“TO EVALUATE RADIOLOGICAL AND FUNCTIONAL OUTCOME OF CEMENTED MODULAR BIPOLAR HEMIARTHROPLASTY IN ELDERLY PATIENTS WITH FEMORAL NECK FRACTURES”

By

Dr. VISHNUDHARAN N R MBBS

DISSERTATION SUBMITTED TO SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, KOLAR, KARNATAKA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE

DEGREE OF

MASTER OF SURGERY

IN

ORTHOPAEDICS

Under the Guidance of

DR. PRABHU ETHIRAJ MBBS, M.S. ORTHO

PROFESSOR

DEPARTMENT OF ORTHOPAEDICS

SRI DEVARAJ URS MEDICAL COLLEGE

TAMAKA, KOLAR 563101

JUNE 2023

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, TAMAKA, KOLAR, KARNATAKA

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled "**TO EVALUATE RADIOLOGICAL AND FUNCTIONAL OUTCOME OF CEMENTED MODULAR BIPOLAR HEMIARTHROPLASTY IN ELDERLY PATIENTS WITH FEMORAL NECK FRACTURES"** is a bonafide and genuine research work carried out by me under the guidance of **Dr. PRABHU ETHIRAJ,** Professor, Department of Orthopaedics, Sri Devaraj Urs Medical College, Kolar, in partial fulfilment of University regulation for the award "M.S.DEGREE IN ORTHOPAEDICS", the examination to be held in May/June 2023 by SDUAHER. This has not been submitted by me previously for the award of any degree or diploma from the university or any other university.

Dr. VISHNUDHARAN NR
Postgraduate
Department of Orthopaedics
Sri Devaraj Urs Medical College

Date:

Place: Tamaka, Kolar.

Sri Devaraj Urs Academy of Higher Education and Research Centre

(Deemed University), Tamaka, Kolar.

Tamaka, Kolar

CERTIFICATE BY THE GUIDE

This is to certify that the dissertation entitled "**TO EVALUATE RADIOLOGICAL AND FUNCTIONAL OUTCOME OF CEMENTED MODULAR BIPOLAR HEMIARTHROPLASTY IN ELDERLY PATIENTS WITH FEMORAL NECK FRACTURES**" is a bonafide research work done by Dr. VISHNUDHARAN NR, under my direct guidance and supervision at Sri Devaraj Urs Medical College, Kolar, in partial fulfilment of the requirement for the degree of "M.S. IN ORTHOPAEDICS"

Dr. PRABHU ETHIRAJ

Professor

Department of Orthopaedics

Sri Devaraj Urs Medical College

Tamaka, Kolar – 563101

Date:

Place: Kolar

Sri Devaraj Urs Academy of Higher Education and Research Centre

(Deemed University), Tamaka, Kolar.

CERTIFICATE BY THE HEAD OF DEPARTMENT

This is to certify that the dissertation entitled "**TO EVALUATE RADIOLOGICAL AND FUNCTIONAL OUTCOME OF CEMENTED MODULAR BIPOLAR HEMIARTHROPLASTY IN ELDERLY PATIENTS WITH FEMORAL NECK FRACTURES**" is a bonafide research work done by DR. VISHNUDHARAN NR, under direct guidance and supervision of DR. PRABHU ETHIRAJ, Professor and Unit head, Department of Orthopaedics at Sri Devaraj Urs Medical College, Kolar, in partial fulfilment of the requirement for the degree of "M.S. IN ORTHOPAEDICS".

Dr. ARUN.H. S
Professor & HOD
Department of Orthopaedics
Sri Devaraj Urs Medical College
Tamaka, Kolar

Date:

Place Kolar

Sri Devaraj Urs Academy of Higher Education and Research Centre

(Deemed University), Tamaka, Kolar.

ENDORSEMENT BY THE HEAD OF THE DEPARTMENT OF ORTHOPAEDICS,

PRINCIPAL

This is to certify that the dissertation entitled "**TO EVALUATE RADIOLOGICAL AND FUNCTIONAL OUTCOME OF CEMENTED MODULAR BIPOLAR HEMIARTHROPLASTY IN ELDERLY PATIENTS WITH FEMORAL NECK FRACTURES**" is a bonafide research work done by DR. VISHNUDHARAN NR, under the direct guidance and supervision of DR. PRABHU ETHIRAJ, Professor and Unit head, Department of Orthopaedics, Sri Devaraj Urs Medical College, Kolar, in partial fulfilment of university regulation for the award "M.S. DEGREE IN ORTHOPAEDICS".

Signature of the Head of Department

Dr. ARUN H S
Professor & HOD
Department of Orthopaedics
Sri Devaraj Urs Medical College
Tamaka, Kolar –563101

Date:

Place:Kolar

Signature of the Principal

Dr. SREERAMULU P N
Principal
Sri Devaraj Urs Medical College
Tamaka, Kolar – 563101

Date:

Place: Kolar

Sri DevarajUrs Academy of Higher Education and Research Centre

(Deemed University)

Tamaka, Kolar

ETHICAL COMMITTEE CERTIFICATE

This is to certify that the Ethical Committee of Sri Devaraj Urs Medical College, Tamaka, Kolar has unanimously approved **Dr. VISHNUDHARAN NR**, student in the Department of Orthopaedics at Sri Devaraj Urs Medical College, Tamaka, Kolar to take up the dissertation work entitled "**TO EVALUATE RADIOLOGICAL AND FUNCTIONAL OUTCOME OF CEMENTED MODULAR BIPOLAR HEMIARTHROPLASTY IN ELDERLY PATIENTS WITH FEMORAL NECK FRACTURES**" to be submitted to the Sri Devaraj Urs Academy of Higher Education and Research Centre, Tamaka, Kolar**.**

Signature of the Member Secretary

Ethical Committee

Sri Devaraj Urs Medical College

Tamaka, Kolar–563101

Date:

Place: Kolar

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION

AND RESEARCH, TAMAKA, KOLAR, KARNATAKA

COPYRIGHT DECLARATION BY THE CANDIDATE

Date: Signature of the Candidate

Place: Kolar **DR. VISHNUDHARAN NR**

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION & RESEARCH

Tamaka, Kolar 563103

Certificate of Plagiarism Check

Title of the Thesis/Dissertation	TO EVALUATE RADIOLOGICAL AND FUNCTIONAL OUTCOME OF CEMENTED MODULAR BIPOLAR HEMIARTHROPLASTY IN ELDERLY PATIENTS WITH FEMORAL NECK FRACTURES
Name of the Student	DR. VISHNUDHARAN NR
Registration Number	20OR1043
Name of the Supervisor / Guide	DR. PRABHU E
Department	ORTHOPAEDICS
Acceptable Maximum Limit (%) of Similarity (PG Dissertation /Ph.D. Thesis)	10%
Similarity	10%
Software used	Turnitin
Paper ID	1990676168
Submission Date	10-01-2023

Signature of Student

Signature of Guide/Supervisor

DR. PRABHU E
PROFESSOR
DEPT. OF ORTHOPAEDIC
KMC NO : 68342

HOD Signature

DR. ARUN H.S
PROFESSOR AND HOD
DEPT. OF ORTHOPAEDICS
KMC NO : 46362

University Librarian

Learning Resource Centre
SDUAHER, Tamaka
KOLAR-563103

Coordinator UG and PG Program

Turnitin Originality Report

TO EVALUATE RADIOLOGICAL AND FUNCTIONAL OUTCO... By Vishnupharan N

Similarity Index	Similarity by Source
10%	[illegible]

DR. PRABHU E

DEPT. OF ORTHOPAEDICS

University Library Learning Resource Centre

TAMAKA, KOLAR-563103

turnitin

Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	Vishnudharan Nr
Assignment title:	PG dissertation 20-21
Submission title:	TO EVALUATE RADIOLOGICAL AND FUNCTIONAL OUTCOME ...
File name:	RE.docx
File size:	1.78M
Page count:	78
Word count:	16,694
Character count:	94,027
Submission date:	10-Jan-2023 04:20PM (UTC+0530)
Submission ID:	1990876168

DR. PRABHU E
PROFESSOR
DEPT. OF ORTHOPAEDICS

ACKNOWLEDGEMENT

First and foremost, I express my profound gratitude to my beloved parents **SRI. NAGARAJAN G** and **SMT. CHITRA N**, my wife **Dr. RAVEENA KETHINENI,** and my sister **Dr. GURU SINDHUJA** for giving me continuous encouragement, unfailing support, and unconditional love throughout my life.

I want to acknowledge all those who have supported me in completing my dissertation and throughout my post-graduation course.

I express my deepest gratitude to my guide, **Dr. PRABHU ETHIRAJ**, Professor, Department of Orthopaedics, for his unwavering guidance, support, and encouragement throughout my research journey. His expertise and experience were invaluable in helping me navigate the complexities of my project, and his insights helped me to refine my ideas and bring them to fruition. His patience and understanding were greatly appreciated when I felt overwhelmed, and his belief in me helped me stay focused and motivated. I am genuinely grateful for the opportunity to have been mentored by such an exceptional person, and I feel honored to have learned from him. This experience will stay with me throughout my academic and professional career.

I want to express my sincerest gratitude to, **Dr. ARUN H S**, Professor and Head of the Department of Orthopaedics, for his unwavering support and guidance. His encouragement and constructive feedback have been instrumental in ensuring the quality of my work and pushing me to reach my full potential. His willingness to go above and beyond to provide me with the resources and support I needed to complete my dissertation is genuinely appreciated. His dedication and commitment to excellence have been a constant source of inspiration for the entire department and me.

I express my heartful gratitude to my mentor **Dr.NAGAKUMAR J S**, Professor, Department of Orthopaedics, for being helpful throughout the study. He offered his invaluable guidance and moral support during my entire postgraduate course, which enabled me to complete my work.

It gives me immense pleasure to extend my sincere thanks to Associate Professor **Dr. HARIPRASAD.S** for his guidance, motivation, and moral support during my entire postgraduate course, which enabled me to complete my work.

I am highly thankful to **Dr. SAGAR, Dr. SANDESH AGARAWAL, Dr. MANOJ, and Dr. VINOD** for their constant help and guidance throughout the course. They were the source of encouragement, support, and for patient perusal, to which I am deeply obliged. My heartful thanks to my seniors **Dr. KARTHIK**, **Dr. SAIGANESH, Dr. ARUN, Dr. DARSHAN, Dr. ANIL, Dr. ABHI, Dr. NANDINI, Dr. MADHAVAN** for their support and help in carrying this study and throughout the graduation course. I sincerely thank my colleagues and dear friends, **Dr. SIYAD, Dr. HRUSHIKESH, Dr. KIRAN, Dr. JAGADISH, Dr. HARSHA, Dr. VAISHNAV, and Dr. TARUN,** for their constant support.

I thank my juniors **Dr. GOWTHAM, Dr. BASANTH, Dr. AKSHAY, Dr. ARYA, Dr. NAVIN, Dr. AYUSH, Dr. ROHITH, Dr. GILS, Dr. MUTHU, Dr. SHOBHET** for providing support throughout the study. I am also thankful to all the **INTERNS, OT, OPD,** and **PARAMEDICAL STAFF** for their valuable help while performing this study.

I express my special thanks to all my patients and their families, who are the best teachers in conclusion, and without whom, this study would have been impossible.

Last but not least, I would be failing in duty if I did not express my gratitude to the ALMIGHTY who helped me mentally and physically during this study and throughout the post-graduation course.

Date:

Place: Kolar **DR. VISHNUDHARAN N R**

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Glossary	**Abbreviations**
ADL	Activities of Daily Living
AIIS	Anterior Inferior Iliac Spine
ETS	Exeter Trauma Stems
HA	Hemiarthroplasty
BHA	Bipolar Hemiarthroplasty
HAL	Hip Axis Length
HDPE	High Density Polyethylene
HHS	Harris Hip Score
HRQoL	Health-Related Quality of Life
ROM	Range of Motion
THA	Total Hip Arthroplasty
UHMWPE	Ultra-High Molecular Weight Polyethylene
AO/ OTA	Arbeitsgemeinschaft für Osteosynthesefragen/ Orthopaedic Trauma Association

ABSTRACT

BACKGROUND: One of the more significant health issues that plague the elderly is proximal femur fracture. For describing femoral neck traumas and directing surgical therapy, the classification by Garden and Pauwel remained the standard. Total hip arthroplasty (THA) or Hemiarthroplasty are promising therapies for achieving mobility in elderly people. The best approach is still debatable; while THA improves function and relieves pain, it also lengthens surgery and causes more loss of blood, both of which raise the chance of death. Left untreated, a fracture at the neck of the femur leads to avascular necrosis, a non-union neck of the femur, disability, persistent pain, and significant morbidity and mortality associated with it. There are very limited studies in India on radiological and functional outcomes following standalone cemented modular bipolar hemiarthroplasty hip.

AIMS AND OBJECTIVES: To use Harris hip score for functional assessment and radiological outcome using the existence of articular surface erosion, superior and medial migration, subluxation, and sclerosis after cemented modular bipolar hemiarthroplasty in fractured Neck of Femur.

MATERIALS AND METHODS: At R. L. Jalappa Hospital and Research Center, associated with Sri Devaraj Urs Medical College, a prospective study was done among patients hospitalized in the Orthopaedics ward with the neck of femur fractures from the Emergency medical department and Outpatient department, affiliated to SDUAHER university meeting the inclusion criteria between December 2020 to July 2022.

RESULTS:A t the 6th month follow-up, on assessment of Harris Hip score, 38.71% had an excellent score, 58.06% had a good score, and 3.23% had a fair functional score.At the first month follow-up, the radiological score was 41.94% excellent,and the rest, 58.06%, were good. It remained the same at the 3rd-month and 6th-month follow-ups.

CONCLUSION: The results of the radiological examination were excellent and good in the first month of the follow-up and remained the same in the third and sixth months. Through successive follow-ups, functional scores, which were evaluated by the Harris hip score, gradually improved. Our study reveals that modular bipolar cemented hemiarthroplasty provides good radiological and clinical outcomes in older individuals having fractures of the femoral neck and can be considered the preferred modality of care in such patients.

KEYWORDS: Neck of femur fracture, Bipolar Hemiarthroplasty, Harris hip score, cemented replacement, Modular prosthesis

INTRODUCTION

INTRODUCTION

One of the more significant health issues that plague the elderly is proximal femur fracture.[1] The prevalence of co-morbidities in the senior population not only makes recovery time from surgery longer, it also raises the danger of death and morbidity following the surgery.[2]The reported rate of death following femoral neck fracture in geriatric patients is 9.6% in the first 30 days and rises to 30% in the following year. The precise rate, however, varies and may be influenced by the type of fracture, previous functional level, and baseline health before the accident.[3,4,5]For describing femoral neck fractures and directing surgical therapy, the Pauwel & Garden system of classifications have remained the standard.[6]While displaced fractures are often treated with arthroplasty, nondisplaced fractures are mostly addressed by hip preservation.[4]To prevent nonunion and avascular necrosis in subjects treated with screw fixation, which has been found to be as high as 39%, arthroplasty is the main rationale for treatment in elderly people with displaced fractures of femoral neck.[7,8]

Hemiarthroplasty(HA) or total hip arthroplasty (THA) are indeed the preferred therapies for mobility in elderly people. The best approach is still debatable; while THA improves function and relieves pain, it also lengthens surgery and causes more loss of blood, both of which raise the chance of death.[5]The design of a uni- or bipolar prosthesis is still up for dispute. Bipolar articulation offers the potential to reduce movement at the prosthesis-acetabulum contact by transferring some hip motion to the inner bearings of the prosthesis.[9]

There has been an increase in the frequency of proximal femur fractures globally over the past 20 years as the average population age has grown. In fact, it is anticipated that by the year 2050, there would have been 4.5 million hip fractures worldwide, up from 1.26 million in 1990.[10]An older patient's proximal femur fracture can be a life-altering experience, taking away from them their already possibly diminished capacity for self-sustainability. After a hip fracture, only 40–60% of elderly people regain their pre-fracture level of mobility and ability to do daily tasks within a year.[11]

In a bipolar hemiarthroplasty, an extra inner bearing is positioned at the endoprosthetic head component and stem interface. Theoretically, this design would minimize dislocation, protrusion, and acetabular erosion. Additionally, it enhances hip functionality and preserves the stability of the joint.[12,13] According to Attarian[14]Subluxation and dislocation are quite rare with bipolar prostheses because they have a self-aligning acetabular part that selects the proper orientation on its own (a self-centering mechanism). Cementless fixation supports physiological fixation and can lessen cardiovascular toxicity, however cemented fixation offers the benefit of increasing initial strength of fixation in individuals with poor bone quality.[15]Cemented hemiarthroplasty may result in reduced periprosthetic fracture and prostheses loosening in neck fractures of femur, but it also increases the risk of emboli and lower cardiac output while the bone cement is being inserted.[16]On the other hand, uncemented hemiarthroplasties has shorter time to complete and cause less intraoperative blood loss, but have higher rates of postoperative prosthesis loosening.[17]

Following molded cup arthroplasty, Harris Hip Score (HHS) was created as an outcome metric. It is a disease and location-specific health-related quality of life (HRQoL) assessment by a licenced healthcare practitioner. It was developed to provide hip impairments and treatment options, an assessment methodology. The categories that are covered include pain, performance, paucity of deformity, and the ability to move.[18]

NEED FOR THE STUDY

Large portions of rural environments frequently have femur neck fractures. An untreated neck of femur leads to avascular necrosis, non-union neck of femur, disability and persistent pain and significant morbidity and mortality associated with it. The elderly are treated with hemiarthroplasty because they have poor bone quality, limited healing capacity, and related co-morbidities that may not merit additional procedures if the original osteosynthesis fails. There are very limited studies in India on radiological and functional outcome following standalone cemented modular bipolar hemiarthroplasty hip.

AIMS AND OBJECTIVES

AIMS AND OBJECTIVES

- To analyze the functional results of a cemented modular bipolar hemiarthroplasty in a fractured neck of the femur using the Harris hip score.
- To evaluate radiological outcome of cemented modular bipolar hemiarthroplasty in fracture Neck of Femur by assessing the presence of acetabular erosion, superior or medial migration, subluxation and sclerosis.

REVIEW OF

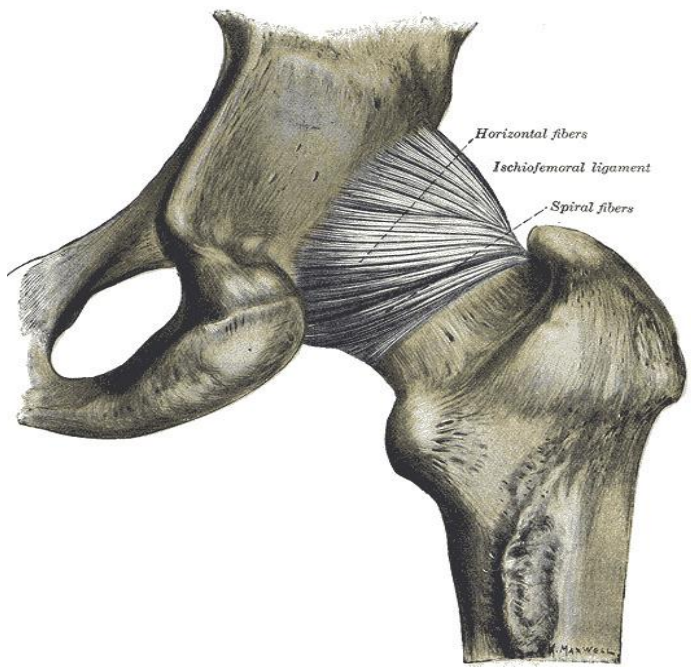
LITERATURE

REVIEW OF LITERATURE

Gross anatomy of the hip joint

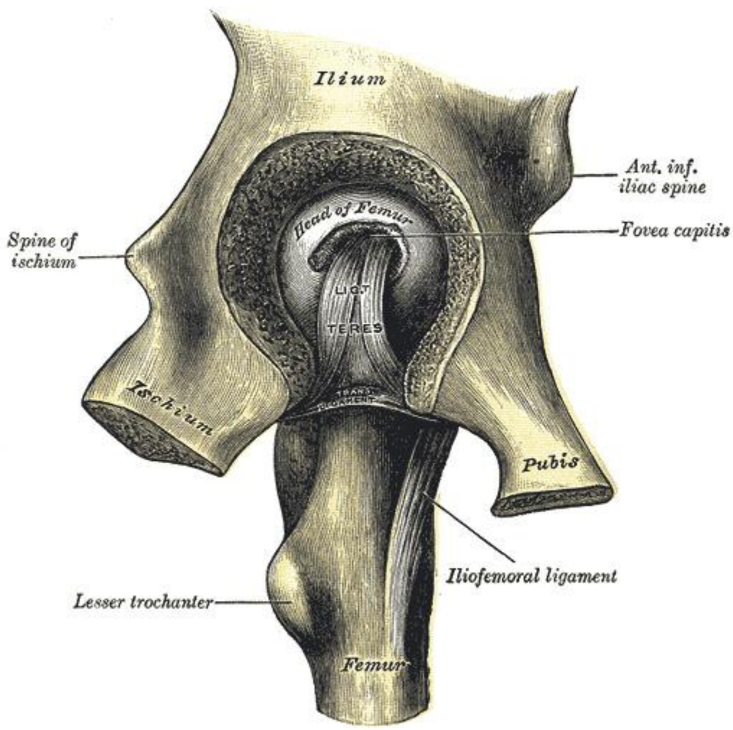
“The globular femoral head is cupped into to the acetabular or cotyloid hollow of the hip bone to create a ball-and-socket synovial joint known as the hip. It is crucial to the locomotor system's static and dynamic physiology. The head, neck, and trochanters are located at the distal end of the femur. The subcapital sulcus is where the head joins the narrowed neck to make up two-thirds of a sphere. The neck may move through a large range of motion before impinging on the malleable labrum acetabulare since it is only 3/4th the equatorial circumference of the head.The anterior inferior iliac spine (AIIS) is connected to the intertrochanteric ridge of the femur via the iliofemoral ligament, which is the body's strongest ligament. Excessive extension, abduction, and hyperextension are all prevented by the pubofemoral ligament, ischiofemoral, and iliofemoral, respectively.[20,19,21]

Figure 1:Spiral fibres, Ischiofemoral Ligament, Horizontal fibres, and the Hip joint from behind [22]



The cotyloid notch's apex and the femoral head's fovea are connected by the intracapsular ligamentum teres, often known as the femoral head ligament.The ligamentum teres is the route taken by the foveal artery, a branch of the obturator artery that supplies the femoral head in newborns and young children.This proportionate vascular element of the blood flow to the femoral head is small in adults. Lesions of the foveal artery and femoral head osteonecrosis can arise from dislocations that cause ligamentum teres injuries".[21]

Figure 2: Left Hip Joint, Femur, Ischium, Pubis, Ilium, Fovea Capitis, Iliofemoral ligament.[22]



The medial glutes are crucial for enabling appropriate walking and lower limb functionality. The adductor canal is located deep to sartorius muscle and spans from the trigone proximally to the hip flexor hiatus distally. The adductor canal houses the saphenous nerve, vastus medialis nerve, superficial femoral artery, and femoral vein. The main thigh neurovascular bundle can pass via this adductor canal and go from the proximal to the distal thigh.[23]

Multiple concentric and eccentric muscle contractions, both voluntarily and unconsciously, are required to create a smooth walk. When assessing the pathology of the hip's articular surface, it is crucial to comprehend the synchronisation of muscle spasms that enable balanced walking.[24]

Table 1: Hip Flexors: [30]

Muscle	Origin	Insertion	Innervation
Psoas major	T12-L5 vertebrae	Lesser trochanter	Femoral nerve
Psoas minor	T12-L1 vertebrae	Iliopubic eminence	L1 ventral ramus
Pectineus	Pectineal line of pubis	Pectineal line of femur	Femoral nerve
Iliacus	Iliac fossa/ Sacral ala	Lesser trochanter	Femoral nerve

Table 2: Hip Extensors and External Rotators[30]

Muscle	Origin	Insertion	Innervation
Gluteus maximus	Ilium, dorsal sacrum	ITB, gluteal tuberosity	Inferior gluteal nerve
Obturator externus	Ischiopubic rami, obturator membrane	Trochanteric fossa	Obturator nerve

Table 3: Short External Rotators[30]

Muscle	Origin	Insertion	Innervation
Piriformis	Anterior sacrum	Superior greater trochanter	Nerve to Piriformis (S2, posterior division of lumbosacral plexus)
Superior gemellus	Ischial spine	Medial greater trochanter	Nerve to obturator internus (L5-S2, anterior division of lumbosacral plexus)
Obturator internus	Ischiopubic rami, obturator membrane	Medial greater trochanter	Nerve to obturator internus (L5-S2, anterior division of lumbosacral plexus)
Inferior gemellus	Ischial tuberosity	Medial greater trochanter	Nerve to quadratus femoris (L4-S1, anterior division of lumbosacral plexus)
Quadratus femoris	Ischial tuberosity	Intertrochanteric crest	Nerve to quadratus femoris (L4-S1, anterior division of lumbosacral plexus)

Table 4: Hip Abductors[30]

Muscle	Origin	Insertion	Innervation
Tensor fascia latae	Iliac crest, ASIS	Iliotibial band/proximal tibia	Superior gluteal nerve
Gluteus medius	Ilium between anterior and posterior gluteal lines	Greater trochanter	Superior gluteal nerve
Gluteus minimus	Ilium between anterior and posterior gluteal lines	Greater trochanter	Superior gluteal nerve

Table 5: Hip Adductors[30]

Muscle	Origin	Insertion	Innervation
Adductor magnus	Pubic ramus, ischial tuberosity	Linea aspera, adductor tubercle	Obturator nerve, Sciatic nerve
Adductor longus	Body of pubis	Linea aspera	Obturator nerve
Adductor brevis	Body and inferior pubic ramus	Pectineal line, Linea aspera	Obturator nerve
Gracilis	Body and inferior pubic ramus	Proximal medial tibia (pes anserinus)	Obturator nerve

Movements of the hip

"When we talk about hip motions, we mean the femoral mobility in relation to the pelvis at the midpoint of the hip joint. The hip has a large range of motion (ROM), allowing for rotation of 50 degrees, abduction of 70 degrees, extension of 10 degrees, and flexion of 120 degrees. The hip has a larger range of motion (ROM) in the anterior and diagonal planes than most other joints do during level gait.[25]The hip is flexed during the initial heel contact of a stance phase before the hip joint extends till the end of the stance phase, where flexion begins. During midstance, the hip starts to abduct till the conclusion of the stance phase before moving into adduction until the gait cycle is complete.

