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Study of Internal Fixation of Subtrochantric Fracture of Femur with Dynamic Hip Screw, Dynamic Condylar Screw and Proximal Femoral Nail

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Abstract- Subtrochanteric fracture is commonly seen in young adult and middle age man by high velocity trauma. Present study was taken up to study fracture fixation by PFN, DHS &DCS and compare their result in view of union rate, complication, functional outcome, operative risk and effectiveness of implant. This study helps to decide appropriate implant for subtrochanteric fracture.

Aims and Objectives:
1. To determine the rate of union in subtrochanteric fractures treated with proximal femoral nail, dynamic hip screw & dynamic condylar screw.
2. To determine operative risk in subtrochanteric fracture treated with proximal femoral nail, dynamic hip screw and dynamic condylar screw.
3. To determine functional outcome in subtrochanteric fracture treated with proximal femoral nail, dynamic hip screw and dynamic condylar screw.
4. To determine the effectiveness of proximal femoral nail, dynamic hip screw & dynamic condylar screw in treatment of subtrochanteric fractures.
5. To determine the complications involved in the management of subtrochanteric fractures.

Methods and Materials: Study is done clinically, in a retro to prospective manner by comparing 75(50 cases retro and 25 cases prospectively) cases of either sex above the age of 18years from May 2010 to May 2014.All fracture are classified by Seinsheimer classification system. Fracture is fixed with DHS, PFN or DCS in 25 cases each. Patients with PFN implant were discharged when they started walking independently or with help of walker. Patients with DCS or DHS were discharged when they were able to sit on edge of table or bed with hip and knee in 900flexion. Patients were evaluated clinically and radiologically for recovery of movement, fracture union, stiffness, and presence of infection or other complications.

Results: Males with an average age group 21-40 years were commonly affected with right femur fracture due to high velocity RTA. Fracture pattern was commonly type IIC as per seinsheimer classification .Mean union rate and clinical outcome for PFN is high.

Conclusion: Sub trochanteric fracture is common in high velocity trauma. They have high stress concentration, slow healing time with predominance of cortical bone involvement and difficulties in getting biomechanically sound reduction because of comminution. This has lead to evaluation of various internal fixation devices.PFN attempts to combine advantage of a sliding hip screw with those of intramedullary fixation devices. Cases treated with PFN nail have shown easier rehabilitation, less blood loos, less surgical trauma, early mobilization, early rate of fracture union when compared to those cases treated with DHS & DCS barrel plate as per observation of our study.
With our study PFN has given us encouraging results over conventional DHS& DCS. Hence we recommend PFN as better implant for fixation of subtrochanteric fracture.

Index Terms- Sub trochanteric fracture, DHS, PFN, and DCS.

I. Introduction

Subtrochanteric fractures are femoral fractures where the fracture occurs below the lesser trochanter upto 5 cm distally in the shaft of femur.[1]

These fractures occur typically in two age groups. In young and healthy individuals, the injury results from high-energy trauma, whereas in the elderly population, most of the fractures are osteoporotic, resulting from a fall. With the increase in the aging population, there is also considerable growth in the number of pathological fractures and fractures around hip prosthesis (periprosthetic fractures).

These fractures occur typically at the junction between trabecular bone and cortical bone where the mechanical stress across the junction is highest in femur, which is responsible for heir frequent comminution. These fractures account for 10% to 34% of all hip fractures.

Subtrochanteric region is usually exposed to high stresses during activities of daily living. Axial loading forces through the hip joint create a large moment arm, with significant lateral tensile stress and medial compressive load. In addition to the bending forces, muscle forces at the hip also create torsional effects that lead to significant rotational shear force. During normal activities of daily living, up to 6 times the body weight is transmitted across the subtrochanteric region of the femur.

As a result of these high forces, the bone in this region is a thick cortical bone with less vascularity and results in increased potential for healing disturbances. Hence subtrochanteric fracture is difficult to manage and associated with many complications.

The obvious advantages of operative treatment are

Accurate reduction and anatomical alignment.

Early mobilization and weight bearing, is possible with this (PFN) implants and fixation technology.

The two primary options for treatment of subtrochanteric fractures are intramedullary fixation and extra medullary fixation. Many internal fixation devices have been recommended, but because of high incidence of complications like non- union and implant failure, a series of evolution in designing a perfect implant has begun. Only recently because of better understanding of biology, reduction techniques and biomechanically improved implants like Gamma nail, Russell Taylor nail, Proximal femoral nail these fractures have been addressed with consistent success.

Closed management of these subtrochanteric fractures thus poses difficulties in obtaining and maintaining a reduction, making operative management the preferred treatment. The goal of operative treatment is restoration of normal length and angulation to restore adequate tension to the abductors.

Subtrochanteric fracture treated in a long quadrilateral cast-brace with a pelvic belt. patients with severely comminuted fractures in which stability can not be obtain by internal fixation ,as well as those with open fractures ,are considered candidates for such treatment by traction followed by a ambulatory cast-brace with pelvic band resulted in a shorter period of treatment, an excellent range of motion of the hip and knee**.**

BIOMECHANICS

The plane of the femoral head and neck is anteverted 13°±7°to the plane of the femoral shaft in most adults. In Asian populations, anteversion may approach 30°. The average neck-shaft angle in women is $133°\pm6.6^0$ and it is 129°±7.3°in men. The plane of the femoral neck and head is also anteriorly positioned 1 to 1.5 cm in relation to the central axis of the femoral shaft. If the centerline of the femoral shaft is continued through the intertrochanteric region ,it emerges from the femur in the piriformis fossa.

The lesser trochanter is a posteromedial prominence at the termination of the intertrochanteric ridge and serves as the prominent insertion point of the iliacus and psoas tendons. The femoral shaft is bowed primarily anteriorly, but also slightly laterally.

The trabeculae of the compressive system carry heavier stresses than those of the tensile system in corresponding positions. The maximum tensile stress at section 8 in the outermost fiber is 771 pounds per square inch, and at the corresponding point on the compressive side the compressive stress is 954 pounds per square inch. The thickness and closeness of spacing of the trabeculae varies in proportion to the intensity of the stresses carried by them. The trabeculae lie exactly in the paths of the maximum tensile and compressive stresses. The tensile system of trabeculae correspond exactly with the position of the lines of maximum and minimum tensile stresses which were determined by mathematical analysis. The amount of vertical shear forces varies almost uniformly from a maximum of 90 pounds to a minimum of 5.7 pounds.

