"COMPARISON OF FUNCTIONAL OUTCOME OF FEMUR INTERTROCHANTERIC FRACTURE FIXATION WITH HEMIARTHROPLASTY AND PROXIMAL FEMORAL NAIL SYSTEMS"

By

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In partial fulfilment of the requirements for the degree of

MASTER OF SURGERY in

ORTHOPAEDICS

Under the guidance of

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I hereby declare that this dissertation entitled "**COMPARISON OF FUNCTIONAL OUTCOME OF FEMUR INTERTROCHANTERIC FRACTURE FIXATION WITH HEMIARTHROPLASTY AND PROXIMAL FEMORAL NAIL SYSTEMS**" is a bonafide and genuine research work carried out by me under the guidance of DR. DAYANAND B B
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The Ethical Committee of this University met on **Saturday, 18th March, 2023 at 11.30 a.m. in the CAL Laboratory, Dept. of Pharmacology,** scrutinizes the Synopsis/ Research Projects of Post Graduate Student / Under Graduate Student /Faculty members of this University /Ph.D. Student College from ethical clearance point of view. After scrutiny, the following original/ corrected and revised version synopsis of the thesis/ research projects has been accorded ethical clearance.

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ABSTRACT

ABSTRACT

Introduction: Intertrochanteric femur fractures represent a significant health challenge in the elderly population, associated with considerable morbidity, mortality, and socioeconomic burden. While proximal femoral nail (PFN) systems are widely accepted as the standard treatment for these fractures, hemiarthroplasty has emerged as an alternative approach, particularly for elderly patients with osteoporotic bone. Despite ongoing debate regarding the optimal management strategy, comparative studies evaluating functional outcomes between these two approaches remain limited. This study aimed to compare the functional outcomes, pain control, and rehabilitation milestones between hemiarthroplasty and PFN for the treatment of intertrochanteric femur fractures in elderly patients.

Methods: This prospective comparative study included 50 patients with intertrochanteric femur fractures, divided equally between hemiarthroplasty (n=25) and PFN (n=25) groups. Demographic data, operative parameters, and hospital stay duration were recorded. Functional outcomes were assessed using the Harris Hip Score at 1, 3, and 6 months postoperatively. Pain was evaluated using the Visual Analog Scale (VAS) at the same intervals. Time to fully weight-bearing was documented for all patients. Statistical analysis was performed using appropriate tests with significance set at p<0.05.

Results: The groups were comparable regarding age, gender distribution, comorbidities, and BMI. Operative time was significantly shorter in the PFN group (71.6±13.9 vs. 81.3±12.6 minutes, p=0.01), while hospital stay was similar between groups. The PFN group demonstrated significantly lower pain scores at all follow-up intervals (p<0.05). At 1 month, functional outcomes favored hemiarthroplasty, with all patients achieving fair Harris Hip Scores compared to poor scores in the PFN group. However, by 3 months, the PFN group showed better improvement (p=0.02), and at 6 months, the PFN group demonstrated superior outcomes with 56% achieving excellent scores versus 24% in the hemiarthroplasty group (p=0.006). Patients in the hemiarthroplasty group achieved fully weight-bearing status significantly earlier than those in the PFN group (7.28±1.79 vs. 9.32±1.95 weeks, p<0.001).

Conclusion: While hemiarthroplasty offers advantages in terms of earlier weight-bearing and better initial functional scores, PFN provides superior outcomes in terms of operative efficiency, pain control, and mid-term functional recovery. The optimal treatment approach should be individualized based on patient characteristics, fracture pattern, and rehabilitation potential. For patients with good rehabilitation potential and reasonable life expectancy, PFN may offer better overall functional outcomes despite delayed weight-bearing.

Keywords: Intertrochanteric fracture; Hemiarthroplasty; Proximal femoral nail; Functional outcome; Harris Hip Score; Pain; Weight-bearing; Elderly

ABBREVIATIONS

AO/OTA: Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association

AP: Anteroposterior

BMD: Bone Mineral Density

BMI: Body Mass Index

BPH: Bipolar Partial Hemiarthroplasty

CI: Confidence Interval

CRP: C-Reactive Protein

DHS: Dynamic Hip Screw

DVT: Deep Vein Thrombosis

ESR: Erythrocyte Sedimentation Rate

FDA: Food and Drug Administration

HHS: Harris Hip Score

IOHS: Immediate Operative Hip Surgery

LMWH: Low Molecular Weight Heparin

MVA: Motor Vehicle Accident

NSAID: Non-Steroidal Anti-Inflammatory Drug

ORIF: Open Reduction and Internal Fixation

PE: Pulmonary Embolism

PFN: Proximal Femoral Nail

PFNA: Proximal Femoral Nail Antirotation

PMMA: Polymethylmethacrylate

PROM: Patient-Reported Outcome Measure

ROM: Range of Motion

INTRODUCTION

Intertrochanteric femur fractures represent one of the most common and devastating injuries in the elderly population, with significant implications for both individual health outcomes and healthcare systems worldwide. These fractures occur in the region between the greater and lesser trochanters of the proximal femur and account for approximately 45% of all hip fractures, with an increasing incidence due to the aging global population and the prevalence of osteoporosis.[1] The global incidence of hip fractures is projected to reach 6.3 million by 2050, with intertrochanteric fractures comprising a substantial proportion of this burden.[2] These fractures are associated with high mortality rates, ranging from 15-30% in the first year following injury, while survivors often experience significant functional decline, loss of independence, and reduced quality of life.[3] The socioeconomic impact is equally concerning, with the direct healthcare costs for hip fractures estimated to exceed $9.8 billion annually in the United States alone, underscoring the critical importance of optimizing treatment approaches to enhance functional outcomes and reduce the associated morbidity and mortality.

The management of intertrochanteric fractures has evolved significantly over the past decades, transitioning from predominantly conservative approaches to surgical intervention as the standard of care. This paradigm shift has been driven by the recognition that early surgical fixation facilitates more rapid mobilization, reduces complications associated with prolonged immobilization, and improves overall functional recovery.[4] Despite this consensus regarding the necessity of surgical intervention, considerable debate persists regarding the optimal fixation method for these fractures, particularly in the elderly population with osteoporotic bone. The ideal fixation method should provide stable construct that allows early weight-bearing, minimizes the risk of fixation failure, and optimizes functional recovery while considering the patient's physiological age, bone quality, fracture pattern, and comorbidities. The two predominant surgical approaches that have emerged in contemporary practice are internal fixation using proximal femoral nail systems and replacement arthroplasty procedures, specifically hemiarthroplasty, each with distinct biomechanical principles, technical considerations, and outcome profiles that warrant comprehensive comparative analysis.

Proximal femoral nail (PFN) systems represent an evolution in the internal fixation paradigm for intertrochanteric fractures, designed to address the biomechanical limitations of earlier fixation devices. These intramedullary devices function as internal splints that share load with the femoral shaft, providing a shorter lever arm compared to extramedullary devices, thereby theoretically reducing the bending forces at the implant-bone interface.[5] The development of various intramedullary nail designs, including those with helical blades, integrated lag screws, and anatomical configurations, has aimed to enhance rotational stability, prevent cut-out complications, and accommodate diverse fracture patterns. The purported advantages of PFN systems include the potential for minimally invasive insertion through smaller incisions, reduced operative blood loss, preservation of the fracture hematoma which may facilitate biological healing, and mechanical advantages in load-sharing that may permit earlier weight-bearing. However, technical challenges in achieving optimal reduction and proper implant positioning, along with complications such as cut-out, implant failure, non-union, and malunion, particularly in severely comminuted fractures or those with poor bone quality, have prompted consideration of alternative approaches for specific patient populations.

Hemiarthroplasty, involving the replacement of the femoral head and neck with a prosthesis while retaining the native acetabulum, represents an alternative surgical strategy that has gained traction for the management of unstable intertrochanteric fractures in elderly patients with poor bone quality. The fundamental principle underlying this approach is the elimination of the fracture site as a problem, circumventing concerns regarding fracture reduction, bone healing, and implant-related complications associated with internal fixation.[6] By replacing the damaged proximal femur with a prosthesis, hemiarthroplasty theoretically permits immediate full weight-bearing, eliminates the risk of fixation failure in osteoporotic bone, and potentially expedites functional recovery—considerations of paramount importance in frail elderly patients for whom prolonged immobilization or restricted weight-bearing may precipitate a cascade of adverse outcomes. Contemporary hemiarthroplasty prostheses, including both unipolar and bipolar designs, coupled with the option for cemented or uncemented fixation, provide surgeons with versatility in addressing individual patient needs. Nevertheless, concerns regarding increased surgical invasiveness, higher blood loss, potential acetabular erosion, prosthetic dislocation, and periprosthetic infection have tempered enthusiasm for the universal application of this approach.

The decision-making process regarding the optimal surgical approach for intertrochanteric fractures necessitates a nuanced consideration of multiple variables, including patient factors (age, functional status, bone quality, comorbidities), fracture characteristics (stability, comminution, extension), surgeon expertise, and healthcare resource availability. While both PFN systems and hemiarthroplasty have demonstrated efficacy in appropriate clinical scenarios, the comparative effectiveness of these modalities across various outcome dimensions remains incompletely characterized, with existing literature yielding heterogeneous results. Several studies have suggested potential benefits of hemiarthroplasty in unstable fracture patterns and severely osteoporotic bone, highlighting improved early weight-bearing capability, reduced reoperation rates, and enhanced early functional outcomes.[7] Conversely, other investigations have demonstrated comparable or superior results with properly executed PFN fixation, emphasizing the importance of appropriate surgical technique, optimal implant selection, and careful patient selection.[8] These divergent findings underscore the need for rigorous comparative analysis to elucidate the relative merits and limitations of each approach, particularly as they relate to functional recovery—the ultimate determinant of successful intervention from the patient perspective. The assessment of functional outcomes following intertrochanteric fracture treatment presents methodological challenges that have contributed to the uncertainty regarding optimal management. Functional recovery encompasses multiple domains, including mobility, activities of daily living, pain, and overall quality of life, necessitating comprehensive and standardized evaluation instruments. The Harris Hip Score, Parker Mobility Score, modified Barthel Index, and health-related quality of life measures such as the SF-36 and EQ-5D have emerged as validated tools for quantifying functional outcomes in this population.[9] However, heterogeneity in outcome measures, assessment timepoints, and follow-up durations across studies has complicated direct comparisons between treatment modalities. Moreover, the interaction between treatment-related factors and patient characteristics, such as pre-fracture functional status, cognitive function, and social support, introduces complexity in interpreting observed outcomes. A methodologically robust comparison of functional outcomes between PFN systems and hemiarthroplasty must account for these confounding variables to provide clinically meaningful insights that can guide evidence-based decision-making.

Recent meta-analyses and systematic reviews have attempted to synthesize the available evidence comparing internal fixation and arthroplasty for intertrochanteric fractures, but have been limited by the heterogeneity of included studies, methodological constraints, and the evolution of implant designs and surgical techniques over time. A comprehensive systematic review by Yu et al. involving 1,395 patients across 8 studies found that compared to internal fixation, arthroplasty demonstrated potentially superior Harris Hip scores and reduced risk of reoperation, but with increased operative time, blood loss, and length of hospital stay.[10] However, most comparative studies have focused predominantly on unstable fracture patterns, limiting the generalizability of findings across the spectrum of intertrochanteric fractures. Furthermore, the rapid evolution of both PFN designs and arthroplasty techniques necessitates continuous reassessment of comparative outcomes as innovations emerge and surgical expertise develops. The incomplete characterization of the relative benefits and limitations of these approaches across diverse patient populations and fracture patterns represents a significant knowledge gap that impedes evidence-based clinical decision-making.

The economic implications of treatment selection for intertrochanteric fractures cannot be overlooked in an era of healthcare resource constraints and value-based care initiatives. While the initial costs of implants and surgical procedures constitute important considerations, the comprehensive economic evaluation must encompass downstream expenditures related to complications, reoperations, rehabilitation, and long-term care requirements. Limited evidence suggests potential economic advantages of primary arthroplasty in specific patient subgroups due to reduced reoperation rates and earlier functional recovery, despite higher initial costs compared to internal fixation. However, robust cost-effectiveness analyses comparing contemporary PFN systems and hemiarthroplasty, particularly those incorporating quality-adjusted life years and accounting for indirect costs, remain scarce. Such economic evaluations, integrated with clinical outcome assessments, would provide valuable insights for healthcare policy formulation and resource allocation decisions.

The evolution of surgical approaches for intertrochanteric fractures continues unabated, with emerging technologies and techniques potentially reshaping the treatment landscape. Innovations in implant design, including augmentation techniques for enhancing fixation in osteoporotic bone, patient-specific instrumentation, and advanced biomaterials with enhanced osseointegration properties, may address current limitations of both internal fixation and arthroplasty approaches. Concurrently, the development of enhanced recovery protocols, multimodal pain management strategies, and comprehensive rehabilitation programs offers opportunities for optimizing perioperative care and functional recovery, regardless of the selected surgical approach. The integration of these evolving modalities with appropriate patient selection criteria based on comprehensive pre-operative assessment may ultimately transcend the dichotomous debate between fixation and replacement, fostering a more nuanced, patient-centered approach to intertrochanteric fracture management.

The persistent controversy surrounding the optimal management strategy for intertrochanteric fractures, particularly in the elderly population, underscores the need for rigorous comparative investigation of functional outcomes between PFN systems and hemiarthroplasty. While both approaches have demonstrated efficacy in appropriate clinical scenarios, the relative impact on functional recovery, complication profiles, and cost-effectiveness across diverse patient populations and fracture patterns remains incompletely characterized. This knowledge gap impedes evidence-based clinical decision-making and potentially compromises patient outcomes. The present study aims to address this critical need through a comprehensive comparative analysis of functional outcomes following intertrochanteric fracture fixation with hemiarthroplasty versus PFN systems, employing validated assessment instruments, standardized evaluation timepoints, and rigorous methodological approaches. By elucidating the relative merits and limitations of these surgical modalities across multiple outcome dimensions, this investigation seeks to inform clinical practice guidelines, refine patient selection criteria, and ultimately enhance the quality of care provided to this vulnerable patient population. The findings will contribute to the ongoing evolution of intertrochanteric fracture management, potentially influencing surgical decision-making, implant design, perioperative protocols, and rehabilitation strategies to optimize functional recovery and improve quality of life for affected individuals.

AIM & OBJECTIVES

AIM:

Comparison of functional outcome of femur intertrochanteric fracture fixation with hemiarthroplasty and proximal femoral nail system

OBJECTIVES:

1. To compare the functional outcomes (as measured by Harris Hip Score, mobility status, and activities of daily living) between patients treated with hemiarthroplasty versus proximal femoral nail system for intertrochanteric fractures of the femur at 3, 6, and 12 months post-surgery.
2. To evaluate and compare the complication rates, reoperation incidence, mortality, and quality of life measures between the two surgical approaches for the management of intertrochanteric fractures in order to establish evidence-based guidelines for optimal treatment selection.

REVIEW OF LITERATURE:

REVIEW OF RELATED ARTICLES

Song QC et al (2022)[45] "has conducted study on comparison of clinical outcomes with proximal femoral nail anti-rotation versus bipolar hemiarthroplasty for the treatment of elderly unstable comminuted intertrochanteric fractures where he has taken sample size of 62 cases and he has conducted 30 BHA and 32 PFNA, where he found both are effective and safe safe in ITFs earlderly population. BHA allows early weight bearing activity and walking".

Chen WH et al (2021)[46] "compared the clinical outcomes of arthroplasty and PFNs in the treatment of unstable IFFs in elderly patients. They concluded that compared with PFN, arthroplasty can achieve weight bearing earlier and shorten hospital stay, but it cannot achieve a better clinical outcome. Arthroplasty cannot replace PFNs in the treatment of unstable IFFs in elderly individuals".

Kumar P et al (2020)[47] "had done research over unstable intertrochanteric femoral fractures in the elderly patients showing PFN is better than hemiarthroplasty. PFN shows better results in outcomes and has lower mortality rate. Showing benefits of less blow loss and faster surgical procedure".

Tajima K et al (2020)[48] "evaluated the functional and clinical outcomes of bipolar hemiarthroplasty for unstable intertrochanteric fractures in older persons. They concluded that primary bipolar hemiarthroplasty for treating unstable intertrochanteric fractures eliminates the need for prolonged immobilization and permits early ambulation. As reported by others, hip hemiarthroplasty is an effective treatment choice for unstable intertrochanteric femoral fracture in older patients".

Tu DP et al (2020)[49] "evaluated the clinical efficacy of internal fixation *versus* hemiarthroplasty in the treatment of unstable intertrochanteric fractures in the elderly. Compared with the internal fixation group, those in the hemiarthroplasty group could carry out weight-bearing training early and implant-related complications were reduced, but it requires longer operation time and there is greater intraoperative blood loss. There is no difference in mortality, the incidence of DVT, non-union, HHS, reoperation, length of hospital stay, and superficial infection. Hemiarthroplasty may be a better choice for unstable intertrochanteric fractures in the elderly".

Jolly A et al (2019)[50] "Conducted study that concluded internal fixation with PFN gave a significantly better outcome in long term with less number of implant related complication, primary cemented hemiarthroplasty gave a significantly better functional outcome in early weight bearing until 3 months post-surgery ,comparable at 6 months. PFN group showed a significantly better outcome when followed up 12 months.

Zhou S et al (2019)[51] compared the curative effects of proximal femoral nail anti-rotation (PFNA) and cementless bipolar hemiarthroplasty (CPH) on femoral intertrochanteric fracture in the elderly. They concluded that both PFNA and CPH are safe and effective treatments for femoral intertrochanteric fracture in elderly patients. Nonetheless, CPH allows faster mobilization and recovery".

Nie B et al (2017)[52] "Has done a comparative study over IMF and arthroplasty, shows the use of arthroplasty reduces implant related complications, reoperative rate, although for IT fractures internal fixation using IMF is mainstay treatment. suggest that arthroplasty may be considered as primary treatment in patients with highly unstable fractures with poor bone quality and other conditions with a higher risk for early failure.

Hari Prasad S et al (2017)[53] performed a retrospective analysis of 54 patients, of which 27 each were operated with cemented bipolar hemiarthroplasty (BPA) and proximal femur nail (PFN). The HHS was significantly higher for BPA group at all follow ups, at 4 weeks of follow up was 77.81 for BPA and 71.18 for PFN (p-value = 0.001) and at 1 year of follow up was 85.55 for BPA and 77.03 for PFN (p-value = 0.001). Statistically significant differences were found between BPA and PFN groups with reference to intraoperative blood loss, transfusion rate, surgical time, bed to chair time, chair to walking time, limb length discrepancy at final follow up. They concluded that the bipolar hemiarthroplasty group had fewer complications and earlier mobilization with better Harris hip score at all follow ups, which indicate bipolar hemiarthroplasty is a better option in the treatment of unstable intertrochanteric fractures in senile osteoporotic patients.

Görmeli G et al(2015)[54] has conducted a comparative study of femur intertrochanteric fracture fixation with hemiarthroplasty and proximal femoral nail systems where he included 43 patients which have met the study criteria and has shown that internal fixation with PFN had higher re operative rates , less surgical complications".