In clinical gait analysis, the term hip joint angles refers to the three consecutive rotations (Cardan angles) required to alter the alignment of the pelvis section to the position of the femur segment. Hip internal-external rotation of the femur's longitudinal axis, hip adduction-abduction around the posterior-anterior axis, and hip flexion extension along the pelvis medio-lateral axis come next. Hip extension, abduction, and rotation are regarded as negative hip angles, while hip flexion, adduction, and range of motion are seen as positive hip angles”.[26]

Biomechanics of the hip joint

“By applying straight forward mathematical techniques to the equilibrium of forces and situations surrounding the hip joint, it is possible to estimate the effect of changes in joint structure or different treatment techniques on the hip joint reaction force.[27]The centre of gravity, which exerts an equal amount of stress on both hips while the body is supported by both legs, is located midway between the two hips. Standing on one leg causes the effective center of gravity to move distally and away from the supporting leg because the non-supporting leg is now part of the body mass pressing against the weight-bearing hip. The center of the femoral head rotates as a result of this downward force. The activity of the abductor muscles also creates a moment in the center of the femoral head, but this moment's arm is considerably shorter than the effective lever arm of body weight.Thus, the abductors combined force must be more than the victim's body weight. The ratio between the moment arms of the body weight and the abductor muscle, or the lever arm ratio, significantly affects the magnitude of the forces(a:b).[28]Standard single-leg stance levels are 3 times bodyweight, or a level proportion of 2.5.[29]Walking transfers a substantial amount of body mass to the hip joint, but jogging, running, and contact sports produce far larger pressures”.

The joint reactive force, which is the compressive force felt at the femoro articular surface articulation, is caused by the need to balance the body's expanding period arms with the tugging of the hip abductors at the trochanter to maintain a level pelvis. The majority of the joint reactive force is composed of the muscle forces utilized to level the pelvis while walking and standing, with body weight making up a smaller fraction of it.[30]

This force has been reported to be anywhere from as 2 to 4 times the muscle mass in level strolling and stair climb and some what greater during stair descent. Its magnitude changes depending on activities like the solitary stride and phase of gait. During these activities, a strain is also imparted to the femoral neck due to the proximal femur's geometric offset and anteversion, which must be tolerated by the bone and calcareous tissues.[31]

The stresses and contact areas felt at the joint surface can be significantly affected by changes in the intrinsic skeletal stability of the hip. Although the literature has shown hip joint contact loads that readily surpass 500% BW and reach up to 400–5000 N during routine exercises, healthy people normally do not experience spontaneous fractures. However, ageing, osteoporosis, or metastatic tumours can damage bone tissue to the point where spontaneous fractures develop.[32]

The femoral neck bends as a result of vertical pressure on the hip joint, creating tension at the neck's superior surface and tension at the neck's inferior side. Usually, the beginning of failure is caused by tensile stresses at the superior aspect.[33]Therefore, the superior lateral portion of the subcapital area of the femoral neck is the location of fracture beginning most frequently under vertical stress.[34]When compared to forces needed to cause a fracture from a vertical impact loading, sideways fall forces are far smaller. When people fall sideways, they are more likely to get trochanteric or basi cervical fractures.[35]

Fracture neck of femur

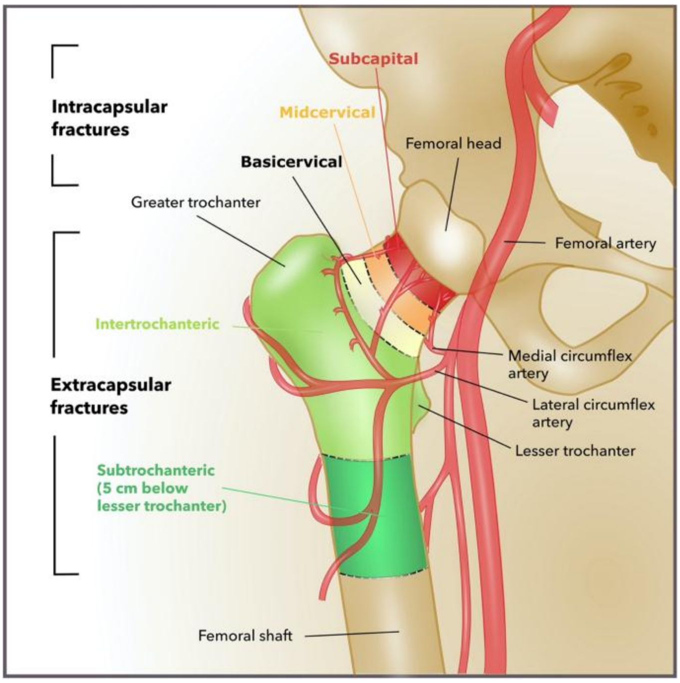
Femoral neck fractures are an example of intracapsular hip fractures. The femoral neck connects the femoral head and shaft. The hip joint is made up of the acetabulum and the femoral head. The junctional positioning of the femoral neck makes it susceptible to fracture. The femoral head's blood supply, which passes through the femoral neck, must be considered in displaced fractures.[36]Older individuals are more likely to have low-energy trauma, which might include either directly or indirectly processes. A fall onto the iliac crest or a forceful eversion of the lower extremity that impinges the femur neck into the posterior lip of a acetabulum are instances of direct mechanisms. When muscular forces are higher than the strength of the proximal femur, indirect processes occur.[6]

Anatomy and physiology

The femoral neck, which forms an angle of about 127° between the femoral head and the shaft, is radiographically outlined by tensile and compressive trabeculae, which often form the ward triad as a region of low trabecular density.[37,38]The calcar femorale is a crucial contribution to stability and offers vertical strengthening of the trabecular bone.[39]Therefore, a proper reduction of the calcar femorale is essential for the surgical intervention of a femur neck fracture. The trabecular structure deteriorates with age, and stabilizers like the calcar femorale suffer corresponding structural integrity loss. Hip fractures are most commonly caused by low power falls, which occur more frequently as people age. The superolateral cortex of the femoral neck experiences compressive force during such falls, which is thought to be the primary cause of femoral neck fracture damage.[40,41]Increased diameter and thin cortex of the femoral head, as well as osteoporosis, all increase the vulnerability to buckling.[42,43]

“Both the femoral head's cellular coverage, which deteriorates with age and thus restricts the influx of osteoprogenitor cells after a femoral neck fracture, and the vascular supply of the femoral neck, which can be easily disrupted by fracture displacement or increased intracapsular stress, are crucial for bone healing. In adults, just 20% of the femoral neck's surface is covered with cellular periosteum.[44] The primary blood vessels that supply the femoral head are the retinacular arteries, which arise from the deep stem of the median circumflex femoral artery, as well as the round ligament arteries”.[45]

Figure 3: Bony and vascular anatomy of the proximal femur[46]



Disrupted retinacular arteries, the femoral head's primary blood supply, have a strong correlation with the onset of post traumatic femoral head necrosis.[47]All retinacular arteries seem to be damaged in Garden Type IV fractures as a consequence of extensive dislocation.[45]

Anatomical Classification

Femoral neck fractures are classified as subcapital, transverse, and basicervical fractures based on where they occur. The transverse-cervical femoral fracture, which occurs more frequently than 86% of the time, is very common in older patients.[48]

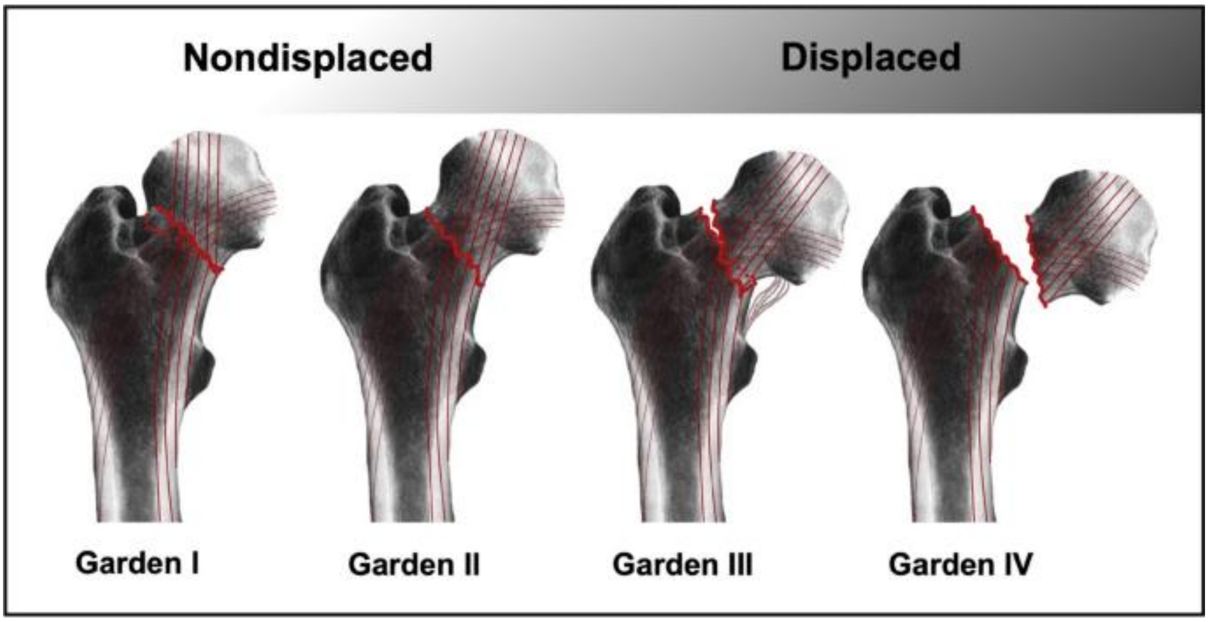
Garden's classification:

The Garden classification, which was first presented by R.S. Garden in 1961, is the one that is most frequently used. Femur neck fractures are divided as non-displaced (Garden types I and II) and displaced traumas depending on the fracture displacement as shown on an AP radiograph (Garden type III and IV). Garden types II depict complete fractures without displacement, Garden types III and IV indicate complete fractures with partial and complete displacement respectively, and Garden types I describe fractures that are incomplete.[49]

Table 6: Garden's classification for femoral neck fractures:[50]

Type	Description	Non-displaced or displaced
I	Incomplete fracture with valgus impact, damage of the lateral cortex, but preservation of the medial cortex	Non-displaced
II	Complete and undisplaced fracture	Non-displaced
III	Change in the angle of the trabeculae indicates a complete fracture and partial displacement.	Displaced
IV	Complete displacement, complete fracture, and parallel trabeculae orientation	Displaced

Figure4:Non-displaced (Garden types I and II) and dislocated (Garden types III and IV) proximal femur fracture are classified by Garden's system.[49]

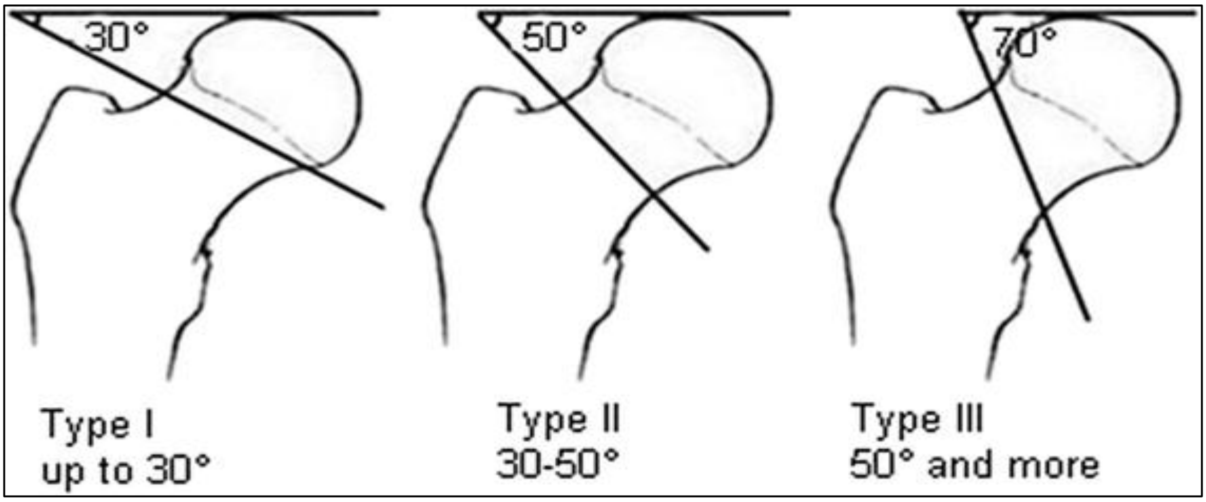


Pauwels classification:

The biomechanical forces that apply pressure to the fracture line are the focus of the Pauwels classification. Type I refers to a compression force that predominates and has a fracture line that is up to 30 degrees from the horizontal. Shearing strain is present in type II, and the fracture line is between 30° and 50°. Fracture lines in type III are 50 degrees or greater. When shearing force predominates and is accompanied by a sizable quantity of varus force, fracture dislocation and varus collapse are more likely to occur. [51]

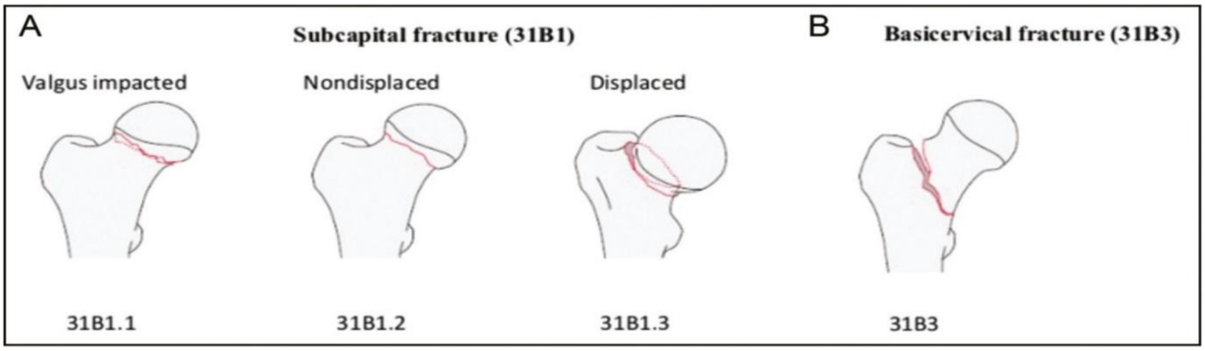
Although its use is presently limited, authors continue to allude to it and frequently misinterpret it. The reasons for this misunderstanding are mostly related to the extent of fracture line inclination in Grades III and II of the categorization.[52]

Figure 5: Classification according to Pauwels [52]



The only widely used worldwide classification system is the AO/OTA classification, which stands for ArbeitsgemeinschaftfürOsteosynthesefragen. A plain radiograph's description of the position, dislocation, and quantity of fracture lines serves as the basis for this current categorization system. The femoral neck has the classification 31B according to AO/OTA. Its intricacy prevents it from being used in standard clinical procedures.[53]

Figure 6: AO/OTA Classification [53]



Older categories may only apply to a small percentage of patients (Pauwels) or, in the instance of Garden, are still commonly used but have questionable validity. The major factors in deciding on therapy and indicating the likelihood of problems are whether the fracture is intracapsular or extracapsular (lower cervical), as well as whether it is displaced or not.[54]

Epidemiology

A rise in the share of the old population has also occurred throughout Asia, along with an increase in urbanisation and an increasing average life span. According to predictions, by 2050, more than half of these fractures will mostly show up in Asia as a result of shifting global population dynamics. Although the exact cause of this geographical location is not fully understood, potential explanations include genetic factors, a loss in physical activity, an aging population, a deterioration in bone mineral density, and outside factors including diet as well as vitamin D levels.[55]The Indian population is distinct from other populations throughout the world in a variety of respects, making it more susceptible to generalised osteoporosis and osteoporotic hip fractures. In addition to age, menopause, and alcohol consumption, other factors that affect peak bone mass include diet, smoking, and physical exercise.[56]

Etiology

The most of hip fractures in the older population are caused by falls. Among the many factors that raise the likelihood of falls in the elderly population are a tendency of falls, abnormal stride, the use of walkers, loss of balance, neurodegenerative diseases, and anti - epileptic medications.[57]

Risk factors

Black people have a stronger proximal femur due to more advantageous geometric factors such a lower hip axis length (HAL) and a bigger femoral neck cortex.[58] Due to their shorter HAL and smaller neck-shaft angle, Additionally, Asian women have a two fold higher risk of hip fractures than White women (NSA).[59]Osteoporosis is mostly to blame for the rise in femoral neck fracture incidence rates with ageing.[60]Hip fracture risk factors include widespread calcium and vitamin D inadequacy, disregard for osteoporosis, alcohol use, smoking, low levels of physical exercise, obesity, and immigration status.[55]

Disease course & natural progression

Conservative patient care is still debatable when it comes to femoral neck fractures. A small percentage of individuals, though, are ruled unfit for surgery. Less is recognized about the normal course and prognosis of these individuals. It is commonly believed that those who receive non-surgical treatment do poorly, high degrees of discomfort, restricted movement, and a high frequency of issues. In addition, a high level of mortality is thought to be a factor.[61]

Clinical presentation

Individuals with dislocated femoral neck injuries frequently have groin and thigh discomfort, are non-ambulatory, and their lower extremities shorten and rotate externally. However, patients who have impacted or stress fractures of the femoral neck can not exhibit any deformity and possibly be able to support weight. Attempts to move the hip range of motion frequently result in discomfort, along with pain from axial compression and soreness to groin palpation. When it comes to the reduced fracture that typically affects elderly people, a thorough medical history is crucial.[6]

Diagnosis

Lateral and Anteroposterior projection xrays of the affected proximal femur, as well as an anteroposterior projection of the bilateral pelvis, should be included in the radiographic examination of a probable hip fracture. An nondisplaced femoral neck injury may be displaced as a result of a frog view lateral position, which is contraindicated.[62]As it removes the natural femoral neck anteversion, an internal rotated position of damaged hip might be useful to better define the fracture pattern and select further recommendations. Particularly in the presence of an femoral shaft fracture, a thin-slice computed tomographic scan can aid in the detection of neck fractures.[63]The imaging technique of choice nowadays for identifying fractures that are not visible on conventional radiographs is magnetic resonance imaging.[64]

Figure 7: Femoral Neck fracture[36]

Morbidity, mortality associated complications

Elderly patients frequently experience a life-altering event with a fractured neck of the femur, losing their already possibly diminished capacity for self-sustainability. Only 40–60% of elderly individuals who suffer hip fractures regain their pre-fracture level of mobility and daily activity ability within a year.[11]Generally speaking, research findings presenting aggregate basic activities of daily living (ADL) results at various time intervals after hip fracture show that, compared to before the injury, 40–60% of persons are independent in basic ADLs.[11]After a year, 20% to 60% of people who were autonomous in self-care duties like dressing and cleaning themselves before the fracture need help with these activities.[65]Following a hip fracture, 10-20% of patients in high-income nations are institutionalized.[11]

Management

Surgery is the main form of treatment for femur neck fractures. While CRIF is routinely performed on patients between the ages of 20 and 50, the management of geriatric patients with intraarticular femoral neck fractures is heavily influenced by local conditions, patient characteristics, personal preferences, and the surgeon's level of expertise. Patient care is solely determined by personal opinions, not by analysis of the literature.[66,67]Treatment options for femoral neck fractures include hemiarthroplasty, complete hip replacement, and osteosynthesis. When treated conservatively, there is an 83% probability of subsequent fracture dislocations in individuals with more than one illness above the age of 70, making surgery the preferred course of action for these individuals. The biological age of the patient, who is healthy and active, should be considered to select the implant type. In healthy older patients, the paradigm has shifted away from hemiarthroplasty and toward complete arthroplasty due to the high functional needs and younger biological age relative to the biological age referred to as the golden-ager.The benefits of hemiarthroplasty include a quicker recovery period and a lesser risk of dislocation.[68,69]

HISTORY

In 1940, Moore and Bohlman developed hemiarthroplasty following the resection of a femoral head giant cell tumour. In the years since, it has also been used to treat femoral neck fractures. It had the unique qualifications: The collared, solid, linear, perforated stem with, polished unipolar head is intended for use in non-cemented applications.[70,71]

According to Thompson, between 1946 and 1953, the Judet brothers created a short-stemmed endoprosthesis that was first composed of acrylic. The light bulb prostheses was a short-stemmed metal prosthesis created by Thomson in 1950. The prosthesis was constructed from stainless steel or titanium. Because of its narrow stem, which makes it challenging to obtain stability within the femur, it is now routinely used in conjunction with cement. These were quickly replaced by intramedullary prosthesis with longer stems.[72]The Austin Moore replacement was introduced about the same time. This replacement had a shoulder and a femoral stem with fenestrations to prevent rotation in the femoral canal. [73] Early in the 1950s, McKeever and Collison created bipolar endoprostheses using metal cups lined with Teflon put atop a femoral endoprosthesis made by metal in an effort to better the outcomes with conventional unipolar endoprostheses.[74]Giliberty and Bateman separately created the first bipolar endoprostheses in 1973, employing high-density polyethylene coated cups that were secured firmly onto to the head of the femur.[75]

The uncemented and cemented prosthesis which are Austin-Moore and Thompson's respectively are frequently referenced in the bulk of published material on hemiarthroplasty results. Meta-analyses commonly compare complications and results between these historical hemiarthroplasties and more modern prostheses since they are frequently classified in the same category. The recent developments are 81 CPT stems, 50 Exeter Trauma stems (ETS) (monoblock), 228 Lubinus stems, 68 Corail stems, 43 Meretes stems,.[76]

Cemented modular bipolar hemiarthroplasty in fracture Neck of Femur

Bipolar implant was first utilised for hip reconstruction in 1974 by James E. Bateman and Gilberty. It was mostly used for femoral neck nonunions, aseptic necrosis, and new fractures in elderly patients.[76] The outer and inner headshells of the acetabulum made up the two surfaces that made up the bipolar implant. Therefore, a bipolar implant is one in which movement happened in two articulations. Bipolar prosthesis, which consists of a polished femoral head prosthesis and ultra-high molecular weight polyethylene (UHMWPE) bearings that joins with the head of a standard femur component, was developed to alleviate the issues with monopolar.[77]

Figure 8: Bipolar prosthesis

The Monk-Duopleet Hip Prosthesis includes a polyethylene cup that is capped by a cap made of titanium or stainless steel and an exterior diameter range of 41 to 57 mm. The femoral stem is available Thompson type or Austin Moore type, with a size of up to 250 mm, and can be implanted with or without acrylic cement. The acetabular component can be separated using a specific separator while the prosthesis is still in place, allowing the hemiarthroplasty to be upgraded to a total replacement hip if necessary in the future.[78]Dr. Talwalker was the person who worked on bipolar prostheses the most in India, and his work was particularly well suited to the country's squatting customs. His prosthesis consisted of a single piece, a stainless steel head held in a cup made of high density polyethylene. The stem of the Talwalkar prosthesis is 157mm in length, 8mm in thickness, and is made of stainless steel AIS 316. Fenestration is not required to be present in the stem. It features a lengthy neck measuring 35.0 mm in length, a neck shaft angle of 125 degrees, and a diameter of the neck about 19.00 mm. It also has a vertical shoulder that rests on the medial calcar. The inner bearing has a 26 mm diameter. The acetabular or outer cup, which goes with the acetabulum, is in contact with the inner surface of the inner bearing. High Density Polyethylene (HDPE) covers the acetabular cup's interior surface, while stainless steel AIS 316 makes up the outside. The acetabular cup can range in size from 37 to 53mm.[79]

The most basic of the available prostheses like the Indian bipolar version and the Monk bipolar prosthesis is attached to the outer metallic cup and UHMWPE insert complex via an Austin Moore type stem. Modern, enhanced bipolar prostheses have a modular stems that can be long, dense, fenestrated, absorbent, conventional, or press appropriate. Additionally, a smaller diameter head (made of metal/ ceramic) that enables neck length modification.