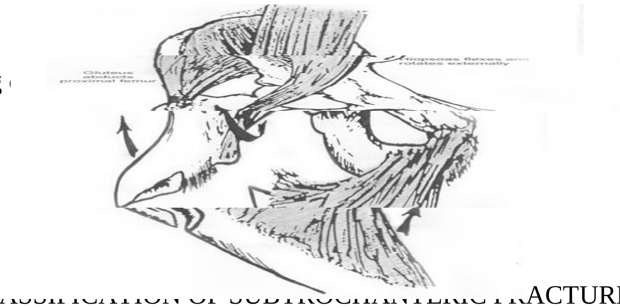
Mechanism of injury:

The unique anatomy of the proximal femur due to the femoral neck-shaft anatomy is one of the key factors in determining the specific configuration of subtrochanteric fractures. The transition from the cortical compact bone in the diaphysis to the cancellous trabecular bone in the proximal femur also explains the characteristic comminution with proximal and distal extensions.

The majority of subtrochanteric fractures result from complex loading patterns.

Nevertheless, there are specific loading patterns that produce characteristic fractures:

Fig



CLASSIFICATION OF SUBTROCHANTERIC FRACTURES

1) FIELDING AND MAGLIATO'S CLASSIFICATION (1966)

Fielding and Magliato’s classification

Type I: Fracture occurring at the level of lesser trochanter.

Type II: Fractures occurring in an area one to two inches (2.5-5.0) below the upper border of the lesser trochanter.

Type III: Fractures occurring in an area two to three inches (5.0-7.5 cm) below the upper border of the lesser trochanter.

2) SEINSHEIMER CLASSIFICATIONS:

Seinsheimer described the classification of the types I till V based on fracture pattern, with sub groups A, B and C based on the stability and comminution.

Type 1: non displaced fracture; any fracture with less than 2 millimeters of displacement of the fracture fragments.

Type 2: two part fracture

(A) Transverse fracture;

(B) Spiral fracture with lesser trochanter attached to proximal fragment;

(C) Spiral fracture with the lesser trochanter attached to distal fragments.

Type 3: three part fracture

(A) Spiral fracture in which the lesser trochanter is a part of the third fragment, which has
inferior spike of cortex of varying length;

(B) Fracture of the proximal one third of femur with third part a butterfly fragment.

Type 4: comminuted fracture: 4 or more fragments

T**ype 5: Subtrochanteric-Intertrochanteric fracture: any subtrochanteric fracture with extension through the greater trochanter**

3) AO classification:

AO/ASIF group in their manual of internal fixation recommended a three part classification A,B and C (simple, transverse and oblique fracture, fracture with three major fragments). Each of the three types is subdivided into three subgroups 1, 2 and 3 for allowing further fracture description. This classification did not consider about the trochanteric extension.

4) RUSSELL AND TAYLOR CLASSIFICATION

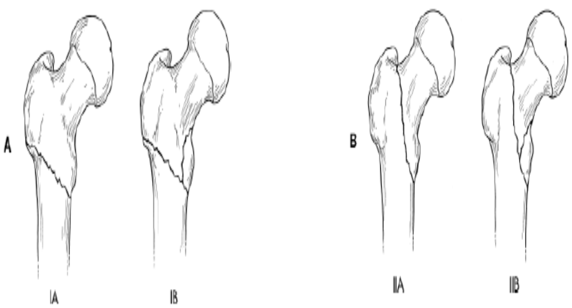
Russel and Taylor devised a classification scheme based on lesser trochanteric continuity and fracture extension posteriorly on the greater trochanter involving the piriformis fossa, the major two variables influencing treatment.

Type I - Fractures does not extend into the piriformis fossa.

Type IA- Comminution and fracture lines extend from below the lesser trochanter to the femoral isthmus. Any degree of comminution may be present in this area, including bicortical comminution.

Type IB -Fracture line and comminution involving the area of the lesser trochanter up to the isthmus.

Rusell Taylor Classification-Type I
Figure no .9



Type II

Fracture extends proximally into the greater trochanter and involves the piriformis fossa, as detected on the lateral roentgenogram of the hip, which complicates closed nailing techniques.

Type IIA

Fracture extends from the lesser trochanter to the isthmus with extension into the piriformis fossa, as detected on lateral roentgenograms, but significant comminution or major fracture of the lesser trochanter is not present.

Type II B

The fracture extends into the piriformis fossa with significant comminution of the medial femoral cortex and loss of continuity of the lesser trochanter.

MANAGEMENT OF SUBTROCHANTERIC FRACTURES:

1. **Non-operative Treatment: 2.Operative treatment:**
Open Method: Closed Method:

1) **Bone quality 2) Fragment Geometry 3) Reduction 4)Fixation Device 5) Device Placement**

I)EXTRAMEDULLARY DEVICES:

1. Fixed angle nail-plates 2. AO. 95 degree blade-plate 3. DCS 4. DHS 5. Medoffs axial compression Screw

Fixed angle nail plates:
Ex. JEWETT nail. Jewett nail
Figure no. 12

Dynamic condylar screws:

The 95°dynamic condylar screw is a two-piece device with the same basic design as the 95°condylar blade plate but with the blade replaced by a large-diameter cannulated lag screw that is inserted over a guide pin after its channel is reamed and tapped. The device is technically easier to insert than the blade plate. Varus/valgus malalignment of the guide pin is easily corrected, and flexion/extension can be adjusted by rotation of the lag screw. Moreover, the 95°dynamic condylar screw may provide better purchase in osteopenic bone than the condylar blade plate. It does not, however, provide as much control of the proximal fragment as does the 95°blade plate, and it requires insertion of an additional screw through the plate into the proximal fragment for rotational stability.

Sanders and Regazzoni reported on a consecutive series of subtrochanteric fractures in which 22 patients were available for follow-up at an average of 238 months. The union rate was 77% (17 of 22), with functional results rated as good or excellent in 68% (15 of22). All five technical failures were associated with extensive bone comminution; of these, four were not bone grafted.

Dynamic hip screws:

The popularity of the sliding hip screw in the early 1970s led to use of this device for stabilization of subtrochanteric fractures. The sliding mechanism allows impaction of fracture surfaces as well as medial displacement of the femoral shaft relative to the proximal fragment, which serves to reduce the bending movement on the implant and thus decrease the possibility of varus displacement or device failure.

Intra-medullary fixation:

During the past century a better understanding of the biomechanics of pertrochanteric and subtrochanteric fracture has led to the development of better implants and radical changes in treatment modalities. Koch analyzed mechanical stresses on the femur during weight bearing and found that compression stresses exceeded 1200 Lb per sq inch in the medial subtrochanteric area 1 to 3cms distal to lesser trochanter.

This explains why the typical comminution on the medial side after a fracture and underlines the importance of restoring medial cortical support after fracture fixation in order to achieve stable fixation.

