtrochanteric fracture of femur with this technique in 20 patients. But it was difficult to achieve close reduction with this technique, so we aligned the fracture closely in 7 patients in one plane only and this was usually done in the frontal plane only with persistent flexion and external rotation, we achieved this with kuntscher's technique. But in three patients we were not able to align the fracture in one plane, so open reduction of the fracture and primary bone grafting of fracture to ensure the healing and as it also provide additional medial buttress, when it gets incorporated into the fracture. Here is comparison of open technique and closed technique in the treatment of subtrochanteric fractures.

Table 13: Comparison between Open and closed technique

	Closed Technique	Open Technique
Fracture Hematoma	Preserved	Disturbed
Surgical	+	++++
Reduction	Anatomical alignment	Anatomical reducation
Fixation	Stable	Rigid
Biomechanical	Intra operative screening	Medial support important
Rehabilitation weight bearing	Early graduated weight bearing, gait training is possible	Need to be delayed until medial cortical support is restored
Complication	Fixation failure, deformities	Implant failures

RESULTS AND CONCLUSIONS

In the age groups, 57% belonged to 30-40 age group while only 7 % were >60 years category. 83% of the patients included males. The mode of injury presented were 77% with RTA and 3% with pathological fractures. In 50% of the cases there were no associated injuries while 3% of the patients had presented with contralateral femur fracture too. 53% of the patients presented with complaint on the right side. Type 1b classification had 67% of the patients whereas 7% of the patients were included in the type 2b category. 90% of the cases were operated under closed reduction and the rest 10% required open reduction. On an average, 67% of the patients were operated within 1.5 to 2 hours and 4% required to be operated for 2.5 - 3 hours. Among the cases that went into Union, all patients (20 cases) in type 1b category had went into union in an average of 4 months. 2 patients who were in type 2b category, had one patient going into union in 5 months whereas the other patient suffered non union. 53% of the patients had 'good' outcome while 3% had an outcome of 'Poor'. Intraoperatively 8 cases proved out to be difficult to pass entry and 2 cases had a flaring of tip of the nail. Early complications Included 8 cases as shortening. There were no bed sores or mortality. As a late complication, knee stiffness were present in 6 of the cases and one patient suffered from non Union /implant failure.

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