ASSOCIATED ANATOMY

ANATOMY OF FEMUR

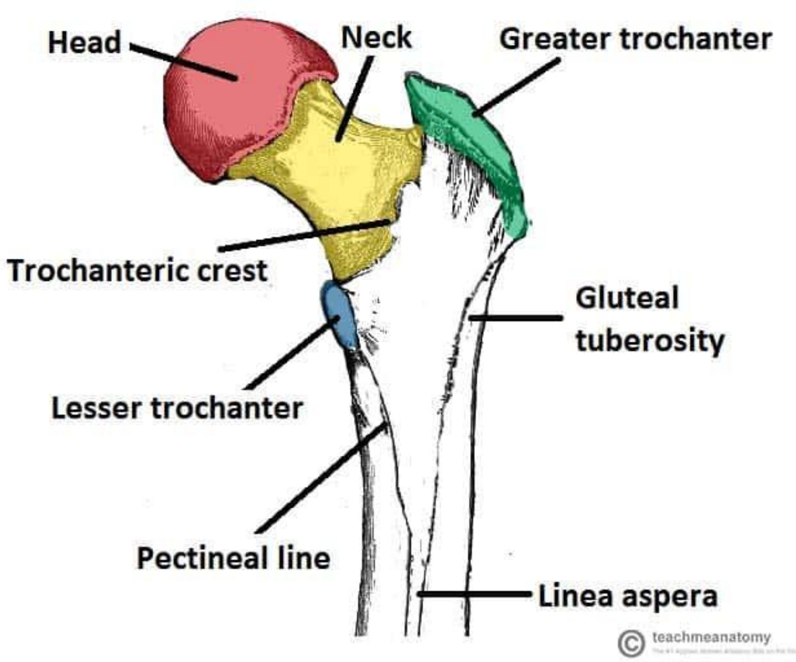
The “longest, heaviest, and strongest bone in the human body is the femur. The pyramid-shaped neck at the proximal end connects the cylindrical shaft at the base with the spherical head at the apex. The greater and lesser trochanters, two noticeable bone protrusions, connect to the muscles that move the hip and knee. In the normal adult, the inclination angle—also referred to as the angle between the neck and shaft—is approximately 128 degrees. But as people age, the inclination angle gets less.Other significant characteristics are the linea aspera and the adductor tubercle, which is where the posterior part of the adductor magnus attaches”.[11, 12]

STRUCTURE

“The head, neck, and greater and lesser trochanters make up the specific metaphyseal area that makes up the proximal portion of the femur. The metaphyseal flare, which extends distally into the medial and lateral femoral condyles and is divided by the intercondylar notch, makes up the femur. The segment inferior to the lesser trochanter and terminating at the metaphyseal flair and condyles is known as the shaft, or diaphysis. Traditionally, the subtrochanteric region—the first 5 cm distal to the lesser trochanter—is regarded as a distinct fracture pattern. The muscle deforming stresses make these fractures difficult to treat.[13] The femoral shaft starts at the inferior border of the subtrochanter, according the Arbeitsgemeinschaft für Osteosynthesefragen (AO) classification of fractures. The largest width of the femoral condyles is the distance at which it stops proximally to the condyles”.[14]

“A smooth cylinder with variations in cortical thickness along its length, the diaphysis may be useful in evaluating intraoperative femoral rotation. The linea aspera is the main cortical thickening along the posterior aspect of the femur. It serves as a compressive cortical strut and is an attachment site for muscles and the medial and lateral intermuscular septa.[15] The femur is bowed anteriorly with an average radius of curvature of 120 cm (+/- 36 cm); the smaller the radius, the greater the bow”.[16]

Figure 1: Anatomy of Proximal Femur



FUNCTION

Weight bearing and gait stability are the femur's primary roles.Each femoral head bears an equal amount of the upper body's weight. “The femoral head is held within the pelvic acetabulum by the capsular ligament, a robust, thick sheath that encircles the proximal femur and acetabulum periosteum. External rotation is permitted but internal rotation is restricted by the capsular ligament.[17, 18]

Between the proximal tibia and distal femur, the knee is a hinge-type synovial joint. The tibiofemoral joint is cushioned and stabilized by the medial and lateral meniscus. A valgus or varus deformity is prevented by the medial and lateral collateral ligaments. The anterior and posterior cruciate ligaments in the knee joint permit some rotational mobility of the knee while preventing the tibia from moving anteriorly or posteriorly.Knee extension uses the patellofemoral joint".[17, 19]

EMBRYOLOGY

The cells of the lateral plate mesoderm initiate the formation of the "limb buds of the femur and lower limb. In the fourth week, these cells become active and develop into the limb bud. Shortly after the upper limb buds, the lower limb forms.

Leg growth and development are induced by the limb bud's apical ectodermal ridge. The femur develops from endochondral ossification, in which bone replaces hyaline cartilage models, and is derived from the lateral plate somatic mesoderm of the lower limb bud. There is no cartilage model for the intramembranous ossification process that creates articular cartilages and epiphyseal plates.

Tendons, the perimysium, and the epimysium are also produced by the lateral plate somatic mesoderm. The femur muscles are produced by the myotomic component of the somites. Via the nearby blood supply, the periosteum, which envelops the femur, provides nutrition. Strength is provided by the femur's compact bone, which is highest in the middle third of the femur, where stresses are greatest".[20]

BLOOD SUPPLY

"The femoral artery, a continuation of the external iliac artery, provides the femur's primary blood supply. The femoral artery splits into the superficial femoral artery (SFA) and deep femoral artery (DFA), also referred to as the profunda femoris, after passing beneath the middle section of the inguinal ligament. The femoral shaft and surrounding soft tissues are supplied by the DFA, whereas the tissues beneath the knee are supplied by the SFA. The DFA gives rise to several branches, chief among them the perforating arteries that surround the femur. The inner two thirds of the cortex and bone marrow are supplied by one or more nutritional arteries that emerge from the DFA or its branches. The metaphyseal-epiphyseal system is where they anastomose. The outer portion of the cortex is supplied by the periosteal blood supply".[21]

Figure 2: Blood Supply to Femur

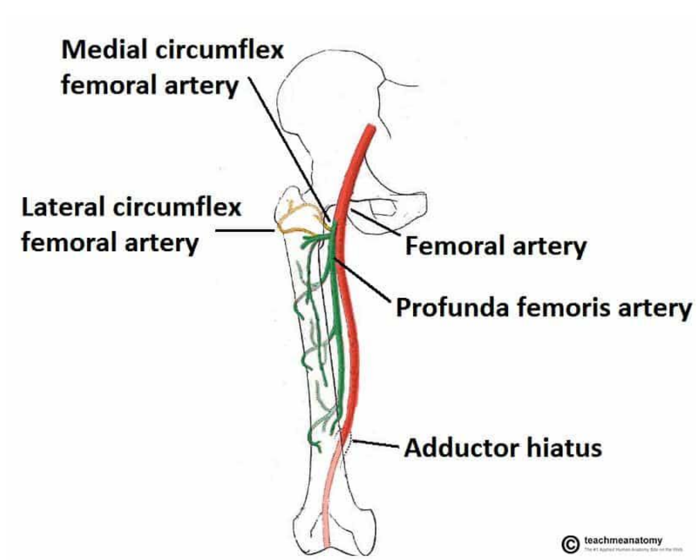
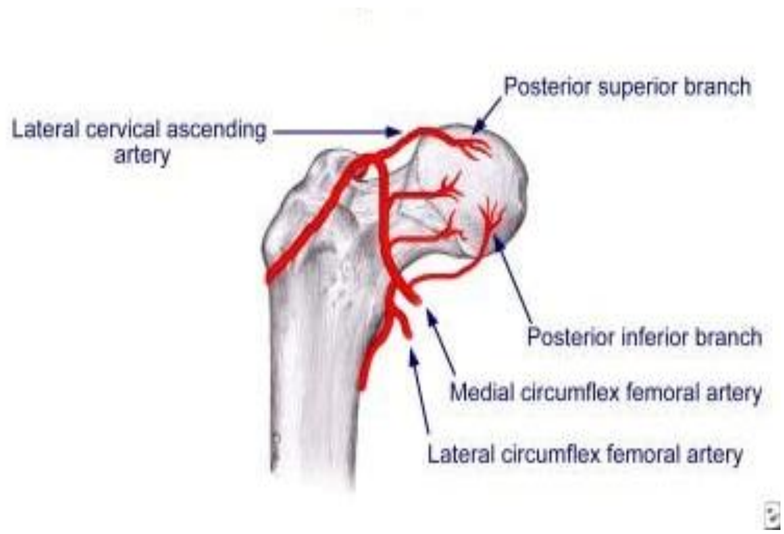


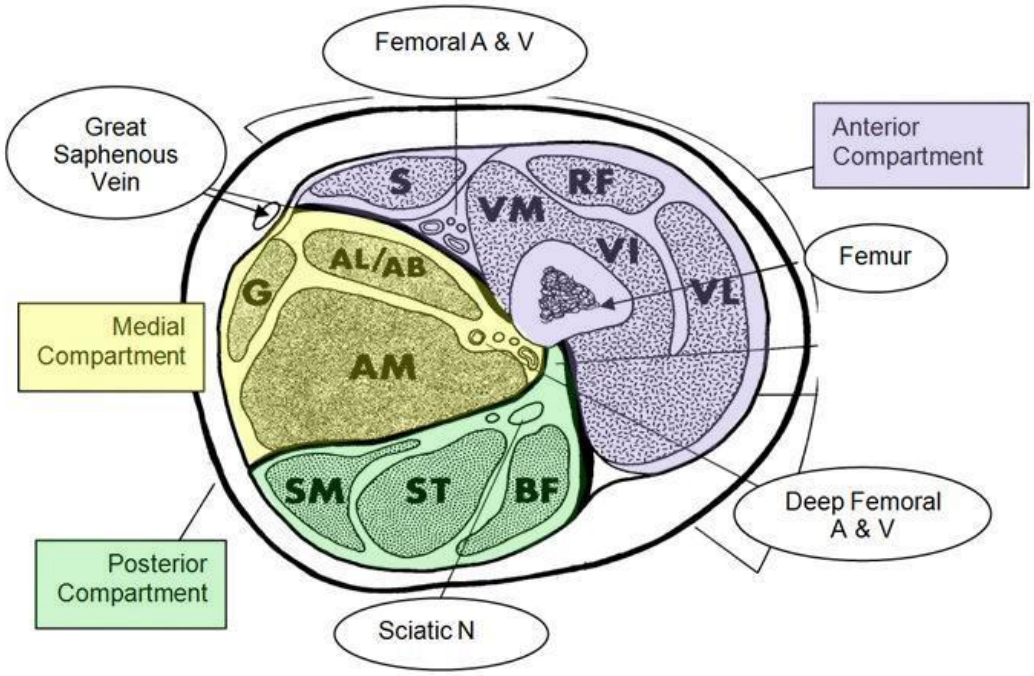
Figure 3: Blood Supply to Femoral Neck



MUSCLES

The femur is surrounded by three large muscle divisions. The femoral nerve is located in the anterior or extensor compartment, which is in charge of knee extension. The sciatic nerve is located in the posterior or flexor compartment, which is also in charge of knee flexion. The adductor muscles are located in the medial compartment. Due to its proximity to the femoral shaft, the sciatic nerve—more especially, the peroneal division—is most vulnerable to damage in FSF. The obturator nerve is located in the adductor compartment. Along with encircling and attaching to the proximal femur and shaft, the gluteal muscles also encompass the superior and inferior gluteal nerves and contain the gluteus maximus, medius, and minimus. Depending on where the fracture is, the muscles in FSF apply deforming stresses to the fracture pieces.The iliopsoas and hip abductors often flex, abduct, and externally rotate the proximal segment. The adductor muscles adduct the distal portion, whereas the quadriceps and hamstrings draw it proximally (shorten it).[22]

Figure 4: Muscular Compartments of Femur



PROXIMAL FEMUR FRACTURES

A significant percentage of trauma patients who require hospitalization have proximal femoral fractures.[23] The vast majority of these patients (>90%) are over 50. These fractures are two to three times more common in women than in men.[24] They are divided into three categories based on the anatomical position of the fracture: subtrochanteric, intertrochanteric, and neck of the femur. Each of these fracture types has its own set of difficulties and debates over the best management approach, necessitating unique treatment approaches.

Fracture neck of femur

"These fractures occur in the region between the head of femur and inter trochanteric region.[25] These fractures are prone to non-union because of three reasons:

A) Being intracapsular, hip synovial fluid impedes the healing process.

B) Loss of blood supply to femoral head and neck due to disruption of lateral ascending cervical branches of the medial femoral circumflex artery. This also increases the risk for avascular necrosis of femoral head.

C) Absence of cambium layer of periosteum in this region".

Subtrochanteric fractures

"These are fractures occurring between the lesser trochanter and isthmus of the shaft of femur. The frequency of these fractures is less than that of neck femur and inter trochanteric fractures.[25] Subtrochanteric fractures constitute 10–30% of all hip fractures.[26] These fractures usually unite by primary cortical healing. These fractures are notorious for intra operative difficulty in reduction and post-operative complications like non-union and malunion. The reason for this being the muscular forces from around the hip acting on the fracture fragments which cause distraction and mal–rotation at the fracture site. The proximal fragment is abducted due to the pull of gluteus medius and minimus. In addition this fragment is forced in flexion and external rotation by iliopsoas. The adductors, on the other hand pull the distal fragment medially into adduction thus increasing the fracture deformity".[26]

Inter trochanteric fracture femur[27]

Extracapsular fractures of the proximal femur that happen between the greater and lesser trochanters are known as intertrochanteric fractures. Dense trabecular bone makes up the femur's intertrochanteric aspect, which lies between the greater and lesser trochanters.These fractures may affect both the larger and lesser trochanters and take place in the space between them. Forty-five percent of hip fractures are intertrochanteric.There is less chance of avascular necrosis and non-union since this area has a lot of cancellous bone, weight-bearing trabeculae, and vascularity.There are numerous ways to categorize intertrochanteric (IT) fractures, including...This fracture is classified as either stable or unstable (reverse oblique and coronal split fractures) by Evan's classification, Boyd and Griffin's classification, AO/OTA classification, and Jensen's classification

Etiology

Although both young people and the old can sustain these fractures, the elderly with osteoporosis are more likely to do so because of a low energy mechanism. The ratio of men to women ranges from 2:1 to 8:1. Additionally, compared to individuals who sustain femur neck fractures, these patients are usually older. These fractures usually arise from a high-energy mechanism in the younger population.[28]

Pathophysiology

These fractures are categorized as either stable or unstable and typically occur in the elderly as a result of a ground-level fall. Determining stability is crucial since it aids in identifying the kind of fixation needed to maintain stability. Once decreased, stable fractures will withstand compressive stresses because the posteromedial cortex is intact. Comminution of the posteromedial cortex, a thin lateral wall, a displaced lesser trochanter fracture, subtrochanteric extension, and reverse obliquity fractures are a few instances of unstable fractures. Intertrochanteric femur fractures are categorized by Evans according to displacement, number of fragments, and type of fragment displaced. Two-part fractures are Type I, three-part fractures are Type II, and four-part fractures are Type III. Non-displaced fractures fall under the A subclassification of type I fractures, whereas displaced fractures fall under the B subclassification. In type II fractures, a three-part fracture with a distinct

GREATER trochanter fragment is described by the A subclassification, whereas a three-part fracture with an LESSER trochanter fragment is described by the B subclassification. Four-part fractures are type III fractures.[29]

History and Physical

The lower extremities of these patients are usually short and externally rotated when they first arrive. To prepare for postoperative rehabilitative care and to maximize perioperative management, past medical and social history should be acquired. Assessing the neurovascular condition and the skin (open versus closed fracture) is crucial. Pain usually prevents a range of motion from being evaluated. Prior to surgical stabilization, basic laboratory tests such coagulation studies, complete blood counts, and comprehensive metabolic panels should be acquired to identify any anomalies that might take some time to resolve. To medically optimize surgical candidates for operative repair, it is best to incorporate an interdisciplinary team as soon as possible, including anesthesia, internal medicine, and geriatrics.

Evaluation

"Plain radiographs are the initial films chosen to evaluate for these fractures. The recommended views include the anteroposterior (AP) pelvis, AP and cross-table lateral of the affected hip and full-length radiographs of the affected femur. Although the diagnosis can be made without pelvic films, pelvic radiographs are useful to assist in preoperative planning for restoration of the proper neck-shaft angle. Full-length radiographs of the femur are useful to assess for deformities of the femur shaft which could affect the placement of an intramedullary nail and evaluation of prior implants in the distal femur. CT and MRI are typically not indicated but can be used if radiographs are negative, although the physical exam is consistent with a fracture. MRI is indicated if there is an isolated greater trochanteric femur fracture and intertrochanteric extension is of concern. Additionally, a physician-assisted AP traction view of the injured hip can be helpful in further characterizing fracture morphology and feasibility of closed reduction or need for open reduction techniques”.[30]

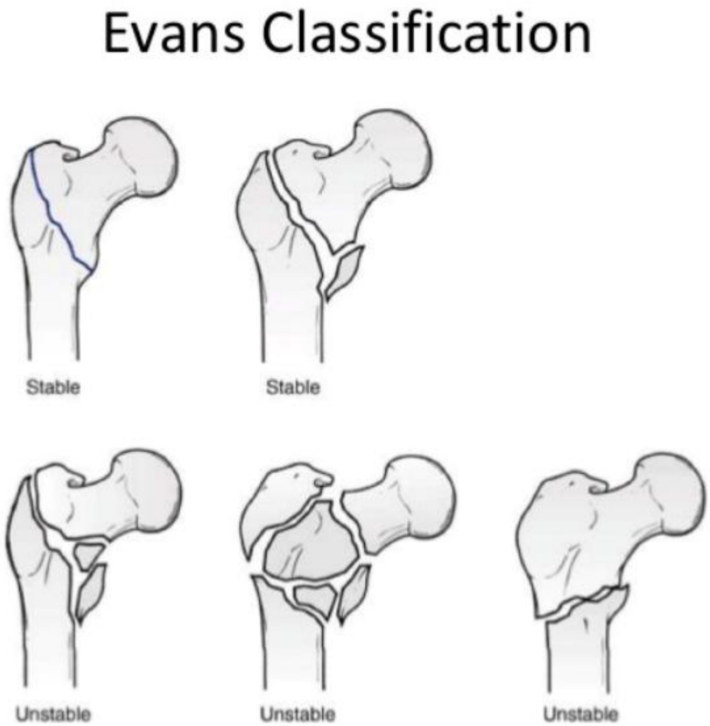
Evans Classification:

In “1949, Evans[31] published his classification on intertrochanteric (IT) fractures according to which IT fractures are classified into Stable and Unstable fractures. Stable fractures have intact or minimally communited posteriomedial cortex, while Unstable fracture has greater communition of posteriomedial cortex. Unstable fractures after reduction can be converted to stable fracture if the posteriomedial cortex opposition can be achieved. Reverse oblique pattern was considered inheritably unstable fracture as distal femur has tendency to drift medially due adductor pull”.

Figure 5: Evans Classification

Type	Stability	Description
Evans Classification		
Type - I	Stable	Undisplaced fractures
		Displaced but after reduction overlap of the medial cortical buttress make the fracture stable
	Unstable	Displaced and the medial cortical buttress is not restored by reduction of fracture.
		Displaced and comminuted fractures in which the medial cortical buttress is not restored by reduction of the fracture.
Type - II	Unstable	Reverse obliquity fractures.
Jensen's Modification of the Evans Classification		
Type I	Stable	Displaced or un-displaced stable 2-fragment fractures
Type II	Unstable	3-fragment fractures with greater or lesser trochanter fracture
		4-fragment fractures

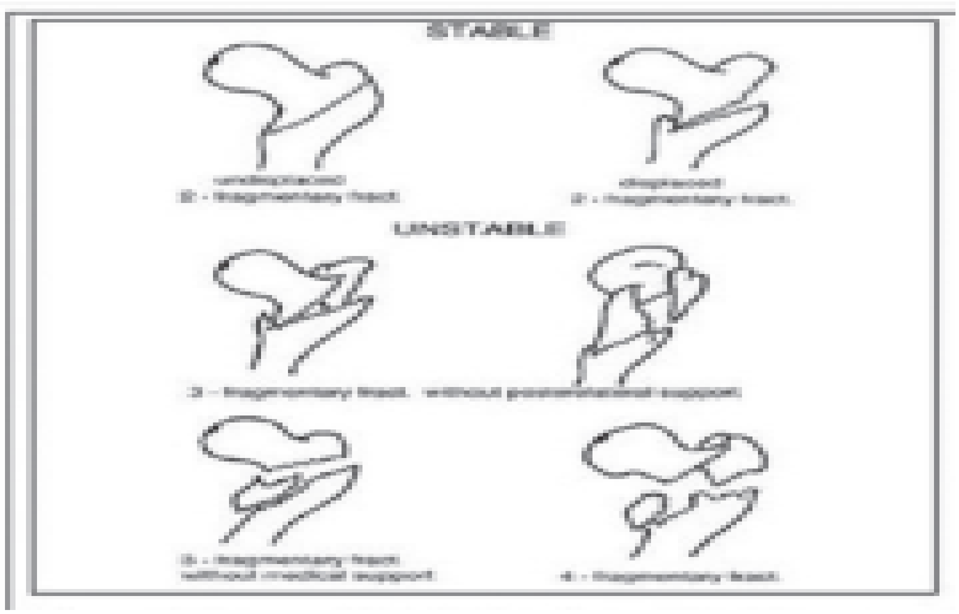
Figure 6: Evans Classification



"Jensen's modification of the Evans classification

Jensen (1975)[32] later modified Evans classification into three groups depending upon the number of fragments. This classification reduced the number of types from 6 to 5 by including the extremely rare fracture with a reversed oblique fracture line and large greater trochanter fragment into Type 3. Modification of the Evans system offers the best prediction of the possibility of obtaining reliable anatomical reduction and the risk of secondary fracture dislocation.

Figure 7: Jensen's modification of the Evans classification



Boyd and griffin classification

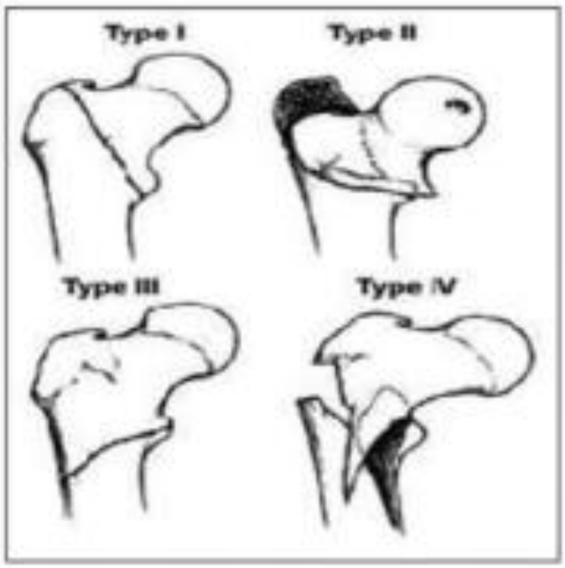
Boyd and Griffin (1949)[33] were first to mention instability in both coronal and sagittal plane. This classification, included fractures from the extracapsular part of the neck to a point 5cm distal to the lesser trochanter. It is classified into 4 groups and each group has clinical relevance".

