"A STUDY OF SURGICAL MANAGEMENT OF PERITROCHANTERIC FRACTURE OF FEMUR WITH PROXIMAL FEMORAL NAIL"

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DISSERTATION SUBMITTED TO THE
SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH,
TAMAKA, KOLAR ,KARNATAKA.

IN PARTIAL FULFILLMENT

OF THE REQUIREMENT FOR THE DEGREE OF

M.S

IN

ORTHOPAEDICS

UNDER THE GUIDANCE OF

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TAMAKA, KOLAR .

MAY - 2012

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ACKNOWLEDGEMENT

*I thank the **LORD ALMIGHTY** for showering his blessings on me.*

It is indeed a great pleasure to recall the people who have helped me in completion of this dissertation. Naming all the people who have helped me in achieving this goal would be impossible, yet I attempt to thank a select few, who have helped me in diverse ways.

*I express my deep sense of gratitude and indebtedness to my teacher and guide **Prof. Dr. P.V.MANOHAR,** M.S. (Ortho), Professor, Department of Orthopaedics, Sri Devaraj Urs Medical College, Tamaka, Kolar for his valuable suggestions, guidance, great care and attention to the detail that he has so willingly shown in the preparation of this dissertation.I am blessed and privileged to be taught by such an eminent teacher.*

*I am grateful and my most sincere thanks to **Prof. Dr. N.S.GUDI.** ,M.S(orth), Professor & HOD , Department of Orthopedics , Sri Devaraj Urs Medical College, Tamaka, Kolar for his constant encouragement and kind help and kindly advices and available suggestions support throughout .*

*I thank **Prof. Dr. Shaik Nazeer** , professor, Department of Orthopeadics , for his kindly advice and support during the preparation of this study .*

*I am thankful to **Dr.Arun** H S, professor, Department of Orthopeadics, for the kind of guidance given to make this study possible.*

*I am thankful to **Dr.Venkatesh reddy,** Associate professor for his valuable support and constant encouragement during this study.*

*I am thankful **Dr.Sridhar N reddy and Dr.Prabhu E** for their invaluable suggestions and advice during the preparation of this study.*

*My sincere thanks to all my **POST – GRADUATE COLLEAGUES** for their whole hearted support.*

*My deep felt gratitude to **MY DEAR PARENTS**,without whom I would not be the person I am today.They have given me constant support, wise advise and let me fulfill all my desires. Their prayers and sacrifices have done wonders for me.*

*Finally, I thank **ALL MY PATIENTS** who formed the backbone of this study without whom this study would not have been possible.*

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LIST OF ABBREVATIONS USED

#	Fracture
AO	The Arbeitsgemeinschaft fur osteosynthese
AP	Anteroposterior
ASIF	Association of study of internal fixation
DM	Diabetes mellitus
GA	Gustilo Anderson
HTN	Hypertension
PA	Posteroanterior
PFN	Proximal femoral nail
Wks	Weeks
RTA	Road Traffic Accident

ABSTRACT

Background and objectives:

Peritrochanteric fractures are devastating injuries that most commonly affect the elderly population and also the young. Peritrochanteric fracture is a leading cause of hospital admissions in elderly people. The number of such admissions is on a raise because of increasing life span and sedentary habits. Conservative methods of treatment results in malunion with shortening and limitation of hip movement as well as complications of prolonged immobilization like bed sores, deep vein thrombosis and respiratory infections. This study is done to analyze the surgical management of Peritrochanteric fractures using Proximal Femoral Nail.

Methods:

This is a prospective study of 20 cases of trochanteric and subtrochanteric fractures admitted to R.L.Jalappa Hospital and Research Centre, S.D.U,M.C ,Kolar, between July 2009 to October 2011. Cases were taken according to inclusion and exclusion criteria i.e., patients with Peritrochanteric fracture above the age of 18yrs and post traumatic peritrochanteric fractures. Pathological fractures and patients with associated co-morbidities posing a risk for surgery are excluded from the study.

Results :

In our series of 20 cases there were 15 male and 5 female, maximum age of 90 yrs and minimum age of 23 yrs, most of the patients were between 30 to 65 yrs. Mean age of

50.3 yrs. 70% of cases were admitted due to RTA and with predominance of right side. Out of 20 cases, 6 were trochanteric and 14 were subtrochanteric.

In Trochanteric class 83.3% were Boyd and Griffin type 2, 16.67% were B type 3 and in Subtrochanteric class 7.1% were type1, 21.4% were Sinsheimer type 2a, 28.6% were 2b, 21.4%were 3a, 7.1% were type 3b and 14.3% were type 4. Mean duration of hospital stay is 20.67 days and mean time of full weight bearing is 16.3 wks. Excellent results were seen in 50% cases, good in 33.3% cases, fair in 16.7% in trochanteric fractures. In subtrochanteric fractures excellent results were seen in 64.3%, good in 21.4% cases and fair were seen in 14.3%.

Conclusion :

From this sample study, we consider that PFN is an excellent implant for the treatment of Peritrochanteric fractures. The terms of successful outcome include a good understanding of fracture biomechanics, proper patient selection, good preoperative planning, accurate instrumentation, good image intensifier.

KEY WORDS: PFN; Peritrochanteric; Subtrochanteric; Trochanteric

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INTRODUCTION

Peritrochanteric fractures are devastating injuries that most commonly affect the elderly and also in young, have a tremendous impact on both the health care system and society in general. Peritrochanteric fractures mainly comprise of fractures of trochanter and subtrochanteric region. Despite marked improvements in implant design, surgical technique and patient care, peritrochanteric fractures continues to consume a substantial proportion of our health care resources.

Trochanteric fractures are common in the elderly people. The frequency of these fractures has increased primarily due to the increasing life span and more sedentary life style brought on by urbanization. Trochanteric fractures occur in the younger population due to high velocity trauma, whereas in the elderly population it is most often due to trivial trauma.

The incidence of trochanteric fractures is more in the female population compared to the male due to osteoporosis. In a Swedish study of more than 20,000 patients, the incidence of hip fractures in women doubled every 5.6 years after the age of 30 years. The trochanteric fractures can be managed by conservative methods and there is usually union of the fracture. If suitable precautions are not taken the fracture undergoes malunion, leading to varus and external rotation deformity at the fracture site and shortening and limitation of hip movements. It is also associated with complications of prolonged immobilization like bedsores, deep vein thrombosis and respiratory infections. Since this fracture is more common in the elderly patients, the aim of treatment should be prevention of malunion, and early mobilization. Taking all the factors into consideration surgery by internal fixation of the fracture is ideal choice.

There are various forms of internal fixation devices used for Trochanteric Fractures; of them the most commonly used device is the Dynamic Hip Screw with Side Plate assemblies. This is a collapsible fixation device, which permits the proximal fragment to collapse or settle on the fixation device, seeking its own position of stability. The more latest implant for management of trochanteric fractures is proximal femoral nail, which is also a collapsible device with added rotational stability. This implant is a centromedullary device and biomechanically more sound. It also has other advantages like small incision , minimal blood loss.

Pertrochanteric and subtrochanteric fractures of femur posses clinical, structural, anatomical and biomechanical characteristics that distinguish them from intracapsular fractures. Subtrochanteric fractures comprises about 10 to 34% of hip fractures[1]. Subtrochanteric fractures are complicated by malunion and delayed or nonunion. The factors responsible for these complications in subtrochanteric fractures are high stress concentration, predominance of cortical bone and difficulties in getting biomechanically sound reduction because of comminution and intense concentration of deforming forces[2].

The present choice of treatment of subtrochanteric fractures is open reduction and internal fixation. Many internal fixation devices have been recommended for use in subtrochanteric fractures, because of high incidence of complications reported after surgical treatment with each implant. A lack for satisfactory implant in surgical treatment of subtrochanteric fractures has led to series of evolution in design of a perfect implant. Subtrochanteric femoral fractures are associated with high rates of non-union and implant failure, regardless of the method of fixation. Only recently has a better understanding of biology, reduction techniques and biomechanically improved implants allowed for subtrochanteric fractures to be addressed with consistent success.

In spite of the advances in anesthesia, nursing care and the surgical techniques, hip fractures remain a significant cause of morbidity and mortality in the elderly population. In view of these considerations, the present study of Surgical Management of Peritrochanteric Fractures is taken up .

OBJECTIVES OF STUDY

1.To study the anatomical and functional outcome of the peritrochanteric fractures treated with proximal femoral nail.

2.To compare the results with standard studies and draw conclusions.

REVIEW OF LITERATURE

Sir Astley Cooper (1923) divided fractures of proximal femur into intracapsular and extracapsular fractures[3].

Boyd and Griffin (1949), Fielding and Magliato (1966), Zickel (976), suggested surgical management for pertrochanteric and subtochanteric fracture[3].[4]. **Jewett (1952)** published his paper recommending that all hip fractures be treated with 135 degree nail plate device[3]. **Fielding and Maglia To (1966)** proposed a simple classification in which they have defined subtrochanteric fracture[3]. **Ender (1970)** introduced multiple flexible Condylocephalic nails[5].

In 1959, AO blade plates were developed by ASIF. They advised the device to be effective' must function as tension band' with presence of prompt reconstitution of an intact medial cortical buttress[3,6].

In a study of 130 patients with pertrochanteric and subtrochanteric fractures in which 40 patients were treated with AO blade plate. 7 patients were rated as failures and 4 patients developed non-union. Failure is due to poor reduction of fracture fragments and to the initiation of weight bearing too early in the postoperative course[6].

In another study using ASIF blade plate fixation for severely comminuted pertrochanteric and subtrochanteric fractures. The review revealed that ASIF blade plate provides adequate stabilization and fixation with high rate of union[6].

Another study biomechanically compared various methods of stabilization of pertrochanteric and subtrochantric fractures of femur[7].

Russel Taylor introduced reconstructed intramedullary nail for pertrochanteric and subtrochanteric fractures .

Another author compared the results of open reduction and blade plate fixation of subtrochanteric fractures to indirect reduction and fixation[6].

In 1990 another study mentioned about operative stabilization of pertrochanteric and subtrochanteric fractures of femur. This study demonstrates acceptability of implants in management of pertrochanteric and subtrochanteric fractures, provided strict adherence to reconstruction of medial cortex is accomplished[3].

Halder and Williams in 1992 introduced Gamma Nail and Parker described complications of Gamma nail[8].

S.C. Halder in 1992 published paper on the Gamma nail for peritrochanteric fractures[8].

Shepherd F Rosenblun, Joseph D Zukerman, Fredrerick J Kummer and Benjamin Tam published a report on biomechanical evaluation of the Gamma nail in 1992[8].

In 1992 an author presented comparative study of Gamma nail and DHS[9]. In 1993 another author studied about the association of age, race and sex with location of the proximal femoral fractures in the elderly[3]. In 1994 an author presented a case report and review of the literature on post- operative femoral fracture after Gamma nailing[10]. In 1994 Blatter et al studied about treatment of the pertrochanteric and subtrochanteric fractures of the femur with DCS[11].

In 1994 an author studied about pertrochanteric and subtrochanteric fractures of the femur treated with Zickel nail. Zickel nail is not been recommended by them any more for treatment of pertrochanteric and subtrochanteric fractures[12].

In 1994 cole studied about intramedullary nail and lag screw fixation of proximal femur fractures. The vector nail has been introduced as an alternative form of fixation for complex proximal femur fractures[13].

Another author studied about osteosynthesis of proximal femoral fractures with modular interlocking system of rochante AO femoral intramedullary nail[13].

In 1995 an author reviewed 161 pertrochanteric and subtrochanteric fractures and the risk factors influencing outcome, age, fracture pattern and fracture level[14].

In 1996 an author reviewed a series of 128 patients with pertrochanteric fractures of femur and gave results of 81% very good to good and 7% fair with gamma nailing[15].

Another author in 1997 reviewed a series of 65 patients and concluded that the gamma nail enables the surgeon to treat more types of hip fractures with a less invasive technique and achieve equal or better results[16].

In 1999 an author treated 10 cases of ipsilateral hip and femoral fractures and concluded that use of a long gamma nail to fix this dual fractures is recommended whenever possible[17].

In 2000 a group of investigators compared the use of enders nails, hip screws and gamma nails in the treatment of peritrochanteric fractures and concluded that the gamma nail had superseded the rest because of its absolute stability but was technically more demanding with a higher number of intraoperative complications[5].

In 1996 the AO/ASIF developed the proximal femoral nail (PFN) as an intramedullary device for the treatment of unstable per-, intra- and subtrochanteric femoral fractures in order to overcome the deficiencies of the extramedullary fixation of these fractures. This nail as the following advantages compared to extramedullary implant-such as decreasing the moment arm, can be inserted by closed technique, which retains the fracture hematoma an important consideration in fracture healing, decreases blood loss, infection, minimizes the soft tissue dissection and wound complications[18]. In a clinical multicenter study, authors reported technical failures of the PFN after poor reduction, malrotation or wrong choice of screws[18].

Gotze et al. compared the loadability of osteosynthesis of unstable per-and subtrochanteric fractures and found that the PFN could bear the highest loads of all devices[19].

An author compared trochanteric fractures treated with the Gamma nail or the Proximal Femoral nail and concluded that there were no significant differences in the use of either nail in terms of the recovery of previous functional capacity, nor in terms of the time required for fracture healing. With regard to the more significant technical complications recorded, shaft fractures and the cutting-out phenomenon were more common with the use of the Gamma nail, while secondary varus occurred at a greater rate when using the PFN[20].

In 2001 a study concluded that PFN is an excellent implant for treatment of unstable fractures of proximal femur. The terms of successful out come include a good understanding of fracture biomechanics, correct indication and exactly performed osteosynthesis[21].

In 2002 a study concluded that PFN is a method of choice in trochanteric fracture,namely in high subtrochanteric fractures[22].

In 2002 another study concluded that the PFN is a good choice for trochanter subtrochanteric fractures and also the use of the PFN for unstable trochanteric fractures is very encouraging [23].

In 2002 another study to evaluate the PFN for the treatment of 76 unstable trochanteric femoral fractures concluded PFN is a useful device in the treatment of the unstable trochanteric femoral fracture. It is a relatively easy procedure and a biomechanically stable construct allowing early weight bearing[24].

In a prospective randomized controlled trial of subtrochanteric femur fractures treated with a Proximal Femoral Nail compared to a 95 degree Blade plate and concluded that internal fixation of subtrochanteric femur fractures with a 95 degree angled blade plate is associated with increased implant failure and revision compared to closed intramedullary nailing using a Proximal Femoral Nail[25].

In 2003 another study recommended PFN as choice of implant for peritrochanteric fractures[26].

In 2003 a prospective study of proximal femoral fractures treated with PFN on 55 patients and concluded PFN as a intramedullary device for treatment of unstable per, intra and subtrochanteric femoral fractures[27].

In 2003 a study on 24 subtrochanteric femoral fractures treated with long PFN concluded Long PFN is a reliable implant in the treatment of complex subtro-chanteric fractures. Posteromedial wall reconstruction of the proximal femur is mandatory when treating sub-trochanteric fractures with Long PFN to avoid mechanical failure and non-union [28].

In 2004 a study concluded both PFN and gamma nail had comparable results except that PFN had less intraoperative blood loss and concluded that pit falls and complications were similar and mainly surgeon or fracture related, rather than implant related[29].

In 2004 another study concluded that PFN is a suitable implant for unstable fractures, but the high re-operation rate precludes its routine use for every peritrochanteric fracture[30].

In 2006 another study of 83 patients of proximal femoral fractures treated with PFN, has confirmed the advantages of PFN if compared with other present osteosynthetic methods[31]'

In 2007 a study on 87 consecutive patients treated with a proximal femoral nail (PFN) for trochanteric femoral fractures concluded PFN is useful for the treatment of trochanteric femoral fractures[32].

In 2007 a study of 30 skeletally mature patients treated with PFN for peritrochanteric fractures concluded that proximal femoral nail is the implant of choice for subtrochanteric fractures and its use in unstable trochanteric fractures is very encouraging[33].

In 2007, a prospective study on 100 consecutive patients concluded Osteosynthesis with the PFN offers the advantages of high rotational stability of the head-neck fragment, an unreamed implan- tation technique and the possibility of static or dynamic distal locking and PFN is useful for treating stable and unstable trochanteric fractures[34].

In 2009, a retrospective review of 26 cases concluded PFN is a suitable implant for unstable intertrochanteric femoral fractures needing open reduction internal fixation. It has low per operative and post operative morbidity[35].

In 2009,another study on 35 patients concluded that the correct position of the osteosynthesis material and use of an intramedullary nail providing a stronger fixation of the proximal part may reduce mechanical complications following the treatment of unstable intertrochanteric hip fractures[36].

In 2010, a prospective comparative study of 107 patients treated with proximal femoral nail antirotation (PFNA) and third generation targon gamma nail concluded that PFNA provides less blood loss and shorter fluoroscopy but functional outcomes were same in both[37].

In 2011, a retrospective study of 62 patients with peritrochanteric hip fractures treated with PFNA concluded that good reduction of fractures and optimal positioning and length of hip helical blade are crucial for achievement of good outcome[38].

In 2011, a study concluded that new PFNA Asia(proximal femoral nail antirotation) yields better results in the treatment of unstable trochanteric fractures in elderly patients by closely matching Asian femoral anatomy and thereby, reducing complications related to implants[39].

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ANATOMY OF PROXIMAL FEMUR

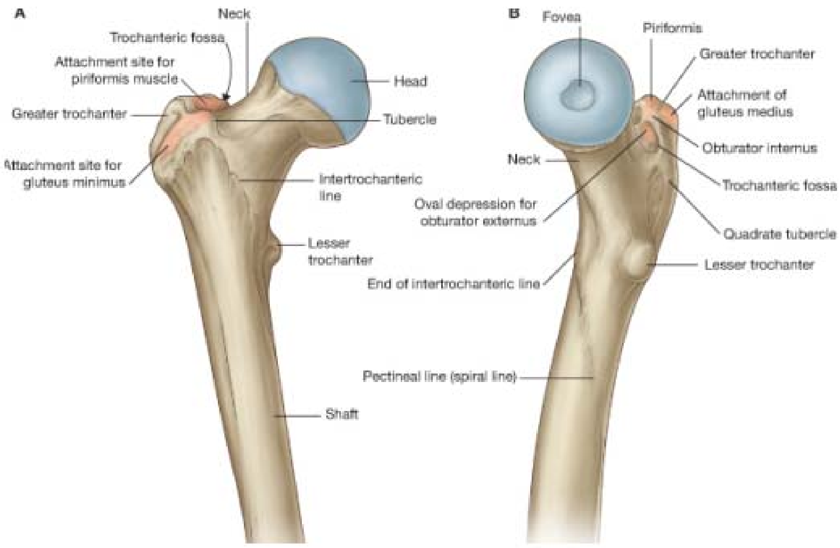
The femur is the longest and strongest bone of the body and like all long bones consists of a shaft and two ends. It articulates at its upper end with the hip bone and at its lower end with both the patella and the tibia. The upper end of the femur comprises a head, a neck, a greater and a lesser trochanter.

