"A clinical study of functional outcome of unstable intertrochanteric fractures treated with proximal femur nail anti rotation system II"

BY

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In partial fulfilment of the requirements for the degree of

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IN
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Under the guidance of

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LIST OF ABBREVIATIONS

AO	**Arbeitsgemeinschaft Fur Osteosynthesefragen**
AP	**Anteroposterior**
Lat	**Laeral**
cm	**Centimeter**
CRIF	**Close Reduction And Internal Fixation**
DHS	**Dynamic Hip Screw**
DM	**Diabetes Mellitus**
F	**Female**
HTN	**Hypertension**
M	**Male**
mm	**Millimeter**
ORIF	**Open Reduction And Internal Fixation**
PFN	**Proximal Femoral Nail**
PFNA	**Proximal Femoral Nail Antirotation**
PFNA II	**Proximal Femoral Nail Antatirotion System Two**

ABSRACT

Background

Unstable, comminuted intertrochanteric fractures continue to pose a challenge to the orthopedic surgeon because of severe osteoporosis and medical disorders that increase the risks associated with surgery and anesthesia. For treatment of these unstable intertrochanteric fractures, PFNA was designed by AO in 2004. To overcome problems like lateral wall impingement and prominence of the proximal end of the nail, the PFNA-II was introduced in 2008. The PFNA II design modifications include the flat lateral shape of the proximal portion and a decrease in the mediolateral bending angle from $6^0$to 5^0.The purpose of the study is to confirm that the PFNA II eliminates the problem of lateral wall impingement experienced with previous intramedullary nailing systems and provides stable fracture fixation with positive functional outcome.

Aim

To evaluate the functional and radiological outcome of unstable intertrochanteric fracture, treated PFNA-II in our population.

Materials and methods

This study is conducted between 1^{st} November 2018- 31^{st} may 2020 among 32 patients who were diagnosed with unstable intertrochanteric fracture of femur and underwent closed reduction internal fixation with proximal femoral nail antirotation system II. All patients were followed up for minimum of 6 months. Functional outcome was assessed with modified haris hip score and radiological outcome was assessed with TAD score and implant related complications.

Results

Fracture union was appreciated on an average 4 months of postoperative period.4 patient had superficial infection while 1 patient had deep infection. Only 1 patient had cut off of helical blade. According to modified harris hip score, excellent outcome in 37.5% patient, good outcome in 43.8% patients, fair outcome in 12.5% patients, poor in 6.3 cases was noted.

Conclusion

From our study, we have come to the conclusion that PFNA II is a reliable implant for treatment of unstable intertrochanteric fractures leading to high rate of union restoring the anatomical alignment and reduced chance of implant failure.

Key words: Intertrochanteric fracture, Internal fixation, PFNA II.

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INTRODUCTION

Intertrochanteric fractures commonly occur in elderly patients with osteoporosis and its incidence will continue to rise due to the increasing life expectancy[1]. Nearly nine of 10 hip fractures occur in patients older than 65 years old.

Operative treatment of hip fractures was introduced in the 1950s. Many methods have been recommended for the treatment of intertrochanteric fractures. Implants may be either extramedullary or intramedullary in nature [2].

Treatment of intertrochanteric fractures in elderly patients is a huge challenge for many trauma surgeons, mainly because many such patients have severe osteoporosis and medical disorders that increase the risks associated with surgery and anesthesia [3].

The most commonly used extramedullary implant is the sliding hip screw. Other examples include the Gamma nail, the intramedullary hip screw, the proximal femoral nail (Synthes). PFNA was designed by AO in 2004, is an intramedullary device with a helical blade rather than a screw for better purchase in the femoral head[2].

Proximal Femoral Nail Anti-rotation (PFNA) has the rotational and angular stability with a helical blade which can avoid bone loss that occurs during the drilling and insertion of a standard sliding hip screw. Biomechanical tests also demonstrated a significantly higher cut out resistance in the osteoporotic bone compared to commonly used screw systems [4].

Although it is known PFNA system provides high union rates with low major complication rates, geometric discrepancies exist between the proximal femur and PFNA system. This geometric mismatch is associated with lateral cortical impingement, which causes lateral cortical fracture and intraoperative loss of reduction when inserting the PFNA [5].

PFNA II devices have been introduced as an improved PFNA design to overcome these problems. The PFNA II design modifications include the flat lateral shape of the proximal portion and a decrease in the mediolateral bending angle from 6^0 to 5^{0} [5].

The purpose of the study is to confirm that the PFNA II eliminates the problem of lateral wall impingement experienced with previous intramedullary nailing systems and provides stable fracture fixation with positive functional outcome.

OBJECTIVE OF THE STUDY

- To study the functional outcome of unstable intertrochanteric fracture of femur treated with proximal femur nail anti rotation system II.

REVIEW OF LITERATURE

HISTORICAL REVIEW:

Fractures of the hip were recognized since the time of Hippocrates. Clear explanation of proximal femur fractures was first given by Sir Astley Cooper (1822). He divided hip fracture into extracapsular and intracapsular fractures.

In 1860, Buck introduced adhesive plaster traction in the treatment of fracture.

Kocher (1841-1917) gave the term 'Pertrochanteric fractures'.

In 1902, Royal Whitman was first one to explain about the reduction of intertrochanteric fractures with abduction, internal rotation, and traction under anesthesia followed by immobilization in hip Spica from the nipple line to toes [11].

In 1907, Fritz Steinmann, introduced new skeletal traction application method. He had drilled two pins into the femoral condyles. To these pins he applied traction [12].

In 1930, Jewett developed a special nail (Jewett Nail), which could be introduced through greater trochanter across the fracture for stability [14].

In 1931, Smith-Peterson developed a tri-flanged nail for proximal femur fractures [15].

In the year 1937, Smith-Peterson nail was modified. Lawson Thornton attached a plate (Thornton plate) to the nail [16].

In 1940, Austin Moore developed a 135-degree angled blade plate implant for trochanteric fractures.

In 1941, Jewett modified the Jewett nail by developing a single piece angled nail plate for management of intertrochanteric fractures [17].

In 1947, Mc Laughlin developed a variable angled nail plate which did not require bending of the plate to change the angle while attaching to the Smith Peterson nail [18].

Boyd and Griffin (1949) suggested surgical management of intertrochanteric fractures [19].

In 1955, Schumpelick and Jantzan reported a sliding screw, which they credited the design to Ernest Pohl [20].

In 1978, 87.5% union rates were achieved with A.O. device as reported by Hanson & Tullos [21].

In 1974 Tronzo used Matchett – Brown endoprosthesis in the primary management of unstable intertrochanteric fractures [25].

In 1978, Seinsheimer classified subtrochanteric fractures in eight subgroups[26].

In 1978, Ender reported a closed method of introducing flexing nails retrograde in to the neck [27].

In 1980, condylocephalic nailing was described by Harris.

In 1986, The Russell-Taylor reconstruction interlocking nail was introduced as a sub-trochanteric fracture fixation device [28].

In 1992, Schlemninger et al, Clawson and Massie popularized DHS which was designed by AO/ASIF group for selected sub-trochanteric fractures [29].

In 1990, Halder introduced Gamma Nail and reported less operative complications in unstable pertrochanteric fractures [30].

In 1996, the AO/ASIF group developed an intramedullary device for the treatment of unstable trochanteric femoral fractures called the proximal femoral nail (PFN). They proved many advantages over extramedullary devices such as decreasing the moment arm, preservation ofthe fracture hematoma, less intra-operative blood loss and operative time, reduced chances of infections.

In 2004, the AO/ASIF group of orthopaedics launched a new cephalo-medullar nailing system, the proximal femoral nail antirotation (PFNA) system. This nail improved the rotational and angular stability with the use of single helical blade. The PFNA blade claims to retard rotation and varus collapse [2].

In 2008, a study conducted by R.K.J. Simmermacher et al concluded that the helical blade of PFNA restrict the rotation of the proximal fragment in unstable trochanteric fractures and is the optimal implant for the management of these fractures especially in osteoporotic bone [28].

In 2010, a study conducted by Wang WY et al concluded that the PFNA is an effective implant for subtrochanteric fractures with less soft tissue damage, high union rates, good functional outcome.It is also associated with less implant related complications [29].

In 2012, Ashok Sunil Gavaskar et al concluded that the cut-out rate of helical blade of PFNA system, was very less which shows good bone impaction in cancellous bone and the anti-rotation concept of the PFNA [30].

PFNA II devices have been introduced as an improved PFNA design to overcome few problems. The PFNA II design modifications include the flat lateral shape of the proximal portion and a decrease in the mediolateral bending angle from 6^0 to 5^0 [5].

In 2012 George A. Macheras MD retrospectively reviewed 108 patients with unstable peritrochanteric fractures, 58 treated with PFNA and 50 with PFNA II. They compared nail positioning, major and minor complication rates, operative and fluoroscopic time, blood transfused, time to mobilization, hospital stay, fracture union and Harris hip score. At 12 months follow the Harris hip score was between 72 and 89 [8].

In 2014 MingHui Listudied intertrochanteric fractures in 163 elderly patients treated with PFNA II. (Mean age: 74.7years). All the included fracture patterns were classified as unstable. (AO type 31A1, 31A2, and 31A3).

Statistical analysis revealed an average operation time of 45.7 min (range, 35–110 min). The Harris hip score was used to assess results.(mean HHS: 85.6 point). This included 41 excellent, 92 good, 26 fair and 4 poor cases as result. His data analysis came to the conclusion that use of PFNA II has positive outcome [3].

In 2015, a comparative study between PFNA and DHS was conducted by Sinan Zehir et al, which concluded that less operative time, fluoroscopy exposures and blood loss in PFNA group as compared to DHS group [31].

In 2015 G.N. Kiran Kumar1 studied 45 patients between 2011 and 2013. All patients had suffered unstable intertrochanteric fractures. Every patient had undergoneoperative treatment with using PFNA II. Of 45, 3 patients had died before 6th months follow up. Therefore, 42 patients were included in the study (26 men and 16 women). The mean age of patients was 61 years. Clinical assessment was done using Harris hip score technique.

The mean follow up period was 15.3 months (range, 9-27). Excellent to good results were accounted for 78% of cases according to Harris hip score [1].

In 2017, a study conducted by Anirudh Sharma et al concluded that the helical blade in PFNA has biomechanical advantage and causes better compaction of osteoporotic cancellous bone than dual screw design of PFN, but overall functional outcomes were similar irrespective of implant used [32].

In 2017 Won Chul Shin, MD, PhD retrospectively studied 100 consecutive patients with intertrochanteric fracture patients where 38 treated with proximal femoral nail anti-rotation PFNA], 62 with PFNA II. Postoperative assessments were performed using postoperative radiographs for the proximal protruding length of nail tip, quality of reduction, implant position and the presence of lateral cortical impingement.

No impingement was detected in patients treated with PFNA II, whereas 13 cases of lateral impingement were observed in patients treated with PFNA [5].

In 2018, Dr. Raju lal Yadavstudied30 patients of age group 60 yr and above. All patients were treated operatively with proximal femoral nail antirotation type II and its outcomes were assessed using Harris hip score and Garden Alignment Index GAI and complications were observed with follow up to 12 months clinically and radiological imaging.

Out of 30 patients, 18 were male and 12 female with average age group 74 yrs. Excellent to good result achieved in 80% patients assessed by HHS and GAI.

In 2018 Dr. Akshay Jain studied 40 patients, with a mean age of mean age 77± 8.93 years who suffered unstable intertrochanteric femur fracture.

At final follow up, following results obtained according to Harris Hip Score which was - 45% patients Excellent, 32.50% patients-Good, 20% patients- Fair, 2.50% patients-Poor [7].

In 2018 Ahmad M. Radaideh retrospectively evaluated 50 cases of unstable intertrochanteric fractures.Mean age was of 72.8 years.allthe fractures were operated using the PFNA implant.

On 18 months of mean follow up, solid union was found in all fractures. There were no cases of implant failure or varus collapse encountered. The mean Harris Hip Score was 79.34 ± 9.10 points (excellent to good) [9].

SURGICAL ANATOMY [33, 34, 35, 36]:

HIP JOINT

Hip joint is one of the ball and socket types of synovial joint in our body. In hip joint the femoral head articulates with the acetabulum pelvic bone.Unlike any other ball and socket type of joint, the hip joint is peculiarin having very high degree mobility as well as stability provided by muscles and ligaments.

The stability of hip joint depends upon many factors such as:

- Acetabular depth
- The acetabular labrum.(reduces the diameter of acetabular mouth)
- Tension and strength generated by ligaments .
- Femoral neck length
- Obliquity of the neck of the femur.
- Negative Atmospheric pressure between two articular surfaces.
- Femurhas a long neck.It is narrow than the equatorial diameter of the head. This allows wide range of mobility.

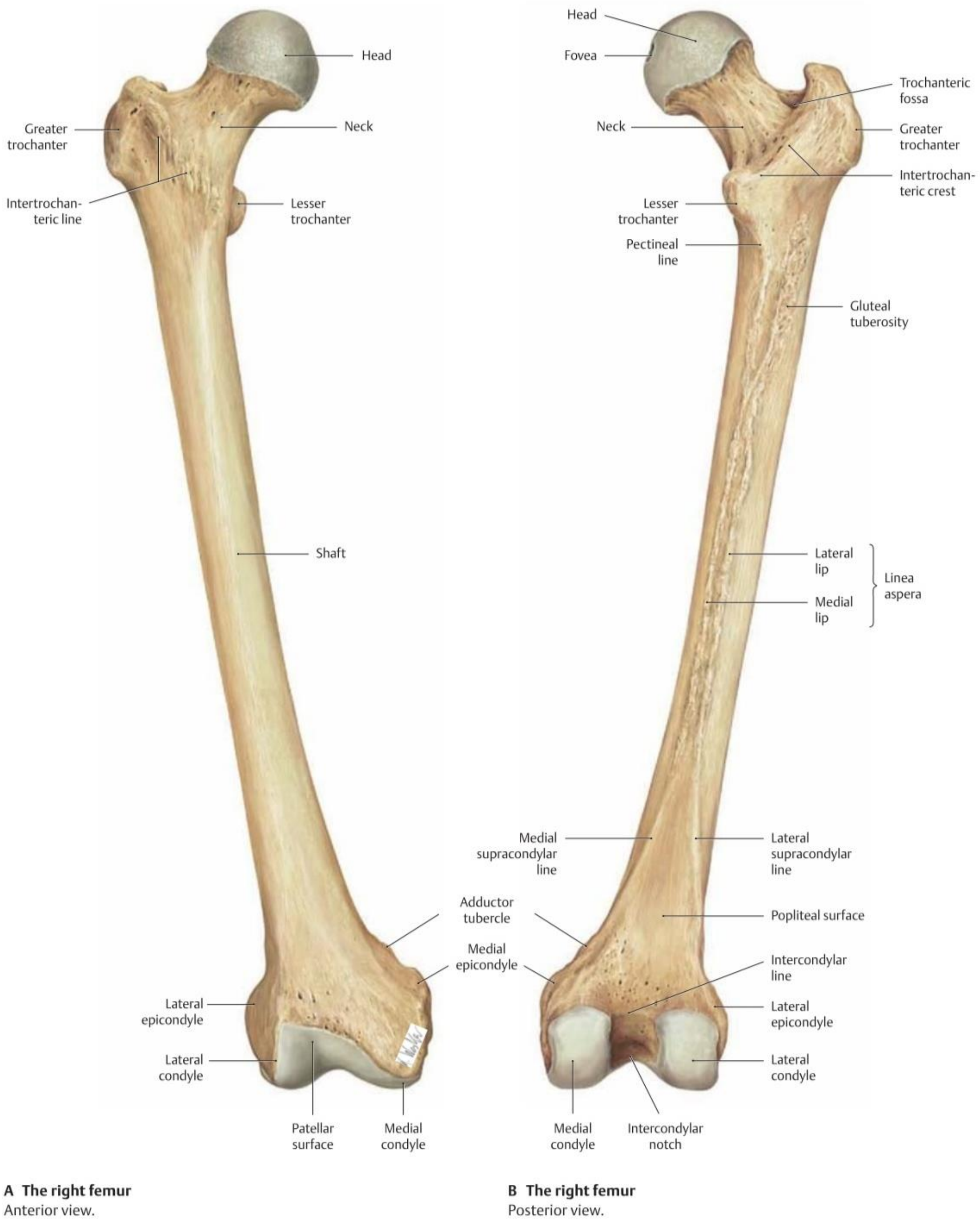


Figure 1 ANATOMY OF FEMUR BONE

1. **Acetabulum:**

On the lateral aspect of the pelvic bone, acetbulum is a hemispherical cavity. Its opening faces forwards, downwards and laterally. The lower margin of the acetabulum is deficient. This deficient portion is known as the acetabular notch. Acetabular notch is bridged by a ligament called as the transverse acetabular ligament. The floorarea which does not take part in femoro-acetabular articulation is roughened. This roughened par is called the acetabular fossa. This fossa is filled with fat which is lined by the synovial membrane. Out of the hemispheric cavity of acetabulm onlyanterior, superior and posterior surfaces takes part in articulation. A fibrocartilagenous rim is attached to the periphery of the acetabulum is called as acetabular labrum. This increases the depth of the acetabular cavity.

2. **Femur (Thigh bone):**

The femur is known for being the longest and strongest bone of the human body. It has an upper end, lower end and a shaft in between two ends. The upper (proximal) end of the femur consists of the femoral head, the neck of the femur, the greater trochanter, the lesser trochanter. In between greater and lesser trochanter there lies the intertrochanteric line and intertrochanteric creast.

- **Head:**

The head of the femur is a globular structure which forms more than half a complete sphere. It faces medially, upwards and slightly in forwards direction. fovea is a roughened pit just distal and posterior to the centre of the head.In the fovea, ligament of teres of femoralhead is attached.

- **Neck:**

In an average individual length of the neck is about 4 cm. With femoral shaft it subtends an angle of about 125 degrees. Infemales this angle is less as compared to males. This difference in angle is due to their wider female pelvis. While in motion presence of this angle allows both lower limbs to swing clear off the pelvis. The neck has superior and inferior border. It has two surfaces, anterior and posterior surface. The inferior border is oblique and straight, which ends at the shaft at the lesser trochanteric region. The upper border is horizontal and concave. This border continues over the shaft near greater trochanter. The anteriorly, the flat surface is completely inside the capsule.This surface ends at the shaft near the intertrochanteric line. The posterior convex (from above downwards and from side to side)surfacemeets the shaft at the intertrochanteric crest. Half of this surface is extracapsular.

The transverse axis of the head subtends an angle with the transverse axis of distal femoral condyles. This angle is called as angle of anteversion or angle of femoral torsion. Normally this angle measures around 15°.

- **Lesser trochanter:**

It is a cone shaped prominence. It is directed medially and backwards. It is located at the junction of the infero-posterior part of the neck and shaft. It has an apex. On roughened anterior surface there is attachmentof the psoas major muscle. The smooth posterior surface is covered by a bursa. This bursa is situated deep to the upper horizontal fibers of the adductor magnus muscle. The base of the trochanter is expanded. Its anterior and medial surfaces has attachment of the iliacus which extends downwards for a short distance behind the spiral line.

- **Greater trochanter:**

It is a large quadrangular shaped area located at the proximal end of the femur. It is present at the neck-shaft junction. The proximalextent of the greater trochanter is present at the level of the centre of the head. The greater trochanter has aproximal border with an apex. It also hasanterior, medial andlateralsurface. At the apex of greater trochanter there is an attachment of the piriformis muscle.

Rough lateral part of anterior surface gives attachment to the gluteus minimus. The medial surface has a rough area above, where the obturator internus and the superior and inferior gemelli get inserted and where obturator externus gets inserted in a deep trochanteric fossa below. An oblique ridge crosseslateral surface, directed downwards and forwards to which the gluteus medius gets inserted. The trochanteric bursa of the gluteus medius lies in front of the ridge, while the trochanteric bursa of the gluteus maximus lies behind the ridge.

- **Inter-trochanteric crest:**

This prominence on bone demarks the junction of the posterior aspect of the neck and the femoral shaft. This ridge begins proximal to the posterosuperior angle of the greater trochanter and terminates at the lesser trochanter. Just above the middle of intertrochanteric creast, a rounded elevation is present called as the quadrate tubercle. Quadratus femoris is attaced to this tubercle.

- **Inter-trochanteric line:**

It denotes the intersection of the anterior neck surface and the femoral shaft. It is a noticeable roughened ridge, which starts above at the anterosuperior edge of the greater trochanter as a tubercle and is continuous below with the spiral line in front of the lesser trochanter. The spiral line twists around the shaft distal the lesser trochanter to approach the posterior shaft surface. Thecapsular ligament of the hip is attached to this line along with upper and lower bands of the iliofemoral ligament. The proximal most fibers of the vastus lateralis muscle originates from the upper end of inter-trochateric line. Thehighest fibers of the vastus medialis arise from distal end of itertrochanteric line.

- **Shaft of femur:** (can be divide into upper, middle and lower 1/3rd parts)

The shaft is round and hollow structure. Its diameter is lowest in the middle and itincreasesproximally and distally. Femur shaft hasforward arch (anterior bowing) and is oriented obliquely downwards and medially as the upper ends of the femora are separated wide apart by the pelvis.

The upper one-third of the shaft is divided into four surfaces (anterior,medial, lateral, posterior) byfour borders (medial, lateral, spiral line and the lateral lip of the gluteal tuberosity). The medial and lateral borders are the distinct medial and lateral lips of the linea aspera.In between these two line the posterior surface is enclosed.

3. **Muscles:**

The hip joint is surrounded by powerful muscles from all sides.

According to their primary function they can be grouped as follows:

- **The flexors:**

The iliopsoas muscleis formed ofthree muscles, psoas major psoas mino, illiacus.

Out of these three muscles , psoas major and illiacus attaches of lesset trochanter. These muscles are responsible for the flexion at hip joint. They aslo causes displacement of the fragment is highly unstable fracture.

- **The Abductors:**

This groups of muscles includes gluteus maximus, gluteus medius,tensor fascia lata arises from the outer border of the iliac crest & inserts on the iliotibial band. The gleuti control the pelvic tilt in the frontal plane.

- **The short external rotators:**

These muscles include the piriformis, obturator internus, obturator externus, superior and inferior gemili and quadratus femoris. They insert along the posterior aspect along the inter trochanteric crest.

- **Gluteus maximus:**

This is the largest muscle of the body. It arises from the ilium, sacrum and coccyx and inserts into the iliotibial band and the gluteal tuberosity. It extends thigh, assists in its lateral rotation and assists in raising the trunk from flexed position.