Figure 8: Boyd and Griffin Classification

Table 1: Boyd and Griffin (1949) classification with clinical relevance

Type	Description	Clinical relevance
Type 1	Fractures that extend along the intertrochanteric line.	Reduction usually is simple and is maintained with little difficulty. Results generally are satisfactory.
Type 2	Comminuted fractures with the main fracture line along the intertrochanteric line but with multiple secondary fracture lines (may be in coronal plane).	Reduction of these fractures is more difficult because the comminution can vary from slight to extreme.
Type 3	Fractures that extend to or are distal to the lesser trochanter.	These fractures usually are more difficult to reduce and result in more complications at operation and during convalescence.
Type 4	Fractures of the trochanteric region and proximal shaft with fractures in at least two planes.	If open reduction and internal fixation are used, two-plane fixation is required because of the spiral, oblique, or butterfly fracture of the shaft.

Figure 9: Boyd and Griffin Classification



"A.O. / OTA (Muller) classification

The classification system devised by Muller and the A.O. group is extremely comprehensive and complete.[34] Each region of the skeleton is assigned an alpha- numerical value and is further classified into a type and a sub group.

Types and subtypes of AO / OTA Classification

According to AO/OTA alphanumeric classification intertrochanteric fractures have been assigned as 'Type 31A' (Bone = femur = 3, Segment = proximal = 1, Site = trochanter = A which has 3 types = A1, A2, A3). ***Type - A1*** is simple (two-part) fractures, with the typical oblique fracture line extending from the greater trochanter to the medial cortex; the lateral cortex of the greater trochanter remains intact. ***Type - A2*** fractures are comminuted with a posteromedial fragment; the lateral cortex of the greater trochanter, however, remains intact.

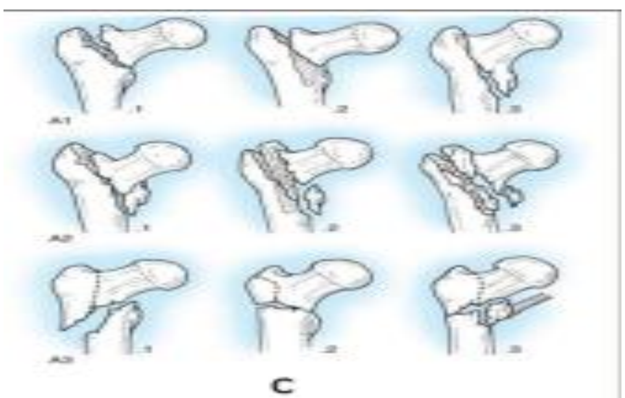
Fractures in this group are generally unstable, depending on the size of the medial fragment.

Type - A3 fractures are those in which the fracture line extends across both the medial and lateral cortices; this group includes the reverse obliquity pattern or subtrochanteric extensions. Each type (A1, A2, A3) is then further classified into three subgroups".

Figure 10: Types and subtypes of AO / OTA Classification

Type	Stability	Description
31-A1: Peritrochanteric simple	Stable	31-A1.1 Along intertrochanteric line
		31-A1.2 Through greater trochanter
		31-A1.3 Below lesser trochanter
31-A2: Peritrochanteric multifragmentary	Stable	31-A2.1 With one intermediate fragment
	Unstable	31-A2.2 With several intermediate fragments
		31-A2.3 Extending more than 1 cm below lesser trochanter
31-A3: Intertrochanteric	Unstable	31-A3.1 Simple oblique
		31-A3.2 Simple transverse
		31-A3.3 Multifragmentary.

Figure 11: Types and subtypes of AO / OTA Classification



Clinical importance AO/OTA Classification

"This helps in predicting prognosis and suggests treatment for the entire spectrum of IT fractures. Fractures A1.1 through A2.1 are commonly described as stable, and fractures A2.2 through A3.3 usually are unstable. Generally, the Evans-Jensen type I fracture is represented by the 31-A1 group. Evans-Jensen type II fractures are in the 31-A2 group. The so-called reverse obliquity intertrochanteric fracture is in group 31-A3. It's alphanumeric and standardized format make this system useful, particularly for research and documentation. As per this classification, those who has criteria of instability needs special attention".

MANAGEMENT OF INTERTROCHANTERIC FRACTURES:

The first films selected to assess for these fractures are plain radiography. Full-length radiographs of the damaged femur, the anteroposterior "(AP) pelvic, and the AP and cross-table lateral of the affected hip are among the suggested views. Pelvic radiographs are helpful in preoperative planning for the restoration of the correct neck-shaft angle, even if the diagnosis can be made without them. To check for femoral shaft abnormalities that can impact the positioning of an intramedullary nail and the assessment of previous implants in the distal femur, full-length radiographs of the femur are helpful. Even though the physical examination is consistent with a fracture, CT and MRI are usually not recommended, however they may be done if radiographs come back negative. If intertrochanteric extension is concerning and there is an isolated greater trochanteric femur fracture, an MRI is recommended. Furthermore, further describing the fracture morphology and the viability of closed reduction or the necessity of open reduction techniques might be aided by a physician-assisted AP traction image of the injured hip".[35,36]

Treatment:

Only patients who are non-ambulatory, have a high risk of perioperative death, or are seeking comfort care measures should be evaluated for nonoperative treatment, which is rarely needed. Because of the elevated risk of decubiti, pneumonia, urinary tract infections, and deep vein thrombosis, this therapeutic approach has poor results.[37]

Given the strong correlation between the failure rate and implant and fracture pattern selection, the kind of surgical therapy is determined by the "fracture pattern and its intrinsic stability. Sliding hip screws would not be used to treat fractures involving the lateral femoral wall, which are thought to be an indication for intramedullary nailing. Intramedullary nailing is also recommended for unstable fracture patterns, such as those with comminution of the posteromedial cortex, a thin lateral wall, displaced lesser trochanter fractures, subtrochanteric extension of the fracture, and reverse obliquity fractures".

The surgical treatment of these fractures is regarded as urgent rather than emergent. This makes it possible to maximize preoperative management of "the numerous comorbidities that patients frequently present with in order to lower morbidity and mortality. Although arthroplasty is an uncommon option, the majority of these fractures are treated surgically with either an intramedullary hip screw or a sliding hip screw.Stable fracture patterns with an intact lateral wall are indications for the sliding hip screw. This procedure produces results comparable to intramedullary nailing when applied to the right fracture pattern. Compared to intramedullary implants, the dynamic hip screw has the benefit of being inexpensive and enabling dynamic interfragmentary compression. The open method and higher blood loss are the main drawbacks. Implant failure may result from the screw's positioning, which should be less than 25 millimeters from the tip apex, or from the lateral wall's lack of integrity".[37]

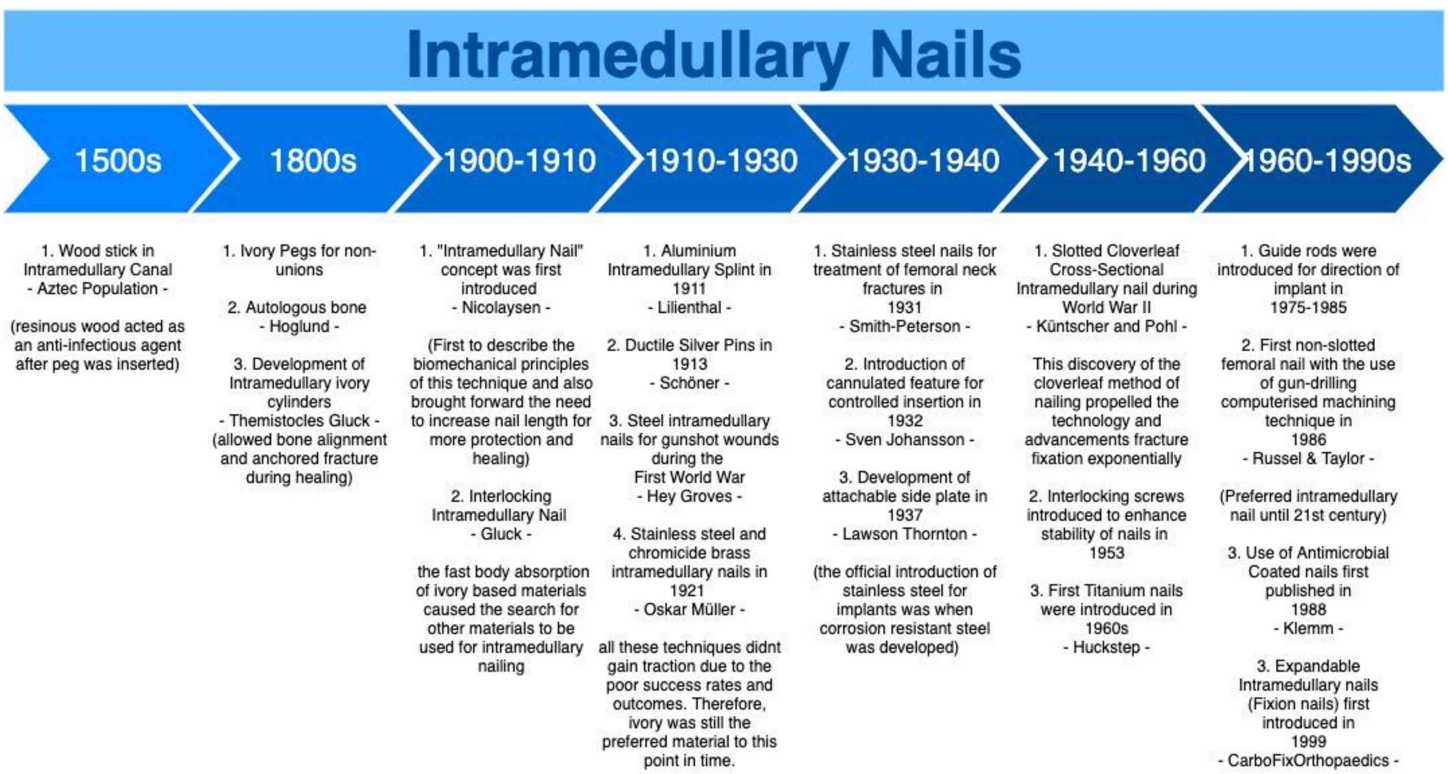
A wider variety of intertrochanteric fractures, including those with more unstable patterns such reverse obliquity, can be treated with intramedullary nailing. “The intramedullary hip screw's minimally invasive technique, which reduces blood loss, is one of its suggested benefits.Young surgeons are increasingly using intramedullary hip screws”, despite the fact that there is no evidence that they are superior than sliding hip screws in treating stable fracture patterns. In these fractures, the decision between short and lengthy intramedullary implants is up for debate.

Usually not recommended as initial treatment, arthroplasty is saved for “patients with a history of degenerative arthritis, severely comminuted fractures, internal fixation salvage, and osteoporotic bone that is unlikely to support internal fixation”.[37]

PROXIMAL FEMORAL NAILS:

In 1997, the AO-ASIF group created a proximal femoral nail to treat proximal femoral fractures. Compared to laterally positioned plate and screw devices, PFN, an intramedullary nail, is subject to reduced bending moment because it is positioned closer to the femur's mechanical axis.[38] The short lever arm reduces tensile strain on the implant, which lessens the chance of implant failure. “Adding more anti-rotational screws will make the head and neck fragment more stable. It is possible to place the nail percutaneously. It has the option of distal static or dynamic locking. The distal locking screws are positioned more proximally to prevent sudden changes in the stiffness of the construct, and the nail is tapered towards the end to reduce the risk of postoperative fracture at the nail tip.[39, 40] This nail's 6º mediolateral angle not only makes insertion easier, but also lowers the risk of intraoperative fracture".

Figure 12: Timeline of the evolution of IMNs



COMPONENTS OF PROXIMAL FEMORAL NAIL

The nail's distal end taper to 9 to 12 mm, while its proximal diameter of 15 mm accommodates the broad medullary canal of the proximal femur. Six degrees is the medio-lateral inclination. Two holes for the insertion of a neck screw and an anti-rotational screw are located in the proximal portion of the nail above the mediolateral angular bend. There are two holes on the nail's distal end where interlocking screws can be inserted. Dynamization up to 5mm is possible through the dynamic bottom hole and the static top hole. The length of the nail varies from 36 to 42 cm, and it is available in angles of 130 to 135 degrees to accommodate different femoral neck-shaft angles and diameters of 9, 10, 11, and 12 mm. In order to stop bone from growing into the nail, the proximal end of the nail also features threads for the end cap to be inserted.

"FEMORAL NECK SCREW: This is an 8.0mm screw which bears and gives main stability in the proximal fragment for fracture fixation the screw is available in lengths from 70-110mm.

ANTI ROTATION HIP SCREW: This is a 6.4 mm stabilization screw, provides the rotational stability for the proximal fragment and the screw is available in lengths from 70-110mm.

DISTAL LOCKING SCREWS: These are 4.9 mm screws inter locking screws.[41]

COMPONENTS OF PROXIMAL FEMORAL NAIL SYSTEM

1. **INSERTION HANDLE**

It helps in the insertion of nail along with conical locking bolt and locking nut. The lugs on the handle should engage the positioning notches at the upper end of nail for insertion. It is used for insertion of proximal neck screws and distal locking screws. The holes in the insertion handle position the locking instruments.

2. THREADED CONICAL BOLT

The threaded bolt is screwed by hand into the nail and assembled with insertion handle. Once the lugs of the handle have engaged in notches, firm tightening is box spanner

3. DRIVING PIECE AND DRIVING HEAD

These are used for insertion of nail with a hammer. Driving piece is screwed onto the threaded conical bolt and driving head is screwed onto the proximal end of the driving piece for insertion with a hammer. The hole in the neck of the driving head allows insertion of Tommy bar

4. LOCKING INSTRUMENTS

a. PROTECTION SLEEVES: These sleeves should be inserted through the zig for proximal neck screws and distal locking screws to guide for insertion of screws.

b. DRILL SLEEVES: These drill sleeves accept 6.5mm / 5.0mm drill bits

c. TROCAR : 8.0mm: This trocar is used with 11mm / 8mm protection sleeves for insertion through

d. DRILL BITS: 6.5mm, 5.0mm, and 4.0mm: The 6.5 mm drill bit and 5.0mm drill bit are used to drill holes for 8.0mm femoral neck screw and 6.4 mm anti rotation hip screw respectively. These two drill bits are cannulated for drilling over a guide wire and are marked to know the length of screws to be inserted. The 4.0mm drill bit is used to drill hole for 4.9mm distal locking bolts.

e. DEPTH GAUZE FOR LOCKING BOLTS: This depth gauze measures up to 115mm. It has a long neck allowing measuring for locking bolts through distal locking holes in insertion handle.

f. HEXAGONAL SCREW DRIVER: This large hexagonal screw driver is used for insertion of 8.0mm femoral neck screw, 6.4mm anti rotational hip screw and 4.9mm distal locking bolts".

Fixing proximal femur fractures is often accomplished with proximal femoral nails. The proximal femur's structure served as the basis for the creation of these nails. The implants that were previously available were made for people in the West. According to studies, the femurs of the Indian and Western populations differ, hence these nails are inappropriate for the Indian population. 3–5 The Indian market offers a variety of proximal femoral nails that have been altered for the Asian population. The anatomical characteristics of these implants differ greatly.[42]

Figure 12: Indian Nails

Table 1: Parameters for Indian Nails[42]

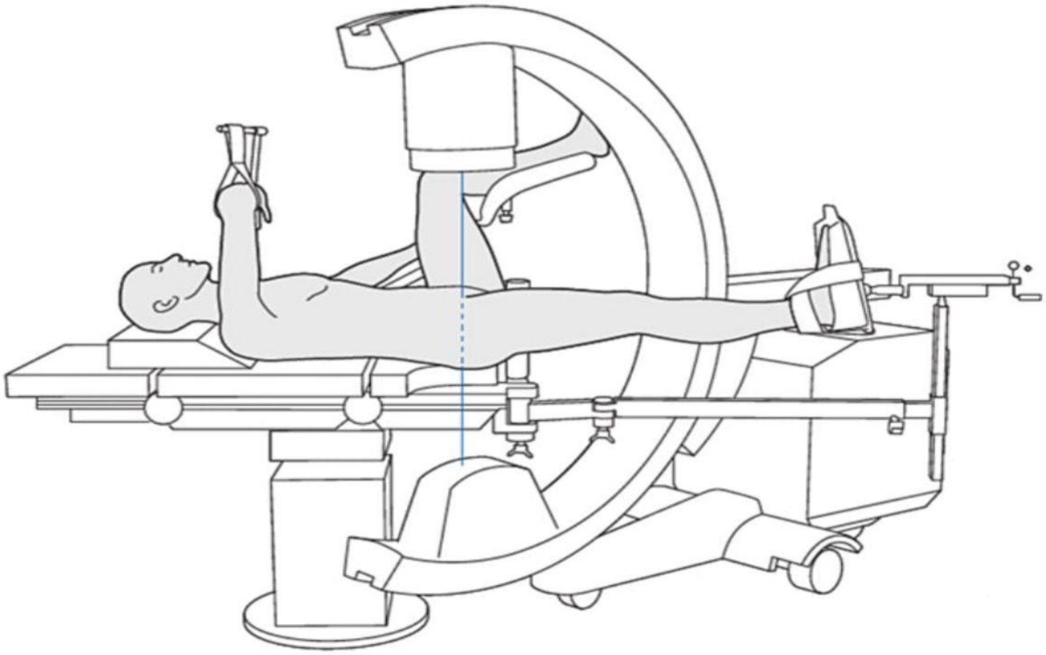
“Parameter	Orthocare	Pitkar	Shakti I	Miraclus	Shakti II
Shape of proximal nail	Cylindrical	Cylindrical	Cylindrical	Cylindrical	Cylindrical
Distance of lag screw from tip (mm	35	25	33.5	25	28
Distance to becomes 10 mm (mm)	90	9	82	73	75
M-L angle (degree)	5	3	4	4	6
Shape of nail shaft	Cylindrical, smooth shaft	Cylindrical, smooth shaft	Cylindrical, smooth shaft	Cylindrical, smooth shaft	Cylindrical, smooth shaft
Configuration of distal screws	01 static, 01 dynamic	01 static, 01 dynamic	01 static, 01 dynamic	01 static, 01 dynamic	02 static

Neck Screw	Single helical blade, 10.5 mm dia. Locking absent	02 (lag-8 mm, Anti-rotation – 6.4 mm)	Single helical blade, 10.5 mm dia. Locking absent	Single helical blade, 10.5 mm dia. Locking absent	02 (lag-8 mm, Anti-rotation – 6.5 mm)
Centrum Colum Diaphysial angle (degree)	130	125 and 130	130, 135	130, 135	130, 135"

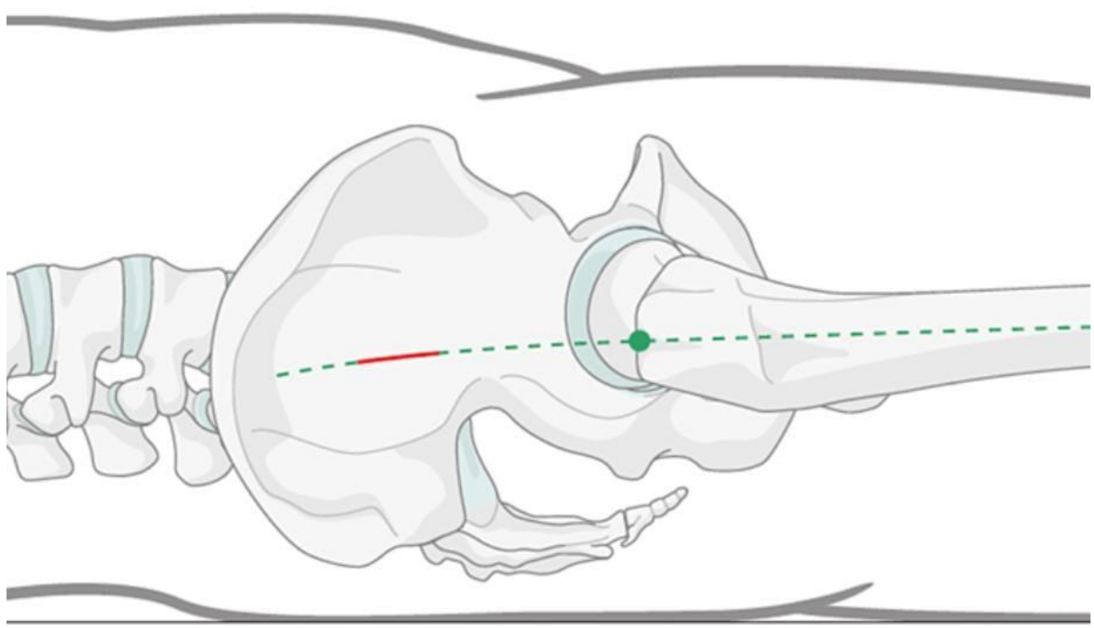
Compared to long proximal femoral nails (PFNs), short PFNs are typically linked to quicker surgical times and reduced blood loss.However, the patient's features and other considerations will determine whether a short or lengthy PFN is appropriate.[43]

PROCEDURE:

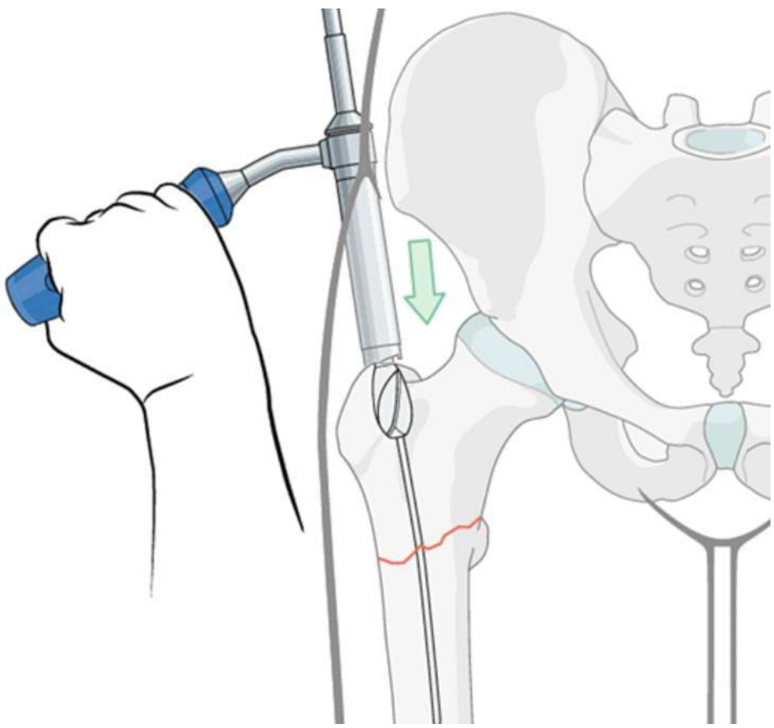
- "Patient shifted from pre-op to OT table , under aseptic precautions spinal anaesthesia has been given. Patient placed in supine position on fracture table with normal leg placed over leg holder and placing the injured leg on traction and pulling in direction of long axis of leg to distract fracture fragments and regain length and adjust internal rotation of femoral shaft until patella facing upward".