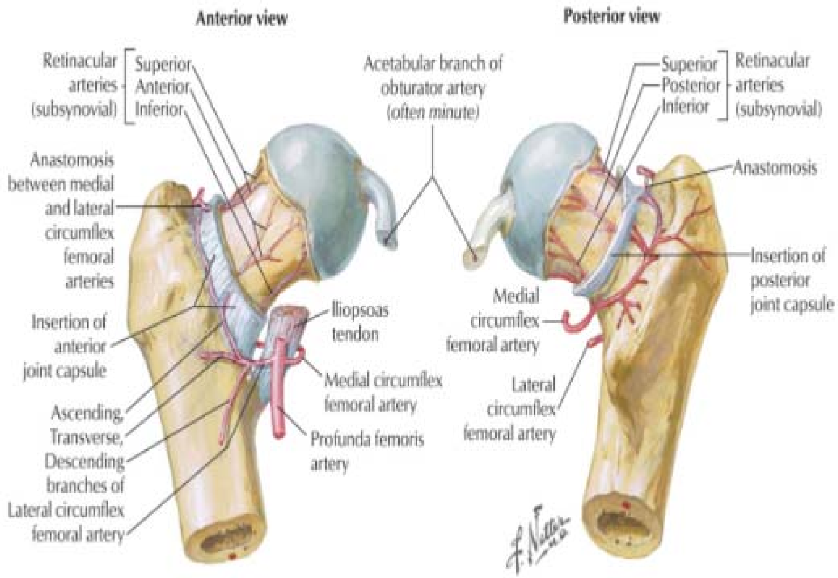
The head of the femur is rather more than half a 'sphere' and is directed upwards, medially and slightly anteriorly. The neck is about 5cm long, connects the shaft, it is a stout bar of bone, roughly pyramidal in shape and flattened anteriorly. The long axis of the neck makes an angle of about 120-130 degrees with the long axis of the shaft and is termed the neck shaft angle. This arrangement allows greater mobility at the hip joint and enables the lower limb to swing clear of the pelvis. Anteriorly, at the junction of the shaft and the neck is a rough bony ridge, the intertronchanteric line. It begins in a tubercle at the upper and medial part of the anterior surface of the greater trochanter and is directed inferomedially where it joins the spiral line, which becomes continuous with the medial lip of the linea aspera. Posteriorly a prominent ridge of bone, the intertrochanteric crest joins the posterior aspect of the greater trochanter. On the upper part of the crest is a round protuberance called the quadrate tubercle[18].

The greater trochanter is large quadrangular laterally positioned and irregular. The upper posterior margin overhangs the trochanteric fossa. The greater trochanter provides insertion for most of the muscles of gluteal region. The upper border of the greater trochanter gives insertion to the piriformis and the medial surface to the common tendon of obturator internus and two gemelli. The gluteus minimus is inserted into the rough impression on its anterior surface. The gluteus medius is inserted into the oblique and flattened strip on its lateral surface. The area behind the insertion is covered by the deep fibres of gluteus maximus with the trochanteric bursa interposed. The trochanteric fossa receives the insertion of the obturator externus.

The lesser trochanter is a conical eminence, which projects medially and back wards from the shaft at its junction with lower and posterior part of the neck. It gives attachment to the psoas major on its summit and iliacus at its base. The shaft of the femur is narrower in its middle, it expands a little as it is traced upwards, but it widens appreciably near the lower end of the bone. In its middle one third the shaft possesses three surfaces (anterior, lateral and medial) and three borders [posterior, lateral and medial]. In its upper one third, the shaft presents a fourth surface which is directed backwards and is called the posterior surface. This is bounded medially by the spiral line which is continuous above with the lower end of the intertrochanteric line and below with the medial lip of linea aspera. On the lateral side the surface is bounded by gluteal tuberosity which extends upwards to the root of the greater trochanter and is continuous below with the lateral lip of linea aspera. In its lower third also the shaft possesses a fourth surface, the popliteal surface of the femur. The lateral and anterior surface of the shaft provides attachment in their upper 3/4**th** for the vastus intermedius. The medial surface is devoid of muscular attachments and is covered by the vastus medialis. The medial edge of the tuberosity provides insertion for the pubic fibres of the adductor magnus. The lateral lip of linea aspera gives origin to the vastus lateralis and medial lip to the vastus medialis. In addition, the linea aspera gives attachment to the adductor longus, the intermuscular septa and the short head of biceps femoris. The posterior surface of the upper third receives the insertions of the pectineus and the adductor brevis[40].

OSTEOLOGY AND VASCULAR ANATOMY OF PROXIMAL FEMUR





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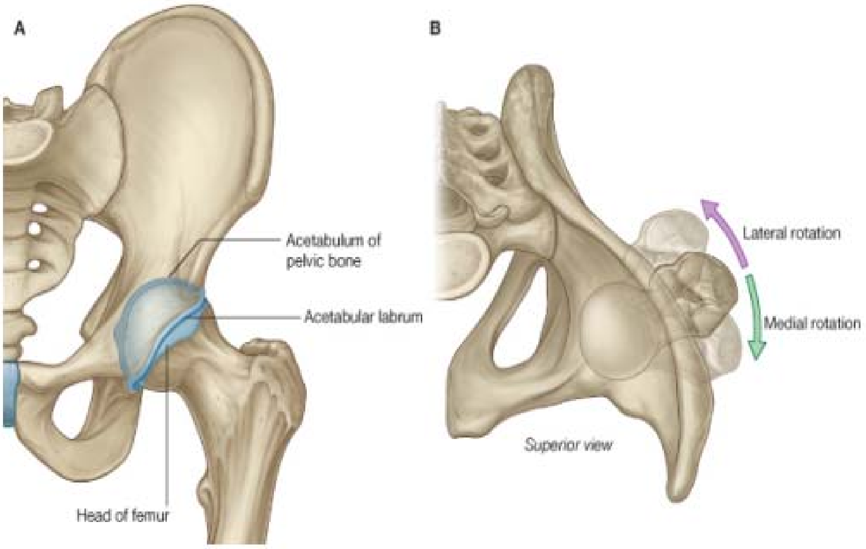
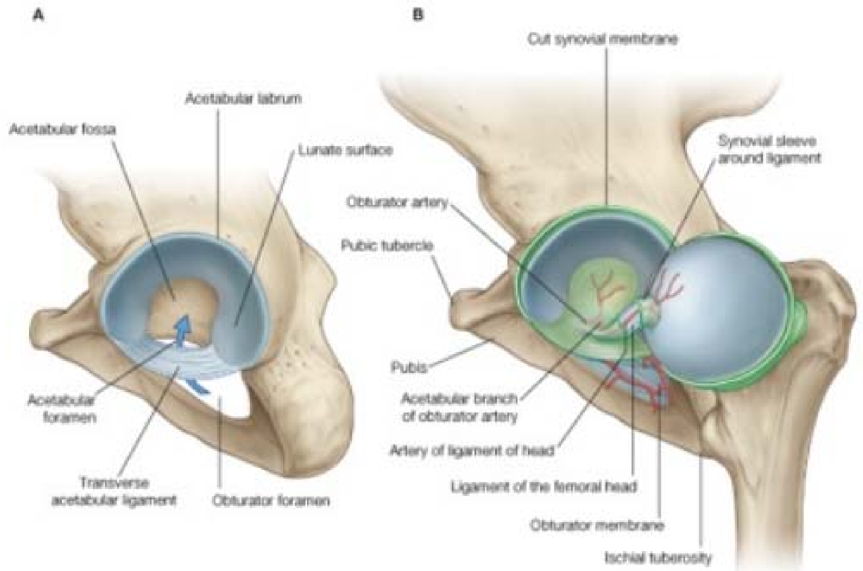
HIP JOINT AND MUSCLES AROUND HIP





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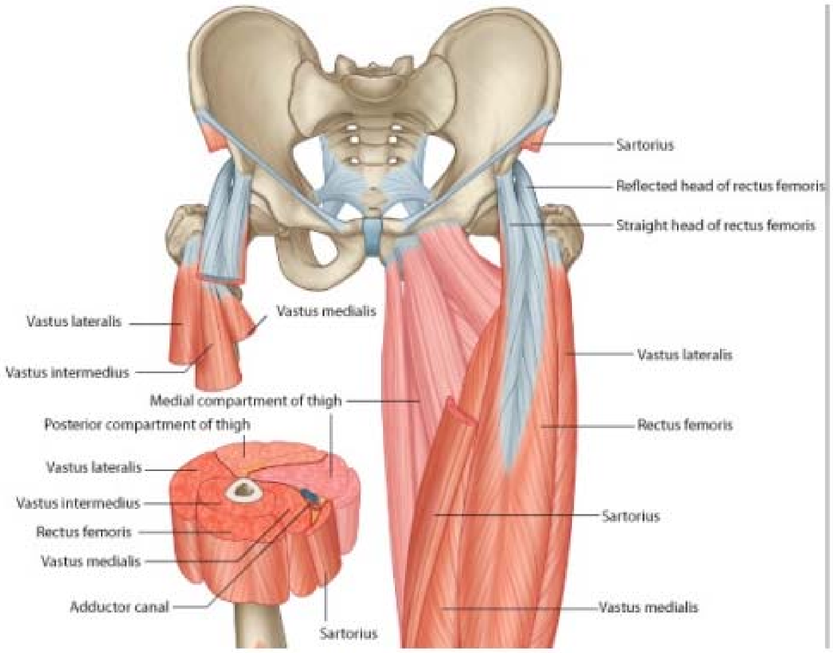
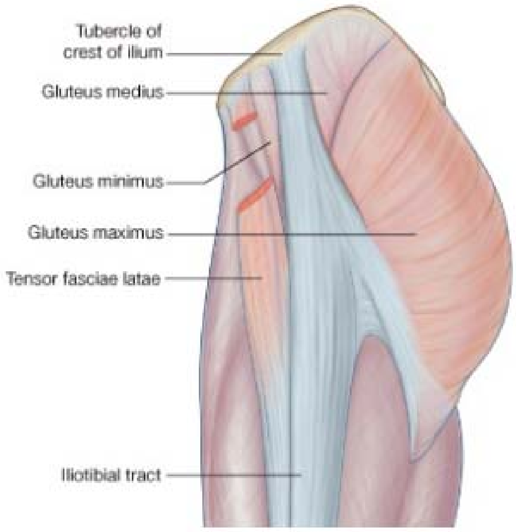
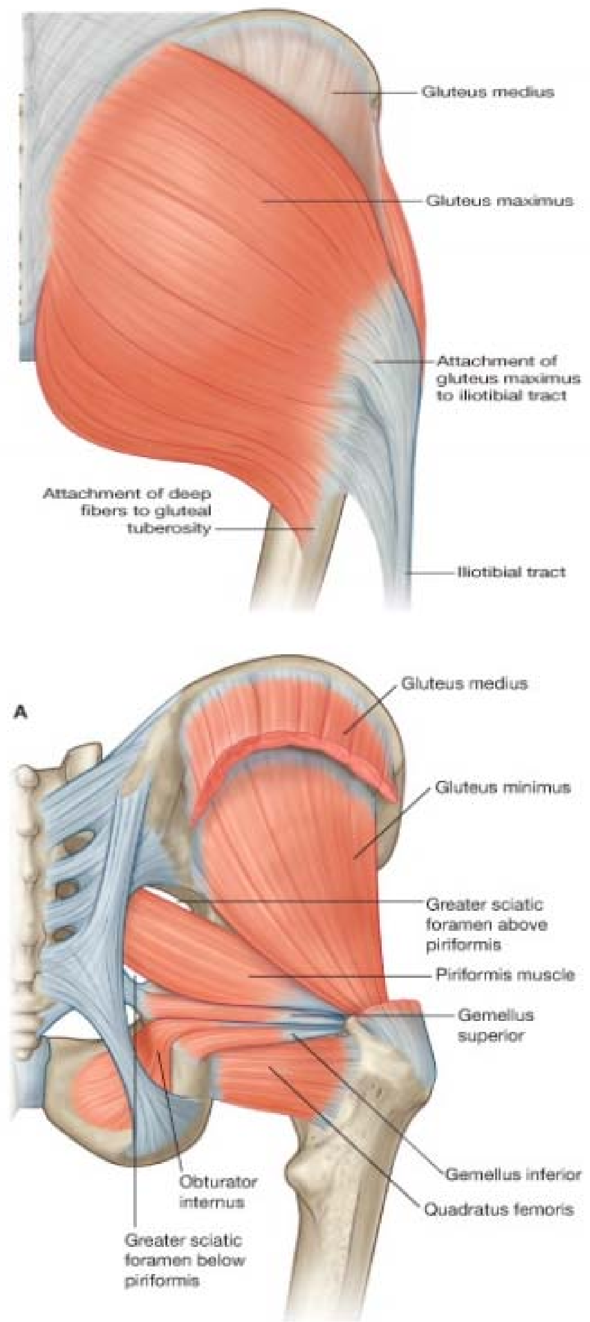


Anterior view



Lateral view



Posterior view

BLOOD SUPPLY:

The description of adult vessels is based on the work of Trueta and Harnington (1953). Since the vascular pattern established during the phase of growth is not replaced at maturity, but persists throughout in life, the basic arrangement is one of an epiphyseal and metaphyseal circulation, even when the growth plate has disappeared outline the anastamotic arrangement around the upper femur[41]. Corck described the blood supply to the proximal end of the femur, which he divided into three major groups.

a. An extracapsular arterial ring located at the base of the femoral neck.

b. Ascending cervical branch of the arterial ring on the surface of the femoral neck.

c. Arteries of the ligamentum teres.

The extracapsular arterial ring is formed posteriorly by large branch of medial femoral circumflex artery and anteriorly by branch from lateral femoral circumflex artery. The ascending cervical branches of retinacular vessels, ascend on the surface of the femoral neck in an anterior, posterior, medial and lateral groups. The lateral vessels are most important. Their proximity to the surface of the femoral neck makes them vulnerable to injury in femoral neck fractures.

As the articular margin of the femoral head is approached by these ascending cervical vessels, a second less distinct ring of vessels is formed, commonly referred to by Chung as the sub synovial intra-articular arterial ring. It is from this ring of vessels that vessels penetrate the head and are referred to as epiphyseal arteries, the most important being the lateral epiphyseal arterial group supplying the lateral weight bearing portion of the femoral head. These epiphyseal vessels are joined by inferior metaphyseal vessels and vessels of the ligamentum teres. Blood supply to the femur, like that of all tubular bone is by the way of metaphyseal, periosteal and endosteal supply. The periosteal supply is related to the multiple muscle origins from the shaft to the femur the nutrient arteries perforate the femoral shaft along the linea aspera. The arteries are derived from perforating branches of profounda femoris artery.

STRUCTURE:

The shaft of the femur is roughly tubular compact bone, with a large medullary cavity. The wall of the cylinder is thick in the middle third of the shaft but above and below, the wall becomes thinner while medullary cavity is gradually filled with trabecular bone, the upper and lower ends of the shaft and the articular extremities consists of trabecular bone, invested by a thin compact layer.

The pertrochanteric and subtrochanteric area can be a site of stress concentration owing to the short radius of curvature at this site. When bone has insufficient opportunity to turnover and remodeling as in metabolic bone disease this may be a site of pathologic fracture.

In 1957, Harley and Griffin clarified the definition of the calcar femorale, as a dense vertical plate of bone within the femur, which originates in the posteromedial portion of the shaft, under the lesser trochanter, and radiates laterally through the cancellous tissues towards the greater trochanter[1].

MUSCULAR FORCES :

The upper end of the femur is surrounded by a mass of powerful muscles. Inclusion of muscle forces necessary during single leg support adds to the complexity of the problem and can increase the stress to much higher values. On the other hand, some muscles such as the tensor fascia lata, may act to partially neutralize bending forces under certain conditions. In a normal hip, the strong gluteal muscles abduct and the powerful psoas flexes and rotates. These forces are balanced by the adductor and hamstrings. With a subtrochanteric fracture, the forces are unbalanced and the unopposed muscular action produces the characteristic abduction, rotation and flexion deformity described by Froimson. The same muscle forces act upon the fixation device after operation. These forces have been shown to generate high forces on the femoral head even when the patient is in bed, which in turn cause stresses in the subtrochanteric area as shown by Koch. Rydell has demonstrated that muscular pull for merely flexing or extending the hip in bed caused as much pressure on the femoral head as did slow walking with or without crutches[41].

MEDIAL BUTTRESS AND CROSS-SECTIONAL AREA :

The medial wall or the so-called medial buttress explodes, because of the great compressive forces. When the medial buttress is absent and the cross sectional area bearing load is minimum, all the stress is concentrated on the plate at the fracture site. This results in fatigue fracture of the implant and non-union. Therefore, the anatomy and functional continuity of the bone at the fracture site should be established by fixing fracture pieces by lag screws, cerclage wires, etc., and the medial wall shoud be reconstructed by massive bone grafting. Thus, the cross sectional area to bear the load is increased and less force acts on the plate. Hence, integrity of the medial wall of the proximal femur is very important[41].

CLASSIFICATION OF TROCHANTERIC FRACTURES Boyd and Griffin (1949) classification:

This classification includes all the fractures from the extracapsular part of the neck to a point 5cm distal to the lesser trochanter.

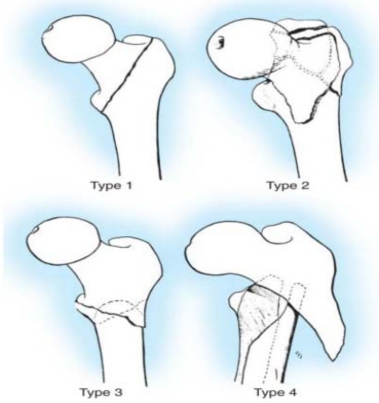
Type 1: Fractures that extend along the intertrochanteric line from the greater to the lesser trochanter. Reduction usually is simple and is maintained with little difficulty.

Type 2: Comminuted fractures, the main fracture being along the intertrochanteric line but with multiple fractures in the cortex. Reduction of these fractures is more difficult because the comminution can vary from slight to extreme.

Type 3: Fractures that are basically subtrochanteric with at least one fracture passing the proximal end of the shaft just distal to or at the lesser trochanter. Varying degree of comminution are associated. These fractures are usually more difficult to reduce and result in more complications.

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

Type 3 and 4, most difficult types to manage account for only one third of the trochanteric fractures.



Boyd and Griffin classification

Evans classification:

Typel: The fracture line extends upwards and outwards from the lesser rochanter.

Type 2: The fracture line is of reversed obliquity, the major fracture line extends outward and downward from the lesser trochanter and are unstable.

A widely used classification system based on the stability of the fracture pattern and the potential to convert an unstable fracture pattern to a stable reduction. Evans observed that the key to a stable reduction is restoration of posteromedial cortical continuity.

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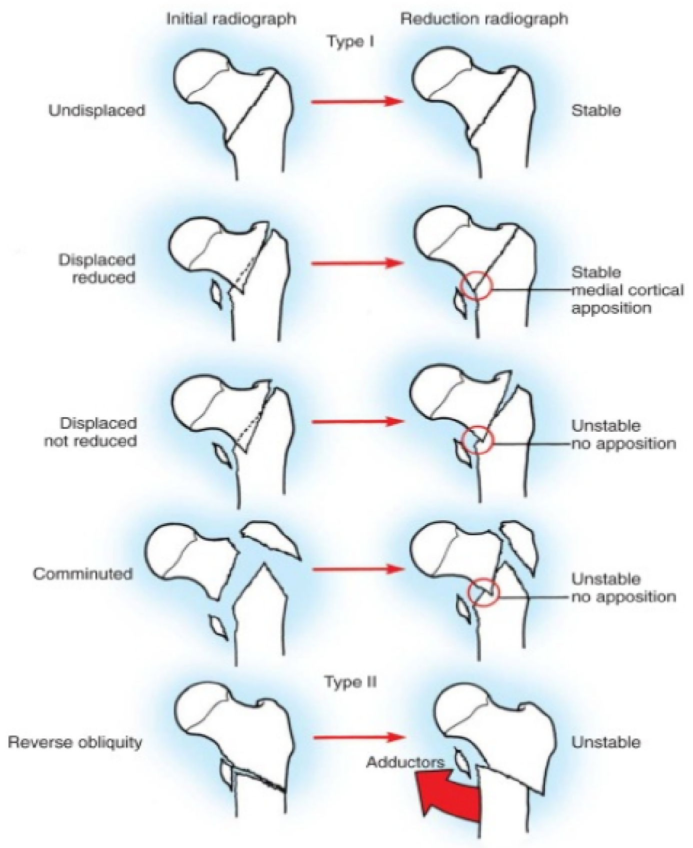


Evans classification of intertrochanteric fractures

Orthopaedic Trauma Association (OTA) Alphanumeric Fracture Classification

31 - A Femur, proximal trochanteric A1

pertrochanteric simple

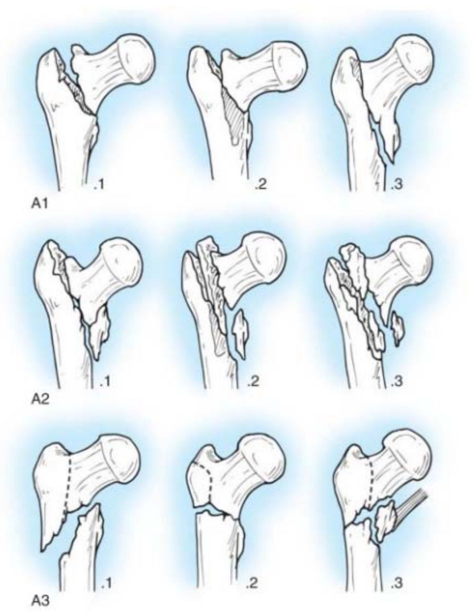
- A1.1 Along intertrochanteric line
- A1.2 Through greater trochanter
- A1.3 Below lesser trochanter A2

pertrochanteric multifragmentary

- A2.1 with one intermediate fragment
- A2.2 with several intermediate fragments
- A2.3 extending more than1cm below lesser trochanter

A3 Intertrochanteric

- A 3.1 Simple oblique
- A 3.2 Simple transverse
- A 3.3 Multifragmentary



AO classification of trochanteric Fractures

MANAGEMENT OF TROCHANTERIC FRACTURES

Watson-Jones[4] states that "fractures through the intertrochanteric line of the upper end of the femur, and peritrochanteric fractures, unite readily no matter what treatment is used because the broad fractured surfaces are richly supplied with blood and there is seldom wide displacement. But at the same time, unless suitable precautions are taken, the fracture may unite in a position of coxa vara with shortening of the limb and limitation of hip movements. Moreover, this fracture occurs in the elderly patients the risks from prolonged immobility and recumbency arise. Thus treatment should be so planned as to encourage union without deformity, and at the same time allow early mobilization."