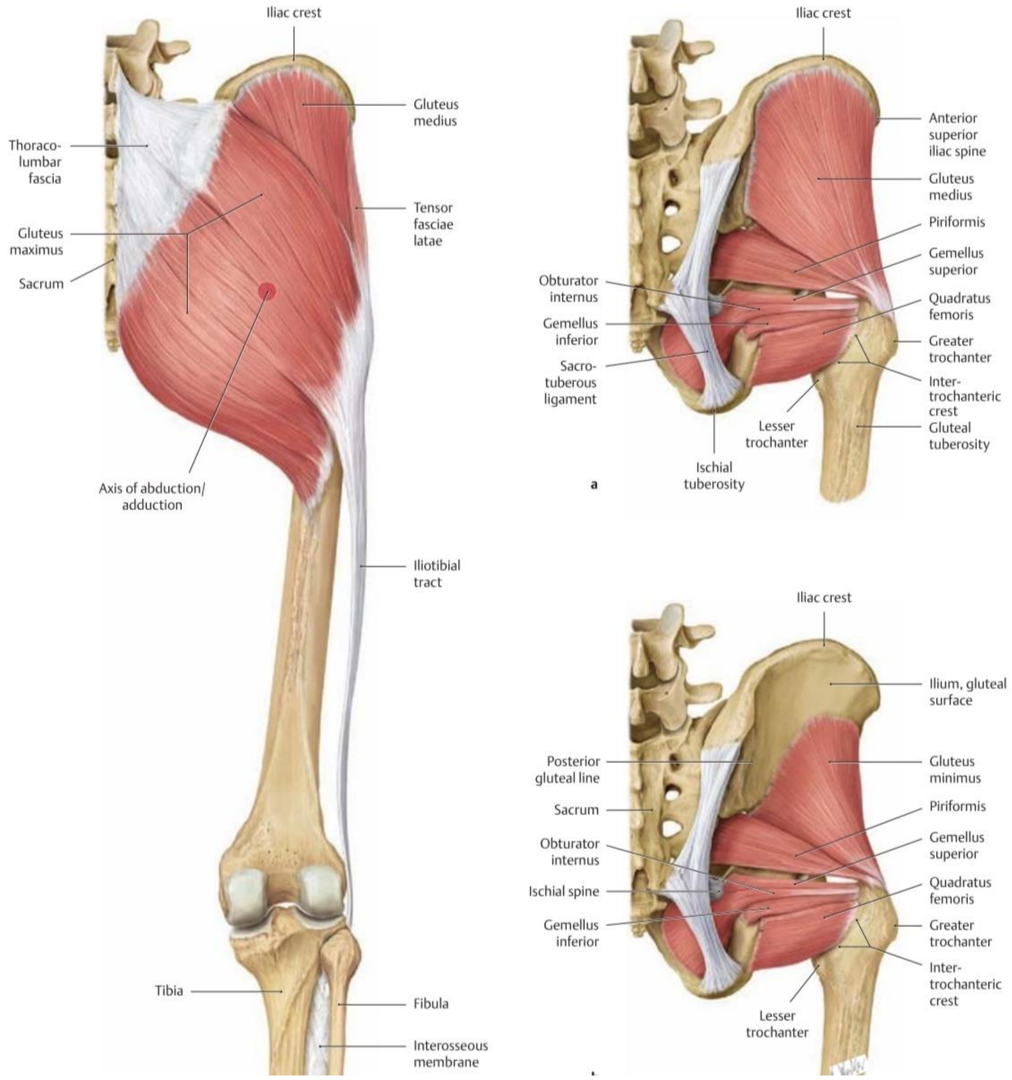


Figure 2 GLUTEUS MAXIMUS, SHORT EXTERNAL ROTATORS, ABDUCTORS

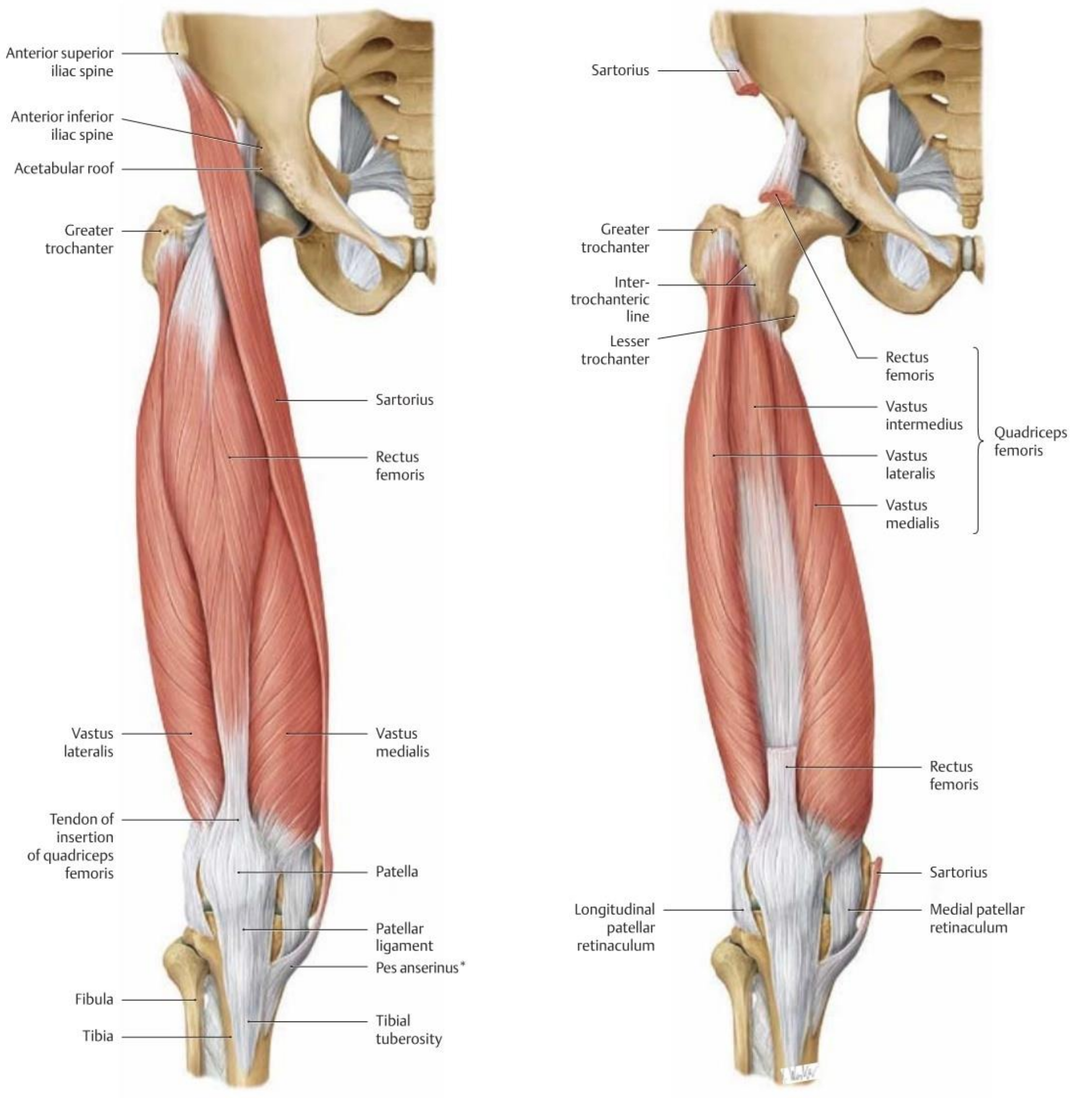


Figure 3 ANTERIOR COMPARTMENT OF THIGH

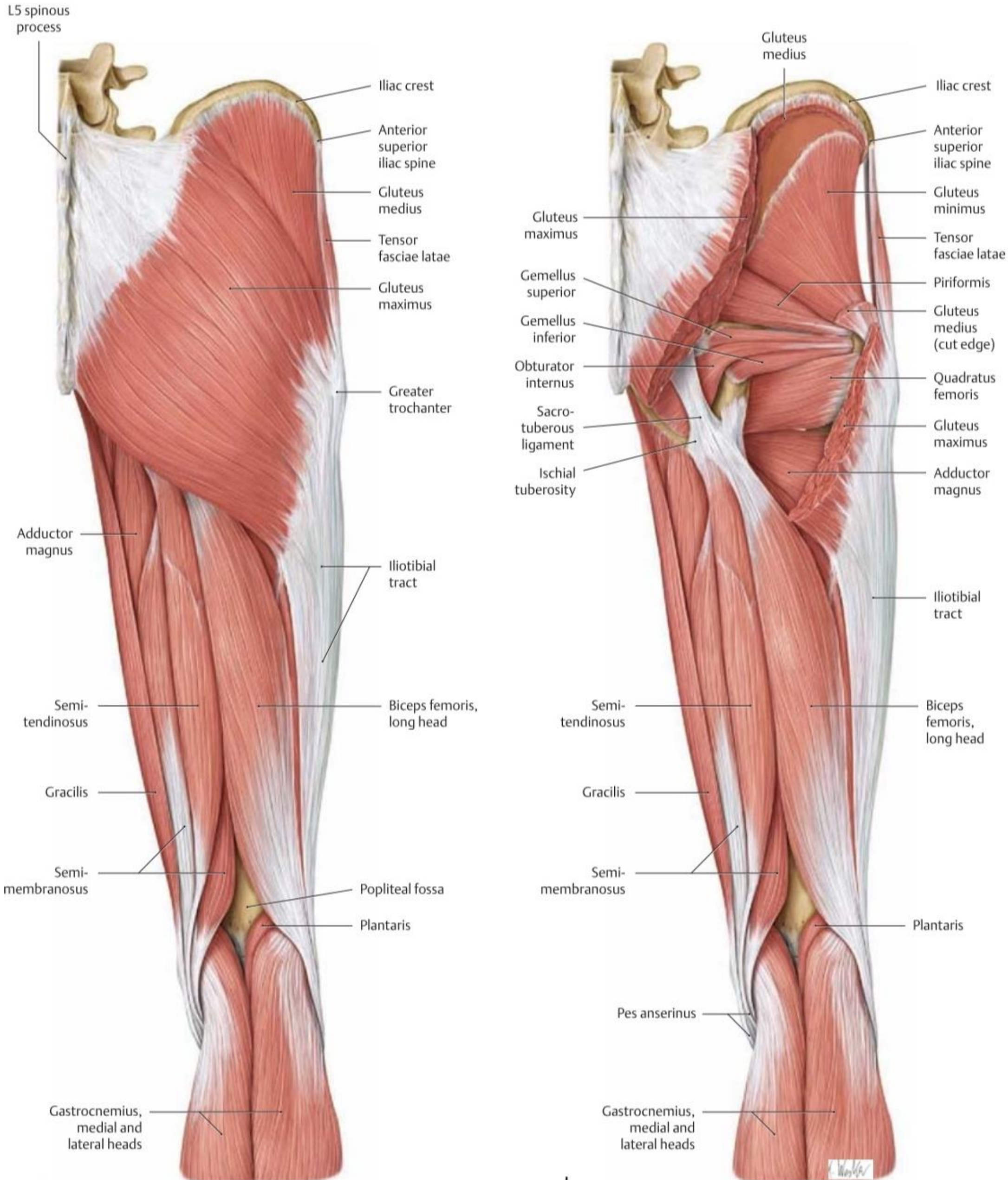


Figure 4 POSTERIOR COMPARTMENT OF THIGH

4. **LIGAMENTS:**

- **Capsule:**

The fibrous capsule of hip joint is strong and dense. It is attached superiorly to the acetabular margin 5-6 mm medial to labral attachment anterioly to outer labral aspect, near the acetabular notch, to transvers ligament and adjuscent rim of acetabulum. Latraly it exteds over femoral head and neck and get attachd anteiorly on to the intertrochanteric line.Posteriorly capsule is attaced 1cm medial to the intertrochanteric crest.thecapsule is thick and firmly inserted anterosuperiorly. The capsule is thin and loosely attached posteroinferiorly.

The capsule consists of two types of fibers. The outer longitudinal fibers reflectes along the neck of the femur to form the retinacula and the inner circular fiber called as zona orbicularis.

- **Iliofemoral ligament**(ligament of Bigelow)**:**

It is triangular or ‘inverted-Y’Shaped ligament intimately blended with capsule.It is present on anterior aspect of the hip joint. Being one of the strongest ligaments in the human body, it can withstand stress as high as 250-750 lb. It prevents hyperextnsion of hip joint. Apex of this ligament is attached to the distal ½ of the anterior-inferior iliac spine. The base of this ligament is attached to intertrochanteric line. Thick and strong bands are formed by the upper oblique and lower vertical fibers.The middle fibers are thin and weak.

- **Pubofemoral ligament** (Triangular ligament)**:**

This ligamentlies on inferior aspect the joint. Proximally, it is insertedon the obturator crest, the iliopubic eminence and the obturator membrane. Distally, it joins with the anteroinferior portin of the capsule and the lower strand of the iliofemoral ligament. This ligament controls excessive abduction and extension at the hip joint.

- **Ischiofemoral ligament:**

It is present on posterior aspect of the hip joint. Its fibers are twisted and extend from the ischium to the acetabulum. The fibers of the ligament form the zona orbicularis (inner circular fibers of capsule). A few fibers get attached to the greater trochanter. This ligament limits extension.

- **Ligamentum teres:**

Ligamentum tere is a flat and triangular shaped ligament. The distal end is attached to the fovea capitis. The base of this ligament is insered onthe transverse ligament along with the margins of the acetabular notch. In some of the population this ligaent may be thin or even be absent. It contains artery to the head of the femur which isbranches of the obturator artery.

- **Synovial membrane:**

The synovial membrane lines the fibrous capsule, the intracapsular portion of the neck of the femur, both surfaces of the acetabular labrum, the transverse ligament, and fat in the acetabular fossa. It also invests the round ligament of the femoral head.

- **Acetabular labrum:**

Acetabular labrum is a fibrocartilaginous structure. This is attached to the peripheral margins of the acetabulum and helps in inreasng stability at hip joint byreducin diameterof the mouth of the acetabulum.

- **Transverse acetabular ligament:**

It is a portion of the acetabular labrum which crosses the acetabular notch converting it into a foramen thoughwhich tacetabular vessels and nerves passes to the hip joint. It is devoid of chondrocytes.

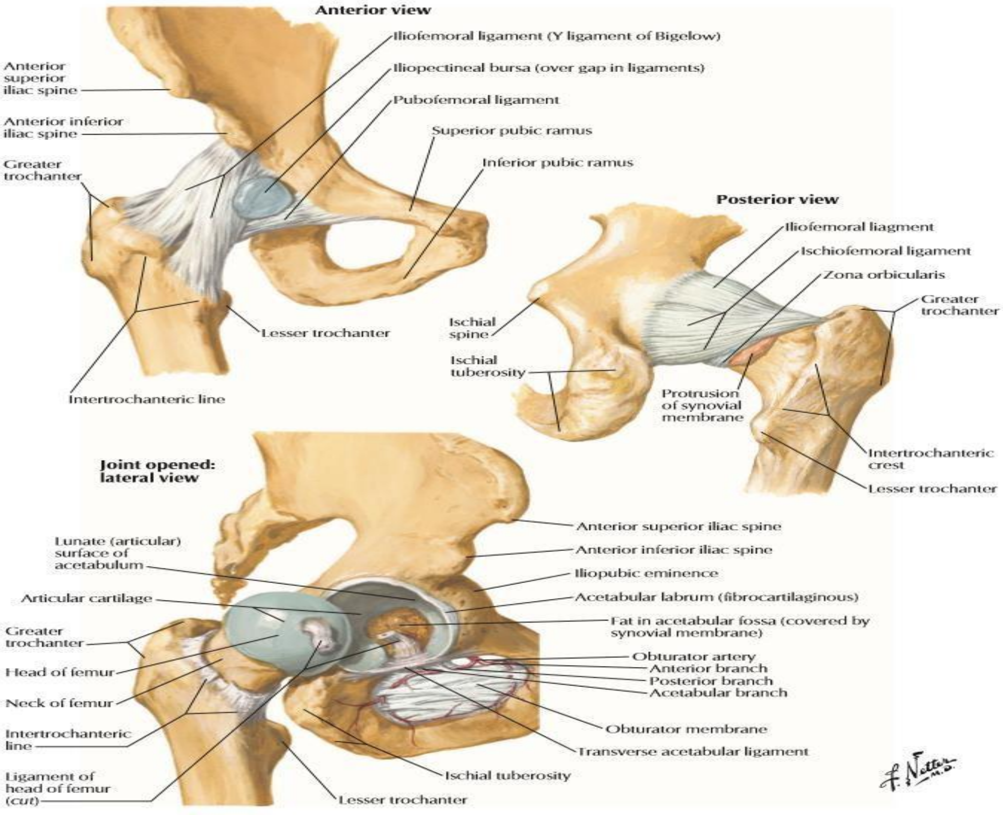


Figure 5 LIGAMENTS AND CAPSULAR ATTACHMENT OF FEMORAL NECK

5. BLOOD SUPPLY OF THE PROXIMAL FEMUR [37, 38, 39]:

- **Arterial supply:**

- Artery of ligamentum teres(branch ofObturator artery)
- Superior and inferior metaphyseal artery (branches of Medial circumflex femoral artery)
- Superior and inferior gluteal arteries.

Blood supply of femoral head: (described by crock)

It is divided it into three major groups.

a) Extra-capsular arterial ring present arround the base of the neck of femur.

b) Ascending cervical branches of the arterial ring lying on the surface of the femoral neck.

c) Arteries of ligamentum teres.

Posteriorly, large branch of the medial femoral circumflex artery forms the extra capsular ring. On anterior aspect same is contributed by a branch from the lateral femoral circumflex artery.

The ascending cervical branches travel up on the surface of the femoral neck in four groups(anterior, posterior, medial and lateral). Out of theses four, the posterior group vessels are the most important group. Disruption of this group of vessels due to any reason, there will be increased the risk of necrosis of the femoral head. Another less prominent ring of vessels, referred to by Chung as the ‘subsynovial intra articular arterial ring” is formed atthe articular margin of the femoral head by the ascending cervical vessels. From this ring, vessels which penetrate the head are called as the Epiphyseal Arteries. These are joined by the superior Metaphyseal vessels and vessels from the ligamentum teres, which are branches of the obturator and medial circumflex femoral arteries.

On the lateral iliopsoas muscle lie the ascending branches of the lateral femoral circumflex artery to reach the femur at the inter-trochanteric line. The lateral femoral circumflex artery also supplies two or three trochanteric branches to the anterior and lateral surfaces of the greater trochanter, which pierce the posterior surface of the trochanter along with the branches from the first perforating artery.

Proximal to the lesser trochanter, the medial femoral circumflex artery passes around the femur and gives off two or three branches to the lesser trochanter. Its branches also supply the posterior surface of the base of the neck. It gives two or three branches into the upper surface of the neck also as its passes more laterally near its junction with the greater trochanter.

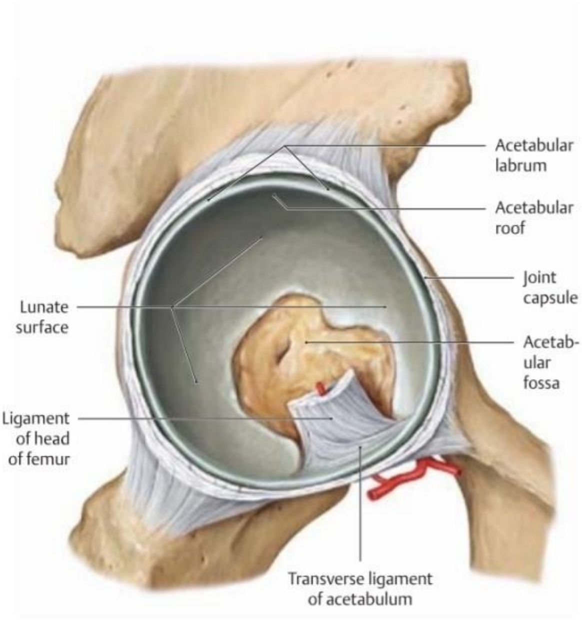


Figure 6 ARTERY OF LIGAMENTUM TERES

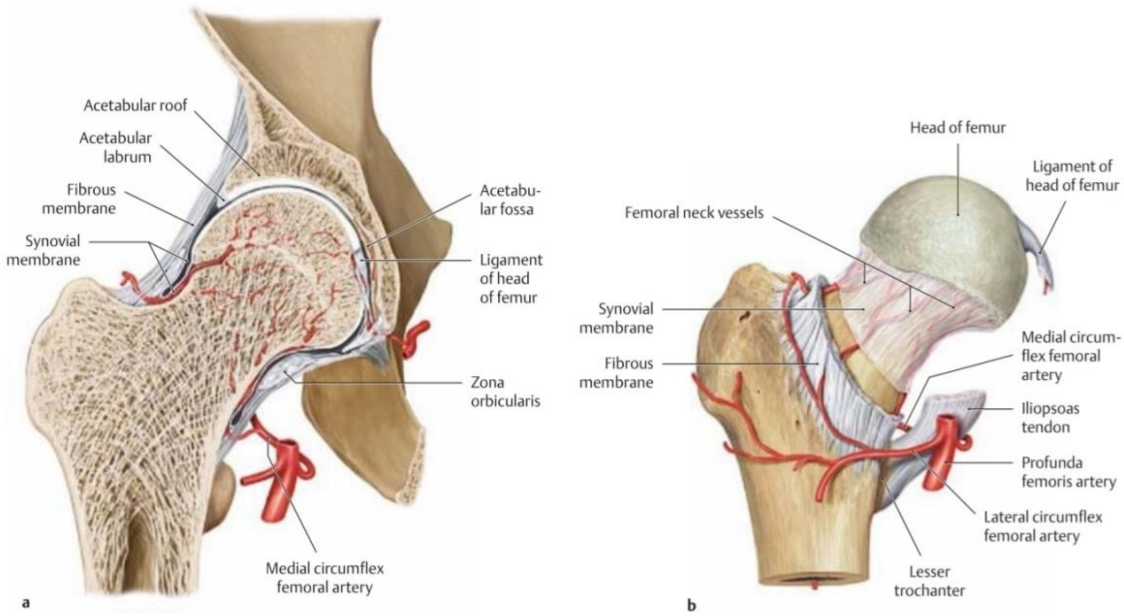


Figure 7 BLOOD SUPPLY OF PROXIMAL FEMUR

- **Venous drainage:**

As described by Phillips,Lamino-capsular veins consist of a double or a single channel arises inferomedially which drains into the obturator vein. A diffuse plexus of the circumflex group are found in the basal portion of the femoral neck and greater trochanter, near to the plexus in the region of the ischial tuberosity.

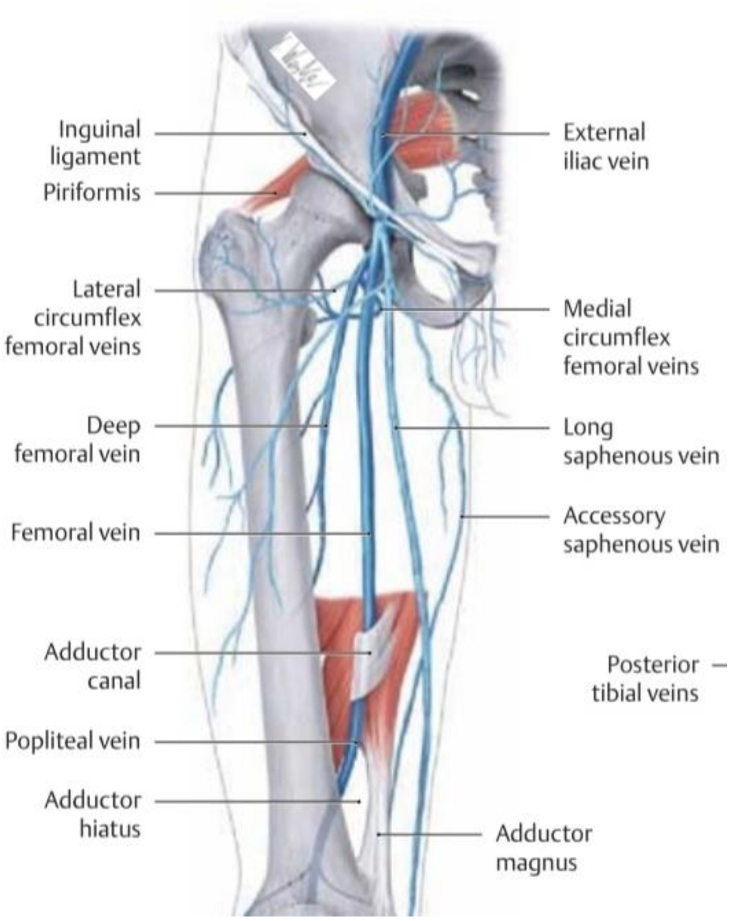


Figure 8 VENOUS DRAINAGE

6. NERVE SUPPLY:

Thefemoral nerve is main nervous inervation supplying directly or indirectly through its muscular branches. Theobturator, the accessory obturator nerve to quadratus femoris and gluteal nerve also contributes in it.

7. MOVEMENTS AT HIP JOINT:

Sagital plane movements:

- Flexion:Neutral to 90 degrees to 100 degrees with knee extended

  : Neutral to 130 degrees with knee flexed

- Extension: Neutral to10-20 degrees

Coronal plane movements:

- Abduction: Neutral to 30-45 degrees
- Adduction: Neutral to 30-40 degrees

Rotational movements:

- Medial:Neutral to 30 degrees
- Lateral :Neutral to 30-40 degrees

8. PATTERN OF TRABECULAR MESHWORK IN THE PROXIMAL FEMUR:

The proximal end of the femur is a made up of cancellous bone. It is composed of two characteristic systems of trabeculae. Thesetrabeculae are found to form two arches when seen in the coronal section. One arch arises from the medial cortex of the shaft of the femur called as compressive trabaculae and the other starts from the lateral cortex called as tensile group of trabaulae. Comprssive trabaclae are direced along the lines of maximum compression forces where as tensile trabaculae are directed along maximum tensile stresses produced during weight bearing process.

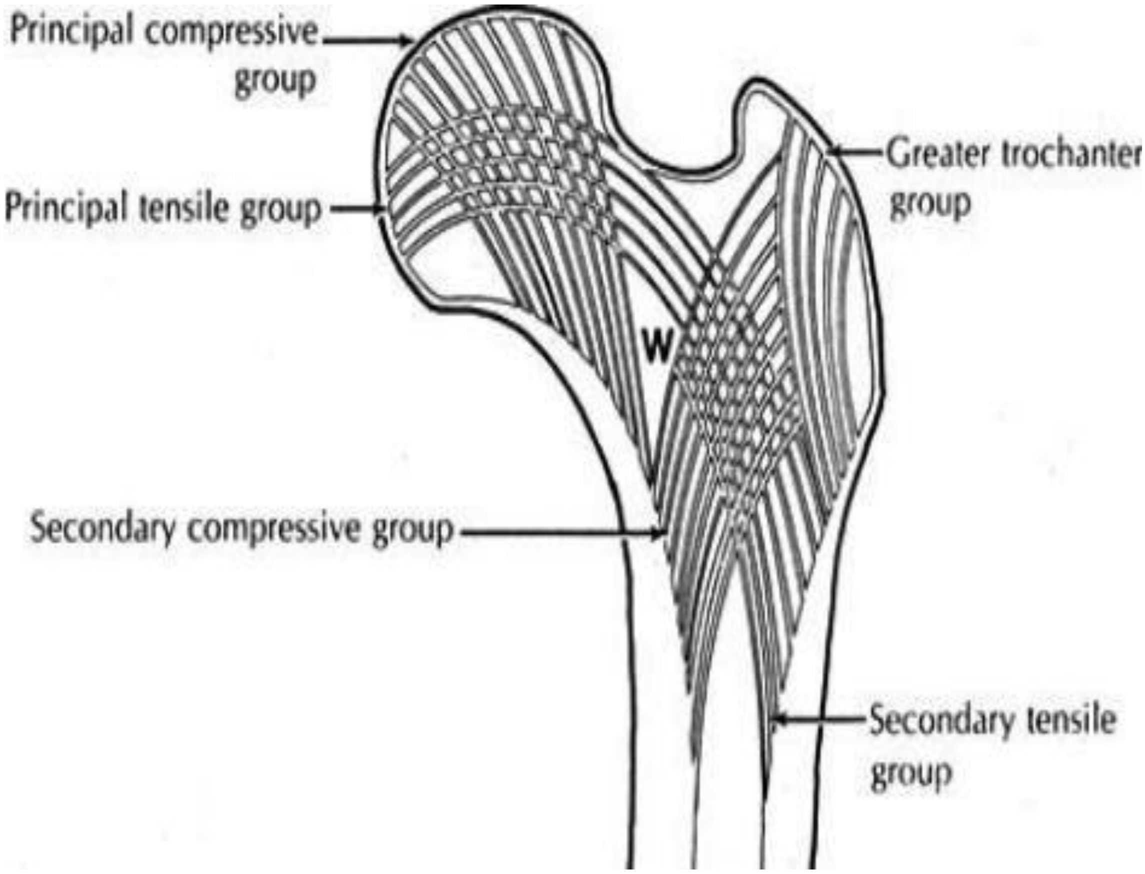


Figure 9 TRABECULAR PATTERN OF THE PROXIMAL FEMUR

This trabecular meshwok is divided into five types of group as follows :

- Primary compressive group: This starts from the medial cortex of the proximal femur and ends in the proximal aspectof the head of the femur running in bit of curved radial lines. Portion these are thickest and closely arranged together.

- Secondary compressive group: These are present just below the principle compressive group of trabaclae. Except principle group, all other compression trabeculae arising from the inner cortex of the prximal shaft, constitute the secondary compressive group. They trabacula also has curve which is directed upwards and laterally facing the greater trochanter and the upper portion of the neck of femur. Unlike principle trabaculae, these are slender and widely spaced.

- Primary tensile group: Thickest among the tensile group, these trabeculae spring from lateral cortex immediately below the greater trochanter, curves upwards and inwards across the neck of the femur to end in the inferior portion of the femoral head.

- Secondary tensile group: The trabeculae which arise from the lateral cortex below the principle tensile trabeculae, curving upwards and medially across the upper end of the femur and more or less irregularly after crossing the midline.

- Greater trochanter group: These slender and poorly defined tensile trabeculae arise from the lateral cortex just below the greater trochanter and curves upwards to end near its superior surface.

"Ward's Triangle" is area in the neck of femur containing some thin and loosely arranged trabeculae enclosed by 3 groups of trabaculae (the primary compressive, primary tensile trabeculae and the secondary compressive). The trabeculae of the upper end of the femur can be studied by making roentgenograms of the hip region using an exposure sufficient to delineate the macroscopic details of the internal architecture of bones. The thick trabeculae appear as dense continuous lines while the delicate ones are not visible. The area of Ward's triangle appears empty while rest of the trabeculae are delineated accoding to their density.

9. **Singh and Maini's Index[40]:**

It is used to grade the trabecular appearance in X-ray in following way:

Grade VI: All the trabeculae groups are visible. Upper end of the femur is completely cancellous.

Grade V: Principle (Primary) tensile and compressive trabeculae are accentuated.

Secondary trabeculae are absent. Ward's triangle becomes prominent.

Grade IV: Principle tensile trabeculae are reduced. But still can be traced from the lateral cortex to the upper end of the femur.

Grade III: The tensile trabeculae opposite the greater trochanter are brocken.

Grade II: Only principle compressive trabeculae are found. Others are more or less completely resorbed.

Grade I: Even principle compressive trabeculae are markedly reduced.

