COMPARATIVE ANALYSIS OF FUNCTIONAL OUTCOME OF DYNAMIC HIP SCREW VERSUS PROXIMAL FEMORAL NAILING IN INTERTROCHANTERIC FRACTURES

DISSERTATION SUBMITTED FOR

M.S DEGREE EXAMINATION

MS ORTHOPAEDICS

APRIL 2011

TIRUNELVELI MEDICAL COLLEGE

THE TAMILNADU Dr. M.G.R. MEDICAL UNIVERSITY

CHENNAI.

CERTIFICATE

This is to certify that the work entitled **"COMPARATIVE ANALYSIS OF FUNCTIONAL OUTCOME OF DYNAMIC HIP SCREW VERSUS PROXIMAL FEMORAL NAILING IN INTERTROCHANTERIC FRACTURES"** which is being submitted for M.S. Orthopaedics, is a bonafide work of **Dr. R.Naveen Kumar**, Post Graduate Student at Department of Orthopaedics, Tirunelveli Medical College, Tirunelveli.

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He has completed the necessary period of stay in the Department and has fulfilled the conditions required for the submission of this thesis according to the University regulations. The study was undertaken by the candidate himself and the observations recorded have been periodically checked by us.

Recommended and forwarded

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TIRUNELVELI MEDICAL COLLEGE AND HOSPITAL,
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INSTITUTIONAL ETHICAL COMMITTEE

CERTIFICATE OF APPROVAL

This is to certify that the INSTITUTIONAL ETHICAL COMMITTEE of TIRUNELVELI MEDICAL COLLEGE AND HOSPITAL, TIRUNELVELI-11 has unanimously approved the dissertation titled COMPARATIVE STUDY OF FUNCTIONAL OUTCOME OF TROCHANTERIC FRACTURES OF FEMUR TREATED WITH DYNAMIC HIP SCREW WITH THAT OF PROXIMAL FEMORAL NAILING. by DR.R.NAVEEN KUMAR, M.S.,(ORTHO) II YEAR student, TIRUNELVELI MEDICAL COLLEGE, TIRUNELVELI-11 in its meeting held on 09.10.2009.

TIRUNELVELI

13 .10.2009.

To
The Concerned.

SECRETARY
Secretary,
Ethical Committee,
Tirunelveli Medical College,
Tirunelveli-11.

ACKNOWLEDGEMENT

The most pleasant part of writing a thesis is acknowledging once gratitude to all those who have helped in its completion.

I take this opportunity to express my deep sense of gratitude although I find words inadequate to express the greatness of **Prof. R. RAMAKRISHNAN**, Prof. and Head Department of Orthopaedics, Tirunelveli Medical College who has been a pillar of discipline, courage and immense kindness and who was instrumental in guiding me throughout the course of this thesis. I consider myself fortunate and privileged to work under his affectionate guidance, superb supervision and sustained support.

I am immensely thankful to **Prof. Elangovan Chellappa** and **Prof. R. Arivasan**, Prof. of Orthopaedics for their guidance and ingenious suggestions and ever available help. But for their co-operation, this study would not have been possible.

I am extremely thankful to **Dr. N. Manikandan**, Asst. Prof. of Orthopaedics, who had been a constant source of inspiration to me and whose excellent guidance, day to day help and dedication paved the way for successful completion of this study.

I humbly acknowledge and express my thanks to **Dr. A. Sureshkumar, Dr. Ajith Inigo**, **Dr. Senthil Kumar** and **Dr. Prabhu** for their excellent encouragement and constructive criticism without which it would not have been possible to complete this study.

I am extremely thankful to all my Assistant Professors for their constant help, guidance and expert advice towards the successful completion of this study.

Last, but not the least, I extend my thankfulness to all the patients who have participated in this study. But for their co-operation this exercise would have been futile.

CONTENTS

INTRODUCTION

With the tremendous improvements achieved in the field of medicine over the decades, life span of an individual has also increased. Gediatrics is anew field in its own. Intertrochanteric fractures are one of the most common and most devastating injuries in the elderly. The incidence of these fractures have increased with the advancing age.

These patients are limited to home ambulation and are dependent for their basic day to day activities either on a family member or a walking aid, hence become a liability. Mortality rates are very high due to limited ambulation. Due to improved treatment, early ambulation is possible and better functional outcome is achieved with reduction in the morbildity rates. Incidence is gender and race dependent and varies from country to country. In the United States ratio is 63 per 100,000 in females and 34 per 100,000 in males. In India with the incidence is increasing due to the increased life span.

Femur is the most important weight bearing bone of the lower limb. Proximal femur has two ridges the greater trochanter and the lesser trochanter. A fracture involving the area between the two trochanter is called the intertrochanteric fracture.

Intertrochanteric fractures are caused by road traffic accidents, even low velocity fall injury, especially in elderly patients with osteopenic bone. Treatment of intertrochanteric fracture is by both non-operative and operative

methods. Non-operative method includes skeletal traction and derotation boot. Operative methods are by dynamic hip screw, intramedullary nailing and prosthetic replacement.

Two main mode of operative management are dynamic hip screw and intramedullary nailing mainly proximal femoral nailing. Operative treatment has better prognosis and reduces mortality due to fracture. Different types of implants are used according to type of intertrochanteric fracture.

This is a study mainly to analyse the functional outcome of dynamic hip screw and proximal femoral nailing when used in all types of intertrochantric fractures.

REVIEW OF LITERATURE

HISTORY:-

This history of proximal femur starts as early as:-

- 1564 - AMBROSE PARE described the fracture of proximal femur.
- 1882 - SIR JACOB ASTLEY COOPER - was the first to distinguish between intra and extra capsular fracture. In those days therapeutic options were few and patients were treated with bed rest.
- 1960's - operative management consisting of fracture reduction and stabilization which permits early mobilization, minimising many of the complications of prolonged bed rest, became the treatment of choice.
- 19th century the concept of traction was introduced with the goal of minimizing limb shortening and deformity. But prolonged bed rest in traction, until fracture healing, followed by a lengthy prolonged ambulation training was associated with high complication rates especially elderly with decubitus ulcers, UTI, joint contractures, pneumonia and thromboembolism resulting in high mortality rate. In addition, fracture healing was generally acompanied by varus deformity and shortening, in order to counteract the deforming forces.
- 1930 - SMITH PETERSON introduced a nail which allows immediate fixation and early mobilization.

Unstable fractures still remain a big problem, so in 1960 various osteotomies were advocated by Dimon Hugston. Sarmiento used rigid fixation device to create a stable fracture from an unstable configuration. Unfortunately both of the procedures have been asociated with increased morbidity and mortality due to increased surgical time and post operative shortening which is unacceptable to the patients.

CLAWSON and MASSIE introduced sliding devices that allowed impaction of fracture fragments. This led to superior results in the treatment of intertrochantric fracture. Intramedullary devices where introduced in 1970's in the form of Ender's nail a condylocephalic nail for fixation of intertrochantric fracutres. These devices are traced retrograde from entry site near the knee using percutaneous techniques under fluoroscopic control. Theorotical advantage include decreased bending movement on the device as previously described for the gamma nail, elastic fixation which was proposed to aid fracture healing. Later series shows a high incidence of varus deformity and knee pain caused by migration of pins, this lead to high incident of reparation. Some surgeons believe there is place for Ender's nail in elderly with stable fracture. Most recent devices are the gamma nail and proximal femoral nail. The gamma nail (RUTHERFORD New Jersy) was developed to circumvent these drawbacks by combining the advantages of intramedullary fixation with those of the sliding device.

ANATOMY

Proximal femur is an important part of the lower limb it forms the major part of the hip joint. Intertrochanteric region is the important part of the proximal femur greater trochanter is the prominent projection from the junction of the upper end of the shaft and upper part of the neck. Anterior surface of the trochanter has a rough impression for the insertion of gluteus minimus, lateral surface has an oblique strip for insertion of gluteus medius, upper body receives the insertion of piriformis, posteromedial to the trochanter is an hollow fossa called trochantric fossa where the obturator externus gets inserted into it, more anteriorly the medial surface of the trochanter receives the insertion of common tendon of obturator internus and two gamelli.

Lesser trochanter is a conical projection at the junction of posteroinferior part of the neck with the shaft the iliacus and posas major are inserted into it the intertrochanteric line is continuous below with spiral line the following structures are attached to it - capsule of the hip joint, upper and lower bands of iliofemoral ligament to its upper and lower parts respectively upper part gives origin to the highest part of the vastus lateralis, the lowest part gives origin to the highest fiber of vastus medialis, intertrochanteric crest connect the two trochanters posteriorly at the junction of the shaft with the neck a little above its middle is the prominence called quadrate tubercle which receives the insertion of quartatous femoris and adductor magnus.

BIOMECHANICS

Extra capsular fractures (intertrochanteric) fractures primarily involved cortical and cancellous bones because of the complex stress configuration in this region and its homogenous nature osseous structure and geometry, fractures ocur along the path of least resistance through the proximal femur. The amount of energy absorbed by the bone determines the fracture whether it i simple or is characterized by a more extensive communited pattern.

Bone is stronger in compression than in tension cycle of repetitive loading of bone. At loads lower than its tensile strength can cause a fatigue fracture, each load causes microscopic cracks that can coalesce into a single macro crack which inturn functions as stress riser Failure can, thus occur if healing of these micro fractures doesn't take place in repetitive loading the fatigue process is affected by the frequency of loading as well as by magnitude of the load and number of repetition.

Muscle force place a major role in the biomechanics of the hip joint during gait or stance, bending movement are applied to the femoral neck by the weight of the body resulting in the tensile stress and strain on superior cortex, the contraction of gluteus medius however generates axial compression causing stress and strain in the femoral neck that acts as a counter balance to the tensile stress and strain when the gluteus medius is strained and fatigue and opposed tensile stress arises in the femoral neck. Stress fractures are usually

substantiated as a result of continuous strenuous physical activity that causes the muscles to gradually fatigue and loose their ability to conteract and neutralize stress on the bone.

MECHANISM OF INJURY

Intertrochanteric fractures in younger individuals are usually a result of high energy injury such as motor vehicle accidents or fall from heights. Ninety percent of intertrochanteric fractrures in the elderly results from simple fall. The tendancy to fall increases with patients age and is exacerbated by several factors like poor vision and decreased muscle power. Labile blood pressure, decreased reflexes, vascular diseases and coexisting musculoskeletal pathology.

Laboratory research indicates that faith in an elderly individual from an erect position typicaly generates atleast 16 times. The energy necessary to fracture the proximal femur.

Although these datas suggests that such falls should cause fracture almost every time they occur, only 5% to 10% of falls occur in older people. The factory that the majority of falls do not result in a hip fracture implies that mechanism of fall are important in determining whether fracture will occur.

According to cummings, four factors contribute to whether a particular fall results in a fracture of the hip. (1) The fall must be oriented so that person lands on or near hip. (2) Protective reflexes must be inadequate to reduce the energy of fall below a certain critical point threshold. (3) Local shock absorbers must be inadequate. (4) Bone strength at the hip must be insufficient.

Person must land on or near the hip for the energy of the fall to be transmitted to the proximal femur. Falling onto the lateral thigh or buttock near

the greater trochanter is much more likely to cause hip fracture than impacts anywhere. Such falls are also such common likely when there is little or no forward movement as the person is standing still or walking slowly. Further more the reaction time is late and less muscle strength, less protective responses which is all seen in older people.

Skin, fat and muscle surrounding the hip can absorb large amounts of energy from an impact. There is decline in the muscle mass around the hip has accounted for the increased incidence of the fracture with aging. Although the muscle surrounding the hip gives protection, the contraction of the muscles during fall may actually lead to increased rates of hip fractures. In a laboratory study, Hayes found that muscle relaxed during falls has a decreased incidence of hip impact and so fracture incidence also reduces.

CLASSIFICATION

There are 3 classifications given for intertrochanteric fractures. These helps to study the fracture pattern and also helps to plan the surgery also.

The most important classification is the BOYD AND GRIFFIN CLASSIFICATION. It is divided into 4 types.

TYPE 1- Fracture line extends from greater trochanter to lesser trochanter. Reduction usually is simple and is maintained with little difficulty. Results Generally are satisfactory.

TYPE 2 - Comminuted fractures, the main fragment being alone the intertrochanteric line but with multiple fractures in the cortex. Reduction of these fractures is more dificult because the comminution can vary from slight to extreme. A particularly deceptive form is the fracture in which an anteroposterior linear intertrochanteric fracture occurs as in type - 1, but with an additional fracture in the coronal plane, which can be seen in lateral radiograph.

TYPE 3 - Fractures that are basically subtrochanteric with atleast one fracture passing across the proximal end of the shaft just distal to or at lesser trochanter. Varying degrees of comminution are associated. These fractures usually are more difficult to reduce and result in more complications at operation and during convalescence.

TYPE 4 - fractures of the trochanteric region and proximal shaft with fracture in atleast 2 planes. one of which is in sagittal plane and may be difficult to see on

routine anteroposterior radiographs. If open reduction and internal fixation are used, two plane fixation is required because of the spiral oblique or butterfly fracture of the shaft.

EVANS CLASSIFICATION

It is divided into 2 types:

1. Stable fractures
2. Unstable fractures

STABLE FRACTURES:

These are divided into

1. Stable, undisplaced
2. Displaced, reduced
3. Displaced, not reduced
4. Comminuted

TYPE - 2 is reverse oblique fracture.

AO FRACTURE CLASSIFICATION

31-A	-	Femur, Proximal Trochanteric
31-A1	-	Peritrochanteric simple
31-A1-1	-	Along - Intertrochanteric Line
31-A1-2	-	Through greater trochanter
31-A1-3	-	Below lesser trochanter
31-A2	-	Peritrochanteric Multifragmentary
31-A2-1	-	With one intermediate fragment
31-A2-2	-	With several intermediate fragments
31-A2-3	-	Extending more than 1cm
		Below lesser trochanter
31-A3	-	Intertrochanteric
31-A3-1	-	Simple Oblique
31-A3-2	-	Simple Transverse
31-A3-3	-	Multifragmentary

INVESTIGATIONS

The most important investigation is the X-ray.

1. Standard anteroposterior view of the pelvis.

2. Cross table lateral view of the proximal femur.

Ap pelvis view allows comparison of the affected side with the normal side and helps to identify the nondisplaced fractures. The lateral x-ray helps to assess the posterior communition of the proximal femur. A cross table lateral view is preferred to a for lateral view because the later requries abduction, flexion and external rotation of the lower extremity and involves risk of fracture displacement. A traction and internal rotation view helps to study the fracture pattern also. Internally rotating the involved femur 10-15 degree offsets the anteversion of the femoral neck and provides a view of the fracture. A second ap view is also taken for preopertive planning.

When a hip fracture is suspected, but not on standard x-rays, a technetium bone scan or a magnetic resonance imaging scan would be obtained. CT scan can be taken for severely comminuted fractures to study the fracture pattern for fixation.

PRINCIPLES OF MANAGEMENT

Before the introduction of fixation devices, Treatment of intertrochanteric fractures were of non-operative measures. Prolonged traction with bed rest and lengthy ambulation. In elderly patient, morbidity rate was incresed many folds, typical problems included decubitus ulcers, urinary tract infection, joint contractures resulting pneumonia and thrombo embolic complications resulting in a high mortality rate. In addition fracture healing was accompanied by varus deformity and shortening because of inability of fracture to effectively counter act the deforming mascular forces.

Techniques of operative fixation have changed dramatically since the 1960's and problems associated with early fixation devices have been overcome. Operative management consists of fracture reduction and stabilization, which permits early patients mobilization and minimizes many of the complication of prolonged bed rest, has consequently become the treatment of choice for intertrochanteric fractures.

Fracture fixation mainly depends on the type of fracture the implant is selected. Mostly the fraction fixation varies between stable and unstable trochanteric fractures. Stable fractures can be fixed with dynamic hip screw plate fixation. Unstable fractures can be fixed with dynamic condylar screw plate or intra medulary nail fixation.

Factors mainly determining the type of treatment are as follows:

1. Type of fractures
2. Stability of the fractures
3. Degree of comminution
4. Extent of soft tissue injury
5. Presence of multiple trauma
6. Degree of osteoporosis
7. Complex associated injuries

Main Objectives:

1. Anatomical reduction and rigid fixation
2. Early ambulation and reduced morbidity
3. Regain full range of function of limb
4. Treat the associated injuries

METHODS OF TREATMENT

The treatment of intertrochanteric fracture are mainly classified into two types. They are:

Non-operative and Operative methods.

Aim of the treatment is to get a stable and rigid fixation of the proximal femur with return of near normal function with adequate soft tissue healing and prevention of late degenerative changes.

Conservative Management

Skeletal Traction

Derotation boot immobilization

Operative Treatment

Dynamic hip screw platting fixation

Conventional sliding hip screw fixation

Variable angle sliding hip screw fixation

Talon compression hip screw fixation

Trochanteric stabilizing plate

Medoff plate fixation

Percutaneous compression plate fixation

Gamma nailing

Trochanteric fixation nailing

Proximal femoral nailing

External fixation

Prosthetic replacement

Indications for conservative management

1. Elderly person whose medical condition caries an ecessively high risk of mortality from anesthesia and surgery.
2. Non ambulatory patient who has minimal discomfort following fracture.

Conservative Management

Skeletal Traction

This technique involves the use of Steinmann pin inserted in the upper tibial shaft. The limb is kept in a splint. Traction is applied for nearly 10-12 weeks with bed rest until fracture healing occurs.

Derotation Boot immobilization

After the fracture the limb is flexed abducted and externally rotated hence by means of conservative method, Derotation boot is applied by reducing the fracture by bringing the limb to the neutral position weight is also applied to the derotation boot. It can be applied to a range of 8-12 weeks till fracture healing occurs.

