"A PROSPECTIVE CLINICAL STUDY OF SURGICAL MANAGEMENT OF INTRACAPSULAR FRACTURE NECK FEMUR WITH HEMIARTHROPLASTY USING CEMENTED BIPOLAR PROSTHESIS"

By

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MASTER OF SURGERY
IN
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Under the guidance of

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2013

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I hereby declare that this dissertation entitled **"A PROSPECTIVE CLINICAL STUDY OF SURGICAL MANAGEMENT OF INTRACAPSULAR FRACTURE NECK FEMUR WITH HEMIARTHROPLASTY USING CEMENTED BIPOLAR PROSTHESIS"** is a bonafide and genuine research work carried out by me under the guidance of DR. ASHOK R. NAYAK, PROFESSOR OF ORTHOPAEDICS.

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Dr. MONISH BAMI

LIST OF ABBREVIATIONS

S-P nail	Smith Peterson Nail
HHS	Harris Hip Score
i.e.	That is
DVT	Deep Vein Thrombosis
Rt.	Right
Lt	Left
ORIF	Open Reduction and Internal Fixation
RTA	Road traffic accident
IHD	Ischemic Heart Disease
COPD	Chronic Obstructive Pulmonary Disease
RBS	Random Blood Sugar
RTA	Road Traffic Accident
ROM	Range of Motion
DOA	Date of Admission
DOD	Date of Discharge
DOS	Date of Surgery
UHMWPE	Ultra High Molecular weight Polyethylene

ABSTRACT

BACKGROUND AND OBJECTIVE:

Hip fractures are devastating injuries that most commonly affect the elderly and have a tremendous impact on both the health care system and society in general. Fracture neck of femur has been recognized since the time of Hippocrates and is a common orthopaedic problem in elderly, especially with the increase in incidence of osteoporosis. Various methods of treatment have been employed, but the problem remains an enigma unsolved till today.

The blood supply to the neck and head of the femur is extensive, intricate and complicated. Healing process of the bone mainly depends on the good blood supply. Since the blood supply to the neck is usually damaged, this handicaps the treatment of these fractures and the healing process is always in doubt.

The objective of this study was to evaluate the results of Cemented Bipolar Prosthesis in the management of intracapsular neck femur fracture by analysing its post-operative functional outcome using Harris Hip Score.

METHODS:

The study was conducted between the period of October 2011 to May 2013 in B.L.D.E University, Shri. B. M. Patil Medical College and Research Centre, Bijapur. 66 patients with diagnosis of intracapsular neck femur fracture were treated with cemented bipolar prosthesis. Patients over the age of 40 years and willing to participate in the study were included whereas patients with bilateral fractures and Polytrauma patients were excluded from the study. The patients were evaluated at 6 weeks, 3 months and 6 months and the final results were evaluated using the modified Harris Hip Score.

RESULTS:

The study included 66 patients, 40 male and 26 females aged from 53 to 86 years with mean of 64.65 years. The average duration of follow-up was 7.8 months ranged from 6-13 months. Using the modified HHS, we had excellent results in 24(36.36%), good in 30(45.45%), fair in 10(15.15%) and poor results in 2(3.03%) patients. The average score according to Harris Hip Score was 86.5. In our study we had good to excellent results in 54 of the 66 patients(81.81%), while poor result was noted in only 2(3%) patients.

CONCLUSION:

As per our results, we conclude that cemented bipolar hemiarthroplasty is a good procedure in cases of femoral neck fractures in the elderly. It is cost effective and provides early rehabilitation which helps avoid the complications of prolonged best rest, non-union and osteonecrosis of the femoral head.

KEY WORDS:

Femoral neck fracture, Hemiarthroplasty, Cemented bipolar.

CONTENTS

LIST OF TABLES

LIST OF GRAPHS

LIST OF FIGURES

INTRODUCTION

INTRODUCTION

Hip fractures are devastating injuries that most commonly affect the elderly and have a tremendous impact on both the health care system and society in general. Despite marked improvements in implant design, surgical technique and patient care, hip fractures consume a potential proportion of our health care resources[1].

Fracture neck of femur has been recognized since the time of Hippocrates and is a common orthopaedic problem in elderly, especially with the increase in incidence of osteoporosis. Various methods of treatment have been employed, but the problem remains an enigma unsolved till today[1]. The prolonged immobilization in elderly will jeopardize the life span of patient and further complicates the problem. This forces one to totally abandon the complete immobilization to achieve a bony union, or to resort early ambulatory procedures by surgery.