Figure 9: Modular bipolar prothesis

A small head on a bipolar prosthesis articulates with a polyethylene cup, while a larger metallic head linked to the cup's outer side articulates with the acetabulum. Movement occurs in either of the two expressions at any given moment, spreading stress from daily activities. This character is meant to reduce component wear as well as stress in the acetabulum region.[80,81]Due to a dual design, the bipolar HA has the potential to reduce acetabular wear. The possibility of polyethylene wear, which might eventually lead to mechanical loosening, as well as the chance of developing inter-prosthetic dissociation in some bipolar systems, which would need resurgery, are possible drawbacks.[82]Dissociation, nevertheless, seems to be uncommon in contemporary bipolar surgical systems.

The surgical technique used to access the femur and the application of cement are additional variables that might affect the frequency of dislocations.

APPROACH

The posterior approach to the hip was made popular by Moore in the 1950s. The method preserves the abductor muscles while exposing the condyle and femur surgically.[83]The femur and acetabulum can be exposed extensively as needed, which is another advantage. The incision is made distal to the trochanter, focused on the femoral articular surface distal to the trochanter, bending 6 cm toward posterior superior iliac spine, in lateral decubitus posture. The muscle is bluntly dissected through the short external rotators once fascia latae has been removed. When the gluteus maximus is abducted with a Charnley retractor, the sciatic nerve is properly protected since it travels straight posterior to the small external rotators. The short external rotator cuff muscles and piriformis are tenotomized, labelled at their insertion exposing the posterior joint capsule. Capsule is incised disclosing the femoral head and neck, once piriformis has been identified. The delivery of femoral head is by internally rotating the hip, followed by femoral neck osteotomy. Hohmann retractors are used to visualize the glenoid cavity and femur articulation after the osteotomized bone has been removed, allowing sufficient exposure for the reconstruction.[84]

Figure 10:The posterior technique is used for retractor implantation and acetabular exposure. Short external rotators are retracted with the aid of tagging suture, which drapes them over the sciatic nerve.[84]

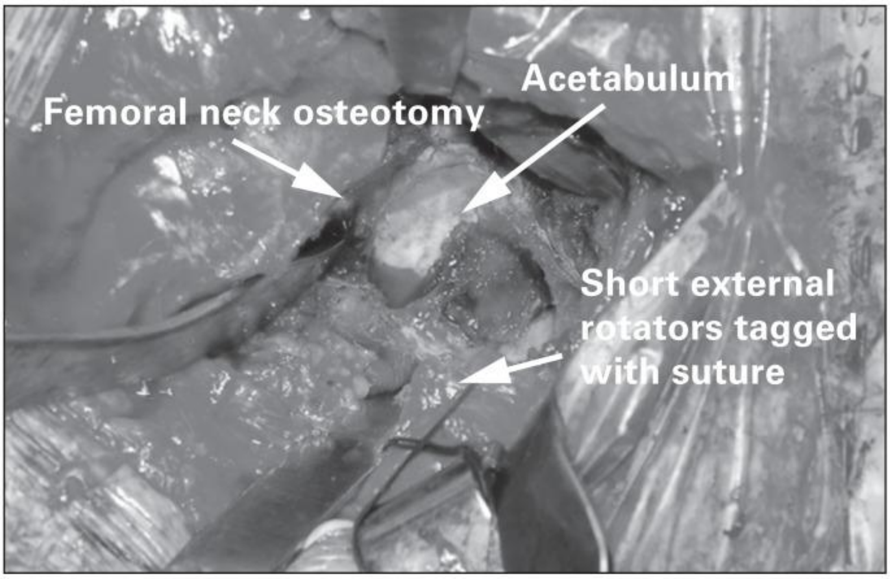
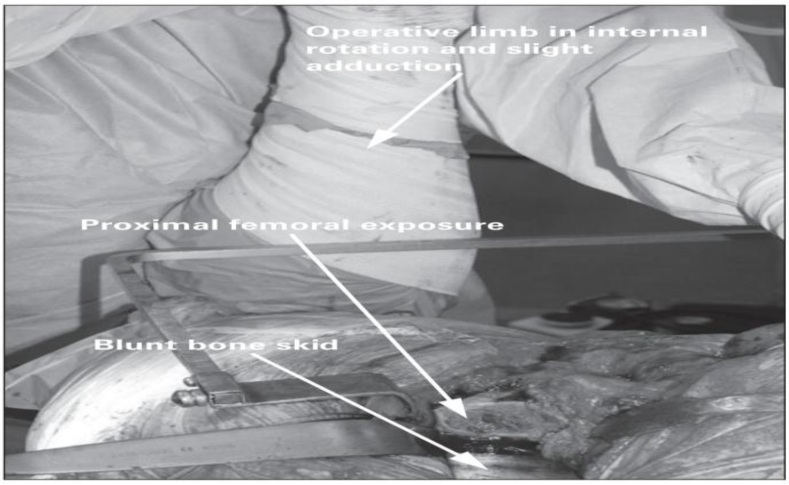


Figure11 :Posterior approach:Position of the operative limb. Hohmann retractors used to elevate the proximal femur during preparation[84]



After reconstruction, either direct repair to soft tissues in the proximal femur are used to restore the shorter external rotators and subsequent capsule.

Effectiveness in terms of outcome

After the unipolar HA, acetabular degradation occurred at a higher rate (20% vs. 5%), according to Hedbeck et al. Additionally, the finding that individuals with acetabular erosion had a tendency towards decreased functions and lower HRQoL after one year may indicate deterioration in future in the unipolar prostheses.[80]33 individuals with bipolar replacements were compared to modular unipolar replacements in a short-term randomised research of Cornell et al.[85] Bipolar group had improved range of motion and mobilized more quickly, even though there was lack of change in scores at 6 month review.The same group is tracked in a related follow-up research of Inngul et al. at a 4-year research. In comparison to unipolar, the bipolar group experiences improved HRQoL results after the first two years following surgery.[86]In comparison to the unipolar, the bipolar group also demonstrated a delay in acetabular erosion. Jia et al. confirmed that patients with bipolar implants had comparable or better results in terms of function, pain, and quality of life, but Yang et al. reported that there was a significantly lesser rate of acetabular erosion in the bipolar prosthesis group (1.2%) comparison to a unipolar group (5.5%).[87,88]Excellent outcomes clinically and a lower rates of revision with cemented bipolar systems have been demonstrated by Mak et al. The long-term outcomes in the setting of displaced neck of femur fractures are contrasted with THA, which is linked to increased morbidity perioperatively.[89]

It has shown excellent clinical results and low revision rate with the cemented bipolar system. In the context of displaced fracture neck of femur, the long-term results can be compared with THA which is associated with higher perioperative morbidity

Cemented bipolar hemiarthroplasty provides advantages over uncemented bipolar hemiarthroplasty in terms of reduced postoperative discomfort, a lower risk of postoperative complications, and improved mobility, according to Khan et al. After cemented bipolar hemiarthroplasty, long operating time and higher blood loss intraoperatively are common complications.[90]The results of metaanalysis by Azegami et al., which combined quasi-RCTs and 8 RCTs (the methodological quality of 2 studies received 4 out of a possible 12 points for quality), showed that cemented hemiarthroplasty produced superior functional results and reduced postoperative discomfort.[91] A prospective research revealed that compared to uncemented bipolar hemiarthroplasty, cement bipolar hemiarthroplasty had a superior functional result, greater mobility in the recovery of postoperative hip function, less residual discomfort, and fewer implant-related problems.[92]

Advantages and disadvantages

Advantages:[81,89,93,94]

- The bipolar implant's design allows for inter-prosthetic mobility between the inner and outer heads, which results in less persistent discomfort and improved function when the prosthesis is cemented.
- For patients who are younger and more active, this putative mechanical advantage leads in minimum acetabular degradation without running the danger of dislocation.
- The benefit of a modular bipolar hip prosthesis is that it may be adjusted for differences in limb length during surgery.
- The use of bipolar prostheses also reduces acetabular erosion over the long run.

Disadvantages:[82,89,93,95]

• Inserting cement into the proximal femur's medullary canal enhances the operation's morbidity and raises the possibility of cardiovascular collapse. The possibility of polyethylene wear, which might eventually lead to mechanical loosening, as well as the possibility of inter-prosthetic dissociation in some bipolar HAs, which would call for open reduction, are possible drawbacks. The bipolar prosthesis often costs more than unipolar implants.

• If the bipolar prosthesis dislocates, closed reduction may not work, necessitating open reduction.

•The possibility of wear particles from the bearing surface causing osteolysis is another possible drawback.

• According to certain research, the prosthesis becomes a unipolar implant immediately after fixation. This is because the motion occurring at inner bearing stops.

Harris hip score

It is a joint-specific score with 10 components encompassing functional activities, deformity, discomfort, hip range of motion, and function, is completed by both the doctor and the patient.[18] The domain of Pain contributes 44 points. Gait and everyday life activities are subcategories of function. The motion is divided based on usefulness, and the range of motion are then multiplied by a specified index factor to determine the ROM score. The total scoring for ROM is then calculated by summing the index scores and multiplying them by 0.05. The Harris Hip Score consists of the domains Pain, Function, Deformity and ROM, and gives a maximum of 100 points in the total score (Harris 1969)

Table 7: The Harris Hip Score [18]

Category	Points
Pain	
None	44
Slight, occasional	40
Mild, normal activity	30
Moderate, activity concessions	20
Marked, severe concessions	10
Totally disabled	0
Range of motion (ROM)	
Full	5
Partial*	4
Limited*	2
Gait/limp	
None	11
Slight	8
Moderate	5
Unable to walk	0
Gait/support	
None	11
Cane for long walks	7
Cane, full time	5
Crutch	4
Two canes	2
Unable to walk	0
Gait/distance	
Unlimited	11
6 blocks	8
2 or 3 blocks	5
Indoors only	2
Bed and chair	0
Function/stairs	
Normal	4
Normal with banister	2
Any method	1
Unable	0
Socks and shoes	
Easy	4
With difficulty	2
Unable	0
Sitting	
Any chair 1 hour	5
High chair ½ hour	3
Unable to sit ½ hour	0
Public transport	
Able	1
Not able to use	0
Deformity†	
Absence of all 4	4
Presence of 1	0
Total score:	/100

*ROM: no specific instructions for definition of partial ROM. For the purposes of this study, partial ROM was when either hip flexion was 115° or internal rotation was 15°. If both limitations were present this was scored as limited ROM. Deformity: the presence of 1 of the following 4 deformities led to a 0 score in this category: less than 10° abduction, leg length discrepancy 3.18 cm, flexion contracture 30°, or leg fixed in 10° internal rotation in extension.[18]

The two primary factors, which were also given the most weight, were pain and function (44 points and 47 points, respectively). Deformity and range of motion both obtained 5 and 4 marks since they are rarely of main concern. A score of 70 or less is regarded low, 70 to 80 fair, 80 to 90 good, and 90 to 100 excellent. With an 8% change in score, a 4 point difference is the smallest clinically significant difference.[18]

Functional assessment by Harris hip score for cemented modular bipolar hemiarthroplasty in Neck of Femur fracture

Patients over 60 with traumatic displaced femoral neck fractures were randomly assigned into receiving either a cemented unipolar prosthesis or a cemented modular bipolar prosthesis in this randomised prospective research, and it showed mean HHS in bipolar group which was significantly higher at three months (77.72.) than in the unipolar group (75.84.2). HHS at 6 months was 82.02.5 in unipolar group and 80.92.8 in bipolar group (p-value >0.05). The mean HHS for the unipolar group and bipolar groups at 12-month follow-up were 83.2 1.2 and 83.1 2.2, respectively, which was not significant statistically (p value >0.05). The mean HHS of the unipolar and the bipolar groups, respectively, were 85.52.4 and 85.22.8 at last follow-up of 24 months, however these values were not significant statistically (p value >0.05). The research discovered that bipolar hemiarthroplasty initially had a better functional outcome in terms of mean HHS, but after a longer follow-up, we were unable to discern any benefit of group with bipolar hemiarthroplasty over unipolar hemiarthroplasty for elderly patients with femur neck fractures.[94]When intracapsular femur neck fractures were assessed for the functionality of cemented bipolar hemiarthroplasty, they ranged in age from 50 to 80. Ravi Kumar et al. found excellent outcomes in 70%, good results in 20%, fair results in 10%, and poor results in 0% of cases finally at 6 months.[96]

Mean Harris hip score in the last follow-up at 12 months was 85.83 7.54. A study of senior patients (60 years of age) undergoing cemented bipolar hemiarthroplasty for femur neck fracture revealed that 42.5% had outstanding outcome, 37.5% acceptable, 12.5% fair, and 7.50% had bad outcomes.[97]Mal et al. found an outstanding clinical and radiological outcome when they used bipolar hemiarthroplasty following long-term follow-up in a retrospective assessment of single design bipolar hemiarthroplasties. At an average follow-up of about 13.1 years, the mean Harris hip score for pain was 40.6 of 44. With range about 8.2–18.3 years. Most of the patients, they said, were still pain-free.[89]

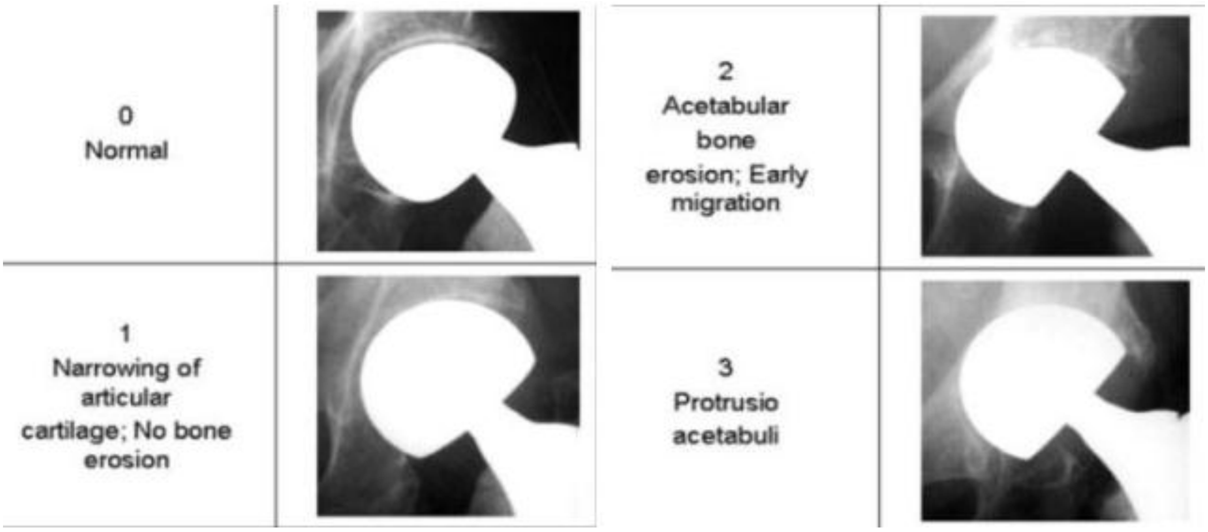
Radiological outcome of cemented modular bipolar hemiarthroplasty in fracture Neck of Femur by assessing the presence of acetabular erosion, superior and medial migration, subluxation and sclerosis.

The bipolar prosthesis lessens acetabulum erosion and protrusion due to motion in between metal head and polyethylene cover as well as movement in between metal cup and the acetabulum (outer bearing). Additionally, size and length of femoral head can be changed to create a THA.[98]After a bipolar hemiarthroplasty, there is a chance of developing cotyloiditis, by scraping the prosthesis hard head on the acetabulum's articular surface which is soft according to the study by Moon et al.[99] The acetabular cartilage's estimated mean linear deterioration was found to be 0.23 0.0107 mm/yr. The duration of the prosthesis real articulation with the acetabular cartilage determines how much deterioration occurs.[100]Garden stage III or IV displaced fracture patients, 80 years of age or older were randomly assigned to receive a cemented Exeter HA with a unior bipolar head. Early follow-ups revealed a more rate of acetabular erosion who had unipolar hemiarthroplasties, with a difference that was statistically significant at 12 months followup (unipolar 20% and bipolar 5%, p = 0.03). No discernible changes noted at the 24 and 48 months follow-ups, however the frequency of acetabular erosion increased in the bipolar groups at further follow-ups.[86]

Femoral stem tilt along distal length discrepancies were comparable between the groups, according to Barşhan et al. study on trying to compare the clinical and radiological outcomes of displaced femoral neck fractures handled with bipolar or total hip arthroplasty (THA) in older patients. Stem migration less than 2 mm seen in 6.3% of THA patients and 9.1% of bipolar patients. 4.5% of the bipolar group had a 1 mm radiolucent line in femoral stem zone-7, but THA did not show this. 9.1% of the bipolar group had acetabular erosion of less than 2 mm; and no acetabular cup wear in the THA group. However, 1-mm radiolucency in zone- 2 was seen in 12.6% of THA patients. While component was vertically displaced 2 mm, even in the 12.6% of cases where the angle changed by 2° (12.6%), mean acetabular component angle in the THA group was 37.9° (ranging 30°–50°). No horizontal displacement seen. In both groups, heterotopic ossification manifested. Grade 1, grade 2, and grade 3 of heterotopic ossification was observed in 19.0%, 4.8%, and 14.2% of patients in the bipolar group, respectively. Grade 3 and grade 4 of heterotopic ossification, however, were only seen in 38.5% and 7.7% of THA, respectively. Between the groups, the rate of heterotopic ossification was comparable.[101]

Movement occurs at the point of the prosthesis head joins with acetabular cartilage after the intra prosthetic movement is reduced and the articulation stiffens. It causes more motion around the joint, which increases the rate of erosion. Such erosion causes the prosthesis to migrate in the proximal or medial direction, increasing impairment and necessitating revision surgery.[102]At mid-term follow-up, there is a considerable rise in acetabular erosion as time following surgery is increased, but functional activity is often not considerably changed when the erosion progress.[103]

Figure 12: Grades of acetabular erosion.[103]



When the head of prosthesis was bigger than the real femoral head, Shah et al. discovered a substantial raise in the quantity of superior acetabular erosion after bipolar hemiarthroplasty (P-value 0.039). When system was bigger than the actual femoral head, the medial acetabular erosion also increased, but the trend was not found to be statistically significant.[102]

Mak et al. reported an outstanding funtional and radiological outcome with the use of the bipolar prosthses in a retrospective assessment of single design bipolar hemiarthroplasties. In long-term follow-up, 3.7% of total patients had acetabular erosion averaging to 6.2 years. Due to erosion, none of the patients needed to be revised.[89] No occurrence of acetabular protuberance, stem subduction, heterotopic new bone formation, or articular surface erosion in the subjects during the follow-up, according to a prospective study evaluating radiographic outcome of bipolar hemiarthroplasty of patients over 60 who had intra-capsular fractures in the femoral neck after being operated on with cemented bipolar hemiarthroplasty.[104]

Figure 13: Bipolar hemiarthroplasty used to repair the femoral neck fracture. Press fit and cemented (top left panel) (upper right panel). Bipolar hemiarthroplasty complications that need complete hip arthroplasty include luxation (bottom left panel) and protrusion of the acetabulum (lower right panel).[105]

In their controlled randomized study comparing clinical and radiological results between contemporary cemented with uncemented hydroxide ions apatite coated stems after a year in patients treated surgically for a neck of femur fracture, Inngul et al. discovered no much difference was seen between the cemented and uncemented groups in regard to heterotopic ossification or acetabular erosion.[106]It appears that the short- and semi functional results are not significantly impacted by acetabular erosion.[86]

Acetabular cartilage degeneration and joint space reduction were seen in 14% of people in the fixed hip group and 4% of cases in the bipolar group, with a significant statistical difference (P 0.05). In the bipolar group, the superior and medial migration in the acetabulum were, respectively, 0-1.6 mm and 0-1.0 mm (average of 0.5 mm and 0.7 mm). In the fixed-head group, they were 0-12 mm (average of 3.4 mm) and 0-8 mm (average of 3.0 mm), respectively. The superior and medial migration showed statistical significance between the two groups (P 0.05). In three cases with Austin Moore prostheses, calcar resorption or subsidence was detected very early about four months after surgery. In the fixed-head group, there were two occurrences of acetabular protrusion, but not one in the bipolar group. [107]

Recent Studies:

In a prospective observational research, Sharma et al. (2022) examined 50 senior patients (age 60 years) who had cemented bipolar hemiarthroplasty. At the conclusion of 12-month period, 40 of the 50 patients were still alive. On followup, 42.50 percent had great outcomes, 37.50 percent had good, 12.50 percent had acceptable, and 7.5 percent had bad outcomes. They came to the conclusion that, when considering the complication rates, elderly with neck of the femur fractures who underwent cemented bipolar hemiarthroplasty had good outcomes in terms of pain-free motion, daily activities, and independent activities.[97]

In a prospective trial, Ramasamy et al.(2022)assessed the outcomes of bipolar hemiarthroplasty in older patients with neck fractures. Three uncemented implants were used throughout the majority of the procedures. 43 patients over 50 years old were examined, of whom 90.69% had neck fractures and 9.31% had fractures of trochanter. Cemented implants were used by 93%. 50% of the subjects had a Harris hips ROM score of 5, whereas 42.5 and 7.5% had a score of 4 and 3, respectively. 40% of participants had excellent functional scores, 45% had good scores, 7.5% had fair scores, and 7.5% had bad scores. Only 5% of subjects had a radiolucent zone larger than 2 mm, and 2.5% had prosthesis subsidence greater than 5 mm. An effective alternative for treating a fractured neck of femur in geriatric patients with several comorbidities is a bipolar hemiarthroplasty. Each participant experienced an adequate functional outcome in terms of normal daily activities, a shorter hospital stay, less discomfort after surgery, and fewer postoperative problems. It is applicable to routine clinical practise.[108]

Shah et al. (2022)conducted a retrospective investigation of acetabular erosion following BHA based on the assessment of diameter difference between implanted cup and femoral head at a minimum follow-up of 10 years. They looked back on 117 hips who had undergone BHA for femur neck fractures. Bipolar cup size > real head was present in group A, equal head size was present in Group B, and small cup size was present in Group C. According to the study, a larger-sized cup speeded up the acetabulum's superior cartilage deterioration following BHA; as a result, an ideal cup size should be taken into account while having BHA done on older individuals.[102]

In their study, Kumar et al. (2022) examined individuals with femoral neck fractures who had hemiarthroplasty utilising a lateral approach and a modular bipolar prosthesis (Hardinge approach). The average was 39.46 using Oxford Hip Score, which indicates that joint is functionally good and that additional therapy may not be necessary. The average score for forgotten artificial joints was 83.46, which indicates a high level of forgetfulness. Following surgery, the patients extremely high Forgotten Joint and Oxford Hip Scores indicated that they had regained or maintained their independence and were doing well. This further suggests that hemiarthroplasty performed in approved situations provides a satisfactory functional result and a long-term treatment for these fractures despite improvements in surgical methods and implants for osteosynthesis.[109]

In a prospective research of twenty two instances of neck of femur fractures, Arun KN et al. (2021)110 were evaluated and analysed the outcomes of the care of neck of femur fracture using cemented modular BH. At 1-year follow-up evaluation with the Harris Hip Score, 36.36% received a Excellent rating, 50% a Good rating, 9.09% a Fairr ating, and 4.54% a Poor rating. There was no indication of prosthesis subsidence, distal migration, radiolucent zones, or loosening at the conclusion of the final follow-up. The study found that bipolar cemented modular HA for displaced intracapsular neck of femur fractures provides multiple benefits, good functional outcomes, and few problems. These findings are comparable with that of earlier studies. They recommended more research of a bigger sample size and an extended study duration to better understand the long-term outcomes of cemented modular bipolar hemiarthroplasty.[110]

Elmenshawy et al. (2021) did a comprehensive evaluation of pertinent literature. Uncemented hemiarthroplasty, according to the research, was linked to considerably reduced loss of blood (p = 0.0001), a reduced recovery period (p = 0.0001), fewer infections (p = 0.03), a decreased likelihood of developing heterotopic ossification (p = 0.007). However, compared to patients who had cementless implantation, individuals who had cemented hemiarthroplasty experienced considerably less postoperative thigh discomfort (p 0.00001). According to the available data, compared to cemented implantation, uncemented bipolar hemiarthroplasty provides faster operating times, reduced blood loss, less surgical site problems, and a similar risk of systemic issues and secondary surgeries**.**[111]

Wang et al. (2021) examined the results of cementing and uncemented hemiarthroplasty for patients with neuromuscular illness who had femoral neck fractures. According to the study, both arthroplasties can effectively repair femoral neck fracture in individuals with neuromuscular illnesses throughout the course of the next several years.[112]

In order to examine the effectiveness of cemented and uncemented hemiarthroplasty for the treatment neck of femur fractures in geriatric patients, Li et al. (2021) carried a systematic study. The meta-analysis includes eleven RCTs. According to this meta-analysis, cemented hemiarthroplasty may be the optimal option for treating elderly individuals with unstable femoral neck fractures.[113]

In a prospective randomised research, Khan et al. (2021) evaluated the mechanical and also radiological outcomes of cemented unipolar and modular bipolar HA in the setting of displaced neck of femur fracture in an elderly group. The bipolar group had a better functional outcome in terms of Harris Hips Score, the study revealed, despite the absence of a statistically significant distinction in the functional result between the two groups after 3, 6, 12, & 24 months of follow-up. Unipolar hemiarthroplasty of hip takes less time to perform and is statistically significant when compared to bipolar hemiarthroplasty. [94]

In a retrospective and prospective investigation, Ravi Kumar et al. (2021) evaluated the clinical success of cemented bipolar HA in patients with intraarticular femur neck injuries aged 50 to 80. Most patients who had cemented modular bipolar hemiarthroplasty experienced good to exceptional functional outcomes. As a result, Cemented Modular Bipolar HA is a secure and efficient modality for femoral neck fractures for people ranging in age from middle-aged to old.[96]

For Intracapsular femoral neck fracture treated with cemented bipolar hemiarthroplasty in 30 individuals over the age of 60., Chhabra et al. (2020) evaluated the functional success of the procedure. The study found that, despite having several co-morbidities, bipolar prosthesis is a safe alternative for managing femoral neck fracture in older patients with satisfactory recovery.[104]

In an observational,comparative research by Singh et al. (2020), 52 elderly subjects with neck of femur fractures were split into two groups of 26, each of whom received cemented or uncemented bipolar hemiarthroplasty. The study came to the conclusion that hemiarthroplasty, both cemented and uncemented, is a suitable alternative for treating femoral neck injuries in older patients. But it had been found that the group receiving uncemented hemiarthroplasty had less issues and recovered faster than the group receiving cemented hemiarthroplasty.[114]

In a comprehensive review of the literature, Anand Metri et al. (2020) compared BH outcomes with UH outcomes for displaced femoral neck fractures. Although BH had a better clinical outcomes in terms of hip functioning, long-term (for a year) outcomes were similar for both groups. The findings show that BH is superior than UH in terms of acetabular degradation, whereas BH is preferable to UH in terms of displacement and reoperation. Follow-up found that the UH group had a greater rate of articular surface erosion, but this had no effect on the final HHS, which was about 80.45% for bipolar patients and about 78.52% for unipolar patients. In comparison to BH, UH is less expensive.[115]

Mak et al. (2019) conducted a retrospective assessment of 108 single-design BHA procedures (a total of 105 individuals), all of which were performed in single facility on patients who had displaced fractures before the age of 75, narrow femoral canals that precluded the use of a monoblock implant, or who had tried unsuccessfully to treat a fracture internally. Five percent of the patients needed additional surgery; two underwent debridement for infection, and four required revision total hip arthroplasty (THA) due to infection or aseptic loosening.There was no case of realignment. Acetabulum erosion did not require correction. The survival rate for 15-years without revision for any causes was 93.1%, while the survival rate owing to aseptic loosening was 97.1%. The trial with the cemented bipolar system had shown favourable clinical outcomes and a low revision rate. The long-term effects of THA, which has greater perioperative morbidity, can be compared to those in the setting of displaced neck of femur fractures.[89]

In a systematic review Yoo et al. (2019) examined the probable effects of cement usage and favorable pre-injury activity levels on the health outcomes of BHA in comparison to THA in older patients with femur neck fractures. In comparison to individuals managed with cementless BHA, Harris Hip Score was considerably greater in those treated with cementless Total replacements. The dislocation incidence increased where THA was carried on older subjects with femur neck fractures who were competent walkers before injury. Additionally, uncemented THA was related to an increased dislocation rate than cemented.[116]

LACUNAE IN LITERATURE:

The gadget design features, the operating surgeon's experience and the implantation method, and also unique patient characteristics of age, gender, weight, activity level, and general health, may all have an impact on the results and durability of a hip implant. Understanding factor-related progress and how changes to these factors encourage recovery after hip replacement is crucial given the rising demand for hip arthroplasty and the rise in the number of revision surgeries. The available literature is based on studies done at tertiary care centers and our study aims to determine the functional and radiological outcomes of cemented modular bipolar hemiarthroplasty in fractured Neck of Femur in the elderly in a rural setting.

MATERIALS AND METHODS

STUDY DESIGN: Prospective study

SOURCE OF DATA: Patients admitted in Orthopaedics ward from Outpatient department and Emergency medicine department of R. L. Jalappa Hospital, part of Sri Devaraj Urs Medical college, affiliated to SDUAHER university meeting the inclusion criteria.

STUDY PERIOD: December 2020 to July 2022

INCLUSION CRITERA:

- Patients aged above 60 years and diagnosed with femoral neck fractures.

EXCLUSION CRITERIA:

- Patients who are unwilling and unfit for surgery.
- Patients with pre-existing osteoarthritis of hip.

METHOD OF COLLECTION OF DATA

SAMPLE SIZE:

Kari Kantoetal[4] had reported that the 83% of the subjects who underwent Bipolar Hemiarthroplasty had regained ambulatory ability. Assuming alpha error of 5% (95% confidence limit) and an absolute precision (d) of 15%. The minimum required sample size to assess post-surgery ambulatory ability was estimated to be 31.

The sample size was derived from the following formula:

Sample size (n) = $\frac{\square^2(\square*\square)}{\square^2}$

Z is the value for Confidence Interval

D is the absolute precision

P is the expected proportion and q=1-p

The sample size was calculated using OpenEpi software version 3.01 (Open Source Epidemiologic Statistics for Public Health).

METHODOLOGY

- All the patients were assessed by taking detailed history, clinical examination & radiographic findings. A sample size of 31 was selected meeting the inclusion and exclusion criteria.
- Patients have undergone cemented modular bipolar hemiarthroplasty via posterior approach after pre-anesthetic evaluation.
- Post operative follow up was done at 1st, 3rd and 6th months. At the time of follow up patient were assessed functionally and radiologically.
- Functionally patients were evaluated using Harris hip score.
- Radiologically patients were evaluated by the presence of acetabular erosion, superior and medial migration, subluxation and sclerosis.

INVESTIGATIONS:

- CBC
- RFT
- HIV, HBsAg status
- Blood grouping and typing
- BT and CT
- ECG

RADIOLOGICAL INVESTIGATIONS

- Plain X-ray pelvis with bilateral hip AP
- Chest xray AP view

Statistical Methods

Radiological score and functional score were depicted as outcome parameters. Age, sex (Male/Female), mode of injury etc. were denoted as the study relevant variables.

Basic analysis of describing mean and standard deviation for continuous measurements, frequency and percentage for categorical data. Bar chart, pie diagram etc., were used for pictorial representation. Categorical outcomes comparison done between study groups with Chi square test. P value < 0.05 was indicating significance statistically. Data analysis is done by coGuide Statistics software, Version 1.0

RESULTS

RESULTS

A total of 31 samples included into the study.

Table 8: Distribution of Age (years) (N=31)

Age	Count	Percentage
60-70	20	64.52%
70-80	7	22.58%
>80	4	12.90%

Among the study population, 20 (64.52%) participants were between 60-70 years age group, 7 (22.58%) were between 70-80 years, 4 (12.9%) were aged between >80 years. (Table 8 & Figure 14)

Figure 14: Bar chart of Age groups (years) (N=31)

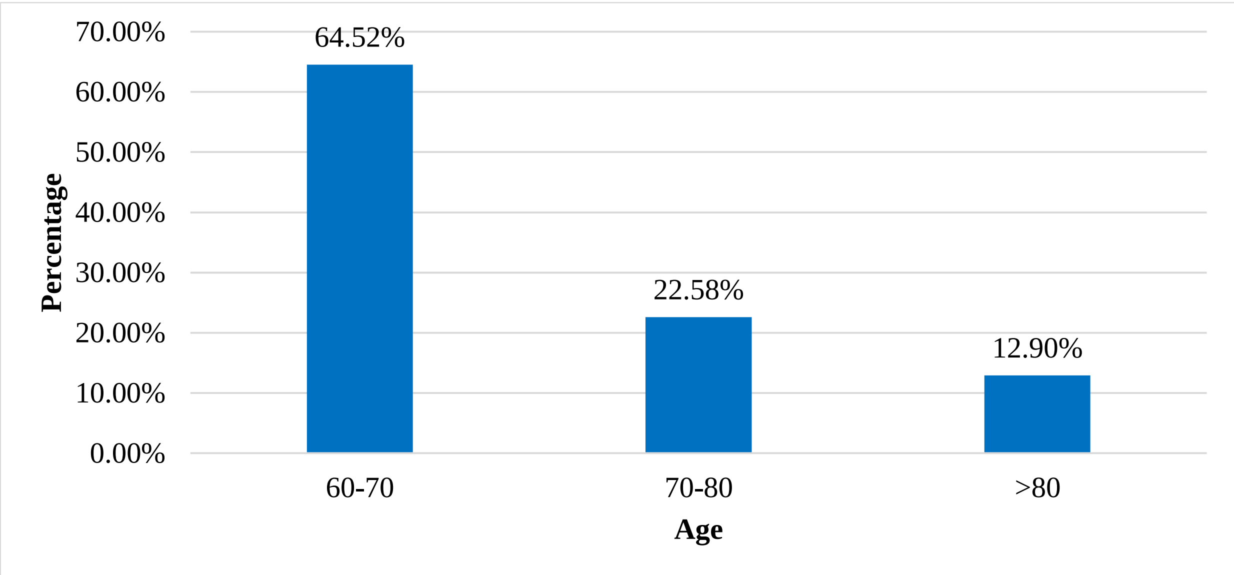


Table 9: Descriptive analysis of Gender in the study population (N=31)

Gender	Frequency	Percentage
Male	12	38.71%
Female	19	61.29%

In the study samples, 12 (38.71%) participants were male and remaining 19 (61.29%) participants were female. (Table 9 and Figure 15)

Figure 15: Bar graph ofGender in the study(N=31)

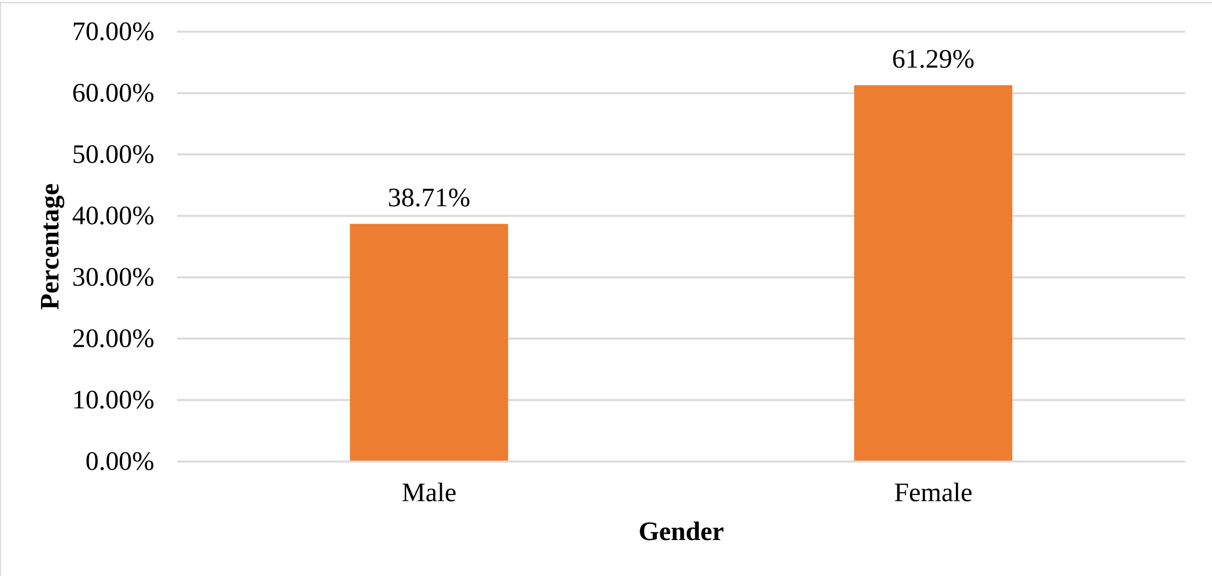


Table 10: Descriptive statistics of Side in the study cases (N=31)

Side	Frequency	Percentage
Right	17	54.84%
Left	14	45.16%

In the study population, 17 (54.84%) participants had injury at right side and 14 (45.16%) participants had left side. (Table 10 and Figure 16)

Figure 16: Pie chart of Side in the study population (N=31)

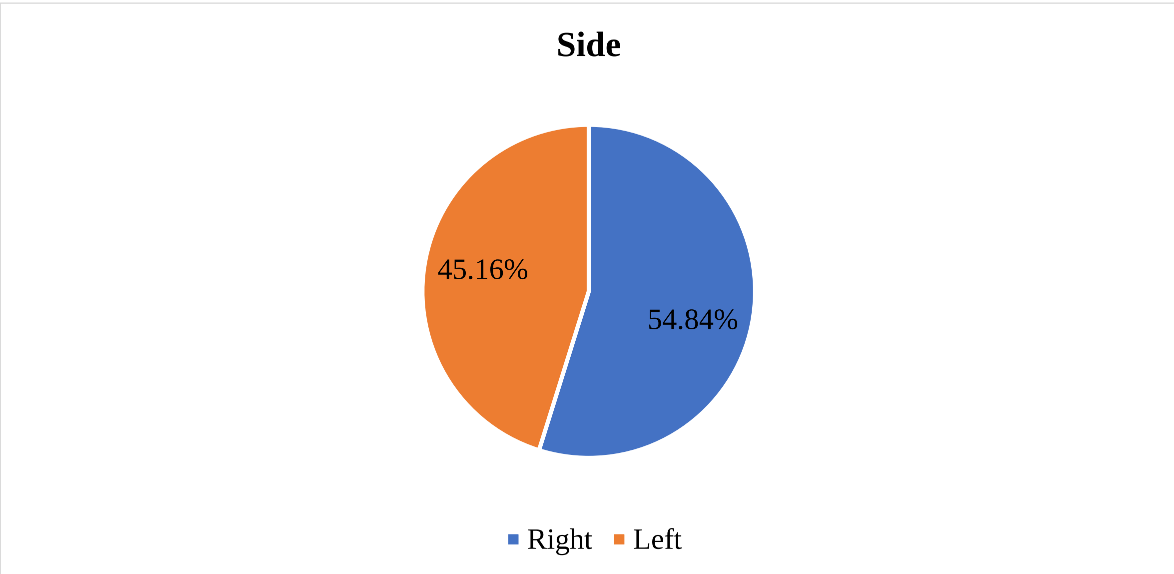


Table 11: Distribution of Mode of Injury in the samples studied (N=31)

Mode of Injury	Frequency	Proportion
Self-fall	23	74.19%
RTA	6	19.35%
Fall from height	2	6.45%

In the study population, 23 (74.19%) participants had self-fall mode of injury, 6 (19.35%) participants had RTA and 2 (6.45%) participants had fall from height mode of injury. (Table 11& Figure 17)

Figure17: Bar graph of Mode of Injury in the study population (N=31)

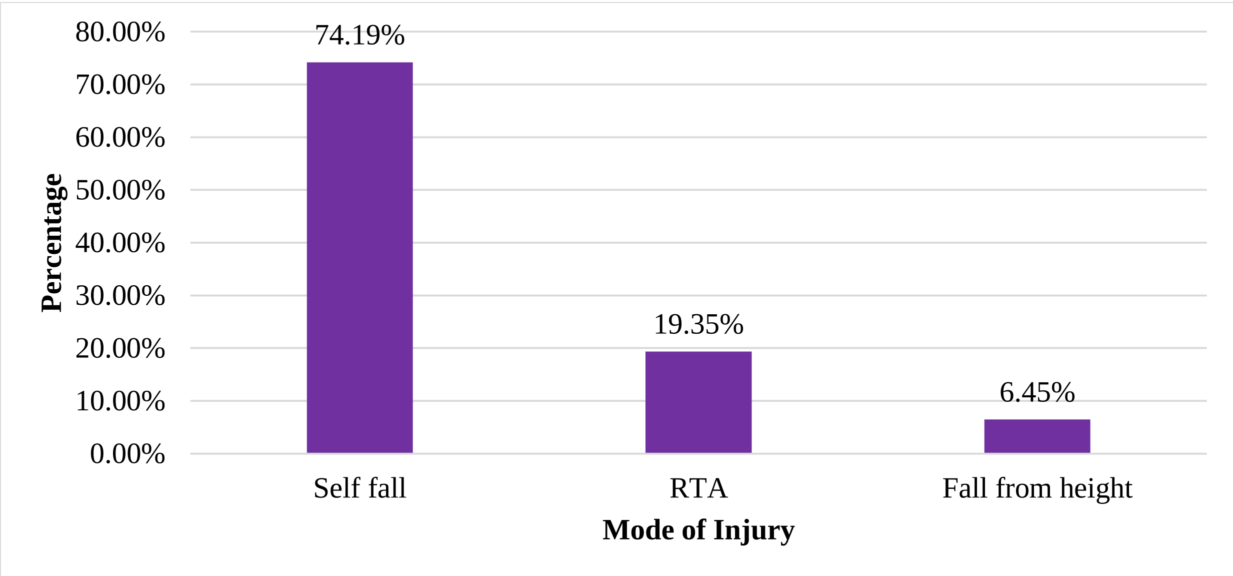


Table 12: Garden's Stage distribution in our study participants (N=31)

Garden's Stage	Frequency	Percentage
Stage 3	14	45.16%
Stage 4	17	54.84%

In the study population, 14 (45.16%) participants were in stage 3 and 17 (54.84%) participants were in garden's stage 4. (Table 12 and Figure 18)

Figure 18: Pie chart of Garden's Stage in the study samples (N=31)

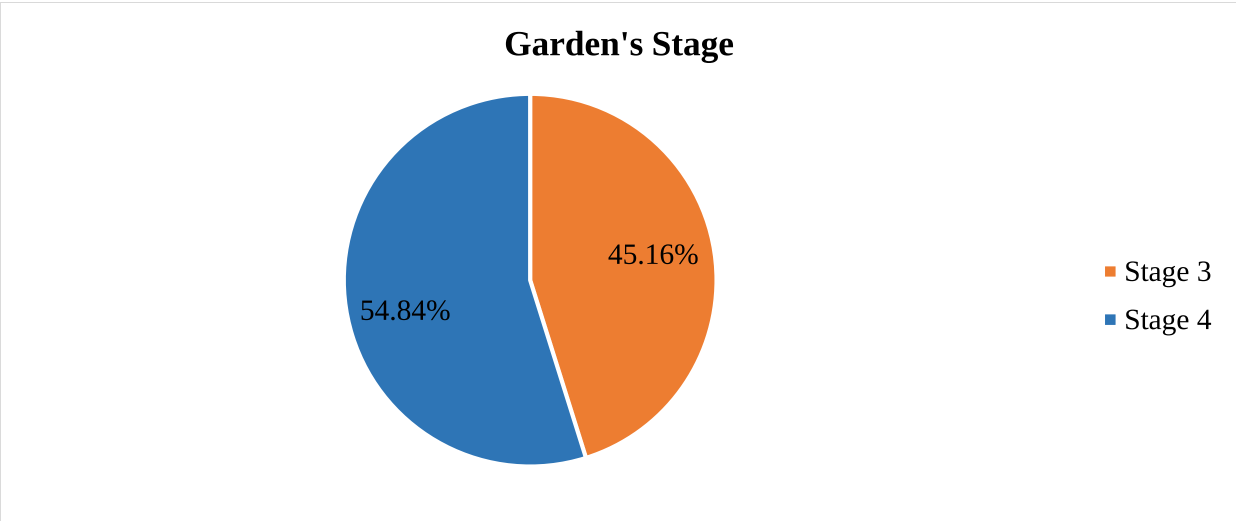


Table 13: Descriptive stats of Presentation (hours) (N=31)