For most subtrochanteric femur fractures, the implant of choice is an intramedullary nail. Biomechanically, these devices offer several advantages over plate and screw fixation:

II) INTRAMEDULLARY DEVICES:

1] Condylocephalic-Enders pins 2] Cephalomedullary;

i) AP Gamma Nail ii) Russel and Taylor reconstruction Nail, iii) Zickels Nail, iv) Uniflex Nail, v) Proximal Femoral Nail

Proximal Femoral Nail:

In 1997, the proximal femoral nail was introduced for treatment of peritrochanteric femoral fractures. It was designed to overcome implant-related complications & facilitate the operative treatment of unstable peritrochanteric fractures. The proximal femoral nail uses two implant screws for fixation into the femoral head & neck. The larger screw, the femoral neck screw, is intended to carry the majority of the load. The smaller screw, the hip pin, is inserted to provide rotational stability. Biomechanical analyses of the proximal femoral nail show a significant reduction of distal stress and an increase of overall stability compared with the Gamma nail. Evaluation of treatment results of the proximal femoral nail show a relatively low percent of complications and a low incidence of implant failure.

METHODOLOGY

The present clinical retrospective to prospective comparative study consists of 75 patients, from may 2010 to may 2014, of traumatic subtrochanteric fractures of femur, out of which 25 patients are treated with Dynamic Hip Screw and barrel plate and 25 patients are treated with Proximal femoral nail and the rest 25 with dynamic condylar screw in the Department of Orthopedic surgery, M.V.J .medical college and hospital and research center Bangalore.

Patients operated after may 2010, were collected from operation theater record book, patients operated in our hospital after may 2013 to may 2014, with subtrochanteric fracture by either method were recorded at the time of discharge. patients were called by telliphonic/email/postel address for follow up and record mentain and proforma prepaired.

Total 50 patients are collected from retrospectively from operation theater record book from may 2010 to may 2013.25 patients were collected prospectively from may 2013 to may 2014.last follow up were made up to may 2015.

This study was carried to find out age, sex and side incidence of subtochanteric fractures and to testify rate of union, functional outcome and functional outcomes of treatment with DHS & Barrel plate, DCS & Barrel plate and proximal femoral nail.

All these 75 patients, who were available for study, were followed at regular intervals up to fracture union.

Once the patient was admitted to the hospital, all the essential information was recorded in the proforma prepared for this study. They were regularly observed during their hospital stay and were discharged with the advice to come to the outpatient department regularly. Those who did not come were reminded by post. One patient, who could not come for subsequent follow up answered the necessary questions. The patients were followed up for one year after surgery at regular intervals and if necessary subsequent follow ups were done.

STATISTICAL METHODS APPLIED

1. Descriptive statistics: 2.**Chi-square test** **3.Contingency table analysis** **4.Independent samples‘t’ test:**

INCLUSION CRITERIA:

1) Subtrochanteric fractures in adults more than 18yrs

EXCLUSION CRITERIA: 1) Pathological fractures. 2) Fractures in children. 3) Old neglected fractures. 4) Open fractures

DATA COLLECTION:

When the patient with subtrochanteric fracture were admitted to hospital, from may 2013 to may 2014,all the necessary clinical details were recorded in proforma prepared for this study. After the completion of the hospital treatment patients were discharged and called for follow up at outpatient level at regular intervals for serial clinical and radiological evaluation. The patients were followed up till fracture union and functional recovery. At regular intervals if necessary subsequent follow up was done.

MATERIALS:

A. Dynamic Hip Screw with Barrel Plate:

1. It consists of a cannulated lag screw with a threaded distal portion. It comes in various lengths from 2 1/4 inch to 4 1/2 inch. It is cannulated to accept a 3.2 mm guide wire.

2. This screw is inserted into a barrel side plate, into which it can slide.

3. There is a groove in the shaft of the lag screw which corresponds to a 'key' in the barrel which prevents rotation.

4. The side plate accommodates 4.5 mm cortical bone screw, and comes in different hole lengths.

Static and Dynamic Compression: The ability to allow impaction at the fracture site is a central feature of this device. The compression obtained on the O.T. table with the compression apparatus is called static compression. The sliding feature which is achieved by body weight and muscle contraction keeps the fragments compressed later and this phenomenon is known as dynamic traction.

Figure no.16

INSTRUMENTS OF DHS & PLATE FIXATION

DHS & BARREL PLATE-IMPLANT

B. Dynamic Condylar Screw with barrel plate

- The DCS Plate has a 95°barrel angle, allowing it to enter the femur more proximally than the DHS Plate and allowing insertion of two or more screws into the calcar.
- Its two round proximal plate holes permit insertion of 6.5 mm Cancellous Bone Screws, for stable proximal fixation
- There is a groove in the shaft of the lag screw which corresponds to a 'key' in the barrel which prevents rotation.
- The side plate accommodates 4.5 mm cortical bone screw, and comes in different hole lengths.
- Static and Dynamic Compression is also obtained as in the case with Dynamic hip Screw and plate

Figure no. 17

INSTRUMENTS OF DCS & PLATE FIXATION

DCS & BARREL PLATE-IMPLANT

PROXIMAL FEMORAL NAIL

The implant consists of proximal femoral nail, self tapping 6.5mm pin, self tapping 8mm femoral neck screw, 4.9mm distal locking screw and an end cap .PFN is made up of either 316L stainless steel or titanium alloy which comes in following sizes,

1. Length; Standard PFN-250 mm.
Long PFN; 340, 380, 420 mm.
2. Diameter 9, 10, 11, 12 mm.
3. Neck shaft angle range 125 ,130, 135 degrees.

The nail is having 14mm proximal diameter. This increases the stability of the implant There is 6 degrees mediolateral valgus angle which prevents varus collapse of the fracture even when there is medial communition.

The distal diameter is tapered to 9-12 mm which also has groove to prevent stress concentration at the end of the nail and avoids fracture of the shaft distal to the nail

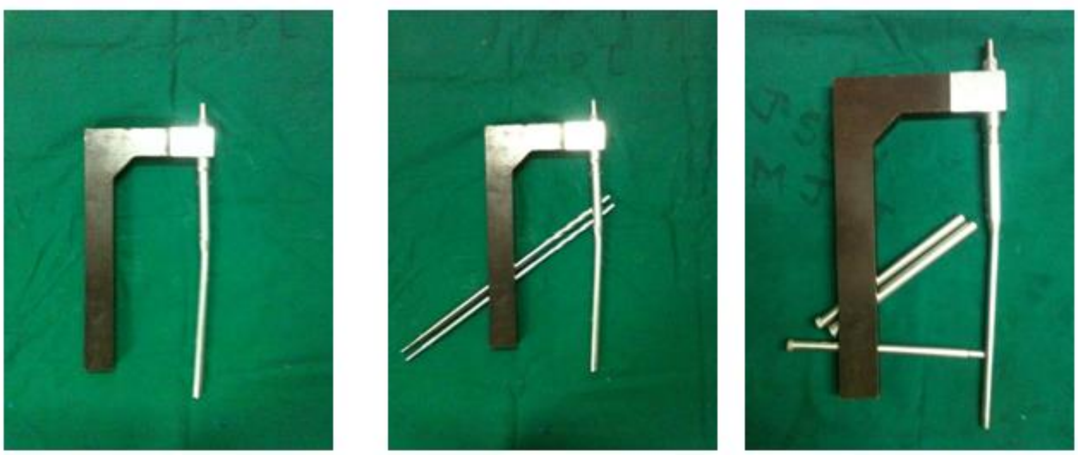
Proximally it has two holes, the distal one for insertion of 8mm neck screw which acts as a sliding screw and the proximal one is for 6.5mm hip pin which helps to prevent the rotation.