- “And then reduction checked in both AP and Lateral view with fluoroscopy till reduction looks satisfactory. Scrubbing, painting, and draping has been done. Incision was taken by palpating the greater trochanter 5 centimeters proximal to it.



- Soft tissue dissection has been done, fascia lata has been incised followed by blunt dissection and fibers has been splitted then awl has been placed at an entry point - slightly medial to tip of greater trochanter and checked in both AP and Lateral view; Once satisfactory entry obtained, a guide wire has been passed and checked in fluoroscopy, then an entry reamer has been passed and entry point been reamed then serial reaming has been done then appropriate size nail has been mounted to jig and inserted first guide wires for both lag screw and derotational screw has been passed checked in fluoroscopy then appropriate drill bit used for it.



- First Lag screw was placed but not fully tightened then derotational screw has been placed followed by traction has been released then complete tightening of lag screw has been done checked in fluoroscopy once satisfactory, then distal locking has been done. Thorough wash has been given then followed by layer by layer suturing has been done".

Surgical Details

“Short PFNs

- Have a shorter operating time
- Have less blood loss
- Have lower transfusion rates

Long PFNs

- Span the length of the femur
- Can be better for elderly patients with osteoporosis
- Can have a higher risk of anterior cortical impingement
- Can have a higher risk of iatrogenic insertion fractures

Other factors

Patient characteristics:

- Younger male patients may be better served by a short PFN
- Frail and elderly patients may be better served by a long PFN

Surgeon preference: The surgeon's preference and familiarity with the implants may be a factor

Cost: Long PFNs can be more expensive than short PFNs

Hemiarthroplasty for Intertrochanteric Fractures[43, 44]

Hemiarthroplasty is a surgical procedure that involves replacing half of the hip joint while leaving the acetabular component (socket) intact. While it's commonly used for femoral neck fractures, its application for intertrochanteric fractures is more controversial and less common”.

Indications

“Hemiarthroplasty may be considered for intertrochanteric fractures in:

- Elderly patients with poor bone quality
- Unstable fracture patterns
- Patients with pre-existing arthritis
- Cases where fixation failure is likely

Advantages

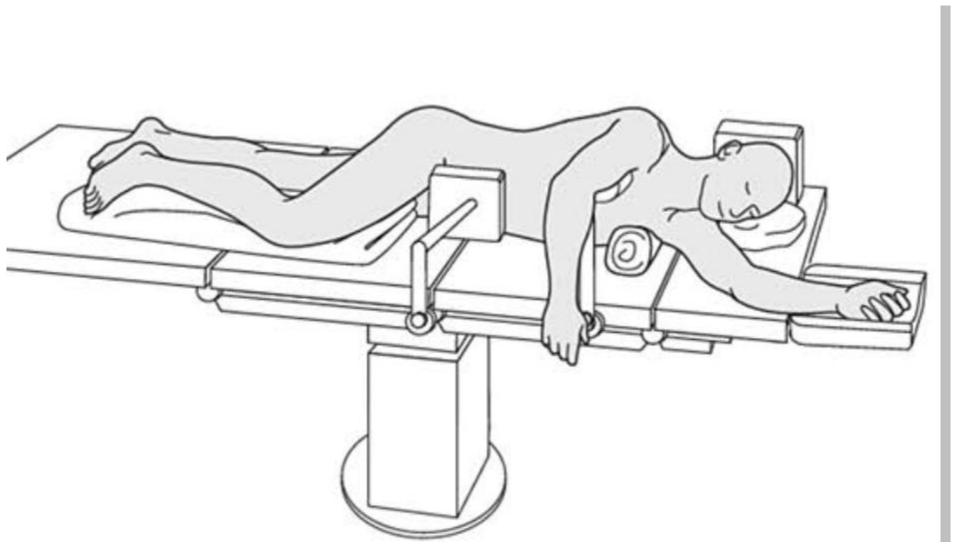
- Earlier weight-bearing and mobilization
- Reduced risk of fixation failure
- Elimination of fracture healing concerns
- Potentially better functional outcomes in selected patients

Disadvantages

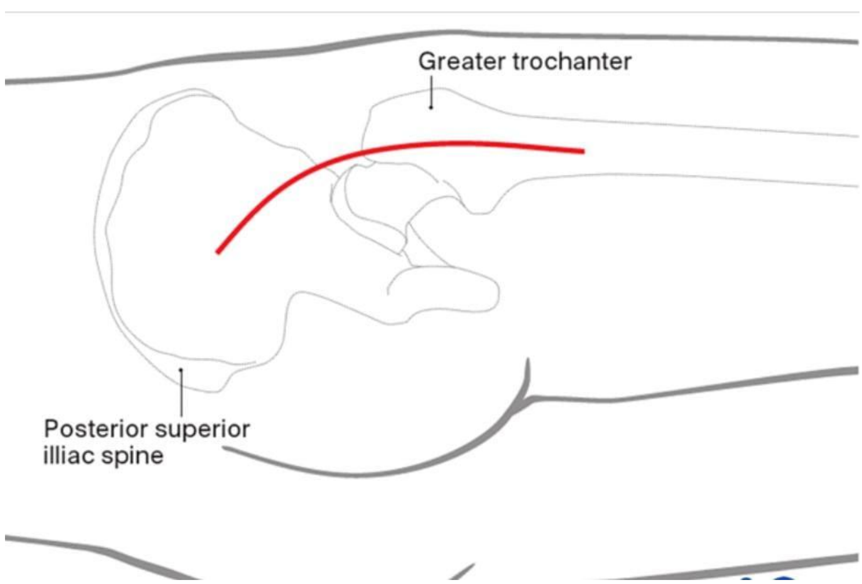
- More invasive procedure
- Higher blood loss and operative time
- Increased risk of prosthetic complications
- Higher initial cost"

PROCEDURE:

- "Prophylactic antibiotics were administered following the induction of spinal anaesthesia. Over a bean bag, the patient was positioned in the lateral decubitus posture.

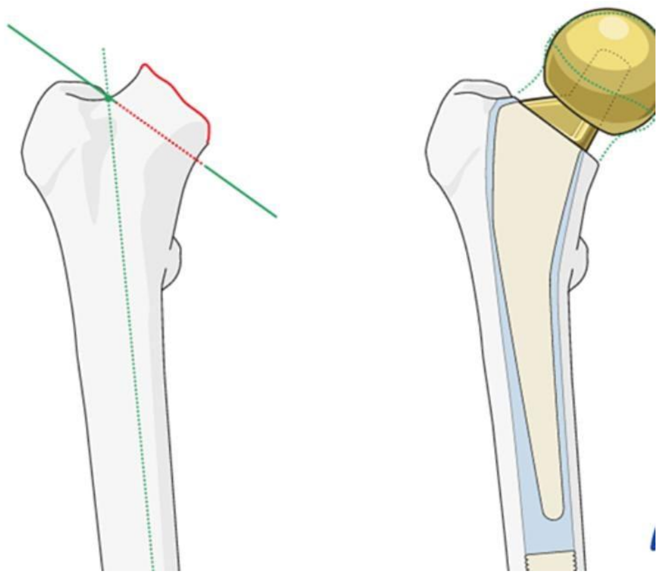


- Every bony protrusion had enough padding. In preparation for surgery, the lower extremity was prepared and draped. The skin incision began at the greater trochanter's posterior third and went 8 cm proximally to a location 2 finger breadth below the PSIS. After that, the incision was stretched 5 cm distally across the thigh's lateral side.

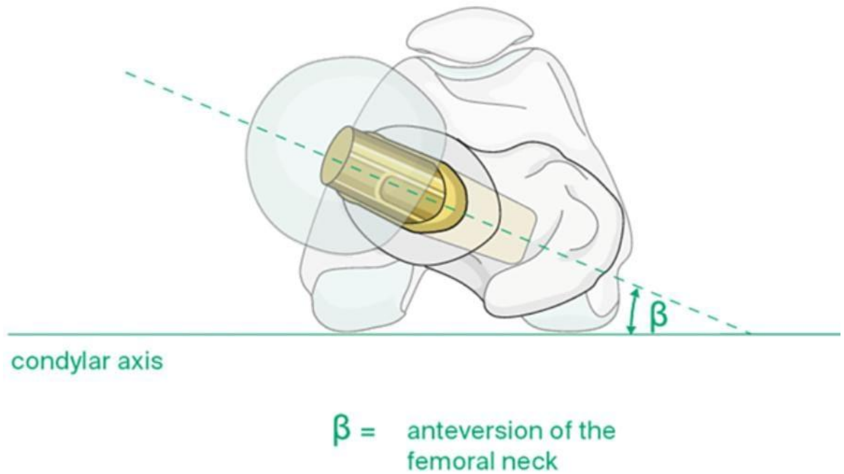


- . The incision was made through the iliotibial band and subcutaneous tissue. They positioned the Charnley bow retractor. A Hohmann was positioned between the gluteus minimus and the capsule to address the posterior portion of the hip first. The quadratus femoris, obturator externus, piriformis, and conjoint tendon were cut off at their entrance into the greater trochanter.

- It was possible to identify the fracture. Using the template, the femoral neck was cut one finger's width proximal to the lesser trochanter.



- Using the corkscrew tool, the femoral head was extracted and measured. They removed the labrum. The femur was internally rotated to 90 degrees and flexed. A bent Hohmann was positioned laterally, a curled cobra was positioned medially, and a jaws retractor was positioned anteriorly. The external rotators that remained were taken out. A cookie cutter was employed, followed by a pilot hole reamer and a T-bar reamer. As intended, the femoral canal was gradually reamed to the proper diameter. Anatomically, the broach was positioned between 10 and 15 degrees anteverted.



- They reamed the calcar. The ball of the proper size was put on the neck. They found the hip. After being measured, range of motion was determined to be satisfactory.
- The length of the legs seemed to be equal. Every element of the trial was removed. Pulse lavage was done. The proper press fit and anteversion were used for inserting the femoral component. Making sure there was no soft tissue interposition, the proper ball was positioned onto the femoral head and moved into the acetabulum. Drill holes were used to bring the external rotators and capsules closer to the greater trochanter. A drain was positioned through the anterolateral skin, deep to the IT band. The IT band was closed using the #1 running PDS. #1 Two layers of PDS were used for subcutaneous closure. 2-0 The vertical mattress was disturbed with Prolene, staples. After being put on the hospital bed in a supine position, the patient was brought to the recovery room."

MATERIAL AND METHODS

- **Study design:** Prospective comparative study
- **Study area:** Department of Orthopedics, BLDE (DEEMED TO BE UNIVERSITY) Shri B. M. Patil's Medical College, Hospital and Research Centre, Vijayapura
- **Study period:** Research study was conducted from January 2023 to January 2025. Below is the work plan.

- **Sample size**: 50

t tests - Means: Difference between two independent means

(two groups) Analysis: A priori: Compute required sample size Input: Tail(s)=Two Effect

size d = 1.0790862 ***a*** err prob = 0.05 Power

(1-P err prob)=0.96 Allocation ratio N2/N1=1

Output: Noncentrality

parameter 5 = 3.8151458 Critical t = 2.0106348

Df = 48

Sample size group 1=25

Sample size group 2=25

Total sample size=50 Actual power = 0.9622813

Sample size:

Using G*power ver 3.1.9.4 software for sample size calculation.

The post operative mobility score fro PFN and bipolar , this study requires a total sample size of 50 (25 cases fro each group assuming equal group size .) So to achieve a power of 96% for detecting a difference in Proportions. 5 % level of significance.

Sample size: 50 (25 cases in each group)

- **Inclusion criteria:**
  1. Patients > 55 years of age
  2. Diagnosed with a primary, unilateral, recent INTERTROCHANTERIC fracture by X-RAY/CT scan.
  3. Boyd and griffin classification fractures (type 2,3,4)
  4. Able to give informed consent
- **Exclusion criteria:**

1. Multiple fractures
2. Immobility or walking difficulties before fracture
3. Deep vein thrombosis
4. Infections
5. Failure of follow up 6 months after surgery.

- **Methodology:**

Source of Data

This prospective comparative study was conducted at the Department of Orthopedics in BLDE (Deemed to be University) Shri B.M. Patil Medical College, Hospital and Research Centre, Vijayapura. The study included patients diagnosed with intertrochanteric fractures of the femur who were admitted to the department between August 1, 2022, and January

31, 2024. All patients who met the inclusion criteria were thoroughly informed about all aspects of the study, including the treatment options, potential complications, rehabilitation protocols, and follow-up requirements. Written informed consent was obtained from all participants prior to enrollment in the study. The study protocol was approved by the Institutional Ethics Committee of BLDE University (Reference No. BLDE/IEC/2022-23/OR-05) and was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

The study population comprised patients aged 60 years and above who were diagnosed with intertrochanteric fractures of the femur. Patients were assigned to either the hemiarthroplasty group or the proximal femoral nail (PFN) group based on predefined clinical criteria, fracture characteristics, and surgeon's assessment. The assignment to treatment groups was not randomized but was based on clinical judgment considering factors such as age, bone quality, fracture pattern, comorbidities, and pre-fracture functional status. All surgical procedures were performed by experienced orthopedic surgeons who were proficient in both surgical techniques.

Study Design and Patient Selection

A total of 60 patients with intertrochanteric fractures who fulfilled the inclusion criteria were enrolled in the study, with 30 patients allocated to the hemiarthroplasty group and 30 patients to the PFN group. The inclusion criteria encompassed patients aged 60 years and above with acute intertrochanteric fractures (AO/OTA classification 31-A1, 31-A2, and 31-A3), ability to walk independently or with minimal assistance prior to the fracture, and medical fitness for the planned surgical intervention. Patients with pathological fractures, previous ipsilateral hip surgery, polytrauma, open fractures, neuromuscular disorders affecting gait, inability to comprehend instructions for functional assessment, and those who declined to participate were excluded from the study.

Upon admission, a detailed medical history was obtained, including demographic data, mechanism of injury, pre-fracture functional status, and coexisting medical conditions. Each patient underwent a comprehensive clinical examination, which included assessment of vital parameters, systemic examination, local examination of the affected limb for skin condition, neurovascular status, deformities, and associated injuries. The fractures were classified according to the AO/OTA classification system based on the radiographic findings. Preoperative optimization was performed for all patients, which included pain management, thromboprophylaxis, and treatment of medical comorbidities as per standard protocols.

Preoperative Evaluation and Preparation

All patients underwent a standardized preoperative evaluation protocol. Radiological assessment included anteroposterior and lateral radiographs of the affected hip, as well as a radiograph of the pelvis with both hips. In selected cases, computed tomography (CT) scanning was performed to better delineate the fracture pattern and to aid in surgical planning. Laboratory investigations included complete blood count, bleeding time, clotting time, blood glucose levels, blood urea, serum creatinine, liver function tests, serum electrolytes, urinalysis, HIV and HBsAg screening, and blood grouping and Rh typing. Preoperative cardiac evaluation included electrocardiography and echocardiography when indicated. Chest radiographs were obtained to assess cardiopulmonary status.

Anesthetic fitness was assessed by the anesthesiology team, and patients were categorized according to the American Society of Anesthesiologists (ASA) physical status classification system. Preoperative optimization was tailored to individual patient needs, including management of comorbidities, correction of anemia, and electrolyte imbalances. Thromboprophylaxis was initiated as per institutional protocol, typically involving low molecular weight heparin. Prophylactic antibiotics were administered within one hour prior to surgical incision, typically a first-generation cephalosporin, with alternative agents for patients with penicillin allergy. The affected limb was prepared, and skin traction was applied in cases with significant pain or muscle spasm.

Surgical Procedures

All surgical procedures were performed under either spinal anesthesia or general anesthesia, depending on the anesthesiologist's assessment and patient factors. The choice between hemiarthroplasty and PFN fixation was made based on the patient's age, bone quality, fracture pattern, functional demands, and surgeon's assessment of the optimal treatment approach.

For patients in the hemiarthroplasty group, the procedure was performed through a posterolateral or direct lateral approach with the patient in the lateral decubitus position. After exposing the hip joint, the femoral head and neck were excised, taking care to preserve as much of the calcar as possible. The proximal femoral canal was prepared with graduated reamers and broaches. The prosthesis size was determined based on preoperative templating and intraoperative assessment. The stability of the prosthesis was assessed intraoperatively, and cemented or uncemented fixation was employed based on bone quality and intraoperative findings. In most cases, a modular bipolar prosthesis was utilized. The greater trochanter and calcar fragments were secured to the prosthesis and femoral shaft using stainless steel wires or non-absorbable sutures when necessary. Meticulous soft tissue repair was performed, including capsular repair and reattachment of the external rotators when the posterolateral approach was used.

For patients in the PFN group, the procedure was performed on a fracture table with the patient in the supine position. Closed reduction of the fracture was attempted under fluoroscopic guidance, with open reduction performed when satisfactory closed reduction could not be achieved. A small incision was made proximal to the greater trochanter for nail insertion. After appropriate entry point preparation, a guidewire was inserted, followed by reaming of the proximal femur. The appropriate nail size was selected based on preoperative templating and intraoperative assessment. The nail was inserted, and the position was confirmed under fluoroscopic guidance. The lag screw and anti-rotation screw or blade were inserted into the femoral head, ensuring appropriate positioning in the inferior-central portion of the femoral head on both anteroposterior and lateral views. Distal locking was performed as per the implant design and fracture characteristics. The incisions were closed in layers, and sterile dressings were applied.

Intraoperative parameters including surgical time, blood loss, need for blood transfusion, and intraoperative complications were meticulously documented for both groups. Immediate postoperative radiographs were obtained to assess the position of the implant and quality of reduction.

Postoperative Management and Rehabilitation

Postoperative management protocols were standardized for both groups, with minor modifications based on individual patient factors and intraoperative findings. All patients received appropriate analgesics, thromboprophylaxis, and prophylactic antibiotics as per institutional protocols. The rehabilitation program was initiated on the first postoperative day with emphasis on early mobilization.

In the hemiarthroplasty group, patients were typically allowed to bear weight as tolerated with appropriate assistive devices from the first postoperative day, unless contraindicated by intraoperative findings or medical conditions. Hip precautions were instituted to prevent dislocation, particularly for patients who underwent the procedure through a posterolateral approach. Active and passive range of motion exercises were initiated under the supervision of physical therapists.

In the PFN group, weight-bearing status was determined based on the stability of the fixation, quality of reduction, and bone quality. In cases with stable fracture patterns and satisfactory fixation, partial weight bearing with assistive devices was typically allowed within the first week, progressing to full weight bearing as tolerated based on clinical and radiological assessment. In cases with unstable fracture patterns or concerns about fixation stability, protected weight bearing was recommended for 4-6 weeks. Active and passive range of motion exercises for the hip and knee were initiated on the first postoperative day. All patients received individualized physical therapy during their hospital stay and were provided with a structured home exercise program upon discharge. The discharge criteria included adequate pain control with oral analgesics, independent mobility with appropriate assistive devices as per the recommended weight-bearing status, ability to perform basic activities of daily living, and absence of wound complications.