Hence the trochanteric fractures can be managed in two ways

1. Conservative or Non-operative method.
2. Operative method.

CONSERVATIVE MANAGEMENT:

"Two strong men will suffice by making extensions and counterextension" as stated by **Hippocrates** (350 BC).

The indication for non-operative treatment of intertrochanteric fractures is unclear. The indications for conservative management are :

a. The terminal patient.

b. A patient with an old fracture.

c. A non-ambulatory patient who is comfortable with the fracture

d. If the fracture could not be stabilized adequately by open reduction.

Conservative Treatment Regimes include:

- Simple support with pillows.
- Splinting to the opposite limb.

- Buck's traction.
- Skeletal traction through the lower femur or upper tibia.
- Well-leg traction.
- Russell's balanced traction.
- Plaster spica immobilization.

Buck's Traction:

This is the skin traction applied to the lower extremity. The traction force is applied over a large area of skin. This spreads the load, and is more comfortable and efficient. In treatment of fractures, the traction must be applied only to the limb distal to the fracture site.

Buck, in 1861 introduced the application of adhesive plaster to the skin of the leg for the purpose of achieving isotonic traction in the treatment of fracture of femur into surgical practice shortly before the Civil war of America. According to **John D.M. Stewart,** the maximum traction weight that can be applied with skin traction is 15lb (6.7kg). When the skin traction is applied in senile patients with thin, atrophic, inelastic skin, the result is often most distressing. The control of lateral rotation of the limb in skin traction is also difficult. Hence in the treatment of intertrochanteric fractures, which frequently occur in the aged patients, a skeletal traction is preferred.

Skeletal Traction[42]:

In 1907, **Fritz Steinmann,** of Bern described a method of applying skeletal traction through the femur by means of two pins driven into the femoral condyles. Shortly, after the initial description of the two pin technique, in 1916 he introduced the Steinmann pins, which are rigid stainless steel pins of varying lengths, 3-5 mm in diameter and perfected the 'through and through' pin technique.

In 1909, **Martin Kirschner,** of Greifswald introduced small diameter wires for application of skeletal traction. These wires are insufficiently rigid until pulled taut in a special stirrup introduced by him in 1927. Rotation of the stirrup is imparted to the wire.

In 1929, **Bohler** of Austria introduced a special stirrup that is attached to the Steinmann pin. The Bohler stirrup allows the direction of the traction to be varied without turning the pin in the bone.

In 1972, **Denham** introduced a pin identical to the Steinmann pin, except for a short raised threaded length situated towards the end held in the introducer. This threaded portion engages the bony cortex and reduces the risk of the pin sliding. This type of pin is particularly suitable for use in cancellous bone or in osteoporotic bone in the elderly. For management of an intertrochanteric fracture by skeletal traction, a metal pin or wire is driven through the lower end of femur or the upper end of tibia. By this means the traction force is applied directly to the skeleton. It may be employed as a means of reducing or maintaining the reduction of a fracture, by overcoming the muscle spasm. A serious complication of skeletal traction is osteomyelitis.

After applying the skeletal traction the limb is applied the limb may be rested on a Bohler-Braun frame. It acts as a cradle for the limb. The patient's body and the proximal fragment move relative to the distal fragment, which is immobile. This may predispose to the occurrence of a deformity at the fracture site.

Well-Leg Traction[42]:

Roger Anderson in 1932 described a traction method wherein; skeletal traction was applied to the injured leg, while the 'well' leg was employed for counter-traction. It is valuable in correcting an abduction or adduction deformity at the hip. The principle of this method is that, if there is an abduction deformity at the hip, the affected limb appears to be longer. When traction is applied to the 'well' limb and the affected limb is simultaneously pushed 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.

Russell's Balanced Traction[42]

Hamilton Russell of Melbourne introduced it in 1924. It is an extremely simple and uncomplicated form of balanced traction. The underlying principle is the application of two forces at the knee, which tend to establish a resultant of their pull more or less in the axis of the femur.

Non-Operative Treatment of intertrochanteric fractures may follow one of the two fundamentally different approaches.

1) Early mobilization:

In this approach, the patients are mobilized immediately, just as if they had been operated. They are given analgesics and placed in a chair daily. If the physical condition improves, they are begun on non-weight bearing crutch walking. Shaftan and colleagues reported that fracture pain after a few days is rarely more severe than wound pain after open reduction. They also stressed that non-operative treatment by their technique did not prevent the fracture from healing.

However, in this approach, a deformity of varus, external rotation, and shortening is accepted.

2) Traction: Aufranc [42] recommended skeletal traction in balanced suspension for 10 to 12 weeks. The leg is kept in slight abduction, which allows easier reduction and maintenance of the normal head-neck angle. The patient is then mobilized and allowed partial weight bearing until fracture healing is solid.

Aufranc and associates noted that partial weight bearing might be required for 6 months before good fracture stability is obtained and that varus displacement could occur as late as 3 to 4 months after fracture.

If conservative treatment is elected, especially those methods requiring prolonged traction, great care must be taken to avoid the secondary complications of pneumonia, urinary tract infection, pressure sores over the sacrum and heels, equinus contractures of the foot and thromboembolic disease. Finally, the cost of this method of treatment should be considered.

OPERATIVE MANAGEMENT:

The treatment of choice of intertrochanteric fractures should be operative, employing some form of internal fixation. The goals of operative treatment is -

- Strong and stable fixation of the fracture fragments.
- Early mobilization of the patient.
- Restoration of the patient to his or her pre-operative status at the earliest.

Kaufer, Matthews and Sonstegard [43] have listed the variables that determine the strength of the fracture fragment-implant assembly. The variables are -

- Bone Quality.
- Fracture Geometry.
- Reduction.
- Implant Design.
- Implant Placement.

1. Bone Quality:

The mechanical properties of bone (hardness, elasticity and strength etc) vary considerably depending on age, sex, race, general state of the health, muscle mass and level of activity. Bone strength varies between in the same individual as well as different areas in the same bone. Pertrochanteric and sub trochanteric fractures occurring in elderly people are relatively low energy trauma injuries occurring in atrophic, osteoporotic or ostemoalacic bone. The X-ray density of bone is dependent on technique and the overlying soft tissues and hence is a relatively insensitive index.

Singh et al have developed a roentgenographic method for determining bone strength that is based on the trabaecular pattern of the proximal femur. This method is simple, readily available, requires no special equipment, correlates well with histologic controls, is sufficiently sensitive and prognostically useful. Loss of continuity of the primary tension trabeculae (i.e., Grade III) marks the transition between the bone capable of holding an internal fixation device and bone so weak- that these device become ineffective. In a laboratory study of cadaveric femoral using cyclic loads, at was found that regardless of other variables, internal fixation failed in 80% of fractures of the bone of Grade III or less, but was successful in 80% of cases with bone of Grade-IV or better. Clinical experience confirms that regardless of other variables, complications of fixation are most frequent in bone of poor quality[41]

2. Fragment Geometry :

Much clinical attention has been focused on the number, size, shape, location and displacement of sub trochanteric fracture fragments. De Lee used the concept of stable and unstable fractures in place of specific classification system. Stable subtrochanteric fractures are those in which it is possible to re-establish bone to bone contact of the medial and posterior femoral cortex anatomically, when this is possible,. an internal fixation device will act as a tension band on the lateral femoral cortex, and impaction and weight bearing can occur directly through the medial cortex (Frankel and Brustein, 1970; Muller, 1970 and Seinshemimer, 1978). In unstable fractures, medial cortical oppositions is not attainable secondary to comminution or fracture obliquity. Any lateral plate or intramedullary device will be subjected mainly to bending stress and the loads will concentrate in one area of the implant. This will result in implant failure or loss of fixation[41].

The bone quality and fracture geometry, are beyond the control of the surgeon. Therefore the surgeon has within his control the quality of reduction and the choice and placement of implant to achieve a stably reduced and internally fixed peritrochanteric fracture.

Surgical Techniques:

In the 19th century, patients with intertrochanteric fractures were simply placed in bed for prolonged periods of time until healing or more commonly until death.

Plate and Screw Devices:

The first successful implants in the treatment of intertrochanteric fractures were **Fixed Angle Nail Plate devices** (e.g., Jewett nail, Holt nail) consisting of a triflanged nail fixed to a plate at an angle of 130 to 150 degrees.

The use of fixed angle nail-plates of the Jewett type in pertrochanteric and subtrochanteric fractures has been met with mixed results. Froimson reported that the heavy duty Jewett nail supplemented by circumferential wire and screws when indicated was reliable in the management of the unstable comminuted sub trochanteric fractures. Postoperatively however, patients were allowed partial weight bearing only after two months.

Hamson and Tullos demonstrated 88% union rate after a single operation using a nail plate device. They recognized that implant failure was secondary to the nonunion and not the reverse.

Fielding noted an increasing incidence of nonunion and implant failure with fixed angle nail plates as the fracture site moved more distally, since 57% of his type-III failed to unite. However fielding believed that the internal fixation with strong Jewett nail, possibly supplemented by an anterior plate and bone grafting was the best method available then. Fielding and Magliato recommended a valgus reduction and axial plate fixation in type-I fractures to increase bony stability and prevent medial migration of the distal fragment.

A high incidence of varus deformity, acetabular penetration and implant failure associated with the Jewett nail led to the discontinuance of this type of implant for routine use in subtrochanteric fractures (Teitge, 1976; Waddell, 1979). Waddell also fixed with angle plates of Jewett or of McLaughlin type, especially in comminuted subtrochanteric fractures[41].

The **Sliding Nail Plate devices** were devised with the following solution - **Screw threads on the hip nail** - to improve purchase in the porotic bone of the femoral head. **Blunt tip on the screw** - to minimize the chance of head penetration. **Sliding feature** -to allow collapse and impaction of the fracture while maintaining the neck-shaft angle and controlling rotation. **Tongue in groove barrel collar** - to control rotation and provide additional strength at the nail plate junction. One early modification to the sliding hip screw maximized fracture impaction by allowing the proximal lag screw to telescope within the plate barrel and the plate to slide axially along the femoral shaft. To accomplish this bi-directional sliding, the plate was modified by replacing the round screw holes with slotted screw holes - **Egger's Plate.**

More recently, a two-component plate device, the **Medoff Plate** was introduced in which a central vertical channel constrains an internal sliding component.

Kulkarni G.S[44]. has modified the Richard's hip screw called the **Miraj Screw,** to make the procedure simpler and biomechanically sounder. The following modifications have been made in the standard device -

a. The lag screw is longer, while its proximal end has coarse threads as in the standard device; its distal end is also threaded. The compression is applied by a nut, which passes over the distal end instead of the nut entering the distal end. This makes the procedure simpler.

b. The distal shaft thread junction is made tapering to prevent the distal end of the barrel getting stuck.

c. The key and slot mechanism in the screw and barrel of the standard device, which prevent rotational movement of the fragment, has been eliminated.

In unstable trochanteric fractures in patients with severely osteoporotic bone some authors have suggested the use of **Polymethylmethacrylate (PMMA)** to augment the fixation and improve the stability.

The **Alta Expandable Dome Plunger** is a modified sliding hip screw designed to improve fixation of the proximal fragment by facilitating cement intrusion into the femoral head. Cement is kept away from the plate barrel so that the device's sliding potential is maintained. The method of insertion is similar to that of the sliding hip screw, except that the dome unit is manually pushed into the pre-reamed femoral neck and head proximal fixation is achieved as the plunger is then advanced, expanding the dome in the cancellous bone of the femoral head and extruding the contained cement.

Intramedullary Devices:

Intramedullary fixation of the intertrochanteric fractures from the medial side began with **Lezius** in 1950, who inserted the nail at the junction of the proximal and middle thirds of the femur.

In 1964 **Kuntscher** moved the point of insertion to the medial femoral condyle, where the cortex was thinner and minimal soft tissue requiring less exposure. The results were impressive, but the large diameter of the nail, the use on guide wire and inflexibility of the nail led to problems with its use.

In 1970 **Ender and Simon-Weidner** published the first accounts of the nailing using three pins that were smaller and more flexible and patterned after the 3/16 inch Rush pin. A later report by Ender and Simon-Weidner in 1974 included a modification of the hook end of the pins to a flattened end with a hook that allowed the use of hook extractor.These devices are inserted under image intensification in a retrograde manner. The advantages of this technique are -

- The incision remote from the fracture site reducing bleeding and infection.
- Minimal soft tissue dissection simplifying the surgery and thereby shortening the operative and anesthetic time.
- Intramedullary placement allowing for fracture impaction with weight bearing, while maintaining the normal neck shaft angle.
- As they are placed close to the mechanical axis of the femur, they are subjected to smaller bending moments than a plate and screw device. They have been associated with a significant incidence of complications such as -
- Rotational deformity.
- Supracondylar femur fracture.
- Proximal migration of the nails through the femoral head.

- Back out of the nail with resultant knee pain and knee stiffness.

- **Zickels Nail:**The first successful intramedullary device was developed by Zickel in the early 1960s. This was the single most effective device used in pertrochanteric and subtrochanteric fracture through the 1970s and early 1980s. In a series of pertrochanteric and subtrochanteric fracture at Hennepin country medical center treated with the Zickel nail and telescoping screw with early bone grafting, success was high.

- The Zickel appliance consist of a specially shaped medullary nail with a tunnel through its proximal par. A tirflanged nail is inserted through this tunnel into the femoral head and neck and then locked in place with setscrew. This accomplished secure fixation of both the proximal and distal fragments and is designed to permit early mobilization and ambulation. The present design consists of a tapered medullary rod 17 mm in diameter proximally with stem diameter of 11, 13 and 15 mm. The tunnel in the proximal end of the rod through which the triflanged nail is inserted passes through at an angle of 125 degrees with stem. The disadvantages of the procedure are, it has an open operating technique and the present design does not provide any compression mechanism for the femoral neck component of the implant and also does not provide distal locking facility. Earlier reported series made a mention of intraoperative comminution of greater trochanter, rotational and varus deformity[12].

Other intramedullary devices such as the **Gamma Nail, Intra medullary Hip Screw, Proximal Femoral Nail and Russell Taylor Reconstruction Nail** have been used for the fixation of intertrochanteric fractures. Second generation of interlocking nails called the **Trochanteric Gamma Nail** can be used without extension into the subtrochanteric area.

AP Gamma Locking Nail:

Halder introduced this new intramedullary device for the treatment of unstable pertrochanteric and subtrochanteric fractures. Because this device is intramedullary it lies more medial than the standard sliding compression hip screw and plate therefore less force is dissipated on the implant with weight bearing. The device therefore transmits the patients body weight closer to the calcar than the sliding compression hip screw. This results in greater mechanical strength.

Duration of surgery and blood loss is minimal with this implant. Halder reports no cases of fatigue fracture or implant failure and has noted no nonunion with the use of this implant. Coxa vara has occurred in minimal number of patients. Despite good results the authors have noted some cases in which nail cut out of femoral head and neck [8].

According to Davis and associates, the additional advantage of Gamma nail includes its closed method of insertion, which allows fixation without periosteal stripping and it is load sharing and not load sparing device [10].

Leung and colleagues compared the use of gamma nail and DHS for pertrochanteric and subtrochanteric fractures and concluded that Gamma nail was associated with shorter operating time, smaller incision, less blood loss and quicker return to full weight bearing

Bridle and co-workers recommended Gamma nail for intertrochanteric fractures with subtrochanteric extension and intertrochanteric fractures with reverse obliquity .

K S Leung[9] noted intraoperative fracture of lateral cortex with Gamma nail and also noted postoperative stress fracture of femoral shaft same as noted by Bridle et al and Halder 1992.

More or less the length of AP Gamma nail was found to be inadequate to fix comminuted pertrochanteric and sub trochanteric fracture extending into middle 1/3 of femoral shaft. These intramedullary methods of treatment of intertrochanteric fractures require extensive operative experience with the technique and expensive operating equipment, image intensification. The high incidence of complication reported with their use has resulted in a loss of popularity of these devices.

The **Intramedullary Hip Screw** couples a sliding hip screw with a locked intramedullary nail. This design offers several potential advantages -

- The intramedullary fixation, because of its location, theoretically provides more efficient load transfer than does a sliding hip screw.
- The shorter lever arm of the intramedullary device can be expected to decrease tensile strain on the implant, thereby decreasing the risk of implant failure.
- As it incorporates a sliding hip screw, the advantage of controlled fracture impaction is maintained.
- It theoretically requires shorter operative time and less soft tissue dissection.

These devices are associated with the risk of late femoral fractures at the tip of the device or the distal locking screws.

Russel Taylor Reconstruction Nail:

Klemn and Schellman, Grosse, Kempf and Lafforgue initially established guidelines for medullary nailing of femoral fractures. Stable fractures of the isthmus (transverse, short oblique, spiral or mildly comminuted fracture of the lateral cortex) are treated with unlocked nails, fracture proximal to isthmus are treated with proximally locked nails and more distal fractures are treated with distally locked by one or two screws. Although excellent results have been reported with the use of these guidelines, most large series report postoperative shortening because of unrecognized nondisplaced cortical fracture or overestimation of fracture stability. Union can be obtained in almost all pertrochanteric and sub trochanteric fractures with static interlocking and that rotation and length can be better controlled. Regular interlocking medullary nails may be used for fixation of most femoral fractures between distal fifth of the femur and a point just distal to lesser trochanter.

Russel Taylor reconstruction femoral nails are available in diameter of 12,13,14 and 15mm. The proximal 8cm section of the nail is expanded to 15mm to give extra strength for lag screw insertion into the femoral head. Proximally the inferior screw is 6.4mm. Both screws are self tapping and partially threaded to allow sliding compression. Distally 6.5mm fully threaded self tapping bone screws are used to allow bicortical fixation and reduce the possibility of screws backing out [13].

The **Russell Taylor Reconstruction nail** has been recommended for use in unstable intertrochanteric fractures or in fractures with reverse obliquity or subtrochanteric extension.

Prosthetic Replacement:

Prosthetic replacement for intertrochanteric fractures has not gained widespread support.The indications for primary prosthetic replacement remain ill defined. Most authors cite elderly, debilitated patients with a comminuted, unstable intertrochanteric fracture in severely osteoporotic bone, as the primary indication for prosthetic replacement. The indications for primary prosthetic replacement as per **Kenneth J. Koval** [45]are -

1. Symptomatic ipsilateral degenerative hip disease, where a total hip replacement is ideal.

2. Attempted open reduction and internal fixation that cannot be performed because of extensive comminution and poor bone quality, where the procedure should be aborted and a hemiarthroplasty should be carried out.