Surgical Management

Introduction

Techniques of operative fixation have changed dramatically since the 1960's and the problems associated have been overcome. The combination of properly designed implants, better understanding of thepersonality of fracture minimal soft tissue handling techniques, pre operative antibiotics have made surgical fixation safe and practical while treating fractures. The goals of operative treatment are as follows:

1. Anatomical reduction and stable fixation
2. Early mobilization and reduced morbidity
3. Return normal functional recovery

Operative treatment is indicated in all types now a days and until any medical contra indication for surgery exists.

Pre Operative Planning

Pre operative planning is mandatory and gives better results.

Proper x-rays and also traction views gives better idea to the surgeon about the personality of the fracture and operative strategy. Good radiological evaluation is needed, proper instrumentation planning is mandatory.

1. Anatomical reduction by direct means
2. Stable fixation
3. Minimal soft tissue damage.

Surgical Exposure

Exposure of the trochanter is mainly done by means of lateral approach. It is the best approach for any kind of fixation. Planned surgical approach should provide adequate trochanter visualization with preservation of all vital structures and minimal soft tissue handling and osseous devitalisation. Skin incision for trochanteric fractures are vertical incision on the lateral thigh. Upper third with greater trochanter as marking point. Incision length varies on the type of fixation also. The exposure varies depending on fixation type.

Reduction Techniques

Reduction of trochanteric fractures can be attained by direct or indirect means. Direct reduction can be done by either open or percutaneous means indirect reduction mainly done with the help of fluoroscopy on the traction table. Reduction adjusted witht he help of fluoroscopy best and recent method is mainly indirect reduction by help of fluoroscopy and then fixation. So after indirect reduction, both dynamic hip screw fixation and proximal femoral nailing fixation can be done.

Post Operative Protocal

Limb elevation should be given immediately after surgery, hip mobilization and ambulation training be initiated on post operative day 1. Hip abduction and knee mobilization exercises are started, weight bearing is allowed as much as tolerated. Full weight bearing is allowed after stable fixation and radiological evidence of callous.

COMPLICATION

The complication following operative treatment has been reduced due to better operative technique and post operative care.

Complication of Fracture

1. Malunion
2. Non union
3. Varus deformity
4. Shortening
5. Post traumatic arthritis
6. Osteo necrosis of femoral neck

Complications of Operative Treatment

1. Infection
2. Improper reduction
3. Hardware Failure
4. Malrotation deformity
5. Periprosthetic fractures
6. Non union

Infection

The major drawback of operative fixation is infection. Incidence of infection is 3-38%. Incidence is more in unstable fractures and long surgical incision surgeries. Bad post operative care and improper surgical procedure leads to infection. Even with infection, implant should be retained. As stable infected fractures can be managed better than unstable fracture. If the infection is severe then the implant should be removed and other means should be tried.

Improper Reduction

Another important complication is the improper reduction whatever it is direct or indirect means. Improper reduction can lead to malunion and also non union. Even if the fracture fixation is stable in improper reduction, the fractrures united with deformity.

Hardware Failure

Another problem is the failure of the implant like cut through of the screws from the femoral head (z-effect). Breakage of the screws, plates and nails can lead to refracture and deformity.

Malunion

Most common-complication after surgery is mal union. Very much common in unstable and comminuted fractures. More of varus deformity occurs in trochanteric fracture fixation.

Post Traumatic Arthiritis

One of the preventable complications after surgery. Mostly it occurs due to improper physiotherapy to the adjoining joints. Better avoided by starting mobilization of the adjacent joint from the first post operative day itself.

Non union

A rare complication in operative treatment compared with other fractures. Various causes are implant failure, improper reduction and improper physiotherapy. Osteoporosis (gross) is also important cause of non union. If the implant is unstable implant is to be removed and bone grafting may be tried.

PRE AMBLE

The intertrochanteric fractures are the most common hip fractures in the elderly in whole world. These factors affect the hip function and stability. A well aligned and stable fixation is the prime goal of treatment of all operative fixation methods. It helps to restore and preserve good hip function following operative fixation. Anatomical restoration of proximal femur, maintainence of mechanical axis and restoration of hip function can be achieved.

Both stable and unstable fractures are fixed now-a-days by various fixation methods. Complex anatomical features, associated complications, patients general condition all have bearing on early surgical management of these fractures.

The study includes 20 patients all of whom were adults. It includes all four types of intertrochanteric fractures < boyd and Griffin Classification > fixed either with dynamic hip screw fixation and proximal femoral nailing fixation.

Based on our findings, we here by submit

Comparitive study of functional outcome of intertrochanteric fractures of femur treated with dynamic hip screw with that of proximal femoral nailing.

AIM OF STUDY

Intertrochanteric fractures are one of the most important fractures which increases morbidity in a person manifolds as the person is bedridden. So there is absolute necessity to fix the fracture and to start early ambulation of the patient.

So early fixation is very much essential in all types of intertrochanteric fractures to reduce the morbidity and early ambulation and to bring near normal hip function.

Our aim is to study the functional outcome of fixation of intertrochanteric fractures with both dynamic hip screw fixation and proximal femoral nailing fixation. All types of intertrochanteric fractures are included in this study to know the outcome.

MATERIALS AND METHODS

This is a prospective study of 20 cases of intertrochanteric fractures treatedby early surgical fixation with both dynamic hip screw fixation and proximal femoral nailing.

The period of survey and follow up extends from July 2008 to September 2010.

It includes all types of intertrochanteric fractures.

The time protocol extends from within 24 hours of injury to 14 days of injury.

The cases were analysed as per the following criteria.

AGE DISTRIBUTION

SEX DISTRIBUTION

SIDE OF INJURY

MODE OF INJURY

CLASSIFICATION OF FRACTURES

IMPLANT USED

TIME INTERVAL BETWEEN INJURY AND SURGERY

ASSOCIATED INJURIES

DURATION BETWEEN INJURY AND HOSPITALISATION

DURATION OF POSTOPERATIVE STAY

DURATION OF UNION - 6 WEEKS, 10 WEEKS, 14 WEEKS

RANGE OF MOVEMENTS

POSTOPERATIVE COMPLICATIONS

REHABILITATION

DYNAMIC HIP SCREW PLATE SYSTEM

DHS PLATES

Standard Barrell - 38mm.

Standard plate with barrel angles - 135, 10, 145, 150 degrees. Most common - 135 degrees.

135 degree DHS plates are available in 2, 4, 6, 8, 10, 12, 14, 16 holes.

Lengths from 46mm to 206mm.

Thickness - 5.8mm.

Width - 19mm.

Hole spacing - 16mm.

Barrell outside diameter - 12.6mm.

DHS PLATE

135 degrees, 25mm Barrell.

Short Barrel available with 4, 5, 6 holes.

Length 78mm to 110mm.

DHS Screws

Smooth shaft and partially threaded and cannulated.

Thread tapered at the tip and has reverse cutting flute.

Screws available in length from 50mm to 145mm in 5mm increments.

Thread diameter - 12.5mm.

Thread length - 22mm.

Shaft diameter - 8mm.

PROXIMAL FEMORAL NAIL

The proximal femoral nail is a cephalomedullary nail in which the larger diameter lag screw has been replaced with a 6.5mm superior and an 11mm inferior screw.

Material -steel or titanium

Proximal diameter - 17mm.

Distal diameter - 10mm, 11mm, 12mm, standard > 11mm <long>

Length - 170 to 235mm <standard>, 300 to 460mm <long>

Lag screw insertion angle - 125, 130, 135 degrees.

MI angle - 6degrees.

Lag screw diameter 11mm neck screw and 6.5mm hip pin.

Distal screw diameter 4.9mm.

Enc cap-yes.

PROCEDURE AND POSTOPERATIVE PROTOCOL

General Measures:

All patients received in the emergency ward were resuscitated for hypovolemia with fluids and blood. Major injuries were treated first. After the general condition of the patient is improved, x-ray pelvis anteroposterior view and the affected hip anteroposterior and lateral views are taken. Then the fracture was immobilized in bohler brawn splint with upper tibial pin traction.

Once the patient is assessed by the anaesthetist for surgery, all 4 types of intertrochanteric fractures are fixed with both dynamic compression screw fixation and proximal femoral nailing. Most of the cases are taken up for elective surgery before 5^{th} day. Its taken after 5 days if there is any associated injuries or factors affecting the assessment for surgery.

Fixation with Dynamic Hip Screw:

All 4 types of intertrochanteric fractures are fixed with dynamic compression screw fixation. The preoperative lag screw size and length of plate also was assessed. The fracture table was used. Patient is positioned in supine position with traction was given in affected limb with 15 degrees of internal rotation. Uninjured limb is flexed abducted. Padding the are of peroneal nerve.

Reduction:

Reduction of the intertrochanteric fracture is done with the help of fluoroscopy. Fragment position is checked in both anteroposterior and lateral views. Reduction is done with traction, adduction and internally rotate. Thus reduction is done and confirmed by fluoroscopy on both the views.

Draping:

Draping is done only after reduction of the fracture.

Exposure:

Proximal femur is approached laterally from the greater trochanter and extend distally. Length of incision depends on length of implant used.

Elevate the vastus laterails off the intermuscular septum with coagulating the branches of profounda femoris.

Guide Pin Insertion:

Entry point is mainly 2cm below the vastus lateralis ridge for the 135 degree angle plate. Guide pin is inserted in the femoral head. Confirm the placement of guide pin in both views.

Reaming of the Head:

After confirming the pin position, the triple reamer is adjusted the size after measuring with the direct measuring device. Then slowly reaming of the femoral head is done and stopped in front of subchondral bone.

Insertion of Lag Screw:

After tapping, the lag screw is fixed of proper length without piercing the subchondral bone, short barrel or long barrel is fixed according to the length of the lag screw.

Plate Attachment:

Length of the plate depends on the extension of the fracture line. Plate is fixed with cortical screws to the bone. Then traction is released and compression screw on the lag screw is applied. Wound closed in layers. Suction drain attached.

FIXATION WITH PROXIMAL FEMORAL NAILING

All 4 types of trochanteric fractures are fixed with proximal femoral nailing. Nail size and the size of the lag screws are measured preoperatively.

Patient Position:

Patient on fracture table in supine position with traction on injured limb. Other limb is flexed and abducted.

Reduction:

Reduction is done with the help of fluoroscopy. Fracture is reduced by adjusting to adduction and also rotation. Reduction is confirmed with fluoroscopy in both the views.

Draping done only after reduction of the fracture.

Incision made 3 to 4cm above greater trochanter adequate enough to make entry point. Entry point for this nail is the greater trochanter. Bone awl is used for the entry point. Once confirmed in both views, guide wire is inserted.

After checking the position of the guide wire in both the views, the adequate length nail is fixed.

Nail has proximally 2 holes for cancellous screws in the head. Incision is made for the fixation of 2 cancellous screws. First the antirotation screw is fixed and then larger lag screw is fixed. Length of both the screws is checked on both views. Proximal screw should be shorter than the distal lag screw.

Always distal locking should be done with help of cortical screws. Wound closure is done.

POSTOPERATIVE PROTOCOL

Dynamic Hip Screw:

Postoperative rehabilitation was decided by the stability of the fracture. In all types of trochanteric fractures with dynamic hip screw fixation, mobilization exercises started in day one. Touch down weight bearing by 10^{th} day.

Partial weight bearing allowed after radiological evidence of callus by 4-6 weeks. Full weight bearing is allowed only after radiological evidence of union.

Proximal Femoral Nailing:

In type-1, and type-2 fractures, postoperative rehabilitation started by starting mobilization exercises on post operative day one. Touch down weight bearing is started by 6th day. Partial weight bearing is started by 2-3 weeks with crutches. Full weight bearing is allowed only by radiological evidence of union. In type-3 and 4 fractures, partial weight bearing is allowed by 4-5 weeks. Full weight bearing only after full radiological union.

PITFALLS AND THEIR MANAGEMENT

Infection:

4 cases developed wound infection, 3 of them were superficial stitch abscess and one was deep infection. The treatment protocol for superficial infection was continuation of antibiotics and daily dressing. All 3 healed without complications.

A case of deep infection was treated with thorough irrigation, excision of slough and debridement of infective material with continuation of antibiotics sensitive to the organism. Once the wound started granulating secondary suture is done.

Malunion:

Malunion occurred in 2 cases. Since the patient was more than 60 years and his functional disability was minimal with existing malunion, his hip movements are painfree and good, they are left without any intervention.

Delayed Union:

Delayed union occurred in 2 cases. It took 5 months to get complete union in both these cases. Active physiotherapy is given regularly for delayed union.

Bed Sores:

It developed in one patient who has 70 years old. It was of grade-1 and it healed with proper dressing and antibiotics.

Limb Length Inequality:

Shortening of 1-2cm occurred in 5 patients, none of them had any functional deficit.

Lag Screw Pull out:

It occured in one patient due to early weight bearing and so implant is removed and active physiotherapy given.

OBSERVATIONS

This study comprised of 20 patients who were admitted in the department of orthopaedics Tirunelveli Medical College hospital. The following are the observations and the results compiled at the end of study.

Table No. 1:

AGE WISE DISTRIBUTION (n = 20)

Sl. No.	Age Group (in Years)	No. of Cases	Percentage (%)
1.	40 - 50 Yrs	2	10
2.	50 - 60 Yrs	4	20
3.	60 - 70 Yrs	8	40
4.	70 – 80 Yrs	6	30

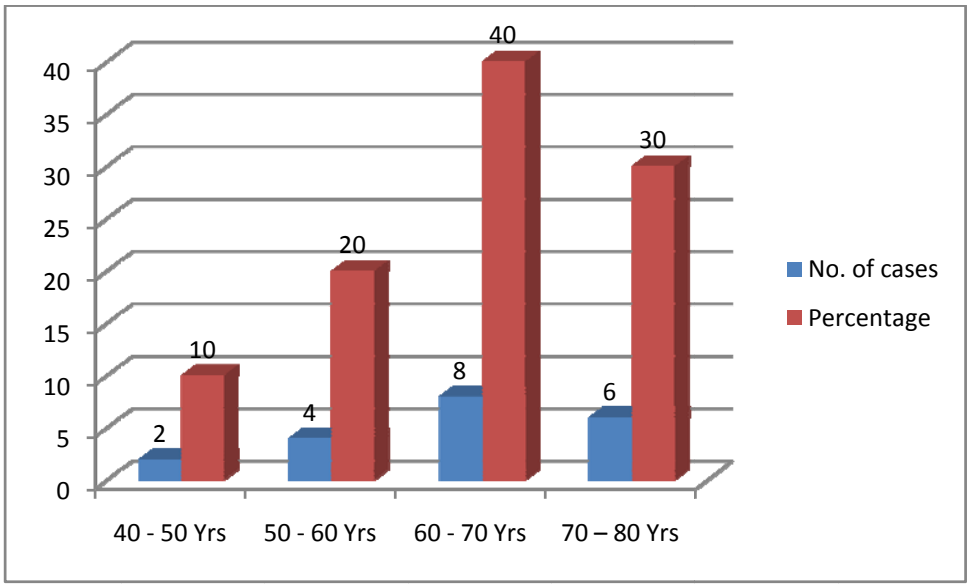


Table No. 2:

SEX WISE DISTRIBUTION (n = 20)

Sl. No.	Sex	No. of Cases	Percentage (%)
1.	Male	12	60
2.	Female	8	40

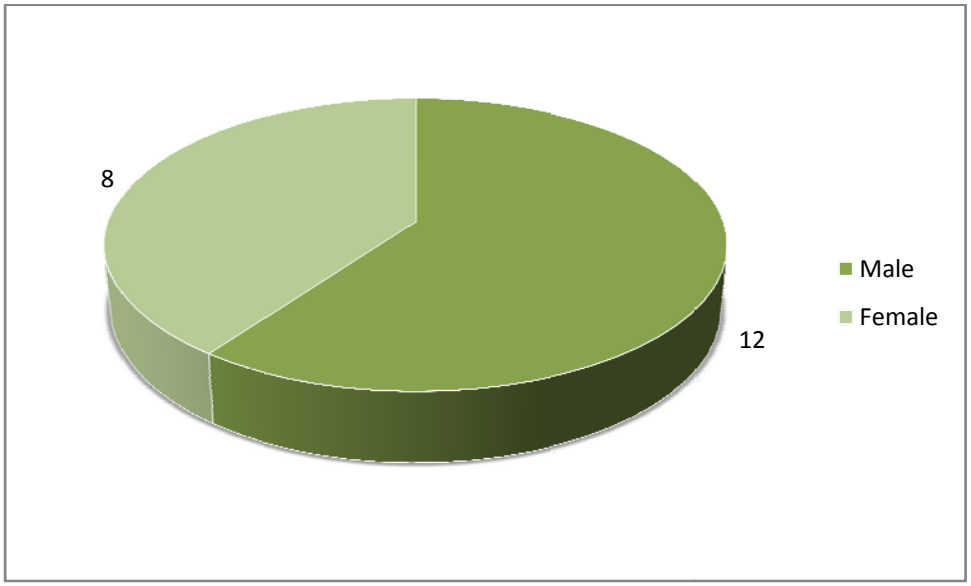


Table No. 3:

DISTRIBUTION ACCORDING TO MODE OF INJURY (n=20)

Sl. No.	Type of Injury	No. of Cases	Percentage (%)
1.	Fall Injury	12	60
2.	Road Traffic Accidents	6	30
3.	Fall of Heavy Objects	2	10