Follow-up and Outcome Assessment

Patients were followed up at 1 month, 3 months, and 6 months postoperatively. Additional follow-up visits were scheduled as needed based on clinical progress or complications. At each follow-up visit, patients underwent clinical and radiological assessment. Clinical evaluation included assessment of pain using the Visual Analog Scale (VAS), hip range of motion, walking ability, use of assistive devices, and functional status. Radiological evaluation included anteroposterior and lateral radiographs of the affected hip to assess implant position, fracture healing, presence of complications such as implant failure, non-union, malunion, or prosthetic-related complications.

The primary outcome measure was the functional outcome as assessed by the Harris Hip Score (HHS) at 1, 3, and 6 months postoperatively. The HHS evaluates pain, function, absence of deformity, and range of motion, with a maximum score of 100 points. Scores were categorized as follows: excellent (90-100), good (80-89), fair (70-79), and poor (<70). Secondary outcome measures included the Parker Mobility Score to assess walking ability, the modified Barthel Index for activities of daily living, and the EuroQol-5D (EQ-5D) for health-related quality of life. Radiological outcomes included assessment of fracture union, implant position, and radiological complications. Time to return to pre-fracture functional status was also documented.

Complications were systematically recorded and categorized as intraoperative, early postoperative (within 30 days), and late postoperative complications. Specific complications monitored included surgical site infection, dislocation in the hemiarthroplasty group, implant-related complications in the PFN group (such as cut-out, implant breakage, or loosening), thromboembolic events, medical complications, re-operations, mortality, and readmissions.

Ethical Considerations

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and the Indian Council of Medical Research (ICMR) guidelines for biomedical research. The study protocol was approved by the Institutional Ethics Committee of BLDE University. Written informed consent was obtained from all participants or their legally authorized representatives after providing a detailed explanation of the study procedures, potential risks, benefits, and alternatives in a language they could understand. Participation was voluntary, and patients were informed of their right to withdraw from the study at any time without affecting their standard of care.

Confidentiality of patient data was maintained throughout the study. Patient records were coded, and identifying information was removed from the research database. Access to the data was restricted to the research team. Privacy was ensured during all clinical evaluations and procedures. The study design included measures to minimize discomfort and inconvenience to the participants, with follow-up visits coordinated with routine clinical appointments when possible.

The study was registered with the Clinical Trials Registry-India (CTRI) prior to patient enrollment. The findings will be reported in accordance with the CONSORT guidelines for reporting of comparative studies, regardless of the outcomes.

STATISTICAL ANALYSIS

Data was entered in excel sheet and analyzed using the Epi Info software version 7.. Results were presented in tabular and graphical forms Mean, median, standard deviation and ranges were calculated for quantitative data. Qualitative data were expressed in terms of frequency and percentages. Student t test (Two Tailed) was used to test the significance of mean and P value <0.05 was considered significant.

REPRESENTATIVE CASES

PATIENT 1

Name- SHRISHAIL

Age/Sex- 65 years/Male

Diagnosis- Left femur intertrochanteric fracture

A 65 year old male came with alleged history of self fall at home with no head injuries or internal injuries. The patient complained of pain over the left hip joint and inability to bear weight over the affected limb. A pelvis with bilateral hip joint X-ray was taken which showed left femur intertrochanteric fracture which was confirmed and was planned for modular bipolar hemiarthroplasty.

Figure 1: pre op x ray of pelvis with both hip joints AP view

Figure 2: Lateral decubitus position

Figure 3: skin incision

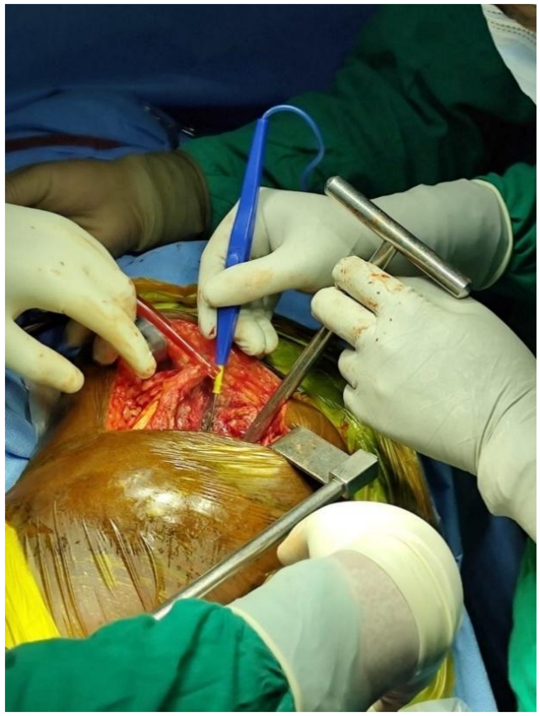


Figure 4: Femoral head excised

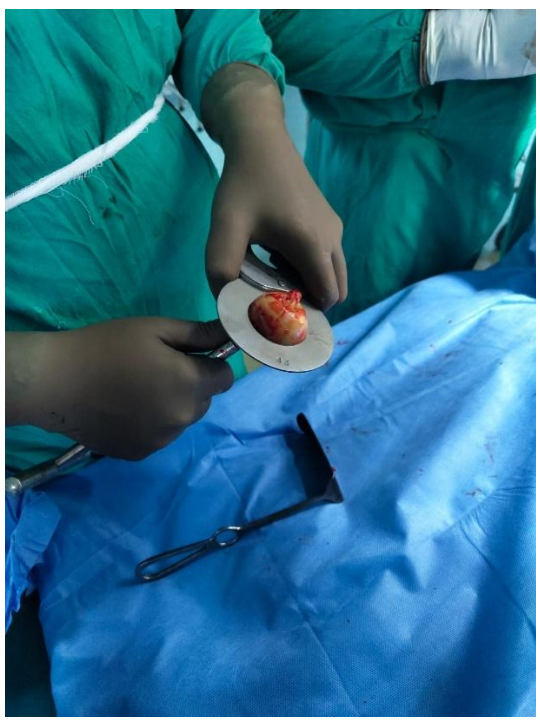


Figure 5: Femoral head size measured

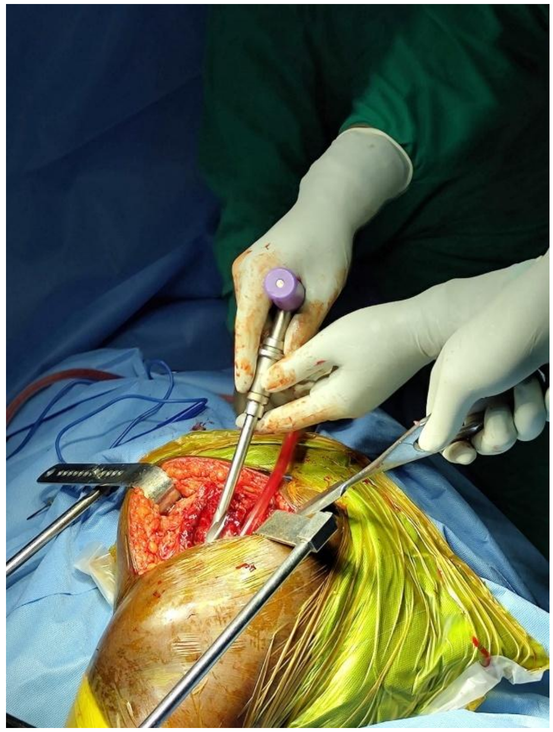


Figure 6: Femoral canal reamed

Figure 7: Femoral stem placed

Figure 8: Femoral head placed

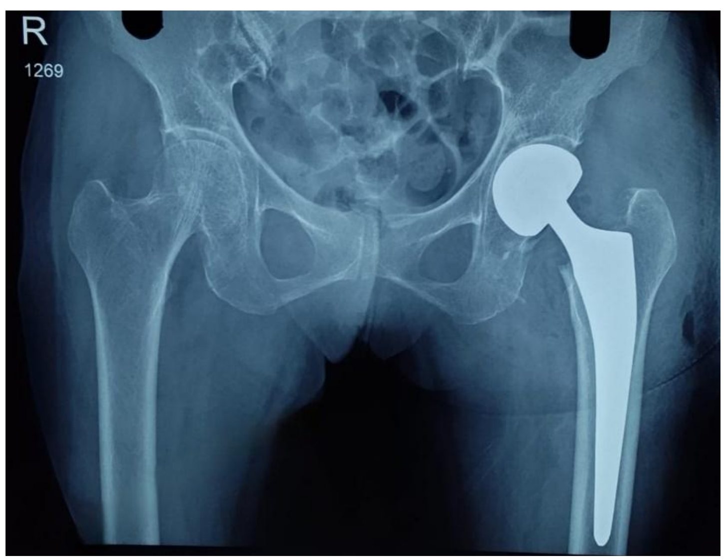


Figure 9: post op x ray

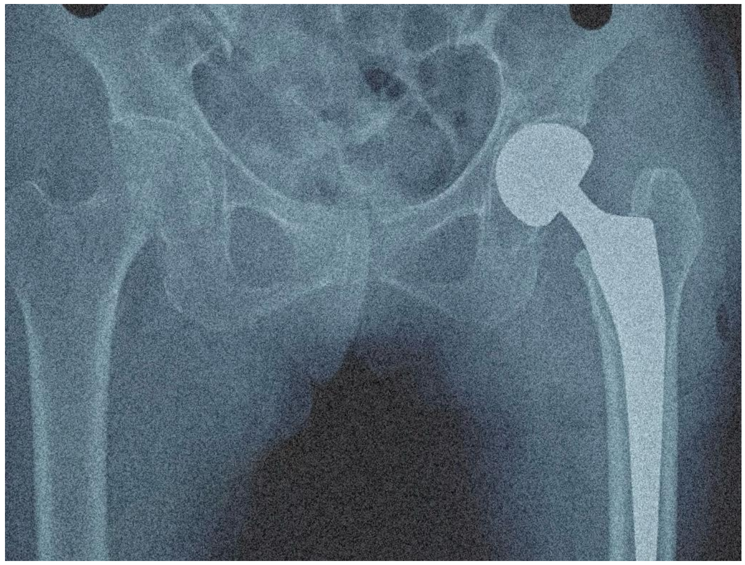


Figure 10: 6 months old post op x ray

Figure 11:Post op rehabilitation

PATIENT 2 :

Name- HUSUNAPPA

Age/Sex- 70/ MALE

Diagnosis- Right intertrochanteric femur fracture

A 70 year old male came with alleged history of slip and fall at home with no head injuries or internal injuries. The patient complained of pain over the right hip joint and inability to bear weight over the affected limb. A pelvis with bilateral hip joint X-ray was taken which showed right femur intertrochanteric fracture which was confirmed and was planned for proximal femoral nailing.

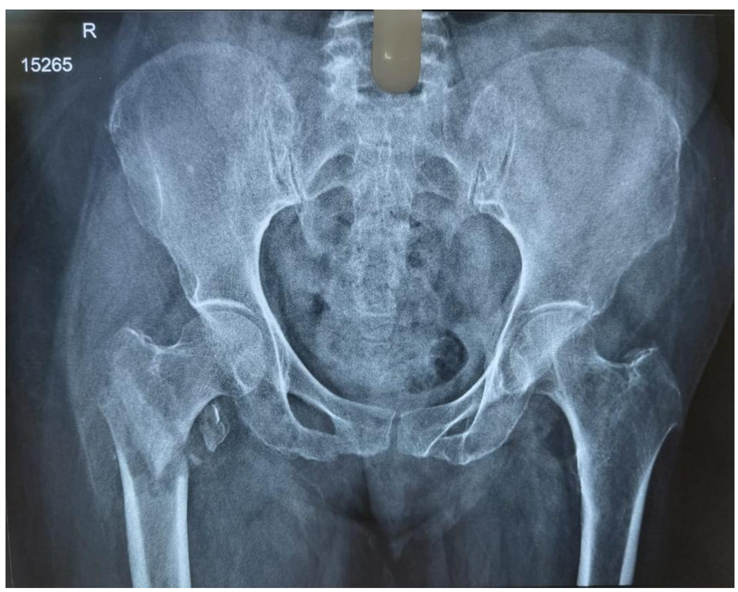


Figure 12: pre op pelvis with both hip joint AP view x ray

Figure 13:patient placed on traction table

Figure 14: Guide wire has been placed

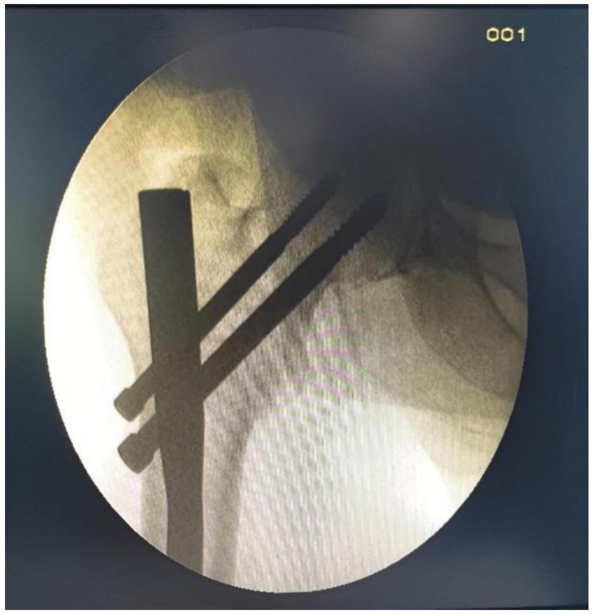


Figure 15:Intra op AP view of fluoroscopy image

Figure 16:Intra op lateral view fluoroscopy image

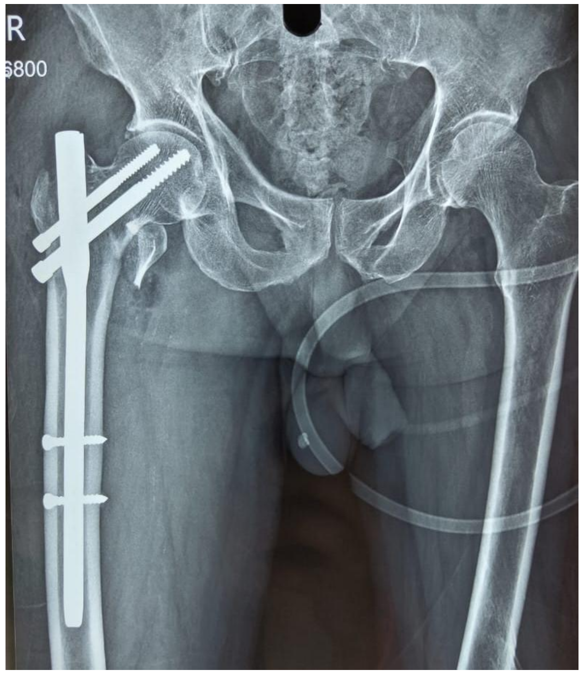


Figure 17: 1 month old post op x ray

Figure 18: 6 months old post op x ray

RESULTS

The present comparative study was conducted in patients admitted in Department of Orthopedics in BLDE (DEEMED TO BE UNIVERSITY) Shri B. M. Patil's Medical College, Hospital and Research Centre, Vijayapura, with diagnosis of cervical radiculopathy from August 2022 to January 2024 to compare functional outcome of femur intertrochanteric fracture fixation with hemiarthroplasty and proximal femoral nail system.

Following are the results of the study.

Table 1: Comparison of groups according to age

Age (in years)	Hemiarthroplasty	PFN	p-value
50-60	3 (12%)	4 (16%)	0.89
61-70	14 (56%)	12 (48%)	
71-80	7 (28%)	7 (28%)	
81-90	1 (4%)	2 (8%)	
Total	**25 (100%)**	**25 (100%)**	

The age distribution shows that both the hemiarthroplasty and proximal femoral nail (PFN) groups were predominantly composed of patients between 61-70 years old (56% for hemiarthroplasty and 48% for PFN). The age groups were relatively evenly distributed, with smaller percentages in the 50-60 and 81-90 year ranges. The p-value of 0.89 indicates there was no statistically significant difference in age between the two groups, suggesting good age matching in the study.

Figure 1: Comparison of groups according to age

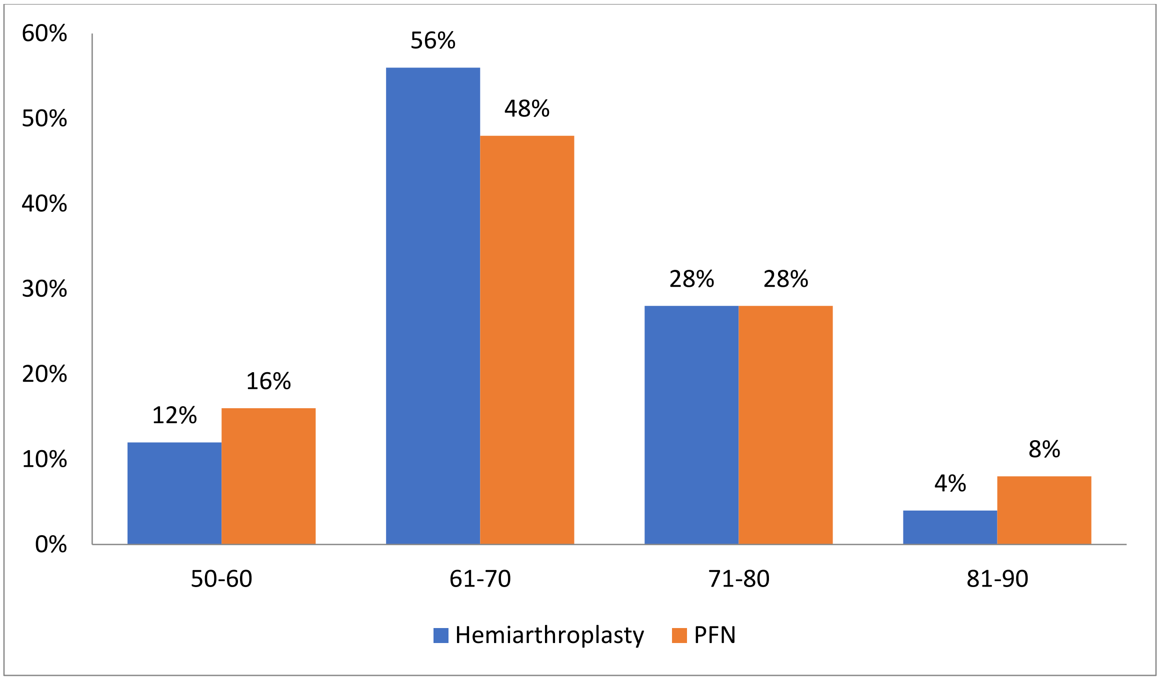


Table 2: Comparison of groups according to gender

Gender	Hemiarthroplasty	PFN	p-value
Female	17 (68%)	12 (48%)	0.15
Male	8 (32%)	13 (52%)	
Total	**25 (100%)**	**25 (100%)**	

In terms of gender, the hemiarthroplasty group had a higher proportion of females (68%) compared to the PFN group (48%). Conversely, the PFN group had more males (52%) than the hemiarthroplasty group (32%). However, the p-value of 0.15 suggests that this difference in gender distribution was not statistically significant, indicating that gender was relatively balanced between the two groups.

Figure 2: Comparison of groups according to gender

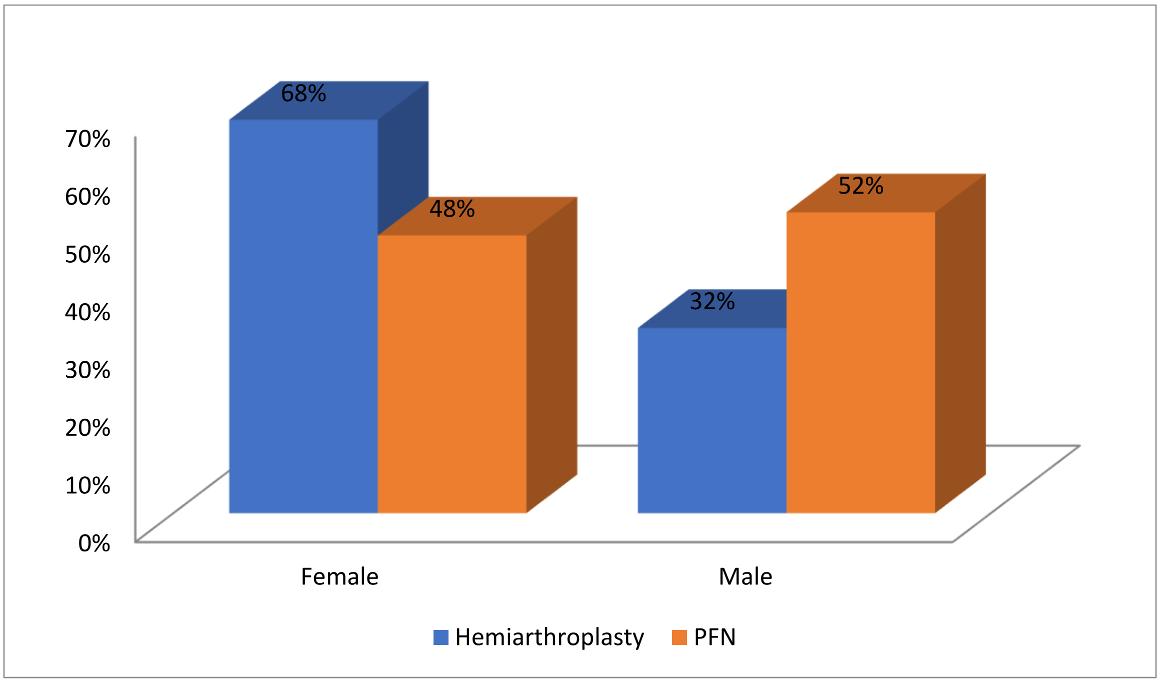


Table 3: Comparison of groups according to co-morbidities

Co-morbidities	Hemiarthroplasty	PFN	p-value
Diabetes mellitus	4 (16%)	9 (36%)	0.107
Hypertension	11 (44%)	12 (48%)	**0.77**

The study examined two primary co-morbidities. Diabetes mellitus was more prevalent in the PFN group (36%) compared to the hemiarthroplasty group (16%), with a p-value of 0.107. Hypertension was similarly distributed, with 44% in the hemiarthroplasty group and 48% in the PFN group, showing a p-value of 0.77. These results suggest no statistically significant difference in co-morbidities between the two groups.