Presentation (hours)	Count	Proportion
<24	18	58.06%
24-48	12	38.71%
>48	1	3.23%

In the study population, 18 (58.06%) participants were taken <24 hours, 12 (38.71%) participants were taken 24-48 hours and 1 (3.23%) participants were taken >48 hours presentation. (Table 13 and Figure 19)

Figure 19: Bar chart of Presentation (hours) in the study population (N=31)

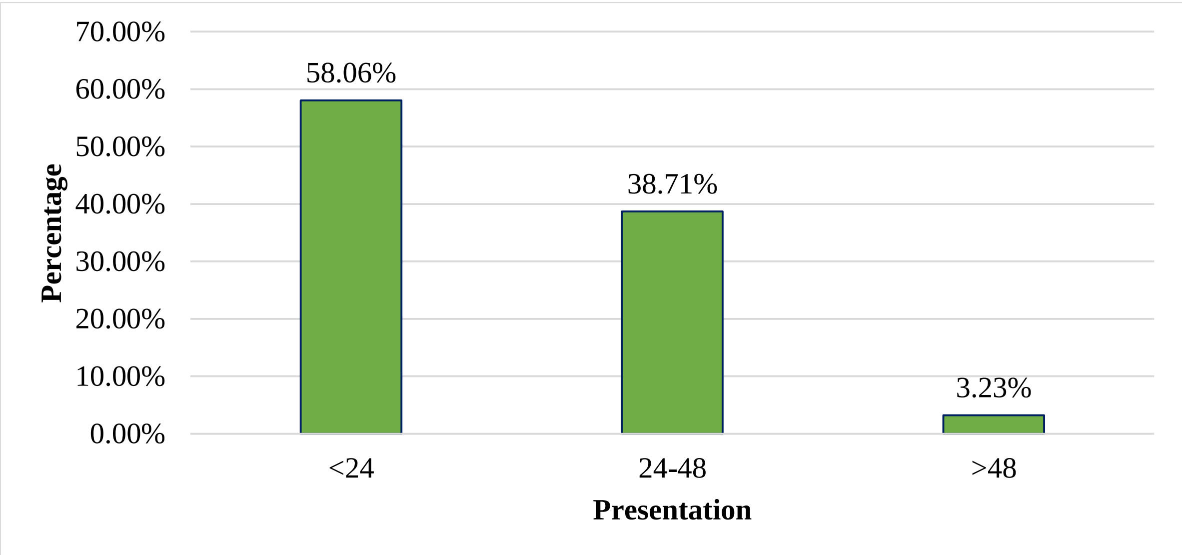


Table 14: Descriptive analysis of Functional Score in the study population (N=31)

Functional Score	Frequency	Percentage
@ 1st Month		
Fair	7	22.58%
Poor	24	77.42%
@3rd Month		
Excellent	6	19.35%
Good	20	64.52%
Fair	5	16.13%
@6th Month		
Excellent	12	38.71%
Good	18	58.06%
Fair	1	3.23%

In the study population, at 1st month 7 (22.58%) participants had fair functional score and 24 (77.42%) participants had poor functional score. At 3rd month 6 (19.35%) participants had excellent, 20 (64.52%) participants had good and 5 (16.13%) participants had fair functional score. At 6th month 12 (38.71%) participants had excellent, 18 (58.06%) participants were with good and 1 (3.23%) participant reported fair functional score. (Table 14)

Table 15: Descriptive statistics for Radiological Score (N=31)

Radiological Score	Count	Percentage
@1st month		
Excellent	13	41.94%
Good	18	58.06%
@3rd month		
Excellent	13	41.94%
Good	18	58.06%
@6th month		
Excellent	13	41.94%
Good	18	58.06%

In the study population, at 1st month 13 (41.94%) participants had excellent radiological score and 18 (58.06%) participants had good. At 3rd month 13 (41.94%) participants had excellent, 18 (58.06%) participants had good radiological score. At 6th month 13 (41.94%) participants had excellent, 18 (58.06%) participants had good radiological score. (Table 15)

Table 16: Comparison of Functional score 1st month with Radiological score 1st month in the study population (N=31)

Functional Score 1st Month	Radiological Score 1st Month		Chi square value	P value
	Excellent(N=13)	Good(N=18)		
Fair	4 (30.77%)	3 (16.67%)	0.86	0.4130
Poor	9 (69.23%)	15 (83.33%)		

Among the cases reported excellent radiological score, only 4(30.77%) reported fair functional score and from good radiological score also very less 3(16.67%) only reported fair functional score at 1 month. The difference between functional score at 1st month and radiological score 1st month was insignificant because the P value was 0.4130. (Table 16)

Table 17: Functional score 3rd month and Radiological score 3rd month association in the study population (N=31)

Functional Score 3rd Month	Radiological Score 3rd Month		Chi square value	P value
	Excellent(N=13)	Good(N=18)		
Excellent	3 (23.08%)	3 (16.67%)	1.23	0.5419
Good	9 (69.23%)	11 (61.11%)		
Fair	1 (7.69%)	4 (22.22%)		

Among the cases reported excellent radiological score 3 (23.08%) reported excellent functional score, 9 (69.23%) reported good functional score and only 1 (7.69%) reported fair functional score and from good radiological score 3 (16.67%) reported excellent functional score, 11 (61.11%) reported good excellent score and 4 (22.22%) reported fair functional score at 3rd month. The difference between functional score 3rd month and radiological score 3rd month reported to be insignificant statistically (P value 0.5419). (Table 17)

Table 18: Association of Functional score 6th month with Radiological score 6th month in the study population (N=31)

Functional Score 6th Month	Radiological Score 6th Month		Chi square value	P value
	Excellent(N=13)	**Good(N=18)**		
Excellent	6 (46.15%)	6 (33.33%)	*	*
Good	7 (53.85%)	11 (61.11%)		
Fair	0 (0.00%)	1 (5.56%)		

Note: **Due to 0 in cells statistical test could not be applied*

In the sample with excellent radiological score of 6th month, 6 (46.15%) participants were with excellent and remaining 7 (53.85%) were with good functional score. In good radiological score participants of 6th month, 6 (33.33%) participants were of excellent, 11 (61.11%) participants were of good and remaining 1 (5.56%) was with fair functional score. (Table 18)

Table 19: Descriptive analysis of Pain at Final Follow Up in the samples used in study (N=31)

Pain at Final Follow Up	Count	Proportion
Mild	26	83.87%
Moderate	5	16.13%

Among the study population, 26 (83.87%) participants were having mild and remaining 5 (16.13%) participants were moderate pain at final follow up. (Table 19 & Figure 20)

Figure 20: Bar graph of Pain at Final Follow Up in the study people (N=31)

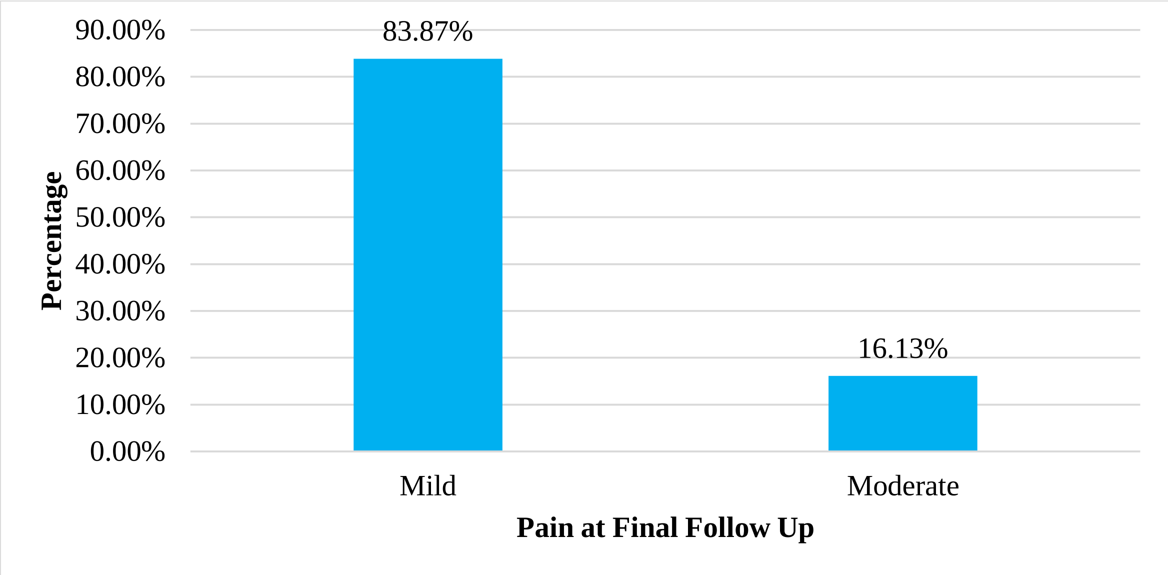


Table 20: Descriptive analysis of Gait at last Follow Up(N=31)

Gait at Final Follow Up	Summary as count	Percentage
No Limp	7	22.58%
Mild	22	70.97%
Moderate	2	6.45%

Among the study cases, 7 (22.58%) had no limp, 22 (70.97%) participants had mild limp and remaining 2 (6.45%) participants had moderate limp at final follow up. (Table 20)

Table 21: Descriptive analysis of Climbing Stairs at Final Follow Up in the study population (N=31)

Climbing Stairs at Final Follow Up	Frequency	Percentage
Unable	3	9.68%
With support	20	64.52%
Without support	8	25.81%

Among the study population, 3 (9.68%) participants were unable, 20 (64.52%) participants were able to with support and remaining 8 (25.81%) participants were Climbing Stairs without support at Final Follow Up. (Table 21 & Figure 21)

Figure 21: Pie chart of Climbing Stairs at Final Follow Up (N=31)

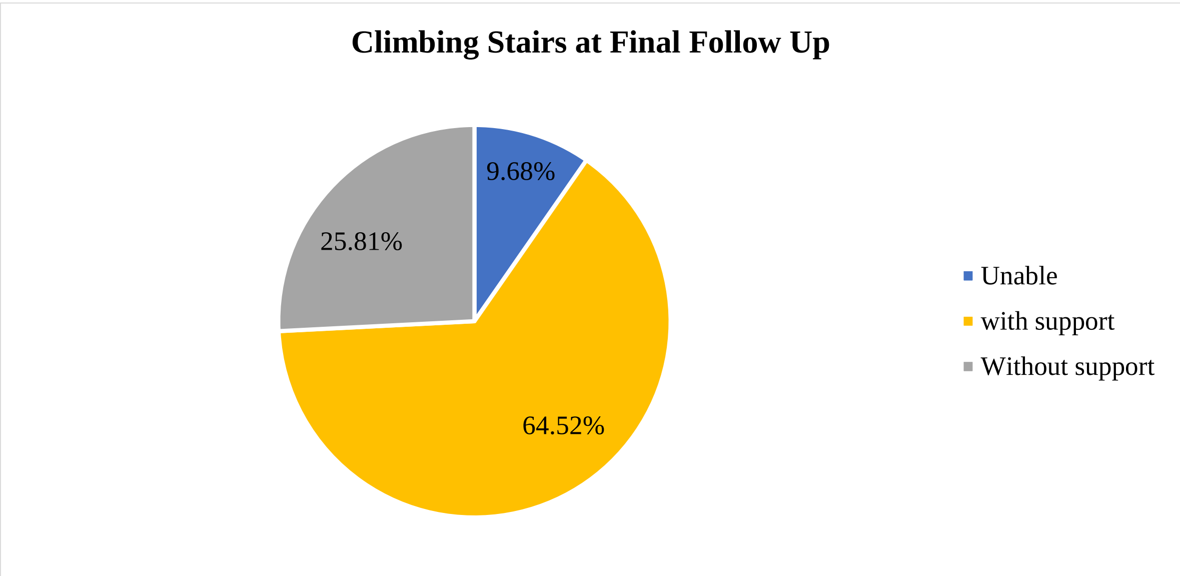


Table 22: Descriptive analysis of Ability to Put on Shoes Follow Up final time in cases of study (N=31)

Ability to Put on Shoes at Final Follow Up	Frequency	Proportion
With ease	21	67.74%
With diffficulty	10	32.26%

Among the study population, 21 (67.74%) participants were with ease of ability to put on shoes, 10 (32.26%) participants were with difficulty in Ability to Put on Shoes at Final Follow Up. (Table 22)

Table 23: Descriptive analysis of Ability to Sit on Chair at last Follow Up (N=31)

Ability to Sit on Chair at Final Follow Up	Frequency	Summary as Proportion
>1 hour	26	83.87%
< 1/2 hour	5	16.13%

Among the study population, 26 (83.87%) participants had >1 hour Ability to Sit on Chair, 5 (16.13%) participants had <1/2 hour Ability to Put on Shoes at Final Follow Up. (Table 23)

Table 24: Descriptive analysis of Walking Distance at Final Follow Upin the study population (N=31)

Walking Distance @ last Follow Up	Count	Summary (Percentage)
Unlimited	2	6.45%
<1 Km	25	80.65%
< 500 m	4	12.90%

Among the study population, 2 (6.45%) participants had unlimited walking distance, 25 (80.65%) participants had <1 km and 4 (12.90%) had <500 m walking distance at final follow up. (Table 24& Figure 22)

Figure 22: Bar graph of Walking Distance at Final Follow Up participants of our study (N=31)

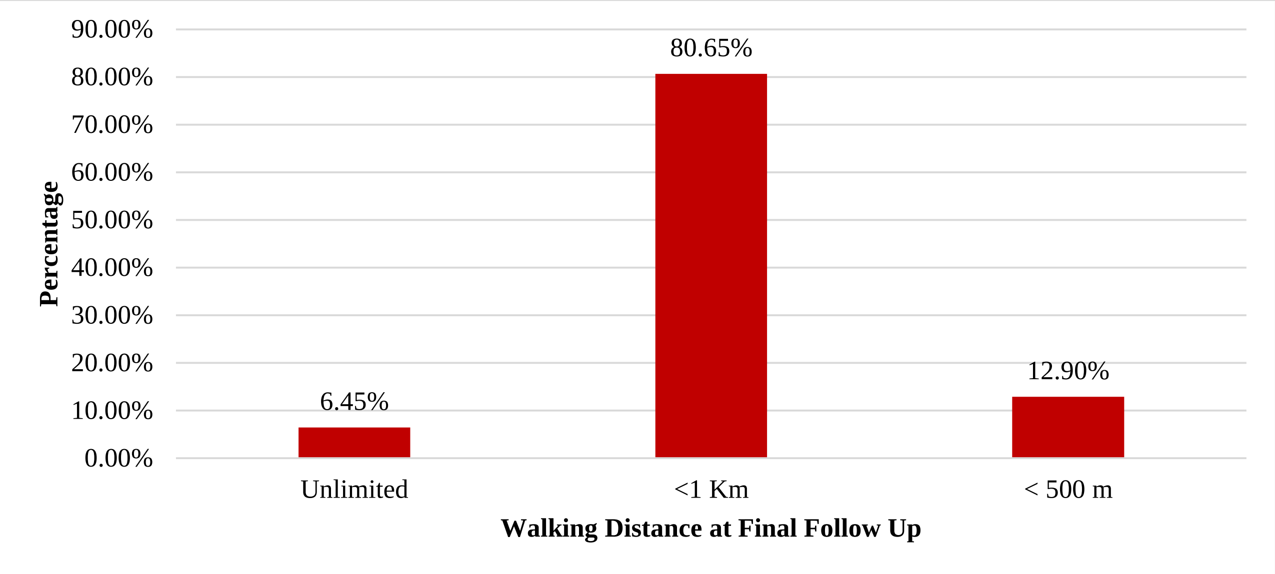


Table 25: Descriptive analysis of Ambulation at Follow Up of last time in our study cases (N=31)

Ambulation at Final Follow Up	Summary (Frequency)	Summary (Percentage)
No Walker Support	27	87.09%
Walker Support	4	12.90%

Among the study population, 22 (70.97%) participants had no walker support, 9 (29.03%) participants had walker support for Ambulation at Final Follow Up. (Table 25)

DISCUSSION

DISCUSSION

Femur neck fractures are among the most prevalent problems affecting the hip joint. It is the most frequent injury leading to morbidity and death in patients of geriatric age, which has become more prevalent in older patients in recent years. The best way to treat femoral neck fractures is still up for debate. Treatment options include complete hip replacement, unipolar or bipolar hemiarthroplasty, and internal fixation techniques. The current prospective study is designed to analyse the radiological outcome by looking for acetabular erosion, superior and medial movement, subluxation, and sclerosis, as well as the clinical outcome of cemented modular bipolar hemiarthroplasty in fracture neck of femur. The study includes all patients hospitalised to the in patient ward of R. L. Jalappa Hospital and Research Institute who are over 60 and have been diagnosed with femur neck fractures.

A total of 31 subjects satisfying the inclusion criteria are considered for the study. Sharma et al.'s study included 50 older subjects who sustained femoral neck fracture managed with cemented bipolar hemiarthroplasty.[97] Ravi kumar et al. treated subjects between 50-80 years of age with intracapsular femoral neck fracture with cemented modular BH.[96]In the research by Mohabey et al., 40 elderly people with surgically repaired displaced femoral neck fractures were included, 20 of whom underwent cemented hemireplacement while the remaining 20 underwent uncemented hemireplacement.[117]Adapureddi et al.'s study included 50 subjects who have been diagnosed with intracapsular femoral neck fracture with age ranging between 55 to 85 years operated with modular bipolarhemiarthroplasty.[118]A total of 43 patients among which 90.69% with neck of femur fractures and 9.31% with trochanteric fractures were analysed in Ramasamy et al.' study. Bipolar hemiarthroplasty was performed with 93% receiving cemented implants, and 7% uncemented.[108]In a prospective study of 20 cases of neck of femur fractures, Rakshith Kumar et al. surgically treated all with modular bipolar hemiarthroplasty.[119]

Majority of the study population in our study, 64.52%, are aged between 60-70 years, followed by 22.58% aged between 70-80 years, and 12.9% aged >80 years. Sharma et al. had 90% of the patients in the 60-69 age group with just 6% in the 70-79 age group and 4% above 80 years of age.[97]In Adapureddi et al.'s study, the age of subjects ranged from 55 years to 85 years with an average age of 65 years.[118]The majority of (34.8%) study participants were aged between 71 years and 80 years, followed by 61–70 and 50–60 years age group was 30.2 and 18.7%, respectively in Ramasamy et al.'s study.[108]Rakshith Kumar et al.'s study included patients age ranging from 50 to 92 years of age, with an average age of about 65 years.[119]

Our study population had majority of females at 61.29% with 38.71% male subjects.As is seen in our study, Sharma et al. also had majority of female patients at 80% in their study.[97]The gender distribution in Ravi Kumar et al.'s study is comparable with our study with 57% females and 43% males.[96]Mohabey et al. also had a preponderance of females over male patients with 55% females.[117]As seen with the above studies, Adapureddi et al.'s study also had predominantly females subjects at 62%. [118]Ramasamy et al. had 45.5% females and 54.5% male population, in their research.[108]Similar to our study, Rakshith Kumar et alstudy.'s included 60% women and 40% men.[119]Low energy injuries can result in a femoral neck fractures mostly in the elderly due to their severe osteoporosis, which has become one of the primary hazards to the decrease of quality of life or mortality in the old, especially in females.

Table 26: Gender distribution across studies

Study	Male	Female
Current study	38.71%	61.29%
Sharma et al.[97]	20%	80%
Ravikumar et al.[96]	43%	57%
Mohabey et al.[117]	45%	55%
Ramasamy et al.[108]	54.5%	45.5%
Adapureddiet al.[118]	38%	62%

As regards to the side of the fracture, 54.84% had right femoral neck fracture and 45.16%, left. In Sharma et al.'s study, 36% fractures were of left side and 64% were right side.[97]In Ravi Kumar et al.'s study 56.67% were left side fractures and 43.33% were right side fractures.[96]Mohabey et al.'s study had 60% left side and 40% right side fractures.[117]In Adapureddi et al.'s study, left side fractures (65%) were more common than the right.[118]In Rakshith Kumar et alstudy.'s there was a modest left-sided fracture preponderance compared to the right.[119]

As is seen commonly in the elderly population, majority at 74.19% had self-fall as the mode of injury, 19.35% had RTA and 6.45% had fall from a height as the mode of injury. Sharma et al. reported that 16% had high energy trauma and 84% had low energy trauma in their study.[97]Similar mode of injury was seen in Ravi Kumar et al.'s study with 90% have slip and fall injury and 10% RTA.[96]As stated above, 97.5% of the patients in Mohabey et al research.'s suffered minor trauma, with the majority of them slipping and falling on level ground or in bathrooms and being unable to walk or stand as a result. Road traffic collision only included one patient.[117]Likewise, Adapureddi et al.'s study also reported 70% of injuries sustained through trivial injuries.[118]In the senior population, when impaired eyesight and a lack of neuromuscular rhythm are issues, this is a fairly prevalent occurrence. RakshithKumar et al. also reported 70% of injuries in their study population were due to accidental tripping and falling with low energy trauma and 30% had RTA.[119]

Table 27: Mode of injury across studies:

Study	Low-energy trauma	RTA	High energy trauma
Current study	74.19%	19.35%	6.45%
Sharma et al.[97]	84%	NA	16%
Ravi Kumar et al.[96]	90%	10%	NA
Mohabey et al.[117]	97.5%	2.5%	NA
Adapureddi et al.[118]	70%	NA	30%
Rakshith Kumar et al.[119]	70%	30%	NA

NA: not available

Garden type 3 and 4 fractures are seen in our study population, with 45.16% having type 3 and 54.84% with Garden's type 4. In Sharma et al.'s study, majority had Garden type 4 fracture, followed by 40% with type 2 fracture, and 2% had type 1.[97]

On analysis of presentation to the ED after injury, 58.06% presented within 24 hours of the injury, 38.71% in the 24-48 hours period and 3.23% took more than 48 hours to be seen in the hospital. Majority of the patients at 21% took more than week after the injury to present to the hospital in Sharma et al.'s study. Only 8% presented within 24 hours of injury, 12% in the 24-72-hour period and 9% 72 hour to a week.[97] According to Adapureddi et al., 15% of the patients were admitted to the hospital during the first 72 hours to one week and 15% of the patients appeared for treatment one week later and 15% of patients three weeks later.[118]In our country, it is a frequent occurrence for patients to delay the hospital visit resulting in a challenging post-operative rehabilitation course.