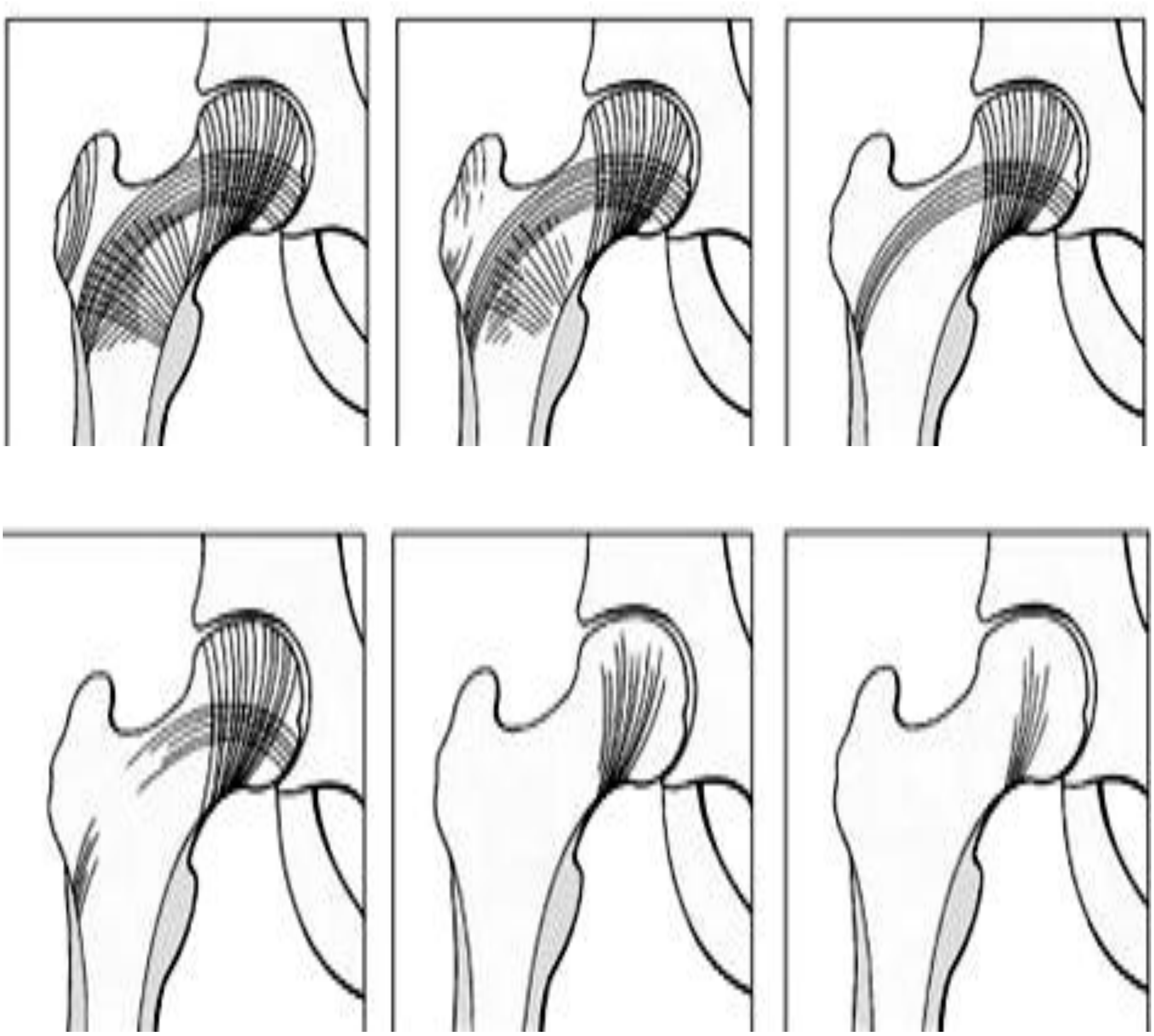


Figure 10 SINGH AND MAINI'S INDEX

TROCHANTERIC FRACTURES [41]:

It is defined as the fracture in which the main plane of bony discontinuity passes through the tip of the greater trochanter obliquely downwards, inwards to or through the lesser trochanter. It occurs in the area just distal to the capsule of the hip joint, and above the area of isthmus of the medullary canal.

Sub trochanteric region is between lesser trochanter and a point 5cm distal to lesser trochanter. This segment is subject to high bio-mechanical stress. The medial and postero medial cortices are sites of high compressive forces, whereas lateral cortex experiences tensile forces.

MECHANISM OF INJURY:

Most(90%) of inter-trochanteric fractures occurring in geriatric populations are result from a trivial trauma. As the age progresses, tendency to fall increaseswhich is exacerbated by several factors including poor vision, diminished reflexes, vascular disease and coexisting musculoskeletal diseases like osteoporosis. Research in elderly patient suggests that the fall of an elderly individual from standing position generates energy as high as 16 times the energy sufficient to cause fracture of proximal femur. But, only 5% to 10% of falls in older patients result in any fracture, and less than 2% in a hip fracture. This disparityconcludes that the mechanics of injury is important in predicting if the fracture will occur.

In younger population individuals, high energy trauma such as motor vehicle accident or fall from height results in fracture.

According to Cummings, there are 4 contributing factors which determines whether a particular mode of injury will results in hip fracture.

- Person shoulddirectly fall on or near the hip joint.
- Impaired protective reflexes.
- Inadequacy o local shock absorbers such as muscles and fat.
- Poor bone quality the hip.

Subtrochanteric fractures are often associated with comminution as they occurs as a result of high-energy trauma involving large areas of the proximal end of the femur. They have potential for significant soft tissue damage even in closed injuries, and with compromise of the vascularity of the fracture fragments. Most of the time forces are oriented directly lateral to the proximal part of the thigh or by axial loading failure in the subtrochanteric region. Transverse, short, oblique or spiral fractures usually results from low- energy trauma.

BIOMECHANICS BEHIND TROCHANTERIC FRACTURE:

Pertrochanteric fractures mainly occur in cortical and compact cancellous type of bone. Fractures line passes along the path of least resistance. Amount of energy absorbed by the bone determines whetherthe fracture is a simple two-part] fracture or is characterized by a more extensively comminuted.

Bone can withstand compressive forces better than tension forces. Cyclic loading of bone with loads lower than its tensile capacity can lead to fatigue fracture. Each cycle of loading causes microscopic injury to the bony structure leading to formation of microscopic cracks. When many of such small cracks coalesce into a single macroscopic break, it acts as a stress riser. Failure occurs because of non-healing of such microfractures. In cyclical loading, the fatigability is directly proportional to the frequency and the magnitude of the load.

Muscle forces have major role in the biomechanics of the hip joint. During gait (stance phase), bending moments are laid on to the femoral neck by the body weight. This results in tensile stress and strain on the superior cortex. The action of gluteus medius produces an axial compressive stress and strain in the femoral neck whichcounteracts the tensile stress and strain. When thismechanics fails due to muscular fatigue, unopposed tensile stress arises in the femoral neck are generated. Stress fractures are generally caused by continuous strenuous physical activity that leads the muscles gradually to fatigue and loss of their ability to perform contraction and nullify the stress on the bone.

The subtrochanteric region is an area of high stress concentration. The proximal end of the femur has been likened to a cantilevered arch that transfers the force of weight bearing from the lower extremity to the hip and pelvis.

The sub trochanteric region is mainly composed of cortical bone. Therefore, there is less vascularity in this region and the potential for healing is diminished.

DEFORMITY:

The extent of clinical deformity is reflected by the degree displacement a fracture site. The deformity is depends upon two factors, the direction of the forces which induced the fracture and muscular pull at the fragments.

If the short external rotators stays attached to the proximal fracture fragment, this segment will lie in full external rotation. When the fracture line is proximal to the attachment of the short external rotator, the distal fragment lands up in external rotation.

Hamstrings and gluteus maximus are at higher mechanical advantage over rectus femoris as it produceanterior angulation in the sagittal plane.

The lesser trochanter getsfractured by compression-extension injury type. Gluteus medius and gluteus minimus produces tilting of the proximal fragment. Action of the adductors muscles causes medial tilting the distal fragment. Together, these two deforming forces produces coxa-vara deformity.

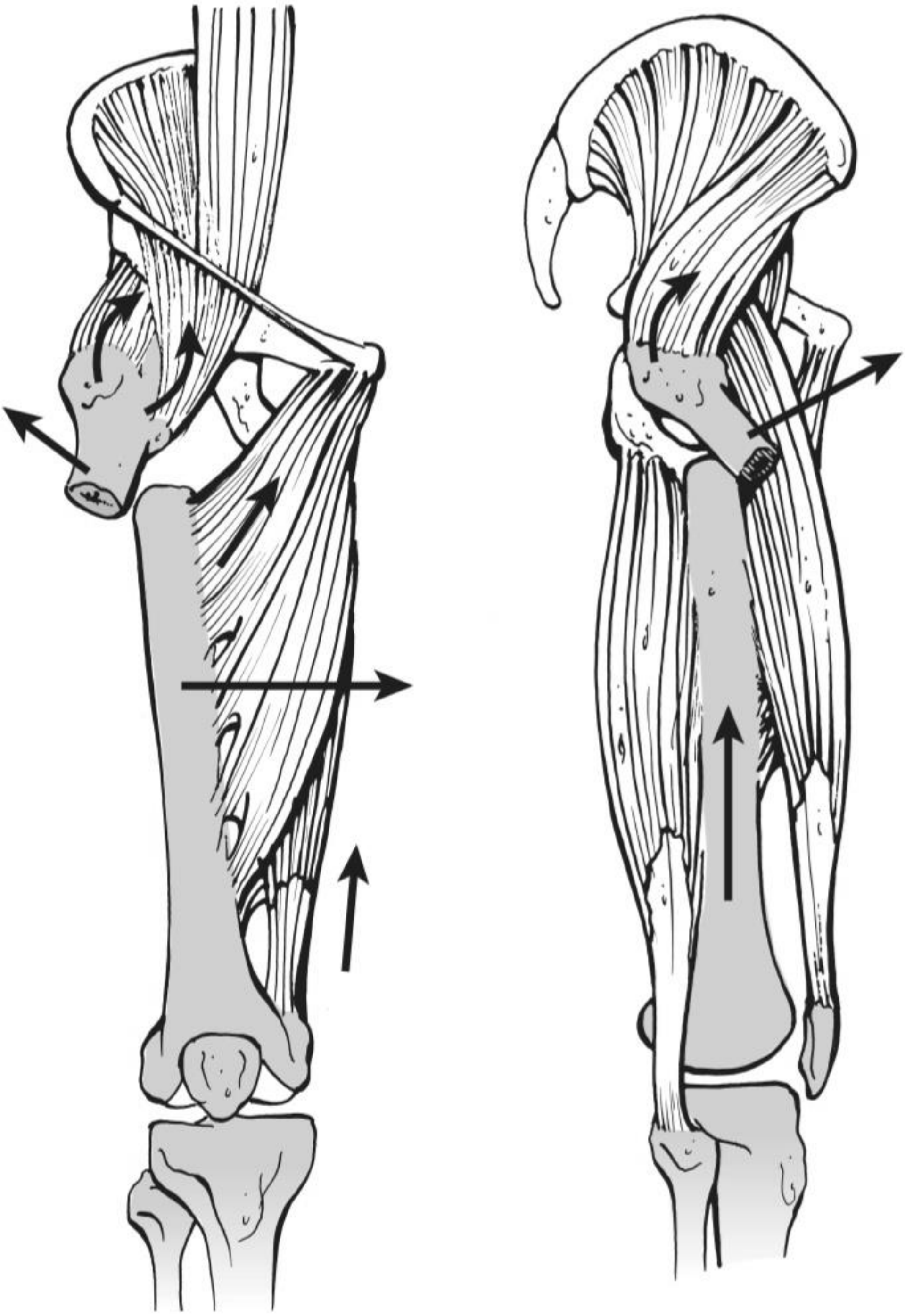


Figure 11 DEFORMITY AND DEFORMING FORCES AT THE FRACTURE SITE

CLASSIFICATION OF TROCHANTERIC FRACTURES

There are many classification system for trochanteric fracture of femur. Some of the classifications systems are as follows:

- ✓ Boyd & Griffin classification.
- ✓ Evan‘s classification.
- ✓ Orthopaedic trauma association (OTA) classification.
- ✓ Seinsheimers classification.
- ✓ Russell and Taylor classification .
- ✓ Fielding classification.

- **BOYD AND GRIFFIN (1949) CLASSIFICATION [19]:**

Fractures which are in extracapsular part of the neck to subtrochanteric areaare included in this classification system.

Type 1: Fracture line extends along the intertrochanteric line. Reduction of these fractures is simple and is maintained with little difficulty.

Type 2: It includes comminuted fractures.Here,the main fracture starts along the intertrochanteric line but is associated with multiple fractures lines in the cortex. Reduction of these fractures is more difficult because of the comminution .

Type 3: These are basically subtrochanteric fractures. Here fracture line passes or extends to the area within 5cms from lesser trochanter. Varying degree of comminution can be associated with main fracture line. These fractures are usually more difficult to reduce and an to maintain the reduction.

Type 4: Fractures of the trochanteric region and the proximal shaft, with fracture in at least two planes. If open reduction and internal fixation is used, two plane fixations is required.

Type 3 and 4, most difficult type to manage which accounts for only one third of the trochanteric fractures.

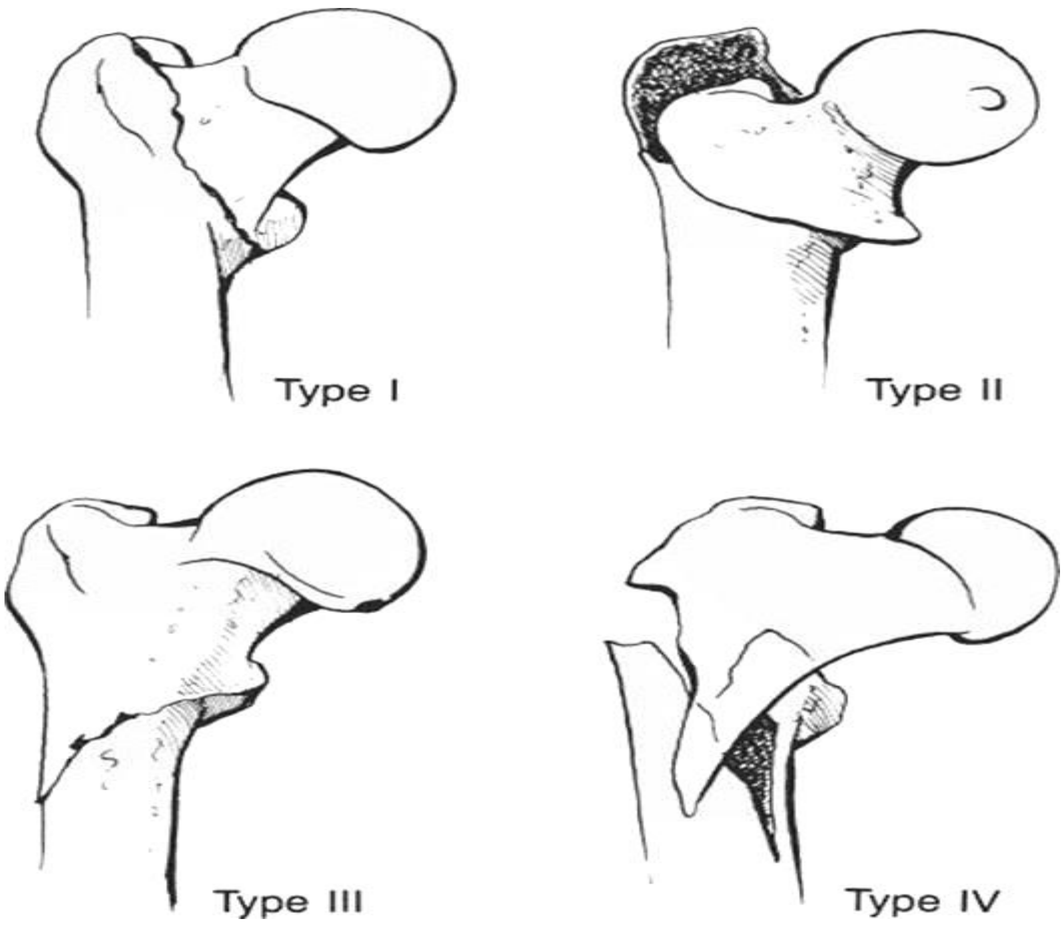


Figure 12BOYD & GRIFFIN CLASSIFICATION

- **EVAN'S CLASSIFICATION:**

Type 1: The fracture line extends upwards and outwards from the lesser trochanter.

Type 2: The fracture line has reversed obliquity where in the major fracture line extends outward and downward from the lesser trochanter. These are defined as unstable.

A widely used classification (Evans claasification) systemis based on the stability of the fracture morphology and its expectation to convert an unstable fracture into a stable reduction. Evans observed that restoration of posteromedial cortical continuity is the key to a stable reduction.

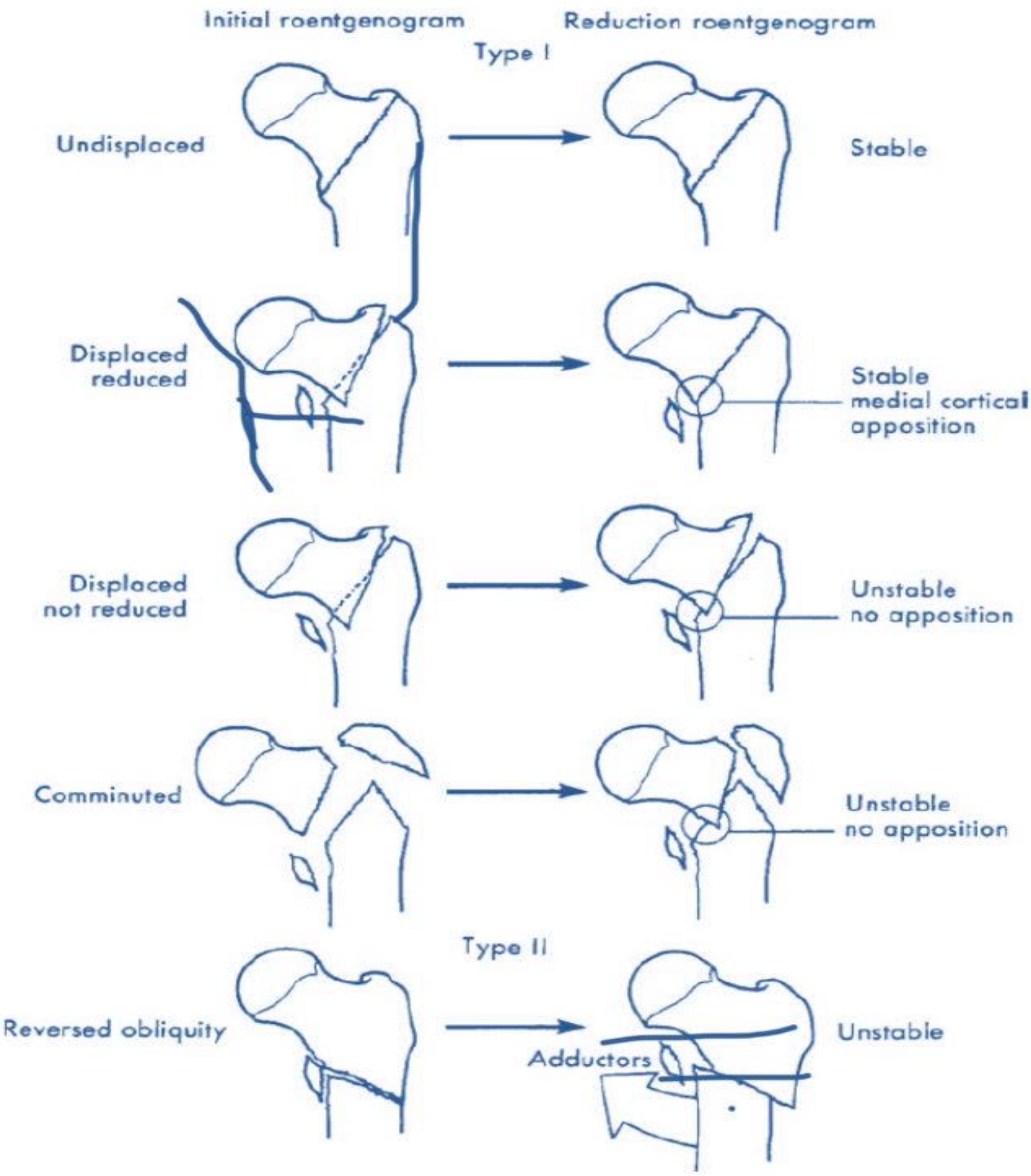


Figure 13 EVANS CLASSIFICATION

- **OTA ALPHANEUMERIC FRACTURE CLASSIFICATION [42]:**

31 A: - Proximal femur trochanteric fractures.

A1: Pertrochanteric simple

A1.1: Parallelto intertrochanteric line

A1.2: Greater trochanteric involvement.

A1.3: Distal to lesser trochanter.

A2: Pertrochanteric multi-fragmentary fractures.

A2.1: Associated with only one intermediate fragment.

A2.2: Associated With several intermediate fragments.

A2.3: Extend to area more than 1cm distal to lesser trochanter.

A3: Fracture line extending into lateral cortex (reverse oblique fracture)

A3.1: Simple oblique

A3.2: Simple transverse

A3.3: Multi fragmentary.

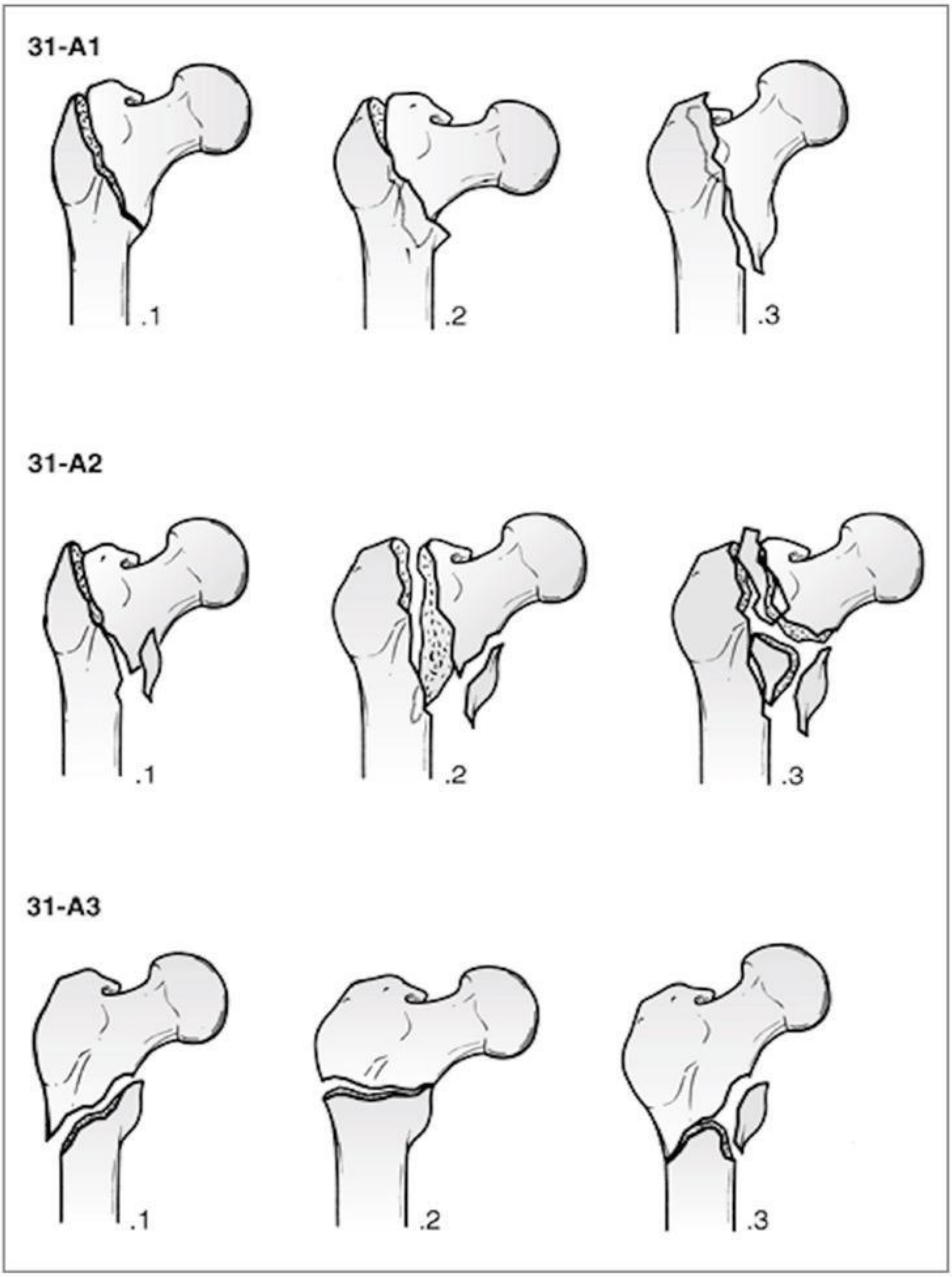


Figure 14 ORTHOPAEDIC TRAUMA ASSOCIATION (OTA) CLASSIFICATION

- **SEINSHEIMER'S CLASSIFICATION** [43]**:**

Type I:

Nondisplaced fracture or any fracture which has less than 2 mm of displacement of the fracture fragments, regardless of pattern.

Type II: Two-part fractures.

IIA: Two-part transverse femoral fracture.

IIB: Two-part spiral fracture with the lesser trochanter attached to the proximal Fragment.

IIC: Two-part spiral fracture with the lesser trochanter attached to the distal fragment. (reverse obliquity pattern)

Type III: Three-part fractures

IIIA: Three-part spiral fracture in which the lesser trochanter is part of the third fragment, which has an inferior spike of cortex with varying length.

IIIB: Three-part spiral fracture of the proximal third of the femur, with the third part as a butterfly fragment.

Type IV: fracture patterns having comminution with four or more fragments

Type V: Subtrochanteric-intertrochanteric fracture, including any subtrochanteric fracture with extension through the greater trochanter.