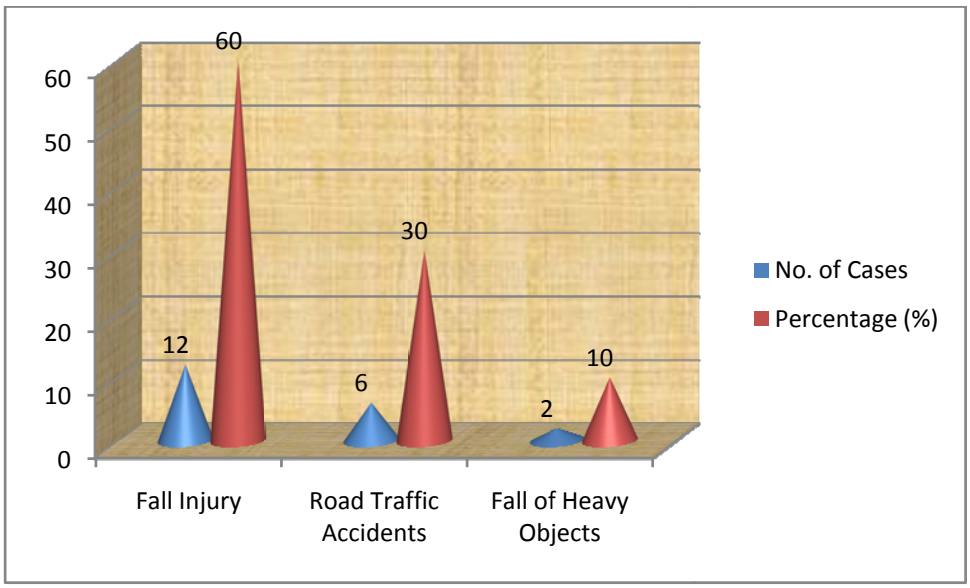
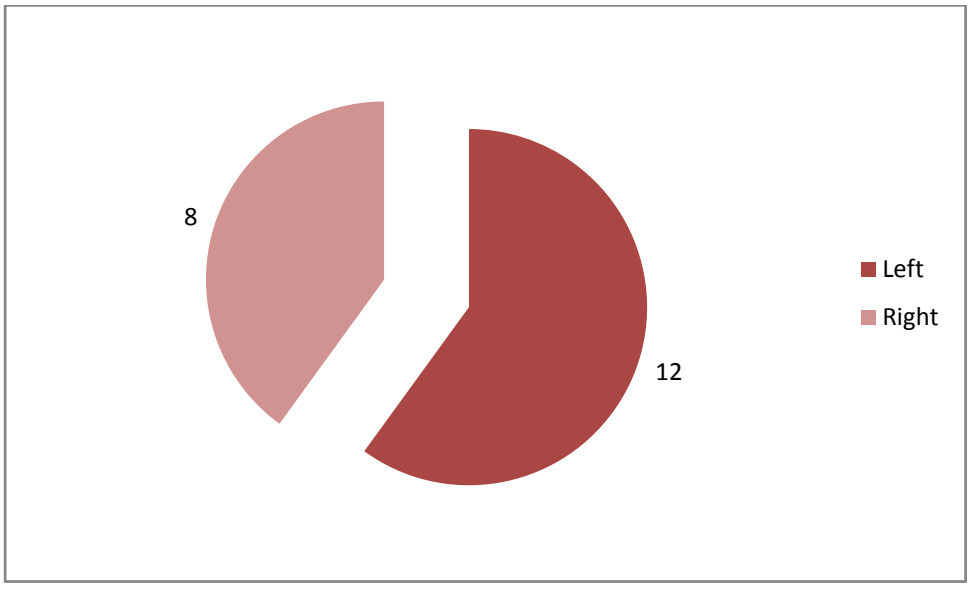


Table No. 4:

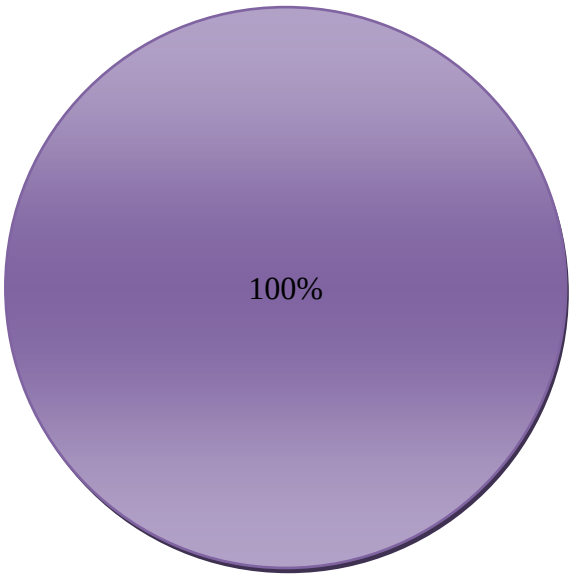
DISTRIBUTION ACCORDING TO THE SIDE (n = 20)

Sl. No.	Side	No. of Cases	Percentage (%)
1.	Left	12	60
2.	Right	8	40



TYPE OF FRACTURES

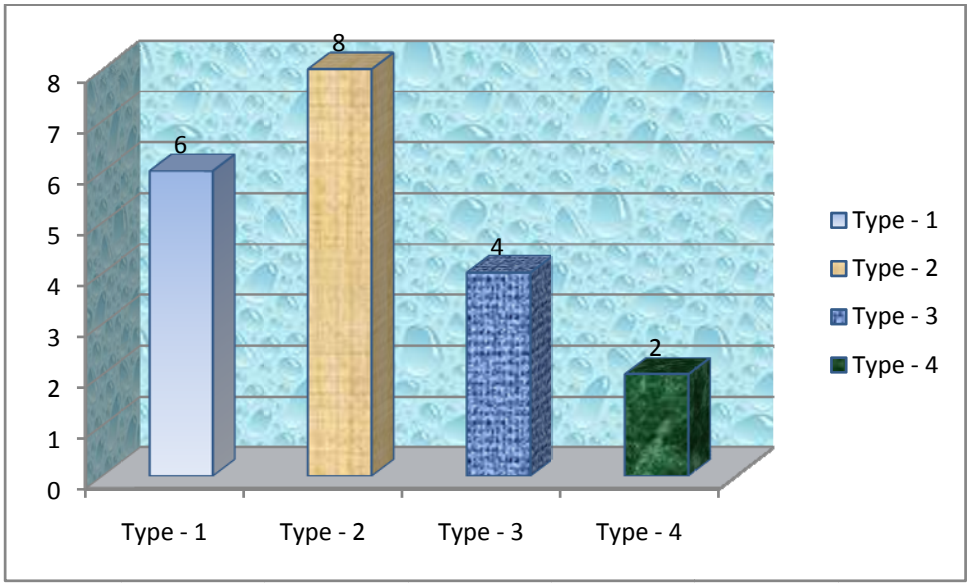
CLOSED 100%



CLASSIFICATION

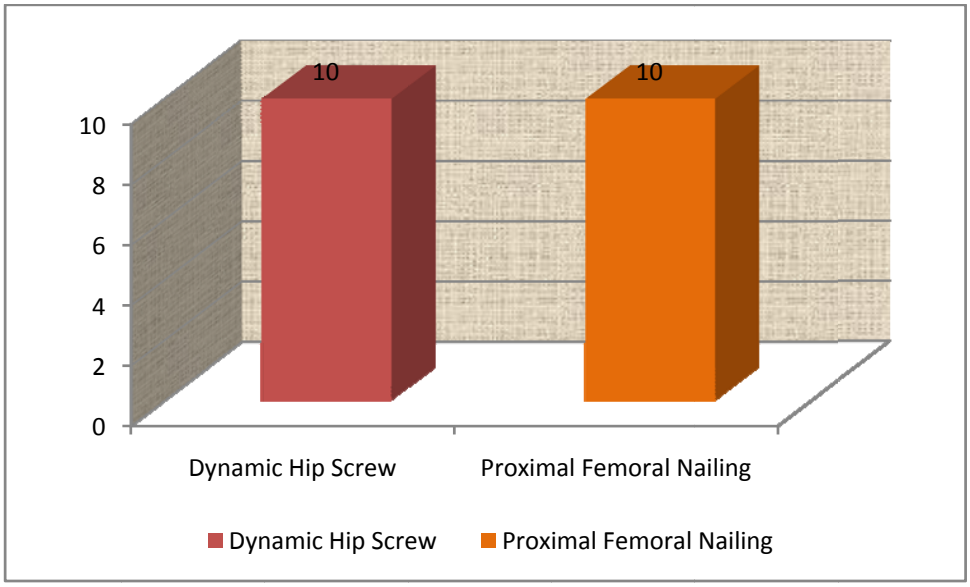
BOYD AND GRIFFIN CLASSIFICATION

Type	No. of Cases	Percentage
Type - 1	6	30%
Type - 2	8	40%
Type - 3	4	20%
Type - 4	2	10%



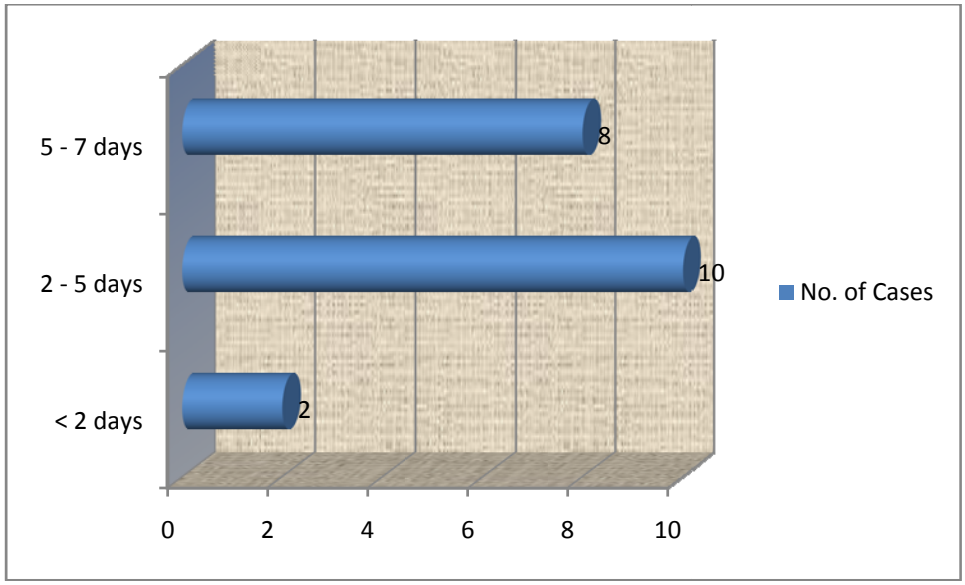
IMPLANT USED

Implant Used	No. of Cases
Dynamic Hip Screw	10
Proximal Femoral Nailing	10



TIME INTERVAL BETWEEN INJURY AND SURGERY

Time Interval	No. of Cases	Percentage
< 2 days	2	10%
2 - 5 days	10	50%
5 - 7 days	8	40%



ASSOCIATED INJURIES

Pubic Ramus Fractures are the most commonly associated fractures with intertrochanteric fractures.

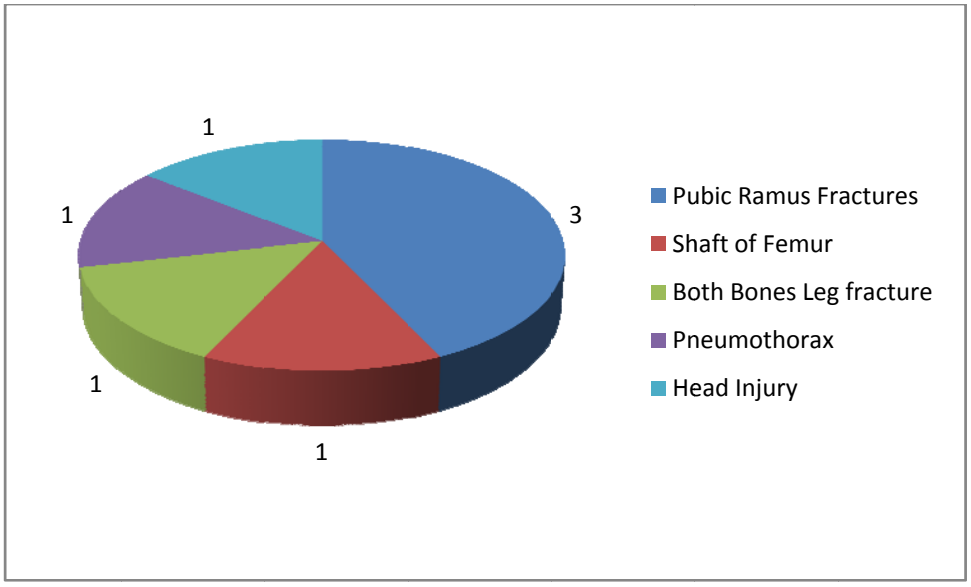
Pubic Ramus Fractures - 3 cases

Shaft of Femur - 1 case

Both Bones Leg fracture - 1 case

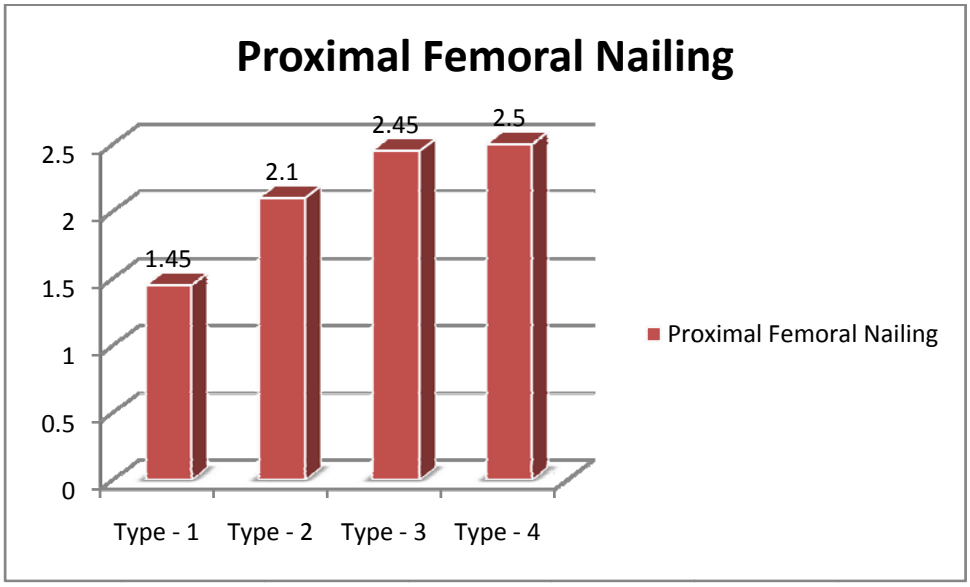
Pneumothorax - 1 case

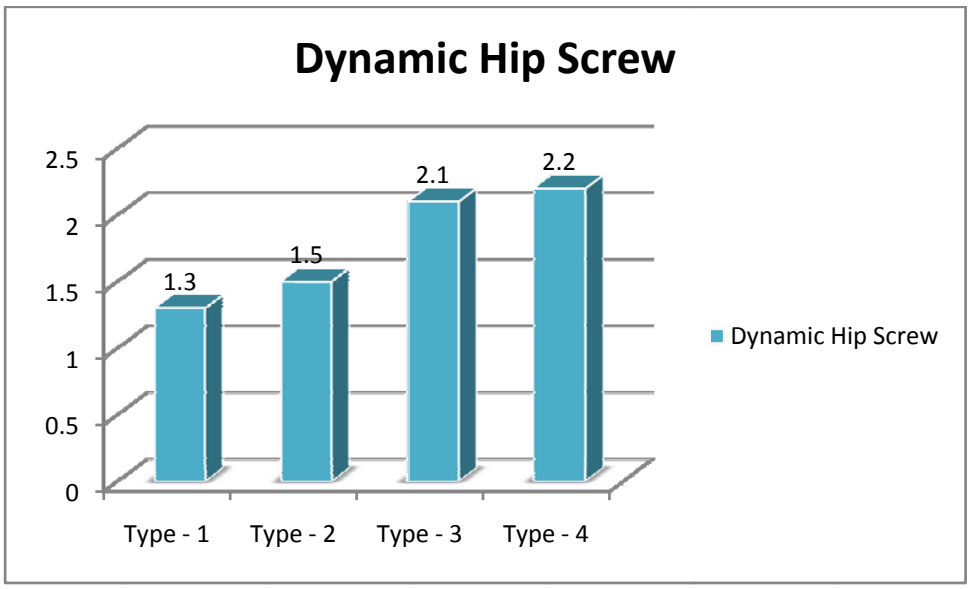
Head Injury - 1 case



OPERATING TIME

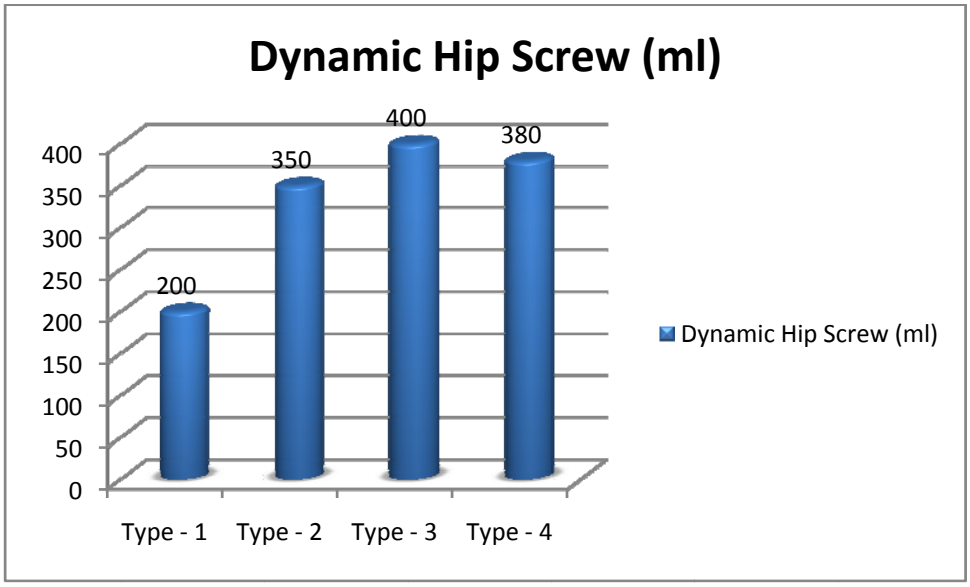
Operating Time	Proximal Femoral Nailing	Dynamic Hip Screw
Type - 1	1.45 Hrs	1.30 Hrs
Type - 2	2.10 Hrs	1.50 Hrs
Type - 3	2.45 Hrs	2.10 Hrs
Type - 4	2.50 Hrs	2.20 Hrs