The blood supply to the neck and head of the femur is extensive, intricate and complicated[2]. Healing process of the bone mainly depends on the good blood supply. Since the blood supply to the neck is usually damaged, this handicaps the treatment of these fractures and the healing process is always in doubt. Under such circumstances one has to decide whether the prolonged immobilization has to be employed to achieve the bony union or quick ambulation by hemireplacement arthroplasty, to achieve fair degree of function. It is a known fact that the hip is a weight bearing joint and has to perform many functions. A successful operation at the hip joint should provide painless, stable hip with wide range of movements. But none of the accepted procedures have been able to achieve this goal fully. The patient also needs to go through, in many instances, multiple surgical procedures and a prolonged rehabilitation in order to preserve his original joint.

Hemireplacement arthroplasty by using vitallium or stainless steel as popularly practiced by Austin Moore's produced fairly good results[3-5]. The bipolar prosthesis was first introduced by James E. Bateman and Giliberty in 1974[6]. This clinical study presents the short term results of prospective study of hemiarthroplasty for the treatment of displaced femoral neck fractures in the elderly. Outcomes at 6 weeks, 3 months and 6 months were analysed by modified Harris hip scoring system and by radiographs taken during follow up.

AIMS AND OBJECTIVES

The objective of this study was to evaluate the results of Cemented Bipolar Prosthesis in the management of intracapsular neck femur fracture by analysing its post-operative functional outcome using Harris Hip Score[7].

REVIEW OF LITERATURE

Femoral neck fracture has been recognised since the time of Hippocrates (460-377 BC)[8]. The first description of hip fractures was by a French Surgeon, Ambroise Pare, in 1564[9]. He did not clearly distinguish between a fracture and dislocation of the hip.

However, Sir Astley Cooper gave a clear description of fracture of the neck of femur and other fractures and dislocations about the hip[9]. In 1822, in his book titled "A treatise on dislocations and fractures of joints", he has clearly delineated the differences between intracapsular and extracapsular fractures of proximal femur. He believed that non-union of intracapsular fractures was due to loss of blood supply to the proximal fragment and most femoral neck fractures would eventually heal with a fibrous union and that such patients would suffer "permanent lameness"[10,11]. He also noted that incomplete fractures would unite by ossification. Astley Cooper advocated a regimen of bed rest with affected limb extended and supported by pillows until pain subsided, followed by mobilization with crutches and gradual weight bearing. He also did post-mortem examination of patients who died after femoral neck fractures and concluded that none of the fractures were united by bone (ossific union).

In 1866, Hamilton and Stimson explained the preferential treatment of internal fixation for fracture neck of femur, quoting surgeries performed by John Ray Burton in Philadelphia in 1834[10]. In 1867, Philips introduced a technique for longitudinal and lateral traction to be used in the treatment of femoral neck fractures to eliminate "shortening or other deformity"[10]. In 1876, Maxwell reported successful use of this technique in the treatment of his patients. In 1921, Ruth advocated closed reduction and maintainence in a “Philips Splint” for 8 weeks[12].

In 1883 Nicholas Senn advocated closed reduction and impaction of fragments which would cause union of fracture[13]. According to Senn “the only cause for nonunion in case of an intracapsular fracture is our inability to maintain co-aptation and immobilization of the fragments during the time required for the union to take place”.

In 1838, internal trabecular pattern of femoral head and neck was described by Ward[14,15,16]. Vascular anatomy of femoral head was described by Crock[17]. Mechanism of injury for fracture neck femur was suggested by Kocher. He also advocated excision of head as intracapsular fracture would fail to unite. Whitman and Leadbetter methods of closed reduction were important contributions to the conservative management[18].

In 1902, Whitman advocated careful closed reduction under X-ray control followed by hip spica application with a union rate of 30%. This produced a few satisfactory unions, but was associated with extremely high morbidity and mortality. In 1911, Cotton recommended artificial impaction of fracture fragment by blows from a heavy mallet applied to a padded trochanter before cast application[19]. In 1908, Davis reported use of ordinary wood screws for the fixation of femoral neck fractures[18]. Similar screws were used by Da’Costa in 1907, Delbet in 1919 and Martin and Knight in 1920[20]. The use of autogenous bone peg graft as a method of internal fixation was popularized in America by Albee in 1911[21]. But frequently, the bone peg graft was broken and non-union developed. Hey Groves in 1916 designed a quadriflanged nail to obtain better fixation but it failed because of unsatisfactory material[21].