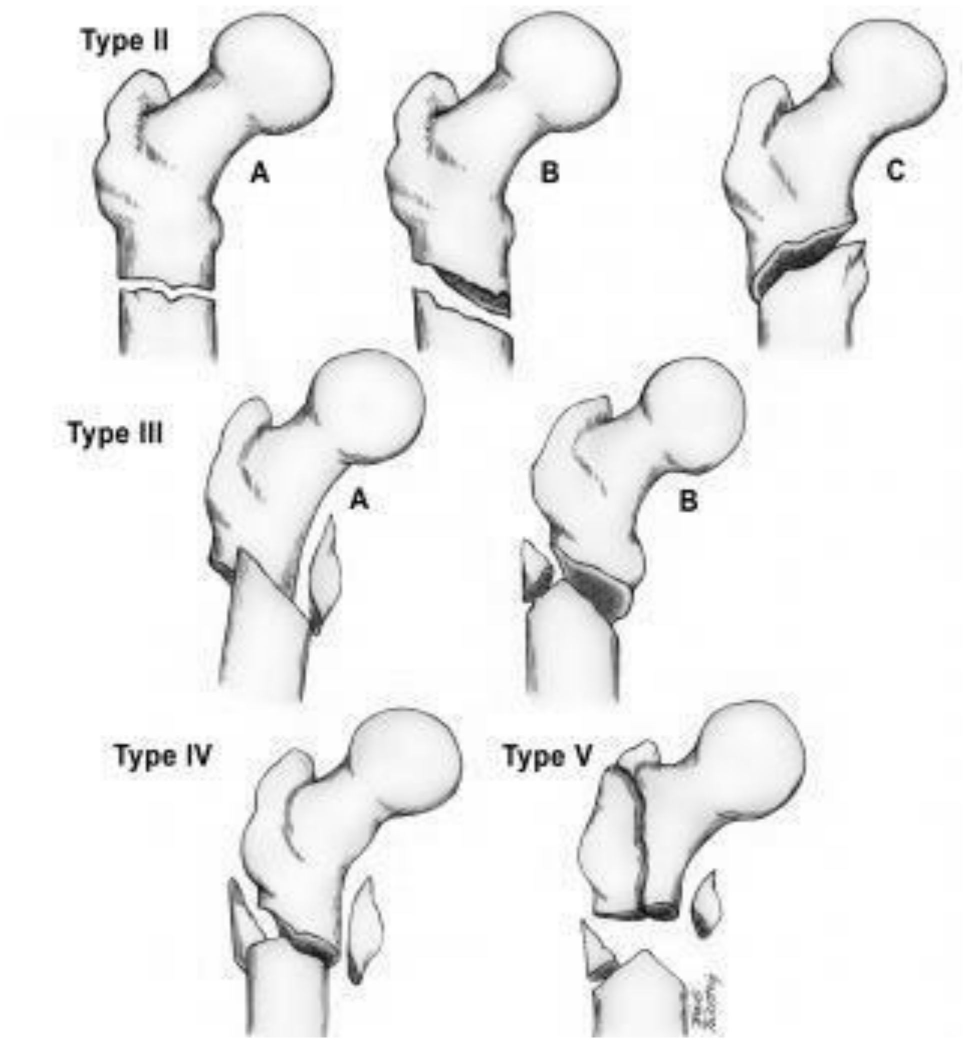


Figure 15 SEINSHEIMER CLASSIFICATION

- **RUSSEL TAYLOR CLASSIFICATION [44]:**

Type I: Fractures with an intact piriformis fossa in which:

IA: The lesser trochanter is attached to the proximal fragment.

IB: The lesser trochanter is detached from the proximal fragment.

Type II: Fractures that extend into the piriformis fossa and:

IIA: Have a stable medial construct (posteromedial cortex).

IIB: Have comminution of the piriformis fossa and lesser trochanter, associated with varying degrees of femoral shaft comminution.

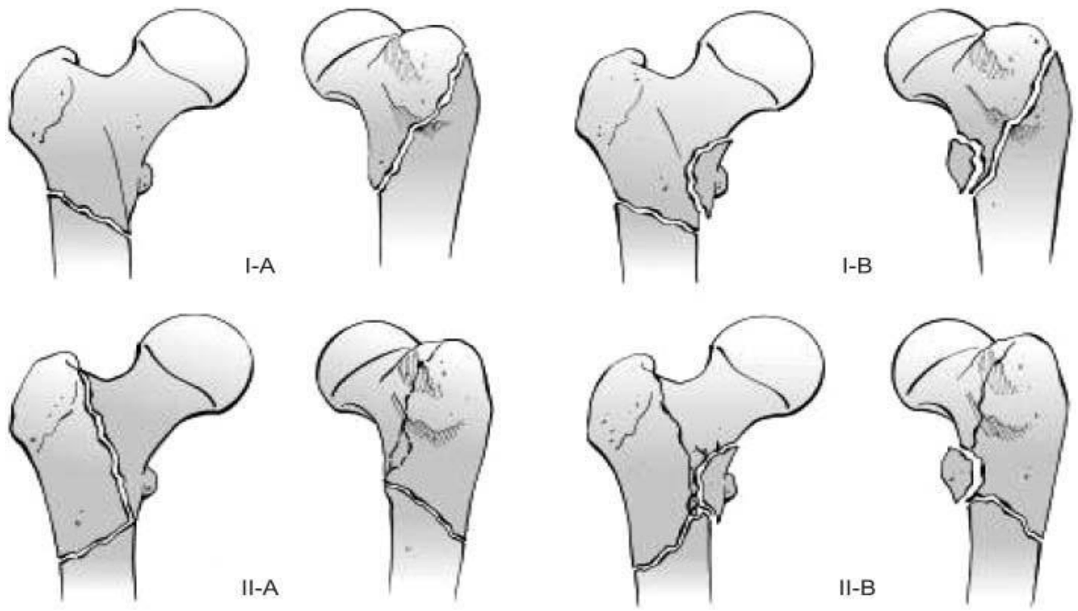


Figure 16 RUSSELL AND TAYLOR CLASSIFICATION

- **FIELDING CLASSIFICATION [45]:**

Type I: At the level of the lesser trochanter.

Type II: <2.5 cm below the lesser trochanter.

Type III: 2.5 to 5 cm below the lesser trochanter.

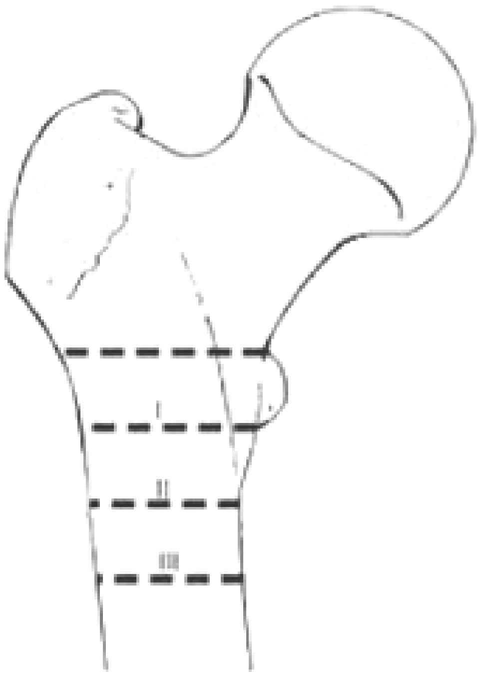


Figure 17 FIELDING CLASSIFICATION

FRACTURE GEOMETRY AND INSTABILITY:

Stability the fracturelargely depends on the geometry of the fracture pattern. The most commonly encountered patterns of instability are as follows:

- Lesser trochanter comminution.
- Reverse oblique fracture.
- Inter-trochanteric fracture having sub- trochanteric extension.

A truly stable Inter-trochanteric fracture [46] is one that when reduced has cortical contact without a gap posterior-medially. This contact prevents further displacement into varus and retroversion. In the stable fracture the posterior & medial cortices are not comminuted and there is no displaced fracture of the lesser trochanter.

The size & amount of displacement of lesser trochanteric fragment is the key to evaluating the stability of the fracture. Up to 60% of inter-trochanteric fractures are unstable which increases risk of complications.

- **The Lateral Wall [47]:**

In the past the lateral wall of the trochanteric region has been given less importance. Now it is proved that sever comminution of the lateral wall requires to be repairedthus the development of the trochanteric plate which ca buttress the lateral wall.

- **Reverse Oblique Fracture:**

In this type of fracture, the fracture line extends from lesser trochanter inferiorly to the lateral cortex. The geometry of the fracture is inherently unstable. If this fracture is missed & treated with a sliding hip screw with plate, it results in medialization of the distal fragment. Such fractures needs to be treated with a 95 egree angled blade plate or an intra medullary nailing device.

- **Intertrochanteric Fracture with Sub-Trochanteric Extension:**

These are highly unstable injuries. The marked comminution of the posteromedial buttress along with distal extension of the fracture renders them unstable which often makes lating difficult. An intramedullary nail is the better option in these type of fracture.

SIGNS AND SYMPTOMS:

The clinical presentation of paient varies widely depending on type, severity, and cause. Displaced fractures are clearly symptomatic. These patients usually cannot stand or ambulate. Patients with undisplaced fractures may be ambulatory and experience little pain. Some patient may complain of thigh or groin pain but have no history of antecedent trauma. Hence, the clinician must exclude the possibility of hip fracture in anyone who complains of thigh or groin pain.[31]

PHYSICAL EXAMINATION:

Patients with a undisplaced fracture may present without any clinical deformity, whereas those with a displaced fracture exhibit the classic presentation of a shortened and externally rotated lower limb. Patient can have tenderness over the area of the greater trochanter. Ecchymosed (subcutaneous hematoma) may appear. Evaluation range-of-motion should be avoided because of pain. Although neurovascular injury is rare after hip fracture, careful evaluation is nevertheless mandatory [48].

IMAGING:

Itshould include Standard xray of the hip includes an antero-posterior (AP) view of the pelvis both hip joint (allows comparison of the involved side with the opposite side) and an AP and a cross-table lateral view of the affected proximal femur. The lateral x-ray can help to assess posterior comminution of the proximal femur.

A traction and internal rotation view of the injured hip may be helpful to further delineate the fracture morphology. Internally rotating the femur by 10 to 15 degrees nullifies the ante version of the femoral neck and brings proximal femur in a true AP plane. X-ray in this position helps in preoperative planning.

When a hip fracture is suspected clinically but not visible on standard x-rays further investigations such as a technetium bone scan or a magnetic resonance imaging (MRI) scan should be obtained. MRI has been proved to be at least as accurate as bone scanning in identification of occult fractures of the hip, and it will reveal a fracture within 24 hours of injury [48].

MANAGEMENT OF TROCHANTERIC FRACTURES :

Trochanteric fractures can be managed either with non-operative (conservative) methods or operative methods.

CONSERVATIVE (NON-OPERATIVE) MODALITIES OF TREATMENT MANAGEMENT:

Before the introduction of suitable fixation devices in the 1960s treatment for intertrochanteric fractures was of necessity nonoperative, consisting of prolonged bed rest in traction until fracture healing occurred (usually 10 to 12 weeks) followed by a lengthy rehabilitation programme. In elderly patients conservative management was associated with high complication rates which included decubitus ulcer, upper respiratory track infection, urinary tract infection, joint stiffness, pneumonia, pulmonary embolism. Tarochanteric fractures heals mostly with varus malalignment with shortened extremity because of the inability of traction in effectively counteracting the deforming muscular forces.

The indications for conservative management are as follows:

- Patients with high medical risk for anaesthesia and surgery.
- Non-ambulatory patient with minimal clinical discomfort following fractures.

Methods of conservative management:

- Immobilization with pillow support.

- De-rotation boot cast application
- Splint application including opposite limb.
- Skeletal traction through the lower end of femur or upperend of tibia.
- Well-leg traction.
- Buck's traction.
- Balanced traction of Russell's.
- Immobilization in Plaster Spica cast.

Buck's Traction:

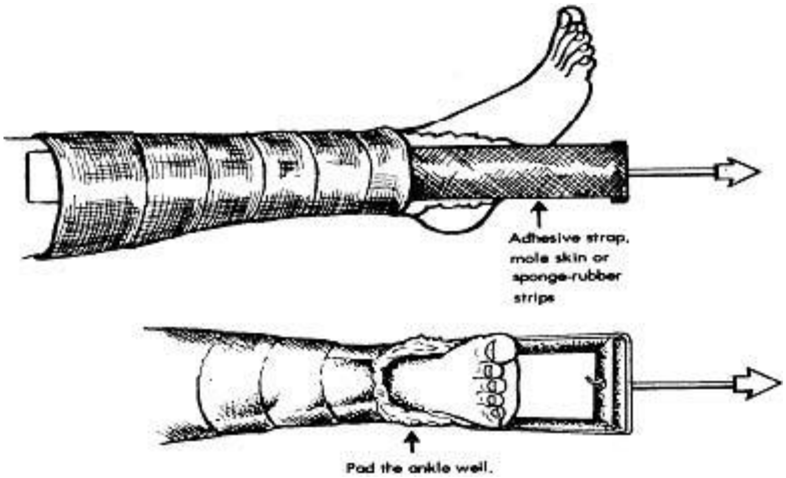


Figure 18 BUCK'S TRACTION

In this type of skin traction, the pulling forces are distributed on large surface area of lower. Therefore it is more comfortable and effective. In this type of traction method, traction apparatus must be applied on the limb distal to the fracture site.

Skin traction when applied on old patients with atrophic skin causes distress. Rotation at lower limb is difficult to be controlled with this skin traction. Hence forthe treatment of intertrochanteric fracture, a skeletal traction is preferred over skin traction in elderly patients.

Skeletal Traction:

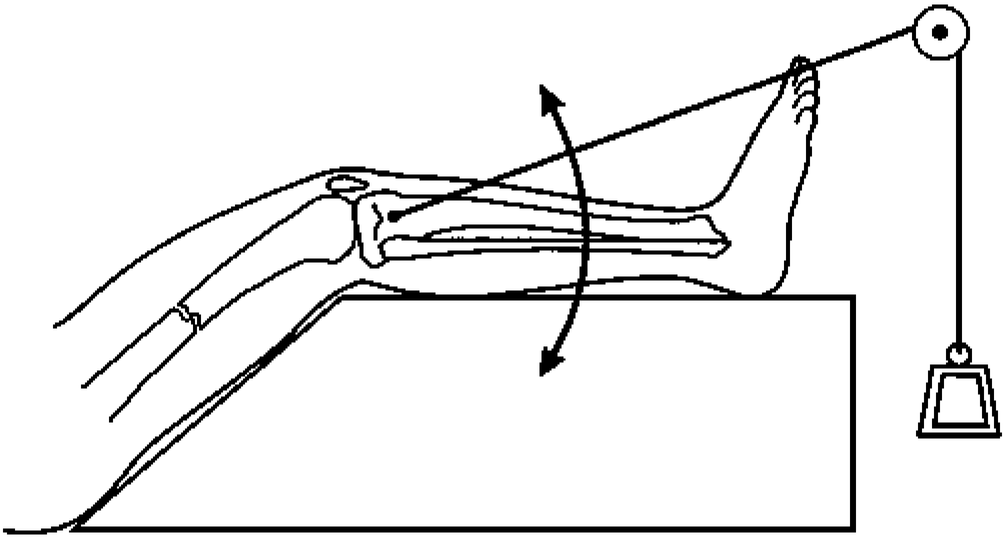


Figure 19 SKELETAL TRACTION

In skeletal traction, a stainless steel pin is applied through the distal femur or proximal tibia. In this technique, the force is applied directly over the distal fragment. It can carry out both reduction and maintenanceof the reduction at fracture site. A serious complication of skeletal traction is osteomyelitis. Pin loosening, superficial infection, fractures can also occur.

The limb issupported with Bohler- Braun splint after puting the skeletal traction.Along with he patient body weight and the proximal fragment moves relative to the distal fragment. At times, this may predispose to the occurrence of a fracture site deformity.

Russell's Balanced Traction:

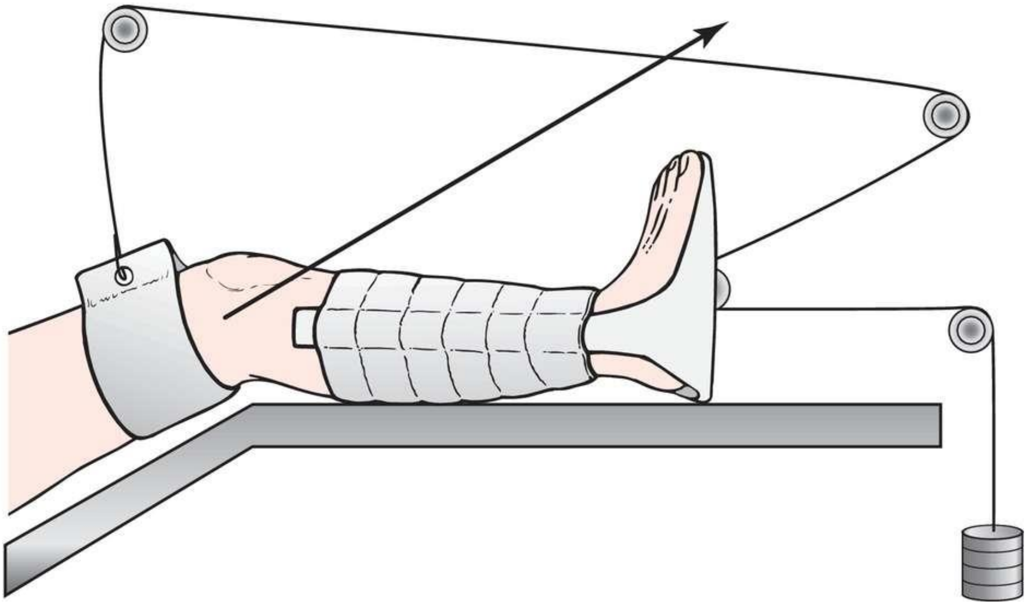


Figure 20 RUSSELL'S BALANCED TRACTION

Introducedin 1924 by Hamilton Russell of Melbourne, is aless complicated form of balanced traction. Principle behind this type of traction is the application of two forces at the knee forms a resultant vector force along the long axis of the fractured femur. Equinus contractures of the foot and thromboembolic disease are one of the main complications of its use.

Well - Leg Traction:

Described by Roger Anderson in 1932 as unique traction method.in this method both the lower limbs are involved.To the affected limb skeletal traction is applied. Unaffected limb is used for the provision of counter traction.

It is mainly correct coronal deformities at the pelvi-acetabular joint. In cases of abduction deformity at one side, the affected limb looks lengthened. In such cases traction force is applied to unaffected side. On the other hand, affected limb is simultaneouushed up counter traction], the abduction deformity is reduced. Reversing the arrangement will reduce an adduction deformity.

This technique allows the patient to be moved from bed to chair and eliminates the cumbersome apparatus required by skeletal traction. But, using the normal limb for counter traction can lead to skin problems and ulceration in the elderly.

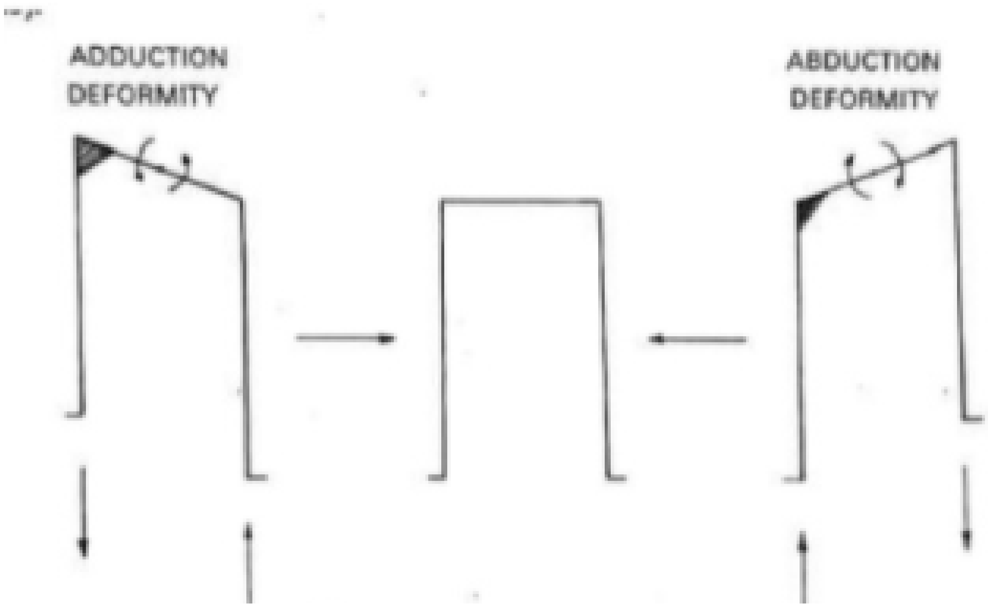


Figure 21 WELL LEG TRACTION PRINCIPLE

SURGICAL MANAGEMENT:

Surgical management of trochantric fracture took giant leap in the 1960s and the problems associated with early fixation devices have largely been solved. Operative management permits early patient mobilization and minimizes many of the complications associated with prolonged bed rest. Hence operative management have consequently become the treatment of choice for trochanteric fractures.

Rigid internal fixation of trochanteric fractures with early mobilization of the patients should be considered standard treatment.

Aim of operative treatment of trochanteric fracture:

- Rigid fracture fixation.
- Relative stability at fracture site.
- Early weight bearing following operation.
- Reduce hospital stay.
- Restoration of preoperative mobility level.

Stability of fracture fixation depends on:

- ➢ Bone quality.
- ➢ Fracture morphology and its reduction
- ➢ Implant design.
- ➢ Implant placement (procedure).

FOLLOWING ARE SOME OF THE IMPLANTS USED IN TROCHANTERIC FRACTURE FIXATION:

1) Extramedullary Implants:

- Fixed angle nail-plate system
- 95 degree angled blade-plate system by AO
- DHS (dynamic hip screw)
- Dynamic compression screw (DCS)
- Medoff�shaxial compression Screw

2) Intramedullary Implants

- Enders nailing system: (Condylocephalic)
- Cephalomedullary:

  I) Russell and Taylor reconstruction Nail.

  II) Gamma Nail.

  III) Zickel Nail.

  IV) Trochanteric femoral nail (TFN)

  V) Proximal Femoral Nail (Short PFN& Long PFN)

  VI) Proximal Femoral Nail Antirotation system I (PFNA-I)

  VII)Proximal Femoral Nail Antiroatation System II (PFNA II)

3) Prosthetic Replacement

I) Hemiarthroplast

II) Total hip replacement

4) External Fixation

- **Fixed angle nail plates: (JEWETT NAIL):**

Figure 22 JEWETT NAIL

From 1940 to l960 Jewett nail was most widely used nailing system forintertrochanteric fractures. It has a triangular nail attached to a plate with different angles (130° to 150°). It provides rigid hold on the proximal fragment and stabilization it on to the distal fragment. In postoperative period when mobilization is started, this nailing system did not allow collapses at fracture site to minimize the fracture gap.Any movement at fracture site resulted in cutting out of the nail through the superior part of the femoral neck and head leading to poor outcome. If the gap at fracture sitepersists, exclusive loading on the device resulted in either implant breakage at the nail- plate junction or separation of screws along with plate from the femoral shaft leading failure.

- **A.O. 95⁰BLADE PLATE:**

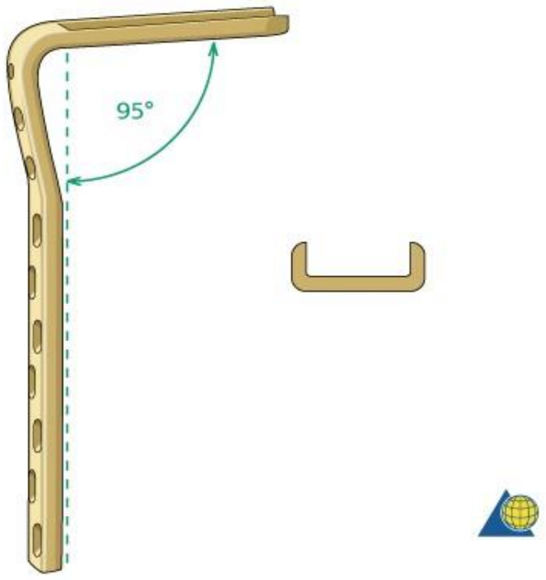


Figure 23 AO BLADE PLATE

In the 1970s AO popularized the 95° blade plate design. This device allows more than one cancellous screws to be fixed into the calcar region through the plate. Theseextra screwsprovides additional fixation of the proximal fracture fragment. An advantage of this device is that the proximal fragment can be addressed before the reduction. At present the device is used rarely to restores femoral alignment and provides ridig fixation. Using the 95° condylar blade plate is a challenging procedure which requires exact three-planarorientation.

- **Dynamic hip screws:**

Figure 24 DYNAMIC SCREW

It is a two-piece device. After reaming and tapping through channel of the devise, a large-diameter cannulated lag screw is put over a guide pin. Thisprocedure is technically muchsimpler than to insert the angled blade plate. While using this device Varus/valgus malalignment of the guide pin can easily be corrected. Flexion/extension deformities can be reduced by rotating the lag screw. The sliding of proximal fragment allows impaction at fracture site as well as medialization of the femoral shaft relative to the proximal fragment. This displacement serves to decrease the bending movement on the implant and thus reducess the possibility of varus collapes. Impactiontakes place freely only when the sliding mechanism crosses the fracture site and the plate must not be fixed firmly to the proximal femur.

- **Medoff's Axial Compression Screw:**

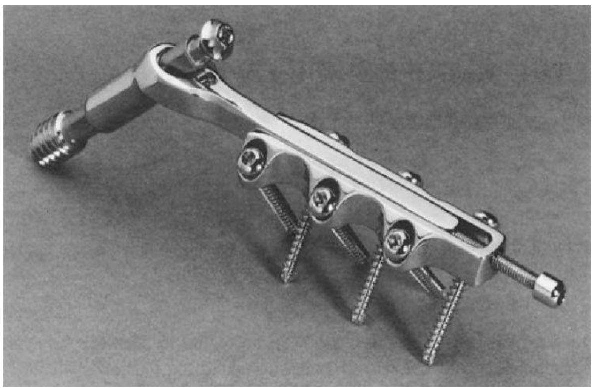


Figure 25 MEDOFF'S AXIAL COMPRESSION SCREW

It was designed in such a way that it will allow compression along the axis of the femoral neck as well as the axis of the femoral shaft. It uses a large-diameter lag screw instead of the usual side plate of the sliding hip screw which allow compression at fracture to impaction parallel to the longitudinal axis of the femur as well as femoral neck axis. A distal compression screw allows longitudinal compression along the femoral shaft.

Gamma Nail:

The Gamma nail had a 12-mm diameter lag screw which passes through a short intramedullary cephalomedullar nail. As it is a intramedullary device, nail lies more medial than the previous sliding compression hip screw and plate system. Hence, less force is concentrated on the implant on weight bearing. Also, the device transmits the patient‘s body weight nearer to the calcar femoris than the sliding compression hip screw. This adds up to the strength of the construct.

Figure 26 GAMMA NAIL

- **Zickel Nail:**

Figure 27 Zickel Nail

Popularized in 1970s, this nail characteristically accommodated the natural anterior femoral bow. In this nail, the proximal part was wide which tapered distally. Tapered disatal portion accommodate the isthmus of femur. It comes indifferent sizes (from 11 to 15 mm). This modified triangled nail suppliments fixation of proximal fragment which is passed through the proximal portion of the nail into the femoral neck.

- **Russell-Taylor reconstruction nail:**

It is cephalomedullary reconstruction nail. It is a stainless steel nail with proximal interlocking screws which extends into the femoral head. It also has distal interlocking screws system similar to that of standard first-generation interlocking nails. The Russell-Taylor reconstruction nail is mainly preferred in fixation of unstable intertrochanteric fractures.