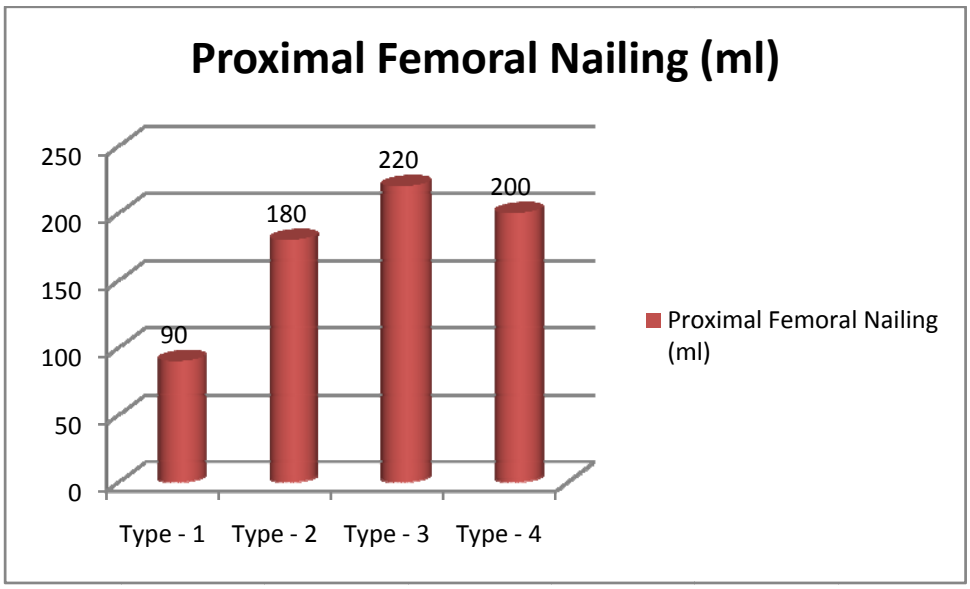




BLOOD LOSS

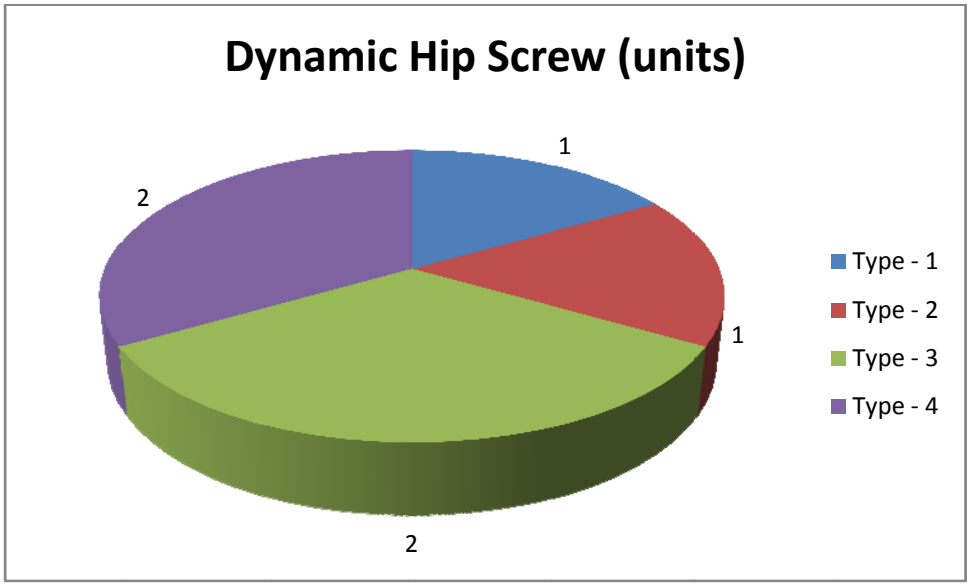
Blood Loss	Dynamic Hip Screw	Proximal Femoral Nailing
Type - 1	200ml	90ml
Type - 2	350ml	180ml
Type - 3	400ml	220ml
Type - 4	380ml	200ml

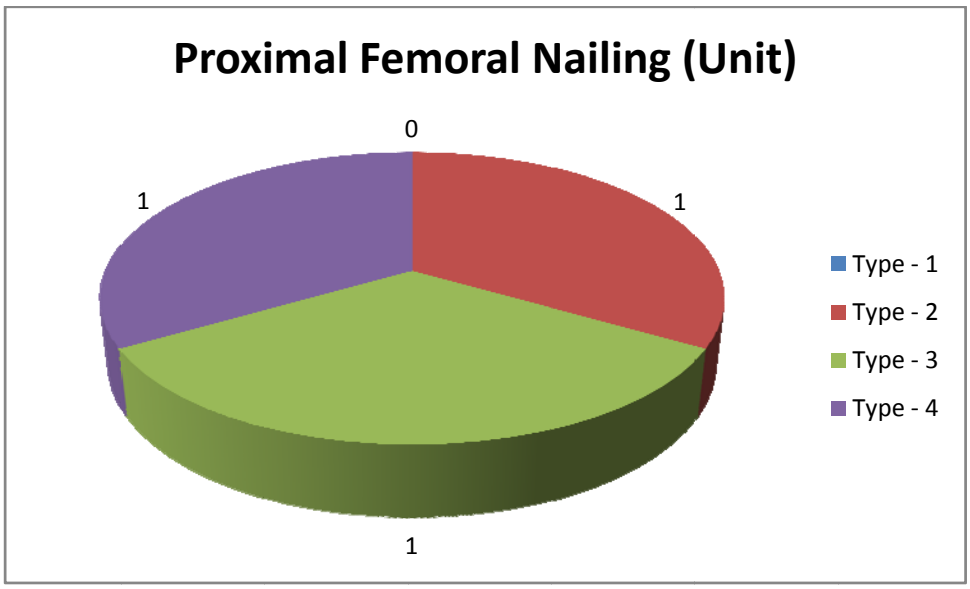




UNIT OF BLOOD TRANSFUSED

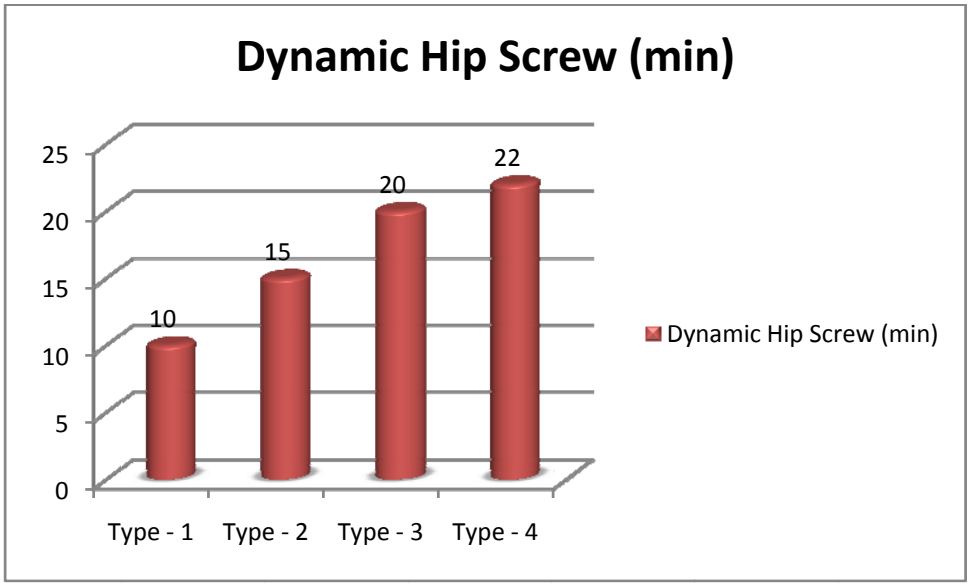
Blood Transfusion	Dynamic Hip Screw	Proximal Femoral Nailing
Type - 1	1 Unit	Nil
Type - 2	1 Unit	1 Unit
Type - 3	2 Units	1 Unit
Type - 4	2 Units	1 Unit

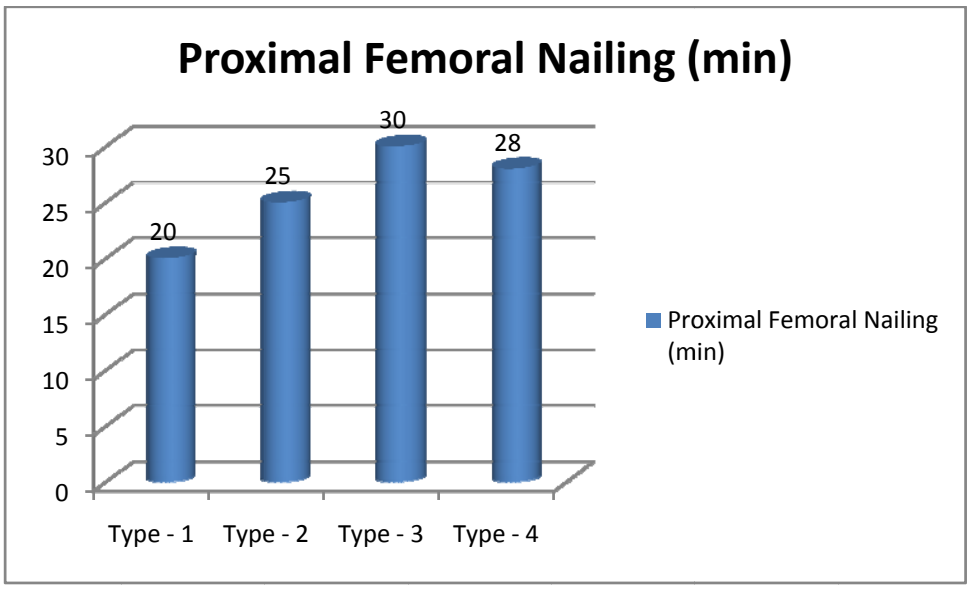




FLUROSCOPIC EXPOSURE

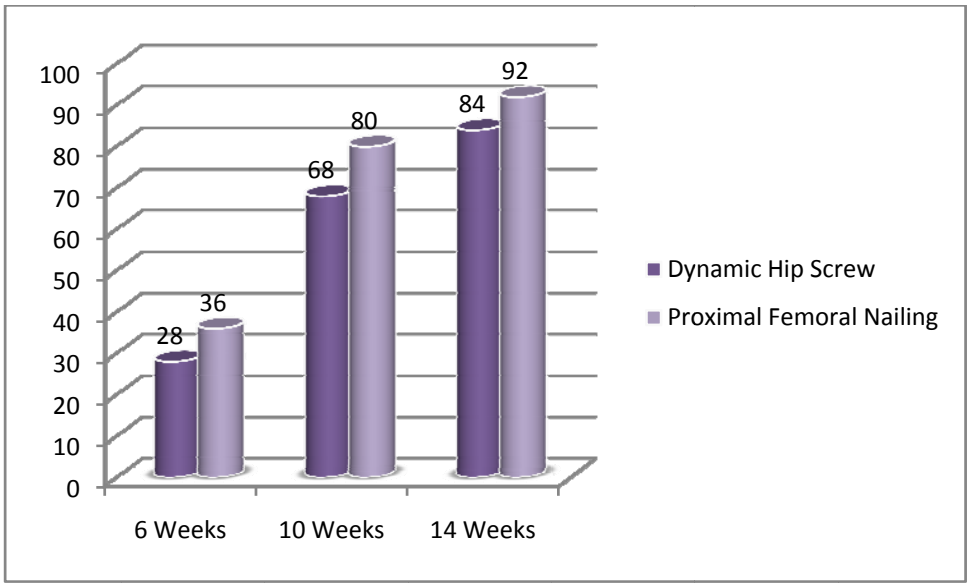
Exposure	Dynamic Hip Screw	Proximal Femoral Nailing
Type - 1	10 min	20 min
Type - 2	15 min	25 min
Type - 3	20 min	30 min
Type - 4	22 min	28 min





TIME OF UNION

Time	6 Weeks	10 Weeks	14 Weeks
Dynamic Hip Screw	28%	68%	84%
Proximal Femoral Nailing	36%	80%	92%



FUNCTIONAL OUT COME

HARRIS HIP SCORE

Pain (maximum score 44)

- ☐ None or ignores it (44)
- ☐ Slight, Occasional, no compromise in activities (40)
- ☐ Mild pain, no effect on average activities, rarely moderate pain with unusual activity; may take aspirin (30)
- ☐ Moderate pain, tolerable but makes concession to pain. Some limitation of ordinary activity or work. May require Occassional pain medication stronger than aspirin (20)
- ☐ Marked pain, serious limitation of activities (10)
- ☐ Totally disabled, crippled, pain in bed, bedridden (0)

Limp (maximum score 11)

- ☐ None (11)
- ☐ Slight (8)
- ☐ Moderate (5)
- ☐ Severe (0)

Support (maximum score 11)

- ☐ None (11)
- ☐ Cane for long walks (7)
- ☐ Cane most of time (5)
- ☐ One Crutch (3)
- ☐ Two canes (2)
- ☐ Two crutches or not able to walk (0)

Distance Walked (maximum score 11)

- ☐ Unlimited (11)
- ☐ Six blocks (8)
- ☐ Two or Three blocks (5)
- ☐ Indoors only (2)
- ☐ Bed and Chair only (0)

Sitting (maximum score 5)

- ☐ Comfortably in ordinary chair for one hour (5)
- ☐ On a high chair for 30 minutes (3)
- ☐ Unable to sit comfortably in any chair (0)

Enter Public Transportation (maximum score 1)

- ☐ Yes (1)
- ☐ No (0)

Stairs (maximum score 4)

- ☐ Normally without using a railing (4)
- ☐ Normally using a railing (2)
- ☐ In any manner (1)
- ☐ Unable to do stairs (0)

Put on Shoes and socks (maximum score 4)

- ☐ With ease (4)
- ☐ With difficulty (2)
- ☐ Unable (0)

Absence of Deformity (All yes = 4; Less than 4 = 0) (maximum score 4)

Less than 30^o fixed flexion contracture	☐ Yes	☐ No
Less than 10^o fixed abduction	☐ Yes	☐ No
Less than 10^o fixed internal rotation in extension	☐ Yes	☐ No
Limb length discrepancy less than 3.2cm	☐ Yes	☐ No

Range of Motion (* indicates normal)

Flexion (*140^o) _____

Abduction (*40^o) _____

Adduction (*40^o) _____

External Rotation (*40^o) _____

Internal Rotation (*40^o) _____

Range of Motion Scale (maximum score 5)

211^o - 300^o (5)	61^o - 100^o (2)
161^o - 210^o (4)	31^o - 60^o (1)
101^o - 160^o (3)	0^o - 30^o (0)

Range of Motion Score: _____

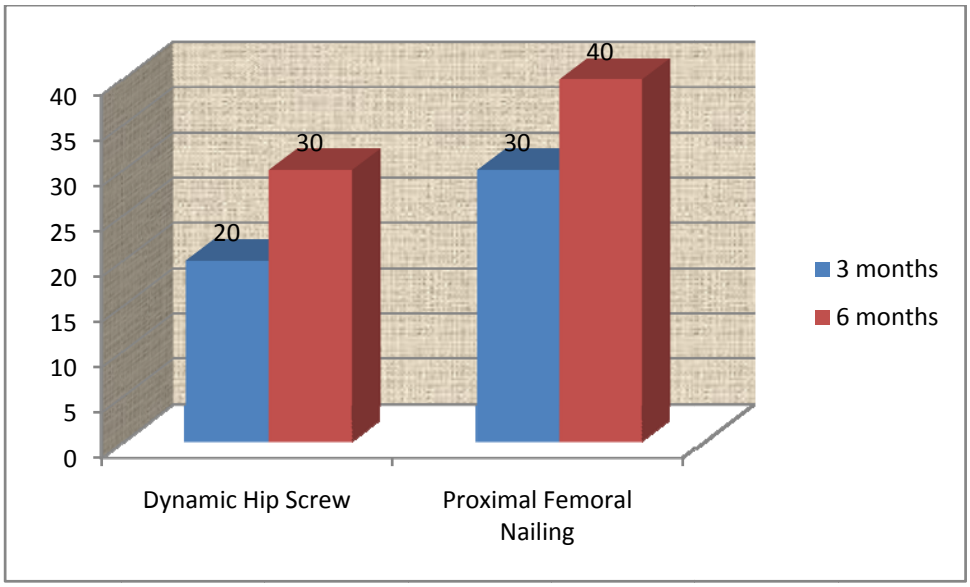
Total Harris Hip Score: Maximum score 100