Distally pin has two holes for insertion of 4.9mm locking screws of which one is static and the other one is dynamic which allows dynamization of 5mm.

Figure no .18

INSTRUMENTS OF PFN FIXATION

PFN -IMPLANT



PFN ASSEMBLY

A) INTERNAL FIXATION OF SUBTROCHANTERIC FRACTURES WITH DYNAMIC HIP SCREW/DYNAMIC CONDYLAR AND BARREL PLATE AND PLATE

a) Method of reduction:

Following spinal/epidural anaesthesia place the patient supine on the fracture table. Fasten both the extremities to foot plate. Apply enough traction in abduction and neutral / internal rotation to restore length and the normal neck shaft angle. Position the extremity to allow for two plane imaging with the C-arm image intensifier.

Check the reduction by anteroposterior and lateral views with the image intensifier with special attention to cortical contact medially and posteriorly. Taking strict aseptic precautions, the operative site, from umblicus above to knee below is painted with savlon, betadine and spirit followed by meticulous draping.

B)Exposure:

The standard lateral, vastus lateralis splitting approach is used.

c) Insertion of guide pin:

Opposite the lesser trochanter, parallel to the floor, at the desired angle insert the guide pin midway between the anterior and posterior cortices. The second guide wire if required is passed 1 cm posterior and inferior to the first wire. All this is done with the help of intra operative image intensifier. Insert the guide pin through the fixed angle guide or insert it with a freehand technique.

In case of Dynamic condylar screw entry point is anterior part of bulge of greater trochanter.

Ideal position of the guide pin should be in the lower half of the femoral head. The screw should be below and tangential to the superior cortex.

A large drill bit can be used to make an opening in the lateral cortex to allow easy insertion of the guide pin.

The guide pin should be either centralized or postero inferior in the femoral head. Placement should not be too far superior or anterior. The guide pin should enter within a distance of 1cm from the articular surface of the femoral head.

Carefully confirm this length with the direct measuring gauge.

d) Reaming of the neck of femur:

Set the triple reamer to the length of the guide pin indicated by the direct measuring gauge. In very osteoporotic bone, set the reamer 5 mm less than the length of the guide pin to reduce the chance of pin withdrawal and to allow better purchase of the lag screw in un reamed bone.

Continue reaming until the lateral cortex. Remove the reamer by gently pulling it, while turning it clockwise.

The guide pin has a threaded portion near its tip and turning the reamer in a clockwise direction lessens the chance of pin withdrawal. If the guide pin is inadvertently withdrawn, reinsert it using the guide pin replacement instrument.

e) Tapping of the femur:

In firm cancellous bone and in younger patients, it is essential to cut the threads of the lag screw. If not tapped properly, it may be difficult to fully seat the lag screw, placing excessive torque demands on the insertion wrench. Also the proximal fragment may rotate during fracture screw insertion.

f) Insertion of the lag screw and plate:

Determine the correct length of the lag screw with the direct measuring gauge; this measurement should allow for 5 mm of compression. If more compression is desired use a shorter screw. A screw 5 mm shorter permit 10 mm of compression and a screw of 10 mm shorter allows 18 mm of compression. In most of our patients we used a 10mm shorter screw. When using a screw shorter than the length indicated by the direct measuring gauge, advance the appropriate mark on the centering sleeve by the amount of shortening. Insert the lag screw with the help of screw inserter over the guide wire.

Confirm the position under the image intensifier.

g) Attachment of the plate:

When proper screw position has been verified under image intensifier, seat the barrel plate in the final position on to the lag screw shaft using the plate tamper. Secure the plate to the shaft by plate holding forceps. Release some traction and manually impact the fracture fragments and readjust the plate holding forceps if necessary.

Use a drill guide and 3.5 mm drill bit to drill screw holes. Determine the length of the cortical screws with the depth gauge and insert the 4.5 mm screws.

Tapping is usually required. Insert the screws with either a power or hand screwdriver.

When all screws are inserted and tightened, release the traction and apply compression with the compression screw. The compression screw exerts a powerful force that must be correlated with the quality of the bone. If fixation of the lag screw in the femoral head seems insecure, as in osteoporotic bone, use only finger pressure to prevent stripping the screw out of the bone. We leave the compression screw in place. Later incision is closed in layers leaving drain in situ.

INTERNAL FIXATION OF SUBTROCHANTERIC FRACTURES WITH PROXIMAL FEMORAL NAIL PATIENT POSITIONING AND FRACTURE REDUCTION

The patient is placed in supine position on fracture table with adduction of the affected limb by 10-15 degrees and closed reduction of the fracture was done by the traction and internal rotation. The unaffected leg is flexed and abducted as far as possible or kept in wide abduction. The image intensifier was positioned so that anterior-posterior and lateral views of hip and femur could be taken. Open reduction is performed if closed reduction failed.

The patient is then prepared and draped as for any standard hip fracture fixation. Prophylactic antibiotic is given in all patients 30 mins before surgery.

APPROACH

The tip of greater trochanter was located by palpation in thin patients and in obese patients, we used image intensifier. 5cms longitudinal incision was taken proximal from the tip of the greater trochanter. A parallel incision was made in fascia lata and gluteus medius was split in line with the fibers. Tip of greater trochanter is exposed.

DETERMINATION OF ENTRY POINT AND INSERTION OF GUIDE WIRE

In AP view on c-arm, the entry point is on tip or slightly lateral to the tip of greater trochanter. In lateral view, guide wire position is confirmed in the center of the medullary cavity. Medullary canal entered with a curved bone awl, the guide wire is inserted into the medullary canal.

REAMING

Using a cannulated conical reamer proximal femur is reamed for a distance of about 7cms.

INSERTION OF PFN

After confirming satisfactory fracture reduction, an appropriate size nail as determined preoperatively is assembled to insertion handle and inserted manually.

This step is done carefully without hammering by slight twisting movements of the hand until the hole for 8mm screw is at the level of inferior margin of the neck. Open reduction is performed in case satisfactory reduction is not possible by closed means.