- **Proximal Femoral Nailing system :**

Figure 28 PROXIMAL FEMORAL NAIL

The proximal femoral nail (PFN) was launched for management of trochanteric fractures. Implant-related complications were marked reduced in this cephalo-medulary nailing system. In this device, two screws are used to hold and fix femoral head and neck over femoral meataphysis. The larger and thicker screw produces compression at fracture site. This screw carry most of the load generated at fracture site. The smaller and thinner screw prevents rotation of femoral neck and head over metaphysis. Z-effect (cut-off of screws) is a serious complication that needs to managed with extensive surgery. Revision surgeries increases rate of complications, morbity and mortality.

- **Proximal Femoral Nail Antirotation (PFNA):**

Figure 29 PROXIMAL FEMORAL NAIL ANTIROTATION SYSTEM I

Unstable proximal femoral fractures are treated successfully with Proximal Femoral Nail Antirotation (PFNA).in this 3 rd generation of cephalo-medullary nailing system cancellous screw is replaced with a helical blade system. Helical blade has a telescopic feature using which optimum compression can be achieved at the fracture site. The inserted PFNA blade achieves an excellent fit through bone compaction and requires less bone removal compared to a screw. These characteristics provide optimal anchoring and stability when the implant is inserted into osteoporotic bone and have been bio-mechanically proven to retard rotation and varus collapse. Wang et al., in their biomechanical study, concludedthat there are lot of advantages of using a single femoral neck screw construct rather than using two femoral neck screws along with the cephalomedullary nails in osteoporotic bones.

Figure 30 REAMED AREA IN HELICAL BLADE AND CANCELOOUS SCREW[10]

- **Proximal femoral nail anti-rotation system II:**

All the features and advantages were carried forward with some modification so avoid possible complications. While using PFNA I system many authors had found that proximal portion the nail does not fit properly in coronal plane. Due to mediolateral angle of 6 degree lateral wall of proximal femur bears excess amount stress concentration leading to impingement or fracture of the same. This problem is resolved in newer version of PFNA system. Mediolateral angle is decreased from 6 degrees to 5 degrees and lateral surfaces is flattenedto accommodate normal anatomy of proximal femur.

Total hip replacement or hemi-replacement :

This modality of treatment is rarely choosen following inter-trochanteric fracture as it is an extenisive and major procedure which puts the patients in many seriours dangers.There are very fewindications for such procedure.

- ✓ Fractured hip with degenerative arthritic changes.

- ✓ Fracture pattern showing sever comminution with osteoporosis.

External Fixation:

In geriatric patients use of external fixation is preferred method of management owing to the associated high risk. The application of an external fixator is safer, less tedious, easier technique. On fracture table, under c-arm imaging guidance, the fracture can be manipulated to attain reduction. Two Schanz pins areinserted through the neck of femur proximal to the fracture and three-four Schanz pins are applied on the femoral shaft. To hold the reduction after manipulation, universal clamps are used to join the tubular connecting rod of appropriate length. Reduction is then confirmed to be stable under c-arm guidance. The complications include pin tract infection,pin loosening, loss of reduction leading to varus deformity at the fracture site. Migration and breakage of pin can also occur.

COMPLICATIONS OF TROCHANTERIC FRACTURES

To manage the patient of trochanteric fracture conservatively,patient needs to be bound to the bed for long period of time.Because of long term immobilizationpatients can land up in some seriouscomplications. These complications contributes to rise in the incidence of morbidity and mortality in the geriatric patients.

Such as:

- Thromboembolic-event
- Deep vein thrombosis
- Upper respiratory tract infection
- UTI (infection of urinary tract)
- CVA such as stroke

In postoperative period, patient may develop following complications.

local complications:

- Hemorrhage
- Superficial Infection
- Deep infection
- Avascular necrosis

The complications due to implant include:

- Varus collapse at fracture site
- Helical blade cut-out
- Helical blade back-off
- Itrogenic fractures
- Implant breakage

MATERIALS AND METHODS

SOURCE OF DATA:

- Patients admitted in Department of Orthopedics in BLDE (DEEMED TO BE UNIVERSITY) Shri B. M. Patil's Medical College, Hospital and Research Centre, Vijayapura with diagnosis of unstable intertrochanteric fracture of femur.
- The patients will be informed about study in all respects and informed written consent will be obtained.
- Period of study will be from 1st November 2018- 31st may 2020.
- Follow up period will be 6 weeks, 3 months, 6 months.

METHOD OF COLLECTION OF DATA:

This study is conducted between 1st November 2018- 31st may 2020 among patients admitted in Department of Orthopedics in BLDE (DEEMED TO BE UNIVERSITY) Shri B. M. Patil Medical College, Hospital and Research Centre, Vijayapura who are diagnosed with unstable inter-trochanteric fracture of femur. 32 patients were assessed by clinical examination, history taking, clinical and radiological examination. All patients underwent closed reduction internal fixation with proximal femoral nail antirotation system II.

INCLUSION CRITERIA:

1. Patient aged 50 years and above.
2. Closed unstable intertrochanteric fracture of femur according to AO classification.
3. Patients willing for treatment and giving informed and written consent.

EXCLUSION CRITERIA:

1. Patients with poly trauma
2. Pathological fractures.
3. Associated neurovascular injury.
4. Patients medically unfit for surgery.
5. Immunocompromised status.
6. Non-union or mal-union cases

After admission complete history regarding mode of trauma, severity of trauma, mechanism of injury, personal history, past medical history were taken from patient and patients relatives. Thorough examination of patient’s general health including vital and all major system along with local examination of affected limb and rest of the extremities were carried out. The affected extremity was examined for swelling, deformity, abnormal mobility, crepitus, shortening, attitude, discoloration of skin, skin condition, neuro-vascular compromise, and signs or symptoms of compartment syndrome. A genral medicine consultation was taken for all the patient in view of their age, comorbidities and cardio-pulmonary status before undergoing surgery.

Investigations or interventions required in this study are routine standardized procedures. There is no animal experiment involved in this study.

INVESTIGATIONS:

- X-ray of affected femur AP & Lateral views.
- X-ray pelvic with both hip joints AP view
- Complete blood count.
- ESR
- Bleeding time, Clotting time.
- Urine- Albumin, sugar and Microscopy.
- Random blood sugar, Blood urea and Serum creatinine.
- HIV and Hbs Ag and HCV
- Blood grouping and Rh- typing.
- ECG.
- 2d echo if necessary.
- Chest X-ray- Postero-anterior view.
- Computed-tomography scan if necessary.
- Other specific investigations whichever needed.

Multiple surgeons were involved in the surgeries in this study. Delay in the time of surgery after admission was usually attributable to poly-trauma or poor medical condition of the patient. After radiological investigation skin traction was applied to affected extremity. Pain management with intravenous analgesics was done.

After all necessary investigations, medical fitness for surgery by physician and pre-anesthetic checkup, patient was taken to surgery. Written informed consent for surgery and high risk consent, if necessary were taken from all the patients.

PRE-OPERATIVE PLANNING:

- Nail diameter was determined by measuring width of inner cortex of the femur at the level of isthmus as it is the narrowest part of medullary cavity. This measurement is taken on an x-ray of affected femur using a software in department of radiology.
- Angle between neck and the shaft was measured on unaffected side. This measurement was taken on an AP x-ray using a transparentgoniometry device.

IMPLANT DETAILS:

PFNA II implant is made up of either 316L stainless steel or titanium alloy.

It consists of an intra-medullary nail, helical blade, distal locking bolts and top screw.

NAIL: Nail has various lengths, diameters and angles.

- Length: 170 mm, 200 mm, 240 mm and Long PFNA-340 to 420 mm.(with increment of 40mm)
- Diameter: 9,10,11,12 mm
- Neck shaft angle range: 130° and 135°.

Figure 31 NAIL IN DIFFERENT SIZES

The nail is having 16.5 mm proximal diameter which increases the stability of the implant. There is 5° mediolateral valgus angle, which prevent lateral wall factures and varus collapse. The long nails have an anterior curvature of 1.5m radius to match the anatomic anterior femoral bowing.

Proximally the nail has 1 hole for the insertion of the 11 mm helical blade with internal locking system. The helical blade provides intra-operative telescopic compression of 5 mm under c-arm guidance, which allows compression at fracture site and prevent rotation.

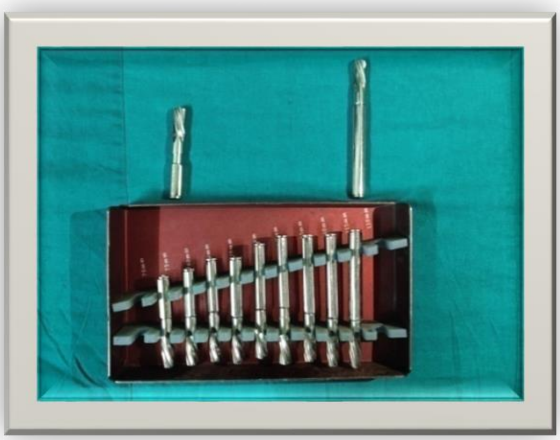
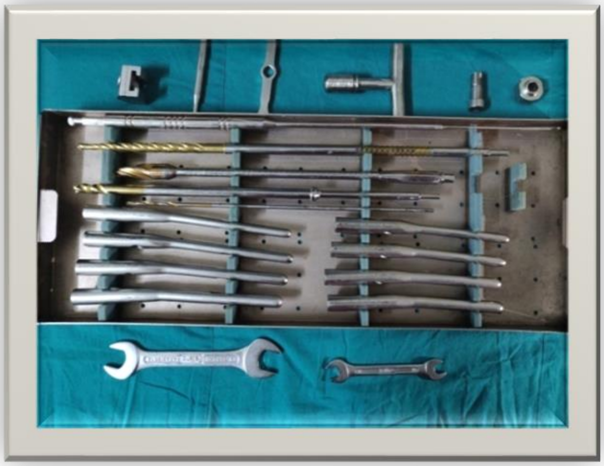


Figure 32 HELICAL BLADES OF DIIFERNT SIZES

Distally, Short nail has one hole for insertion of 4.9 mm locking screws, of which can be used either for 90^0 static locking, oblique locking, dynamic locking with the help of a jig. Long nail has 2 holes of which 1 is used for static locking and 2^{nd}one is used for dynamic locking.

Figure 33 DISTAL LOCKING SCREWS

SET OF INSTRUMENT REQUIRED FOR OPERATION:



OPERATIVE TECHNIQUE:

Prophylactic antibiotic was given to all patients half an hour before incision. All the cases were operated either under Epidural plus spinal anesthesia or under only spinal anesthesia.

- **Patient positioning and fracture reduction:**

After anesthesia, patient is positioned supine on the fracture table. The contralateral is leg well-padded and supported without pressure on to the calf or thigh, fixed with the help of thigh support in flexed and abducted position. A radiolucent bolster support is kept underneath the ipsilateral buttock to facilitate the approach for nail insertion. The ipsilateral arm was positioned in an adducted so as itdoes not intervene during the surgical procedure. The operating limb is adducted to 10° to 15° and internally rotated to about 15°. The image intensifier was positioned between the injured and uninjured legs, so that both AP and lateral views can be obtained easily.

Figure 34 PATIENT POSITIONING ON TRACTION TABLE

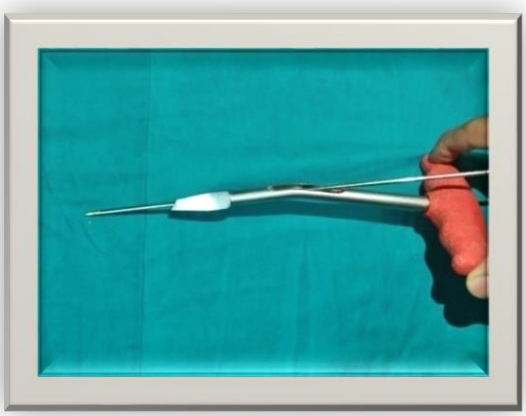
Final examination of fracture patterns morphology is carried out under c-arm guidance. Closed reduction was attempted under traction and manipulation of the limb. Painting with 10% betadine solution and drapping as for the standard hip fracture fixation is carried out.

- **Approach:**

On deep palpation of lateral proximal aspect of thigh, tip of greater trochanter can beappreciatedin lean patients. Inobese patients, because of excess fat grater trochanter may not be palpable. In such situation we have to use image intensifier.a incision of 5cms was taken longitudinally from 1 cm proximal to the tip of the greater trochanter extending upwards. Fascialata incises in line with skin incision and gluteus medius was split along the direction of the fibres. Bursa over the greater trochanter incised and tip of greater trochanter is exposed.

- **Entry point preparation:**

Entry point was made with bone awl. Entry point was created immediately lateral to tip of the greater trochanter in antero-posterior view and along the central axis of femur in lateral view.



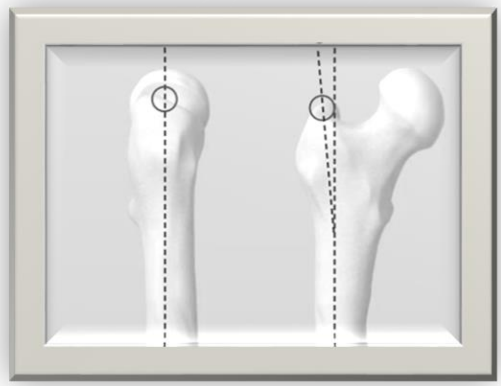


Figure 35 SITE OF ENTRY POINT

- **Guide wire Insertion:**

A 2.8mm ball tipped guide wire fixed to a universal chuck with T handle was manually inserted through the entry point made into the proximal fragment and confirmed under image intensifier in both antero-posterior and lateral view. Then reduction was achieved with traction and manipulation of the fracture site and guide wire passed into distal fragment crossing the fracture site. In cases where reduction was difficult to achieve, a 4.5mm Steinmann pin was drilled only in the lateral cortex of the proximal fragment after making a small incision on the overlying skin and used as a joystick to aid reduction. The guide wire was advanced up to the distal end of femur taking care that the guide wire was centered throughout to avoid eccentric reaming.

Figure 36 GUIDE WIRE INSERTION THROUGH BONE OWL

- **Determination of nail length and diameter:**

The correct length of the nail is determined based on fracture site comminution and fracture pattern instability. The nail diameter is determined by placing the radiographic ruler over isthmus of fractured femur in AP view.

- **Preparation ofproximal medullary canal:**

After the guide wire has been passed, a trochanteric protection sleeve is placed over the trochanter. Reaming done using flexible reamers starting from 8mm diameter with subsequent increments of 0.5mm up to 1mm greater than the nail diameter selected for insertion.for Proximal metaphyseal trochanteric reaming reamer of size 17 mm was used.

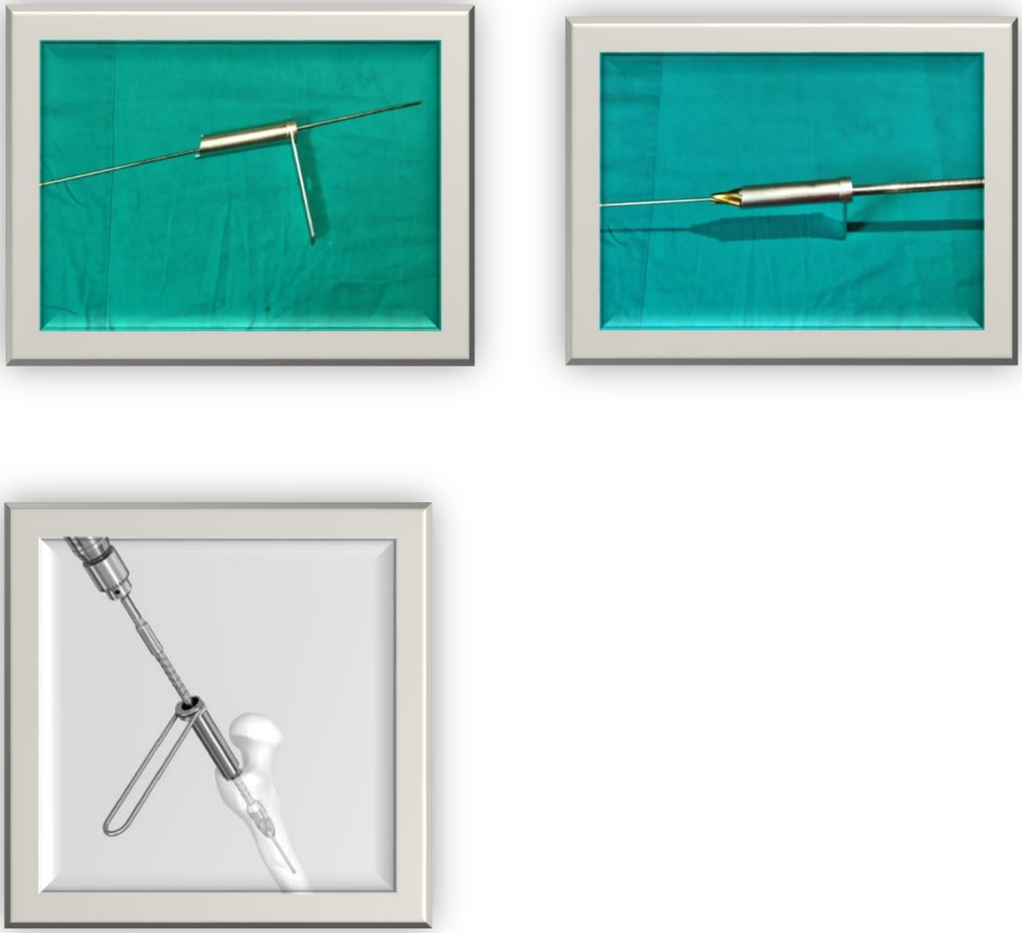


Figure 37ENTRY POINT REAMING

- **Exchange of guide wire:**

Using Teflon tube (Exchange tube),ball tipped guide wire is removed and replaced with the plane tipped guide wire and then the Teflon tube is removed after confirming the position under image intensifier.

- **Insertion of PFNA II nail:**

Under the image intensifier, the selected nail was inserted manually using slight rotator movements of the insertion handle to such a depth that it allowed the helical blade to be placed through the junction of middle and lower third of femoral neck.

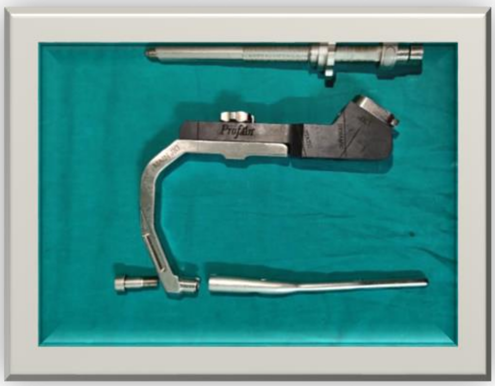


Figure 38 MOUNTING NAIL ON JIG

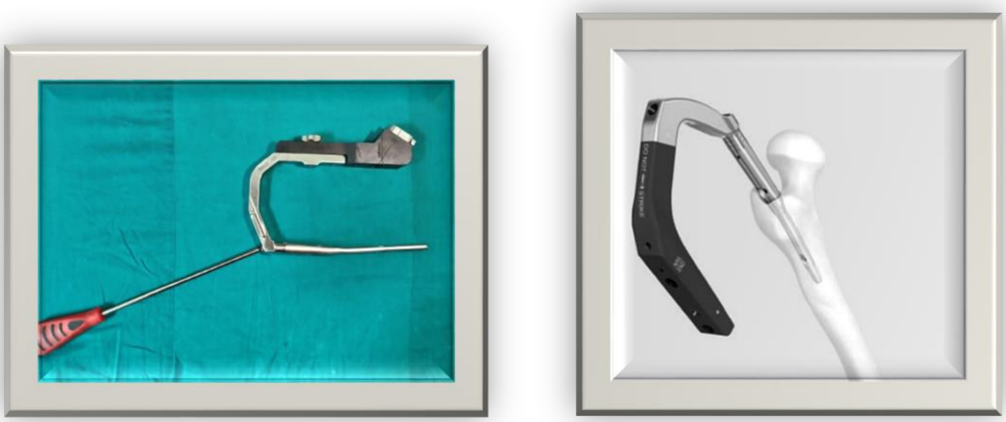


Figure 39 INSERTION OF NAIL

- **Insertion of helical blade:**

The entire sleeve assembly containing drill sleeve and trocar for PFNA II blade was inserte through the aiming arm to the skin and a stab incision in the area of the trocar tip was made.The entire sleeve assembly is advanced till it gets clicked into the aiming arm.

Figure 40ADJUSTMENT OF AIMING ARM

The buttress nut adjustment is carried outtill aiming arm reaches lateral cortex. The trocar was then removed and a 3.2 mm new guide wire was drilled through the sleeve in the femoral neck. It is placed in such a way that it is positioned at the junction of its upper 2/3rd and lower 1/3rd in AP view. it should be in the center of neck in lateral view and center of head in both AP and Lateral view.

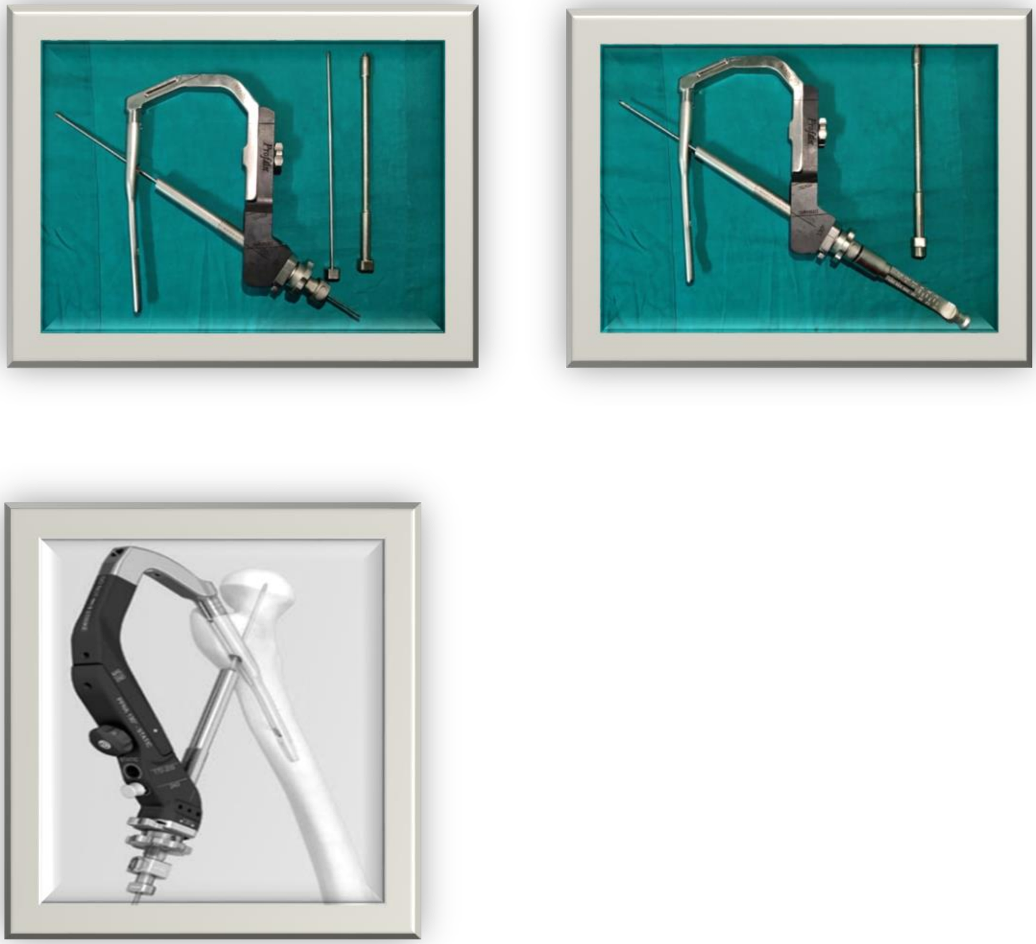


Figure 41 GUIDE WIRE INSERTION FOR HELICAL BLADE

Guide wire is then directed into center of femoral head in both AP and lateral view. The guide wire was inserted till subchondral area ofthe femoral head around 5 mm proximal of the joint. The length of helical blade was measured with the help of depth guage device.

Figure 42 GIDE WIRE POSITIONING IN AN AND LATERAL VIEW

- **Insertion of the helical blade:**

Lateral cortex was openedwith the 10 mm drill bit inserted over the guide wire.

Figure 43DRILLING OF NECK AND HEAD FOR HELICAL BLADE PLACEMENT

The neck was drilled with the 10 mm cannulated reamer to make room for the helical blade. The PFNA II blade is supplied in a locked state. Blade is then unlocked with the impactor screwed counterclockwise into the end of the PFNA II blade.

Figure 44LOCKING AND UNLOCKING OF HELICAL BLADE OVER SCREW DRIVER

The PFNA blade was inserted through fracture site by applying gentle blows with the hammer under guidance of image intensifier. Locking of PFNA II blade is then carried with turning impactor clockwise.

Figure 45 INSERTION OF BLADE WITH GENTLE BLOWS

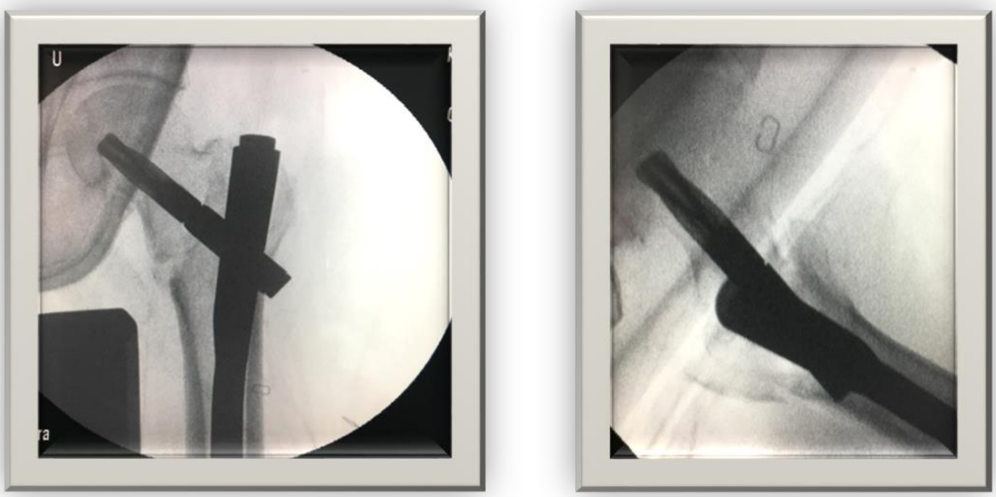


Figure 46 FINAL POSITION OF BLADE AFTER TELESCOPIC COMPRESSION

- **Distal locking:**

In short PFNA nail distal locking was done with the help of jig and in long PFNA nail the distal locking was done using free hand technique under the guidance of image intensifier.The lateral cortex was drilled with a 4mm drill bit and a 4.9mm locking bolt was used for distal locking either in static or dynamic fashion.