The first effective method of internal fixation was introduced in 1931 by Smith Peterson and associates[22]. The triflanged nail now bears his name as S.P. Nail. When properly used it succeeds in preventing the rotation of the head and with improved alloy constituted in the nail, it does not produce any tissue reaction. S-P Nail technique was simplified by the introduction of the cannulated nail by Johannson in 1932 and Westcott in 1934[23]. This allowed closed reduction and fixing the fracture over a guide pin using S-P nail. A side plate was added to the triflanged nail by Thornton in 1937. This ultimately led to the development of a solid nail plate by Jewett in 1941. Telescoping nails or screws which allow gradual impaction at the fracture site were introduced by Schumpelick, Jhontzen and Clawson[24]. In 1945, Virgin and MacAusland introduced the Dynamic Compression Hip Screw (DHS)[25].

Moore (1934) enlarged upon the multiple pin principle of Martin and starting with three pins and gradually increased it to five[26]. He continued to emphasize the need for impaction and devised a punch to accomplish this feat. Knowels (1936) advocated threaded pins placed as far apart as possible in the head, in an effort to obtain “absolute fixation”[27]. Several Modifications have been used like multiple pins, wires, lag screws, cannulated cancellous screws, simple flanged nails, collapsible nails. But none of them so far has been universaly successful under all circumstances. Inspite of various methods of internal fixation, Brown and Abram (1964) noticed a segmental collapse of femoral head in almost 1/3rd of the displaced transcervical fracture in which there was bony union[8]. The complications occured only where there was a total necrosis of the capital fragment and no appreciable contribution to revascularisation from the arteries of the ligamentum teres.

Different methods used for the treatment of femoral neck fracture depending on the type of fracture and age of the patient are:

a. Osteosynthesis:

A successful osteosynthesis is most satisfactory of all operations of fracture neck of femur whether fresh or old ununited[1,28]. Osteosynthesis, whether closed or open, requires anatomical reduction and internal fixation with or without bone graft. This is usually done in younger age group patients with fracture neck of femur to preserve the anatomical head.

b. Osteotomy:

Osteotomy was introduced to obtain a compression force at fracture site resulting in possible union in ununited fracture of the femoral neck in younger age[1,28].

The following procedures are done:

a) Mc Murray's Osteotomy

b) Dickson's Osteotomy

c) Pauwel's Y-Osteotomy

No matter how carefully these are nailed and stabilized, the procedure has got a failure rate of about 33%. Among 2/3rd of cases that healed, there is a possibility particularly in old people, of late complications such as avascular necrosis and degenerative changes in the form of osteoarthritis, which results in painful hip and future surgical procedures to relieve them.

c. Hemiarthroplasty of Hip:

Due to the poor results and associated complications of the above mentioned procedures, new treatment options were researched extensively. This led to the development of hip endoprosthesis which gave a functional stable painless hip without the uncertainty of bony union which had plagued the earlier modes of treatment. The rationale of this procedure is based on the observation that the hip functions fairly satisfactorily, following salvage procedure in which an endoprosthesis has been used for various pathological conditions.

Evolution of Prosthetic Replacement

The history of hip arthroplasty can be considered in five major steps. These include

- Osteotomy arthroplasty- this concept was introduced by A. White in 1822 and was later modified by Mc Murray in 1936 and by Moore in 1944.
- Interpositional Arthroplasty- Ollier first used soft tissue between the two bony surfaces to reduce the friction and the pain in 1885. Later, Murphy in 1902 used tensor fascia lata and Robert Jones in 1921 used Gold foil, but these procedures lead to a high rate of complications.
- Mold Arthroplasty was introduced by Smith-Peterson using glass as the material in 1923.
- Reconstructive Arthroplasty- Among all the procedures developed for this, the procedure described by Girdlestone in 1945 was the most followed and is even practiced today.

- Femoral Replacement Arthroplasty- there has been various advancement in this category, from the simple Austin Moore Prosthesis to the currently used Modular Bipolar Prosthesis and Total Hip Prosthesis.

To create a new joint by interposing a durable substance between the bone ends is an old idea suggested by Aufranc[29]. Many different materials have been used like ivory, silver, gold, tin, steel, synthetic materials like plastic, acrylic H.D.P.E etc.