Primary prosthetic replacement is much more extensive and invasive procedure than internal fixation, with the potential for increased morbidity and complications including prosthetic dislocation. Furthermore, the cost of the prosthesis is high. Hence, prosthetic replacement is a useful technique for the occasional patient with an intertrochanteric non-union and failure of fixation.

External Fixators [46] The application of external Fixators in the management of intertrochanteric fractures is simple, safe and economical. It is the method of choice in high-risk geriatric patients.

Two or three 6.5mm Cancellous Shanz pins are passed percutaneously, into the femoral neck under image intensification, after reducing the fracture on a fracture table. Three or more preloaded 4.5mm Cortical Shanz pins are passed percutaneously transversely into the shaft. These pins are then connected to the tubular rods with universal clamps.

The application as well as removal of the external fixator is simple, and it can be done under local anaesthesia. The patients can be mobilized on the first post-operative day with the help of crutches. The advantages of external fixation are -

- Short operative time
- Minimal blood loss
- Early mobilization.

The complications with external fixation are

- Pin tract infection
- Varus collapse at the fracture site
- Pin breakage
- Proximal pin migration.

DEFINITION AND MECHANISM OF INJURY OF SUBTROCHANTERIC FRACTURES

Definition :

Subtrochanteric fractures of the femur are defined as the fracture located in the proximal third of femur from the level of lesser trochanter to a point 5 cms distally. It may occur as an extension from a trochanteric fracture or as an isolated fracture (Boyd and Griffin, 1949).

Fielding defined subtrochanteric area as three inches below the lesser trochanter and fractures occurring in this area are called subtrochanteric fractures[38].

Mechanism of Fracture :

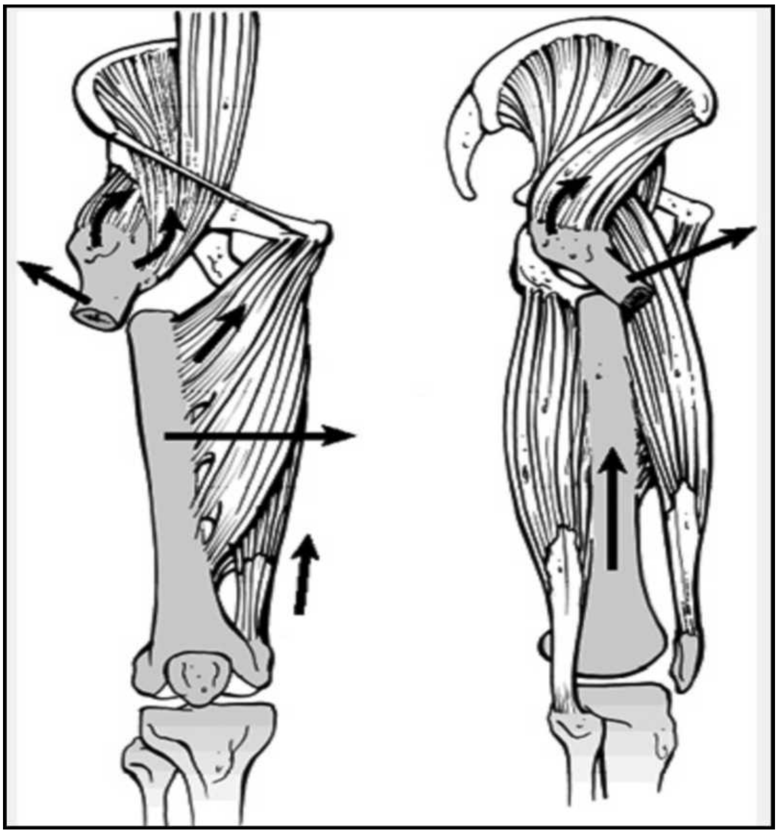
Fractures of the proximal femur occur by one of the three mechanisms. In the elderly, these fracture are usually due to low energy trauma, typically a minor fall. Spiral fractures generally result perhaps with butterfly comminution.

The second mechanism is that of the trivial trauma, with fracture through a defect in the proximal femur due to neoplasia. Most commonly metastatic carcinoma. Such pathological subtrochanteric fractures require assessment and management of the neoplastic process as well as of the fracture.

The third mechanism is high-energy trauma, motor vehicle accident or fall from significant height. Comminution, soft tissue damage including possible open wound and presence of associated injuries are typical concerns[47].

Traumatic anatomy :

Froimson described the pathological anatomy and physiology in fractures in the subtrochanteric region in which strong opposing muscles immediately distort relationships of the fragments. The proximal fragment is flexed and externally rotated by the iliopsoas muscles, abducted and further rotated externally by the gluteal and the short external rotators of the hip. The distal fragment is adducted by the strong adductor and hamstring groups, shortened by the pull of these muscles and usually posteriorly displaced by the weight of the limb when the patient is in the recumbent position[41].



Biomechanical Studies :

During the past century, a betterunderstanding of the biomechanics of subtrochanteric fractures has led to the development of better implants and radical changes in treatment modalities. Koch analyzed mechanical stress on the femur during weight bearing and found that compression stress exceeds 1200 lb per square inch in the medial subtrochanteric area 1 to 3 cms distal to the lesser trochanter in a 200 lb individual and lateral tensile stress measured about 20% less of about 900-1b/in^2. Frankel and Burstein demonstrated significant stress force on the hip and proximal femur with activities such as flexing and extending the hip while supine, indicating continuous stress on the implant system even with bed rest.

Rybicki, Simonen, and Weis found that higher forces are generated with eccentrically placed devices, such as plate and screw devices, compared with centromedullary devices[41].

CLASSIFICATION OF SUBTROCHANTERIC FRACTURES

"A classification is useful only if it considers the severity of the bone lesion and serves as a basis for treatment and for evaluation of the results".

Maurice E Muller - Numerous classification systems have been suggested for sub-trochanteric fractures, which have a prognostic importance and are of benefit in planning treatment.

FIELDING CLASSIFICATION (1966)[41]

They defined substrochanteric area as an area three inches in length extending from the proximal border of lesser trochanter to an area two inches distal to the lesser trochanter.

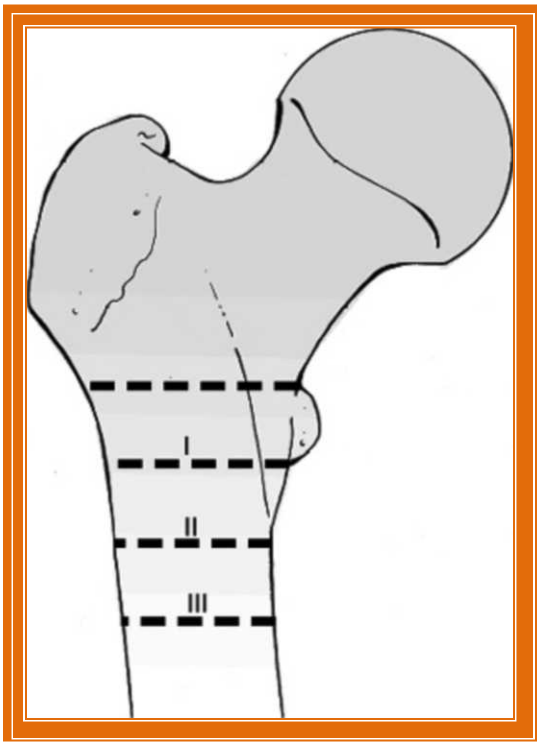
They then classified subtrochanteric fractures on the basis of three anatomic locations.

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

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

Type III : Fractures occurring in an area two to three inches (5.0-7.5 cm) below the upper border of the lesser trochanter. Transverse fractures fit in this classification well but oblique comminuted fractures may involve more than one of the levels described and should be classified according to the level of the major portion of the fracture or the area where the stress of the fracture concentrated.

As a rule fractures at the upper level have a better prognosis for union than at the lower level. Fielding and Magliato recognized an increased incidence of complications following treatment, as the fracture became more distal. Unfortunately this classification does not address the problem of comminution, which is critical in assessing fracture stability.



A.O. CLASSIFICATION (1970) [41]

Type A : Simple, transverse, oblique, spiral

Type B : Fractures that have lateral butterfly.

Type C : Fractures that have medial butterfly.

Type D : Comminuted fractures.

Type E : Shattered fractures.

A.O. Classification not only identifies the fracture pattern but also the most important feature, namely the type of comminution. Type B and Type C fractures can still be reconstructed to yield a stable structural unit, whereas in Type D and Type E fractures which have their hallmark comminution to such a degree that stable unit cannot be achieved. This group includes fractures with an irreconstructable medial buttress or such segmental comminution that it represents a segmental loss.

SEINSHEIMER'S CLASSIFICATION (1978)

Seinsheimer has developed a classification based on the number of fragments and location and configuration of fracture lines.

TYPE I: Non displaced fractures or those with less than 2 mm displacement.

TYPE II: Two part fractures

IIa: Transverse.

IIb: Spiral configuration with lesser trochanter attached to the proximal fragment

IIc: Spiral configuration with lesser trochanter attached to the distal fragment.

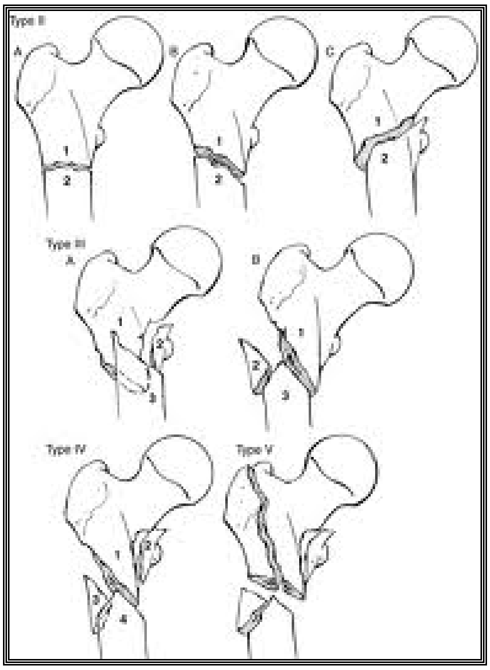
TYPE III: Three part fractures.

IIIa: Three part spiral configuration with lesser trochanter a part of the third Fragment.

IIIb: Three part spiral fracture with the third part a butterfly fragment.

TYPE IV: Comminuted with four or more fragments.

TYPE V: Subtrochanteric -intertrochanteric configuration.seinsheimer classification of subtrochanteric fracture



CLASSIFICATION OF SUBTROCHANTERIC FRACTURES ACCORDING TO FRACTURE STABILITY [41]

Fracture can be divided into stable and unstable injuries and the operative technique of internal fixation is different for both the varieties. It is important to emphasize that further down the shaft of the femur, the primary line is located, the greater the incidence of delayed union and implant failure.

Stable subtrochanteric fractures are those in which it is possible to reestablish bone-to-bone contact of the medial and posterior femoral cortex anatomically. Stable fractures can be displaced or undisplaced. The undisplaced fractures are of no importance and sometimes can be left untreated although it is wise in most cases, as in intracapsular fractures, to err on the side of safety and fix them with a pin and plate rather than risk the embarrassment of dissolution later. Whether displaced or undisplaced, these fractures have the same basic configuration they are two fragment injuries. The type of displacement depends upon whether the lesser trochanter remains attached to the proximal or distal fragment. If it is attached distally the upper fragment will remain in neutral rotation and the fracture can be reduced accurately by internally rotating the leg, while if the trochanter is still attached to the proximal fragment this will be externally rotated by the attached muscles and therefore fracture can only be reduced by external rotation of the leg. Both injuries however are stable when reduced and can be fixed in the normal anatomical position.

Unstable subtrochanteric fracture has been defined by Dimon and Hughston as one where the fracture lacks continuity of bone cortex on the opposing surfaces of the proximal and distal fragments. This is either due to comminution on the medial aspect of the neck in the region of the calcar or due to complete separation of a posterior trochanteric segment.

In unstable fractures medial cortical opposition is not attainable secondary to comminution or fracture obliquity. In this situation there is inadequate medial cortical support. Any lateral plate or Intramedullary device will be subjected mainly to bending stress and the loads will concentrate on one area of the impact. This will result in implant failure or loss of fixation. Unstable fractures are difficult to stabilize by often the patient lands up with a broken or detached pin and plate, and with a fracture which has united in considerable varus. These failures led Mervyn Evans to advice that unstable fracture should be fixed in the position of deformity, while Clawson advocated a return to radical conservation with continuous traction as the treatment of choice. Certainly if treated by conventional pinning, the results are poor and a complication rate of upto 50% can be expected. These fractures need medial displacement of the distal fragment to stablize them, followed by pin and plate fixation. Dimon and Hughston found that by using this technique the complication rate dropped from 51% to 8%. Undoubtedly where there is gross comminution and instability this is the operation of choice[41].

RUSSELL AND TAYLOR CLASSIFICATION [1]

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

Type I fractures do not extend into the piriformis fossa.

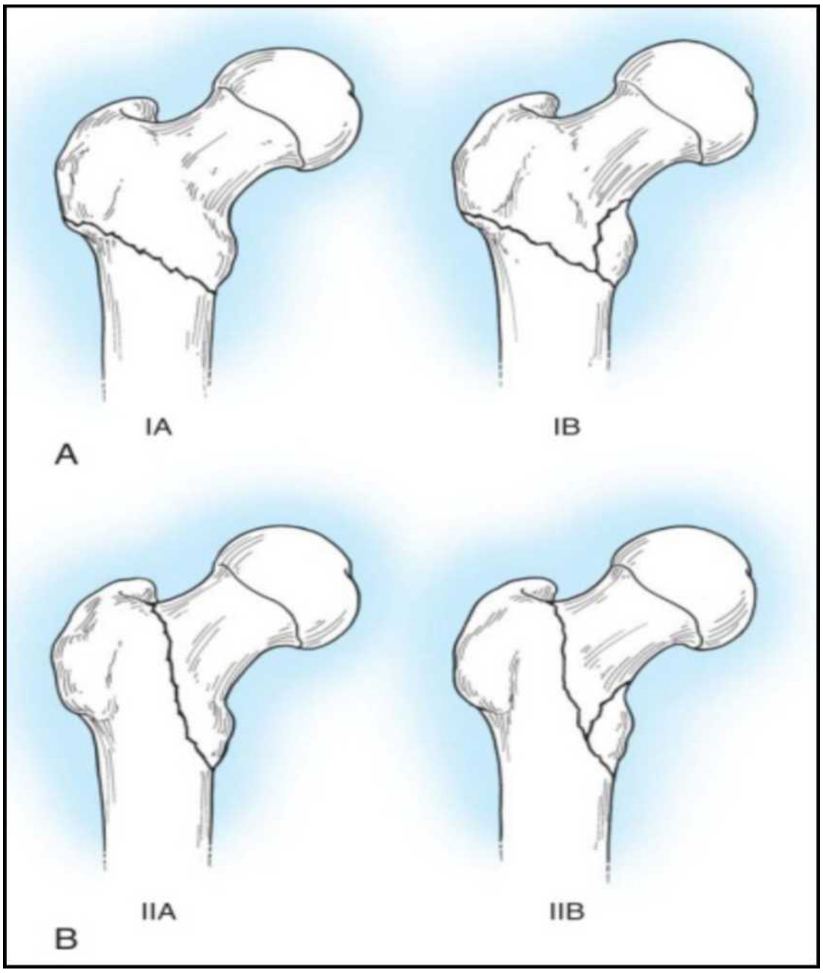
In **type IA** fractures, comminution and fracture lines extend from below the lesser trochanter to the femoral isthmus; any degree of comminution may be present in this area, including bicortical comminution.

Type IB fractures, have fracture line and comminution involving the area of the lesser trochanter to the isthmus.

Type II fractures extend proximally into the greater trochanter and involve the piriformis fossa, as detected on the lateral roentgenogram of the hip, which complicates closed nailing techniques.

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

Type IIB fractures, the fracture extends into the piriformis fossa with significant comminution of the medial femoral cortex and loss of continuity of the lesser trochanter



Russel-Taylor classification of subtrochanteric fracture

MANAGEMENT OF SUBTROCHANTERIC FRACTURES [1]

CLINICAL DIAGNOSIS:

Depending on the extent of the fracture of clinical picture resembles that in a patient with an intertrochanteric or femoral shaft fracture. Open fractures, although uncommon, do occur and signify severe soft tissue and bone injury. Because forces required to produce this fracture are substantial, associated injuries, both of the same extremity and especially elsewhere in the body should be suspected. Haemorrhage in the thigh may be significant and the patient should be monitored for hypovolaemic shock. Emergency splinting with a Thomas splint will prevent further soft tissue damage and haemorrhage. Associated vascular and neurologic injury is not common in subtrochanteric fractures.

RADIOLOGICAL DIAGNOSIS:

Anterior-posterior and true lateral X-ray is necessary to assess the extent of fracture clearly. As in all patients with femoral fractures an X-ray of the pelvis is essential to rule out associated dislocation of the hip or pelvic fracture. The X-ray of the hip and the pelvis is viewed to determine the presence or degree of osteoporosis in elderly patients before a decision regarding open versus closed treatment is made.

TREATMENT :

Subtrochanteric fractures of femur are difficult to manage. Subtrochanteric fractures may occur as an extension from a trochanteric fracture or as an isolated fracture. Most commonly these fractures are seen in two groups of patients. Older patients suffering a minor fall in which the fracture occurs through the weakened bone, who are involved in high-energy trauma.

Problems in treating subtrochanteric fractures are complicated by malunion and delayed or nonunion. Allisin 1981, recognized the complications of shortening, angular deformity and rotational malalignment following this fracture. With the help of muscular force analysis he explained the etiology of these deformities. Slower rate of union and higher rate of malunion is attributed to predominance of cortical bone, which is often comminuted, and highest amount of biomechanical stress present in the subtrochanteric area. The cortical bone vascularity and surfaces available for healing are less than in cancellous bone surfaces in the intertrochanteric fixation devices before bony union occurs.

Koch and Ryddl have shown the magnitude of the mechanical stresses in the subtrochanteric region and this directly influences the rate of failure of internal fixation. Froimson has shown that because of muscle activity, the proximal fragment tends to be abducted, flexed and externally rotated with shortening and angulation at the fracture site. This is true if the trochanter remains attached. It makes treatment of subtrochanteric fractures exceedingly difficult by traction or other non operative methods. If non operative treatment is required or selected, traction of the distal femur with the extremity in a 90-90 position hip and knee in 90 degree flexion is usually preferred, since no direct control of the proximal fragment is possible, the distal fragment must be placed in adduction and external rotation to match the proximal counterpart[41].

The risk or problems after pertrochanteric and subtrochanteric fractures are claimed to be higher than after other types of femur fracture. Malunion, nonunion and mortality have claimed to be 40%. Systemic complication related to effect of injury and immobilization in elderly includes cardiorespiratory, thromboembolic, gastro intestinal and pressure sores as well as debilitation of prolonged inactivity. Local complications include early loss of fixation, delayed union, late fixation failure usually to nonunion or infection and late hardware complications[2].

TRENDS IN SUBTROCHANTERIC FRACTURE TREATMENT

Non-operative Treatment :

Non- operative modalities of treatment are less commonly practiced. The indications are said to be severely comminuted sub trochanteric fractures where, stable osteosynthesis is not possible to attain and in open subtrochanteric fractures. Non-operative modalities of treatment claim for high mortality and morbidity and the final outcome may be varus angulation and rotational deformity[41].