POSTOPERATIVE FOLLOW UP

HARRIS HIP SCORE

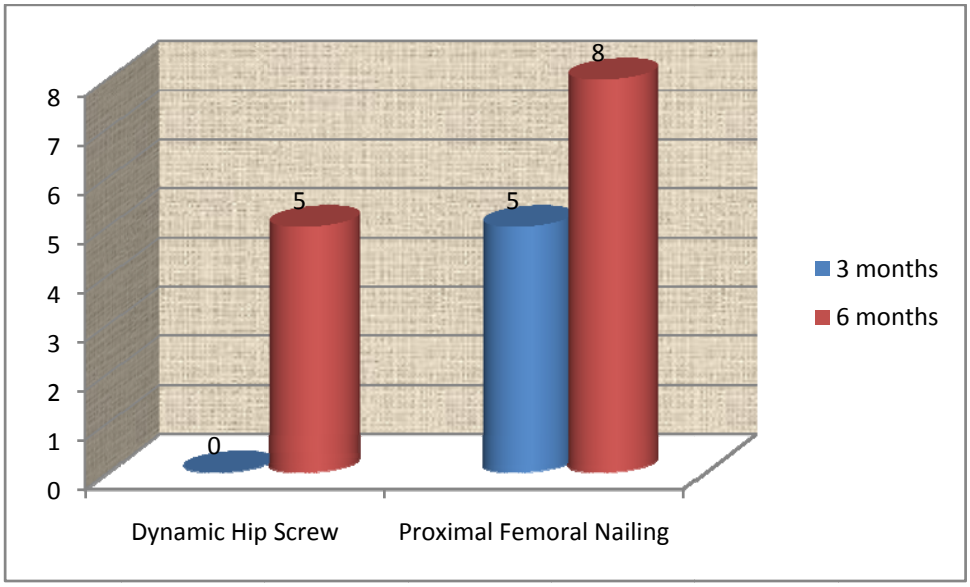
PAIN - MAX SCORE - 44

Months	Dynamic Hip Screw	Proximal Femoral Nailing
3 months	20	30
6 months	30	40



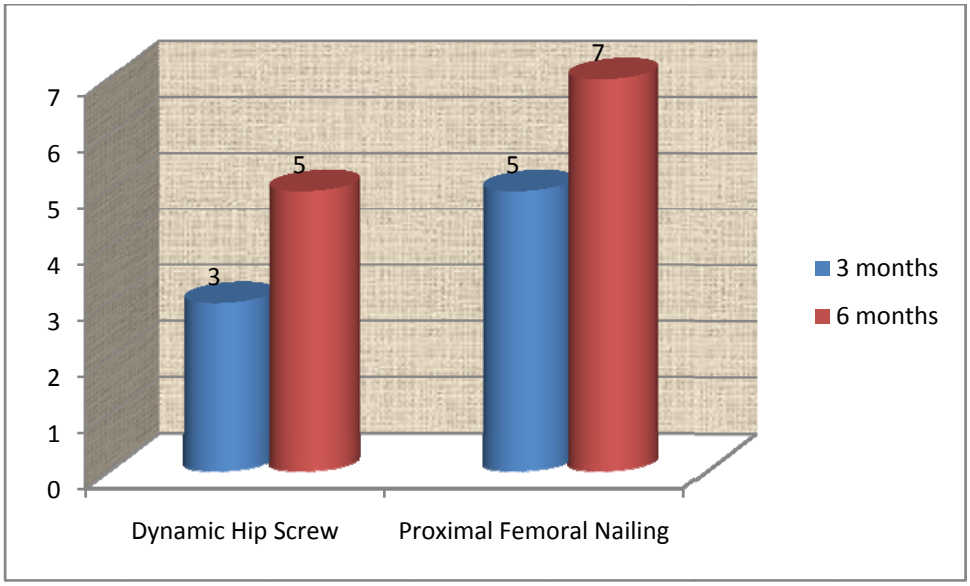
LIMP - MAX SCORE – 11

Months	Dynamic Hip Screw	Proximal Femoral Nailing
3 months	0	5
6 months	5	8



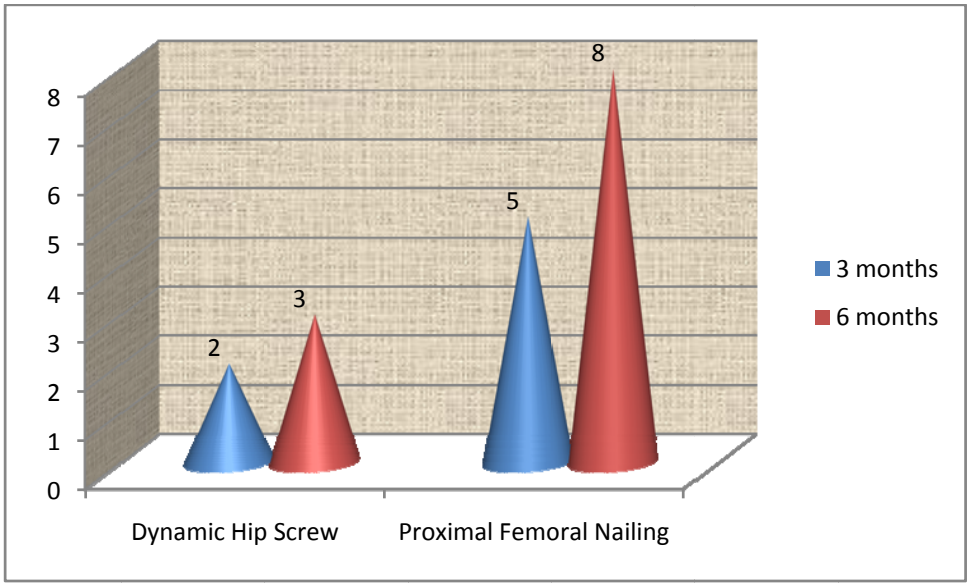
SUPPORT - MAX SCORE 11

Months	Dynamic Hip Screw	Proximal Femoral Nailing
3 months	3	5
6 months	5	7



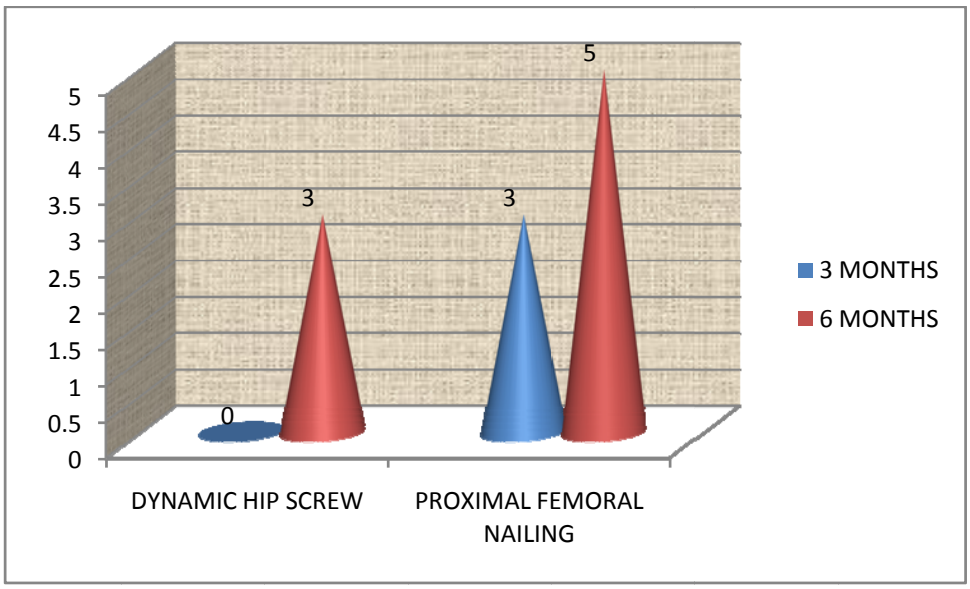
DISTANCE WALKED - MAX SCORE 11

Months	Dynamic Hip Screw	Proximal Femoral Nailing
3 months	2	5
6 months	3	8



SITTING MAX SCORE - 5

MONTHS	DYNAMIC HIP SCREW	PROXIMAL FEMORAL NAILING
3 MONTHS	0	3
6 MONTHS	3	5

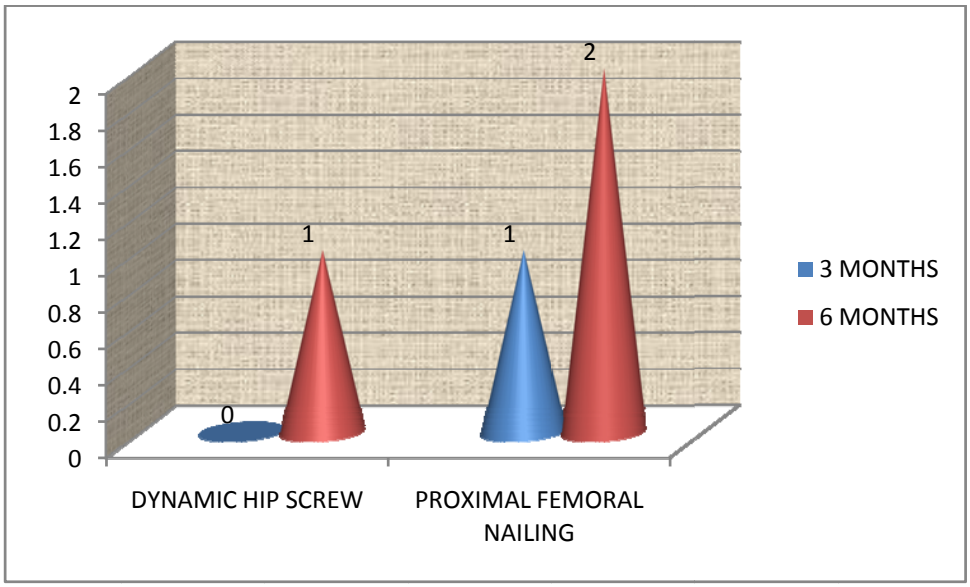


PUBLIC TRANSPORT USE - MAX SCORE 1

Months	Dynamic Hip Screw	Proximal Femoral Nailing
3 months	0	0
6 months	1	1

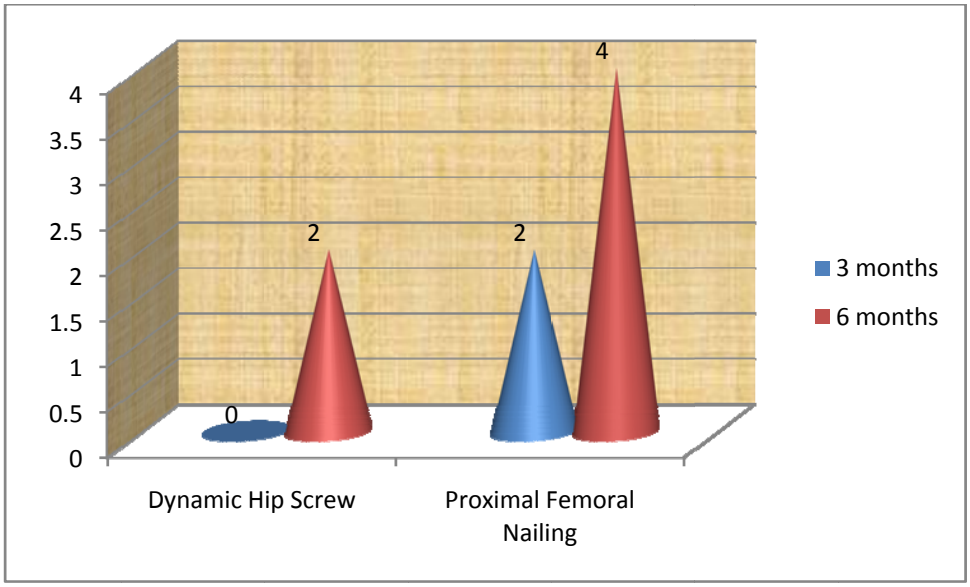
STAIRS MAX SCORE - 4

MONTHS	DYNAMIC HIP SCREW	PROXIMAL FEMORAL NAILING
3 MONTHS	0	1
6 MONTHS	1	2



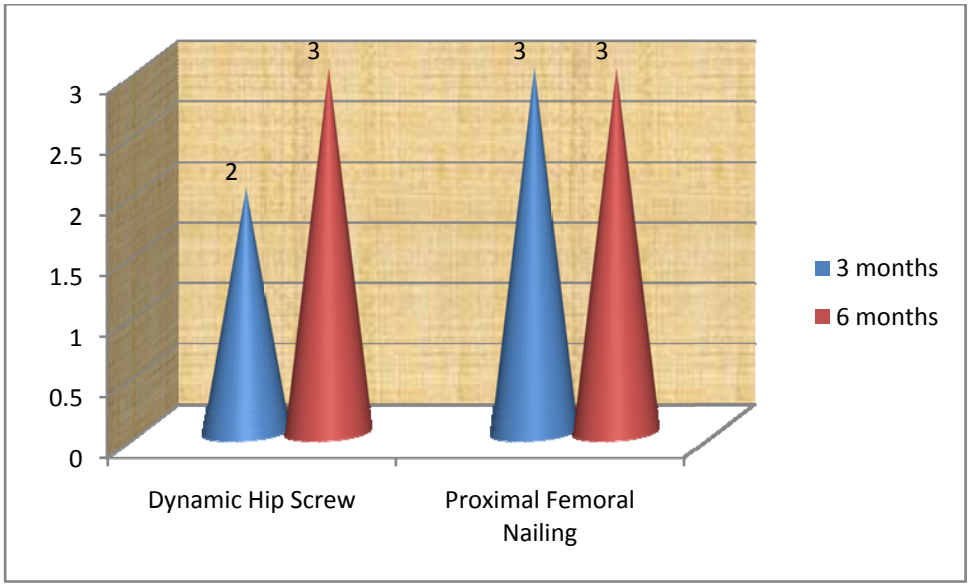
PUT ON SHOES AND CHAPPELS – MAX SCORE 4

Months	Dynamic Hip Screw	Proximal Femoral Nailing
3 months	0	2
6 months	2	4



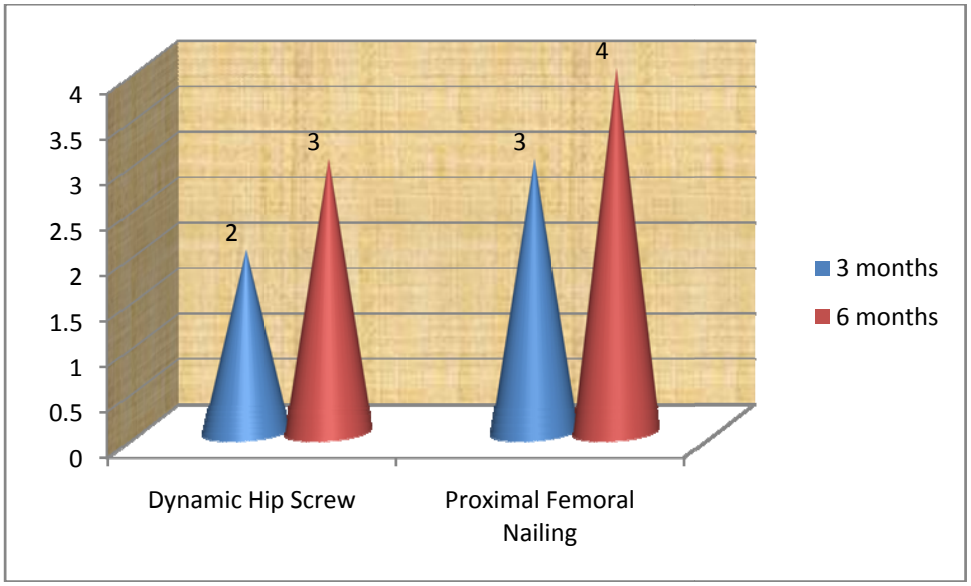
ABSENCE OF DEFORMITY - MAX SCORE 4

Months	Dynamic Hip Screw	Proximal Femoral Nailing
3 months	2	3
6 months	3	3



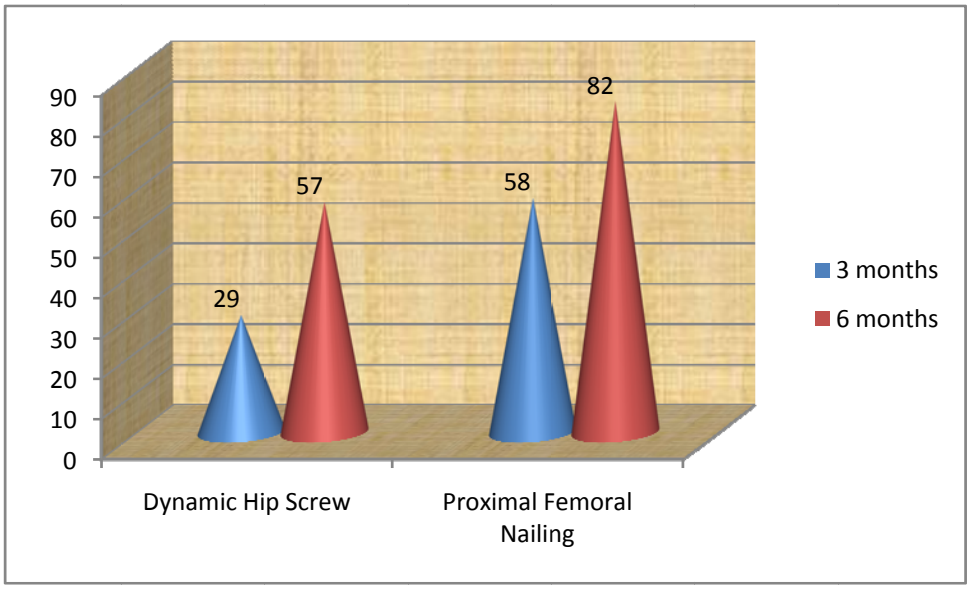
RANGE OF MOTION - MAX SCORE 5

Months	Dynamic Hip Screw	Proximal Femoral Nailing
3 months	2	3
6 months	3	4



TOTAL HARRIS HIP SCORE

Months	Dynamic Hip Screw	Proximal Femoral Nailing
3 months	29	58
6 months	57	82

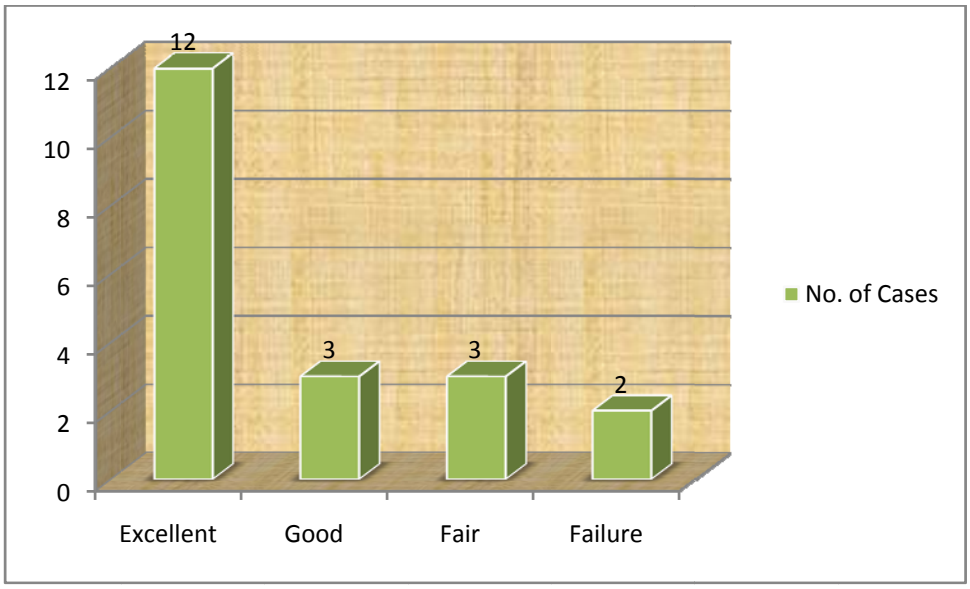


ANALYSIS OF FUNCTIONAL OUTCOME

The rating system followed was that of Harris Hip Score which taken into account pain, movement, function, shortening and angulation. This system is easy to follow and analyse. Others systems are more confusing and takes multiple factors for analysis.