Hey Groove's replaced a femoral head with ivory in 1923 and four years later reported that the patient lead an active life[21]. Starting with Glass (Smith Peterson 1925) did work in mold arthroplasty**.** The mold went through several stages in evolution both in shape and material used. Vitallium became the final choice through a trial and error process[30]. Nevertheless it can be regarded as the ideal material with the surface resistance and low friction approaching that of articular cartilage. Smith Peterson in 1938 used the first vitallium mold arthroplasty in the hip in case of bony ankylosis as a result of rheumatoid arthritis[30].

The Judet brothers introduced acrylic femoral head for the treatment of osteoarthritis in 1954[31]. Furthermore in short stem prosthesis, great stress was put upon the bone, with which it comes in contact. This lead to loosening, but failures did not always result. The marvellous initial results following its insertion were not maintained which lead to the prosthesis being abandoned.

In 1948, Mcbride overcame some problems of Judet prosthesis by introducing threaded stem which was screwed into femoral neck and locked by means of cross screws[32]. He thought that femoral head should not be spherical as this caused pressure to be transmitted to the region of acetabular fossa.

In 1950, Moore[3,33] introduced a self locking cobalt chrome alloy prosthesis, later models have slot in the stem to allow cancellous bone to penetrate and so anchor the device. Hey – Wood – Waddington (1966) reviewing the use of prosthesis for advanced osteoarthritis, reported that results are similar to those after the use of a cup[34]. In 1953, Haboush of New York suggested the use of fast setting methyl methacrylate dental cement as a means of fixing the prosthesis firmly to the femoral shaft.

In 1954, Thompson advocated primary replacement arthroplasty of the hip for fracture neck of femur because of simplicity of the operation and rapid recovery of the function without necessity for elaborate rehabilitation measures[35]. Innumerable reports similar to upper femoral prosthesis have appeared since then including those of McKeever[36] (1961) who used stainless steel, Movin (1957) whose prosthesis has a long stem, Kevethe (1957) who used titanium stem, Fitzgerald (1952) used all purpose stainless steel head and neck prosthesis and Lippmani's Crane type prosthesis (1957). Christiansen described trunion type of bipolar prosthesis which allowed axial movements between head and neck of prosthesis (flexion and extension) and other movements between prosthesis and acetabulum[37].

The erosion of bone on the pelvic side (acetabulum) brought attention to resurface the acetabulum. Metal-on-metal total hip arthroplasty described by McKee Farrar[38] (1966) did not prove satisfactory because of friction and metal wear. The credit of modern total hip replacement should go to Sir John Charnley[38,39] (1967). His pioneer work on low friction arthroplasty using high molecular weight polyethylene cup and metallic femoral components revolutionised the management of hip problems[40,41,42].

The Bipolar prosthesis was first introduced by James. E. Bateman and Giliberty[6] in 1974. The commonly known versions of bipolar prosthesis are Monk (1976), Hastings Bipolar prosthesis[43,44], Modular Bipolar prosthesis (Biotechnic france) and Talwalkar's Bipolar endoprosthesis[45] (Inor, India).

The Bipolar prosthesis has two layers of movements. The first is an inner low friction bearing, where a small metallic head articulates with Ultra High Molecular Polyethylene (UHMWPE) insert. The second is between an outer stainless steel or vitallium shell covering polyethylene insert which articulates with the acetabulum. A friction differential exists at the two planes of movement, thus most of the motion tends to occur at the inner bearing as the torque required is less here. A major advancement in the bipolar cup design was making the axis of the metallic and polyethylene cups eccentric so that with loading of the hip, the metallic cup rotates which will prevent fracture of the polyethylene-bearing insert and dislocation(intrinsic stability).

Due to the size and geometry of the inner bearing, the rim of the polyethylene insert impinges on the metallic neck of the prosthesis after a certain arc of adduction movement. This leads to the movement between the acetabulum and the outer metallic cup and thus the range of motion is increased compared to Austin Moore's Prosthesis.

Bipolar prosthesis was designed primarily with the aim of reducing the friction stresses and thereby decreasing acetabular erosion and stem loosening[46,47,48]. Shock absorbing character of UHMWPE insert also reduces impact load on the acetabulum during weight bearing, thus increasing the life span of the prosthesis.

Langan(1979) reported on 65 fracture neck femurs operated using Giliberty bipolar hip prosthesis and which were followed up for 19 months. The patients showed excellent short term results clinically[49].

Drinker and Murray (1979) compared 101 Bateman hemiarthroplasties with 160 cemented Thompson hemiarthroplasties and found no significant difference in the results. They also studied the motion at the inner bearing by video roentgenography in 20 of their patients. They noted that although some inner bearing motion did occur in most implants, it was less than predicted and in several cases it decreased between two and four years post-operatively[50].