Operative treatment :

Open reduction and internal fixation restores anatomy and allows early mobilization is the treatment of choice in subtrochanteric fractures provided stable osteosynthesis can be achieved at the time of operation. Because of comminution, stable internal fixation is difficult. These fractures are often extending into diaphyseal bone, Which has decreased vascularity and therefore has poor healing potential. This increases the need for stable internal fixation to reduce implant failure[30]. Satisfactory postoperative sub trochanteric fracture stability is determined by:

• Bone quality 'Fragment Geometry 'Reduction

• Fixation Device 'Device Placement

Fixation Device :

High incidence of complications reported after surgical treatment has lead to series of internal fixation devices. Various commonly employed internal fixation devices are:

I) Extra medullary Devices :

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

II) Intramedullary Devices :

1] Condylocephalic- Enders pins

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

AO Blade Plate:

Both Schatzer and Wadell recommended the use of the AO Blade plate in selected subtrochanteric fracture. They believe that it is best suited for those fracture that are slightly more distal in the pertrochanteric and the subtrochanteric region so that an accessory cancellous screw can be inserted beneath the blade into the calcar to increase proximal fixation

Asher and associates and Cech and Sosna also recommended the use of AO Blade plate and stressed the importance of restoring medial cortical stability by the use of interfragmentary compression of medial cortical fragments. Velasco and Comfort supported the use of the blade plate especially in fractures that were transverse and multiple large fractures that could be anatomically reduced to restore medial stability. Waddell reported failure with the AO Blade plated in 20% of fractures. He related failure to poor reduction of fracture fragments, and hence loss of medial cortical support, and to the initiation of weight bearing too early in the postoperative course.

In 1989, Kinast and associates presented a series of pertrochanteric and subtrochanteric fractures treated with a 95-degree condylar blade plate using a new technique of reduction. The goal of this new technique is to avoid soft tissues stripping. No attempt at anatomical restoration of medial cortical buttress is made. This group of patients was compared to a second group in which the anatomical direct reduction was performed and fixation was obtained also with a 95-degree condylar blade plate. The group that underwent indirect fixation had a nonunion rate of 0% compared to 16.6% in the group that underwent direct internal fixation.

The authors suggest that indirect reduction with preservation of soft tissue and pretensioning of the plate will produce faster healing time, lower nonunion, and lower infection rate. They also suggest that bone grafting of these fractures may be superfluous if this indirect method of reduction is used [6].

Dynamic hip screws :

Biomechanical and clinical studies have indicated that pertrochanteric and subtrochanteric fractures can be adequately fixed with hip compression screws and side plate combination. Newer systems have improved fatigue characteristics and loss of fixation usually occurs from cut of the screw from the femoral head rather than from fracture of the plate as occurred with older designs.

Waddell reported satisfactory result in 21 of 24 pertrochanteric and .subtrochanteric fractures using the sliding compression hip screw. Although the slide plate has increased strength, this does not nullify the importance of medial buttress reconstitution.

Burman and Coworkers reported 38 consecutive pertrochanteric and sub trochanteric fractures using the compression interfragmentary screw fixation to secure comminuted fracture to the main fragments the use of the Hirschoms device (used to produce compression beneath the plate) for compression of the short oblique and transverse fractures and bone grafting in all cases with comminution. Using these methods, they had no nonunion, implant failures or varus displacement [14].

The large proximal screw in the compression hip screw system obtains better purchase in the proximal fragment than do nail plate devices. The large sliding screw has a blunt nose, which results in less penetration of the femoral head and acetabulum in those fractures with self- impaction after nailing. The ability of the screw shaft to slide in the collar of the plate allows for impaction at the fracture surfaces, a fact of considerable importance in Fielding type I fractures. This tends to reduce the bending moment and resulting forces that lead to collapse of the medial buttress and varus displacement. For this sliding to occur, the plate must not be fixed with screws into the proximal fragment. Therefore the implant is most useful in the most proximal subtrochanteric fractures. Schatzker and Waddell recommended the use of sliding compression hip screw in high pertrochanteric and sub trrochanteric; fractures in which medialization of the shaft and impaction of the fracture are possible. They suggested that low fractures do better with AO side plate fixation if the medial cortex can be reconstituted. Complications are however still common (Doherty and Lyden 1979, Matthews Sonstegard and Dumbleton 1981, Wolfgang, Bryant and O Neil 1982, Manoli 1986, Amis, Bromage and Lar Vin 1987, Tronzo 1987, Simpson, Varty and Dodd 1989, Davis et al 1990). Problems include the need for considerable dissection, the lateral fixation of the side plate and insecure fixation of comminuted pertrochanteric and sub trochanteric fractures leading to delayed mobilization [5].

Medoffs Axial Compression Screw:

Medoff has designed a device that allows axial compression through the metaphyseal pertrochanteric and subtrochanteric portion through a sliding device that is incorporated into the plate attachment to the shaft of the femur. The compression slide acts as an intermediate segment, capturing the lag screw proximally and engaging barreled side plate distally in a sliding track. The barreled side plate is attached to the femoral shaft with bone screws directed in two planes. Medoff recommends the axial compression screw for transverse, high pertrochanteric and subtrochanteric with or without reverse obliquity, and for most unstable intertrochanteric fractures [48].

Biomechanical Study:

During the past century a better understanding of the biomechanics of pertrochanteric and subtrochanteric fracture has led to the development of better implants and radical changes in treatment modalities. Koch analyzed mechanical stresses on the femur during weight bearing and found that compression stresses exceeded 1200 Lb per sq inch in the medial subtrochanteric area 1 to 3cms distal to lesser trochanter lateral tensile stresses measured about 20% less. Frankel and Burstein demonstrated significant stress forces on the hip and proximal femur with activities such as flexing and extending the hip while supine indicating continuous stresses on the implant system even with bed rest.

Fielding, Cocharan and Zickel called attention to the necessity of a medial cortical buttress to minimize implant stresses and noted that nonunion was the cause of implant failure. Rybicki, Simonen, and Weis found that higher forces are generated with eccentrically placed devices, such as plate and screw devices, compared with centromedullary devices. Tordis noted the torsional effect of stresses in the pertrochanteric and subtrochanteric region, an important development in relation to current concept of static interlocking techniques because rotational shear forces may lead to implant failure cyclical loading. In response to the biomechanical studies, various implant devices have been introduced for subtrochanteric fracture treatment. Tencer et al in 1984 evaluated 7 of these implants to Cadaver models, osteotomies and segmental defects were created to stimulate pertrochanteric and sub trochanteric femoral fractures. Their results showed that interlocking nails and Zickel nails had greater bending stiffness than Ender pins and hip compression screws.

Torsional testing revealed that slotted open section nails and Ender pins restarted < 5% of normal femoral torsional stiffness. Plate and screw devices restarted <5% of normal femoral torsional stiffness. Plate and screw devices restarted approximately 40% of normal femoral torsional stiffness. In single load to failure testing, slotted nails failed at 350 % to 400%) of body weight, plate and screw devices failed at approx. 200%> of body weight. More recently compression screw and side plate devices with higher strengths and longer fatigue lives have been developed and approved for pertrochanteric and sub trochanteric fracture. A subsequent study by Tencer, Calhoun and Miller showed marked improvements in bending stiffness, torsional stiffness, and axial load to failure testing with closed section interlocking devices [48].

Uniflex Nail:

This implant was introduced by Biomet Inc. (Warsaw, Indiana). This nail provides proximal two holes which are obliquely placed for lag screw insertion of same diameter. The diameter of the nail is uniform throughout. The nail has a collapsible slot throughout its length. This implant was popularly used for treating pathological subtrochanteric fractures. It has got all the advantages and disadvantages of other popular interlocking nails. Its uniform diameter compromises its strength in proximal portion, when used in narrow femurs [13].

Interlocking Nails: (Grosse Kempf, AO)

The introduction of special intramedullary nails such as Groose Kempf nail, which allows the insertion of proximal and distal transfixing or locking screws, has extended the indications for locking screws provides rotational stability of the fracture and prevents shortening and varus angulation. These devices are useful only in subtrochanteric fractures below the level of lesser trochanter and without involvement of greater trochanter. The ability to insert these devices without opening the fracture site and preventing further devascularisation of fracture fragments has improved union in these fractures [13].

Proximal Femoral Nail:

In 1996, the AO/ASIF developed the proximal femoral nail (PFN) as an intramedullary device for the treatment of unstable per-, intra- and subtrochanteric femoral fractures.

Proximal femoral nail has all the advantages of an intramedullary device, such as decreasing the moment arm, can be inserted by closed technique, which retains the fracture hematoma an important consideration in fracture healing decreases blood loss, infection, minimizes the soft tissue dissection and wound complications[43].

In addition to all advantages of a nail to be implanted intramedullarily, it has several other favorable characteristics. Pre-drilling is not necessary, it can be dynamically locked, it has a high rotation stability, and mechanical stress concentration on the implant-bone interface is low [49].

The currently used Gamma nail as an intramedullary device also has a high learning curve with technical and mechanical failure rates of about 10%(collapse of the fracture area, cut-out of the implant, fracture of the femur shaft) [48,49]. The Arbeitsgemeinschaft fur Osteosynthesefragen (AO ASIF) therefore developed the proximal femoral nail with an antirotational hip pin together with a smaller distal shaft diameter to avoid these failures. In an experimental study, Gotze et al. (1998) compared the loadability of osteosynthesis of unstable per-and subtrrochanteric fractures and found that the PFN could bear the highest loads of all devices.

Simmermacher et al , in a clinical multicenter study reported technical failures of the PFN after poor reduction malrotation or wrong choice of screws in 5% of the cases. A cut-out of the neck screw occurred in 0.6% [18].

Christian Boldin et al found no fracture of the femoral shaft and no break in the implant, in comparison to the Gamma nail. . This is because of the tapered narrow tip of the nail which prevents the stress concentration [27].

Harris, I Rahme, D in their study of subtrochanteric femur fractures treated with a PFN compared to a 95 degree blade plate found that the fixation failure rated was 24% in the blade plate group. There no fixation failures in the PFN group [25].

METHODOLOGY

The present study consists of 20 adult patients of peritrochanteric factures of femur satisfying the inclusion criteria , who are treated with Proximal Femoral nail in R.L.Jalappa Hospital and Research Centre, attached to Sri Devaraj Urs Medical College, Tamaka,Kolar. The study is carried out from July 2009 to October 2011

Criteria for selection of patients:

Inclusion criteria:

1.Patients with age more than 18 years.

2.Post traumatic peritrochanteric fractures of femur (intertrochanteric and subtrochanteric).

Exclusion criteria:

1.Pathological fractures.

2. Patients with associated co-morbidities posing a risk for surgery.

Data collection :

After the patient with subtrochanteric or trochanteric fracture was admitted to hospital all the necessary clinical details were recorded in proforma prepared for this study. After the completion of the hospital treatment patients were discharged and called for follow up at outpatient level at regular intervals for serial clinical and radiological evaluation.

The patients were followed up till fracture union and function recovery after surgery at regular interval and if necessary subsequent follow up was done.

Management of patients:

As soon as the patient with suspected subtrochanteric or trochanteric fracture was seen, necessary clinical and radiological evaluation done and admitted to the ward after necessary resuscitation and splintage using skin/skeletal traction.

The following investigations were done routinely on all the patients preoperatively:

Blood:

Hb%, total leucocyte count, differential count, blood grouping, cross matching, blood sugar levels, blood urea, serum creatinine, serum electrolytes.

Urine :

Albumin, sugar and microscopic examination.

X-rays :

- Pelvis with both hips-AP view.
- Involved side hip with femur full length-AP and Lateral view in all patients.
- Chest Xray – AP view.

All the patients were evaluated for associated medical problems and were referred to respective departments and necessary treatment was given. Associated injuries were evaluated and treated simultaneously.

Pre-op planning:

1) Determination of nail diameter: Nail diameter was determined by measuring diameter of the femur at the level of isthmus on an AP x ray.
2) Determination of neck shaft angle: Neck shaft angle was measured on the unaffected side on an AP x-ray using goniometer.
3) Length of the nail: Short PFN nail (250mm) and long PFN nail (320mm) were used.

Proximal Femoral Nail implant details:

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

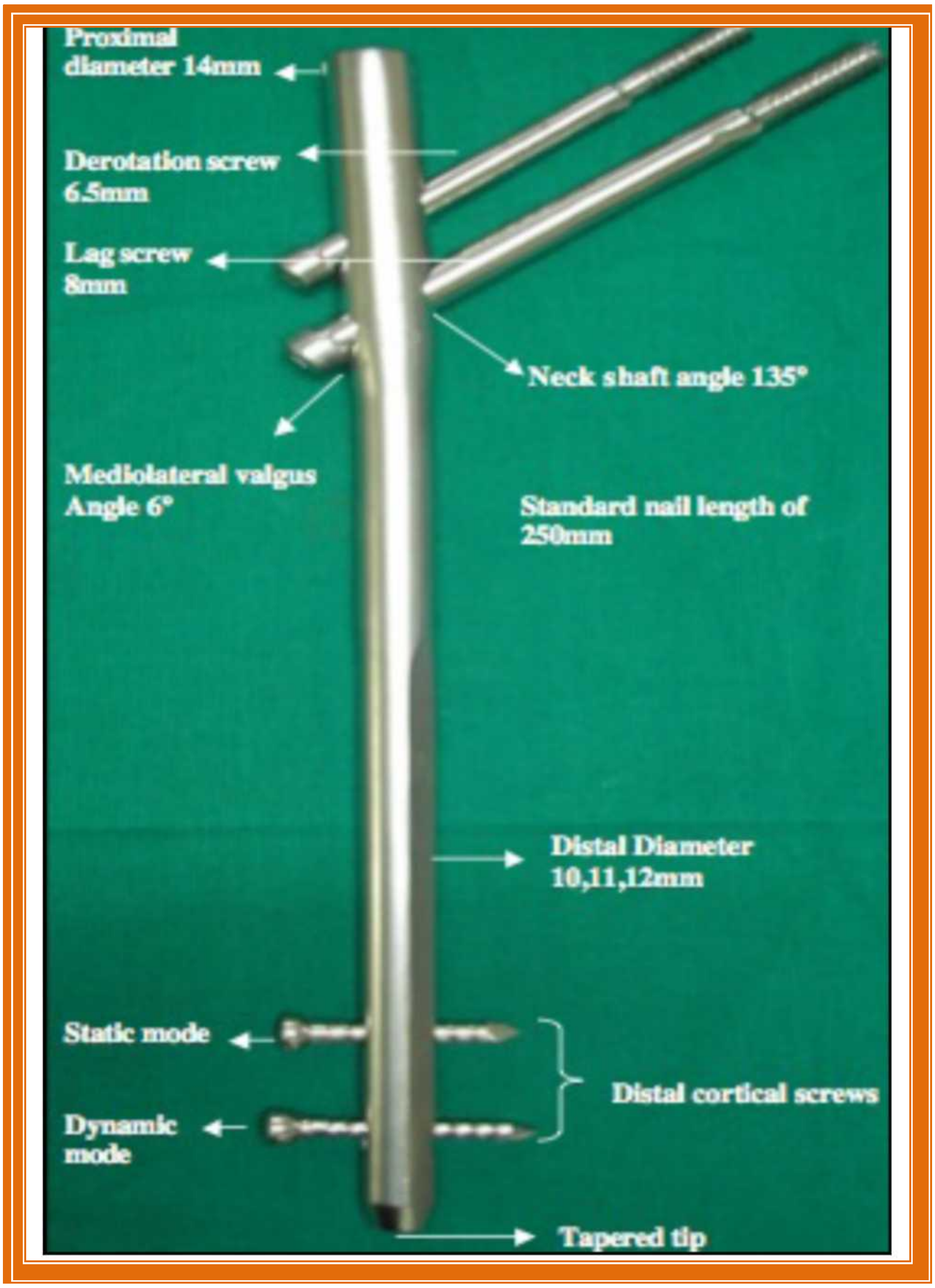
1] Length: standard PFN -250 mm Long PFN- 320, 340, 380mm.

2] Diameter: 9,10,11,12 mm

3] Neck shaft angle range: 125^0, 130^0,$135^{0.}$ The nail is having 14mm proximal diameter. This increases the stability of the implant. There is 6^0 mediolateral valgus angle, which prevent varus collapse of the fracture even when there is medial comminution.

The distal diameter is tapered to 9 to 12 mm which also has grooves to prevent stress concentration at the end of the nail and avoids fracture of the shaft distal to the nail. Proximally it has 2 holes the distal one is for the insertion of 8 mm neck screw which acts as a sliding screw, the proximal one is for 6.5 mm hip pin which helps to prevent the rotation. Distally nail has two holes for insertion of 4.9 mm locking screws, of which one is static and the other one is dynamic which allows dynamization of 5 mm.

In our study we used a standard length PFN of 250 mm with distal diameter of 10,11,12mm.the proximal diameter of nail is 14mm.The pxoximal derotation screw of 6.5mm and distal lag screw of 8mm.Distal locking is done with self tapping 4.9mm cortical screws one in static mode and the other in dynamic mode allowing 5mm dynamisation. The nail is universal with 6 degrees mediolateral angulation and with a neck shaft angle of 135 degrees.


Proximal diameter 14mm
Derotation screw 6.5mm
Lag screw 8mm
Neck shaft angle 135°
Mediolateral valgus Angle 6°
Standard nail length of 250mm
Distal Diameter 10,11,12mm
Static mode
Distal cortical screws
Dynamic mode
Tapered tip

OPERATIVE TECHNIOUE: Patient positioning and fracture reduction :

The patient was placed in supine position on fracture table with adduction of the affected limb by 10 to 15 degrees and closed reduction of the fracture was done by traction and gentle rotation. The unaffected leg was flexed and abducted as far as possible in order to accommodate to image intensifier. The image intensifier was positioned so that anterior-posterior & lateral views of the hip and femur could be taken.

The patient was then prepared and draped as for the standard hip fracture fixation. Prophylactic antibiotic was given to all patients 30 minutes before surgery.

Percutaneous fixation of fracture:

In Trochanteric fractures we fixed the fracture percutaneously using two "k"wires which pass along the anterior cortex of greater trochanter and neck of femur into the head of femur. By doing so we can prevent the fracture opening up on adduction of limb for nail insertion.

Approach :

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

Determination of the entry point and insertion of guide wire :

In AP view on C-arm, the entry point is on the tip or slightly lateral to the tip of the greater trochanter. In lateral view, guide wire position confirmed in the center of the medullary cavity. The guide wire is inserted in this direction to a depth of 30cms with a T handle.

Opening of the femur:

Over the guide wire, a cannulated rigid reamer is inserted through the protection sleeve and manual reaming was done as far as the stop on the protection sleeve.

Insertion of the PFN:

After confirming satisfactory fracture reduction an appropriate size nail as determined pre operatively was assembled to the insertion handle and inserted manually as far as possible into the femoral opening. This step was done carefully without hammering by slight twisting movements of the hand until the hole for 8mm screw is at the level of inferior margin of neck. In cases where satisfactory reduction was not possible by closed means, open reduction was done. **Insertion of the guide wire for neck screw and hip pin :**

These are inserted with the help of the aiming device tightly secured to the insertion handle and using the colour coded drill sleeve systems. A 2.8 mm guide wire was inserted through the drill sleeve after a stab incision with its position in the caudal area of the femoral head for neck screw. This guide wire is inserted 5 mm deeper than the planned screw size. The final position of this guide wire should be in the lower half of the neck in AP view and in the center of the neck in lateral view. Proper positioning of the nail will aid in proper anteversion of the neck screw as there is inbuilt anteversion in the hole on the nail.

A second 2.8 mm guide wire is inserted through the drill sleeve above the first one for hip pin. The tip of this guide wire should be 5mm deeper than the planned hip pin but approximately 25-20 mm less deep than planned neck screw.

Insertion of the hip pin:

The hip pin is inserted first to prevent the possible rotation of the medial fragment when inserting the neck screw. The length of the hip pin is indicated on measuring device and is calculated 5 mm before the tip of the guide wire. Drilling is done over the guide wire with 6.5 mm drill bit to a depth upto the length of hip pin previously measured. The same length 65 mm hip pin is inserted with the help of hexagonal cannulated screwdriver. Length and position to be confirmed with C-Arm Guide wire is then removed.

Insertion of the neck screw:

A measuring device is inserted over the 2.8 mm guide wire until it touches the bone. The correct length is indicated on the measuring device and calculated to end approximately 5 mm before the tip of the guide wire. This length is set on the 8 mm reamer by securing the fixation sleeve in correct position. Drilling is done over 2.8 mm guide wire till the fixation sleeve prevents further drilling. Tapping is not done as the neck screw is self tapping. Neck screw is inserted using cannulated screw driver. Final position confirmed with image intensifier.