OVERALL RESULTS

Grading	No. of Cases	Percentage
Excellent	12	60%
Good	3	15%
Fair	3	15%
Failure	2	10%



RESULTS ACCORDING TO SUBTYPE

Types	Grading
Type - 1	Excellent to Fair
Type - 2	Excellent to Fair
Type - 3	Excellent to Failure
Type - 4	Excellent to Failure

RESULTS ACCORDING TO THE IMPLANT USED

Implant	No. of Cases	Grading	Percentage
Dynamic Hip Screw	6	Excellent	60%
	2	Good	20%
	1	Fair	10%
	1	Failure	10%
Proximal Femoral Nail	7	Excellent	70%
	1	Good	10%
	1	Fair	10%
	1	Failure	10%

DISCUSSION

The aim of study is to evaluate the functional outcome of the fixation of intertrochanteric fractures fixed with both dynamic hip screw and proximal femoral nailing.

We selected 20 cases of intertrochanteric fractures during the time of July 2008 to September 2010. All 4 types of intertrochanteric fractures are included. We had 6 cases of type-1, 8 cases of type-2, 4 cases of type-3, and 2 cases of type-4 fractures. 3 cases of type-1, 4 cases of type-2, 2 cases of type-3, and 1 case of type-4 fractures. Two groups each were fixed with dynamic hip screw and proximal femoral nailing for each groups consisting of 10 cases.

10 cases were fixed with dynamic hip screw and 10 cases were fixed with proximal femoral nailing. The youngest patient in our series is 45 years and oldest patient in our series is 75 years. Average age is 60 years.

We had 12 male cases and 8 female cases. With a ratio of 1.5:1. All the 20 cases were closed fractures. Most common mode of injury is accidental fall injury. In our study we had 12 cases right sided and 8 cases left sided.

Most common associated injuries are 3 public ramus fractures. Others are 1 shaft of femur, 1 both bones leg fractures, 1 pneumothorax and 1 head injury.

Duration between injury and hospitalization, 10 cases were between 6-12 hrs and 7 cases were more than 12 hours, 2 cases were within 3-6 hrs and 1 case within 3 hrs.

All cases were evaluated with x-ray pelvis with both hips anteroposterior view and the affected hip were both anteroposterior and lateral views.

Routine blood investigations with ECG and x-ray chest also taken for assessment for surgery. Traction and internal rotation special view is also taken for the study of the fracture fragments for fixation plan. All 4 types of fractures are fixed with both types of fixation. All fractures are fixed by lateral approach. Preoperative antibiotics are given before surgery. Dynamic hip screw fixation is by lateral approach with fixation of cancellous screw in the femoral head with the side plate to the shaft. Proximal femoral nailing incision is more smaller just for entry point and screw fixation. 2 cancellous screws, one as lag screw and one as hip pin with distal locking in the shaft. Each step of fixation in both these methods is checked with help of fluoroscopy in both anteroposterior and lateral views.

Operating time is longer for proximal femoral nailing than dynamic hip screw fixation. Type-3 and 4 fractures have longer operative time. Blood loss is more for type-3 and 4 fractures and also for dynamic hip screw fixation. 2 units of blood transfusion done for type-3 and 4 fractures. Rest are given only 1 unit and mainly 2 units are given for dynamic hip screw fixation. Fluroscopic exposure is more for the proximal femoral nailing than dynamic hip screw.

Duration of postoperative stay is 12 days for dynamic hip screw and 6 days proximal femoral nailing. All postoperative cases were started with mobilization on first postoperative day itself. Postoperative x-ray is taken and checked for the fixation.

Time of union for dynamic hip screw fixation at 6 weeks is 28%, 10 weeks is 68% and 14 weeks is 84%. Time of union for proximal femoral nailing at 6 weeks is 36%, 10 weeks 80% and 14 weeks is 92%. Full weight bearing allowed only after evidence of full radiological union.

Postoperative outcome of both fixation is measured by Harris Hip Score. Pain is mild in proximal femoral nailing compared to dynamic hip screw nailing. Limping is less in proximal femoral nailing. Support distance walked, using public transport, absence of deformity, sitting, using stairs, range of motion are better in proximal femoral nailing in both 3 and 6 months of follow up using harris hip score than dynamic hip screw.

Functional out come is excellent in 12 cases, good in 3 cases, fair in 3 cases and failure in 2 cases. Type-1 and 2 fractures have excellent to fair results. Type-3 and 4 fractures have excellent to failure results. Dynamic hip screw has 60% excellent results, whereas proximal femoral nailing has 70% excellent results.

Postoperative complications was infection in 4 cases, malunion in 2 cases, delayed union in 2 cases, bed sores in 1 patient, limb length inequality in 5 patients, none of them had any funcitonal deficit, lag screw pull out in one case.

No vascular and neurological complications were noted in these 20 cases.

In our study, outcome of fixation is studied extensively from operation table till full union function till 6 months of follow up.

CONCLUSION

In the present study assessing the functional outcome of intertrochanteric fractures, we reached the following conclusions.

1. Intertrochanteric fractures commonly occur in men around age of 6th decade due to accidental fall injury.
2. Conventional radiographs are not essential to study the fracture pattern, traction and internal rotation view is needed to classify the fractures.
3. Boyd and Griffin classification is essential for classification of intertrochanteric fractures.
4. Fracture stabilization by rigid internal fixation by both methods results in early functional recovery and early ambulation. Perfect anatomical reduction gives excellent results.
5. Blood loss and unit of blood transfusion is less in case of proximal femoral nailing compared with dynamic hip screw.
6. Operative time is longer in proximal femoral nailing than dynamic hip screw.
7. Fluroscopic exposure is longer for proximal femoral nailing than dynamic hip screw.
8. Duration of postoperative stay is longer in dynamic hip screw than proximal femoral nailing.

9. Results of both fixation are better in type-1 and 2 fractures compared with type-3 and 4 fractures.
10. Union rates are also better in type-1 and 2 fractures with both fixation than type-3 and 4 fractures.
11. Postoperative follow up was measured by Harris Hip Score for a follow up of 3 and 6 months.
12. Pain, limp, support, distance walked, sitting, public transport, walking stairs, put chapels, absence of deformity. All these factors are better in proximal femoral nailing for 3 and 6 months follow up than dynamic hip screw.

ADVANTAGES OF PROXIMAL FEMORAL NAILING

1. Less blood loss and blood transfusion.
2. Early weight bearing.
3. Union results better in all 4 types of trochanteric fractures.
4. Postoperative complication is less.
5. Postoperative functional mobility is better.

ADVANTAGES OF DYNAMIC HIP SCREW

1. Less operative time.
2. Shorter fluoroscopic time.
3. Screw pull out is less. <no z-effect>

In our series, proximal femoral nailing has better results than dynamic hip screws. Proximal femoral nailing has better union rates and functional results than dynamic hip screw. It has very good results even in type-1 and 2 stable fractures. Introperative and postoperative complications are less in proximal femoral nailing. But disadvantages is screw pullout <z-effect> is seen and also the operative time and fluoroscopic time is longer which is hazardous to the patient.

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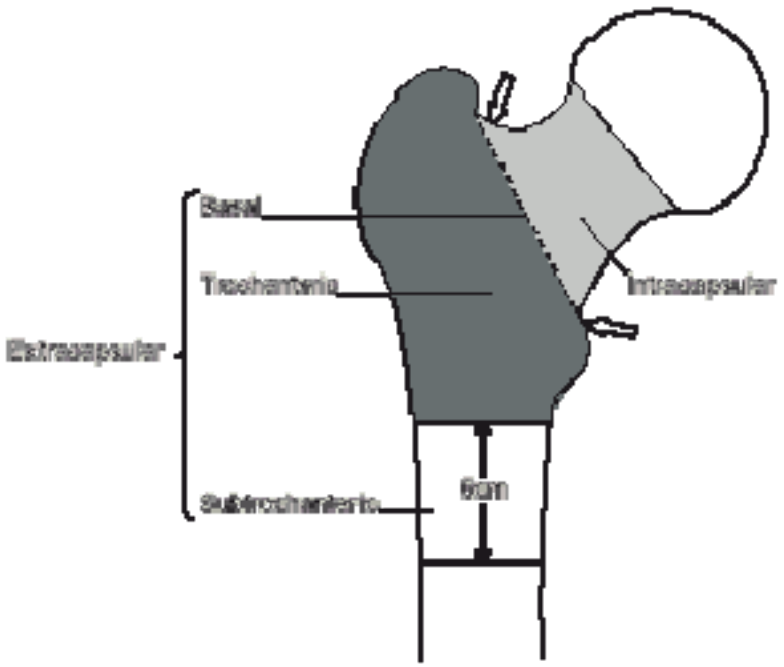
MASTER CHART
DYNAMIC HIP SCREWS

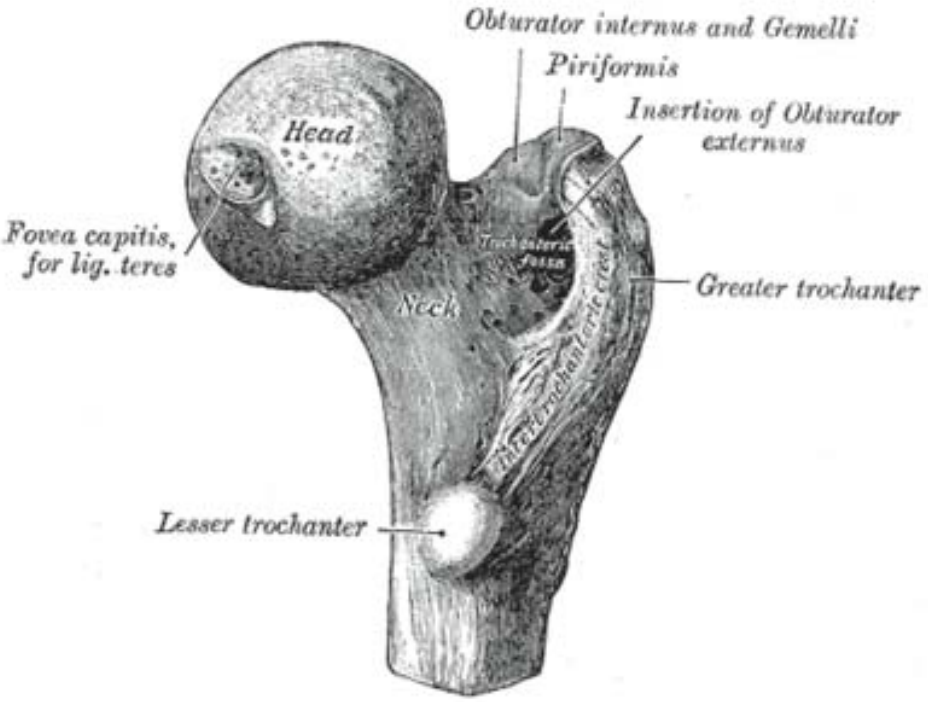
S. NO.	AGE/ SEX	BODY/ GRIFFIN CLASSIFICATION TYPE	MODE OF INJURY	SIDE	ASSOCIATED INJURIES	INTERNAL BETWEEN INJURY & SURGERY	TYPE OF FUNCTION	OPERATION TIME	BLOOD LOSS	FURROSIVE EXPOSURE	COMPLIC-ATIONS	TIME OF UNION (14weeks)	HARRIS H/P SCORE MAX SCORE -100 (6MONTHS)
1.	63 / M	I	FALL INJURY	RIGHT	NIL	5 DAYS	DHS	1.30 HRS	200ML	12 MIN	SHORTENING	78%	61
2.	73 / M	III	FALL INJURY	LEFT	NIL	3 DAYS	DHS	2.20 HRS	420 ML	22 MIN	INFECTION	71%	64
3.	65 / M	II	FALL INJURY	RIGHT	START OF FEVER,FRACTURE	7 DAYS	DHS	1.50 HRS	330 ML	17 MIN	MALUNION	76%	59
4.	74 / M	I	RTA	LEFT	NIL	6 DAYS	DHS	1.30 HRS	190 MIL	24 MIN	NIL	83%	68
5.	64 / M	II	FALL INJURY	RIGHT	PULIC FRACTURE	4 DAYS	DHS	1.40 HRS	360 ML	15 MIN	INFECTION	74%	72
6.	58 / M	III	RTA	LEFT	NIL	1 DAY	DHS	2.10 HRS	310 ML	18 MIN	DELAYED UNION	80%	71
7.	47 / M	II	HEAVY OBJECT FALL	RIGHT	NIL	3 DAYS	DHS	1.50 HRS	370 ML	18 MIN	INFECTION	78%	64
8.	73 / M	II	FALL INJURY	LEFT	NIL	4 DAYS	DHS	1.40 HRS	310 ML	15 MIN	SHORTENING	75%	68
9.	68 / M	IV	RTA	LEFT	PUBLIC RAN FRACTURE	6 DAYS	DHS	2.20 HRS	380 ML	22 MIN	SHORTENING	76%	65
10.	75 / M	I	FALL INJURY	LEFT	NIL	5 DAYS	DHS	1.35 HRS	210 ML	10 MIN	NIL	77%	70

PROXIMAL FEMORAL NAILING

S. NO.	AGE/ SEX	BODY/ GRIFFIN CLASSIFICATION TYPE	MODE OF INJURY	SIDE	ASSOCIATED INJURIES	INTERNAL BETWEEN INJURY & SURGERY	TYPE OF FIXATION	OPERATION TIME	BLOOD LOSS	FURROSIVE EXPOSURE	COMPLIC-ATIONS	TIME OF UNION (14weeks)	HARRIS H/P SCORE MAX SCORE -100 (6MONTHS)
11.	56 / M	I	FALL INJURY	LEFT	LEG BONES LEG FRACTURE	6 DAYS	PFN	1.45 HRS	90 ML	20 MIN	NIL	89%	88
12.	67 / M	II	FALL INJURY	RIGHT	NIL	1 DAY	PFN	2.10 HRS	190 ML	25 MIN	DELAYED UNION	86%	84
13.	78 / M	I	RTA	LEFT	NIL	2 DAYS	PFN	1.35 HRS	80 ML	18 MIN	SHORTENING	79%	83
14.	44 / M	III	FALL INJURY	LEFT	PUBLIC RAWS FRACTURE	5 DAYS	PFN	2.45 HRS	220 ML	35 MIN	INFECTION	81%	88
15.	66 / M	I	FALL INJURY	RIGHT	NIL		PFN	1.55 HRS	86 ML	22 MIN	SHORTENING	94%	94
16.	53 / M	II	HEAVY OBJECT FALL	LEFT	PNE	7 DAYS	PFN	2.20 HRS	180 ML	27 MIN	MALUNION	83%	89
17.	61 / M	II	RTA	RIGHT		3 DAYS	PFN	2.15 HRS	170 ML	29 MIN	NIL	93%	83
18.	70 / M	II	FALL INJURY	LEFT	HEAD INJURY	6 DAYS	PFN	2.00 HRS	160 ML	26 MIN	BED SORE	81%	81
19.	63 / M	III	RTA	RIGHT	NIL	5 DAYS	PFN	2.40 HRS	220 ML	62 MIN	NIL	90%	79
20.	59 / M	IV	FALL INJURY	LEFT	NIL	4 DAYS	PFN	2.50 HRS	200 ML	28 MIN	LAG SCREW PULL OUT	84%	76