Assessment of functional score is done using the HHS and at first month follow up, 22.58% had fair functional score and 77.42% had poor functional score. At 3rd month follow up, 19.35% had excellent functional score, 64.52% had good and 16.13% had fair functional score. At 6th month follow up, 38.71% had excellent score, 58.06% had good score and 3.23% had fair functional score. Our findings are comparable with that of Sharma et al.[97], Adapureddi et al.[118] and Ramasamy et al.[108] and Rakshith Kumar et al.[119]In Sharma et al. study, mean Harris hip score at 12 months was found to be 85.83 7.54, with 42.50% receiving an outstanding score, 37.50% a good score, 12.50% a fair score, and 7.50% a bad outcomes. According to their study, which supported ours, older patients with fractures of the femoral neck who underwent cemented BHA saw satisfactory outcomes in terms of pain-free movements, movement range, and return of normal daily activities.[97]At the final followup of 6 months, the mean Harris hip score in Ravikumar et al.'s study was 88 points with excellent outcomes were observed, in 70% subjects,good in 20% subjects, fair in 10% and poor in 0% subjects.[96]In the research by Adapureddi et al., Harris Hip Score at 1 year of follow-up was averaged to 85.68, with a max score of 93 and a lowest of 65.8. So, overall 35% of people had excellent outcome, 45% got good, 10% got fair, and 10% got poor outcomes.[118]The total HHS at the end of 1 year ranged from 55 - 97 in Ramasamy et al.'s study, 40% had excellent Harris hip scores, 45% good, 7.5% fair, and 7.5% poor.[108]At the last1 year follow up assessment with HHS, 30% achieved 'Excellent' outcomes, 45% achieved 'Good', 10% achieved 'fair' and 15% achieved 'poor' outcomes in Rakshith Kumar et al.'s study.[119]

Table 28: Harris hip functional score across studies:

Study	Excellent	Good	Fair	Poor
Current study	38.71%	58.06%	3.23%	0
Sharma et al.[97]	42.40%	37.50%	12.50%	7.50%
Ravikumar et al.[96]	70%	20%	10%	0
Mohabey et al.[117]	15.79%	52.63%	26.32%	5.26%
Adapureddi et al.[118]	35%	45%	10%	10%
Ramasamy et al.[108]	40%	45%	7.5%	7.5%
RakshithKumar et al.[119]	30%	45%	10%	15%

At first month review, the radiological score was excellent for 41.94% and good for the rest 58.06%. It remained the same at the 3rd month and 6th month follow ups. In the research by Sharma et al., there was no evidence of painful stem loosening, acetabular erosion, protrusion acetabuli, or secondary OA during the study.[97] Ravikumar et al. reported no cases of infection, no cases of hip dislocation, no evidence of Heterotropic Ossification, Stem subsidence, Sciatic nerve palsy, in any of the patients during the follow up period.[96] Adapureddi et al. found no late postoperative complications like erosion, dislocation, protrusion acetabuli, secondary osteoarthritis, loosening, or periprosthetic fracture in their study.[118] There were 5% with a radiolucent zone >2 mm around the prosthesis stem in Ramasamy et al.'s study at one-year radiological follow up. Subsidence of prosthesis> 5 mm in 2.5%. 22.5% of patients had limb length shortening.[108]

At 6th month follow up, 83.87% complained of mild pain and 16.13% had moderate pain. Upon gait analysis at 6th month follow up, 22.58% walked with no limp, 70.97% had a mild limp and 6.45% had moderate limp. On assessing the ability of climb stairs, 64.52% are able to climb stairs with support, 25.81% without support and 9.68% are unable to climb stairs at 6th month follow up. At 6th month follow up, majority at 67.74% are able to easily put on shoes and 32.26% still had difficulty wearing shoes. Majority of the study population, 83.87% had the ability to sit on a chair comfortably for an hour and more while 16.13% are able to sit for less than half an hour in a chair at 6th month follow up. Upon assessment of walking distance, 6.45% are able to walk long distances, 80.65% could walk up to a kilometer and 12.90% could walk less than 500 m at final follow up. By the end of six months, 87.09% required no walker support and 12.90% needed walker support for ambulation. In the research by Ravikumar et al., the majority of patients were able to do daily living activities on their own and needed little assistance from others at the end of 6 months. Additionally, 90% of patients had recovered to their prior functional state.[96] No significant statistical difference between cemented and uncemented groups in Mohabey et al. evaluation of limp (P = 0.088), capacity to walk (P = 0.439), or usage of walking aids (P = 0.270).[117]Adapureddi et alstudy.'s found that of all study participants evaluated with regard to their satisfaction following the operation and capacity to resume their pre-injury level of function, 35% were extremely satisfied,50% were somewhat satisfied, and 15% were not satisfied.Harris Hip Score, an objective measurement, and the degree of satisfaction, a subjective rating, did not correspond well.[118]Most of the participants in Ramasamy et al.'s study had a reduced hospital stay, reduced pain, no major limp, immediate mobilization, quick return to pre-injury level, and a higher quality of life.[108]Rakshith Kumar et al. reported 35% of their study population had a very satisfied result with regards return to pre-fracture levels of activity, 50% had fairly satisfied result and 15% were not satisfied with the procedure.[119]

The primary hypothesis of the current study is that bipolar prosthesis with its additional artificial articulation between the two components offers better stability and functions of the hip, and the cemented prosthesis helps in reduction of pain and improves mobility. Modularity of prosthesis has the advantage of allowing for change in sizes of prosthesis, which aids in maintaining limb length offset and soft tissue tension while also achieving the same anatomy and biomechanics as a hip joint. Upon 6 month follow up after cemented modular bipolar hemiarthroplasty via posterior approach, 38.71% had excellent functional score, 58.06% had good score and 3.23% had fair functional score. Our study demonstrates that modular bipolar cemented hemiarthroplasty gives good functional and radiological outcome in geriatric patients with neck of femur fracture. This is in line with Sharma et al. study, which found that cemented bipolar hemiarthroplasty offers positive outcomes in terms of movement range, painless motions, return to day to day activities, and independent activities in older individuals with neck of femur fracture while taking the complication rates into consideration.[97]Ravikumar et al. attributed the average results from their study to agerelated preoperative constraints in movements and articular surface degeneration involving acetabulum.They concluded that Modular cemented Bipolar Hemiarthroplaty as a management option demonstrated good to excellent outcomes functionally with reduced complications in patients with these fractures.[96]Mohabey et al. found no significant statistical difference (P = 0.589) in the functional outcome between the cemented and uncemented groups. They concluded that both cemented HA and uncemented HA are equally good in managing proximal femoral fractures in older age groups.[117]Overall, it was seen that 80% of the patients had an excellent or good result in Adapureddi et al.'s study. The final functional outcomes, according to them, rely on the patient's age, any related comorbidities, and the best postoperative rehabilitation. Despite not being part of their study, they stated that their observations with modular bipolar implants were noticeably superior to those using Austin Moore's devices.[118]Ramasamy et al. stated that 92.5% of the patients were classified as having a satisfactory to excellent result, and 7.5% of the patients had a poor result in their study. They came to the conclusion that bipolar hemiarthroplasty is an effective treatment for proximal neck of femur fractures in the elderly population based on their research.[108]Overall,75% of the participants had an excellent or good outcome in Rakshith Kumar et al.'s study.

CONCLUSION

CONCLUSION

Garden stages 3 and 4 stage fractures are treated with modular bipolar cemented hemiarthroplasty which resulted in excellent radiological score in 41.94% and good in the rest at first month follow-up. It remained the same at the 3rd month and 6th month follow ups. We noticed gradual improvement in the functional score as per Harris hip score through subsequent follow ups. At 6th month follow up, among those with excellent radiological score, there is good improvement in the functional score too with 46.15% having excellent functional score and 53.85% had good functional score. Among those with good radiological score, at 6th month follow up, 33.33% had excellent functional score, 61.11% had good functional score and 5.56% had fair functional score. Our study demonstrates that modular bipolar cemented hemiarthroplasty gives good functional and radiological outcome in elderly patients with femoral neck fractures.

Limitations and recommendations:

Limited sample size and non availability of extended follow up in this study pose limitations. Due to very short followup, we could not remark on acetabular erosion in thelong-term. Further investigation of long-term effects of cemented modular bipolar hemiarthroplasty in a larger sample size is required. Harris Hip Score was employed in our study to assess the functional outcomes. It is advised to use extra ratings when evaluating the functional result

SUMMARY

SUMMARY

Elderly individuals who have femoral neck fractures can suffer catastrophic injuries that need both medical and surgical care and are extremely difficult for orthopaedic surgeons to cure. About half of all hip fractures involve femoral neck, and the majority of these instances involve older people following simple, low-impact falls. This is a prospective study on patients admitted in Orthopaedics Ward at R L Jalappa Hospital treated surgically with cemented modular bipolar hemiarthroplasty via posterior approach to evaluate the functional and radiological outcome by assessing with Harris hip score. Majority of the patients in our study are at 64.52% are aged between 60-70 years, followed by 22.58% aged between 70-80 years, and 12.9% aged > 80 years. Garden stages 3 and 4 are the stages seen in our study population, with 45.16% having stage 3 and 54.84% with Garden's stage 4. At 6th month follow up, on assessment of Harris Hip score, 38.71% had excellent score, 58.06% had good score and 3.23% had fair functional score.At first month analysis, the radiological score was seen to be excellent in 41.94% and was good in the rest 58.06%. It remained the same at the 3rd month and 6th month follow ups. For femoral neck fractures, cemented modular bipolar hemiarthroplasty offers a higher range of motion, pain relief, and a quicker return to independent activity with a manageable complication rate. The system's value lies in its modularity, which is made possible by its variously sized stems and neck, as well as in how easily it can be transformed into a total hiparthroplasty without requiring the replacement of the femoral stem.

BIBLIOGRAPHY

REFERENCES

1. Lizaur-Utrilla A, Serna-Berna R, Lopez-Prats FA, Gil-Guillen V. Early rehospitalization after hip fracture in elderly patients: risk factors and prognosis. Arch Orthop Trauma Surg. 2015;135(12):1663-1667.
2. Patel K V., Brennan KL, Brennan ML, Jupiter DC, Shar A, Davis ML. Association of a Modified Frailty Index With Mortality After Femoral Neck Fracture in Patients Aged 60 Years and Older. Clin OrthopRelat Res. 2014;472(3):1010-1017.
3. Erickson BJ, Nwachukwu BU, Kiriakopoulos E, Frank RM, Levine B, Villarroel L, et al. In-hospital Mortality Risk for Femoral Neck Fractures Among Patients Receiving Medicare. Orthopedics. 2015;38(7).
4. Miller CP, Buerba RA, Leslie MP. Preoperative Factors and Early Complications Associated With Hemiarthroplasty and Total Hip Arthroplasty for Displaced Femoral Neck Fractures. GeriatrOrthop Surg Rehabil. 2014;5(2):73-81.
5. Maceroli MA, Nikkel LE, Mahmood B, Elfar JC. Operative Mortality After Arthroplasty for Femoral Neck Fracture and Hospital Volume. GeriatrOrthop Surg Rehabil. 2015;6(4):239-245.
6. Florschutz A V., Langford JR, Haidukewych GJ, Koval KJ. Femoral Neck Fractures. J Orthop Trauma. 2015;29(3):121-129.
7. Keating J, Grant A, Masson M, Scott N, Forbes J. Displaced intracapsular hip fractures in fit, older people: a randomised comparison of reduction and fixation, bipolar hemiarthroplasty and total hip arthroplasty. Health Technol Assess (Rockv). 2005;9(41).
8. Ravikumar KJ, Marsh G. Internal fixation versus hemiarthroplasty versus total hip arthroplasty for displaced subcapital fractures of femur — 13 year results of a prospective randomised study. Injury. 2000;31(10):793-797.

9. Giliberty RP. Hemiarthroplasty of the hip using a low-friction bipolar endoprosthesis. Clin OrthopRelat Res. 1983;(175):86-92.

10. Veronese N, Maggi S. Epidemiology and social costs of hip fracture. Injury. 2018;49(8):1458-1460.

11. Dyer SM, Crotty M, Fairhall N, Magaziner J, Beaupre LA, Cameron ID, et al. A critical review of the long-term disability outcomes following hip fracture. BMC Geriatr. 2016;16(1):158.

12. Bhattacharyya T, Koval KJ. Unipolar Versus Bipolar Hemiarthroplasty for Femoral Neck Fractures: Is There a Difference? J Orthop Trauma. 2009;23(6):426-427.

13. Gilbert MS, Capozzi J. Unipolar or Bipolar Prosthesis for the Displaced Intracapsular Hip Fracture? Clin OrthopRelat Res. 1998;353:81-85.

14. Attarian DE. Bipolar arthroplasty for recurrent total hip instability. J South Orthop Assoc. 1999;8(4):249-253.

15. Choy WS, Ahn JH, Ko J-H, Kam BS, Lee D-H. Cementless Bipolar Hemiarthroplasty for Unstable Intertrochanteric Fractures in Elderly Patients. Clin Orthop Surg. 2010;2(4):221.

16. Parker MJ, Gurusamy KS, Azegami S. Arthroplasties (with and without bone cement) for proximal femoral fractures in adults. Cochrane Database Syst Rev. June 16, 2010:(6):CD001706.

17. Khan R, MacDowell A, Crossman P, Datta A, Jallali N, Arch B, et al. Cemented or uncemented hemiarthroplasty for displaced intracapsular femoral neck fractures. Int Orthop. 2002;26(4):229-232.

18. Harris WH. Traumatic Arthritis of the Hip after Dislocation and Acetabular Fractures: Treatment by Mold Arthroplasty: an end-result study using a new method of result evaluation. JBJS. 1969;51(4).

19. Harty M. The Anatomy of the Hip Joint. In: Surgery of the Hip Joint. Springer New York; 1984:45-74.

20. Last RJ. Anatomy, Regional and Applied. Churchill Livingstone; 1984.

21. Gold M, Munjal A, Varacallo M. Anatomy, Bony Pelvis and Lower Limb, Hip Joint.; 2022.

22. Lea &Febiger. Gray's Anatomy. 29th ed; 1973.

23. Burckett-St. Laurant D, Peng P, Girón Arango L, Niazi AU, Chan VWS, Agur A, et al. The Nerves of the Adductor Canal and the Innervation of the Knee. Reg Anesth Pain Med. 2016;41(3):321-327.

24. Glenister R, Sharma S. Anatomy, bony pelvis and lower limb, hip. In: StatPearls [Internet]. StatPearls Publishing; 2021.

25. Bowman KF, Fox J, Sekiya JK. A Clinically Relevant Review of Hip Biomechanics. Arthroscopy: J Bone Jt Surg. 2010;26(8):1118-1129.

26. Sangeux M. Biomechanics of the Hip During Gait. In: The Pediatric and Adolescent Hip. Springer International Publishing; 2019:53-71.

27. Johnston JD, Noble PC, Hurwitz DE, Andriacchi TP. Biomechanics of the hip. The adult hip 2th ed Philadelphia: Lippincott, Williams & Wilkins. 2007:81-90.

28. Martin RB, Burr DB, Sharkey NA, Fyhrie DP. Skeletal Tissue Mechanics. 190. Springer; 1998.

29. Burr DB, Van Gerven DP, Gustav BL. Sexual dimorphism and mechanics of the human hip: A multivariate assessment. Am J Phys Anthropol. 1977;47(2):273-278.

30. Krebs DE, Robbins CE, Lavine L, Mann RW. Hip Biomechanics During Gait. JOrthopSports Physical Therapy. 1998;28(1):51-59.

31. Bergmann G, Deuretzbacher G, Heller M, Graichen F, Rohlmann A, Strauss J, et al. Hip contact forces and gait patterns from routine activities. J Biomech. 2001;34(7):859-871.

32. Cotton DWK, Whitehead CL, Vyas S, Cooper C, Patterson EA. Are hip fractures caused by falling and breaking or breaking and falling? Photoelastic stress analysis. Forensic Sci Int. 1994;65(2):105-112.

33. Kevin Harlan, Ngurah Ronny Kesuma AA, I KomangMahendraLaksana. Cross reference added from Femoral Neck Fracture in Pediatric Patients: A Literature Review. Int J Sci Res. 2021;10(3)1-3

34. Cristofolini L, Juszczyk M, Martelli S, Taddei F, Viceconti M. In vitro replication of spontaneous fractures of the proximal human femur. J Biomech. 2007;40(13):2837-2845.

35. Schileo E, Balistreri L, Grassi L, Cristofolini L, Taddei F. To what extent can linear finite element models of human femora predict failure under stance and fall loading configurations? J Biomech. 2014;47(14):3531-3538.

36. Kazley J, Bagchi K. Femoral Neck Fractures. StatPearls [Internet]; 2022.

37. Gilligan I, Chandraphak S, Mahakkanukrauh P. Femoral neck-shaft angle in humans: variation relating to climate, clothing, lifestyle, sex, age and side. J Anat. 2013;223(2):133-151.

38. Putz R, Simon U, Claes L, Nötzli HP, Wyss TF. FunktionelleAnatomie und Biomechanik. In: AE-Manual Der Endoprothetik. Springer; 2012:21-45.

39. Collin PG, D'Antoni A V., Loukas M, Oskouian RJ, Tubbs RS. Hip fractures in the elderly-A clinical anatomy review. Clin Anatomy. 2017;30(1):89-97.

40. Lu Y, Wang L, Hao Y, Wang Z, Wang M, Ge S. Analysis of trabecular distribution of the proximal femur in patients with fragility fractures. BMC MusculoskeletDisord. 2013;14(1):130.

41. de Bakker PM, Manske SL, Ebacher V, Oxland TR, Cripton PA, Guy P. During sideways falls proximal femur fractures initiate in the superolateral cortex: Evidence from high-speed video of simulated fractures. J Biomech. 2009;42(12):1917-1925.
42. Mears SC, Kates SL. A guide to improving the care of patients with fragility fractures, edition 2. GeriatrOrthop Surg Rehabil. 2015;6(2):58-120.
43. Lee T, Rammohan A V, Chan A, Tan VBC, De S Das, Link TM, et al. The susceptibility of the femoral neck to fracture: An assessment incorporating the effects of age-remodeling and stress reduction. J Biomech. 2012;45(6):931-937.
44. Allen MR, Burr DB. Human femoral neck has less cellular periosteum, and more mineralized periosteum, than femoral diaphyseal bone. Bone. 2005;36(2):311-316.
45. Zhao D, Qiu X, Wang B, Wang Z, Wang W, Ouyang J, et al. Epiphyseal arterial network and inferior retinacular artery seem critical to femoral head perfusion in adults with femoral neck fractures. Clin OrthopRelat Res. 2017;475(8):2011-2023.
46. Bhandari M, Swiontkowski M. Management of Acute Hip Fracture. Solomon CG, ed. New England J Med. 2017;377(21):2053-2062.
47. Calandruccio RA, Anderson 3rd WE. Post-fracture avascular necrosis of the femoral head: correlation of experimental and clinical studies. Clin OrthopRelat Res. 1980;(152):49-84.
48. Beck A, Rüter A. Schenkelhalsfrakturen-Diagnostik und therapeutischesVorgehen. Unfallchirurg. 1998;101(8):634-648.
49. Garden RS. Low-angle fixation in fractures of the femoral neck. J Bone Joint Surg Br. 1961;43(4):647-663.
50. Kazley JM, Banerjee S, Abousayed MM, Rosenbaum AJ. Classifications in Brief: Garden Classification of Femoral Neck Fractures. Clin OrthopRelat Res. 2018;476(2):441-445.

51. Shen M, Wang C, Chen H, Rui Y, Zhao S. An update on the Pauwels classification. J Orthop Surg Res. 2016;11(1):161.

52. Bartoníček J. Pauwels' Classification of Femoral Neck Fractures: Correct Interpretation of the Original. J Orthop Trauma. 2001;15(5):358-360.

53. Kellam JF. eric G. meinberg, julicagel MA, Matthew D. Karan, Craig S. Roberts. Fracture and dislocation classification compendium. J Orthopedic Trauma. 2018;1.

54. Sahoo B, Agrawal A, Kar B, Sakale H, Yadav S, Mittal S. Classification of fracture neck of femur. J Orthop Dis Traumatol. 2018;1(1):5.

55. Ahuja K, Sen S, Dhanwal D. Risk factors and epidemiological profile of hip fractures in Indian population: A case-control study. Osteoporos Sarcopenia. 2017;3(3):138-148.

56. Heaney RP. Bone mass, nutrition, and other lifestyle factors. Nutr Rev. 1996;54(4):S3.

57. Deandrea S, Lucenteforte E, Bravi F, Foschi R, La Vecchia C, Negri E. Risk factors for falls in community-dwelling older people:a systematic review and meta-analysis. Epidemiology. 2010:658-668.

58. Theobald TM, Cauley JA, Gluer CC, Bunker CH, Ukoli FAM, Genant HK. Black-White Differences in Hip Geometry. Osteoporosis Int. 1998;8(1):61-67.

59. Nakamura T, Turner CH, Yoshikawa T, Slemenda CW, Peacock M, Burr DB, et al. Do variations in hip geometry explain differences in hip fracture risk between japanese and white americans? J Bone Miner Res. 2009;9(7):1071-1076.

60. Cummings SR, Melton LJ. Epidemiology and outcomes of osteoporotic fractures. The Lancet. 2002;359(9319):1761-1767.

61. Moulton L, Green N, Sudahar T, Makwana N, Whittaker J. Outcome after conservatively managed intracapsular fractures of the femoral neck.Ann R Coll Surg Engl. 2015;97(4):279-282.

62. Zazirnyi IM, O. Kostrub. Current Management of Femoral Neck Fractures (Literature Review)." VisnykOrtopediiTravmatologiiProtezuvannia,2021;1(108)68-75

63. Hakkarinen DK, Banh K V., Hendey GW. Magnetic Resonance Imaging Identifies Occult Hip Fractures Missed by 64-slice Computed Tomography. J Emerg Med. 2012;43(2):303-307.

64. Gašpar D, Crnković T, Durović D, Podsednik D, Slišurić F. AO group, AO subgroup, Garden and Pauwels classification systems of femoral neck fractures: are they reliable and reproducible? Med Glas (Zenica). 2012;9(2):243-247.

65. Magaziner J, Hawkes W, Hebel JR, Zimmerman SI, Fox KM, Dolan M, et al. Recovery From Hip Fracture in Eight Areas of Function. J GerontolA Biol Sci Med Sci. 2000;55(9):M498-M507.

66. Macaulay W, Pagnotto MR, Iorio R, Mont MA, Saleh KJ. Displaced Femoral Neck Fractures in the Elderly: Hemiarthroplasty Versus Total Hip Arthroplasty. J Am AcadOrthop Surg. 2006;14(5):287-293.

67. Zlowodzki M, Tornetta 3rd P, Haidukewych G, Hanson BP, Petrisor B, Swiontkowski MF, et al. Femoral neck fractures: evidence versus beliefs about predictors of outcome. Orthopedics. 2009;32(4):285-292.

68. LFB Raaymakers E. The non-operative treatment of impacted femoral neck fractures. Injury. 2002;33:8-14.

69. Braun KF, Hanschen M, Biberthaler P. Frakturendoprothetik der medialenSchenkelhalsfraktur. Unfallchirurg. 2016;119(4):331-345.

70. Bucholz Robert W. James D. Heckman Charles M. Court-Brown Charles A. Fractures in adults. 6th ed. Philadelphia. Lippincott Williams & Wilkins. 1996.

71. Moore AT, Bohlman HR. Metal hip joint. A case report. JBJS. 1943;25(3):688-692.

72. Thompson FR. Two and a half years' experience with a vitallium intramedullary hip prosthesis. J Bone Joint Surg Am. 1954;36-A(3):489-502.

73. Moore AT. The self-locking metal hip prosthesis. J Bone Joint Surg Am. 1957;39-A(4):811-827.

74. Steinberg DR, Steinberg ME. The Early History of Arthroplasty in the United States. Clin OrthopRelat Res. 2000;374:55-89.