Distal locking :

Distal locking is usually performed with two cortical screws. For standard PFN , aiming was used. A drill sleeve system was inserted through a stab incision. A drill hole is made with 4 mm drill bit through both cortices length is measured directly from the drill marking. Locking screw is inserted through protection sleeve position confirmed with image intensifier.

Closure:

After the fixation is over, lavage is given using normal saline. Incision closed in layers. Sterile dressing is applied over the wounds and compression bandage given.

After treatment:

Postoperatively, patients pulse, blood pressure, respiration, temperature were monitored. Foot end elevation is given depending on blood pressure. Antibiotics were continued in the post operative period. Analgesics were given as per patients compliance. Blood transfusion was given depending on the requirement. Sutures removed on 10th postoperative day.

Patients were encouraged to sit in the bed after 24 hours after surgery. Patients were taught quadriceps setting exercises and knee mobilization in the immediate post operative period. Patient was taught gait training before discharge from the hospital. Only in very unstable fracture patterns weight bearing was not advised. Rest of the patients were encouraged to weight bear partially with axillary cruthes or walker depending on the pain tolerability of individual patient.

Discharge :

Patients were discharged from the hospital when independent walking was possible with or without walking aids.

Follow up :

All patients were followed up at an interval of 6 weeks till the fracture union is noted and then after once in 3 months till 1year.

At every visit patient was assessed clinically regarding hip and knee function, walking ability, fracture union, deformity and shortening.

Modified Harris Hip scoring system was used for evaluation.

X-ray of the involved hip with femur was done to assess fracture union and implant bone interaction.

Results of the surgery:

Functional Results:

Assessed based following hip scoring system adopted.

Harris Hip Scoring System (Modified)[57] • Maximum points possible

- 100 Pain relief- 44 Function- 47 Range of motion- 5 Absence of deformity- 4

(1) Pain (44 Possible)

- None or ignores it (44)
- Slight, occasional, no compromise in activities (40)
- Mild pain, no effect on average activities, rarely moderate pain with usual activity; may take aspirin (30)
- Moderate pain, tolerable but makes concessions to pain, some limitation of ordinary activity or work; may require occasional medicine stronger than aspirin (20)
- Marked pain, serious limitation of activities (10)
- Totally disabled, crippled, pain in bed, bed ridden (0)

(2) Function (47 Possible) Gait (33 POSSIBLE)

(A) LIMP

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

(B) SUPPORT

- None (11)
- Cane for long walks (7)
- Cane most of the time (5)
- One crutch (3)
- Two canes (2)
- Two crutches (0)
- Not able to walk (0)
-

(C) DISTANCE WALKED

- Unlimited (11)
- Six blocks (8)
- Two or three blocks (5)
- Indoors only (2)
- Bed and chair (0)

Activities (14 Possible) (A)

STAIRS

- Normally without use of railing (4)
- Normally use of railing (2)
- In any manner (1)
- Unable to do stairs (0) (B) SHOES

AND SOCKS

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

(C) SITTING

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

(D) ENTER PUBLIC TRANSPORTATION (1)

(3) Abscense of deformity (All yes = 4; Less than 4 = 0)

- Less than 30 degrees of fixed flexion contracture.
- Less than 10 degrees of fixed adduction.
- Less than 10 degrees of fixed internal rotation in extension.

- Limb length discrepancy less than 3.2 cm.

(4) Range of motion (5 Possible) (* Normal)

Total degree measurements, then check range to obtain score

- Flexion (*140 degrees)
- Abduction (*40)
- Adduction (*40)
- External rotation (*40)
- Internal rotation (*40)

Range of motion scale

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

Total Harris Hip Score

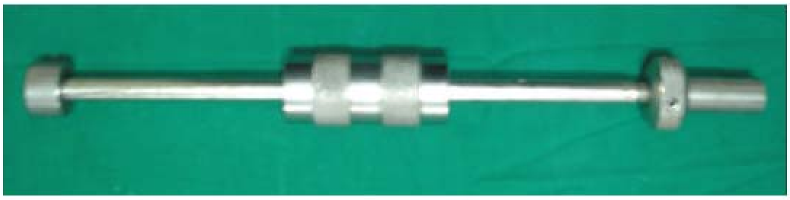
Score	**Rating**
90-100	Excellent
80-89	Good
70-79	Fair
<70	Poor

STRAIGHT AND CURVED AWL

RIGID REAMER AND BOX SPANNER

SOLAPUR SLEEVE WITH OTHERS

4.9mm, 6.5mm, 8mm REAMERS

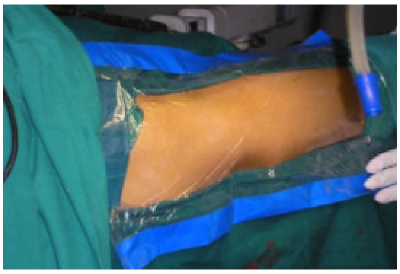


RAM WITH SLOTTED HAMMER USED FOR REMOVAL OF NAIL

INTRAOPERATIVE PHOTOGRAPHS

PATIENT POSITIONING

PAINTING

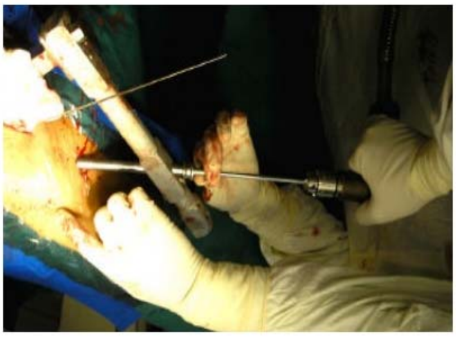


DRAPING

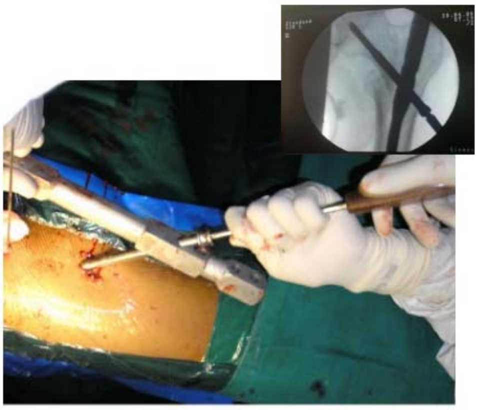
GUIDE WIRE IN SITU

REAMING OF ENTRY POINT OVER GUIDE WIRE

C-Arm View

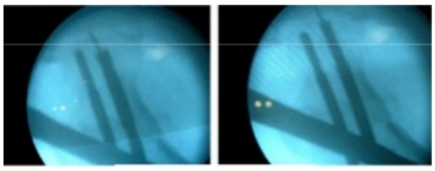


DRILLING ON GUIDE WIRE FOR NECK SCREW

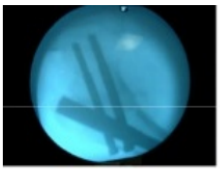


INSERTION OF NECK SCREW

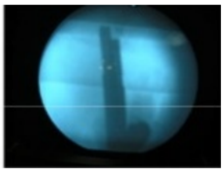
C-ARM PHOTOS



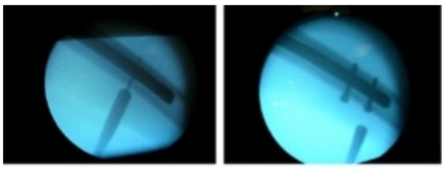
PROXIMAL REAMING



NECK SCREWS PUT IN AP-VIEW



NECK SCREWS PUT IN LATERAL VIEW



DISTAL LOCKING

CLINICAL PHOTOGRAPHS

CASE NO:17

1. SURGICAL SCAR WITH HIP FLEXION

2. **EXTERNAL ROTATION**

3. **PATIENT STANDING ON OPERATED LIMB**

X-RAYS

Pre-op

Immediate post-op

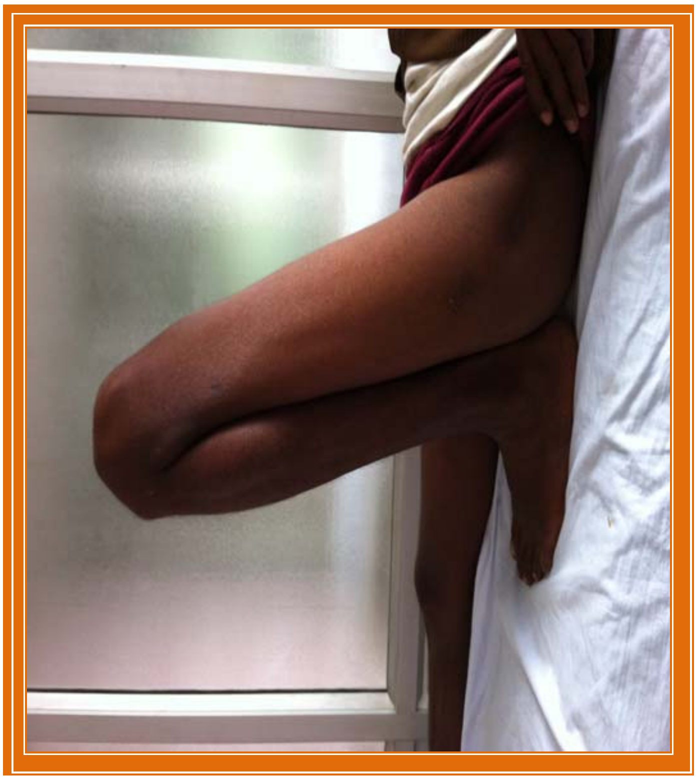
6 months post-op

1 year post-op

CASE NO:12

1. EXTERNAL ROTATION AT HIP

2. SURGICAL SCAR WITH HIP FLEXION



3. SURGICAL SCAR WITH INTERNAL ROTATION

4.SQUATTING

X-RAYS

IMMEDIATE POSTOPERTIVE

6 WEEKS POSTOPERATIVE

12 WEEKS POSTOPERTIVE

6 MONTHS POSTOPERATIVE

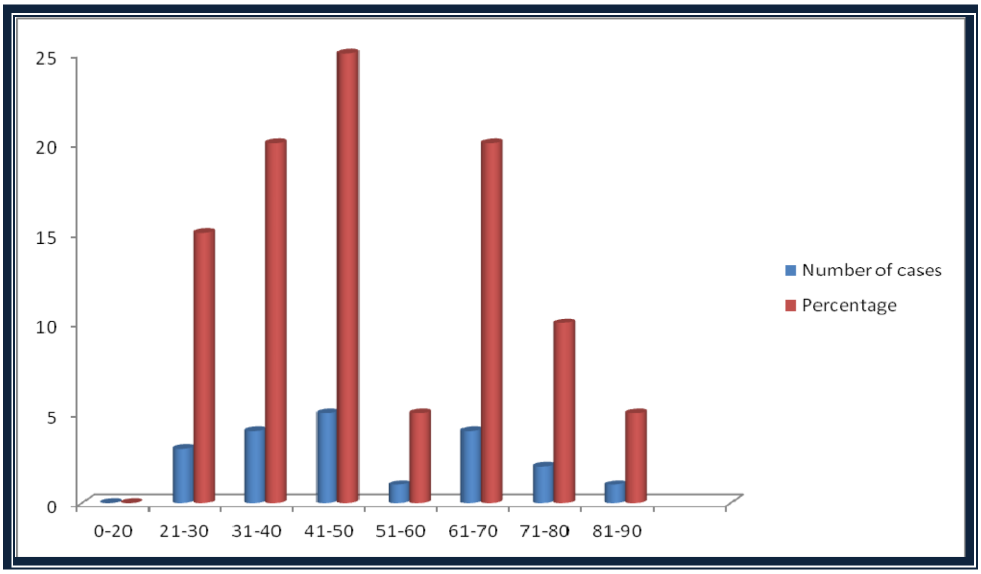
RESULTS

The following observations were made from the data collected during this study of proximal femoral nail in the treatment of 20 cases of Peritrochanteric fractures of proximal femur in the Department of Orthopaedic Surgery, R.L.Jalappa Hospital and research centre attached to Sri Devaraj Urs Medical College, Tamaka, Kolar between July 2009 to October 2011.

1) Age Distribution :

Age in years	Number of cases	Percentage
0-20	0	0
21-30	3	15
31-40	4	20
41-50	5	25
51-60	1	5
61-70	4	20
71-80	2	10
81-90	1	5
Total	20	100

In our series, majority of the cases i.e.12 (60%) were in the age group of 20-50 years, followed by 8 (40%) cases in the age group 50-90 years. The youngest patient was 23 years old and eldest patient was 90 years. The mean age was 50.3 years.

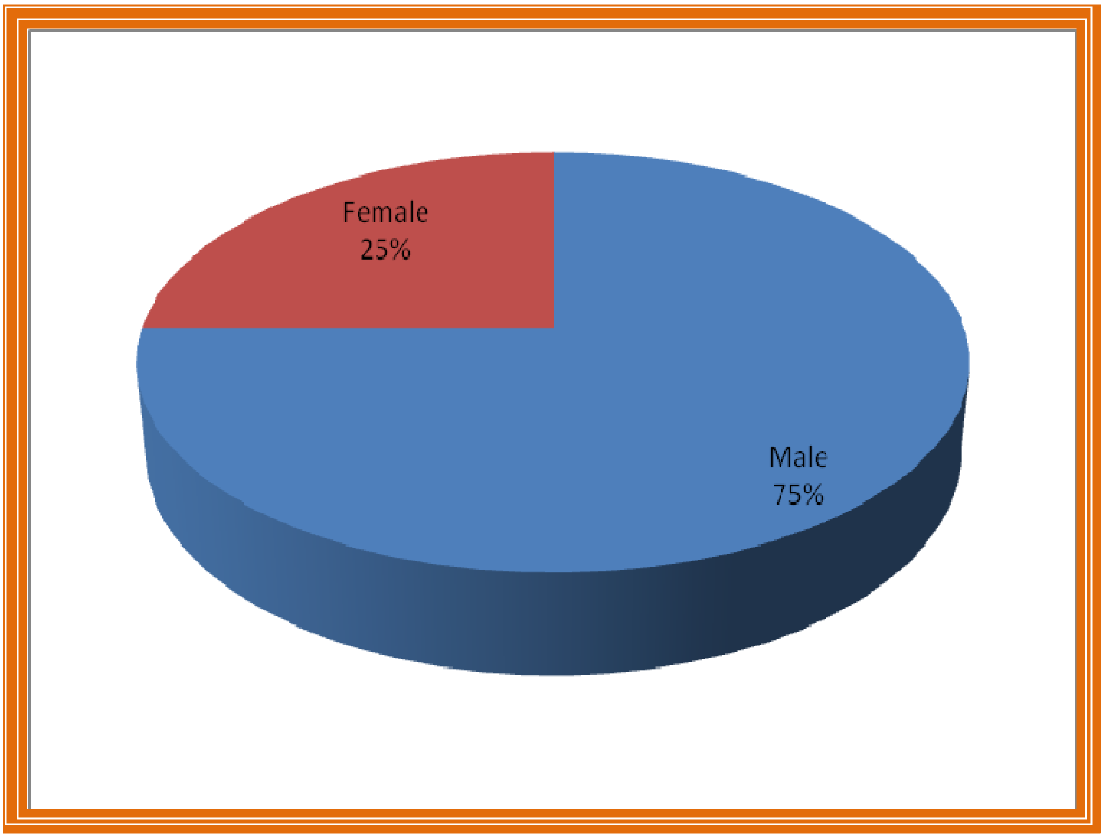


Graph 1-Age distribution

2.Sex Distribution:

Sex	Number of cases	Percentage
Male	15	75
Female	5	25
Total	20	100

In the present series, males were more commonly involved. Majority of the patients were males – 15 cases (75.0%) and 5 cases (25.0%) were females.

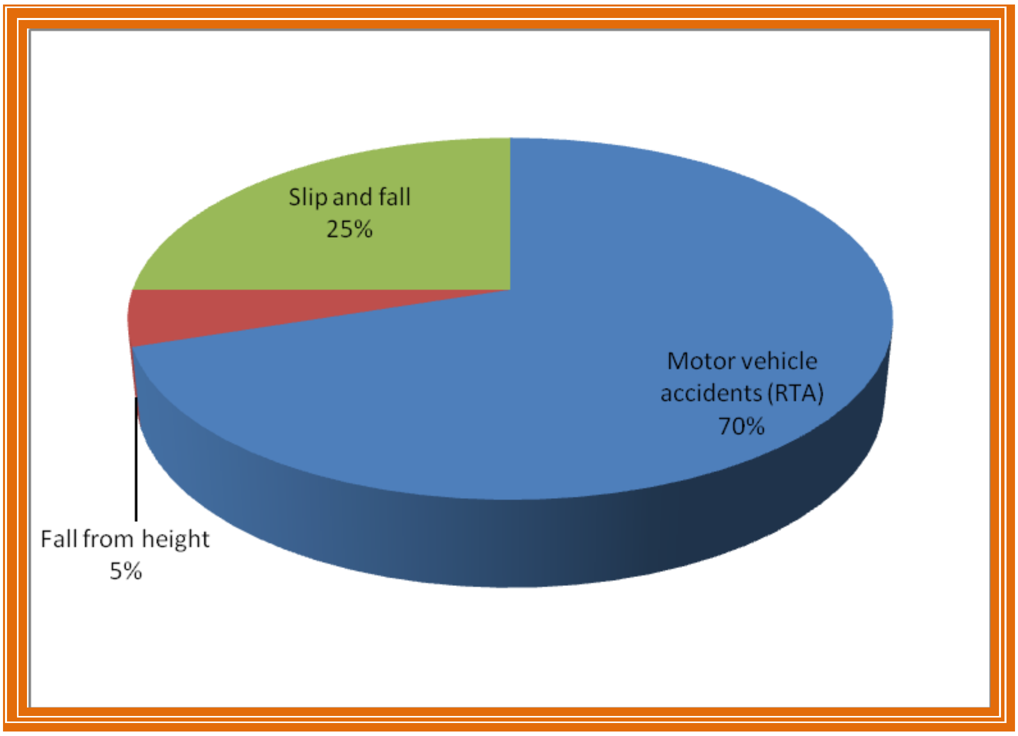


Graph 2- sex distribution

3) Nature of violence:

Nature of violence	Number of cases	Percentage
Motor vehicle accidents (RTA)	14	70
Fall from height	1	5
Slip and fall	5	25
Total	20	100

5 cases (25%) affected were due to Slip and Fall, 14 cases (70%) due to RTA, and 1 case (5%) due to Fall from height. RTA was the most common mode of injury.

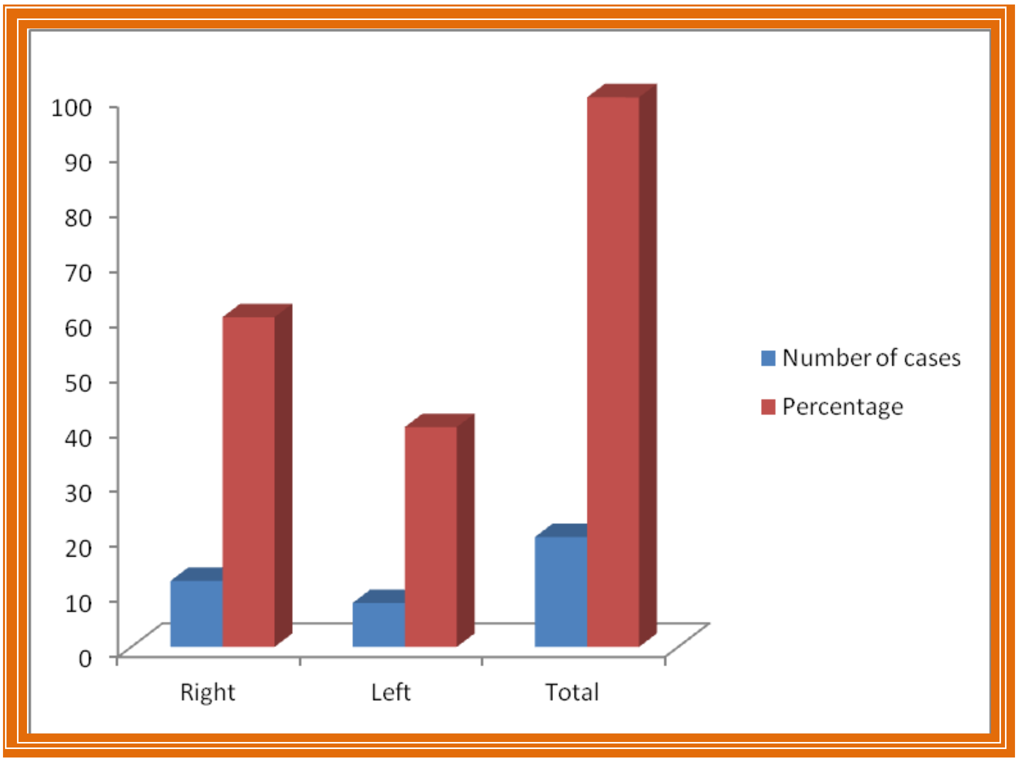


Graph 3 – Nature of violence

4) Side Affected:

Side affected	Number of cases	Percentage
Right	12	60
Left	8	40
Total	20	100

Right side was involved in 12(60%) cases and left in 8 (40%), right side was more commonly involved than left side.