Giliberty(1983) published his series of 200 patients in whom bipolar endoprosthesis was used. 92% had satisfactory results with a mean Harris hip rating of 87 points and 8% had poor results. The morbidity and mortality rates were also low[6].

Devas and Hinves (1983) used bipolar prosthesis in 161 fracture neck of femur and found no acetabular erosion with a four year follow up[51].

Mannarino et al (1986) in his series of 44 cases followed for 22 months had a mean Harris Hip Score of 84.2 with 93.2% patients having mild or no pain. The range of motion was excellent and morbidity was low[52].

Asada et al in 1987 developed a ceramic bipolar prosthesis composed of bioinert fine alumina ceramic rather than a metal head and used it in femoral neck fractures. The follow-up of patients treated with this method showed good results[53].

Yamagata et al compared 682 fixed head prosthesis with 319 bipolar prosthesis and found decreased incidence of acetabular erosion and revision in the bipolar group.

They stated that bipolar prosthesis can be used in younger more active patients where as the fixed ones can be used in older patients[54].

Bray et al compared internal fixation and bipolar endoprosthesis in displaced fracture neck femur in 34 elderly patients followed up for two years and found better functional results in the cemented arthroplasty group[55].

Bochner et al followed 90 patients treated with bipolar prosthesis for two years and found 92% excellent to good results and the weight bearing roentgenograms showing motion at both the bearing surfaces[56].

Lestrange performed 496 bipolar arthroplasties over a period for proximal femoral fractures and compared this series with patients treated with internal fixation and conventional one piece prosthesis. There was significant improvement over internal fixation in terms of morbitidity and mortality. It also offered the advantages over one piece prosthesis in terms of fit, decreased acetabular erosion and improved function[57].

La Bella et al performed cemented Bateman Prosthesis hemiarthroplasty in 128 patients and followed 49 cases for an average of 7 years 5 months. None of the patients developd acetabular protrusion and 88% had none or slight pain[58].

Garrahan and Madden used straight long stem Bateman Prosthesis in more than 500 hips and found uniform patient and physician satisfaction. There was biomechanical fixation by a snug fit in the isthmus, three point fixation within the shaft and biological ingrowth through the fenestration in the proximal stem without stress shielding of the Calcar[59].

Bateman et al performed bipolar arthroplasty in 1213 hips including a group of 760 patients suffering from osteoarthritis of the hip joint. They observed healthy preservation of the acetabulum even after 15 years. They also identified a process of floor reinforcement[60].

Mc Conville et al assessed 100 patients treated with bipolar hemiarthroplasty for degenerative arthritis and found mean harris hip score of 78.8 with good to excellent results in 75.8%. Anterior thigh pain was attributed to femoral component loosening[61].

Vazquez-Vela et al used bateman prosthesis in 286 cases with osteoarthritis(OA) and 114 with rheumatoid arthritis (RA) followed up for an average of 8 years 5 months and found excellent to good results in 92.5%[62].

Vazquez-Vela et al replaced 478 hips with bateman bipolar prosthesis and selected 19 cases with pre-operative acetabular changes randomly for evaluation. Of the 11 cases with protrusion, 6 showed thickening of acetabular wall and 5 showed no changes. In the five patients with subchondral cysts, the cysts tended to gradually disappear. The sclerosis in three patients in subchondral bone also gradually decreased. The authors suggested that the acetabulum tolerates the implant well even with some damage at the time of surgery[63].

Phillips et al used bateman bipolar prosthesis with autologous bone graft reinforcement for 21 dysplastic hips and had excellent or good results in 13 hips and fair in the rest. All the grafts were united with no resorption or migration of the graft fragments[64].

A Randomized Prospective study was done by some authors on 447 patients with 451 displaced fractures of the femoral neck treated with Bateman bipolar hemiarthroplasty (190 cemented and 261 uncemented) between 1985 and 1990 in the authors' institution. During a follow-up period of at least two years, the authors found less thigh pain (13% versus 46.2%) and higher Harris hip scores (86 versus 79) in the cemented bipolar group[65].

A study done in Edinburg on the three fixation methods viz. reduction and fixation, hemiarthroplasty with cemented bipolar prosthesis and cemented total hip replacement done on 207 patients showed that post operatively arthroplasty is better than fixation and in the arthroplasty group total replacement was slightly better than the hemiarthroplasty in view of long term results. The authors concluded that arthroplasty is more clinically effective and cost effective in healthy older patients with displaced fracture neck of femur[66].