INSERTION OF THE GUIDE WIRE FOR NECK SCREW AND HIP PIN

These are inserted with the help of aiming device lightly screwed to the insertion handle. A 2.8 mm guide wire is inserted through the drill sleeve after a stab incision. This guide wire is inserted 5mm deeper than the planned screw size. The final position of the guide wire should be in the lower half of the neck in AP view andin the center of the neck in lateral view.

A second 2.8 mm guide wire is inserted through the drill sleeve above the first one for hip pin. The tip of this guide wire should be approximately 25-20mm less deep than planned neck screw.

INSERTION OF THE NECK SCREW AND HIP PIN

Drilling is done over 2.8mm guide wire until the drill is 8mm short of tip of the guide wire. Tapping is not done as neck screw is self tapping. Neck screw is inserted using cannulated screw driver. Similarly appropriate length hip pin is inserted. Length and position of the screw is confirmed with c-arm image

DISTAL LOCKING

Distal locking is usually performed with two cortical screws. A drill sleeve system is inserted through a stab incision. A drill hole is made with 4mm drill bit through both cortices. Locking screw is inserted and position confirmed with image intensifier.

CLOSURE

After fixation is over, lavage is given using normal saline and incision is closed in layers. Suction drain is used in case open reduction is performed. Sterile dressing applied over wound and compression bandage applied.

STATISTICAL METHODS APPLIED:

Clinical out come was assessed by Kyle's criteria:

Table no .1

	Excellent	Good	Fair	Poor
Pain	No	Mild	Moderate	Pain in any position
Limp	No	Mild	Moderate	Wheel chair bound

Knee range of motion

Flexion	Above 120^0	100^0 to 120^0	71^0 to 100^0	70^0 and below
Extension	Full extension	<20 ^{0}short of full extension	21^0 to 40^0 short of full extension	>40^0 short of full extension

Hip range of motion

Flexion	Above 120^0	101^0 to 120^0	81^0 to 100^0	80 ^{0}and below
Extension	Above 10^0	5^0 to 10^0	Below 5^0	No extension
Adduction	Above 25^0	16 ^{0}to 25^0	15^0 and below	No adduction
Abduction	Above 30 ^{0}	21^0 to 30^0	11^0 to 20^0	10^0 and below
Internal rotation	Above 25^0	16^0 to 25^0	15^0 and below	No internal rotation
External rotation	Above 30^0	21^0 to 30^0	11^0 to 20^0	10^0 and below

PRE-OPERATIVE

GUIDE WIRE PLACEMENT-AP VIEW

GUIDE WIRE PLACEMENT-LATERAL VIEW

REAMING PROXIMAL FEMUR

RICHARD'S SCREW PLACEMENT

BARREL PLATE WITH COMPRESSION SCREW & CORTICAL SCREW APPLIED

Intraoperative Photographs for fixation with Dynamic Condylar Screw & Barrel Plate

II. RESULTS

The following observations were made from the data collected from, retro to prospectively, during this study of Surgical management of subtrochanteric fractures of femur in the Department of Orthopaedic Surgery, M.V.J medical college and hospital and research centre ,Babgalore.

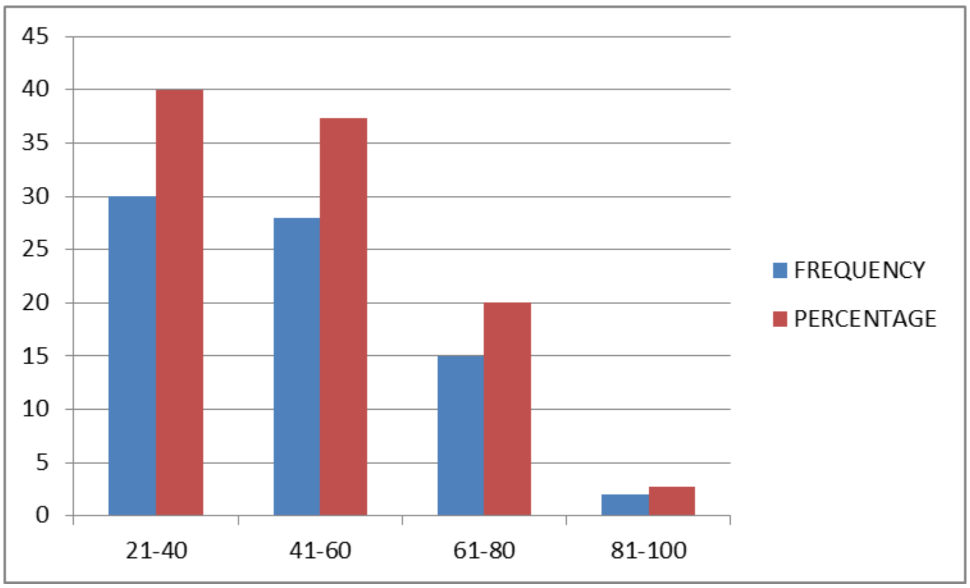
AGE DISTRIBUTION

In our series maximum aged patient was 84 years. Most of the patients were in the age group of 21 to 40 years. The distribution of cases in various age groups is shown below.

TABLE NO: 2

AGE GROUP	FREQUENCY	PERCENTAGE
21-40	30	40
41-60	28	37.3
61-80	15	20
81-100	2	2.7
TOTAL	75	100

GRAPH NO.1 AGE DISTRIBUTION



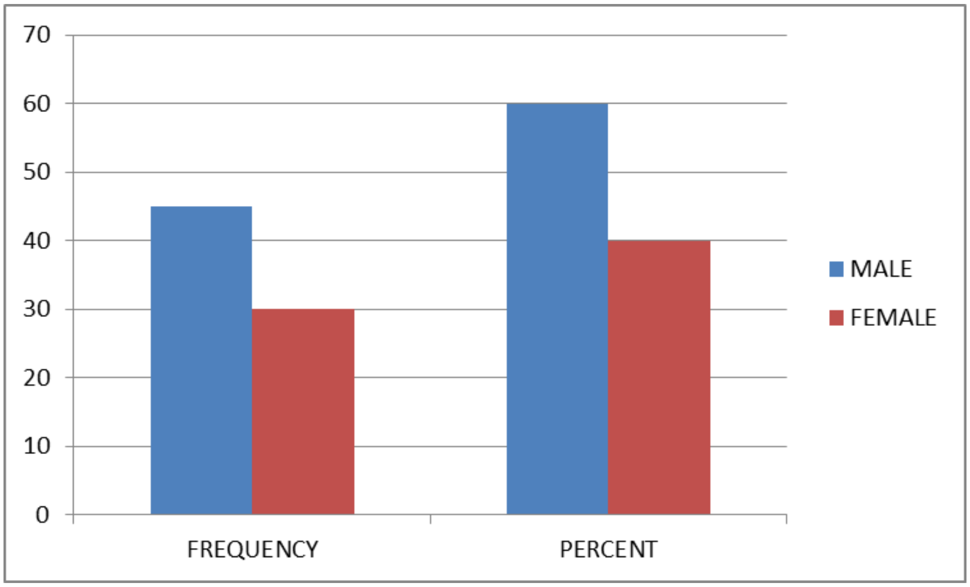
SEX DISTRIBUTION:

In this series 45 patients were male and 35 were female. This shows preponderance of males over females.