Figure 3: Comparison of groups according to co-morbidities

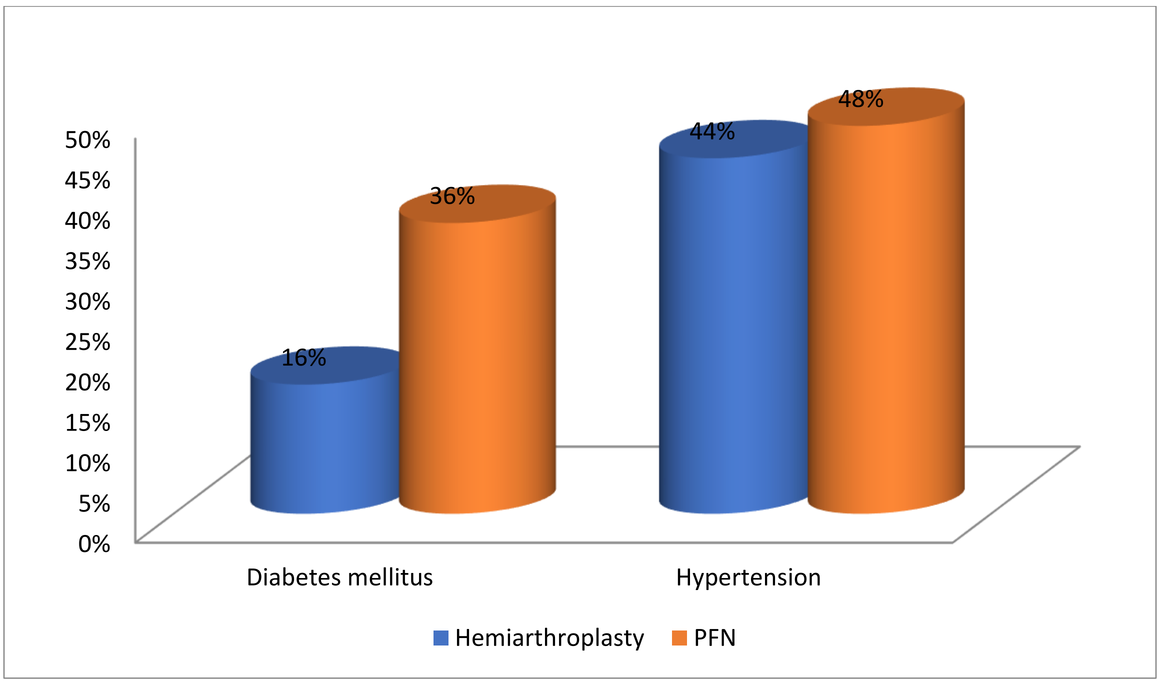


Table 4: Comparison of groups according to BMI

BMI	Hemiarthroplasty	PFN	p-value

<18.5	-	-	0.53
18.5-24.99	9 (36%)	10 (40%)	
25-29.99	10 (40%)	12 (48%)	
>30	6 (24%)	3 (12%)	
Total	**25 (100%)**	**25 (100%)**	

The BMI distribution shows that most patients in both groups fell in the 18.5-24.99 and 25-29.99 ranges. The hemiarthroplasty group had a slightly higher percentage of patients with BMI >30 (24%) compared to the PFN group (12%). However, the p-value of 0.53 indicates no statistically significant difference in BMI distribution between the groups.

Figure 4: Comparison of groups according to BMI

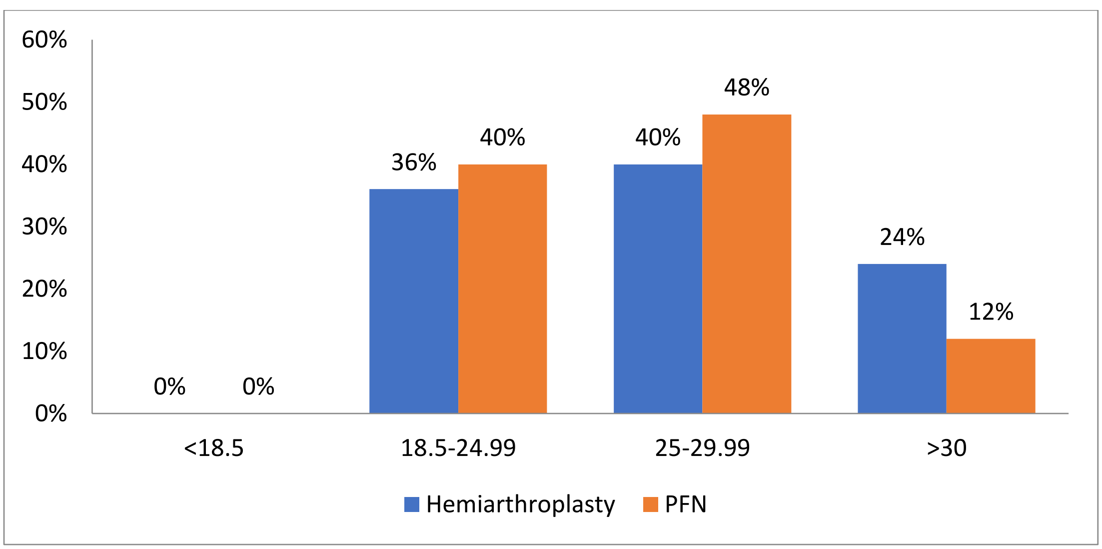


Table 5: Comparison of groups according to different parameters

Parameters (mean±SD)	Hemiarthroplasty	PFN	p-value
Duration of surgery (minutes)	81.3±12.6	71.6±13.9	**0.01**
Length of hospital stay (days)	8.04±2.6	8.64±2.2	0.39

This table reveals a statistically significant difference in the duration of surgery. The hemiarthroplasty group had a longer average surgery time of 81.3 ± 12.6 minutes, compared to 71.6 ± 13.9 minutes for the PFN group, with a p-value of 0.01. However, the length of hospital stay was similar between the groups (8.04 ± 2.6 days for hemiarthroplasty vs. 8.64 ± 2.2 days for PFN), with a p-value of 0.39.

Figure 5: Comparison of groups according to different parameters

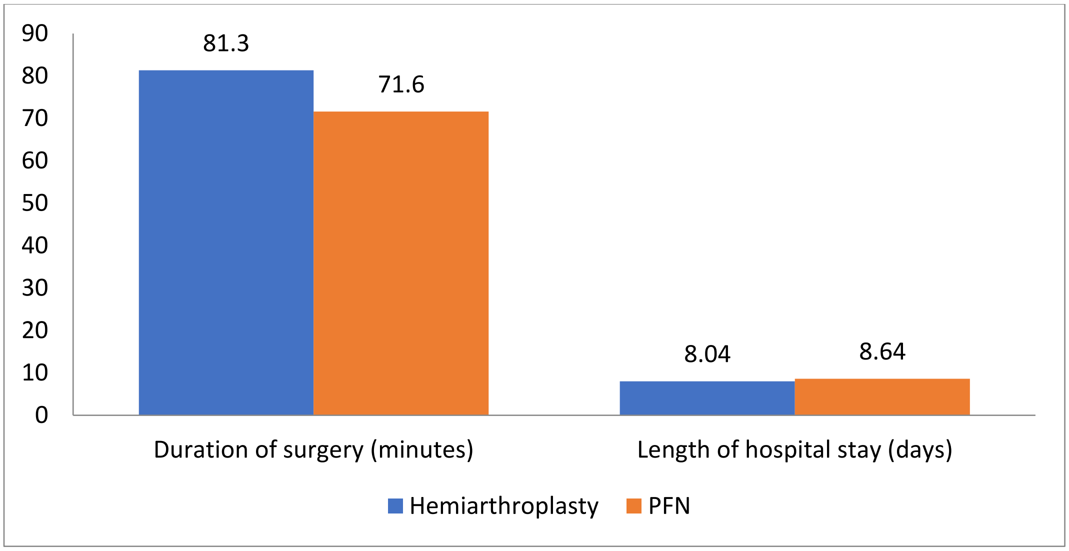


Table 6: Comparison of groups according to VAS at different intervals

VAS (mean±SD)	Hemiarthroplasty	PFN	p-value
1 month	4.3±0.97	3.49±0.75	**0.002**
3 months	3.16±0.63	1.91±0.45	**<0.001**
6 months	1.6±0.85	1.08±0.59	**0.02**

The VAS pain scores showed statistically significant differences at all time points:

- At 1 month: Hemiarthroplasty (4.3 ± 0.97) vs. PFN (3.49 ± 0.75), p-value 0.002
- At 3 months: Hemiarthroplasty (3.16 ± 0.63) vs. PFN (1.91 ± 0.45), p-value <0.001

- At 6 months: Hemiarthroplasty (1.6 ± 0.85) vs. PFN (1.08 ± 0.59), p-value 0.02 The PFN group consistently showed lower pain scores, indicating potentially better pain management.

Figure 6: Comparison of groups according to VAS at different intervals

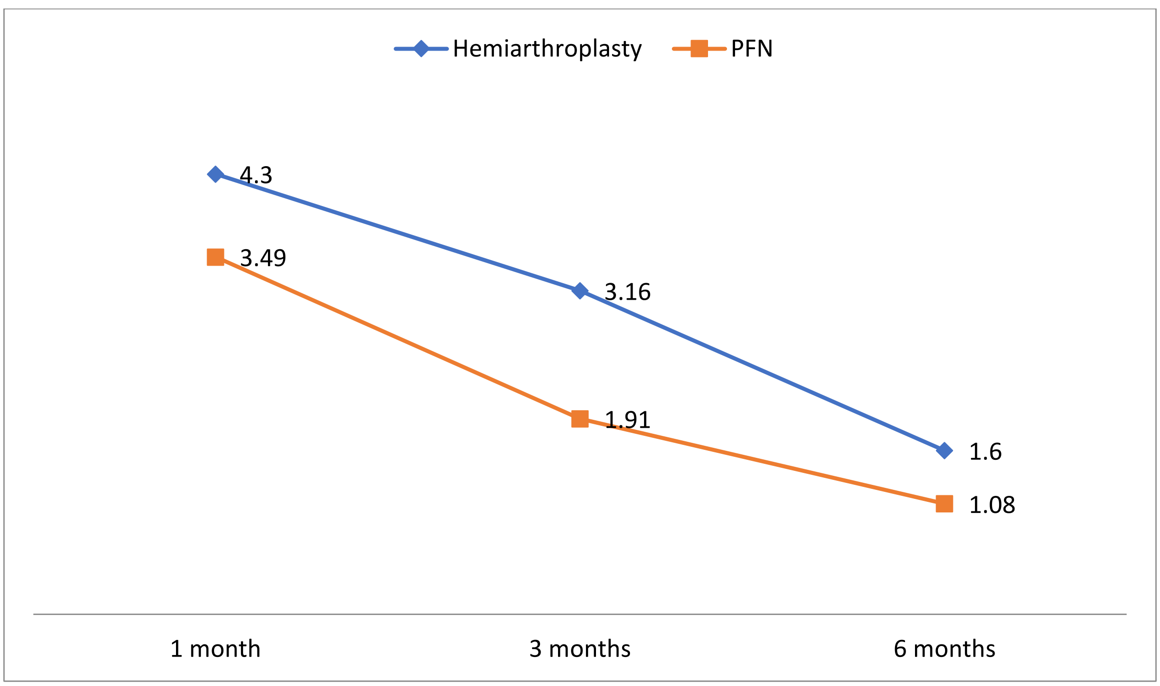


Table 7: Comparison of groups according to Harris hip score at 1 month

Harris hip score	Hemiarthroplasty	PFN	p-value
Poor (<70)	-	25 (100%)	-
Fair (70-80)	25 (100%)	-	
Good (80-90)	-	-	
Excellent (90-100)	-	-	
Total	**25 (100%)**	**25 (100%)**	

At 1 month, all patients in the hemiarthroplasty group had a fair Harris hip score (70-80), while all patients in the PFN group had a poor score (<70).

Figure 7: Comparison of groups according to Harris hip score at 1 month

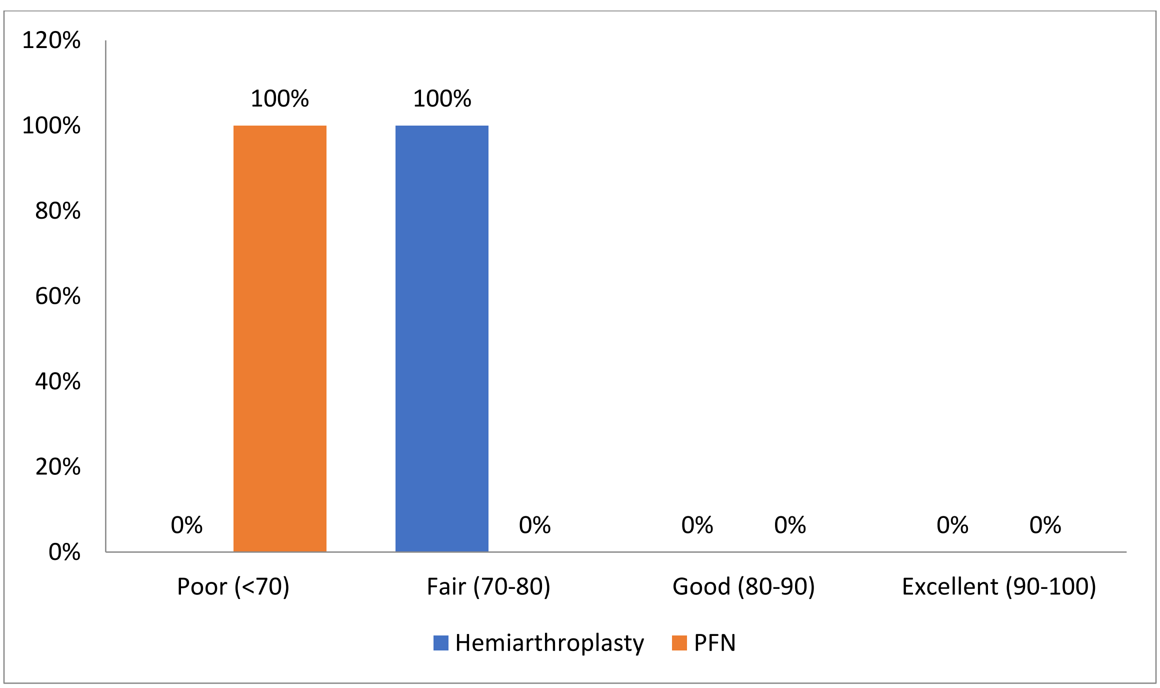


Table 8: Comparison of groups according to Harris hip score at 3 months

Harris hip score	Hemiarthroplasty	PFN	p-value
Poor (<70)	17 (68%)	9 (36%)	**0.02**
Fair (70-80)	8 (32%)	16 (64%)	
Good (80-90)	-	-	
Excellent (90-100)	-	-	
Total	**25 (100%)**	**25 (100%)**	

At 3 months, the distribution changed significantly. The hemiarthroplasty group had 68% poor scores and 32% fair scores, while the PFN group improved to 36% poor scores and 64% fair scores. This difference was statistically significant with a p-value of 0.02.

Figure 8: Comparison of groups according to Harris hip score at 3 months

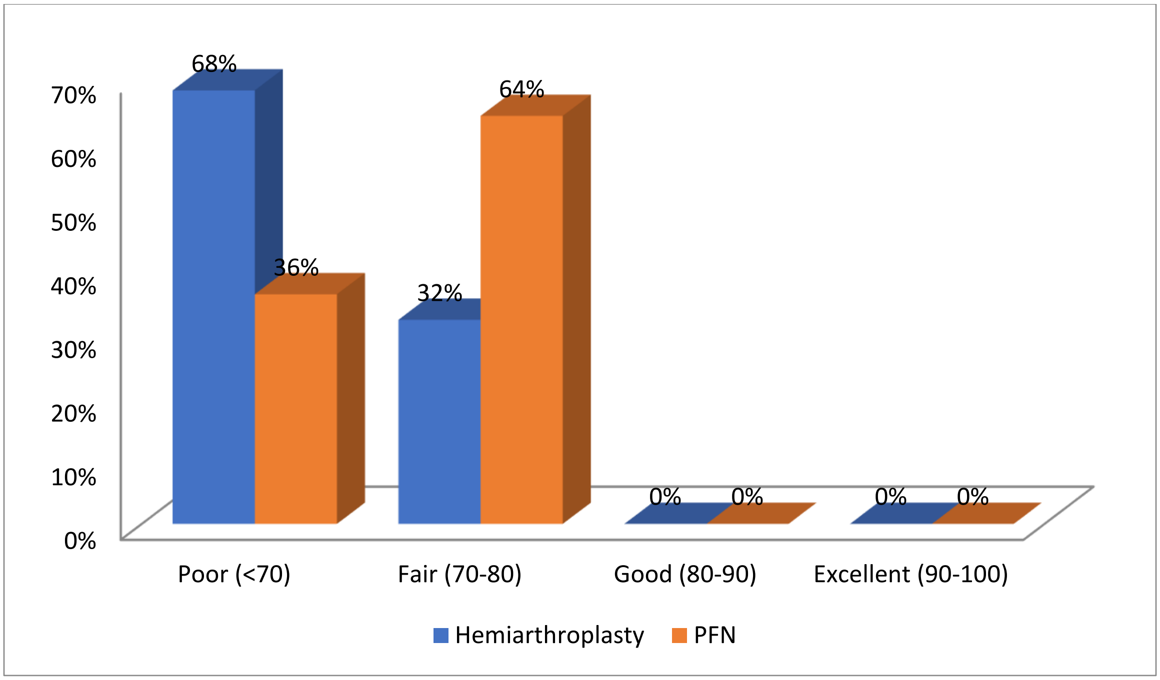


Table 9: Comparison of groups according to Harris hip score at 6 months

Harris hip score	Hemiarthroplasty	PFN	p-value
Poor (<70)	-	-	**0.006**
Fair (70-80)	7 (28%)	0	
Good (80-90)	12 (48%)	11 (44%)	
Excellent (90-100)	6 (24%)	14 (56%)	
Total	**25 (100%)**	**25 (100%)**	

At 6 months, there was a substantial improvement in both groups:

- Hemiarthroplasty: 28% fair, 48% good, 24% excellent
- PFN: 0% fair, 44% good, 56% excellent The p-value of 0.006 indicates a statistically significant difference, with the PFN group showing better functional outcomes.