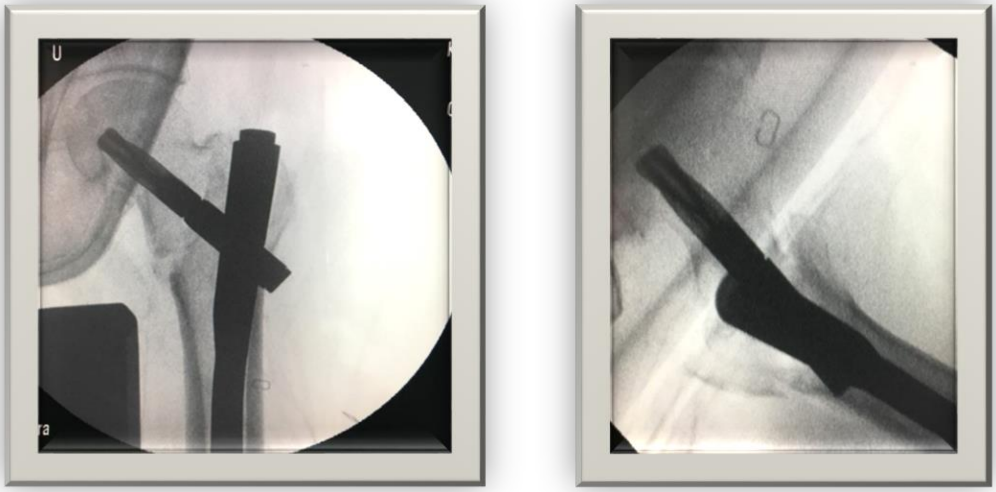


Figure 47 ASSEMBLY FOR DISTAL LOCKING

Figure 48 DISTAL LOCKING

Reduction and stability at fracture site is confirmed in both AP and lateral view under image intensifier.

The jig was then detached by removing the conical bolt. Proximal opening of the nail is closed with top screw if available.

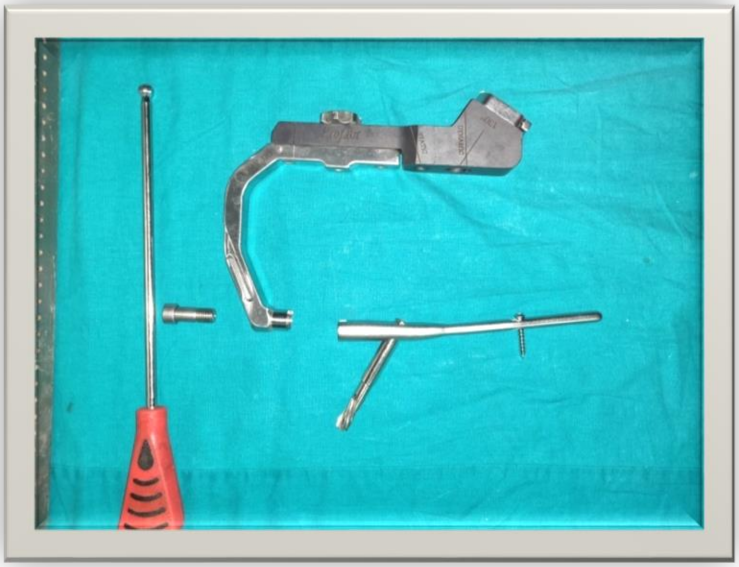


Figure 49 DETACHMENT OF JIG FROM NAIL

Sterile normal saline wash was given, and the wound closed layer by layer. Sterile dressing was applied. After procedure patient was shifted to post-anesthesia recovery ward till the NBM status is relaxed.

POST-OPERATIVE MANAGEMENT:

Isometric and range of motion exercises were begun from post-operative day 1 or day 2. Post-operative AP and cross table lateral view x-rays were taken on day 3.Sterile dressing was done on post-operative day 3, day 6, day 10.Sutures were removed between postoperative day 10 and 12.

All patients had received postoperative course of I.V. antibiotics for 3 to 5 days followed by oral antibiotic regimen.

On the day of discharge following details were noted :

- Day of bedside mobilization

- Complications such as infection, implant related complications, loss of reduction, nerve palsy.

- Condition at discharge
  - Clinical examination
  - Shortening of limb
  - Lengthening of limb
  - Surgical Complications if any
    - Range of movements Active Passive
      1. Flexion
      2. Adduction
      3. Abduction
      4. Internal rotation
      5. External rotation
    - Radiological examination
      1. Tip Apex Index
      2. Implant failure
      3. Periprosthetic fractures

Further clinical and radiological follow up will be done as Proforma at 6 weeks/ 3 months/ 6 months.

In patients with stable internal fixation, toe touch weight bearing of the affected extremity was started as the pain allows. In patients with comminuted fractures and with relatively unstable fixation, weight bearing was delayed until radiological evidence of fracture healing is visible.

Full weight bearing was started in all patient by 12 weeks.

FOLLOW UP:

All the patients were instructed to follow up at following time interval after operation:

1st follow up at 6 week

2nd follow up at 3 month

3rd follow up at 6 month

On each follow up patient was evaluated clinically and radiologically.

Clinically patients were evaluated by presences of fresh complaints, general physical examination, local examination and modifiedHarris Hip Score.

Radiologicaly patients were evaluated by presence of implant and fracture related complication and TAD score.

METHODS OF ASSESSMENT OF RESULTS:

- **Modified Harris Hip Scoring For Functional Evaluation Of Hip:**

Point scale with maximum of 100 points distributed as follows:-

Pain	44
Function	47
Range of motion	05
Absence of deformity	04
Total	100

	PAIN	44
1	Totally disabled, crippled, pain in bed, bedridden	00
2	Marked pain, serious limitation of activities	10
3	Moderate plain, tolerable but makes concession to plain	20
4	Mild pain, no effect on average activities	30
5	Slight, occasional, no compromise in activity	40
6	None, or ignores it	44
Total		
II	Function	47
A	Distance walked	
1	Bed and chair only	00
2	Two or three blocks	05
3	Six blocks	08
4	Unlimited	11
B	Activities	
Shoes & Socks		

1	Unable to fit or tie	00
2	With difficulty	02
3	With ease	04
Public transportation		
1	Unable to use public transportation (bus)	00
2	Able to use transportation (bus)	01
Limp		
1	Severe or unable to walk	00
2	Moderate	05
3	Slight	08
4	None	11
Support		
1	Two crutches or not able to walk	00
2	Two canes	02
3	One crutch	03
4	Cane most of the time	05

5	Cane for long walks	07
6	None	11
Stairs		
1	Unable to do stairs	00
2	In any manner	01
3	Normally using a railing	02
4	Normally without using a railing	04
Sitting		
1	Unable to sit in any chair comfortably	00
2	On a high chair for 30 min	03
3	Comfortably on a ordinary chair for one hour	05
Total		
III	Motions Flexion+ Abduction + Adduction+ External rotation + internal rotation=	05
1	00 to 29°	00
2	30 to 59°	01

3	60 to 99°	02
4	100 to 159°	03
5	160 to 209°	04
6	210 to 300°	05
Total		
IV	Deformity	04
1	Flexion deformity 30° of more	00
2	Flexion deformity less than 30°	01
1	Fixed adduction 10° more	00
2	Fixed adduction less than 10°	01
1	Fixed internal rotation(in extension) 10°or more	00
2	Fixed internal rotation(inextension) less than 10°	0
1	Limb length discrepancy more than or equal to 3.2 cms	00
2	Limb length discrepancy less than 3.2cms	01
	Total	
	Total of I+II+III+IV	100

TOTAL MODIFIED HARRIS HIP SCORE AND ITS INTERPRETATION:

Score between 90 and 100: Excellent result

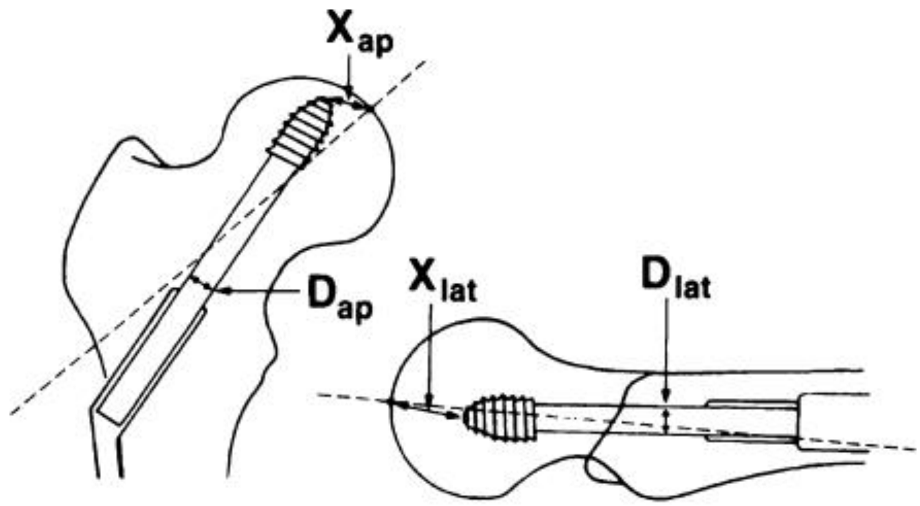
Score between 80 and 89: Good result

Score between 70 and 79: Fair result

Score between 60 and 69: Poor result

- **TAD SCORE :**

Baumgaertner[67] described the T.A.D as the distance from the tip of the screw to the subchondral bone in both the A.P. & lateral views .In his series of 120 cases he notedthat not a single case screw cut out occurred if the T.A.D was maintained less than 25mmas compared to a historical control rate of 8 %.



$$TAD = \left(X_{ap} \times \frac{D_{true}}{D_{ap}}\right) + \left(X_{lat} \times \frac{D_{true}}{D_{lat}}\right)$$

NORMAL RANGE: 20 TO 30

SAMPLE SIZE CALCULATION:

In our study period, we had operated on 52 patients with diagnosis of unstable intertrochanteric fracture using PFNA II implant.6 patient had died before the last follow up due to associated co-morbid condition. 4 patients were categorized as polytraum and 10 pateints could not be followed up till 6 month of post-operative study. At the end of the study period, results of 32 patients formulated and conclusion was driven.

With 95% confidence level and margin of error of ±15%, a sample size of 32 subjects will allow the study to determine the**functional outcome of unstable intertrochanteric fractures treated with proximal femur nail anti rotation system II**with finite population correction (N=120).

By using the formula:

$$n = \frac{z^2 p(1-p)}{d^2}$$

where,

Z= z statistic at 5% level of significance

d is margin of error

p is anticipated prevalence rate (50%)

STATISTICAL ANALYSIS

All characteristics were summarized descriptively. For continuous variables, the summary statistics of mean±standard deviation (SD) were used. For categorical data, the number and percentage wereused in the data summaries and diagrammatic presentation.Chi-square (χ^2) test was used for association between two categorical variables.

The formula for the chi-square statistic used in the chi square test is:

$$\chi_c^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

The subscript "c" are the degrees of freedom. "O" is observed value and E is expected value. C= (number of rows-1)*(number of columns-1)

The difference of the means of analysis variables between more than two independent groups was tested by ANOVA and F test of testing of equality of Variance.

ANOVA

Source	d.f.	SS	MS	F
Treatment	$a-1$	SS_{treat}	$\frac{SS_{treat}}{a-1}$	$\frac{MS_{treat}}{MS_{error(a)}}$
Error (a)	$N-a$	$SS_{error(a)}$	$\frac{SS_{error(a)}}{N-a}$	
Time	$t-1$	SS_{time}	$\frac{SS_{time}}{t-1}$	$\frac{MS_{time}}{MS_{error(b)}}$
Treat x Time	$(a-1)(t-1)$	$SS_{treat\ x\ time}$	$\frac{SS_{treat\ x\ time}}{(a-1)(t-1)}$	$\frac{MS_{treat\ x\ time}}{MS_{error(b)}}$
Error (b)	$(N-a)(t-1)$	$SS_{error(b)}$	$\frac{SS_{error(b)}}{(N-a)(t-1)}$	
Total	$Nt-1$	SS_{total}		

The sources of the variation include treatment; Error (a); the effect of Time; the interaction between time and treatment; and Error (b). Error (a) is the effect of subjects within treatments and Error (b) is the individual error in the model. All these add up to the total.

If the p-value was < 0.05, then the results were considered to be statistically significant otherwise it was considered as not statistically significant. Data were analyzed using SPSS software v.23(IBM Statistics, Chicago, USA)and Microsoft office 2007.

TYPE OF STUDY:

Prospective Cross-Sectional Study

CASE NO. 1:

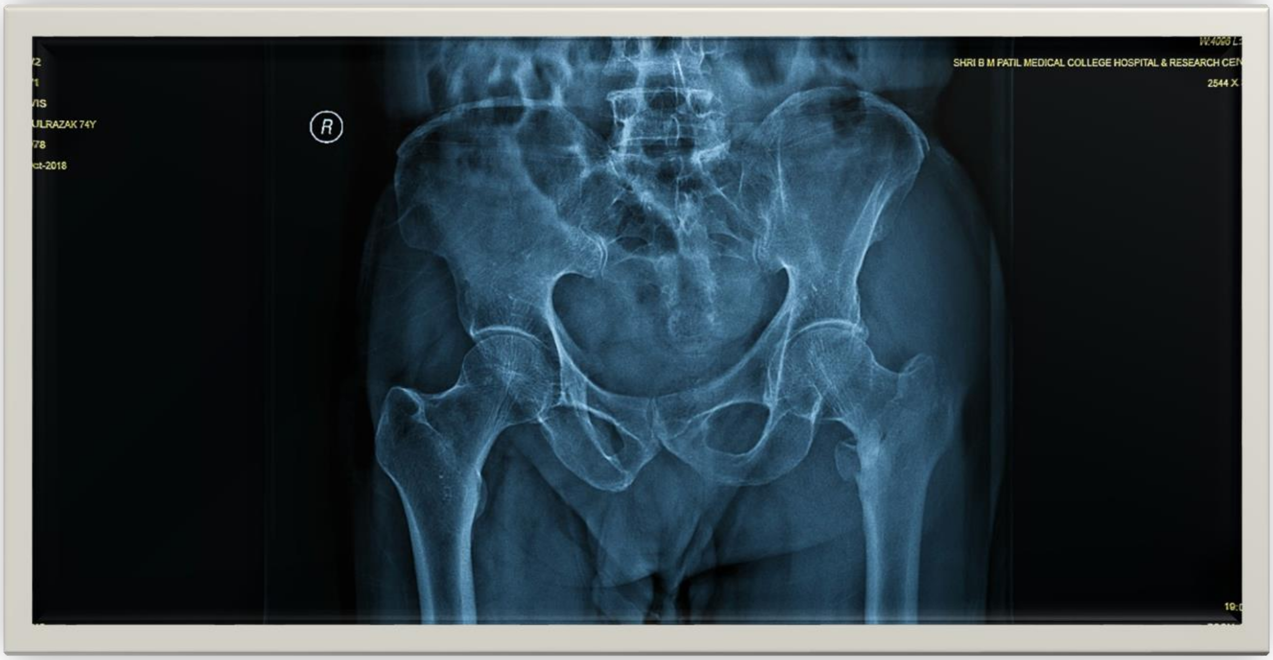


Figure 50 3 MONTHS POST OPP

Figure 51 OPERATIVE 6 MONTH POST

Figure 52 CLINICAL OUTCOME IMAGES

CASE NO. 2:

Figure 53 PREOPERATIVE PELVIC WITH BOTH HIP JOINT XRAY

Figure 54 PREOPERATIVE FEMUR WITH HIP JOINT AP-LAT XRAY

Figure 55 IMMEDIATE POST OPERATIVE IMAGE

Figure 56 POST OPERATIVE 6 MONTH XRAY

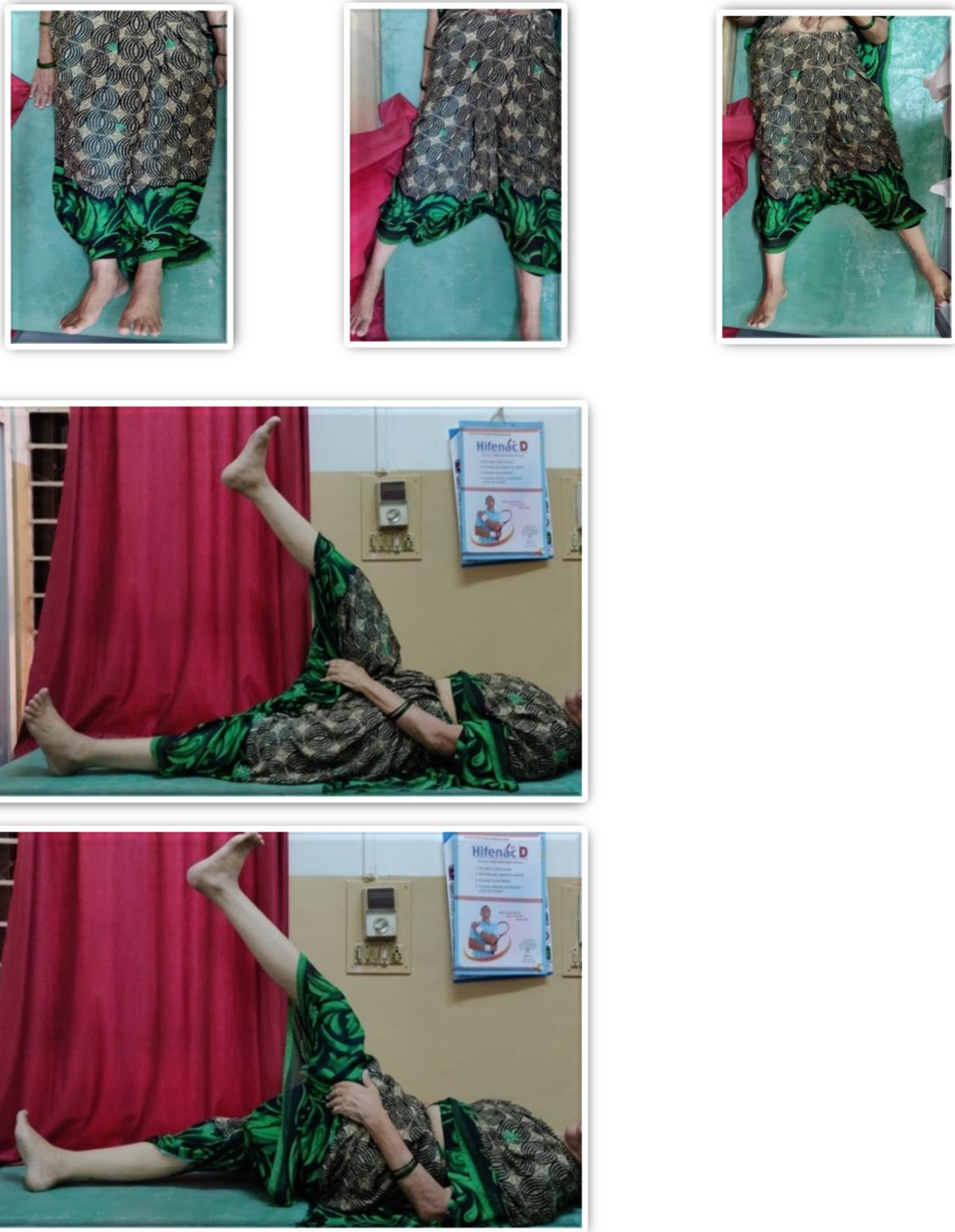


Figure 57 CLINICAL OUTCOME OF CASE 2

CASE NO. 3:

Figure 58 PREOPERATIVE XRAYS OF RT FEMUR WITH HIP JIOT AP-LAT

Figure 59 3MONTH POST OPERATIVE XRAYS

Figure 60 6 MONTH POSTOPERATIVE XRAYS

Figure 61 HIP FLEXION COMPARISION

Figure 62 COMPLETE ABDUCTION POSSIBLE

RESULT

1) Age distribution:

In this study, 56.3% of patient were in the age group of 61 years to 70 years.

Their mean age was found to be 68.5 years.

AGE(YRS)	N	Percent
55-60	5	15.6
61-65	10	31.3
66-70	8	25
71-75	3	9.4
76-80	4	12.5
81-85	2	6.3
Total	32	100

Table no.1: Distribution of Cases according to Age

Descriptive Statistics	Min	Max	Mean	SD
AGE(YRS)	55	85	68.5	8.0

Table no. 2 Descriptive Statistics of cases according to Age

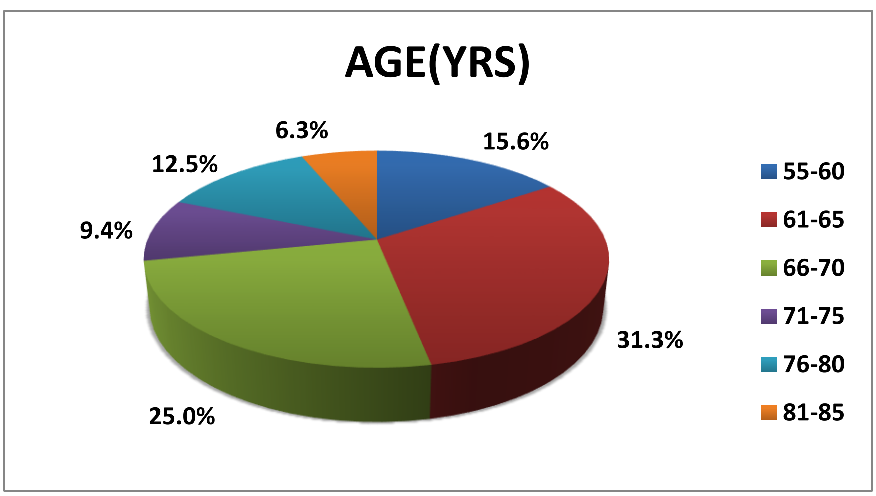


Chart no.1 : Distribution of Cases according to Age

2) Distribution of sex:

In this study, out of 32 patient 22 were female and 10 were male. Higher incidence of trochanteric fracture was found be noted in female population.

SEX	**N**	**Percent**
MALE	10	31.3
FEMALE	22	68.8
Total	32	100

Table no.3: Distribution of Cases according to Sex

Male to Female Ratio = 1.0:2.2

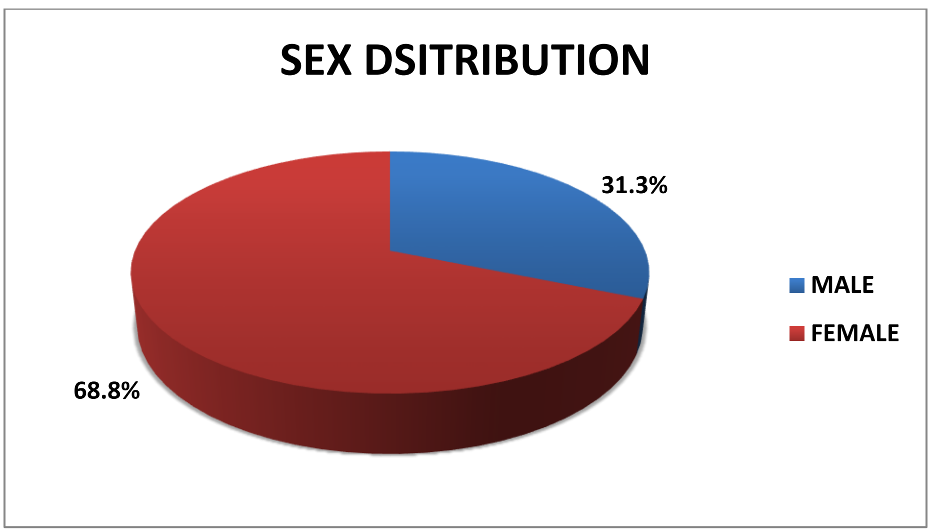


Chart no. 2: Distribution of Cases according to Sex

3) Association of Age& sex:

AGE(YRS)	Male		Female		p value
	N	%	N	%	
55-60	1	10.0%	4	18.2%	0.454
61-65	4	40.0%	6	27.3%	
66-70	2	20.0%	6	27.3%	
71-75	2	20.0%	1	4.5%	
76-80	0	0.0%	4	18.2%	
81-85	1	10.0%	1	4.5%	
Total	10	100.0%	22	100.0%	

Table no.4: Association of Age& sex

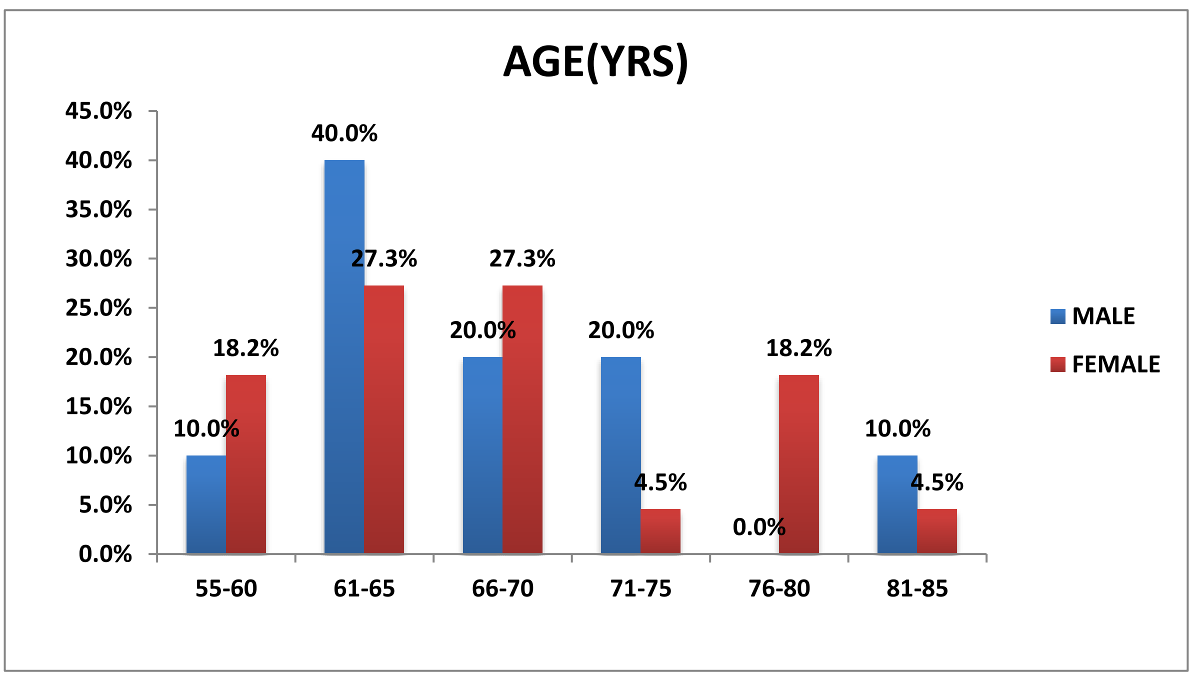


Chart no.3: Association of Age& sex

4) **Distribution of Cases according to MOI:**

In our study, out of 32 patient, 20 patient had suffered fracture of hip due to self fall (trivial trauma) and 12 patient had suffered hip fracture due to road traffic accident (RTA).