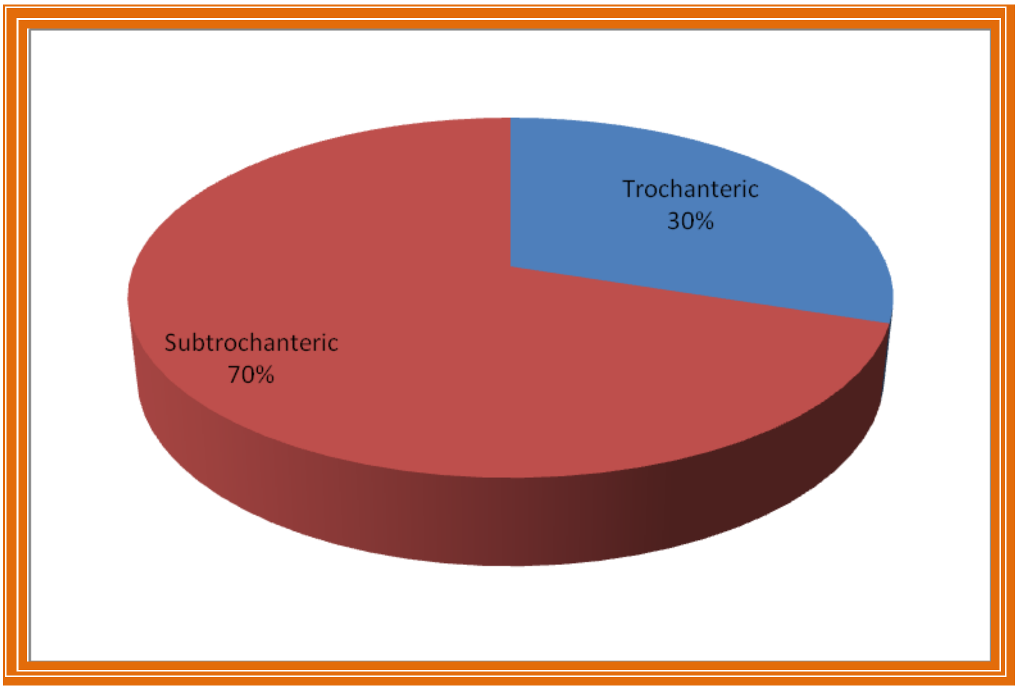


Graph 4- Side affected

5) Type of fracture

Type of fracture	Number of cases	Percentage
Trochanteric	6	30
Subtrochanteric	14	70

In our study 6 cases were Trochanteric and 14 cases were subtrochanteric fractures.



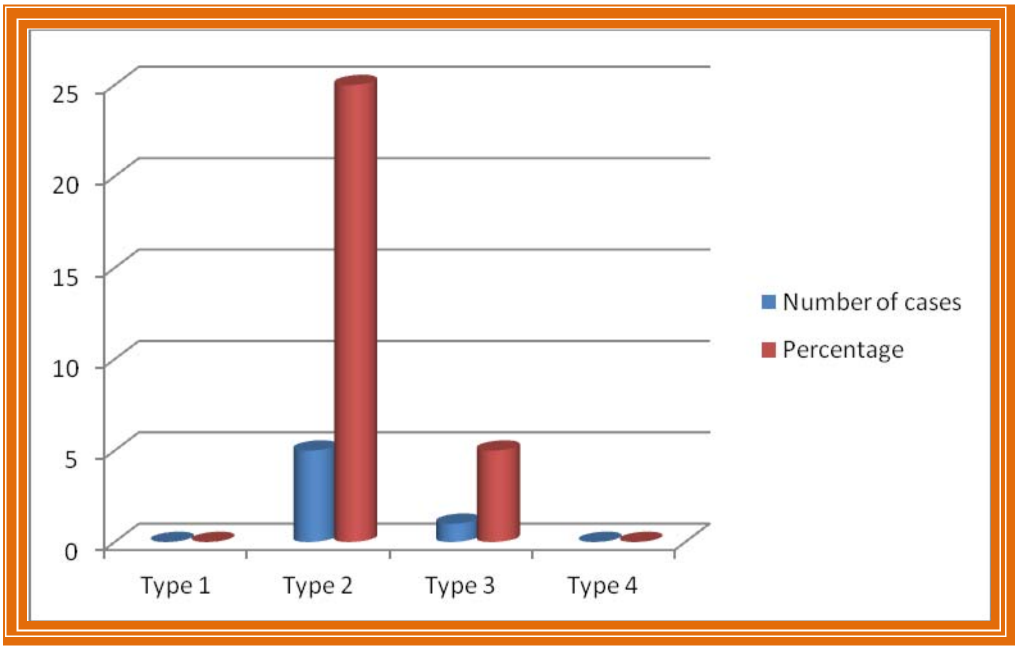
Graph 5- Type of fracture

6) Boyd and Griffin classification

Table - 6 : Trochanteric Fractures are classified according to Boyd and Griffin classification

Type of fracture	Number of cases	Percentage
Type 1	0	0
Type 2	5	25
Type 3	1	5
Type 4	0	0

In the present study, majority of the cases i.e. 5 (25%) had type 2 , followed by 1(5%) case had type 3 Boyd and Griffin type.

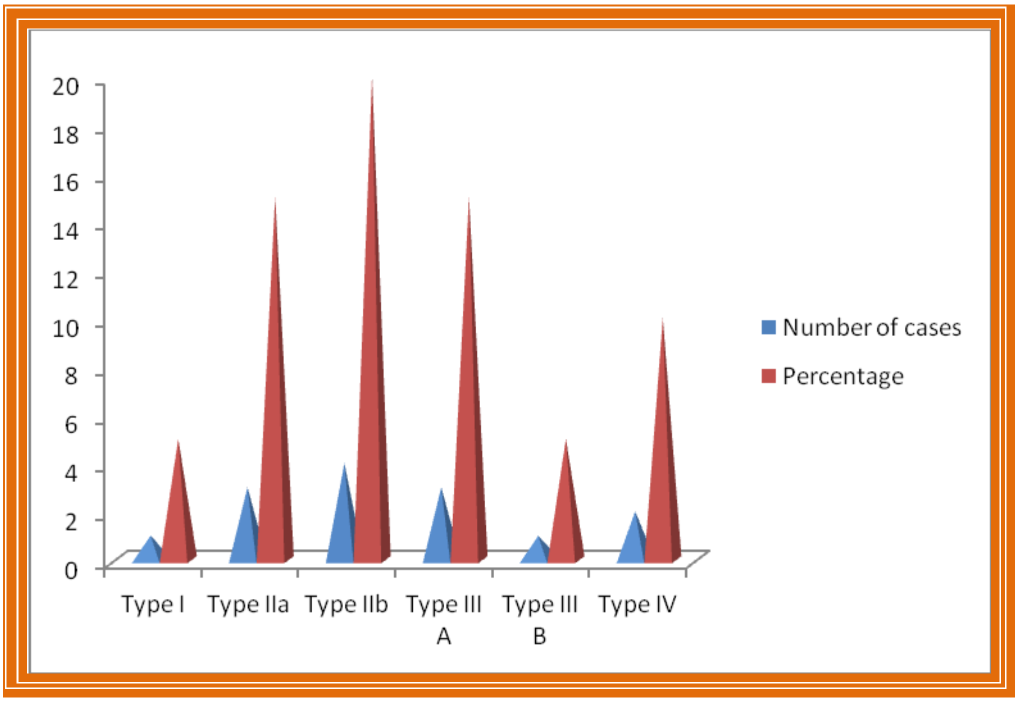


Graph 6- B & G classification

7) Seinsheimer Classification

Table - 7 : Subtrochanteric fractures are classified according to Seinsheimer Classification

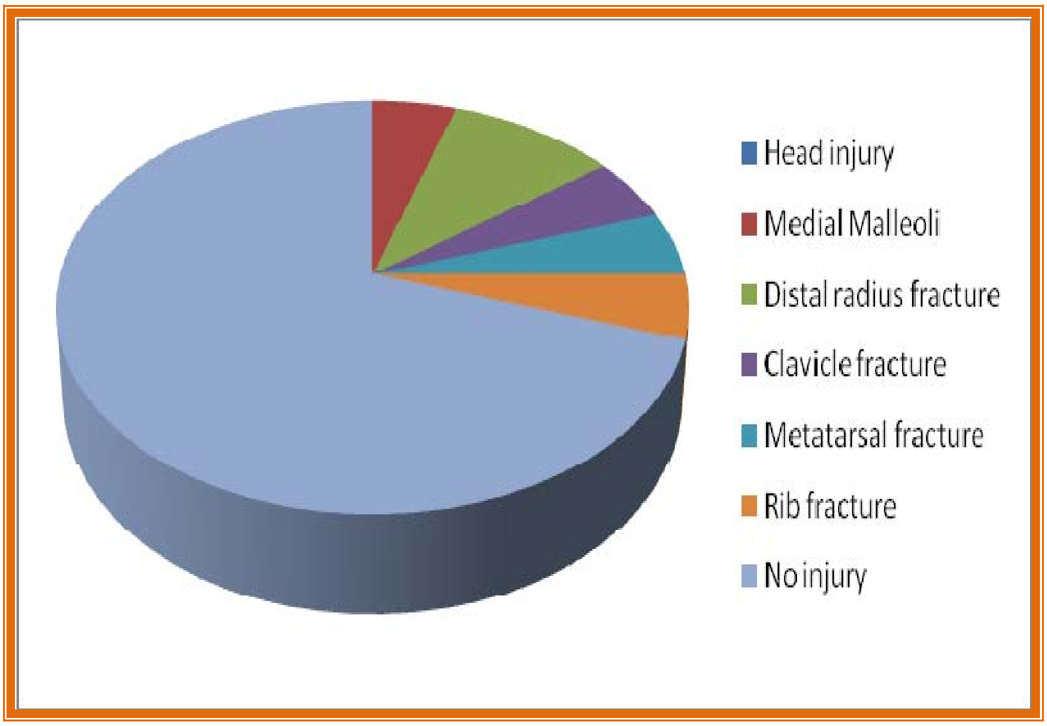
Type of fracture	Number of cases	Percentage
Type I	1	5
Type Iia	3	15
Type Iib	4	20
Type III A	3	15
Type III B	1	5
Type IV	2	10



Graph 7- Seinsheimer classification

Table - 8 :Associated Injuries

Associate Injury	No. Of. Cases	Percentage (%)
Head injury	2	10
Medial Malleoli	1	5
Distal radius fracture	3	15
Clavicle fracture	2	10
Metatarsal fracture	1	5
Rib fracture	1	5
Tibial fracture	2	10



Graph 8- Associated injuries

HEAD INJURY TIBIAL SHAFT-DISTAL RADIUS FRACTURE - CLAVICLE FRACTURE

- Two patients had closed head injury CT brain study impression normal report and were managed conservatively.
- Two patients had fracture shaft tibia out of which one was closed fracture managed with Intramedullary interlocking nail in same setting and another ipsilateral open type GA 1 comminuted fracture mid third.
- Three patients had distal radius fracture .Two of them treated conservatively with reduction and below elbow cast application and other was treated with Open reduction and internal fixation with Locking compression plate
- Two patient had ipsilateral # clavicle and was treated conservatively.

Time of surgery

All the cases included in our study group were fresh fractures who underwent surgery at the earliest possible period after trauma . The delay was due to associated injuries, medical condition of the patients. The patients were operated with a minimum post traumatic duration of 1 day to a maximum of 11 days with an average interval of 6 days .

Intraoperative details:

In our study, we considered various intraoperative parameters such as duration of radiographic screening-more exposure in case of comminuted fractures with difficult reduction. We took less exposure time in cases of intertrochanteric fracture where reduction was not a problem. We took more exposure time for the initial few cases but as we got experience the radiation exposure was less.

Duration of surgery was more for the initially operated cases. More in cases of subtrochanteric fractures when compared to trochanteric fractures and in fractures where we had to do open reduction.

Blood loss-measured by mop count (each fully soaked mop containing 50ml blood) more blood loss was seen in patients who require open reduction.

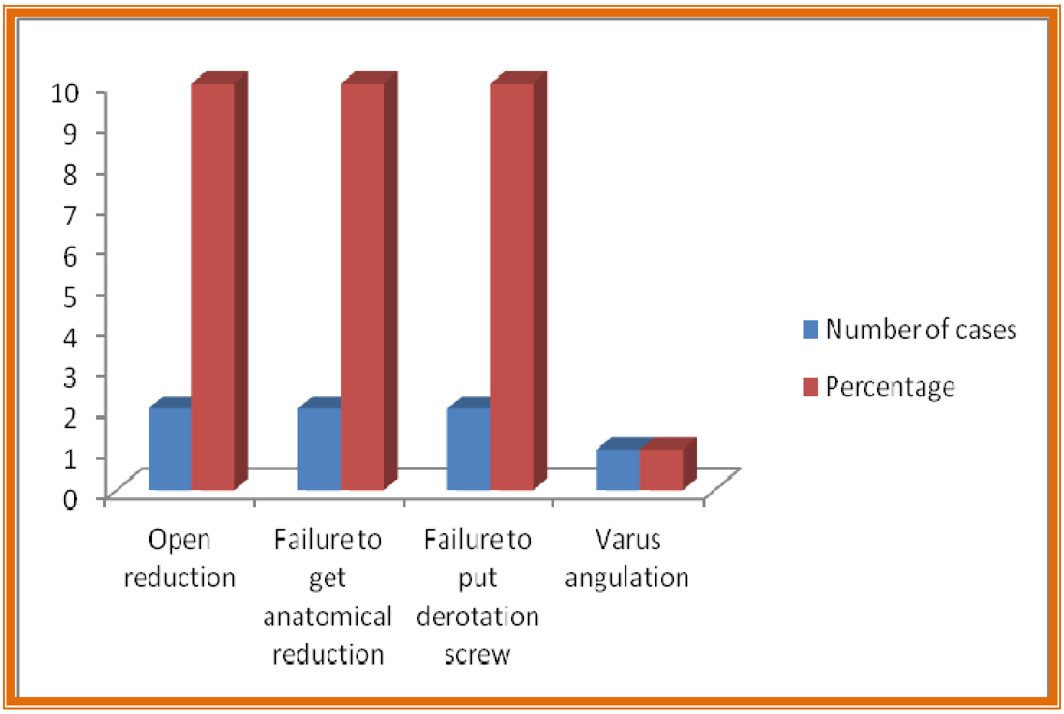
Intraoperative complications:

In our study, we encountered certain complications intraoperatively. Most of these complications occurred in the first few cases.

- In two of our patients we had to do open reduction due to comminuted fracture.
- In two cases we failed to achieve anatomical reduction due to posteromedial fragment .
- In two patients we failed to put derotation screw due to zig mismatch.
- We had one case of fixation of fracture in varus angulation.

Table - 9: Intraoperative complications

Complication	Number of cases	Percentage
Open reduction	2	10
Failure to get anatomical reduction	2	10
Failure to put derotation screw	2	10
Varus angulation	1	1



Graph 9 : Intra operative complications

Post operative complications Immediate complications :

- We had one case of superficial wound infection post operatively, which was managed with regular dressing, culture and sensitivity and appropriate i.v antiobitics. No deep infection was seen

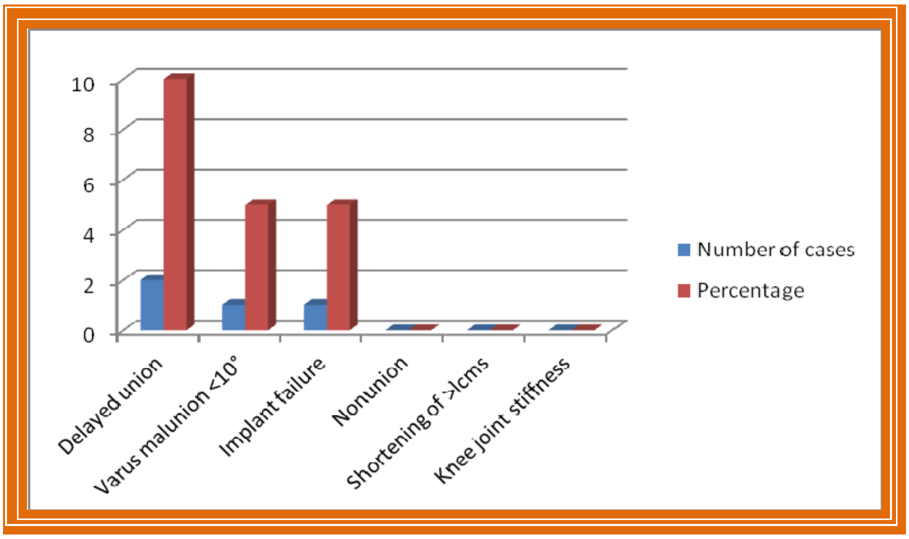
Delayed complications:

• We encountered two cases of delayed union and varus malunion in one case (<10 degrees).

• We had one case of implant failure (breakage of screw after one and a half year).

Table - 10: Delayed complications

Complication	Number of cases	Percentage
Delayed union	2	10
Varus malunion <10°	1	5
Implant failure	1	5
Nonunion	0	0
Shortening of >lcms	0	0
Knee joint stiffness	0	0



GRAPH-10 :DELAYED COMPLICATIONS

In our study the average duration of hospital stay was 20.67 days. The mean time for full weight bearing was 16.3 weeks.

All patients enjoyed good range of hip and knee range of motion.

Post operative mobility was aided in immediate post operative period but later all patients were ambulatory independently with or with out walking aid after 6 weeks.

Follow up:

All patients were followed at 6 weeks , 12 weeks, 6 months and some patients upto one year and further if necessary .

At each follow up radiograph of operated hip with upper half femur was taken and assessed for fracture union and implant failure and screw cut out.

Anatomical Results:

Anatomical results were assessed by presence or absence of deformities, shortening, hip and knee range of motions.

In our study, one patient had varus malunion <10 degrees.