Figure 9: Comparison of groups according to Harris hip score at 6 months

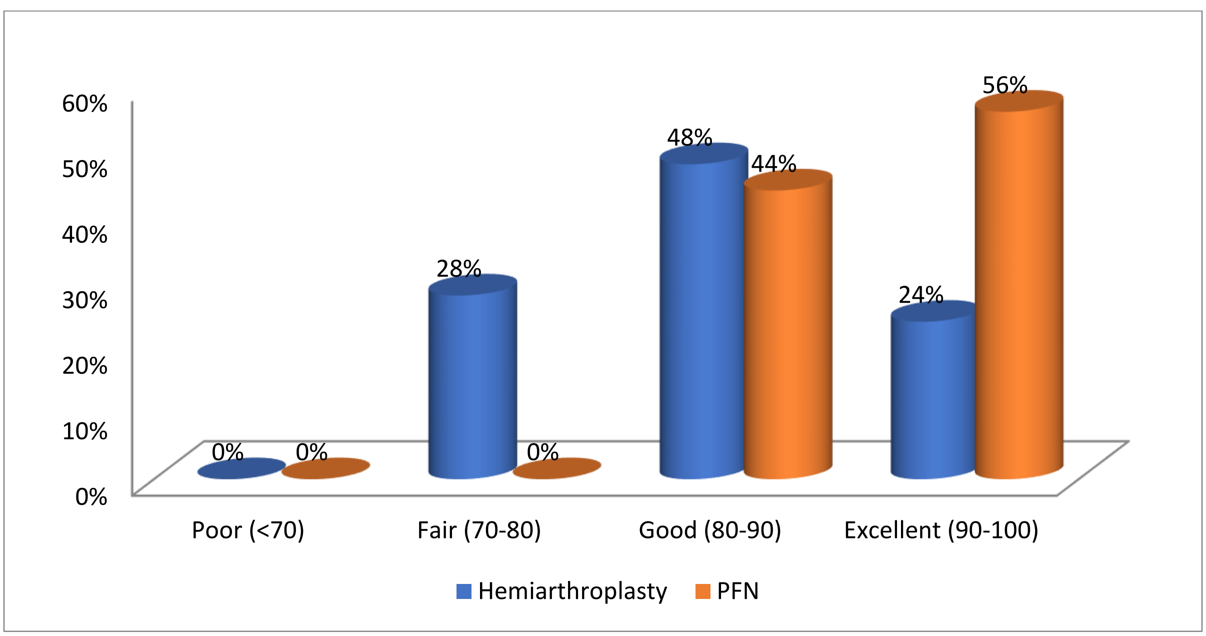
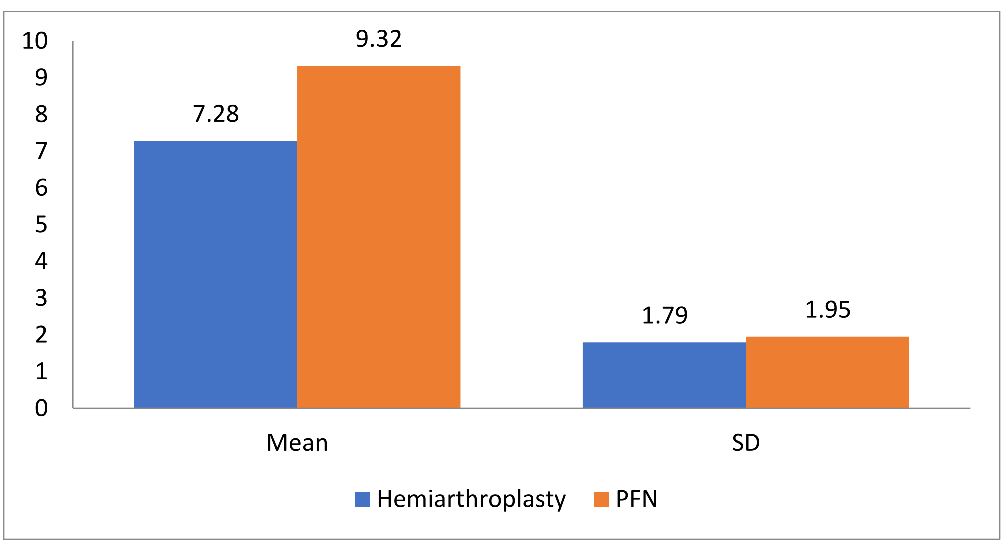


Table 10: Comparison of groups according to time to fully weight bearing

time to fully weight bearing (weeks)	Hemiarthroplasty	PFN	p-value
mean±SD	7.28±1.79	9.32±1.95	**<0.001**

The PFN group took longer to achieve full weight bearing, with a mean of 9.32 ± 1.95 weeks, compared to 7.28 ± 1.79 weeks in the hemiarthroplasty group. This difference was statistically significant with a p-value of <0.001.

Figure 10: Comparison of groups according to time to fully weight bearing



DISCUSSION

Intertrochanteric femur fractures represent one of the most common and devastating injuries in the elderly population, with significant implications for morbidity, mortality, and healthcare expenditure. With the global aging population expanding rapidly, the incidence of these fractures is projected to increase substantially over the coming decades. The management of intertrochanteric fractures has evolved considerably over the years, with current treatment strategies focused not only on fracture stabilization but also on early mobilization and restoration of pre-injury functional status. While internal fixation with proximal femoral nail (PFN) systems has been widely accepted as the standard of care for most intertrochanteric fractures, hemiarthroplasty has emerged as an alternative treatment option, particularly in elderly patients with osteoporotic bone, comminuted fractures, or pre-existing joint disease. The choice between these two modalities remains controversial, with proponents on both sides highlighting various advantages and limitations. Our study aimed to compare the functional outcomes of intertrochanteric fracture fixation with hemiarthroplasty versus PFN systems, evaluating parameters such as pain scores, hip function, time to weight-bearing, and complications. This discussion will contextualize our findings within the existing literature, analyze the factors influencing outcomes with each treatment modality, and provide insights into optimizing management strategies for these challenging fractures.

Demographic Profile and Baseline Characteristics

Our study included a total of 50 patients with intertrochanteric femur fractures, equally distributed between the hemiarthroplasty and PFN groups (25 patients each). The age distribution was comparable between the two groups (p=0.89), with the majority of patients falling within the 61-70 years age bracket (56% in the hemiarthroplasty group and 48% in the PFN group), followed by the 71-80 years group (28% in both). This age distribution aligns with the typical demographic profile of patients with intertrochanteric fractures reported in the literature. Kayali C et al., in their comparative study of 97 elderly patients with unstable intertrochanteric fractures, reported a mean age of 73 years in the hemiarthroplasty group and 75 years in the internal fixation group, slightly older than our cohort but within a comparable range.[55]

Regarding gender distribution, our study showed a female predominance in the hemiarthroplasty group (68%) compared to the PFN group (48%), although this difference did not reach statistical significance (p=0.15). The higher prevalence of intertrochanteric fractures in females, particularly in the elderly population, is well-documented and is attributed to the higher incidence of osteoporosis in postmenopausal women. Kim et al. reported a similar gender distribution in their study comparing cementless calcar-replacement hemiarthroplasty with proximal femoral nail for treating unstable intertrochanteric fractures, with 73.5% females in the hemiarthroplasty group and 62.1% in the PFN group.[56]

Comorbidities play a significant role in determining outcomes following hip fracture surgery. In our study, hypertension was the most common comorbidity in both groups (44% in hemiarthroplasty and 48% in PFN), followed by diabetes mellitus (16% in hemiarthroplasty and 36% in PFN). Although the difference in diabetes prevalence was notable (16% vs. 36%), it did not reach statistical significance (p=0.107). These findings are consistent with those reported by Park et al., who found hypertension and diabetes mellitus to be the most prevalent comorbidities in their comparative study of hemiarthroplasty versus internal fixation for unstable intertrochanteric fractures.[57] They emphasized that comorbidities significantly influence the choice of surgical approach, with surgeons often preferring hemiarthroplasty in patients with multiple comorbidities to allow early mobilization and reduce the risk of prolonged bed rest-Body

Mass Index (BMI) distribution was comparable between the two groups in our study ($p=0.53$), with the majority of patients falling in the overweight category (BMI 25-29.99) in both groups (40% in hemiarthroplasty and 48% in PFN). Interestingly, the hemiarthroplasty group had a higher proportion of obese patients (BMI >30) compared to the PFN group (24% vs. 12%), although this difference was not statistically significant. The impact of BMI on outcomes following hip fracture surgery has been a subject of debate. London DA et al. reported that obese patients undergoing PFN for intertrochanteric fractures had higher rates of technical difficulties during surgery and wound complications compared to non-obese patients.[58] Conversely, Tucker et al. found that low BMI (<18.5) was associated with increased mortality following hip fracture surgery, suggesting a protective effect of higher BMI.[59] In our study, the comparable BMI distribution between the two groups minimizes this potential confounder in outcome assessment.

Operative Parameters and Hospital Stay

The mean duration of surgery was significantly shorter in the PFN group compared to the hemiarthroplasty group (71.6 ± 13.9 minutes vs. 81.3 ± 12.6 minutes, $p=0.01$). This finding is consistent with several previous studies. Choy et al., in their retrospective analysis of 148 patients, reported a mean operative time of 85.5 minutes for hemiarthroplasty compared to 67.2 minutes for PFN, attributing the difference to the additional steps involved in hemiarthroplasty, including femoral head extraction, acetabular preparation, and prosthesis implantation.[60] Similarly, Tang et al. found that the operative time for PFN was approximately 15-20 minutes shorter than for hemiarthroplasty in their comparative study of elderly patients with unstable intertrochanteric fractures.[61]

The shorter operative time with PFN offers several potential advantages, including reduced anesthesia exposure, decreased blood loss, and potentially lower infection risk.

However, it is important to note that operative time can be influenced by various factors, including surgeon experience, case complexity, and institutional protocols. Esen et al. emphasized that the learning curve for PFN is steeper than for hemiarthroplasty, with operative times decreasing significantly after the first 20-25 cases.[62] Experienced surgeons may achieve comparable operative times with either procedure, particularly in straightforward cases.

Despite the difference in operative time, the length of hospital stay was comparable between the hemiarthroplasty and PFN groups in our study (8.04±2.6 days vs. 8.64±2.2 days, p=0.39). This finding contrasts with some previous studies that reported shorter hospital stays with hemiarthroplasty. Shen et al., in their systematic review and meta-analysis comparing arthroplasty with internal fixation for unstable intertrochanteric fractures, found that patients in the arthroplasty group had a mean hospital stay that was 1.8 days shorter than those in the internal fixation group.[66]They attributed this difference to earlier mobilization and weight-bearing in the arthroplasty group, leading to faster rehabilitation and discharge. The comparable hospital stay in our study despite earlier weight-bearing in the hemiarthroplasty group may be due to several factors, including standardized discharge protocols, similar postoperative complications rates, or institutional factors unrelated to the surgical procedure itself.

Pain Assessment and Management

Pain control is a critical aspect of postoperative management following hip fracture surgery, influencing patient satisfaction, rehabilitation participation, and functional outcomes. Our study employed the Visual Analog Scale (VAS) to assess pain at 1, 3, and 6 months postoperatively. The results demonstrated significantly lower pain scores in the PFN group compared to the hemiarthroplasty group at all time points: 1 month (3.49±0.75 vs. 4.3±0.97, p=0.002), 3 months (1.91±0.45 vs. 3.16±0.63, p<0.001), and 6 months (1.08±0.59 vs. 1.6±0.85, p=0.02).

These findings differ from those reported by Kayali et al., who found comparable pain scores between hemiarthroplasty and PFN groups at 6 and 12 months follow-up in their study of 84 elderly patients with unstable intertrochanteric fractures.[64] However, our results align with the observations of Ju et al., who reported consistently lower pain scores in patients treated with intramedullary nailing compared to those undergoing hemiarthroplasty, particularly in the early postoperative period.[65] They attributed this difference to the less invasive nature of intramedullary nailing, which preserves the natural femoral head and involves less soft tissue disruption.

Several factors may contribute to the higher pain scores observed in the hemiarthroplasty group. Firstly, hemiarthroplasty involves more extensive soft tissue dissection and greater periosteal stripping compared to PFN, potentially leading to more postoperative pain. Secondly, the presence of a prosthetic femoral head articulating with the native acetabulum may cause acetabular erosion or impingement, resulting in persistent pain. Thirdly, complications such as prosthesis loosening, subsidence, or periprosthetic fracture, although not specifically analyzed in our pain assessment, may contribute to higher pain scores in the hemiarthroplasty group.

The difference in pain scores, although statistically significant at all time points, showed a decreasing trend over time, with the smallest difference observed at 6 months (1.08±0.59 vs. 1.6±0.85). This convergence of pain scores with time has been noted in other comparative studies. Zhao et al., in their meta-analysis of 8 studies comparing arthroplasty with internal fixation for intertrochanteric fractures, found that while pain scores were higher in the arthroplasty group in the early postoperative period, they became comparable by 12 months.[66] This suggests that the initial pain advantage with PFN may diminish over time as healing progresses and rehabilitation advances.

Functional Outcome Assessment

The Harris Hip Score (HHS) is a widely validated tool for assessing hip function following hip fracture surgery, incorporating parameters such as pain, function, absence of deformity, and range of motion. Our study evaluated HHS at 1, 3, and 6 months postoperatively, revealing distinct patterns of functional recovery in the two groups.

At 1 month, all patients in the hemiarthroplasty group had fair scores (70-80), while all patients in the PFN group had poor scores (<70). This early advantage in the hemiarthroplasty group can be attributed to the immediate stability provided by the prosthesis, allowing earlier weight-bearing and mobilization. Zhou et al. reported similar findings, with significantly higher functional scores in the hemiarthroplasty group at 4 weeks postoperatively compared to the internal fixation group.[67] They emphasized that early mobilization and weight-bearing not only improve functional outcomes but also reduce complications associated with prolonged bed rest, such as pressure sores, deep vein thrombosis, and pneumonia.

By 3 months, a shift in functional outcomes became apparent, with a significantly higher proportion of patients in the PFN group achieving fair scores (64% vs. 32%, p=0.02) and fewer remaining in the poor category (36% vs. 68%). This reversal of the initial advantage suggests that the PFN group experienced more rapid functional improvement between 1 and 3 months. Fichman et al. observed a similar pattern in their prospective study comparing functional outcomes between hemiarthroplasty and intramedullary nailing for unstable intertrochanteric fractures.[68] They attributed this acceleration of recovery in the PFN group to several factors, including preservation of the natural femoral head and neck, maintenance of hip biomechanics, and potentially better proprioception due to the intact hip joint.

The most striking differences in functional outcomes were observed at 6 months, with significantly better results in the PFN group (p=0.006). While both groups showed substantial improvement from the 3-month assessment, with all patients moving out of the poor category, the PFN group had a significantly higher proportion of patients achieving excellent scores (56% vs. 24%) and none remaining in the fair category (0% vs. 28%). The proportion of patients with good scores was comparable between the two groups (44% in PFN vs. 48% in hemiarthroplasty).

The superior functional outcomes in the PFN group at 6 months may be attributed to several factors. Firstly, preservation of the natural femoral head and neck in PFN maintains the normal hip biomechanics and proprioception, potentially allowing for more physiological gait patterns once healing is complete. Secondly, the less invasive nature of PFN preserves the hip abductor mechanism, which is critical for stable gait and prevention of Trendelenburg lurch. Thirdly, the lower pain scores observed in the PFN group may facilitate more active participation in rehabilitation activities, leading to better functional recovery. Finally, the absence of prosthesis-related complications such as acetabular erosion, dislocation, or loosening may contribute to better long-term outcomes with PFN.

Time to Weight-Bearing

The time to fully weight-bearing is a critical parameter in the rehabilitation of patients with hip fractures, influencing hospital stay, functional recovery, and overall outcomes. Our study found that patients in the hemiarthroplasty group achieved fully weight-bearing status significantly earlier than those in the PFN group (7.28±1.79 weeks vs. 9.32±1.95 weeks, p<0.001). This finding is consistent with the fundamental difference between the two procedures: hemiarthroplasty provides immediate stability through prosthetic replacement, allowing early weight-bearing, while PFN requires fracture healing before fully weight-bearing can be safely permitted.

Lin et al. reported similar findings in their comparative study, with patients in the hemiarthroplasty group achieving weight-bearing at an average of 5.2 days postoperatively compared to 42.8 days in the internal fixation group.[69]They emphasized that early weight-bearing is particularly beneficial in elderly patients, reducing complications associated with prolonged immobility and potentially improving survival. Similarly, Camurcu et al. found that patients undergoing hemiarthroplasty for unstable intertrochanteric fractures were able to bear weight approximately 3-4 weeks earlier than those treated with intramedullary nailing.[70]

The ability to bear weight early after surgery is influenced by multiple factors beyond the surgical technique itself. Patient-related factors such as pre-injury functional status, cognitive function, and comorbidities play important roles. Surgeon-related factors, including confidence in the construct stability and rehabilitation protocols, also significantly impact weight-bearing instructions. Institutional factors such as the availability of physiotherapy services and discharge planning considerations further modulate this parameter.

It is worth noting that despite the earlier achievement of fully weight-bearing status in the hemiarthroplasty group, this did not translate into superior functional outcomes at 3 and 6 months follow-up, as evidenced by the Harris Hip Score results. This observation challenges the conventional wisdom that earlier weight-bearing necessarily leads to better functional outcomes. Several studies have explored this apparent paradox.

Clinical Implications and Recommendations

The findings of our study have several important clinical implications for the management of intertrochanteric fractures in the elderly population. The comparable demographic profile and baseline characteristics between the two groups in our study suggest that both hemiarthroplasty and PFN are viable options for a similar patient population. However, the distinct advantages and limitations of each approach warrant careful consideration in individualizing treatment decisions.

Hemiarthroplasty offers advantages in terms of shorter time to weight-bearing (7.28±1.79 vs. 9.32±1.95 weeks) and better early functional scores (at 1 month). These characteristics make it potentially beneficial for specific patient subgroups, such as those with limited life expectancy who would benefit most from rapid mobilization, patients with severe osteoporosis where fixation failure risk is high, and those with pre-existing ipsilateral hip arthritis where replacement could address both conditions simultaneously.

Conversely, PFN demonstrates advantages including shorter operative time (71.6±13.9 vs. 81.3±12.6 minutes), lower pain scores at all time points, and superior functional outcomes at 3 and 6 months. These characteristics suggest that PFN might be preferable for relatively younger patients, those with a longer life expectancy, patients with good bone quality, and those without pre-existing hip disease. Jiang et al. recommended intramedullary nailing as the primary treatment for most intertrochanteric fractures, reserving arthroplasty for selected cases with severe comminution, poor bone quality, or pre-existing hip conditions.[56]

The significantly superior functional outcomes with PFN at 6 months, as evidenced by the higher proportion of patients achieving excellent Harris Hip Scores (56% vs. 24%), challenge the traditional preference for hemiarthroplasty in certain elderly patients based solely on the advantage of early weight-bearing. Our findings suggest that for patients with reasonable life expectancy and rehabilitation potential, the long-term functional benefits of PFN may outweigh the short-term advantage of earlier weight-bearing with hemiarthroplasty.

The choice between hemiarthroplasty and PFN should also consider surgeon experience and institutional capabilities. PFN is technically more demanding and has a steeper learning curve, potentially leading to higher complication rates in less experienced hands. Additionally, the availability of appropriate implants, fluoroscopy, and specialized instrumentation may influence treatment decisions in resource-limited settings. Hemiarthroplasty, while requiring different surgical skills, may be more accessible in certain healthcare environments.

Finally, our study highlights the importance of patient-specific factors in treatment decision-making. Factors such as pre-fracture functional status, cognitive function, comorbidities, and social support significantly influence rehabilitation potential and should be carefully considered in selecting the optimal treatment approach. A comprehensive geriatric assessment, including evaluation of cognitive status, functional capacity, nutritional status, and comorbidity burden, can provide valuable information for tailoring treatment strategies to individual patients.

Study Limitations and Future Directions

While our study provides valuable insights into the comparative outcomes of hemiarthroplasty versus PFN for intertrochanteric fractures, several limitations should be acknowledged. Firstly, our sample size of 50 patients (25 in each group) is relatively small, potentially limiting the statistical power to detect differences in secondary outcomes or subgroup analyses. Future studies with larger sample sizes would provide more robust evidence, particularly for less common complications or outcomes.

Secondly, our follow-up period of 6 months, while sufficient to assess early and mid-term outcomes, may not capture long-term complications or functional trajectories. Complications such as acetabular erosion with hemiarthroplasty or late fixation failure with PFN typically manifest beyond the 6-month mark. Long-term follow-up studies extending to 2-5 years would provide more comprehensive information about the durability of each approach.

Thirdly, our study did not include a detailed analysis of fracture patterns or bone quality, which could significantly influence outcomes with each treatment modality. The AO/OTA classification of intertrochanteric fractures, particularly the distinction between stable and unstable patterns, has important implications for treatment selection. Future studies incorporating detailed fracture classification and bone density assessment would enhance the specificity of treatment recommendations.

Fourthly, we did not include a comprehensive cost analysis comparing the two approaches. Healthcare costs, including implant costs, operating room time, hospital stay, rehabilitation services, and management of complications, represent an important consideration in treatment selection, particularly in resource-constrained environments. Future studies incorporating cost-effectiveness analyses would provide valuable information for healthcare policy and resource allocation.

Finally, our study did not include patient-reported outcome measures (PROMs) beyond pain assessment, such as quality of life indices, satisfaction scores, or mental health outcomes. These patient-centered outcomes are increasingly recognized as important complements to traditional clinical and radiological measures. Future studies incorporating validated PROMs would provide a more holistic assessment of the impact of each treatment approach on patients' overall well-being.

Several directions for future research emerge from our findings. Firstly, prospective randomized controlled trials with larger sample sizes, stratified by fracture pattern and bone quality, would provide stronger evidence for guiding treatment selection. Secondly, studies exploring hybrid approaches, such as fixation-augmentation techniques or novel implant designs that combine the stability of arthroplasty with the tissue preservation of internal fixation, could potentially offer the best of both worlds. Thirdly, research focusing on predictive models to identify which patients would benefit most from each approach based on demographic, clinical, and radiological parameters would facilitate personalized treatment decisions.