TABLE NO.3

SEX	FREQUENCY	PERCENTAGE
MALE	**45**	**60**
FEMALE	**30**	**40**
TOTAL	**75**	**100**

GRAPH NO .2



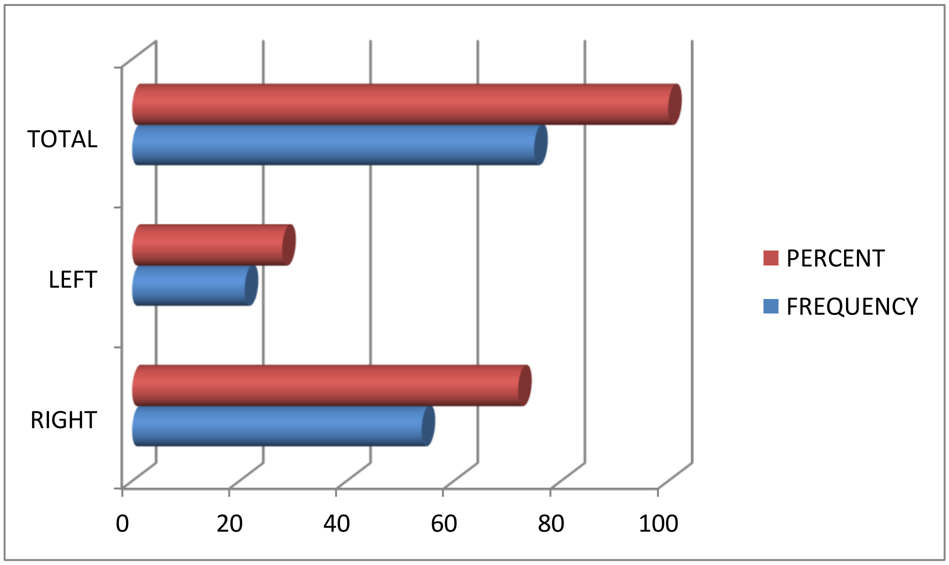
SIDE AFFECTED

In 54 cases Right side was affected and in remaining 21 cases left side was affected

TABLE NO.4

	FREQUENCY	PERCENT
RIGHT	54	72
LEFT	21	28
TOTAL	75	100.0

GRAPH NO.3



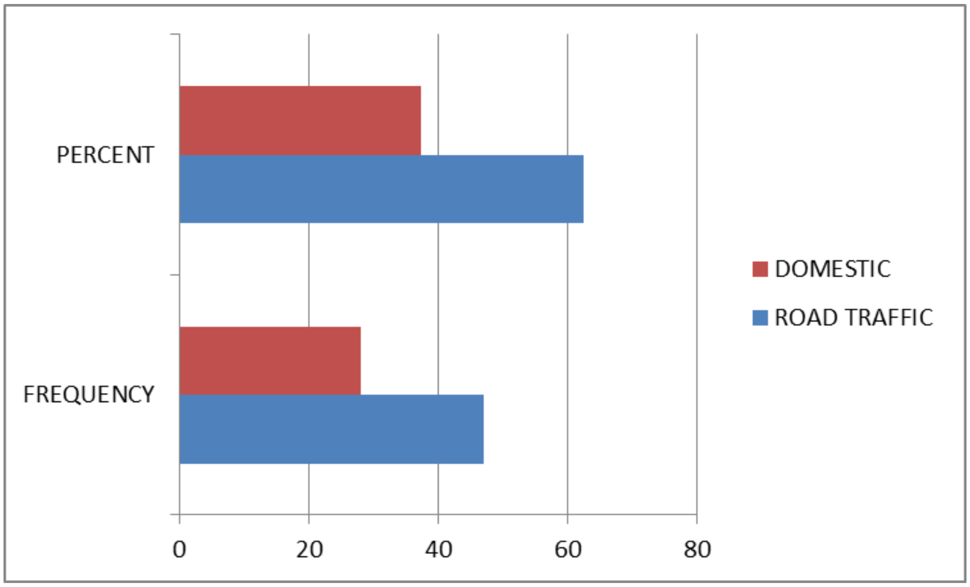
MODE OF INJURY:

Out of 75 cases 47 cases gave history of road traffic accidents, 28 cases gave history of slip and fall. In our series road traffic accidents contributed to 62.6% of the injuries.

TABLE NO.5

	FREQUENCY	PERCENT
ROAD TRAFFIC	47	62.6
DOMESTIC	28	37.4
TOTAL	75	100.0

GRAPH NO.4



FRACTURE PATTERN

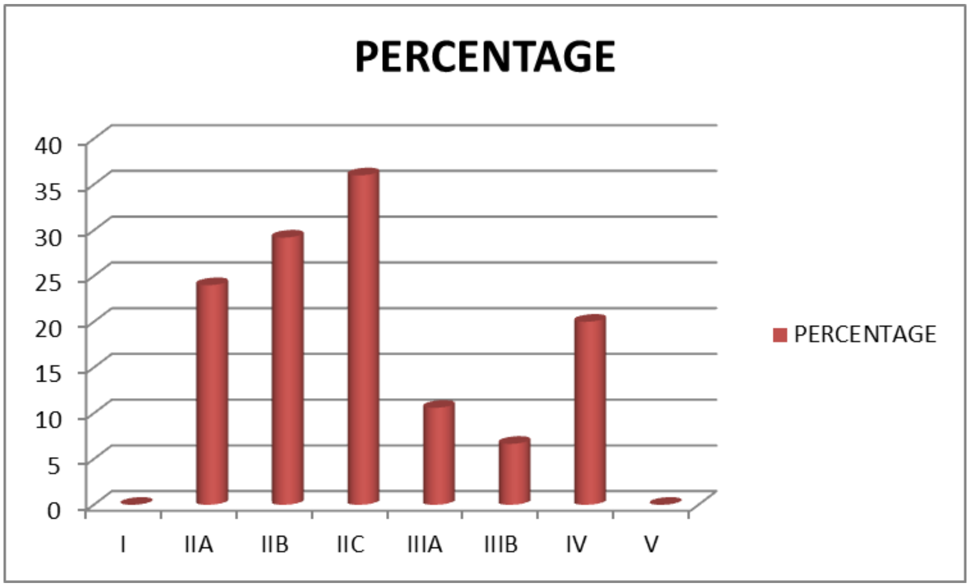
- Subtrochanteric fractures are classified according to Seinsheimer classification.