Functional Results:

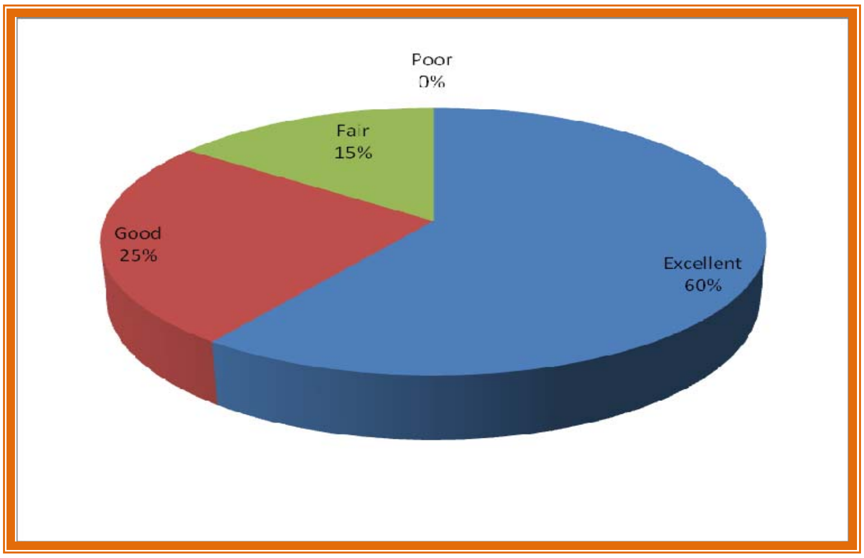
In our series of 20 operated cases , 1 case was lost for follow up. Functional and anatomical results are assessed taking into consideration using Harris Hip Scoring System (Modified)[54]

Intertrochanteric -6

Subtrochanteric -14

Table-11: Functional results of Peritrochanteric fractures

Functional results	Number of cases	Percentage
Excellent	12	60
Good	5	25
Fair	3	15
Poor	0	0
Total	20	100



Graph 11- Functional results

In our study, According to Harris Hip Scoring System (Modified), in Trochanteric class 83.3% were Boyd and Griffin type 2, 16.67% were B & G type 3 and in Subtrochanteric class 7.1% were type1, 21.4% were Sinsheimer type 2a, 28.6% were 2b, 21.4%were 3a, 7.1% were type 3b and 14.3% were type 4. Mean duration of hospital stay is 20.67 days and mean time of full weight bearing is 16.3 wks. Excellent results were seen in 50% cases, good in 33.3% cases, fair in 16.7% in trochanteric fractures. In subtrochanteric fractures excellent results were seen in 64.3%, good in 21.4% cases and fair were seen in 14.3%. We had no case with poor results.

Associated medical problems:

4 patients were known cases of HTN and were on treatment and continued the same.

1 patient was a known case of DM 2.

DISCUSSION

The treatment of pertrochanteric fractures of the proximal femur is still associated with some failures. The reasons are : disregard for biomechanics, overestimation of the potentials of new surgical techniques or new implants or poor adherence to established procedures. High stress concentration that is subject to multiple deforming forces, slow healing time because of predominance of cortical bone, decreased vascularity, high incidence of complications reported after surgical treatment compels the surgeon to give a second thought regarding selection of the proper implant.

The most common current modes of fixation are Blade plate systems, Sliding screw systems and Intramedullary devices. From the mechanical point of view, a combined intramedullary device inserted by means of minimally invasive procedure seems to be better in elderly patients. Closed reduction preserves the fracture haematoma, an essential element in the consolidation process. Intramedullary fixation allows the surgeon to minimize soft tissue dissection there by reducing surgical trauma, blood loss, infection, and wound complications.

PFN is a novel, modern intramedullary implant based on experience with the gamma nail. The currently used gamma nail as an intramedullary device also has a high learning curve with technical and mechanical failure rates of about 10%.The gamma nail is susceptible to fail at its weakest point, the lag screw-implant interface.

The Arbeitsgemeinschaft fur osteosynthesefragen (AO ASIF) in 1996, therefore developed the proximal femoral nail with an antirotational hip pin together with a smaller distal shaft diameter which reduces stress concentration to avoid these failures. Proximal femoral nail has all advantages of an intramedullary device ,such as decreasing the moment arm, can be inserted by closed technique, which retains the fracture haematoma an important consideration in fracture healing, decrease blood loss, infection, minimizes soft tissue dissection and wound complications.

In an experimental study , Gotze et al.(1998) compared the loadability of osteosynthesis of unstable per and subtrochanteric fractures and found that the PFN could bear the highest loads of all devices.

Comparison of Results:

Simmermacher [18] et al (1999),in a clinical multicentric study ,reported technical failures of PFN after poor reduction, malrotation or wrong choice of screws in 5% of the cases. A cut out of the neck screw occurred in 0.6% cases in the study conducted by Simmermacher but we did not encounter such complication in our study. Anatomical fracture reduction was found in 86% of the patients and full weight bearing stability was achieved in 94% . In our study acceptable anatomical reduction was obtained in 90.0% cases but we did open reduction for two fractures.

An intraoperative fracture displacement during manual introduction of the nail into the femoral shaft has not been reported with the gamma nail but this has been a problem with the PFN. One reason may be that the entry point of the PFN at the tip of the greater trochanter is located directly in the fracture region which can cause an intraoperative fracture displacement.

W. M. Gadegone & Y. S. Salphale[34] ,in 2007, reported a study on Proximal femoral nail - an analysis of 100 cases of proximal femoral fractures with an average follow up of 1 year .Postoperative radiographs showed a near-anatomical fracture reduction in 88% of patients.. The fracture consolidated in 4.5 months. No perceptible shortening was noted, 7% had superficial infections which were controlled with antibiotics, 82% had a full range of hip motion.

In our Study we had 90% near normal anatomical # reduction and # consolidated in 16.5 weeks. 88.6% had full range of hip motion and 11.4% had terminal restriction of rotation movements. We encountered no nonunion.

One case of implant failure (breakage of screw) was observed.

Metin Uzun[36] et al, in 2009, In a study of 35 patients reported Long-term radiographic complications following treatment of unstable intertrochanteric femoral fractures with the proximalfemoral nail and effects on functional results .

Reduction was assessed as good or acceptable in all the patients. Complete union was achieved in all but two patients had non union . The mean Harris hip score was 82.1. The results were excellent in 11 patients (31.4%), good in 15 patients (42.9%), fair in seven patients (20%), and poor in two patients (5.7%). Radiographic complications mainly included secondary varus displacement in nine patients (25.7%).Secondary varus displacement was due to cut-out of the proximal screws (n=2), screw loosening due to collapse of the fracture site (n=2), and reverse Z-effect (n=5). In our study mean Harris hip score was 87.1.Radiological complication chiefly include 1 case of varus malunion .We had one implant failure(breakage of derotation screw).

The aim of the study was to study the epidemiology of peritrochanteric fractures in adults and anatomical and functional outcome with this newer method of intramedullary fixation with PFN.

The assessment criteria for the efficiency of surgical technique included duration of surgery, number of intraoperative complications, blood loss and radiographic screening time. Clinical assessment includes post operative walking ability ,hip and knee function, fracture union time ,and implant bone interaction.

In our study, peritrochanteric fractures were more common due to RTA. Age ranged from 23 to 90 years with mean age of 50.3 years. Males were more common contributing of 75% of cases. Right sided fractures were more common in our study accounting for 60% of cases.

In our study Trochanteric fractures contributed 30% of cases ,out of which 83.3% were Boyd and Griffin type 2, 16.7% were B & G type 3 . Subtrochanteric fractures accounted for 70% of cases out of which 21.4% were Sinsheimer type 2a, 28.6% were 2b, 21.4%were 3a, 7.1% were type 3b and 14.3% were type 4.

In the intraoperative period ,

- In two of our patient we had to do open reduction.
- In two cases we failed to achieve anatomical reduction .
- In two patients we failed to put derotation screw.
- We had one case of fixation of fracture in varus angulation.

We had one case of implant failure(breakage of derotation screw),Z-effect or Reverse Z-effect complications. The mean duration of hospital stay was 20.67 days, mean time for full weight bearing was 16.3 weeks. Post operatively all patients were ambulatory of which three of them required walking aids. All patients enjoyed good range of hip and knee motion.

Over all 85% (Harris Hip Score) of our cases had excellent to good results. Fair in 15 % .we had no case with poor results. Our results are comparable with other studies.

CONCLUSION

In the present study 20 patients with peritrochanteric fractures (which includes 06 intertrochanteric, 14 subtrochanteric) of femur were surgically managed with Proximal Femoral Nail.

The data was assessed, analyzed, evaluated and the following conclusions were made:

- Peritrochanteric fracture of the femur is common in the elderly, due to osteoporosis and in young due to high velocity trauma.
- The mode of injury for Peritrochanteric fracture in the elderly is a trivial trauma, however in the young individuals it occurs following a high velocity trauma.
- Since in the elderly the mode of injury is a low velocity trauma, the incidence of associated injuries is less.
- Since the fracture is common in the elderly the incidence of associated diseases requiring medical attention is high.
- As the fracture is more common in the elderly, early reduction and internal fixation increases patient comfort, facilitates nursing care, helps in early mobilization of the patient and decreases the duration of hospitalization.
- Anatomical reduction can be achieved by closed manipulative or open methods. As the incidence of comminution is high, these fractures may require a stable reduction and internal fixation. Bone grafting is required if there is a deficiency.
- PFN has the advantage of collapse at fracture site and is biomechanically sound as it is done by closed technique, fracture opened only when closed reduction could not be achieved and it is an intramedullary device.

- Another advantage of this device is it prevents excess collapse at fracture site thus maintaining neck length.
- The entry point determination is the most crucial step in this procedure which is the tip of trochanter. The device is fixed distally in both dynamic and static mode so in case of delayed union it can be dynamised.
- The two neck screws should be placed in the centre of neck and head, the proximal one acts as derotation screw and the distal one as collapsing screw.
- The nail has a 6^0 mediolateral angulation which prevents medial collapse and a 135^0 neck shaft angle which maintains the normal neck shaft angle.
- Post-operatively early mobilization can be begun as the fixation is rigid and because of the implant design.
- The fixation of Peritrochanteric fractures with a PFN markedly reduces the morbidity and mortality, in the elderly individuals in whom the fracture is more common.
- If the above technical details are achieved, the function of the hip joint is regained to near normal and the rehabilitation of the patient is smooth.
- Most of the complications are surgeon and instruments related which can be cut down by proper patient selection and good preoperative planning.
- With the experience gained from each case the operative time, radiation exposure, blood loss and intraoperative complications can be reduced drastically. Hence I conclude , though the learning curve of this procedure is steep, with proper patient selection, good instrumentation, image intensifier and surgical technique, PFN remains the implant of choice in the management of Peritrochanteric fractures.

SUMMARY

Pertrochanteric femoral fractures are of intense interest globally. Peritrochanteric fracture is a leading cause of hospital admissions in elderly people. The number of such admissions is on a raise because of increasing life span, sedentary habits and increased road traffic accidents.

Conservative methods of treatment results in malunion with shortening and limitation of hip movement as well as complications of prolonged immobilization like bed sores, deep vein thrombosis and respiratory infections.

This study is done to analyze the surgical management of Peritrochanteric fractures using Proximal Femoral Nail.

In our series of 20 cases there were 14 male and 6 female, maximum age of 90 yrs and minimum age of 23 yrs, most of the patients were between 40 to 60 yrs. Mean age of 50.3. yrs. 70% of cases were admitted due to RTA and with predominance of right side. Out of 20 cases, 06 were trochanteric and 14 were subtrochanteric. In our study Trochanteric fractures contributed 30% of cases ,out of which 83.3% were Boyd and Griffin type 2, 16.7% were B & G type 3 . Subtrochanteric fractures accounted for 70% of cases out of which 21.4% were Sinsheimer type 2a, 28.6% were 2b, 21.4%were 3a, 7.1% were type 3b and 14.3% were type 4.

Mean duration of hospital stay was 20.67 days and mean time of full weight bearing was 16.3 wks. Good to excellent results are seen in 83.3% cases of trochanteric fractures and 85.7% cases in subtrochanteric fractures. Overall, we had Good to excellent results in in 85% ,Fair in 15 % .We had no case with poor results.

From this sample study, we consider that PFN is an excellent implant for the treatment of Peritrochanteric fractures. The terms of successful outcome include a good understanding of fracture biomechanics, proper patient selection, good preoperative planning, accurate instrumentation, good image intensifier .

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ANNEXURE-I

PROFORMA FOR PERITROCHANTERIC FRACTURES OF FEMUR TREATED BY PFN

1. NAME :

5. IP NO.:

2. AGE :

6. D.O.A :

3. SEX :

7. D.O.D :

4. ADDRESS :

8.D.O.S :

COMPLAINTS

1. Mode of trauma :
2. Pain in the hip or proximal thigh region :
3. Inability to move the limb :
4. Associated complaints :

HISTORY OF PRESENT ILLNESS

1. History of trauma :

a. Trivial trauma direct/indirect

Sudden slip & fall

Any other mode

b. Forceful trauma direct/indirect

Fall from height/ fall while running

Automobile accident

c. Miscellaneous :

2. Treatment received before reaching the hospital / method of first aid given-

PAST HISTORY

1. History of chronic illness – DM / HTN / BR. ASTHMA / TB

2. Past medical history -------

3. Personal and family history

a. Married / unmarried

b. Nature of work :

c. Menstrual history(in case of females) :

d. Habits : smoker / non smoker
   Alcoholic / non alcoholic

e. Bladder function : normal / altered

GENERAL PHYSICAL EXAMINATION

1. Built : obese / moderate /poor

2. Nourishment : good / moderate / poor

3. Pallor : icterus : cyanosis:

Clubbing : lymphadenopathy :

4. Vital signs :

a. Pulse rate : c. Respiratory rate :

b. Blood pressure : d. Temperature :

OTHER SYSTEMS

1. CVS :

2. RESPIRATORY SYSTEM :

3. PER ABDOMEN :

4. CENTRAL NERVOUS SYSTEM:

LOCAL EXAMINATION

INSPECTION

- Attitude of limb :
- Level of ASIS :
- Apparent shortening :
- Swelling around the proximal thigh / hip :
- Skin changes :
- Position of patella :

PALPATION

- Tenderness :
- Abnormal mobility:
- Crepitus :
- Transmitted movements :
- Local rise of temperature :
- Any abnormal mass felt :
- Palpatory Bryants :

MEASURMENTS	**RIGHT**	**LEFT**
1. APPARENT LENGTH :_		
2. _TRUE LENGTH		
3. Bryant's triangle :		

MOVEMENTS OF HIP

ASSOCIATED INJURIES

INVESTIGATIONS

1. X-RAY of proximal third of femur including hip joint – AP & LATERAL VIEW
2. Screening chest x-ray.
3. ECG
4. Blood :

a. Hb% :
b. Total count :
c. Differential count :
d. Blood grouping & typing :
e. Blood Urea :
f. S. Creatinine :
g. RBS :

i. Any other specific investigations :

FINAL DIAGNOSIS :

MANAGEMENT

PRE OPERATIVE TREATMENT

1. Skeletal traction :
2. Analgesics :
3. Antibiotics :
4. Blood transfusion :
5. Others :

OPERATIVE TREATMENT

1. Date of operation :
2. Anaesthesia :
3. Approach :
4. PFN :
5. Blood Transfusion :
6. Intra operative complications :

POST OPERATIVE TREATMENT

1. Antibiotics :
2. Analgesics :
3. Blood transfusion :
4. Suture removal on :
5. Follow up X-ray :
6. Post- op rehabilitation:

POST OPERATIVE COMPLICATIONS

Immediate

1. Swelling of the limb.
2. Other complications

Early

Late

1.wound infection

2. deep vein thrombosis
3. shortening/ lengthening
4. pulmonary embolism
5. deformity

Follow up:

	After 1 mth	After 3 mts	After 6mts	After 1yr
Range of movements (hip/knee)				
Tenderness at fracture site				
X-ray findings				
Any other complications				

Final Result: Excellent/Good/Fair/Poor.

ANNEXURE - II

CONSENT FORM

I,___________________________ _____________________ in my full senses hereby give my complete consent for _____________________________or any other procedure deemed fit, which is a diagnostic procedure / biopsy / transfusion / operation to be performed on me / my son / my daughter / my ward _____________________________ age ____________________under any anesthesia deemed fit. The nature and risks involved in the procedure(surgical and anaesthetical) have been explained to me to my satisfaction. For academic and scientific purpose the operation/procedure may be televised or photographed or used for statistical measurements.

Date:

Signature/Thumb Impression of Patient/Guardian

Name :

Designation:

Guardian

Relationship

Full Address

Key to Master chart

MOI	Mechanism of Injury
RTA	Road Traffic Accident
IT (B&G)	Intertrochanteric fracture (Boyd and Griffin Type)
ST (S)	Subtrochanteric fracture (Seinsheimer classification)
FDR	Failure to put Derotation screw
DU	Delayed Union
IF	Implant Failure
OR	Open Reduction
HHS	Harris Hip Score
VA	Varus Angulation
FAR	Failure to get anatomical reduction

ANNEXURE -III

MASTER CHART

Sl.no	Name	IP no.	Age in years	Sex	Side	DOA	DOS	MOI	Associated injuries	Classification	Risk factors	Intra Operative Complications	Early complications	Late complications	HHS	Resutls
1	Sydhani Bee	524145	60	F	Rt	7/22/2009	7/26/2009	Fall	- - -	B&G- 2	- - -	- - -	- - -	IF	94	Excellent
2	Doddamuniyamma	525930	75	F	Rt	8/4/2009	8/12/2009	Fall	- - -	B&G-2	- - -	- - -	- - -	- - -	91	Excellent
3	Pillappa	534571	45	M	Rt	9/24/2009	9/25/2009	RTA	# 2-4th ribs lt	B&G-3	- - -	- - -	- - -	- - -	86	Good
4	Narayanappa	542524	65	M	Rt	10/1/2009	10/3/2009	RTA	# Medial malleoli Lt	S-3 A	- - -	- - -	- - -	DU	82	Good
5	Kempamma	568262	65	F	Rt	1/9/2010	1/15/2010	Fall	- - -	B&G-2	HTN	VA	- - -	Varus malunion<10 deg	85	Good
6	Amarnarayanna	574350	38	M	Rt	2/10/2010	2/11/2010	RTA	- - -	S-4	---	OR	- - -	- - -	95	Excellent
7	Reddamma	574331	90	F	Lt	2/22/2010	3/3/2010	Fall	- - -	S-2A	---	FAR	- - -	- - -	74	Fair
8	Venkatramappa	578642	48	M	Lt	4/12/2010	4/15/2010	RTA	# 2 MT Rt	S-2B	HTN	- - -	Superficial skin infection	- - -	78	Fair
9	Munivenkataiah	602453	62	M	Lt	5/13/2010	5/17/2010	RTA	- - -	B&G—2	HTN	- - -	- - -	- - -	88	Good
10	Viji kumar	611548	23	M	Rt	7/6/2010	7/8/2010	RTA	Head injury and ipsilateral tibia #	S-1	- - -	OR	- - -	- - -	92	Excellent
11	Chikkamuniyappa	612761	75	M	Rt	9/2/2010	9/8/2010	Fall	- - -	B&G-2	- - -	- - -	- - -	DU	73	Fair
12	Ramappa	614523	28	M	Lt	10/3/2010	10/4/2010	RTA	# Lt Tibia	S-2A	- - -	- - -	- - -	- - -	95	Excellent
13	Venugopal reddy	634862	45	M	Rt	11/1/2010	11/4/2010	RTA	- - -	S-3B	- - -	- - -	- - -	- - -	94	Excellent
14	Narasimhappa	649992	37	M	Rt	11/12/2010	11/15/2010	RTA	Head Injury	S-3 A	- - -	FAR	- - -	- - -	88	Good
15	lakhmamma	653112	42	F	Lt	11/30/2010	12/2/2010	RTA	# of Lt clavicle	S-2B	- - -	- - -	- - -	- - -	89	Good
16	Narayanappa	657941	65	M	Lt	12/22/2010	12/26/2010	RTA	- - -	S-4	DM-2	- - -	- - -	- - -	82	Good
17	Ramesh	661245	32	M	Rt	1/7/2011	1/10/2011	RTA	#of Lt. distal end Radius	S-2B	- - -	FDR	- - -	- - -	85	Good
18	Sudahakar babu	672701	40	M	Lt	1/29/2011	2/2/2011	RTA	# R Clavicle	S-2B	- - -	- - -	- - -	- - -	95	Excellent
19	Sultan	685433	26	M	Rt	4/16/2011	4/18/2011	RTA	- - -	S-2A	- - -	- - -	- - -	- - -	92	Excellent
20	venkat reddy	689756	45	M	Lt	4/21/2011	4/22/2011	RTA	# distal end radius	S-3A	HTN	FDR	- - -	- - -	84	Good