ANATOMY OF PROXIMAL FEMUR



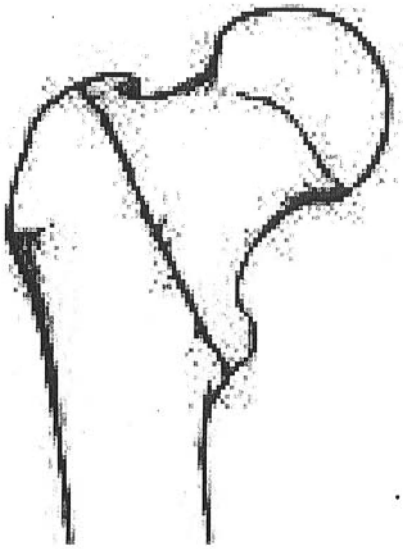


DYNAMICS HIP SCREW AND PLATE

PROXIMAL FEMORAL NAIL

BOYD AND GRIFFIN CLASSIFICATION

TYPE I



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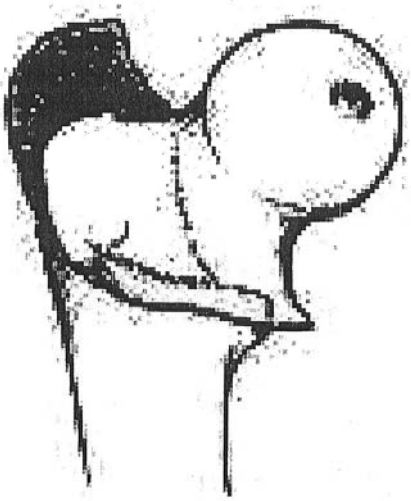

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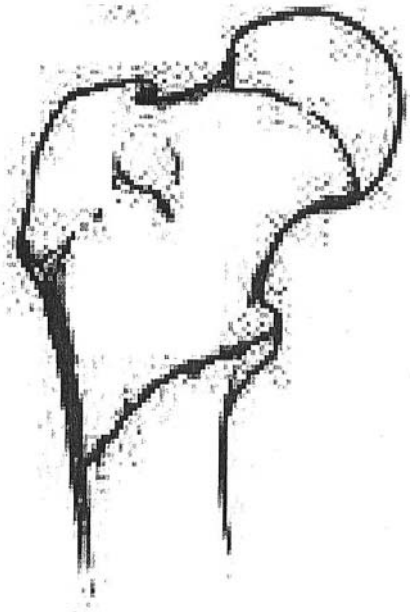
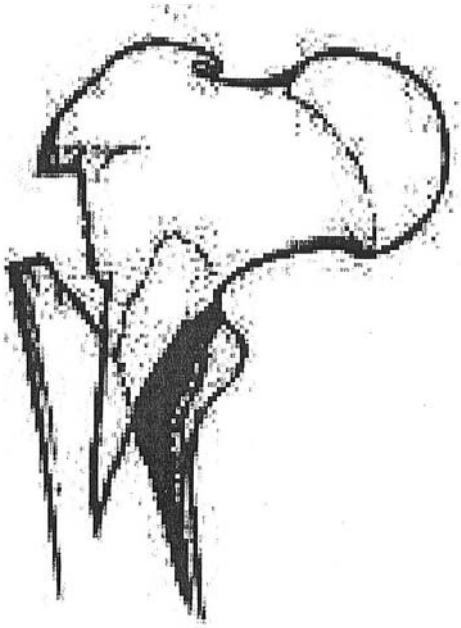
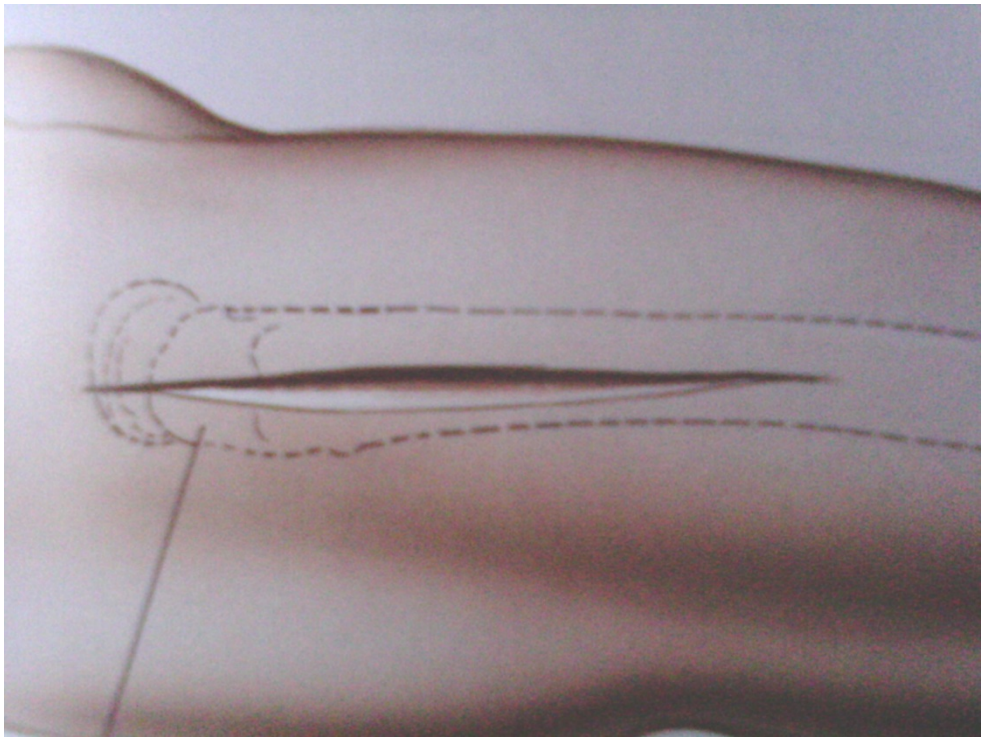


TYPE IV

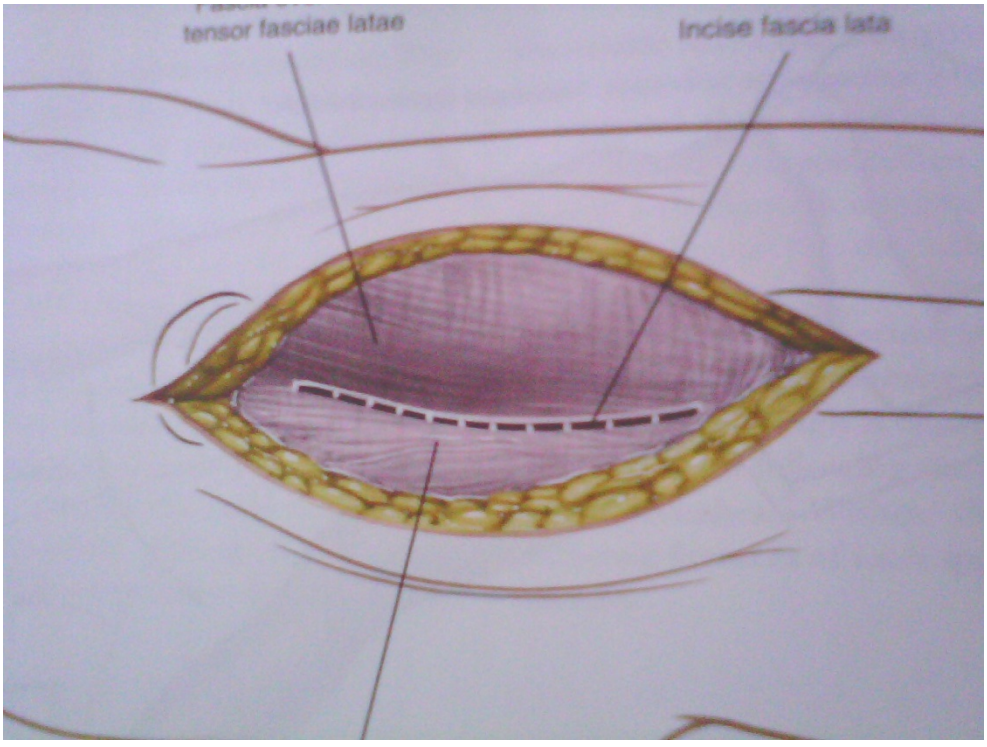


SURGICAL INCISION

STEP 1



STEP 2



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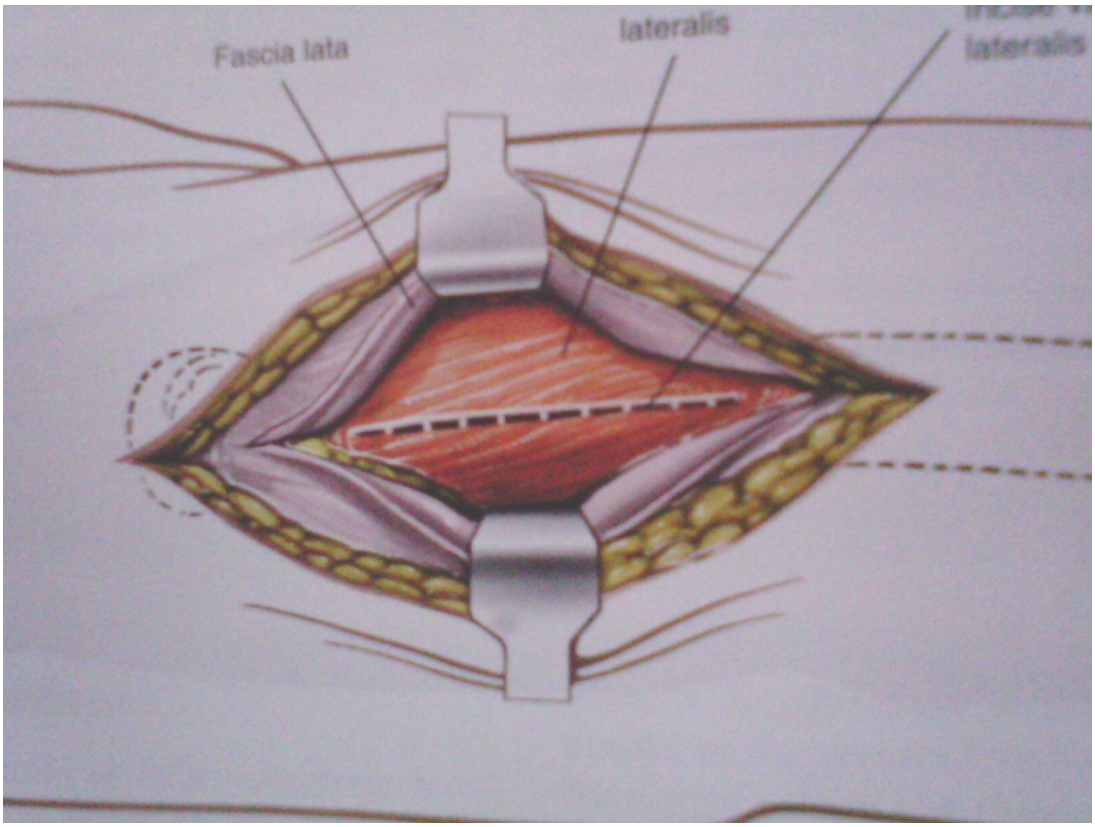
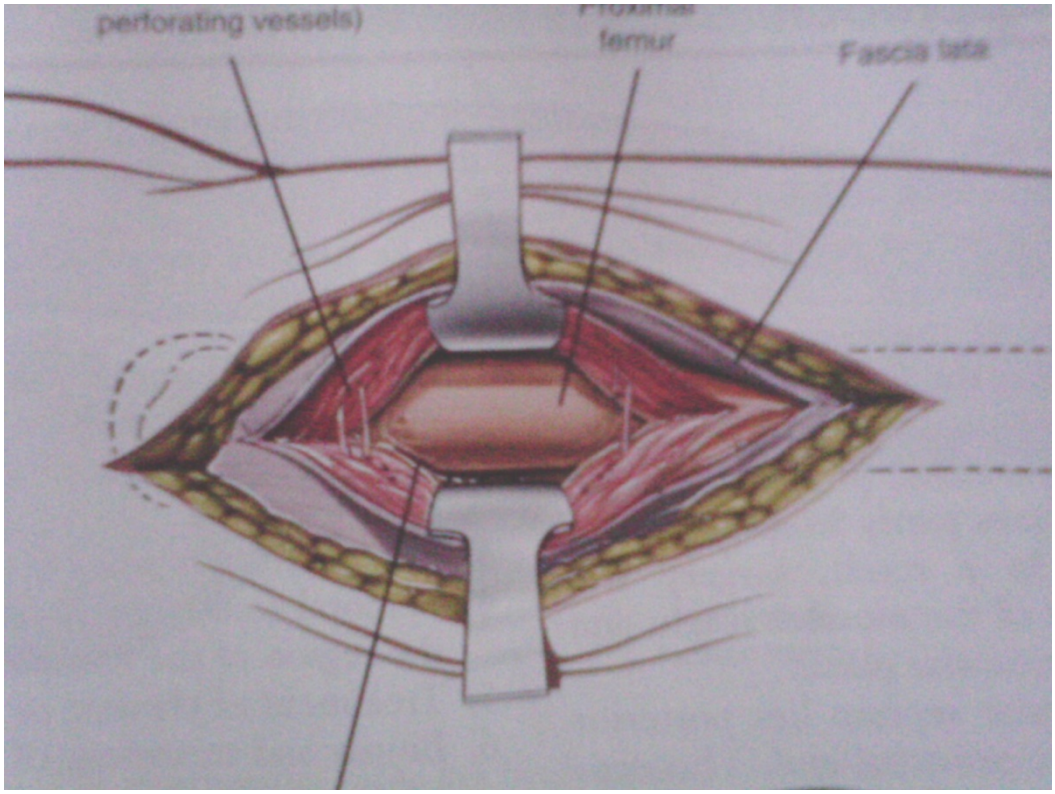
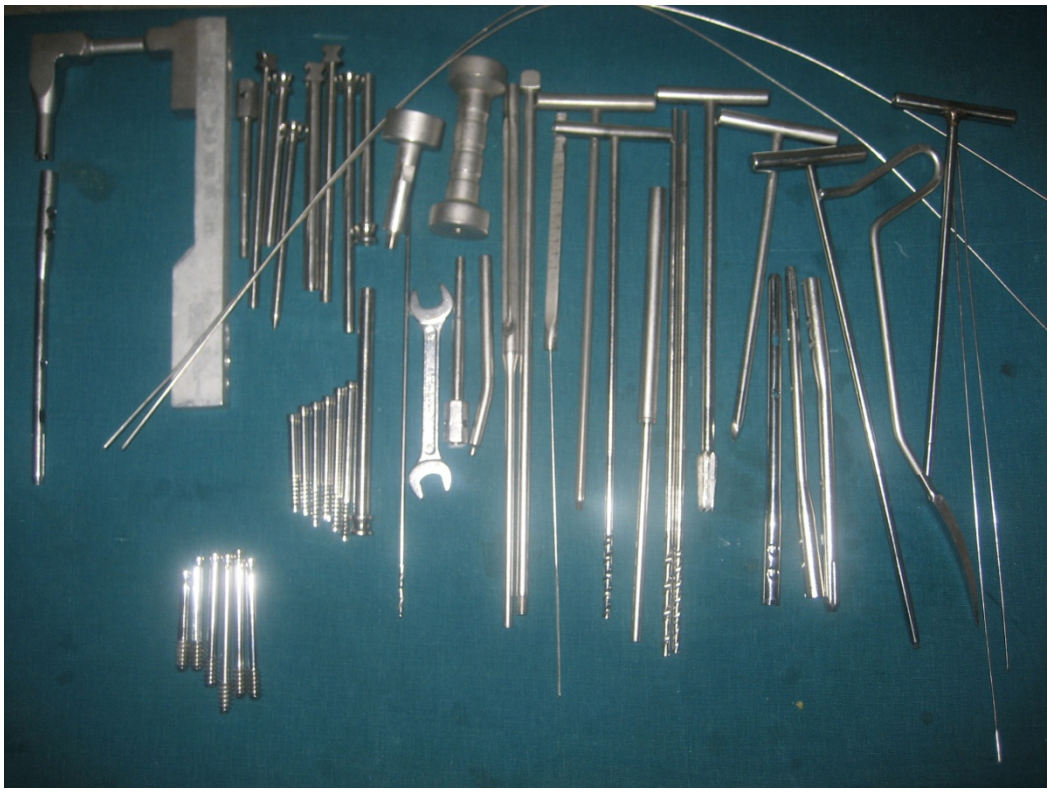
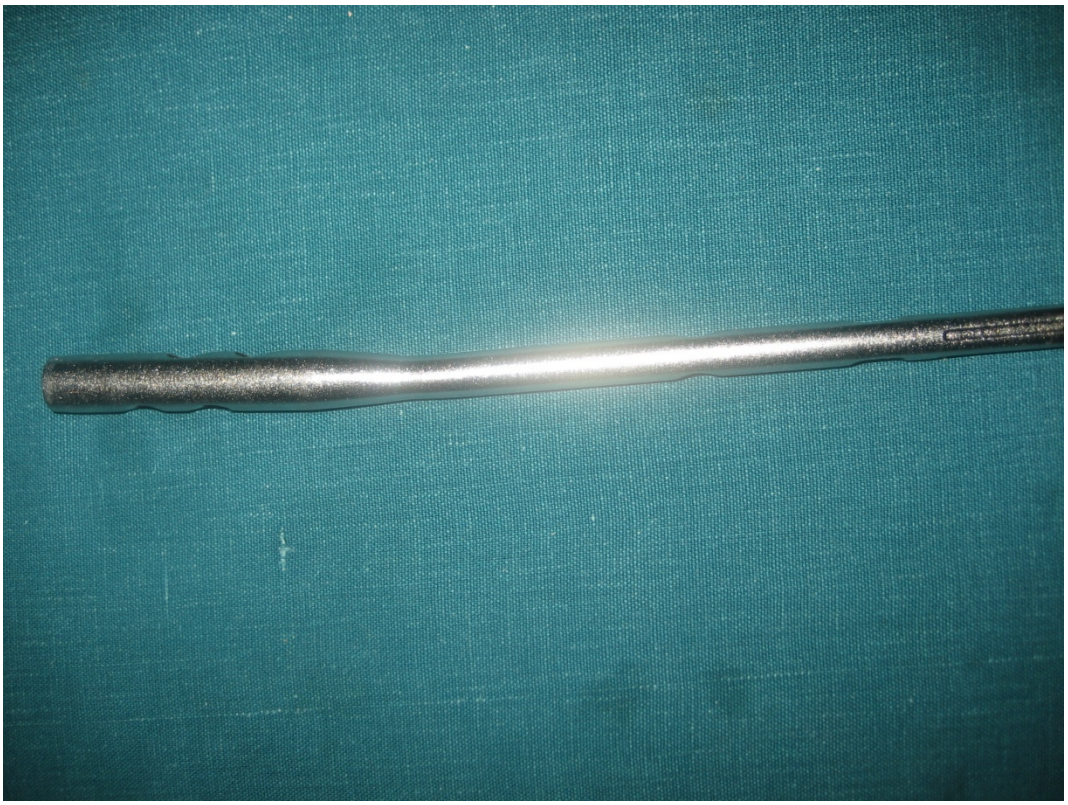