MOI	**N**	**Percent**
RTA	12	37.5
SF	20	62.5
Total	32	100

Table no.5 :Distribution of Cases according to MOI

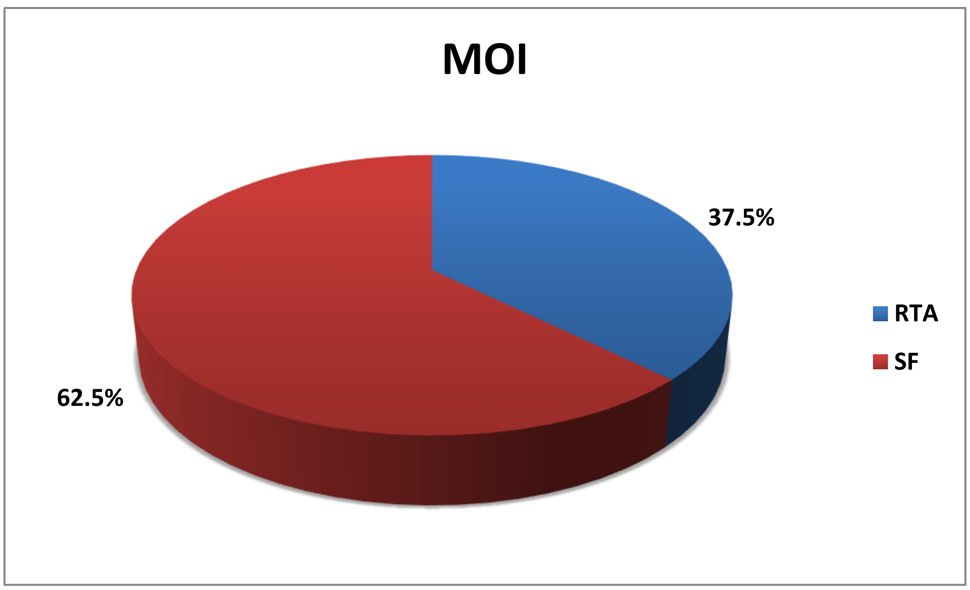


Chart no. 4: Distribution of Cases according to MOI

5) **Distribution of Cases according to Side**

20 patients had suffered fracture on right hip and 12 patients had suffered fracture on left hip.

SIDE	**N**	**Percent**
LEFT	12	37.5
RIGHT	20	62.5
Total	32	100

Table no.6: Distribution of Cases according to Side

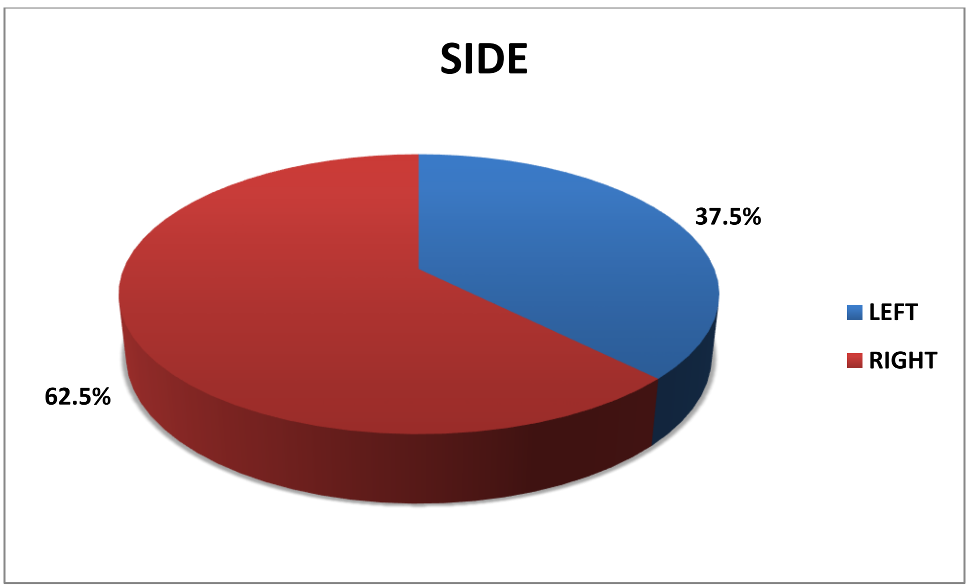


Chart no. 5: Distribution of Cases according to Side

6) **Distribution of Cases according to type of fracture (AO classification):**

In our study all the 32 patient had suffered unstable inter-trochanteric fracture. According to AO fracture classification 18 patients had 31A2 type and 14 patients had 31A3 type of fracture.

AO TYPE	**Number**	**Percent**
31A2	18	56.3 %
31A3	14	43.7 %
Total no.	32	100 %

Table no.7: Distribution of Cases according to AO Type

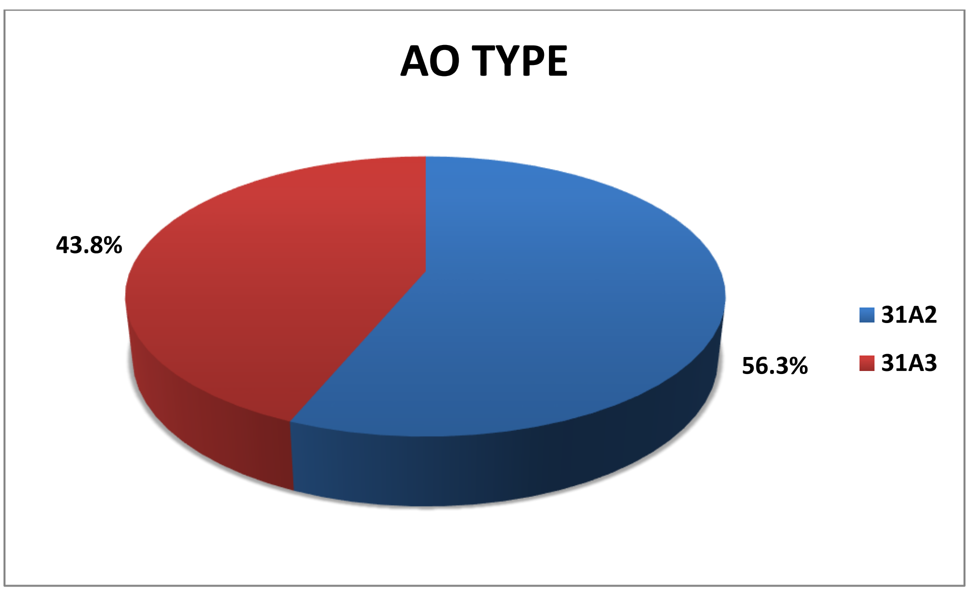


Chart no. 6: Distribution of Cases according to AO Type

7) Associated Injury:

Along with trochanteric fracture, 6 patients had suffered ipsilateral distal end of radius fracture and 3 patients had ipsilateral proximal humerus fracture.

ASSOCIATED INJURY	N	Percent
DERF (distal end radius fracture)	6	18.8
PHF (proximal humerus fracture)	3	9.4
NIL	23	71.9
Total	32	100

Table no. 8: Distribution of Cases according to Associated Injury

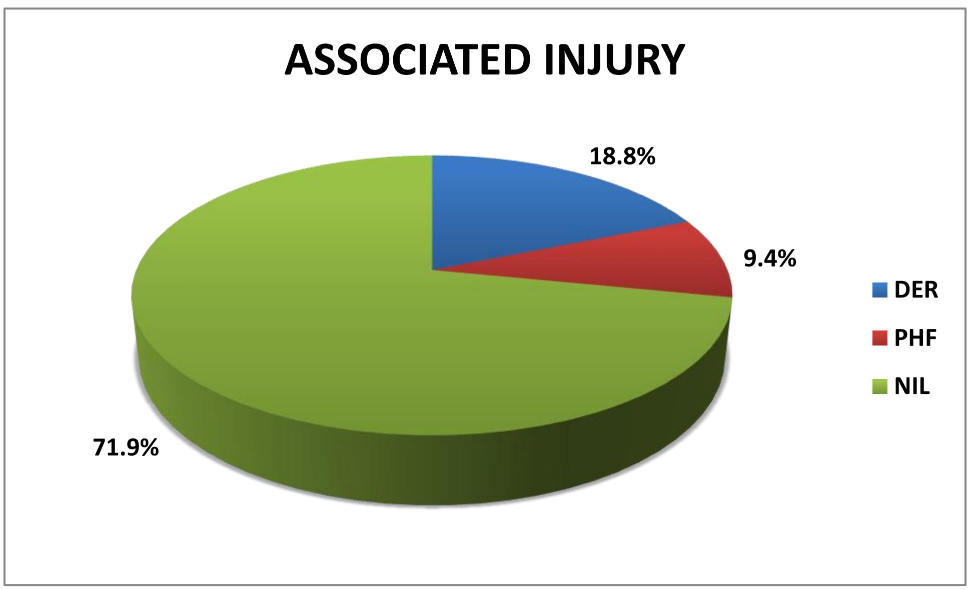


Chart no. 7: Distribution of Cases according to Associated Injury

8) Associated co-morbid conditions:

Among all patient included in this study, 6 patients had diabetes mellitus, 10 patients had hypertension, 3 patients had both diabetes and hypertension. Out of 32 patient, 13 patient had no associated co-morbid condition.

COMORBIDITIES	**N**	**Percent**
DM	6	18.8
HTN	10	31.3
HTN &DM	3	9.4
NIL	13	40.6
Total	32	100

Table no.9: Distribution of Cases according to Co-morbidities

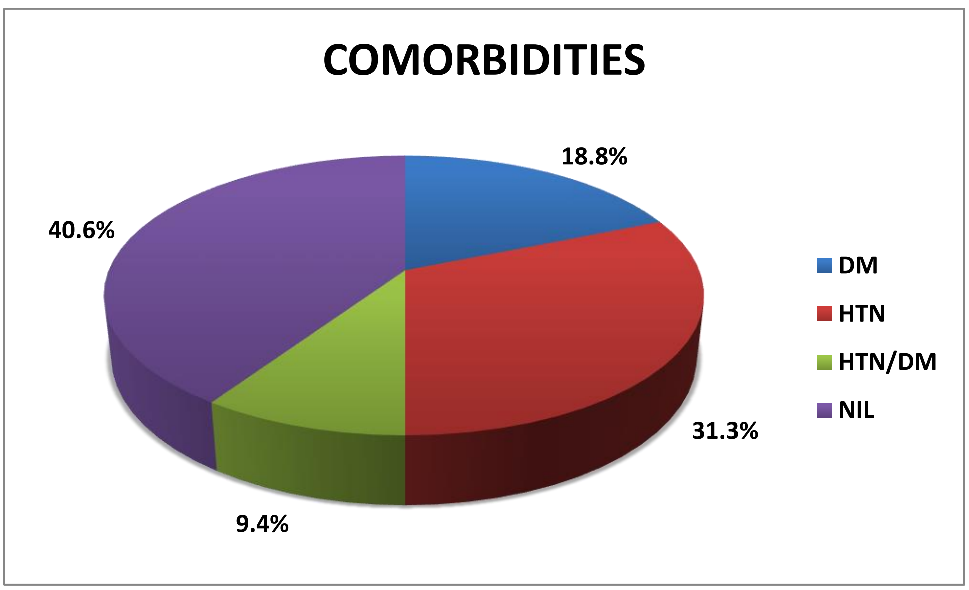


Chart no.8: Distribution of Cases according to Co-morbidities

9) Time of toe touch mobilization:

In this study total of 23 patient (71.9 %) were started with toe touch mobilization on post operative day 5 to 7.

Mean time on which toe touch mobilization was started is 5.9 days.

TTM(pod)	N	Percent
3	1	3.1
4	4	12.5
5	8	25
6	8	25
7	7	21.9
8	3	9.4
9	1	3.1
Total	32	100

Table no. 10: Distribution of Cases according to TTM

Descriptive Statistics	Min	Max	Mean	SD
TTM(pod)	3	9	5.9	1.4

Table no.11:Descriptive Statisticsof cases according to TTM

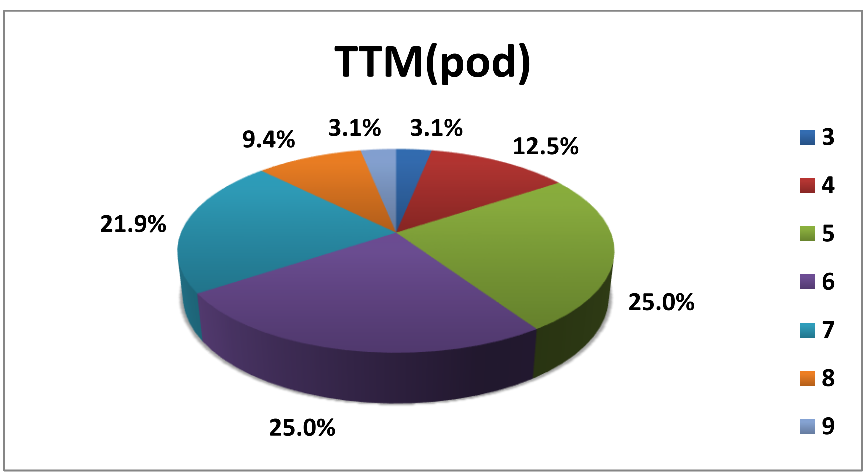


Chart no. 9: Distribution of Cases according to TTM

10) Time of full weight bearing:

Full weight bearing mobilization was started after sign of union on was confirmed on xray.

21 patients (65.7% patients) had started bearing full weight in 4th and 5th month of full weight bearing. Mean time after surgery for full weight bearing x mobilization was found to be 4.4 months.

FWBM(pom)	N	Percent
2	1	3.1
3	5	15.6
4	10	31.3
5	11	34.4
6	5	15.6
Total	32	100

Table no. 12: Distribution of Cases according to FWBM

Descriptive Statistics	Min	Max	Mean	SD
FWBM(pom)	2	6	4.4	1.0

Table no. 13:Descriptive Statistics of cases according to FWBM

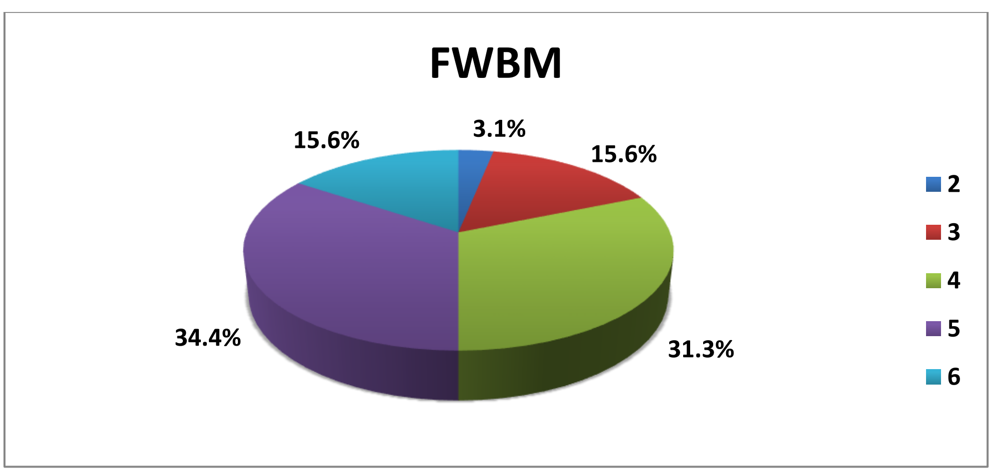


Chart no. 10: Distribution of Cases according to FWBM

11) **Complication associated with surgery:**

Inthis study, 4 patients had superficial infection which was treated with I.V. antibiotics according to culture sensitivity report.

One patient had deep infection which was treated with surgical debridement and I.V. antibiotics for 1 week followed by oral antibiotics.

One patient suffered loss of reduction due to blade cut-off through head in 2nd month of postoperative period. This patient had undergone implant removal prodedure followed by total hip replacement.

COMPLICATION	N	Percent
CO	1	3.1
DI	1	3.1
SI	4	12.5
NIL	26	81.3
Total	32	100

Table no.13: Distribution of Cases according to Complication

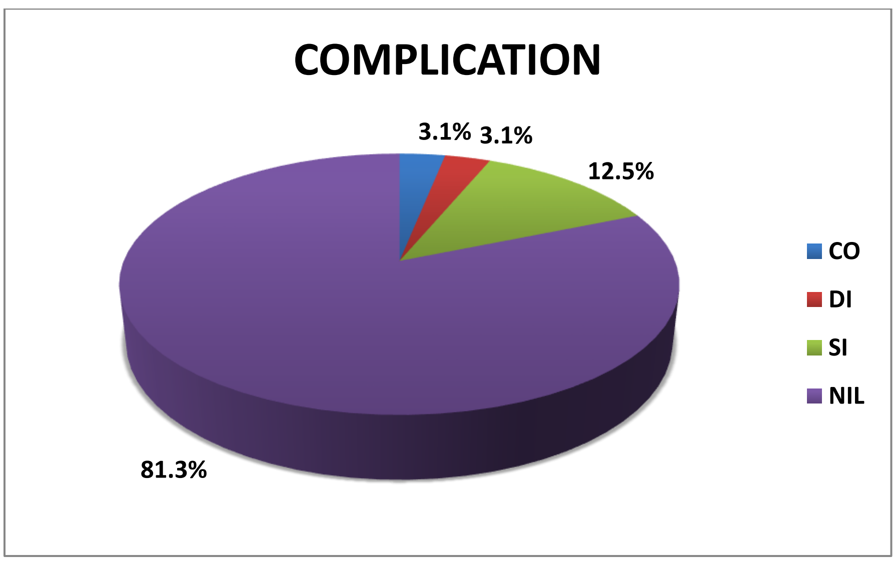


Chart no. 11: Distribution of Cases according to Complication

12) Intra-operative time period:

Mean intra-operative timerequired for surgery was found to be 68 minutes.

Descriptive Statistics	**Min**	**Max**	**Mean**	**SD**
IOT(min)	34	110	68.0	18.2

Table no. 14: Descriptive Statistics of IOT

Descriptive Statistics	**Min**	**Max**	**Mean**	**SD**
TAD	19	28	24.8	1.8

Table no. 15: Descriptive Statistics of TAD

13) Results according to HARRIS HIP SCORE:

RESULT	N	Percent
EXCELLENT	12	37.5
GOOD	14	43.8
FAIR	4	12.5
POOR	2	6.3
Total	32	100

Table no. 16: Distribution of Cases according to Result

Descriptive Statistics	Min	Max	Mean	SD
HHS	68	94	85.1	7.2

Table no.17: Descriptive Statistics of HHS

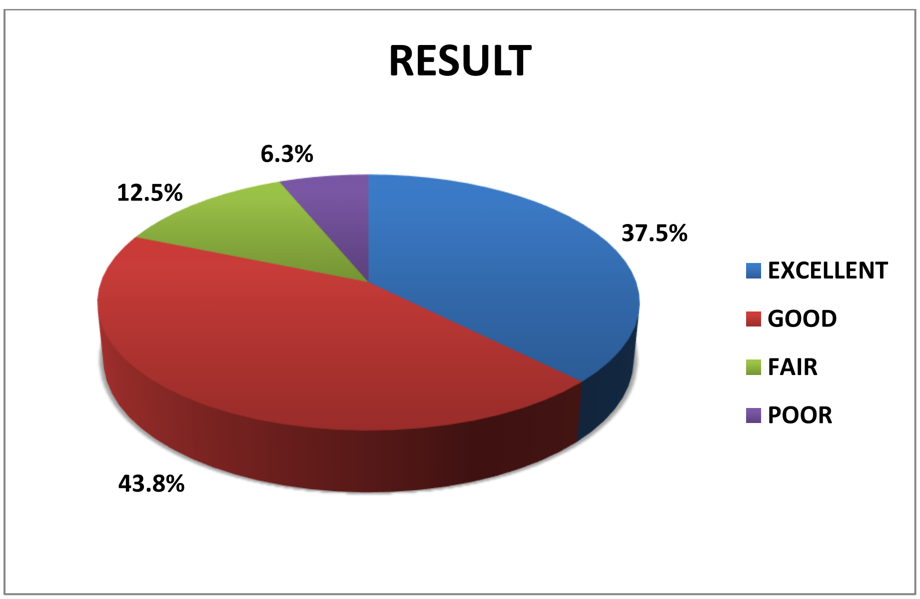


Chart no. 12: Distribution of Cases according to Result

14) Change in Mean IOT according to Result:

PARAMETERS	RESULT				p value
	EXCELLENT	GOOD	FAIR	POOR	
IOT(min)	71.6±19.9	65.5±14.9	53.5±13.5	93.5±4.9	0.046*

Note: * significant at 5% level of significance (p<0.05)

Table no.18: Change in Mean IOT according to Result

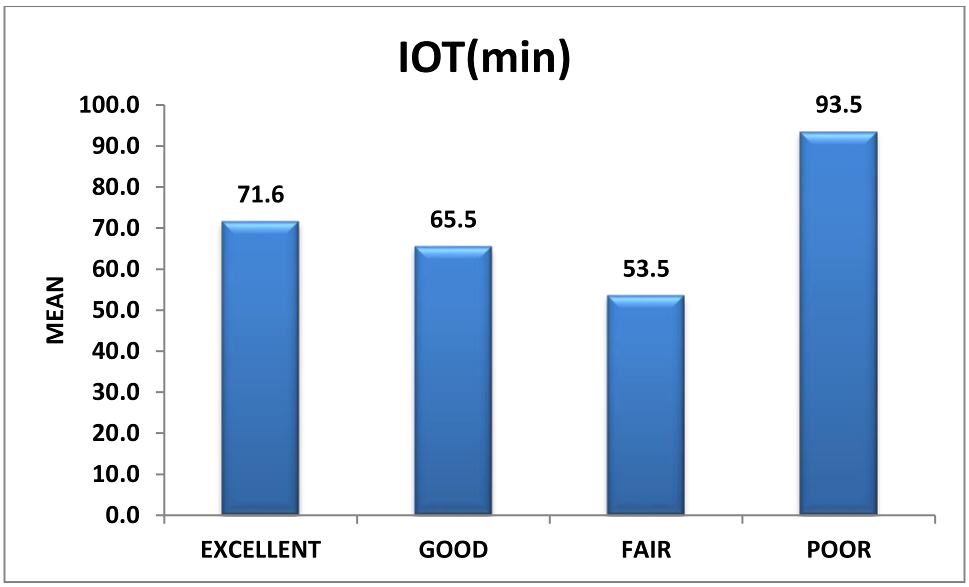


Chart no.13: Change in Mean IOT according to Result

15) Change in Mean TTM according to Result

PARAMETERS	RESULT				p value
	EXCELLENT	GOOD	FAIR	POOR	
TTM(pod)	6.1±0.9	6±1.8	6±1.2	4±0	0.270

Table no. 19:Change in Mean TTM according to Result

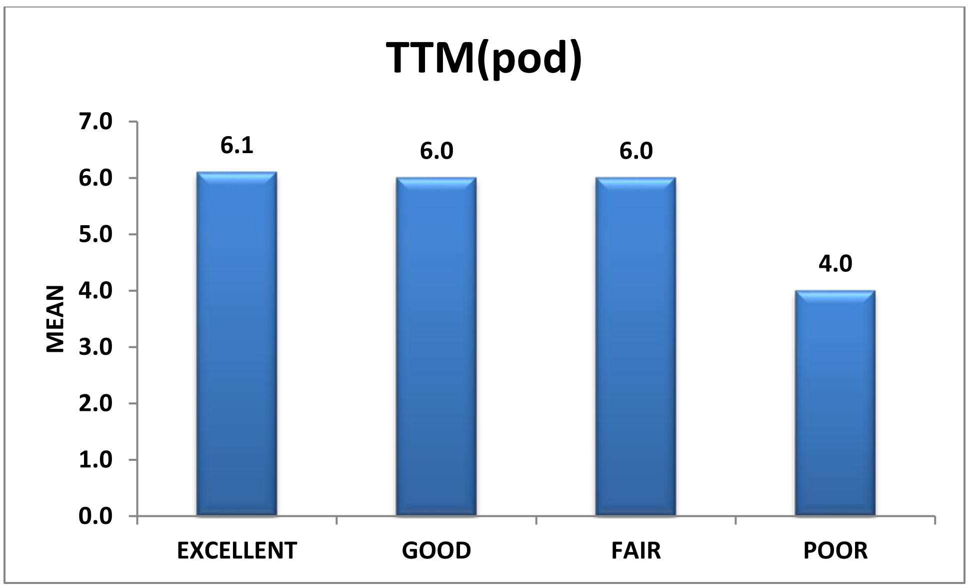


Chart no. 14: Change in Mean TTM according to Result

16) Change in Mean time of Full Weight Bearing Mobilization according to Result

PARAMETERS	RESULT				p value
	EXCELLENT	GOOD	FAIR	POOR	
FWBM(pom)	4.5±1	4.1±0.9	5.3±1	4.5±2.1	0.321

Table no.20:Change in Mean time of Full Weight Bearing Mobilization according to Result

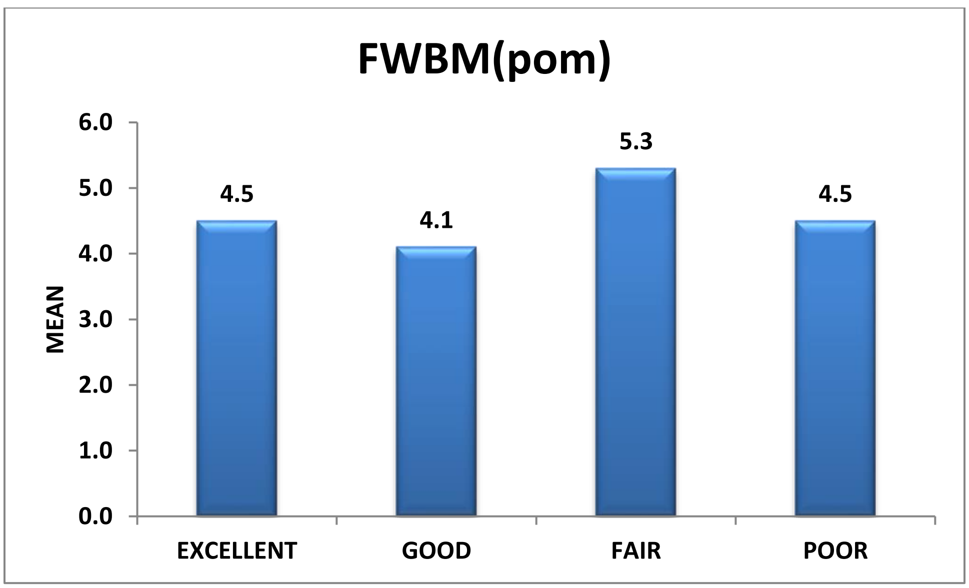


Chart no 15: Change in Mean FWBM according to Result

17) Change in Mean HHS according to Result

PARAMETERS	RESULT				p value
	EXCELLENT	GOOD	FAIR	POOR	
HHS	92.3±1.2	83.7±2.5	77±2	68±0	<0.001*

Note: * significant at 5% level of significance (p<0.05)

Table no. 21:Change in Mean HHS according to Result

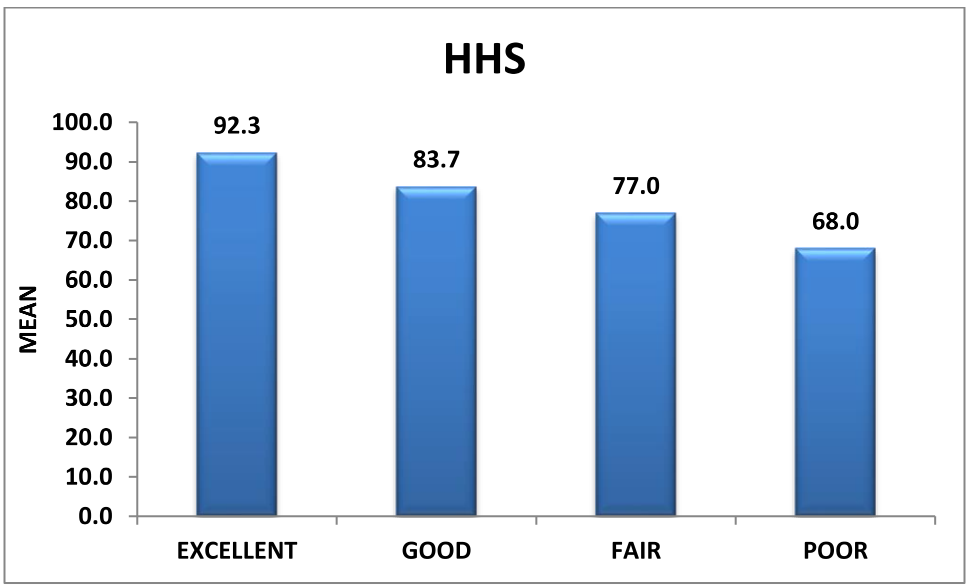


Chart no.16: Change in Mean HHS according to Result

18) Change in Mean TAD according to Result

PARAMETERS	RESULT				p value
	EXCELLENT	GOOD	FAIR	POOR	
TAD	25.3±1.9	24.6±1.3	25.5±1	21.5±3.5	0.038*

Note: * significant at 5% level of significance (p<0.05)

Table no. 22:Change in Mean TAD according to Result

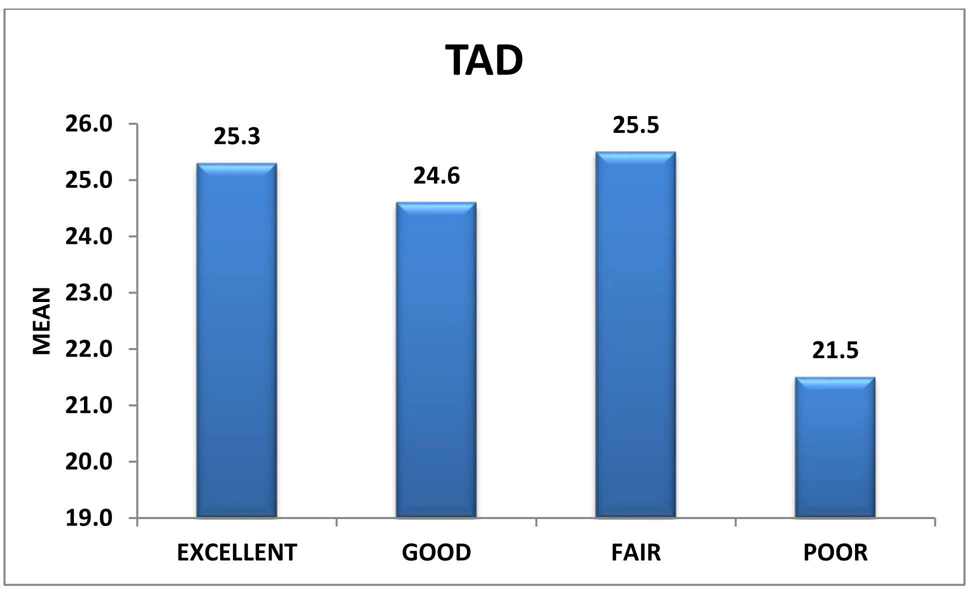


Chart no. 17: Change in Mean TAD according to Result

DISCUSSION

Peritrochanteric fractures are most common in elderly population. As the average life expectancy is increasing, incidence of hip fracture is rising. Owing to the osteoporosis and associated co-morbid conditions, management of hip fractures in older population has always been difficult for an average orthopedic surgeon.