In our study majority of fractures are type 2C and least number of cases are from type 3B and no cases from type 1 & type 5 are reported.

TABLE NO.6

TYPE OF FRACTURE	NUMBER OF CASES	PERCENTAGE
I	0	0
IIA	10	24
IIB	17	29.3
IIC	28	37
IIIA	8	10.6
IIIB	5	6.6
IV	7	20
V	0	0

GRAPH NO .5



COMPLICATIONS

Infection: there were 4 cases of infection seen in the study. All were superficial infection and were treated with antibiotics; none required implant removal and healed.

Shortening & varus angulations: in one case fixation of fracture in varus angulation took place

- One case of non union due to PFN was encountered and was presumed to be due to over distraction at fracture site.

- 

FUNCTIONAL OUTCOME:

In our study, clinical outcome was assessed based on Kyle's criteria.

36% of patients treated with dynamic hip screw, 40% of patients treated by dynamic condylar screw and 76% of patients treated with PFN nail showed excellent results.

Good results were 32% in dynamic hip screw group and 28% in dynamic condylar screw nail group& 16% in PFN

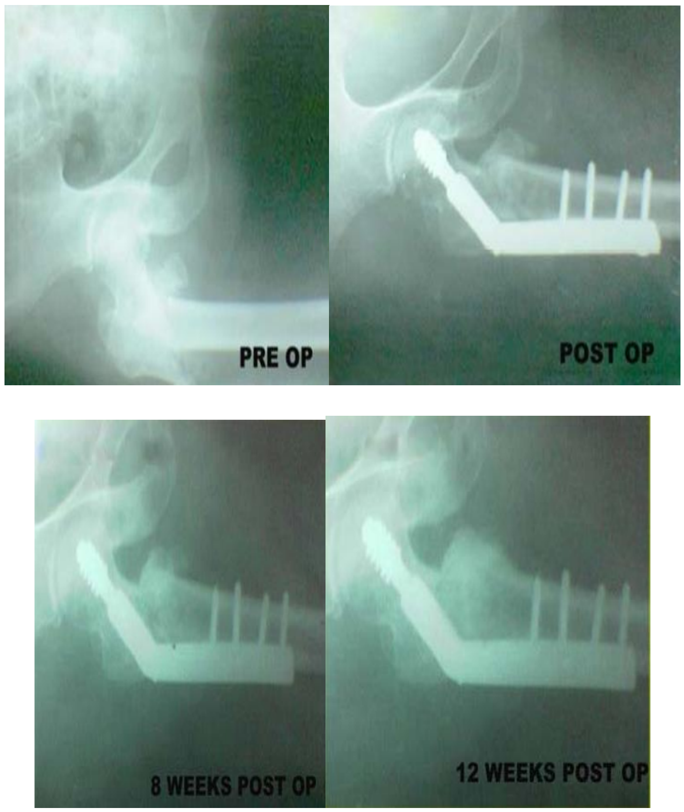
Fair results were 32% in dynamic hip screw group, 32% in dynamic condylar screw group & 8% in PFN group. None of our patients showed poor results.

On the whole 50% showed excellent and 25% showed good results. 24% showed fair results.