Fascia lata
lateralis

STEP 4


perforating vessels)
femur
Fascia late

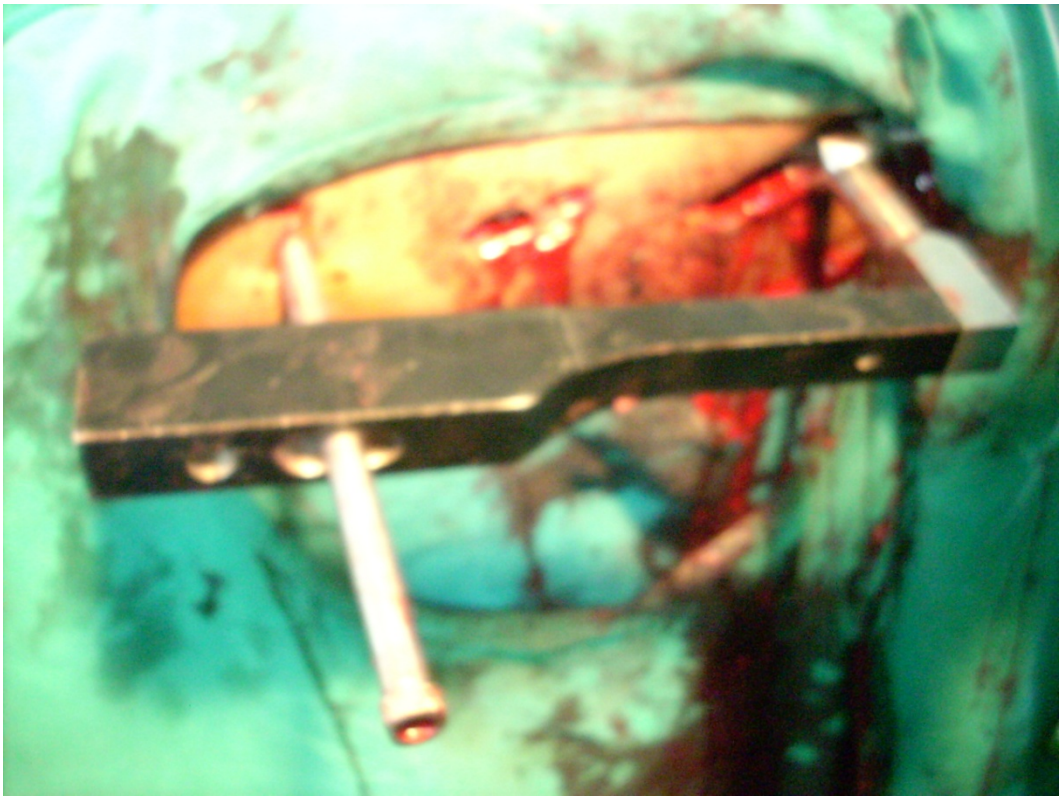
PROXIMAL FEMORAL NAILING INSTRUMENTS SET



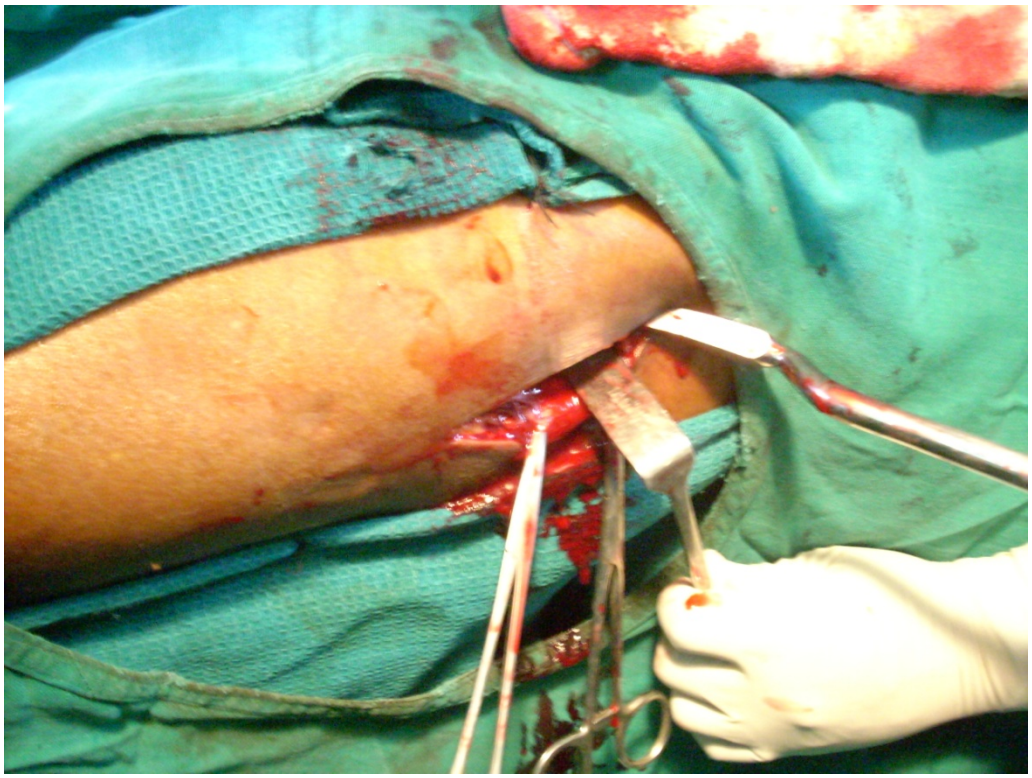


DYNAMIC HIP SCREW INSTRUMENTS

PROXIMAL FEMORAL NAILING INCISION



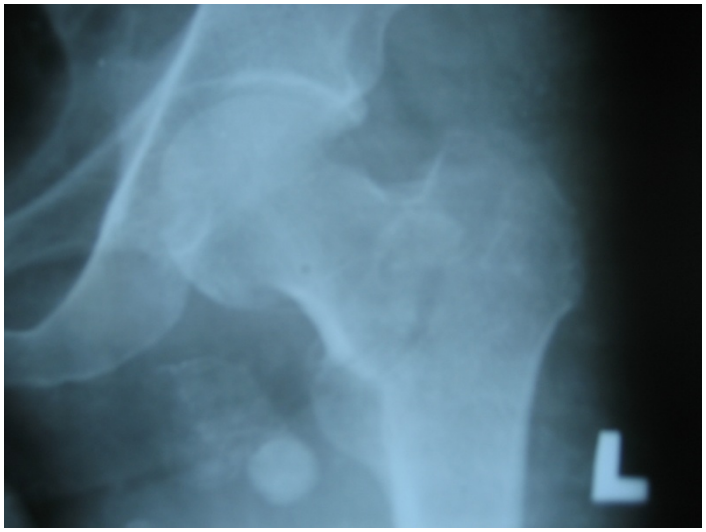
DYNAMIC HIP SCREW SURGERY INCISION



PROXIMAL FEMORAL NAILING FIXATION

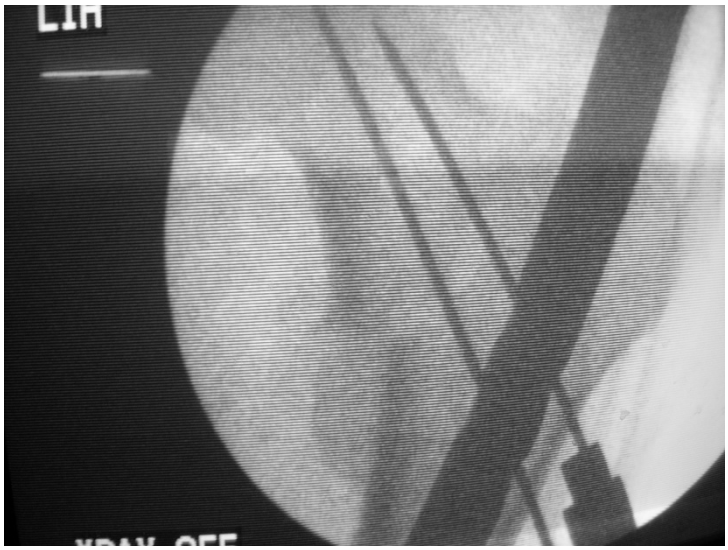
CASE 1

PRE OPERATIVE X-RAY



INTRAOPERATIVE PICTURE

C-ARM PICTURE



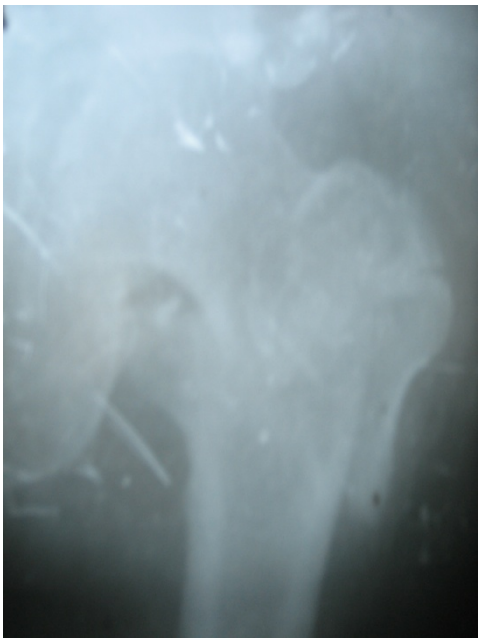
POST OPERATIVE PICTURE

10 WEEKS

14 WEEKS

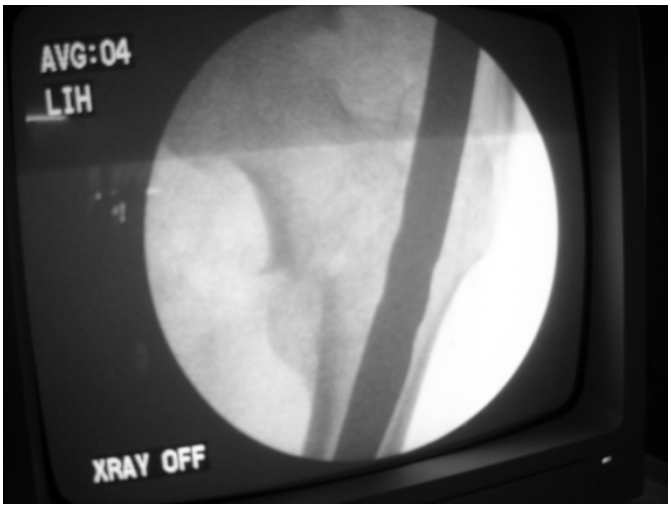
CASE 2

PRE OPERATIVE X-RAY



INTRAOPERATIVE PICTURE

C-ARM PICTURE



POST OPERATIVE X-RAY

6 WEEKS

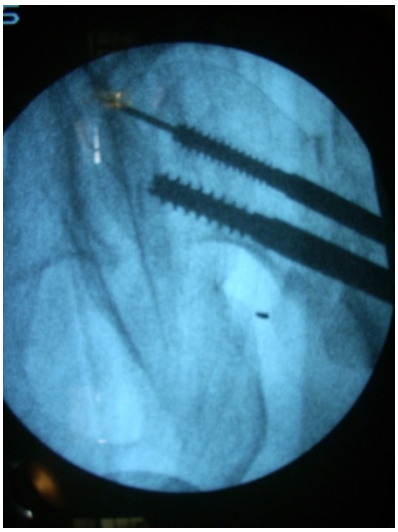
10 WEEKS

14 WEEKS

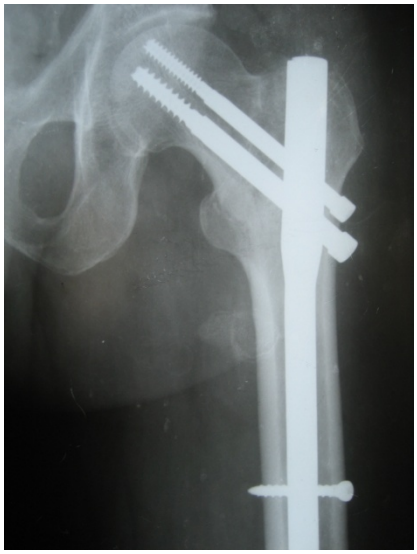
CASE 3

PREOPERATIVE X-RAY

C-ARM PICTURE



POST OPERATIVE X-RAY



6 WEEKS

10 WEEKS

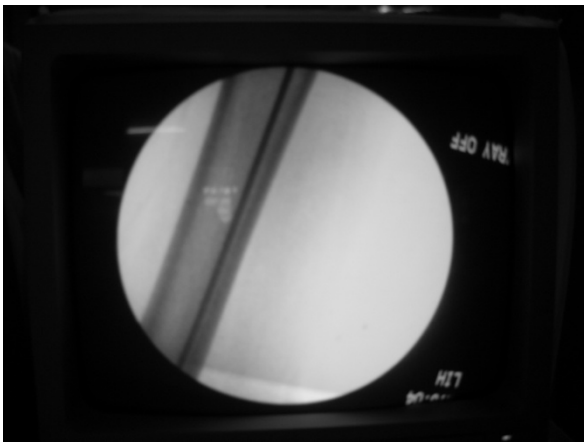
14 WEEKS

FUNCTIONAL OUTCOME

CASE 4

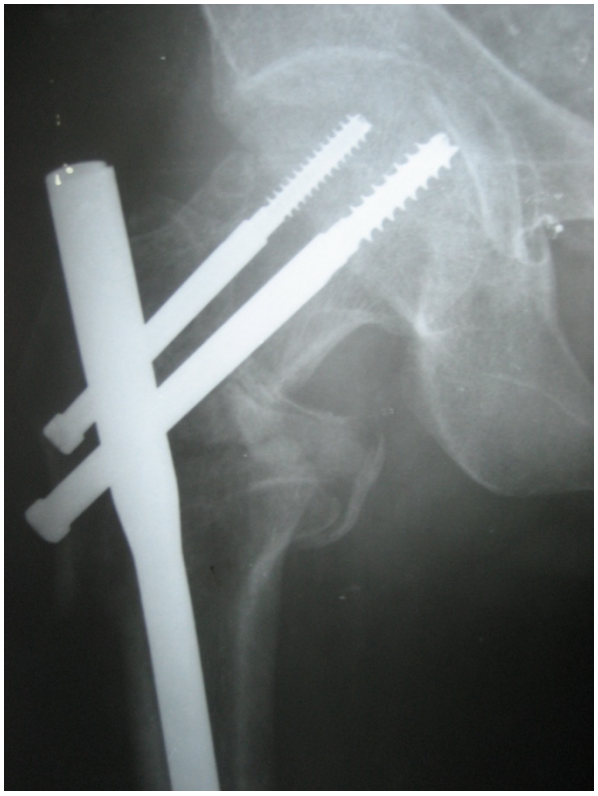
PREOPERATIVE X-RAY

C-ARM PICTURE



POST OPERATIVE X-RAY

6 WEEKS



14 WEEKS

DYNAMIC HIP SCREW FIXATION

CASE 1

PREOPERATIVE X-RAY

POST OPERATIVE

6 WEEKS

10 WEEKS

14 WEEKS

FUNCTIONAL PHOTO

CASE 2

PREOPERATIVE X-RAY

POST OPEARATIVE

10 WEEKS

14 WEEKS

CASE 3

PREOPERATIVE X-RAY

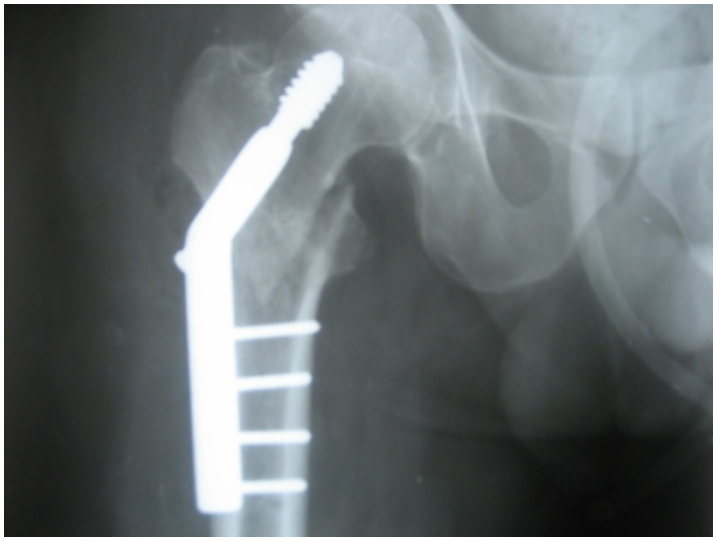
POST OPERATIVE

14 WEEKS

CASE 4

PREOPERATIVE X-RAY

POST OPERATIVE X-RAY



10 WEEKS