Torisu et al used bipolar hip arthroplasty in 37 hips with acetabular deficiency including dysplatic osteoarthritis, revision of failed total hip arthroplasty, reconstruction of malunited bony ankylosis and rheumatoid arthritis. Bone grafting was done in these cases and the results were evaluated. The authors got good results and thus they confirmed the usefulness of expanded application of bipolar hip arthroplasty[67].

Wilson and Scott reconstructed deficient acetabulum using the bipolar socket in 47 cases with acceptable levels of pain relief and functional gait. The mean harris hip score for these patients was 86[68].

In a study conducted in Germany on 203 patients the bipolar prosthesis reported no cases of nerve damage and a higher Harris hip score after cemented bipolar prosthesis[69].

A study undertaken in New Delhi on the various treatment modalities for fixation of fracture neck femur in the elderly on 84 patients showed that hip replacement (hemi or total) is a successful procedure for the elderly population over 70 years with femoral neck fractures[70].

A study undertaken in Banaras Hindu University(BHU) where 55 patients were treated with BHU bicentric bipolar prosthesis in fracture neck femur in elderly showed that at follow up of 4 years the BHU bicentric bipolar endoprosthesis has been shown to be a good option for intracapsular fractures of neck femur with encouraging results[71].

A clinical study undertaken in Malaysia to compare the cemented and uncemented bipolar prosthesis in the treatment of fracture neck of femur in which 17 patients were treated with cemented bipolar prosthesis and 21 were treated with uncemented ones showed that bipolar hemiarthroplasty produces good functional outcomes with minimal complications for displaced intracapsular femoral neck fractures. In the present study, overall outcomes were marginally better in the uncemented prosthesis group in which the mini-incision posterolateral approach was used compared to the cemented prosthesis operated group (conventional posterolateral approach) in terms of amount of blood loss and HHS on last follow up[72].

A study conducted on 196 patients who were treated with cemented bipolar prosthesis showed that bipolar prosthesis is an appropriate and effective treatment option for patients with femoral neck fracture to obtain early return to daily activity. The surgical approach does not affect the functional results[73].

A long term follow up study of 450 patients with femoral neck fractures treated with internal fixation and replacement surgeries showed that at ten years there were 99 failures (45.6%) after internal fixation compared with 17 (8.8%) after replacement. Patient-reported pain and function were similar in both groups at five and ten years.

Primary replacement gave reliable long-term results in patients with a displaced fracture of the femoral neck[74].

In a study undertaken in Massachusetts General Hospital, Boston for treatment of traumatic arthritis by mold arthroplasty a new method of result evaluation for hip surgeries was proposed known as the Harris Hip Score. This system incorporated Pain and functional outcome into one single reliable system which is easily reproducible and can be applicable to different hip problems and different methods of treatment[7].

Gupta et al performed bipolar arthroplasty in 20 patients with fracture neck femur, avascular necrosis of femoral head, osteoarthritis, protusio acetabuli and perthes disease with excellent results in 85%[75].

ANATOMY OF THE HIP JOINT

The hip joint is a multi axial ball and socket joint [Spheroidal joint]. The femoral head articulates with the cup shaped acetabulum[76]. The articular surfaces are reciprocally curved and are neither co-existent nor completely congruent. The surfaces are considered spheroid or ovoid rather than spherical. The femoral head is covered by articular cartilage except for a rough pit for the ligament of the head (ligamentum teres). In front, the cartilage extends laterally over a small area on the adjoining neck. The cartilage is thickest centrally. Maximum thickness is in the acetabulum's anterosuperior quadrant and the anterolateral part of the femoral head.

The acetabular articular surface is an incomplete ring, the lunate surface, broadest above where the pressure of the body weight fall in erect posture. It is deficient below, opposite to the acetabular notch. The acetabular fossa within it is devoid of cartilage, but contains fibroelastic fat largely covered by synovial membrane.

A. Acetabular Labrum:

It is a fibroacartilagenous rim attached to the acetabular margin, deepening the cup. It is triangular in cross section and its base is attached to the acetabular rim with the apex as the free margin. It bridges the acetabular notch as the transverse acetabular ligament, under which vessels and nerves enter the joint.