Additionally, studies exploring the role of advanced rehabilitation protocols, including accelerated weight-bearing programs with PFN or modified surgical techniques to enhance construct stability, could potentially narrow the early mobilization gap between the two approaches. Finally, research on the optimization of perioperative management, including enhanced recovery protocols, pain management strategies, and complication prevention measures, could improve outcomes regardless of the surgical approach selected.

CONCLUSION

This comparative study of intertrochanteric femur fracture management provides valuable insights into the relative merits of hemiarthroplasty versus proximal femoral nail (PFN) systems. Our findings demonstrate that each approach offers distinct advantages in different phases of treatment and recovery. Hemiarthroplasty allows for earlier weight-bearing and better initial functional scores, advantages that can be particularly beneficial for elderly patients with limited rehabilitation potential or those who require rapid mobilization to prevent complications associated with prolonged bed rest.

Conversely, PFN demonstrates superior outcomes in terms of operative efficiency, pain control, and mid-term functional recovery. The significantly shorter operative time with PFN (71.6±13.9 minutes versus 81.3±12.6 minutes) represents a meaningful advantage, potentially reducing anesthesia-related risks in elderly patients with multiple comorbidities. Furthermore, the consistently lower pain scores in the PFN group at all follow-up intervals (1, 3, and 6 months) suggest better patient comfort throughout the recovery process, which may contribute to improved rehabilitation participation and quality of life.

Perhaps most notably, our study challenges the conventional wisdom that earlier weight-bearing necessarily translates to superior functional outcomes. Despite the significant advantage in time to fully weight-bearing in the hemiarthroplasty group (7.28±1.79 weeks versus 9.32±1.95 weeks), the PFN group demonstrated progressively better functional outcomes at 3 and 6 months follow-up, with 56% of PFN patients achieving excellent Harris Hip Scores at 6 months compared to only 24% in the hemiarthroplasty group. This suggests that the preservation of natural hip biomechanics and native femoral head with PFN may confer substantial functional advantages once fracture healing is complete, outweighing the initial benefit of earlier weight-bearing with hemiarthroplasty.

The optimal treatment approach should be individualized based on patient characteristics, fracture pattern, surgeon expertise, and institutional resources. Hemiarthroplasty may be preferable for patients with severely osteoporotic bone, comminuted fractures, pre-existing hip disease, or very limited life expectancy. PFN represents an excellent option for relatively younger patients within the elderly population, those with adequate bone quality, and those with good rehabilitation potential who would benefit from the superior mid-term functional outcomes observed with this approach.

In conclusion, while both hemiarthroplasty and PFN represent viable treatment options for intertrochanteric femur fractures in the elderly, our study suggests that PFN provides better overall outcomes in terms of pain control and functional recovery at 6 months, despite the delayed weight-bearing. These findings contribute to the growing body of evidence guiding treatment decisions for these challenging fractures, ultimately aiming to optimize functional recovery and quality of life for elderly patients.

SUMMARY

INTRODUCTION

Intertrochanteric femur fractures represent a significant health challenge in the elderly population, associated with considerable morbidity, mortality, and socioeconomic burden. While proximal femoral nail (PFN) systems are widely accepted as the standard treatment for these fractures, hemiarthroplasty has emerged as an alternative approach, particularly for elderly patients with osteoporotic bone. Despite ongoing debate regarding the optimal management strategy, comparative studies evaluating functional outcomes between these two approaches remain limited. This study aimed to compare the functional outcomes, pain control, and rehabilitation milestones between hemiarthroplasty and PFN for the treatment of intertrochanteric femur fractures in elderly patients.

AIMS AND OBJECTIVES

AIM:

Comparison of functional outcome of femur intertrochanteric fracture fixation with hemiarthroplasty and proximal femoral nail system

OBJECTIVES:

1. To compare the functional outcomes (as measured by Harris Hip Score, mobility status, and activities of daily living) between patients treated with hemiarthroplasty versus proximal femoral nail system for intertrochanteric fractures of the femur at 3, 6, and 12 months post-surgery.

2. To evaluate and compare the complication rates, reoperation incidence, mortality, and quality of life measures between the two surgical approaches for the management of intertrochanteric fractures in order to establish evidence-based guidelines for optimal treatment selection.

MATERIAL AND METHODS

This prospective comparative study included 50 patients with intertrochanteric femur fractures, divided equally between hemiarthroplasty (n=25) and PFN (n=25) groups. Demographic data, operative parameters, and hospital stay duration were recorded. Functional outcomes were assessed using the Harris Hip Score at 1, 3, and 6 months postoperatively. Pain was evaluated using the Visual Analog Scale (VAS) at the same intervals. Time to fully weight-bearing was documented for all patients. Statistical analysis was performed using appropriate tests with significance set at $p<0.05$.

RESULTS

This prospective comparative study evaluated the functional outcomes of intertrochanteric femur fracture fixation with hemiarthroplasty versus proximal femoral nail (PFN) systems in 50 patients (25 in each group). The key findings are summarized below:

Demographic and Baseline Characteristics:

- Age distribution was comparable between the hemiarthroplasty and PFN groups (p=0.89), with most patients (56% and 48% respectively) falling in the 61-70 years age bracket.
- Gender distribution showed a female predominance in the hemiarthroplasty group (68%) compared to the PFN group (48%), though this difference was not statistically significant (p=0.15).

- Comorbidities were similar between groups, with hypertension (44% in hemiarthroplasty, 48% in PFN, p=0.77) and diabetes mellitus (16% in hemiarthroplasty, 36% in PFN, p=0.107) being the most common.
- BMI distribution was comparable between groups (p=0.53), with most patients being overweight (BMI 25-29.99) in both groups.

Operative Parameters and Hospital Stay:

- The mean duration of surgery was significantly shorter in the PFN group (71.6±13.9 minutes) compared to the hemiarthroplasty group (81.3±12.6 minutes) (p=0.01).
- Length of hospital stay was comparable between the hemiarthroplasty (8.04±2.6 days) and PFN groups (8.64±2.2 days) (p=0.39).

Pain Assessment (VAS Scores):

- The PFN group demonstrated significantly lower pain scores at all follow-up intervals:
    - 1 month: 3.49±0.75 (PFN) vs. 4.3±0.97 (hemiarthroplasty) (p=0.002)
    - 3 months: 1.91±0.45 (PFN) vs. 3.16±0.63 (hemiarthroplasty) (p<0.001)
    - 6 months: 1.08±0.59 (PFN) vs. 1.6±0.85 (hemiarthroplasty) (p=0.02)

Functional Outcomes (Harris Hip Score):

- At 1 month, all hemiarthroplasty patients had fair scores (70-80), while all PFN patients had poor scores (<70).
- At 3 months, the PFN group showed better improvement, with 64% achieving fair scores compared to 32% in the hemiarthroplasty group (p=0.02).

- At 6 months, the PFN group demonstrated superior outcomes ($p=0.006$):
    - Excellent scores (90-100): 56% in PFN vs. 24% in hemiarthroplasty
    - Good scores (80-90): 44% in PFN vs. 48% in hemiarthroplasty
    - Fair scores (70-80): 0% in PFN vs. 28% in hemiarthroplasty

Weight-Bearing:

- Patients in the hemiarthroplasty group achieved fully weight-bearing status significantly earlier (7.28 ± 1.79 weeks) than those in the PFN group (9.32 ± 1.95 weeks) ($p<0.001$).

These results demonstrate that while hemiarthroplasty offers advantages in terms of earlier weight-bearing and better initial functional scores, PFN provides superior outcomes in terms of operative efficiency, pain control, and mid-term functional recovery, with 100% of patients achieving good to excellent outcomes at 6 months compared to 72% in the hemiarthroplasty group.

CONCLUSION:

While hemiarthroplasty offers advantages in terms of earlier weight-bearing and better initial functional scores, PFN provides superior outcomes in terms of operative efficiency, pain control, and mid-term functional recovery. The optimal treatment approach should be individualized based on patient characteristics, fracture pattern, and rehabilitation potential. For patients with good rehabilitation potential and reasonable life expectancy, PFN may offer better overall functional outcomes despite delayed weight-bearing.

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SHRI B.M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE, VIJAYAPURA - 586103

PROFORMA

CASE NO. :

NAME :

AGE/SEX :

I P NO :

DATE OF ADMISSION :

DATE OF SURGERY :

DATE OF DISCHARGE :

OCCUPATION :

RESIDENCE :

Presenting complaints with duration :

History of presenting complaints :

Family History :

Personal History :

Past History :

General Physical Examination

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

Vitals

PR: RR:

BP: TEMP:

Other Systemic Examination:

Local examination:

Right/ Left Hip

Inspection:

a) Attitude/ deformity

b) Abnormal swelling

- Site
- Size
- Shape
- Extent

c) Skin

<u>Palpation:</u>

a) Local tenderness

b) Bony irregularity

c) Abnormal movement

d) Crepitus

e) Swelling

<u>Movements</u>:	Right	Left
HIP JOINT		
Flexion		
Extension		
Abduction		
Adduction		
Internal rotation		
External rotation		

<u>Intra Operative details:</u>

<u>Post-Operative:</u>

- Rehabilitation protocol as per the guidelines
- Functional outcome evaluation with:
    1. Harris scores

B.L.D.E. (DEEMED TO BE UNIVERSITY) SHRI B.M.PATIL

MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTER,

VIJAY APURA-586103

INFORMED CONSENT FOR PARTICIPATION IN

DISSERTATION/RESEARCH

I, the undersigned,_, S/O D/O W/O_, aged _years,ordinarily resident of_, do hereby state/declare that **TALLAPUREDDY PRANAV TEJA** of Shri. B. M. Patil Medical College Hospital and Research Centre have examined me thoroughly on_at_(place), and it has been explained to me in my language that I am suffering from ________________ disease (condition). This disease/condition mimics the following diseases. Further**, Dr TALLAPUREDDY PRANAV TEJA** informed me that he/she is conducting a dissertation/research titled "**COMPARISON OF FUNCTIONAL OUTCOME OF FEMUR INTERTROCHANTERIC FRACTURE FIXATION WITH HEMIARTHROPLASTY AND PROXIMAL FEMORAL NAIL SYSYTEM"** under the guidance of

Dr DAYANAND B B requesting my participation in the study. Apart from routine treatment procedures, the preoperative, operative, post-operative and follow-up observations will be utilized for the study as reference data.

The Doctor has also informed me that adverse results may be encountered during this procedure. Most of the above complications are treatable but not anticipated; hence there is a chance of aggravation of my condition. In rare circumstances, it may prove fatal despite the anticipated diagnosis and best treatment made available. Further Doctor has informed me that my participation in this study helps evaluate the study's results, which is a useful reference to the treatment of other similar cases soon. Also, I may be benefited from getting relieved from suffering or a cure for the disease I am suffering.

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

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

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

Signature of the patient:

Signature of Doctor:

Witness: 1.

2.

Date:

Place

sl.no	IP NO	NAME	AGE	DOS	DIAGNOSIS	PROCEDU	gend	BMI	DM	HTN	boyd griffin classific	duration of	length of hosp	harris hip scor	HHS 3	HHS 6	VAS 1	VAS 3	VAS 6	time to fully weight beari	surgical site i	implant	reoper	mort ty
1	6263	Srinivas	63	45575	Right IT Fracture	Hemiarthoplast	F	24.9	No	No	4	93	5	54.7	61.9	73.3	4.5	2.2	1.7	9	No	No	No	No
2	1263	Basanna	58	45544	Left IT fracture	Hemiarthoplast	F	30.4	No	No	4	106	6	52.8	70.7	84.3	3.3	2.3	1.5	9	No	No	No	No
3	229413	Tarunak	64	45123	Right IT Fracture	Hemiarthoplast	M	24.2	Yes	Yes	2	91	12	50.6	67.6	78.6	4.3	3.8	1.6	9	No	No	No	No
4	410854	Somavva	70	45296	Left IT fracture	Hemiarthoplast	F	26.9	No	Yes	4	107	5	63	64.9	77	5.7	3.4	1.4	8	No	No	No	No
5	402854	Sidamma	68	45289	Right IT Fracture	Hemiarthoplast	F	28.1	No	No	4	85	6	64.8	74.5	79.5	5.5	2.8	0.2	6	No	No	No	No
6	370743	santabai	73	45264	Left IT fracture	Hemiarthoplast	F	27.4	No	Yes	3	82	11	52.2	64.1	75.4	4.4	2.7	1.1	7	No	No	No	No
7	4E+06	shankkre	65	45257	Left IT fracture	Hemiarthoplast	M	23	No	Yes	3	91	6	61.5	58	71	3.2	3	2.1	7	No	No	No	No
8	1323	Lalita ba	69	45250	Left IT fracture	Hemiarthoplast	F	28.9	No	No	4	85	8	46.6	66.5	71.2	3	3.4	2.5	7	Yes	No	No	No
9	316266	Bharavv	55	45208	Right IT Fracture	Hemiarthoplast	F	23.9	No	Yes	4	100	11	61.6	68.7	74.1	5.3	3.6	0.9	7	No	No	No	No
10	311009	Veerabh	72	45205	Left IT fracture	Hemiarthoplast	M	28.7	No	No	2	72	7	64.9	68.4	66.7	4.8	2.1	1	6	Yes	No	No	No
11	219090	Arjun	65	45156	Left IT fracture	Hemiarthoplast	F	27.2	No	No	2	105	5	48.1	69.3	80.7	3.4	3.3	2.3	4	No	No	No	No
12	6151	Rathana	81	45575	Right IT Fracture	Hemiarthoplast	F	28.9	No	No	2	79	12	64.7	74	75.9	4.4	3.8	2.8	10	No	No	No	No
13	1263	Basanna	70	45544	Left IT fracture	Hemiarthoplast	M	31.2	No	Yes	2	86	12	51.5	63.5	67.2	3.9	2.2	2.7	4	No	No	No	No
14	230880	shankara	68	45479	Right IT Fracture	Hemiarthoplast	F	24.8	No	Yes	3	105	12	60.3	58.4	79.2	3.3	4	2.1	10	No	No	No	No
15	222982	basanna	74	45470	Left IT fracture	Hemiarthoplast	F	30.2	No	No	2	102	6	60.4	66.6	66	5.9	3.7	2.6	8	No	No	No	No
16	201559	gowraba	72	45462	Left IT fracture	Hemiarthoplast	M	28.6	No	No	3	102	12	64.3	67.1	81.6	3	3.6	0.5	7	No	No	No	No
17	88034	Gangaw	66	45371	Right IT Fracture	Hemiarthoplast	M	31.8	Yes	Yes	2	81	6	52.4	62.9	76.6	5.9	3.9	1.6	10	No	Yes	Yes	No
18	231375	Mallappa	65	45344	Right IT Fracture	Hemiarthoplast	F	28.5	No	No	3	70	8	54.4	72.1	78.3	3.9	3.8	2	5	No	No	No	No
19	44269	Bagavva	65	45334	Right IT Fracture	Hemiarthoplast	M	24	No	No	3	106	8	47.6	75	69.1	5.1	2.5	1.9	7	No	No	No	No
20	19425	Pandura	72	45313	Right IT Fracture	Hemiarthoplast	F	31.5	No	No	2	75	6	53.4	71.1	82.8	3.1	4	0.5	7	No	No	No	No
21	2252	Haseena	59	45302	Right IT Fracture	Hemiarthoplast	F	24.3	Yes	No	4	108	7	59.5	74.3	85	3.1	3.4	2.8	5	No	No	No	No
22	4739	Sangam	69	45303	Left IT fracture	Hemiarthoplast	M	22.9	Yes	Yes	3	102	9	55.4	66.1	80.7	4.2	3.1	0	7	No	No	No	No
23	94285	Mahade	74	45378	Left IT fracture	Hemiarthoplast	F	26.5	No	No	2	98	5	48.2	70.5	69.6	5.2	3.6	0.3	7	No	No	No	No
24	283613	Sharamr	77	45516	Left IT fracture	Hemiarthoplast	F	23.3	No	Yes	2	75	10	59.9	56.8	65.3	4	2.7	2.5	6	No	No	No	No
25	299396	Sampat	67	45526	Right IT Fracture	Hemiarthoplast	F	30.5	No	Yes	4	77	6	56.6	59.7	65.2	5.2	2.3	1.6	10	No	Yes	Yes	No
26	182543	Basavap	55	45087	Left IT femur fracture	PFN	F	24.9	Yes	No	3	84	5	63	69.6	87.2	4.1	2.5	0.2	7	No	No	No	No
27	174324	Shivraj	57	45098	left IT Femur fracture with subtrocha	PFN	F	28.1	No	Yes	2	89	9	64.1	63.9	81	3	2.4	1.4	8	No	Yes	Yes	No
28	305941	Basappa	64	45203	Right IT Femur fracture	PFN	F	31.6	No	No	2	57	8	58	73.6	74.4	4.6	1.7	1.1	9	No	No	No	No
29	363453	Mahesh	62	45259	Left IT Femur fracture	PFN	F	28.9	No	No	2	62	5	65.2	75.4	74.2	2	1.7	0.6	12	No	No	No	No
30	34102	Parshura	58	44991	Left IT Femur fracture	PFN	F	30.8	Yes	Yes	2	85	10	54	79	80.6	2.4	2.8	0.3	6	No	No	No	No
31	320702	Shataba	67	45052	Right IT Femur fracture	PFN	M	24.1	No	No	3	52	11	60.7	65.6	77.6	2.7	1.5	1.3	12	No	No	No	No
32	192085	shivagor	68	45448	Right IT Femur fracture	PFN	M	29.6	No	No	2	66	9	52.1	75.3	75.2	4.6	1.1	1.8	9	No	No	No	No
33	171383	Girappa	70	45469	Left IT Femur fracture	PFN	M	29.6	Yes	Yes	2	87	9	52.9	68.7	76.6	4.1	2.1	1.9	8	No	No	No	No
34	295541	Bhaskar	74	45190	Right IT Femur fracture	PFN	F	29.3	No	Yes	2	90	10	65.8	73.5	89.3	4	2.1	1.8	12	No	No	No	No
35	196071	Rudramr	76	45220	left IT Femur fracture	PFN	F	23.9	No	No	4	72	12	53.5	72.2	71.6	3.2	2.4	0.5	9	No	No	No	No
36	69842	Somaww	68	45358	Right IT Femur fracture	PFN	F	26	Yes	Yes	4	52	9	65.1	60.6	71.3	3.2	2.2	0.3	9	No	No	No	No
37	96347	Lakappa	65	45381	left IT Femur fracture	PFN	M	23.9	No	Yes	2	89	11	57.9	70.4	81.1	3.3	1.8	0.1	10	No	No	No	Yes
38	132153	Kallappa	58	45407	left IT femur fracture	PFN	M	26.3	No	No	2	58	7	55.9	62.4	78.7	3	1.3	1	12	No	No	No	No
39	42349	Dharepp	64	45467	right IT Femur fracture	PFN	M	25.1	Yes	Yes	3	89	10	69.5	72.7	80.5	2.5	1.6	1.3	11	No	Yes	Yes	No
40	6181	Ramapp	65	45579	Right IT Femur fracture	PFN	M	23.5	No	No	3	70	6	67	66.7	81.3	4.1	2	2	10	Yes	No	No	No
41	19123	Sakarba	68	44946	left IT Femur fracture	PFN	F	23.4	No	Yes	4	67	6	67	73.6	88.1	4	1.8	1	11	No	No	No	No
42	28648	Chandra	72	44956	left IT Femur fracture	PFN	F	27.5	Yes	No	3	59	5	55.8	78.6	84.8	3	2.3	1.4	12	No	No	No	No
43	40424	Megha	68	44964	left IT Femur fracture	PFN	F	23.4	No	Yes	2	63	11	57.7	65.5	75.1	4.3	2.4	1.6	6	No	Yes	Yes	No
44	13965	Chandra	72	45048	Left IT Femur fracture	PFN	M	26	Yes	Yes	3	57	12	64.1	72.8	84	3.2	1.6	0.2	11	No	No	No	No
45	310105	Siddamn	80	45247	Right IT Femur fracture	PFN	M	28.7	No	No	3	62	10	53.9	76.3	80.1	2.4	2	1.4	7	Yes	Yes	Yes	No
46	362493	Ningamn	82	45254	left IT Femur fracture	PFN	M	24.5	No	Yes	3	82	9	53.6	79.3	80.8	3.9	1.7	0.3	8	No	No	No	No
47	382261	yallappa	88	45268	Left IT Femur fractur	PFN	M	29.9	No	No	3	88	6	64.4	78.9	80.2	3.6	1.3	1.1	7	No	No	No	No
48	100529	Kalavati	76	45296	Right IT Femur fracture	PFN	M	30.6	Yes	No	3	78	7	58	79.4	71.1	3.6	1.8	1.5	8	No	No	No	No
49	283336	Malakaw	66	45349	Right IT Femur fracture	PFN	M	23	Yes	No	3	82	11	54.1	63.2	75.5	4.1	2.5	1.4	9	No	No	No	No
50	233991	Chandub	78	45482	left IT femur fracture	PFN	F	23.1	No	Yes	3	50	8	51	78.5	80.1	4.5	1.2	1.5	10	No	No	No	No

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