75. Bateman JE. Single-assembly total hip prosthesis--preliminary report. 1974. Clin OrthopRelat Res. 1990;(251):3-6.

76. Sullivan NPT, Hughes AW, Halliday RL, Ward AL, Chesser TJS. Early Complications Following Cemented Modular Hip Hemiarthroplasty. Open Orthop J. 2015;9(1):15-19.

77. Rai AK, Agarwal R, Singh S, Ratan R. The BHU bicentric bipolar prosthesis in fracture neck femur in active elderly. J Trauma Manag Outcomes. 2008;2(1):7.

78. Lausten GS, Vedel P. The Monk hard-top endoprosthesis for intracapsular fractures of the femoral neck. Injury. 1981;13(3):233-238.

79. Naser MA, Pathak R, Ahmad A. Superiority of fixed stem bipolar prosthesis over Austin Moore prosthetic in fracture neck femur. Int J Res Orthop. 2018;4(4):577.

80. Hedbeck CJ, Blomfeldt R, Lapidus G, Törnkvist H, Ponzer S, Tidermark J. Unipolar hemiarthroplasty versus bipolar hemiarthroplasty in the most elderly patients with displaced femoral neck fractures: a randomised, controlled trial. Int Orthop. 2011;35(11):1703-1711.

81. Raia FJ, Chapman CB, Herrera MF, Schweppe MW, Michelsen CB, Rosenwasser MP. Unipolar or Bipolar Hemiarthroplasty for Femoral Neck Fractures in the Elderly? Clin OrthopRelat Res. 2003;414:259-265.

82. Varley J, Parker MJ. Stability of hip hemiarthroplasties. Int Orthop. 2004;28(5):274-277.

83. Hoppenfeld S, DeBoer P, Buckley R. Surgical Exposures in Orthopaedics: The Anatomic Approach. Lippincott Williams & Wilkins; 2012.

84. Petis S, Howard JL, Lanting BL, Vasarhelyi EM. Surgical approach in primary total hip arthroplasty: anatomy, technique and clinical outcomes. Can J Surg. 2015;58(2):128-139.

85. Cornell CN, Levine D, O'Doherty J, Lyden J. Unipolar versus bipolar hemiarthroplasty for the treatment of femoral neck fractures in the elderly. Clin OrthopRelat Res. 1998;(348):67-71.

86. Inngul C, Hedbeck C-J, Blomfeldt R, Lapidus G, Ponzer S, Enocson A. Unipolar hemiarthroplasty versus bipolar hemiarthroplasty in patients with displaced femoral neck fractures. A four-year follow-up of a randomised controlled trial. Int Orthop. 2013;37(12):2457-2464.

87. Jia Z, Ding F, Wu Y, Li W, Li H, Wang D, et al. Unipolar versus bipolar hemiarthroplasty for displaced femoral neck fractures: a systematic review and meta-analysis of randomized controlled trials. J Orthop Surg Res. 2015;10(1):8.

88. Yang B, Lin X, Yin XM, Wen XZ. Bipolar versus unipolar hemiarthroplasty for displaced femoral neck fractures in the elder patient: a systematic review and meta-analysis of randomized trials. Eur J Orthop Surg. 2015;25(3):425-433.

89. Mak Y-F, Li H-Y-A, Lee Q-J, Wong Y-C. Modular bipolar hemiarthroplasty for fracture neck of femur using contemporary cementing technique: Long-term results of a single design. JOrthop Trauma Rehabil. 2019;26(1):67-73.

90. Khan RJK, MacDowell A, Crossman P, Keene GS. Cemented or uncemented hemiarthroplasty for displaced intracapsular fractures of the hip—a systematic review. Injury. 2002;33(1):13-17.

91. Azegami S, Gurusamy KS, Parker MJ. Cemented versus Uncemented Hemiarthroplasty for Hip Fractures: A Systematic Review of Randomised Controlled Trials. HIP Int. 2011;21(5):509-517.

92. Patil T, Malve S, Dattu V, Upadhay A. Cemented or uncemented bipolar hemiarthroplasty for femoral neck fractures in aged patients. IntJOrthopSci. 2020;6(1):1327-1332.

93. Li T, Zhuang Q, Weng X, Zhou L, Bian Y. Cemented versus Uncemented Hemiarthroplasty for Femoral Neck Fractures in Elderly Patients: A Meta-Analysis. Thiem U, ed. PLoS One. 2013;8(7):e68903.

94. Khan AQ, Mohammad J, Qamar R, Siddiqui YS, Sabir AB, Abbas M. Cemented unipolar or modular bipolar hemiarthroplasty for femoral neck fractures in elderly patients - which is better? Int J Burns Trauma. 2021;11(6):447-455.

95. Phillips T. The Bateman bipolar femoral head replacement. A fluoroscopic study of movement over a four-year period. J Bone Joint Surg Br. 1987;69-B(5):761-764.

96. Ravi Kumar K, Hemanth R, Mohammed Tanzeem P, Prajwal Sadalagi.Functional outcome of Cemented Modular bipolar Hemiarthroplasty in Fracture Neck of Femur. Nat J Clin Orthop 2021;5(2):20-23.

97. Sharma A, Sahu S, Jain BK, Sagar S, Singh J. A prospective study to evaluate the functional outcome in fracture neck femur treated by cemented bipolar hemiarthroplasty in elderly patients. Int J Health Clin Res. 2022;5(2):147-156.

98. Arti H, Khorami M, AghaieAghdam A. Cemented Versus Cementless Hemiarthroplasty in Patients with Displaced Femoral Neck Fractures. Pak J Med Sci. 1969;32(1).

99. Moon KH, Kang JS, Lee TJ, Lee SH, Choi SW, Won MH. Degeneration of Acetabular Articular Cartilage to Bipolar Hemiarthroplasty. Yonsei Med J. 2008;49(5):719.

100. Squires B, Bannister G. Displaced intracapsular neck of femur fractures in mobile independent patients: total hip replacement or hemiarthroplasty? Injury. 1999;30(5):345-348.

101. Barışhan FC, Akesen B, Atıcı T, Durak K, Bilgen MS. Comparison of hemiarthroplasty and total hip arthroplasty in elderly patients with displaced femoral neck fractures. J Int Med Res. 2018;46(7):2717-2730.

102. Shah SA, Kim JY, Cho H-W, Shon W-Y, Kim S-M. A larger sized cup accelerates cartilage erosion of acetabulum after bipolar hemiarthroplasty in elderly with femur neck fracture. Medicine. 2022;101(14):e29081.

103. Venkatesh KN, Arvind KSM, Vinayagamoorthy, SairamakrishnanS.Acetabular erosion after hemiarthroplasty.Int J Res Orthop2018;4:53-7

104. Chhabra DrSS, Gupta DrU, Gupta DrS. Functional outcome of bipolar hemiarthroplasty in fracture neck of femur. International Journal of Orthopaedics Sciences. 2020;6(3):32-36.

105. Ossendorf C, Scheyerer MJ, Wanner GA, Simmen H-P, Werner CM. Treatment of femoral neck fractures in elderly patients over 60 years of age - which is the ideal modality of primary joint replacement? Patient Saf Surg. 2010;4(1):16.

106. Inngul C, Blomfeldt R, Ponzer S, Enocson A. Cemented versus uncemented arthroplasty in patients with a displaced fracture of the femoral neck. Bone Joint J. 2015;97-B(11):1475-1480.

107. Abdelkhalek M, Abdelwahab M, Ali AM. Bipolar versus fixed-head hip arthroplasty for femoral neck fractures in elderly patients. Strategies Trauma Limb Reconstr. 2011;6(1):1-6.

108. Ramasamy V, Nallan R. Functional Outcome of Bipolar Hemiarthroplasty for Proximal Femoral Neck Fractures in Elderly: A Prospective Study. J Orthop Joint Surg. 2022;4(1):22-25.

109. Kumar S, Kumar A, Venkata Bramesh A, Charan Teja K, Abdul Razek M, Kumar R. Outcome of cemented hemiarthroplasty of hip in elderly patients operated for neck of femur fracture. JOrthop Dis Traumat. 2022;5(2):78.

110. Arun KN, Narendra BS, YugandharTalluri. Study of functional outcome of cemented modular Bipolar Hemiarthroplasty in Intracapsular fracture neck femur in elderly. Int J Orthop Sci 2021;7(4):687-691

111. Elmenshawy AF, Salem KH. Cemented versus cementless bipolar hemiarthroplasty for femoral neck fractures in the elderly. EFORT Open Rev. 2021;6(5):380-386.

112. Wang Y, Wang Z, Tian S, Tan Z, Zhu Y, Chen W, et al. Cemented versus uncemented hemiarthroplasty for femoral neck fractures in patients with neuromuscular diseases: a minimum of 2 years' follow-up study. J Orthop Surg Res. 2021;16(1):418.

113. Li L, Zhao X, Yang X, Yang L, Xing F, Tang X. Cemented versus uncemented hemiarthroplasty for the management of femoral neck fractures in the elderly: a meta-analysis and systematic review. Arch Orthop Trauma Surg. 2021;141(6):1043-1055.

114. Singh H, Rudani TS, Gandhi MP, Rampurwala AJ. a. Int J Res Orthop. 2020;6(2):333.

115. RAM, Shenoy R, Pereira J. Outcome of bipolar vs unipolar hemiarthroplasty in elderly: A systematic review. Int J Orthop Sci. 2020;6(3):696-699.

116. Yoo J-I, Cha Y-H, Kim J-T, Park C-H. Clinical Outcomes of Bipolar Hemiarthroplasty versus Total Hip Arthroplasty: Assessing the Potential Impact of Cement Use and Pre-Injury Activity Levels in Elderly Patients with Femoral Neck Fractures. Hip Pelvis. 2019;31(2):63.

117. Mohabey AV, Warjukar PR, Ravikumar M. Functional outcome of cemented versus uncemented modular bipolar hemiarthroplasty in proximal femoral neck fractures. Int J Orthop Sci. 2017;3(4i):609-611.

118. Adapureddi HT, SB K, Kumar A, Paturi SK, Anne S, Reddy JP. Prospective study of management of fracture neck of femur by hemiarthroplasty with cemented bipolar. J Evol Med Dent Sci. 2015;4(98):16309-16314.

119. Rakshith Kumar K, Maheshwarappa. Prospective study of hemiarthroplasty for intracapsular fracture neck of femur using modular bipolar prosthesis. Int J Orthop Sci 2018;4(4):92-95

ANNEXURES

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH,

TAMAKA, KOLAR - 563101.

PROFORMA

Case no:

IP no:

TITLE: "TO EVALUATE RADIOLOGICAL AND FUNCTIONAL OUTCOME OF CEMENTED MODULAR BIPOLAR HEMIARTHROPLASTY IN ELDERLY PATIENTS WITH FEMORAL NECK FRACTURES**"**

- Patient's Name:
- Age:
- Sex:
- Occupation:
- Address:
- Contact no:
- Date of Injury:
- Mode of Injury:
- Date of admission:
- UHID.No:
- Diagnosis: (Garden's classification)
- Treatment given on admission:

- Investigations :

  Complete haemogram ,Blood urea, RBS ,Sr.Creatinine, BT, CT, ECG

Chest X-ray,Plain X-ray AP view of the affected limb

- Associated illness :
- Plan:
- Date of surgery:
- Procedure done:
- Implants used:
- Intra operative complications if any:
- Post operative complications:
- Post operativemobilisation started at:
- Post operative weight bearing started at:
- Partial:
- Full:
- Follow up:
- Evaluated with AP view of pelvis – radiological assessment and harris hip score
- 1st month post op
- 3rd month post op
- 6th month post op
- Timing of examination :
- Method of examination :

RADIOLOGICAL ASSESSMENT :

Timing of assessment :

EXCELLENT No joint space narrowing

No medial migration

No superior migration

No subluxation

No sclerosis

GOOD Joint space narrowing

No medial migration

No superior migration

Subluxation < 1/4th of head

Slight sclerosis

FAIR Complete loss joint space

Migration < 1cm

Subluxation > 1/4th diameter

No dislocation

Moderate pelvic reaction

POOR Complete loss of joint space

Migration > 1 cm

Dislocation

Pelvic discontinuity or severe sclerosis

Harris Hip Score

Pain *(check one)*

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

Limp

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

Support

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

Distance Walked

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

Sitting

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

Enter public transportation

- ☐ Yes (1)
- ☐ No (0)

Stairs

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

Put on Shoes and Socks

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

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

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

Range of Motion (*indicates normal)

Flexion (*140°) ______

Abduction (*40°) ______

Adduction (*40°) ______

External Rotation (*40°) ______

Internal Rotation (*40°) ______

Range of Motion Scale

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

Range of Motion Score __________

Total Harris Hip Score __________

At maximum period of follow up

Radiological assessment:

Harris hip score:

Overall the patient has _______functional outcome

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH,

TAMAKA, KOLAR - 563101.

PATIENT INFORMATION SHEET

STUDY TITLE: "TO EVALUATE RADIOLOGICAL AND FUNCTIONAL OUTCOME OF CEMENTED MODULAR BIPOLAR HEMIARTHROPLASTY IN ELDERLY PATIENTS WITH FEMORAL NECK FRACTURES**"**

Study location: R L Jalappa Hospital and Research Centre attached to Sri Devaraj Urs Medical College, Tamaka, Kolar.

Details- Patients diagnosed with fracture neck of femur admitted in orthopaedics ward from opd and casualty at R.L.J. HOSPITAL AND RESEARCH CENTRE, attached to SRI DEVARAJ URS MEDICAL COLLEGE, TAMAKA, KOLAR

Patients in this study will have to undergo routine Blood Investigations: -CBC, BT, CT, Blood grouping, RBS, RFT,HIV, HBsAg status,.Radiological investigation:Plain x-ray of pelvis with bilateral hip-AP view.

Please read the following information and discuss with your family members. You can ask any question regarding the study. If you agree to participate in the study we will collect information (as per proforma) from you or a person responsible for you or both. Relevant history will be taken. This information collected will be used only for dissertation and publication.

All information collected from you will be kept confidential and will not be disclosed to any outsider. Your identity will not be revealed. This study has been reviewed by the Institutional Ethics Committee and you are free to contact the member of the Institutional Ethics Committee. There is no compulsion to agree to this study. The care you will get will not change if you don't wish to participate. You are required to sign/ provide thumb impression only if you voluntarily agree to participate in this study.

CONFIDENTIALITY

Your medical information will be kept confidential by the study doctor and staff and will not be made publicly available. Your original records may be reviewed by your doctor or ethics review board. For further information/ clarification please contact

Dr. VISHNUDHARAN.N.R (Post Graduate),

Department Of ORTHOPAEDICS,

SDUMC , Kolar

Mobile No: 9965432334

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH,

TAMAKA, KOLAR - 563101

<u>INFORMED CONSENT FORM</u>

<u>Case no</u>:

<u>IP no</u>:

TITLE: "TO EVALUATE RADIOLOGICAL AND FUNCTIONAL OUTCOME OF CEMENTED MODULAR BIPOLAR HEMIARTHROPLASTY IN ELDERLY PATIENTS WITH FEMORAL NECK FRACTURES**"**

I, ____ aged _____________ ,after being explained in my own vernacular language about the purpose of the study and the risks and complications of the procedure, hereby give my valid written informed consent without any force or prejudice cemented modular bipolar hemiarthroplasty in elderly patients with femoral neck fractures which is a surgical procedure to be performed on me. The nature and risks involved in the procedure have been explained to me to my satisfaction.

I have been explained in detail about the Clinical Research on "TO EVALUATE RADIOLOGICAL AND FUNCTIONAL OUTCOME OF CEMENTED MODULAR BIPOLAR HEMIARTHROPLASTY IN ELDERLY PATIENTS WITH FEMORAL NECK FRACTURES" being conducted. *I have read the patient information sheet and I have had the opportunity to ask any question. Any question that I have asked, have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.* I hereby give consent to provide my history, undergo physical examination, undergo the operative procedure, undergo investigations and provide its results and documents etc to the doctor / institute etc.

For academic and scientific purpose the operation / procedure, etc may be video graphed or photographed. All the data may be published or used for any academic purpose. I will not hold the doctors / institute etc responsible for any untoward consequences during the procedure / study.

A copy of this Informed Consent Form and Patient Information Sheet has been provided to the participant.

Signature/Thumb impression & Name of patient Signature & Name of Pt. Attender

Relation with patient:

Witness:

Signature & Name of Research person /doctor:

ರೋಗಿ ಮಾಹಿತಿ ಹಾಳೆ

ಅಧ್ಯಯನ ಶೀರ್ಷಿಕೆ: " ಮೌಲ್ಯಮಾಪನ ಮಾಡಲು ರೇಡಿಯೊಲಾಜಿಕಲ್ ಮತ್ತು ಕ್ರಿಯಾತ್ಮಕ ಕಾರ್ಯವನ್ನು ಮೌಲ್ಯಮಾಪನ ಮಾಡಲು ಹಿರಿಯರಲ್ಲಿ ಸಿಮೆಂಟೆಡ್ ಮಾಡ್ಯುಲರ್ ಬೈಪೋಲಾರ್ ಹೆಮಿಯಾರ್ತ್ರೋಪ್ಲ್ಯಾಸ್ಟಿ ತೊಡೆಯ ಮೂಳೆಯ ಕುತ್ತಿಗೆಯ ಮುರಿತಕ್ಕೆ ರೋಗಿಗಳಿಗೆ"

ಅಧ್ಯಯನ ಸ್ಥಳ: ಆರ್.ಎಲ್.ಜಾಲಪ್ಪ ಆಸ್ಪತ್ರೆ ಮತ್ತು ಸಂಶೋಧನಾ ಕೇಂದ್ರ, ಕೋಲಾರದ , ಟಮಕ, ಶ್ರೀ ದೇವರಾಜ ಅರಸು ವೈದ್ಯಕೀಯ ಕಾಲೇಜಿಗೆ ಹೊಂದಿಕೊಂಡಿದೆ.

ವಿವರ- ಮೂಳೆ ಚಿಕಿತ್ಸೆ ವಾರ್ಡ್ ನಲ್ಲಿ ಒಪಿಡಿ ಯಿಂದ ದಾಖಲಾದ ಮೂಳೆ ಮುರಿತದಿಂದ ಬಳಲುತ್ತಿರುವ ರೋಗಿಗಳು, ಕೋಲಾರದ ಶ್ರೀ ದೇವರಾಜ ಅರಸು ವೈದ್ಯಕೀಯ ಕಾಲೇಜಿಗೆ ಹೊಂದಿಕೊಂಡಿರುವ ಆ ಆರ್.ಎಲ್.ಜಾಲಪ್ಪ ಆಸ್ಪತ್ರೆ.

ಈ ಅಧ್ಯಯನದ ರೋಗಿಗಳು ದಿನನಿತ್ಯದ ರಕ್ತ ತನಿಖೆಗೆ ಒಳಗಾಗಬೇಕಾಗುತ್ತದೆ: -ಸಿಬಿಸಿ, ಬಿಟಿ, ಸಿಟಿ, ಬ್ಲಡ್ ಗ್ರೂಪಿಂಗ್, ಆರ್ಬಿಎಸ್, ಆರ್ಎಫ್ಟಿ, ಎಚ್ಐವಿ, ಎಚ್ಬಿಎಸ್ಎಜಿ ಸ್ಥಿತಿ, .ವೈದ್ಯಕೀಯ ತನಿಖೆ: ಒಳಗೊಂಡಿರುವ ಹಿಪ್ ಜಂಟಿ-ಎಪಿ ಮತ್ತು ಪಾರ್ಶ್ವ ವೀಕ್ಷಣೆಗಳ ಸರಳ ಎಕ್ಸರೆ.

ದಯವಿಟ್ಟು ಈ ಕೆಳಗಿನ ಮಾಹಿತಿಯನ್ನು ಓದಿ ಮತ್ತು ನಿಮ್ಮ ಕುಟುಂಬ ಸದಸ್ಯರೊಂದಿಗೆ ಚರ್ಚಿಸಿ. ಅಧ್ಯಯನಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ನೀವು ಯಾವುದೇ ಪ್ರಶ್ನೆಯನ್ನು ಕೇಳಬಹುದು. ನೀವು ಅಧ್ಯಯನದಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳಲು ಒಪ್ಪಿದರೆ, ನಾವು ನಿಮ್ಮಿಂದ ಅಥವಾ ನಿಮಗೆ ಅಥವಾ ಎರಡಕ್ಕೂ ಜವಾಬ್ದಾರರಾಗಿರುವ ವ್ಯಕ್ತಿಯಿಂದ (ಪ್ರೊಫೋರ್ಮಾ ಪ್ರಕಾರ) ಮಾಹಿತಿಯನ್ನು ಸಂಗ್ರಹಿಸುತ್ತೇವೆ. ಸಂಬಂಧಪಟ್ಟ ಇತಿಹಾಸವನ್ನು ತೆಗೆದುಕೊಳ್ಳಲಾಗುವುದು. ಸಂಗ್ರಹಿಸಿದ ಮಾಹಿತಿಯನ್ನು ಕೇವಲ ಲೇಖನ ಮತ್ತು ಪ್ರಕಟಣೆಗಾಗಿ ಮಾತ್ರ ಬಳಸಲಾಗುತ್ತದೆ.

ನಿಮ್ಮಿಂದ ಸಂಗ್ರಹಿಸಿದ ಎಲ್ಲಾ ಮಾಹಿತಿಯನ್ನು ಗೌಪ್ಯವಾಗಿಇಡಲಾಗುತ್ತದೆ ಮತ್ತು ಯಾವುದೇ ಹೊರಗಿನವರಿಗೆ ಬಹಿರಂಗಪಡಿಸಲಾಗುವುದಿಲ್ಲ. ನಿಮ್ಮ ಗುರುತನ್ನು ಬಹಿರಂಗಪಡಿಸುವುದಿಲ್ಲ. ಈ ಅಧ್ಯಯನವನ್ನು ಸಾಂಸ್ಥಿಕ ನೀತಿ ಶಾಸ್ತ್ರ ಸಮಿತಿ ಪರಿಶೀಲಿಸಿದೆ ಮತ್ತು ಸಾಂಸ್ಥಿಕ ನೈತಿಕತೆ ಸಮಿತಿಯ ಸದಸ್ಯರನ್ನು ಸಂಪರ್ಕಿಸಲು ನೀವು ಸ್ವತಂತ್ರರು. ಈ ಅಧ್ಯಯನವನ್ನು ಒಪ್ಪಲು ಯಾವುದೇ ಒತ್ತಾಯವಿಲ್ಲ. ನೀವು ಭಾಗವಹಿಸಲು ಬಯಸದಿದ್ದರೆ, ನೀವು ಪಡೆಯುವ ಆರೈಕೆಯು ಬದಲಾಗುವುದಿಲ್ಲ. ನೀವು ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ಸ್ವಇಚ್ಛೆಯಿಂದ ಒಪ್ಪಿಕೊಂಡರೆ ಮಾತ್ರ ನೀವು ಸಹಿ ಮಾಡಬೇಕು/ ಹೆಬ್ಬೆಟ್ಟು ಗುರುತು ನೀಡಬೇಕು.