B. Fibrous Capsule:

It is strong and dense attached above to the acetabular margin 5-6mm beyond the labrum, in front to the outer and lateral aspect and near the acetabular notch to the transverse acetabular ligament and the adjacent rim of the obturator fossa. Behind, it is attached about 1 cm above the inter-trochanteric crest. Below it is attached to the femoral neck near the lesser trochanter. Anteriorly, many fibres ascend along the femoral neck as longitudinal retinacula containing blood vessels for both the femoral head and neck. The capsule is thicker antero superiorly, where maximal stress occurs, especially in standing. Postero-inferiorly it is thin and loosely attached. The capsule has two layers - inner circular, forming the zona orbicularis around the femoral neck and blending with the pubofemoral and ischiofemoral ligaments, and an outer longitudinal layer. The circular layer is not directly attached to bone.

C. Synovial Membrane:

Starting from the femoral articular surface, it covers the intracapsular part of the femoral neck, then passes to the capsule's inner surface to cover the labrum, ligament of the head and the fat in the acetabular fossa. It is thin on the deep surface of the iliofemoral ligament, where it is compressed against the femoral head. It communicates with the subtendinous iliac (psoas) bursa by a circular aperture between the pubofemoral and the vertical band of the iliofemoral ligament.

D. Iliofemoral Ligament:

It is also known as Bigelow's ligament. Triangular or inverted 'Y shaped. It is one of the strongest ligaments in the body. Its apex is attached between the anteriorinferior iliac spine and the acetabular rim, and its base to the inter trochanteric line anteriorly.

E. Pubofemoral Ligament:

It is triangular with the base attached to the iliopubic eminence, superior pubic ramus, obturator crest and membrane. Distally it blends with the capsule and deep surface of the medial part of iliofemoral ligament.

F. Ischiofemoral Ligament:

It consists of superior ischiofemoral ligaments and the lateral and medial inferior ischiofemoral ligaments, extending from the ischium to the base of the femoral neck on the posterior aspect of the joint.

G. Ligamentum teres:

It is a triangular flat band with apex attached to the pit on the femoral head and base on either side of the acetabular notch. It varies in length and sometimes being represented only by a synovial sheath.

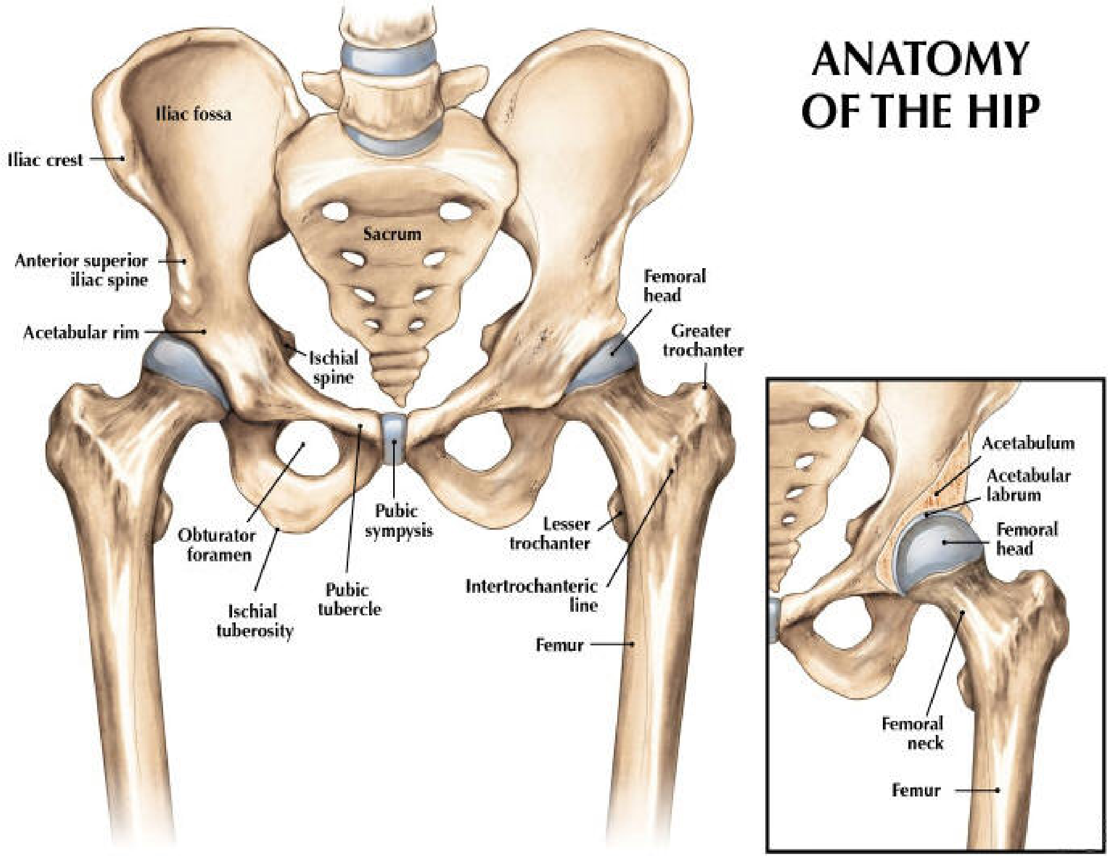


Figure 1: Anatomy of Hip Joint.