To reduce the problems associated with long term bed ridden modality following conservative management, operative management is preferred. Surgical stabilization of fracture allowed early mobilization and return to pre-injury level of daily activities. This significantly reduces fracture related mortality and morbidity.

After long period of controversy, superiority of intra-medullary device over extra-medullary device is been well established over the years.

Intramedullary devices are used widely because of their mechanical and biological advantage.

In 2003AO/ASIF introduced helical blade replacing screw system in proximal femoral nail. Helical blade produces better purchase in osteoporotic cancellous area of femoral head. This is achieved by radial compaction of surrounding cancellous bone around the helical flanges, providing more back out residence.

It is found that there is less reaming of bone stock with helical blade compared to screw. There is no need of additional application of de-rotation screw because of the olive shape of proximal part of helical blade.

PFNA2 was introduced with flattened lateral wall and reduced medio-lateral angle from 6^{o} to 5^{o} [5]. These characteristic changes reduced the problem of lateral wall impingement which was seen with other older implants. Using this device very few studies have been carried out in Indian population.

Functional outcomes of our study were radiologically comparable with previous studies.

In this study, we have assessed functional outcome of unstable inter trochanteric factor treated with proximal femoral nail anti-rotation system II.

In our study, we have included 32 patients with age group of 55 to 85 years of age. Most of the patients were in age group of 61-70 (Mean: 68.5 years). This emphasize on the fact that these fractures are common in elderly population.

Out of 32 patients, 10(31.3%) were male and 22(68.8%) were females.Almost two thirds of the patient had suffered inter-trochanteric fracture due to trivial trauma (self fall) owing to poor bone quality.

Two thirds of the patient had suffered injury on their right side.

In our study, only the patients with unstable inter-trochanteric fracture were included of which 18(53.3%) were classified as 31A2 AO type and 14(43.3%) were classified as 31A3 AO type.

Many patients had more than one fracture following trauma. 6 patients had ipsilateral distal end radius fracture. Out of 6, 3 patients were managed conservatively with manipulation and cast application on the day of trochanteric fracture fixation. 3 patients had undergone closed reduction and k-wire fixation.3 patients had contralateral side proximal humerus fracture which were managed conservatively.

Many patient had associated medical co-morbidites like HTN(31.3%), DM(12.3%), HTN & DM (9.4%) for which physician consultation was taken. These co morbidities have contributed to the delay in time of surgery and hospital stay.

Lateral wall fracture was major drawback with previous many cephalomedullary nailing systems with medio-lateral angle of 6 degrees. In our study, the implant used has medio-lateral angle of 5 degrees. None of the patients included in this study had suffered lateral wall impingement or fracture during the procedure.

We had not encountered any cases of iatrogenic femoral shaft fracture.

All surgeries were carried out by surgeon of our university. Mean intra-operative time was found to be 68 minutes with minimum time noted was of 34 minutes.

Reduced intra operative time period reduces anaesthetic complication and blood loss.

Increased time period of operation owing to difficulty fracture pattern morphology were statistical related to poor functional outcome (p-value: 0.046).

Most of the patients were allowed toe-touch mobilization by $5^{th}$to 7^{th}day of post operative period. Time of starting toe-touch mobilization was not related to function outcome statistically (p-value: 0.2 10).

According to previous literatures, it is found that there is increased rate of cut off of lag screws from superior part of femoral head in extra-medullary devices. On the other hand ceohalomedullary implants have shorter liver arm resulting in decreased rate of varus collapse or screw cut off.

Our study encountered one case of screw cutoff from superior aspect of head and neck.

This patient had TAD score of 19mm.Patient was then managed with implant removal and total hip replacement surgery.

Radiological outcome was assessed on the basis of TAD score and complications related to fracture reduction and implant failure.

On 6 months of follow-up we have encountered one case of screw cutoff from superior aspect of head and neck. This patient had TAD score of 19mm on immediate postoperative x-ray radiograph Patient was then managed with implant removal and total hip replacement surgery. This confirms the association of TAD score with prognosis (Study).

Full weight bearing mobilization was allowed in all at the time of appearance of signs of union on xray. Most of the patient had started full weight bearing by 3-4 months. These values were also not related to clinical outcome at6 months follow up (P=0.321).

In this study all patients were assessed clinically at last follow up at 6 months. Harris hip score in more than 2/3rd of the patient (81.3%) showed excellent to good results. 4 patients (12.5%) had fair outcome as the mobilization of these patients were affected due to associated fractures in other limbs.

2 patients (6.25%) had poor outcome.1 of these 2 patients had to undergo debridement of deep infection leading to reduced HHS at 6 months of 1st operation. This patient was managed with debridement and extended course of I.V antibiotics according to sensitivity of causative organism followed by course of oral antibiotics.

2nd of the two cases was the patient with low TAD score who landed up in cut off of blade and loss of reduction at 3 month follow up. As the patient had undergone second surgery after the last follow up, functional outcome of this patient was assessed as poor.

George A Macheras MD retrospectively reviewed 108 patients of unstable intertrochanteric fractures treated with PFNA I and PFNA II. Aruthur had concluded that patients treated with PFNA II had reduced intraoperative time, blood loss, time of mobilization. Functional outcome assessed using Harris hip score turned out to be between 72 to 89 points which is comparable with our study[8].

Ming Hui Li studied 163 elderly people with unstable inter-trochanteric fracture treated with PFNA2. It compromised of 69 men and 94 women with mean age of 74.7 years. Statistical analysis of this study revealed an average operation time of 45.7min (35-100min) was required. Mean Harris hip score was 85.6 +/- 7.5 points, which included 41 excellent cases (25.15%), 92 good cases (56.44%), 26 fair cases (15.95%) and 4 poor cases (2.45%).All these data's were comparable with our study[3].

G.N.Kulkarni studied 42 patients between the age group of 35years to 90years with mean age of 61years diagnosed with unstable inter-trochanteric fracture. All patients were treated with Closed Reduction Internal Fixation with PFNA II. On follow up of 15.3 months, excellent to good results were found in 78%cases as assessed by Hams hip score which is comparable with our study (HHS : 81.3)[1].

In a study, Won Chul Shin, treated 38 patients with PFNA II and 62 patients with PFNA II. Post operative assessment revealed 13 cases of lateral wall impingement in PFNA I group, while no cases of lateral wall impingement were encountered in PFNA II group. These results were comparable with our study where we did not have any case of lateral wall impingement[5].

Akshay Jain studied 40 elderly patient with unstable intertrochanteric fracture treated with PFNA2 .At final follow up 77.5% patients had excellent to good results. These results were also comparable with our results[7].

In our study all the patients had TAD score readings ranging from 21mm to 30mm except one case where TAD score was 19mm. This patient had poor outcome as helical blade landed up in cutoff through superior margin of head.

Rest of the patient had gained fracture stability till the final follow up. This results were comparable with study done by Nikoloski et. al. where he concluded that recommended TAD score for helical blade is 20mm to 30mm[49].

CONCLUSION

In our study we had collected data from 32 patients. These 32 patients were diagnosed with unstable inter-trochanteric fracture and were treated with PROXIMAL FEMORAL NAIL ANTIROTATION SYSTEM II.

Proximal femoral nail antirotation system II is a newer version of cephalomedullary implants used for inter-trochanteric fracture.After statistically computing, analysing results of our study we have come to following conclusions.

- Unstable intertrochanteric fracture have higher incidence in geriatric population.
- In most of the cases,low energy trauma(self fall) was found to be the cause of the fracture.
- Female population is at more risk than the male population in geriatric age group. Most reliable explanation will be post-menapausal osteoporosis.
- Even though the mode of injury was a low velocity trauma, associated fractures in other limbs were quite common due to generalised osteoporosis.
- Early fracture fixation allows early mobilization of patient. Associated co-morbid condition causes delay in time of surgery and time of recovery. This leads to increased hospital stay.
- As this is a closed reduction and internal fixation type of procedure, fracture hematoma was left undisturbed which helped in early fracture union.
- Even though learning curve of this procedure is highwith the experience gained from each case, intra-operative time, intra-operative blood loss, radiation exposure, anaesthetic complications are markedly reduced.

- When using this type of cephalo-medullary implant, determining entry point of the nail is most important step in the whole procedure. Entry point should be taken just lateral to the tip of the greater trochanter in AP view and at the tip in lateral view.
- Newer helical blade gets strong purchase in proximal fragment. This allows controlled fracture site impaction using telescopic feature of the blade.
- Helical blade should be placed at the junction of upper 2/3rd and lower 1/3rd of neck and center-center position in head of the femur.
- Post-operative time at which the toe-touch mobilization and full weight bearing mobilization is started does not significantly affect the functional out come after 6 months of surgery.
- PFNA II system has option of static and dynamic locking which should be used according to need of fracture morphology.
- Most of the complications are surgeon related which can be cut down by proper patient selection and good preoperative planning.
- The fixation of intertrochanteric fractures with a PFNA II significantly reduces the morbidity and mortality in the elderly individuals in whom the fracture is more common.
- If the above technical details are followed, the function of the hip joint is regained to near normal pre-injury status and the rehabilitation of the patient is smooth.
- From our study, we have come to the conclusion that PFNA II is a reliable implant for treatment of unstable intertrochanteric fractures leading to high rate of union restoring the anatomical alignment and reduced chance of implant failure.

SUMMARY

Pertrochanteric fracture is one of the leading causes of hospital admissions in elderly patients. The number goes on increasing because of continuous changes in people's life style, industrialization and urbanization, increasing life span, sedentary habits, and increased road traffic accidents.

Conservative methods of treatment results in malunion with shortening and restriction of hip movement as well as complications of prolonged immobilization like bed sores, deep vein thrombosis, respiratory infections urinary tract infection. Treatment with extramedullary devices like DHS, DCS are associated with increased complications like nonunion and delayed union. This study is done to analyze the functional outcome of unstable intertrochanteric fractures treated with PFNA II.

In our series of 32 cases there were 10 males and 22 females, maximum age of 85 years and minimum age of 55 years, mean age being 68.5 years. 37.5% of cases were admitted due to Road traffic accidents and 62.5% cases were admitted due to self-fall and with slight predominance of right side. Out of 32 cases, 56.5% patients had 31A2 type and 3.7% patients had 31A3 type of fracture according to AO fracture classification. Out of 32 cases, no deaths reported during the study period. Excellent results are seen in 37.5% cases, good results in 43.8% of the cases, fair results in 12.5% of the cases and poor results in 6.3% of the cases.

From this study, we consider that PFNA II is an excellent device for the treatment of unstable inter-trochanteri fractures. The successful outcome depends upon proper patient selection, good understanding of fracture and surgical skills.

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ANNEXURE I

ETHICAL CLEARENCE CERTIFICATE

B.L.D.E (Deemed to be University)
SHRI.B.M.PATIL MEDICAL COLLEGE HOSPITAL & RESEARCH CENTRE
VIJAYAPUR – 586103

IEC/No:286/2018
17-11-2018

INSTITUTIONAL ETHICAL COMMITTEE

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this college met on 13-11-2018 at 03-15 PM scrutinize the Synopsis of Postgraduate Students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected and revised version synopsis of the Thesis has accorded Ethical Clearance.

Title : A Clinical study of functional outcome of unstable intertrochanteric fractures treated with proximal femur nail anti rotation system II.

Name of P.G. Student : Dr Siddhant Sanjay Gandhi,
Department of Orthopaedics,

Name of Guide/Co-investigator: Dr Santosh S Nandi, Professor of Orthopaedics

DR RAGHAVENDRA KULKARNI
CHAIRMAN
Institutional Ethical Committee
B.L.D.E.U's Shri B.M. Patil
Medical College, VIJAYAPUR-586103.

Following documents were placed before E.C. for Scrutinization:

1) Copy of Synopsis/Research Project
2) Copy of informed consent form.
3) Any other relevant documents.

ANNEXURE II

B.L.D.E. (Deemed To Be University) Shri B.M.Patil Medical College Hospital And Research Center, Vijayapura -586103

Informed Consent For Participation In Dissertation/Research

I, the undersigned,________________ , S/O D/O W/O _________________, aged ____years, ordinarily resident of _____________ do hereby state/declare that Dr. Gandhi Siddhant Sanjay of Shri. B. M. Patil Medical College Hospital and Research Centre has examined me thoroughly on _______________ at _______________ (place) and it has been explained to me in my own language that I am suffering from _________________ disease (condition) and this disease/condition mimic following diseases. Further Dr. Gandhi Siddhant Sanjay informed me that he/she is conducting dissertation/research titled "A Clinical Study Of Functional Outcome Of Unstable Intertrochanteric Fractures Treated With Proximal Femur Nail Anti Rotation System II" under the guidance of Dr. S.S. Nandi requesting my participation in the study. Apart from routine treatment procedure, the pre-operative, operative, post-operative and follow-up observations will be utilized for the study as reference data.

Doctor has also informed me that during conduct of this procedure, adverse results may be encountered. Most of them are treatable but are not anticipated hence there is chance of aggravation of my condition and in rare circumstances it may prove fatal in spite of anticipated diagnosis and best treatment made available. Further Doctor has informed me that my participation in this study help in evaluation of the results of the study which is useful reference to treatment of other similar cases in near future, and also I may be benefited in getting relieved of suffering or cure of the disease I am suffering.

The Doctor has also informed me that information given by me, observations made/ photographs/ video graphs taken upon me by the investigator will be kept secret and not assessed by the person other than me or my legal hirer except for academic purposes.

The Doctor did inform me that though my participation is purely voluntary, based on information given by me, I can ask any clarification during the course of treatment / study related to diagnosis, procedure of treatment, result of treatment or prognosis. At the same time I have been informed that I can withdraw from my participation in this study at any time if I want or the investigator can terminate me from the study at any time from the study but not the procedure of treatment and follow-up unless I request to be discharged.

After understanding the nature of dissertation or research, diagnosis made, mode of treatment, I the undersigned Shri/Smt ____ under my full conscious state of mind agree to participate in the said research/dissertation.

Signature of patient:

Signature of doctor:

Witness: 1.

2.

Date:

Place :

ANNEXURE III

SHRI B.M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE,

VIJAYAPURA – 586103

PROFORMA

CASE NO. :

FOLLOW UP NO. :

NAME :

AGE/SEX :

I P NO :

DATE OF ADMISSION :

DATE OF SURGERY :

DATE OF DISCHARGE :

OCCUPATION :

RESIDENCE :

Presenting complaints with duration :

History of presenting complaints :

Family History :

Personal History :

Past History :

General Physical Examination

Pallor:	present/absent
Icterus:	present/absent
Clubbing:	present/absent
Generalized lymphadenopathy:	present/absent
Built:	poor/moderate/well
Nourishment:	poor/moderate/well

Vitals:

PR: RR:

BP: TEMP:

Systemic Examination:

Respiratory system -

Cardiovascular system -

Per abdomen -

Central nervous system -

Local examination:

Right/ Left Leg

Gait:

Inspection:

a) Attitude

b) Abnormal swelling

- Site

- Size

- Shape
- Extent

c) Shortening

d) Skin condition

e) Compound injury if any

Palpation:

a) Swelling

b) Local tenderness

c) Bony irregularity

d) Abnormal movement

e) Crepitus/ grating of fragments

f) Absence of transmitted movements

g) Wound

Movements:	Active	Passive
Flexion		
Extension		
Abduction		
Adduction		
External Rotation		
Internal Rotation		

MEASUREMENTS: LIMB LENGTH DISCREPANCY

	RT	LT
APPARENT LENGTH:		

TRUE LENGTH:

SEGMENTAL

THIGH -

LEG -

LLD : (SUPRATROCHANTERIC / INFRATROCHANTERIC)

Investigations:

1] X-ray; femur full length with hip and knee AP & Lateral views—No:

Chest PA view— No:

Follow up x-ray of the involved femur with hip and knee AP & LATERAL—No:

2]Blood: Hemoglobin, Total and Differential leucocyte count

ESR, Fasting blood sugar, Blood urea, Serum creatinine & electrolytes, Blood grouping & cross matching

3] Urine: Albumin, Sugar, Microscopy

4] Pus (if any): Culture & Sensitivity

MANAGEMENT:

Conservative/Operative

Pre-operative treatment:

Traction—skin/skeletal

Analgesics

Blood transfusion (if necessary)

Others

Operative details: Date

Type of anaesthesia ………………… Approach ………….

Type of implant…………………….. Blood transfusion:…………..

Intra-operative details:

Duration (min)…….

radatioexosure(sec)…………

Blood loss(ml)………..

Intra operative complications: ………….

Bone grafting: ……………..

Post-operative treatment:

1. Antibiotic
2. Analgesics
3. Blood transfusion
4. Suture removal
5. Bed side mobilization
6. Gait training Non-weight bearing Weight bearing—partial / full

POST-OPERATIVE COMPLICATIONS:

1. Immediate
2. Early
3. Late

FOLLOW UP:

Pain in hip/thigh: Present/Absent

Ability to walk : Unable/Able to walk with support /Able to walk without any support

Swelling of the limb: Nil/After walking/At rest

Gait : Normal/Abnormal

Limb length: Normal/Shortened/Lengthened

Deformity: Hip present/absent ,Knee present/absent

Movements : Hip normal/restricted, Knee normal/restricted

Muscle wasting : Present/absent.

Associated injuries:

management **:**

KEY TO MASTER CHART

IP NO.	IN PATIENT DEPARMENT NUMBER
M	MALE
F	FEMALE
MOI	MODE OF INJURY
SF	SLIP AND FALL
RTA	ROAD TRAFFIC ACCIDENT
L	LEFT SIDE
R	RIGHT SIDE
DER	DISTAL END RADIUS FRACTURE
PHF	PROXIMAL HUMERUS FRACTURE
HTN	HYPERTENSION
DM	DIABETES MELLITUS
IT	INTERTROCHANTERIC FRACTURE
D/O/S	DATE OF SURGERY
POD	POST OPERATIVE DAYS
POM	POST-OPERATIVE MONTH
IOT	INTRA-OPERATIVE TIME
TTM	TOE TOUCH MOBILIZATION
FWBM	FULL WEIGHT BEARING MOBILIZATION
SI	SUPERFICIALINFECTION
DI	DEEP INFECTION
CO	CUT-OUT
MHHS	MODIFIED HARRIS HIP SCORE
TAD	TIP APEX DISTANCE (INDEX)
ASSO.INJ.	ASSOCIATED INJURIES

MASTER CHART

serial no.	NAME OF PATIENT	IP NO.	AGE	SEX	MOI	SIDE	AO TYPE	asso. Inj.	comorbities	D/O/S	IOT(min)	TTM(pod)	FWBM(pom)	compliation	MHHS	TAD	RESULT
1	ANAND	37081	68	M	SF	L	31A2	NIL	HTN	07-11-2018	55	5	3	NIL	92	28	EXCELLENT
2	CHAYAMMA	39900	60	F	SF	R	31A3	DER	NIL	01-12-2018	67	7	5	NIL	88	25	GOOD
3	BAURAVVA	40626	75	F	SF	R	31A2	NIL	HTN	05-12-2018	80	3	4	SI	84	24	GOOD
4	KARABASAPPA	41397	65	M	RTA	R	31A2	NIL	NIL	12-12-2018	78	6	5	NIL	94	24	EXCELLENT
5	RACHAVVA	41791	70	F	SF	R	31A2	NIL	NIL	15-12-2018	45	5	4	NIL	85	25	GOOD
6	RADHABAI	42160	80	F	SF	R	31A3	NIL	HTN	14-12-2018	34	7	6	NIL	78	26	FAIR
7	KALLAPPA	7908	65	M	RTA	R	31A2	NIL	NIL	23-03-2019	55	8	5	NIL	91	23	EXCELLENT
8	PANAWAMMA	11397	55	F	SF	R	31A2	NIL	HTN	25-04-2019	46	9	5	NIL	86	22	GOOD
9	SHANTEVVA	11672	80	F	RTA	L	31A2	DER	HTN	25-04-2019	57	6	5	NIL	92	23	EXCELLENT
10	ANASUYA	14045	65	F	SF	R	31A3	DER	DM	10-05-2019	88	5	4	NIL	82	24	GOOD
11	SARASWATI	14815	70	F	SF	R	31A3	NIL	HTN/DM	17-05-2019	110	6	6	NIL	92	25	EXCELLENT
12	LAXMAN	19472	75	M	SF	R	31A2	NIL	NIL	25-06-2019	56	7	5	SI	78	26	FAIR
13	MALLAPPA	21682	56	M	RTA	R	31A3	PHF	HTN	12-07-2019	67	5	4	NIL	90	25	EXCELLENT
14	MAHADEVAPPA	8439	65	M	SF	R	31A2	NIL	NIL	20-03-2019	87	8	3	NIL	84	24	GOOD
15	GAYATRI	9186	62	F	SF	R	31A3	DER	DM	27-03-2019	78	6	3	NIL	93	25	EXCELLENT
16	UMA	8440	65	F	RTA	L	31A2	NIL	HTN	30-03-2019	97	4	6	DI	68	24	POOR
17	GAURAMMA	41117	70	F	SF	R	31A2	NIL	NIL	09-12-2019	79	6	5	NIL	82	23	GOOD
18	GIRIJA	9994	65	F	SF	L	31A3	PHF	DM	03-04-2019	68	5	4	NIL	91	25	EXCELLENT
19	NAGRAJ	12072	61	M	RTA	L	31A3	NIL	NIL	20-04-2019	63	7	5	NIL	80	25	GOOD
20	AMARAMMA	12735	65	F	SF	L	31A2	NIL	NIL	27-04-2019	65	5	6	SI	74	24	FAIR
21	PARVATI	13276	55	F	RTA	L	31A2	NIL	DM	30-04-2019	55	4	5	NIL	88	26	GOOD
22	SURESH	12132	70	M	SF	R	31A3	NIL	HTN/DM	01-05-2019	44	7	4	NIL	93	27	EXCELLENT
23	LAXMIBAI	18364	60	F	SF	R	31A3	NIL	DM	19-06-2019	48	8	4	SI	83	27	GOOD
24	SHANTABAI	19677	62	F	RTA	L	31A2	DER	NIL	29-06-2019	59	6	5	NIL	93	28	EXCELLENT
25	INDUBAI	20812	80	F	RTA	L	31A2	PHF	HTN	03-07-2019	90	4	3	CO	68	19	POOR
26	MALLANGOUDA	22856	83	M	SF	L	31A3	NIL	NIL	20-07-2019	101	6	6	NIL	94	23	EXCELLENT
27	LAKSHMIBAI	23658	70	F	SF	R	31A3	NIL	NIL	27-07-2019	69	4	4	NIL	82	24	GOOD
28	MARIAVVA	28471	70	F	RTA	R	31A2	NIL	HTN/DM	05-09-2019	70	7	5	NIL	82	24	GOOD
29	HUSAINBAE	31105	78	F	RTA	R	31A3	DER	NIL	23-09-2019	59	5	4	NIL	78	26	FAIR
30	KUMAR	39616	72	M	SF	R	31A2	NIL	HTN	28-11-2019	70	6	3	NIL	81	26	GOOD
31	RADHIKA	6843	70	F	SF	L	31A2	NIL	DM	04-03-2019	50	5	2	NIL	85	26	GOOD
32	SAVANTARAVV	5737	85	F	RTA	L	31A3	NIL	HTN	27-02-2019	87	7	4	NIL	93	27	EXCELLENT