TABLE NO. 12

	EXCELLENT	GOOD	FAIR
PFN	19	4	2
DHS	9	8	8
DCS	10	7	8
TOTAL	38	19	18

CASE 1



FULL FLEXION

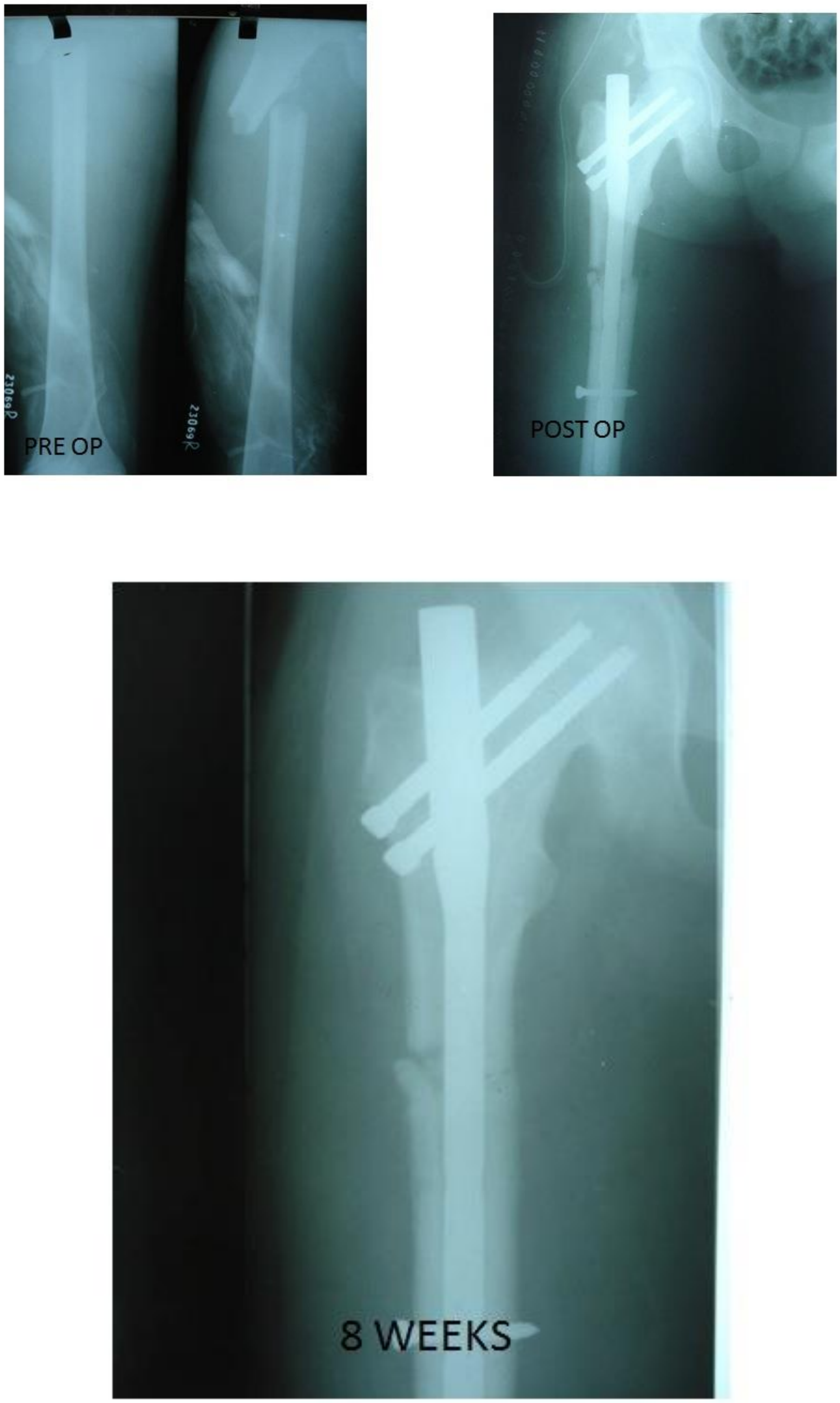
FLEXION & EXTERNAL ROTATION

FULL WEIGHT BEARING

30 DEGREE'S ADDUCTION

40 DEGREE'S ABDUCTION

CASE 2



FULL FLEXION

FULL WEIGHT BEARING

30 DEGREE'S ADDUCTION

30 DEGREE'S ABDUCTION

CASE 3

110 DEGREE'S FLEXION

FULL WEIGHT BEARING

30 DEGREE'S ADDUCTION

40 DEGREE'S ABDUCTION

III. DISCUSSION

The characteristic anatomy, the biomechanical stress and forces acting at the subtrochanteric region makes it difficult to manage these fractures (Cech O, 1974; Fielding JW, 1973; Seinshemier, 1978). Young patients usually sustain high energy trauma, which results in communited fractures whereas in older patients usually communited fractures are seen after minor fall.

At present it is generally believed that all subtrochanteric fractures should be internally fixed to reduce the morbidity and mortality by early ambulation.

Because of communition and high incidence of complications reported after surgical treatment (Fieldeing JW, 1973; Delec JC, Claton TO and Rockwood CA, (1981), surgeons are compelled to give a second thought regarding the selection of proper fixation device. The most common current methods of fixation are blade plate systems, sliding nail plate systems and intramedullary devices.

In our study, the common age group for subtrochanteric fractures is 21 to 40 year which is comparable to those of other Indian authors but was less than most of the studies of western authors.

Males contributed major share in our series which was comparable with other studies.

Right side was more common than left side as seen in other series.

High velocity injuries due to road traffic accidents was the main cause of these fractures seen in our studies similar to other studies Associated injuries such as fracture ribs, Colle's fracture, compression fracture of D8, fracture shaft tibia were seen in our study similar to other studies (Bermon et al 1987) also other injuries like fracture pelvis, fracture calcaneum and visceral injuries as noted in other studies.

In the study group, majority of fractures belonged to class IIC of Seinsheimer's classification i.e., 37% and majority of the fractures were unstable, similar to other studies..

Mean blood loss was significantly more in those fixed with dynamic hip screw and dynamic condylar screw with barrel plate compared to those fixed with proximal femoral nail i.e., 425 ml in DCS, 400 ml in DHS and 300 ml in PFN .Our results matched with other studies.

The period of hospital stay was almost the same in either group and was statistically insignificant.

Shortening was seen in 1 patient treated with dynamic hip screw and barrel plate.. Postoperative quadriceps exercises were started on second day in all cases. Full weight bearing is allowed early amongst the patients fixed with proximal femoral nail group compared to those fixed with dynamic hip screw and barrel plate, dynamic condylar screw and barrel plate i.e. 4 weeks in proximal femoral nail group to 17 weeks in dynamic hip screw and barrel plate & dynamic condylar screw and barrel plate. Our results matched other results.

Mean union rate was faster in those treated with proximal femoral nail 17 weeks than those treated with dynamic hip screw19 week and barrel plate & dynamic condylar screw and barrel plate 20 weeks.

None of the patients in our series showed implant failure, only 5 patients of those fixed with dynamic hip screw and barrel plate & 3 patients fixed with dynamic condylar screw showed superficial infection.

One mortality was seen in our series, treated with PFN, the patient succumbed to cardio respiratory complication.

Overall we had 76% good to excellent results in those treated with proximal femoral nail, 36% good to excellent results in those treated with dynamic hip screw and barrel plate. 40% good to excellent results in those treated with dynamic condylar screw & barrel plate. Our results were comparable to results of other studies.

IV. CONCLUSION

Subtrochanteric fractures are common in high velocity trauma. High stress concentration, slow healing time, predominance of cortical bone and difficulties in getting biomechanically sound reduction because of communition has lead to evolution of various internal fixation devices.

Inspite of evolution of various implants the incidence of complications is high after surgical treatment. Hence, implant of choice in this area is still an unsolved problem.

Proximal femoral nail attempts to combine the advantages of a sliding hip screw with those of intramedullary fixation devices. Cases treated with PFN nail have shown easier rehabilitation, less blood loss, less surgical trauma, early mobilization and early rate of fracture union when compared to those cases treated with dynamic hip screw and barrel plate& dynamic condylar screw and barrel plate as per observations in our study.

With our sample study Proximal femoral nail has given us encouraging results over conventional dynamic hip screw and barrel plate & dynamic condylar screw and barrel plate. Hence we recommend proximal femoral nail as a better implant for the fixation of subtrochanteric fractures.

V. SUMMARY

In our study, of 75 cases of subtrochanteric fractures, 25 were treated with dynamic hip screw and barrel plate and 25 were treated dynamic condylar screw and barrel plate & 25 with proximal femoral nail. All cases were collected from patients attending orthopedic out-patient department at MVJ Hospital, Sion, and Bangalore

According to our study subtrochanteric fractures were common among the middle age and elderly male as a result of high velocity trauma with right side predominance.

Unstable fractures belonging to IIC of Seinsheimen's classification is the most common pattern seen in subtrochanteric fractures of our series. Associated injuries such as Colle's fracture, tibia, vertebral fracture and fracture ribs were seen only in a few i.e., 16.7% of total cases.

Surgery was never done as an emergency and was delayed till patient was stabilized. Mean blood loss intraoperatively being slightly higher for those treated with dynamic hip screw and barrel plate and dynamic condylar screw and barrel plate when compared to patients treated with proximal femoral nail. The mean duration of hospital stay was almost the same in either case irrespective of the implant used.

Postoperative mobility was allowed after a frank period of non weight bearing. Independent and full weight bearing was allowed early i.e., about 4 weeks in those treated with proximal femoral nail group when compared to dynamic hip screw and barrel plate and dynamic condylar screw and barrel plate i.e., 17 weeks.

Superficial wound infection was seen only in 4 patients of those treated with dynamic hip Screw and barrel plate,3 in patients treated with dynamic condylar screw and barrel plate and none amongst those treated with proximal femoral nail.

In one case, fixation of fracture in varus angulation took place. One case of non union due to PFN was encountered and was presumed to be due to overdistraction at fracture site. Mean union rate was faster in those treated with proximal femoral nail 17 weeks than those treated with dynamic hip screw19 week and barrel plate & dynamic condylar screw and barrel plate 20 weeks.

Hence, we conclude by saying proximal femoral nail is a superior implant to dynamic condylar screw & barrel plate and dynamic hip screw & barrel plate for the management of subtrochanteric fractures.

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