ಗೋಪ್ಯತೆ
ನಿಮ್ಮ ವೈದ್ಯಕೀಯ ಮಾಹಿತಿಯನ್ನು ಅಧ್ಯಯನ ವೈದ್ಯರು ಮತ್ತು ಸಿಬ್ಬಂದಿ ಗೌಪ್ಯವಾಗಿಡುತ್ತಾರೆ ಮತ್ತು ಸಾರ್ವಜನಿಕವಾಗಿ ಲಭ್ಯವಾಗುವುದಿಲ್ಲ. ನಿಮ್ಮ ಮೂಲ ದಾಖಲೆಗಳನ್ನು ನಿಮ್ಮ ವೈದ್ಯರು ಅಥವಾ ನೀತಿ ಪರಿಶೀಲನಾ ಮಂಡಳಿಪರಿಶೀಲಿಸಬಹುದು. ಹೆಚ್ಚಿನ ಮಾಹಿತಿಗಾಗಿ/ ಸ್ಪಷ್ಟನೆಗಾಗಿ ದಯವಿಟ್ಟು ಸಂಪರ್ಕಿಸಿ

ಡಾ.ವಿಷ್ಣುಧರನ್ ಎನ್.ಆರ್ (ಸ್ನಾತಕೋತ್ತರ), .
ಮೂಳೆ ಚಿಕಿತ್ಸೆ ಇಲಾಖೆ
ಎಸ್ ಡಿಯುಎಂಸಿ (ಕೋಲಾರ) .
ಮೊಬೈಲ್ ಸಂಖ್ಯೆ: 9965432334

ಮಾಹಿತಿಯುತ ಸಮ್ಮತಿ ನಮೂನೆ

ಪ್ರಕರಣ ಸಂಖ್ಯೆ:

IP ಇಲ್ಲ:

ಶೀರ್ಷಿಕೆ:

"ಫೆಮೋರಲ್ ಕುತ್ತಿಗೆ ಯ ಮೂಳೆಮುರಿತಗಳನ್ನು ಹೊಂದಿರುವ ವಯಸ್ಸಾದ ರೋಗಿಗಳಲ್ಲಿ ಸಿಮೆಂಟೆಡ್ ಮಾಡ್ಯೂಲರ್ ಬೈಪೋಲಾರ್ ಹೆಮಿಆರ್ಥ್ರೋಪ್ಲಾಸ್ಟಿಯ ವಿಕಿರಣಶಾಸ್ತ್ರೀಯ ಮತ್ತು ಕ್ರಿಯಾತ್ಮಕ ಫಲಿತಾಂಶವನ್ನು ಮೌಲ್ಯಮಾಪನ ಮಾಡಲು
ನಾನು, ____ ಅಧ್ಯಯನದ ಉದ್ದೇಶ ಮತ್ತು ಕಾರ್ಯವಿಧಾನದ ಅಪಾಯಗಳು ಮತ್ತು ತೊಡಕುಗಳ ಬಗ್ಗೆ ನನ್ನ ಸ್ವಂತ ಸ್ಥಳೀಯ ಭಾಷೆಯಲ್ಲಿ ವಿವರಿಸಿದ ನಂತರ, ಯಾವುದೇ ಬಲ ಅಥವಾ ಪೂರ್ವಾಗ್ರಹವಿಲ್ಲದೆ ನನ್ನ ಮಾನ್ಯ ಲಿಖಿತ ತಿಳುವಳಿಕೆಯುಳ್ಳ ಒಪ್ಪಿಗೆಯನ್ನು ನೀಡಿ, ವಯಸ್ಸಾದ ರೋಗಿಗಳಲ್ಲಿ ತೊಡೆಯೆಲುಬಿನ ಕುತ್ತಿಗೆ ಮುರಿತ ಹೊಂದಿರುವ ಶಸ್ತ್ರಚಿಕಿತ್ಸಕ ನನ್ನ ಮೇಲೆ ಮಾಡಬೇಕಾದ ಕಾರ್ಯವಿಧಾನ. ಕಾರ್ಯವಿಧಾನದಲ್ಲಿ ಒಳಗೊಂಡಿರುವ ಸ್ವರೂಪ ಮತ್ತು ಅಪಾಯಗಳನ್ನು ನನ್ನ ತೃಪ್ತಿಗೆ ವಿವರಿಸಲಾಗಿದೆ.
ಕ್ಲಿನಿಕಲ್ ರಿಸರ್ಚ್ ಬಗ್ಗೆ " ಮೌಲ್ಯಮಾಪನ ಮಾಡಲು ರೇಡಿಯೊಲಾಜಿಕಲ್ ಮತ್ತು ಕ್ರಿಯಾತ್ಮಕ ಕಾರ್ಯವನ್ನು ಮೌಲ್ಯಮಾಪನ ಮಾಡಲು ಹಿರಿಯರಲ್ಲಿ ಸಿಮೆಂಟೆಡ್ ಮಾಡ್ಯುಲರ್ ಬೈಪೋಲಾರ್ ಹೆಮಿಯಾತ್ರೋರ್ಪ್ಲ್ಯಾಸ್ಟಿ ತೊಡೆಯ ಮೂಳೆಯ ಕುತ್ತಿಗೆಯ ಮುರಿತಕ್ಕೆ ರೋಗಿಗಳಿಗೆ ಮೌಲ್ಯಮಾಪನ ಮಾಡಲು" ವಿವರವಾಗಿ ವಿವರಿಸಲಾಗಿದೆ.

ನಾನು ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆಯನ್ನು ಓದಿದ್ದೇನೆ ಮತ್ತು ನನಗೆ ಯಾವುದೇ ಪ್ರಶ್ನೆ ಕೇಳಲು ಅವಕಾಶ ಇದೆ. ನಾನು ಕೇಳಿದ ಯಾವುದೇ ಪ್ರಶ್ನೆಗೆ ನನ್ನ ತೃಪ್ತಿಗೆ ಉತ್ತರ ಸಿಕ್ಕಿದೆ. ಈ ಸಂಶೋಧನೆಯಲ್ಲಿ ಭಾಗವಹಿಸುವಂತೆ ನಾನು ಸ್ವಯಂಪ್ರೇರಿತವಾಗಿ ಸಮ್ಮತಿಸುತ್ತೇನೆ. ನನ್ನ ಇತಿಹಾಸವನ್ನು ಒದಗಿಸಲು, ದೈಹಿಕ ಪರೀಕ್ಷೆಗೆ ಒಳಪಡಿ, ಶಸ್ತ್ರಚಿಕಿತ್ಸೆ ಗೆ ಒಳಗಾಗುವುದು, ತನಿಖೆಗಳನ್ನು ನಡೆಸಲು ಮತ್ತು ಅದರ ಫಲಿತಾಂಶಗಳು ಮತ್ತು ದಾಖಲೆಗಳನ್ನು ವೈದ್ಯರು/ ಸಂಸ್ಥೆಗೆ ಒದಗಿಸಲು ನಾನು ಈ ಮೂಲಕ ಸಮ್ಮತಿ ನೀಡುತ್ತೇನೆ.
ಶೈಕ್ಷಣಿಕ ಮತ್ತು ವೈಜ್ಞಾನಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಕಾರ್ಯಾಚರಣೆ / ಕಾರ್ಯವಿಧಾನ, ಇತ್ಯಾದಿಗಳನ್ನು ವೀಡಿಯೊ ಗ್ರಾಫ್ ಅಥವಾ ಛಾಯಾಚಿತ್ರ ಮಾಡಬಹುದು. ಎಲ್ಲಾ ದತ್ತಾಂಶಗಳನ್ನು ಪ್ರಕಟಿಸಬಹುದು ಅಥವಾ ಯಾವುದೇ ಶೈಕ್ಷಣಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಬಳಸಬಹುದು. ಕಾರ್ಯವಿಧಾನ / ಅಧ್ಯಯನದ ಸಮಯದಲ್ಲಿ ಯಾವುದೇ ಅಹಿತಕರ ಪರಿಣಾಮಗಳಿಗೆ ನಾನು ವೈದ್ಯರು / ಸಂಸ್ಥೆ ಇತ್ಯಾದಿಗಳನ್ನು ಜವಾಬ್ದಾರರನ್ನಾಗಿ ಮಾಡುವುದಿಲ್ಲ.
ಈ ಮಾಹಿತಿಯುತ ಸಮ್ಮತಿ ನಮೂನೆ ಮತ್ತು ರೋಗಿಯ ಮಾಹಿತಿ ಹಾಳೆಯ ಒಂದು ಪ್ರತಿಯನ್ನು ಸ್ಪರ್ಧಿಗೆ ಒದಗಿಸಲಾಗಿದೆ.

ಸಹಿ/ಹೆಬ್ಬೆರಳ ಗುರುತು & ರೋಗಿಯ ಹೆಸರು & Pt. ಅಟೆಂಡೆಂಟ್ ನ ಹೆಸರು

ರೋಗಿಯೊಂದಿಗಿನ ಸಂಬಂಧ:

ಸಾಕ್ಷಿ:

ಸಹಿ & ಸಂಶೋಧನಾ ವ್ಯಕ್ತಿಯ ಹೆಸರು /ವೈದ್ಯರ ಹೆಸರು:

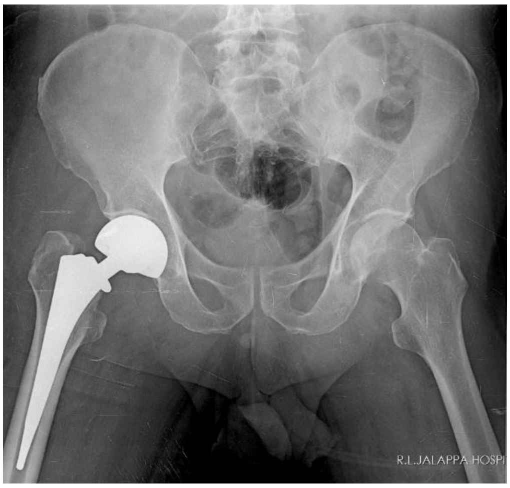
X-RAYS

CASE 14 XRAYS

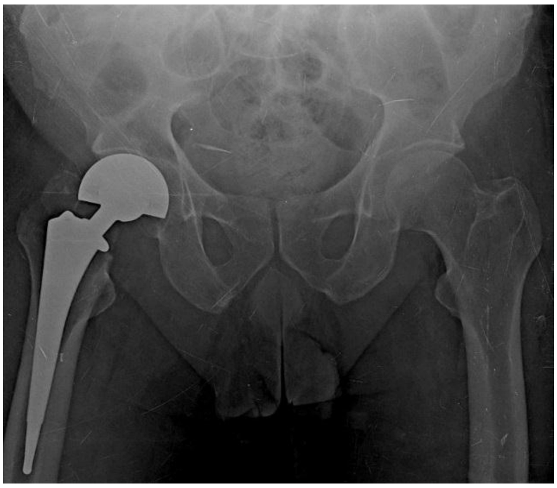
PRE OP

1ST MONTH

3RD MONTH



6TH MONTH

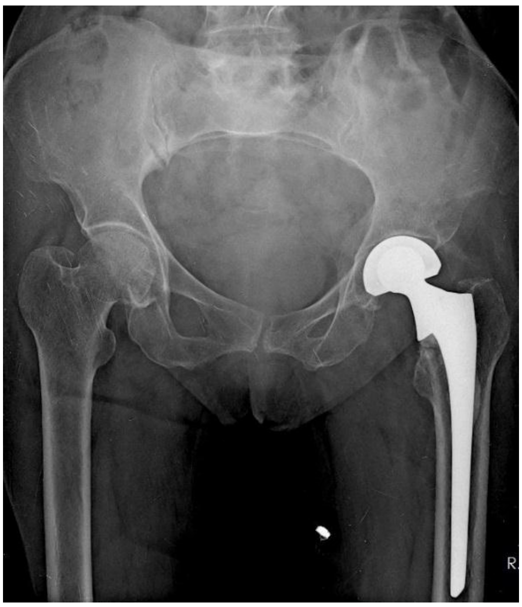


CASE 13 XRAYS

PRE OP

1ST MONTH

3RD MONTH

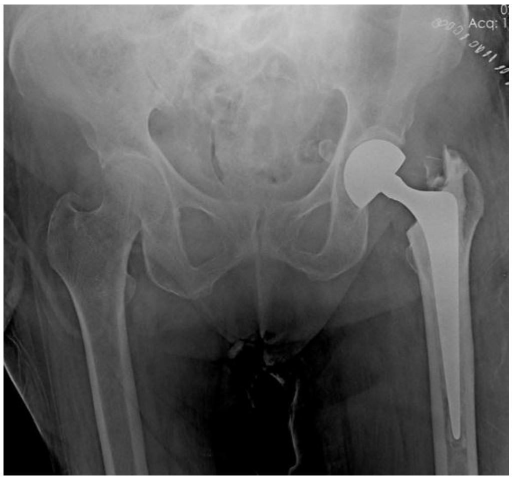


6TH MONTH

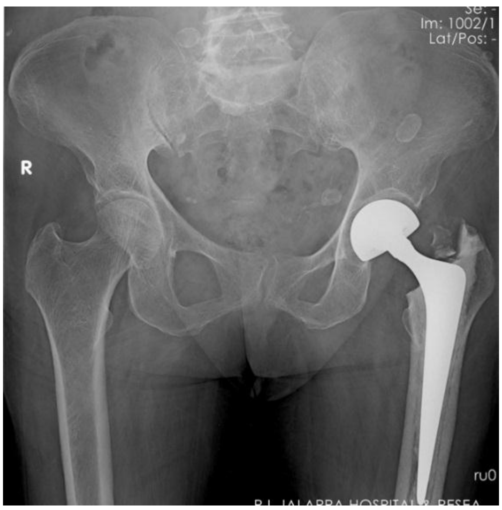
CASE 6 XRAYS

PRE OP

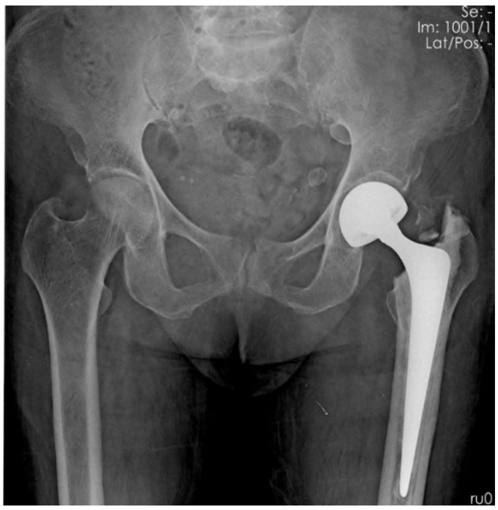
1ST MONTH



3RD MONTH



6TH MONTH



CASE 6 CLINICAL FINAL FOLLOW UP





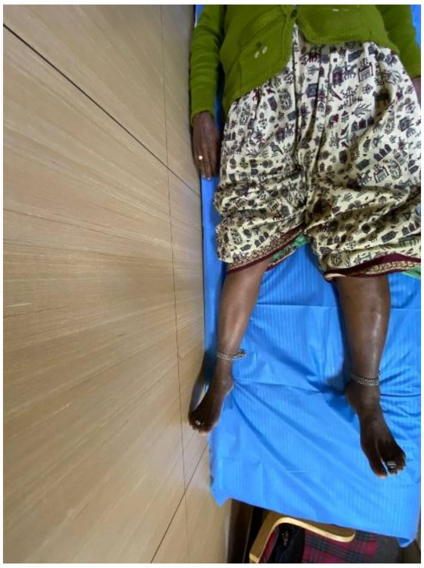


CASE 13 CLINICAL FINAL FOLLOW UP









CASE 14 CLINICAL FINAL FOLLOW UP

INTRA OP IMAGES

INSTRUMENTS

MASTER CHART

PARTIENT NO	AGE 60-70 YRS: 1 70-80 YRS: 2	SEX	SIDE	MODE OF INJURY SELF FALL: 1 RTA: 2	GARDEN'S STAGE STAGE 3: 1	PRESENTATION < 24 HRS: 1 24-48 HRS: 2	FUNCTIONAL SCORE 1ST MONTH EXCELLENT: 1 GOOD: 2	FUNCTIONAL SCORE 3RD MONTH EXCELLENT: 1 GOOD: 2	FUNCTIONAL SCORE 6TH MONTH EXCELLENT: 1 GOOD: 2	RADIOLOGICAL SCORE 1ST MONTH EXCELLENT: 1 GOOD: 2	RADIOLOGICAL SCORE 3RD MONTH EXCELLENT: 1 GOOD: 2
1	60-70	Female	Right	Fall	Stage 3	24-48	Fair	Good	Excellent	Good	Good
2	60-70	Female	Right	Fall	Stage 4	<24	Poor	Good	Good	Excellent	Excellent
3	70-80	Male	Right	RTA	Stage 4	24-48	Poor	Good	Good	Excellent	Excellent
4	>80	Male	Left	Fall	Stage 3	24-48	Poor	Good	Good	Good	Good
5	>80	Female	Left	Fall	Stage 4	<24	Poor	Fair	Good	Excellent	Excellent
6	60-70	Female	Left	Fall from height	Stage 3	<24	Fair	Excellent	Excellent	Good	Good
7	60-70	Female	Right	Fall	Stage 3	<24	Poor	Excellent	Excellent	Excellent	Excellent

8	70-80	Male	Right	RTA	Stage 3	>48	Poor	Excellent	Excellent	Good	Good
9	60-70	Male	Right	Fall	Stage 3	<24	Poor	Good	Good	Good	Good
10	>80	Female	Left	Fall	Stage 4	<24	Poor	Fair	Fair	Good	Good
11	70-80	Male	Left	RTA	Stage 4	<24	Poor	Good	Excellent	Excellent	Excellent
12	60-70	Female	Right	Fall	Stage 4	24-48	Fair	Good	Good	Excellent	Excellent
13	60-70	Female	Left	RTA	Stage 4	24-48	Poor	Fair	Good	Good	Good
14	60-70	Male	Right	Fall	Stage 3	<24	Poor	Good	Excellent	Good	Good
15	60-70	Female	Left	Fall	Stage 4	<24	Poor	Excellent	Excellent	Good	Good
16	60-70	Male	Right	Fall	Stage 3	<24	Fair	Good	Good	Excellent	Excellent
17	60-70	Female	Right	Fall from height	Stage 4	24-48	Poor	Good	Excellent	Good	Good
18	70-80	Female	Right	Fall	Stage 4	<24	Poor	Good	Good	Good	Good
19	60-70	Male	Left	Fall	Stage 3	<24	Poor	Good	Good	Good	Good

20	>80	Female	Left	Fall	Stage 3	<24	Poor	Fair	Good	Good	Good
21	60-70	Female	Left	Fall	Stage 3	<24	Fair	Excellent	Excellent	Excellent	Excellent
22	70-80	Male	Left	Fall	Stage 4	<24	Poor	Good	Good	Good	Good
23	60-70	Female	Left	RTA	Stage 4	24-48	Poor	Excellent	Excellent	Excellent	Excellent
24	60-70	Female	Right	Fall	Stage 4	24-48	Fair	Good	Good	Good	Good
25	70-80	Male	Right	Fall	Stage 4	24-48	Poor	Good	Good	Excellent	Excellent
26	60-70	Female	Right	RTA	Stage 3	<24	Poor	Good	Good	Good	Good
27	60-70	Male	Left	Fall	Stage 4	24-48	Poor	Good	Excellent	Excellent	Excellent
28	60-70	Female	Right	Fall	Stage 3	<24	Poor	Good	Good	Good	Good
29	60-70	Female	Left	Fall	Stage 4	24-48	Fair	Good	Excellent	Excellent	Excellent
30	70-80	Male	Right	Fall	Stage 3	<24	Poor	Fair	Good	Good	Good

31	60-70	Female	Right	Fall	Stage 4	24-48	Poor	Good	Good	Excellent	Excellent

RADIOLOGICAL SCORE 6TH MONTH EXCELLENT: 1 GOOD: 2 FAIR: 3 POOR: 4	PAIN AT FINAL FOLLOW UP MILD:1 MODERATE: 2 SEVERE: 3	GAIT AT FINAL FOLLOW UP NO LIMP: 1 MILD:2 MODERATE: 3	CLIMBING STAIRS WITHOUT SUPPORT:1 WITH SUPPORT: 2 UNABLE: 3	ABILITY TO SIT ON CHAIR >1HOUR: 1 <1/2 HOUR: 2	ABILITY TO PUT ON SHOES WITH EASE: 1 WITH DIFFICULTY: 2 NOT ABLE TO: 3	WALKING DISTANCE UNLIMITED:1 <1KM: 2 <500 M: 3	AMBULATION NO WALKER SUPPORT: 1 WALKER SUPPORT: 2
Good	Mild	Mild	Unable	>1 hour	with ease	<1 Km	NO WALKER SUPPORT
Excellent	Mild	No Limp	with support	>1 hour	with ease	Unlimited	NO WALKER SUPPORT
Excellent	Moderate	Mild	Without support	>1 hour	with ease	<1 Km	NO WALKER SUPPORT
Good	Mild	Mild	Without support	>1 hour	with ease	<1 Km	NO WALKER SUPPORT
Excellent	Mild	Mild	with support	>1 hour	with ease	<1 Km	NO WALKER SUPPORT
Good	Mild	No Limp	with support	< 1/2 hour	with ease	<1 Km	NO WALKER SUPPORT
Excellent	Mild	Mild	with support	>1 hour	with ease	<1 Km	WALKER SUPPORT
Good	Mild	Mild	with support	< 1/2 hour	with diffficulty	<1 Km	WALKER SUPPORT
Good	Mild	No Limp	Without support	< 1/2 hour	with ease	Unlimited	WALKER SUPPORT
Good	Moderate	Mild	with support	>1 hour	with ease	<1 Km	NO WALKER SUPPORT
Excellent	Mild	No Limp	with support	>1 hour	with diffficulty	<1 Km	WALKER SUPPORT
Excellent	Mild	Mild	with support	< 1/2 hour	with diffficulty	<1 Km	NO WALKER SUPPORT
Good	Moderate	Mild	with support	>1 hour	with ease	<1 Km	WALKER SUPPORT

Good	Mild	Mild	with support	>1 hour	with ease	<1 Km	WALKER SUPPORT
Good	Mild	No Limp	with support	< 1/2 hour	with ease	<1 Km	NO WALKER SUPPORT
Excellent	Mild	Mild	with support	>1 hour	with ease	<1 Km	NO WALKER SUPPORT
Good	Mild	Moderate	with support	>1 hour	with diffficulty	<1 Km	NO WALKER SUPPORT
Good	Mild	Mild	Without support	>1 hour	with diffficulty	< 500 m	NO WALKER SUPPORT
Good	Mild	No Limp	with support	>1 hour	with diffficulty	<1 Km	WALKER SUPPORT
Good	Mild	Mild	with support	>1 hour	with diffficulty	<1 Km	NO WALKER SUPPORT
Excellent	Mild	Mild	with support	>1 hour	with ease	<1 Km	NO WALKER SUPPORT
Good	Mild	Mild	Without support	>1 hour	with diffficulty	<1 Km	NO WALKER SUPPORT
Excellent	Moderate	Mild	with support	>1 hour	with ease	<1 Km	WALKER SUPPORT
Good	Mild	Mild	Unable	>1 hour	with ease	< 500 m	NO WALKER SUPPORT
Excellent	Mild	Mild	Unable	>1 hour	with ease	< 500 m	NO WALKER SUPPORT
Good	Mild	Moderate	Without support	>1 hour	with diffficulty	<1 Km	WALKER SUPPORT
Excellent	Mild	No Limp	with support	>1 hour	with ease	< 500 m	NO WALKER SUPPORT
Good	Mild	Mild	with support	>1 hour	with ease	<1 Km	NO WALKER SUPPORT
Excellent	Mild	Mild	Without support	>1 hour	with ease	<1 Km	NO WALKER SUPPORT
Good	Mild	Mild	with support	>1 hour	with diffficulty	<1 Km	NO WALKER SUPPORT
Excellent	Moderate	Mild	Without support	>1 hour	with ease	<1 Km	NO WALKER SUPPORT