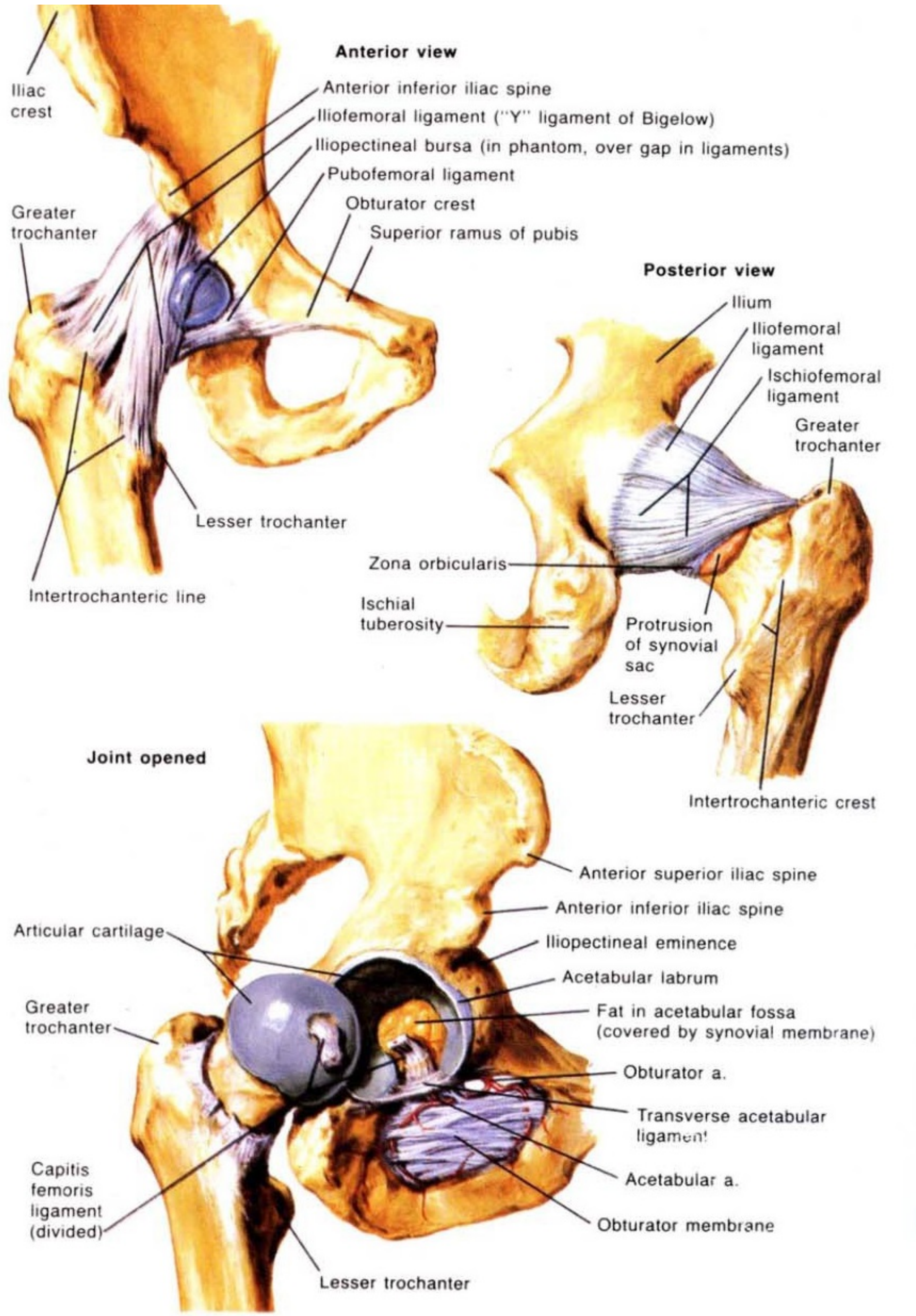


Figure 2: Ligaments of the Hip

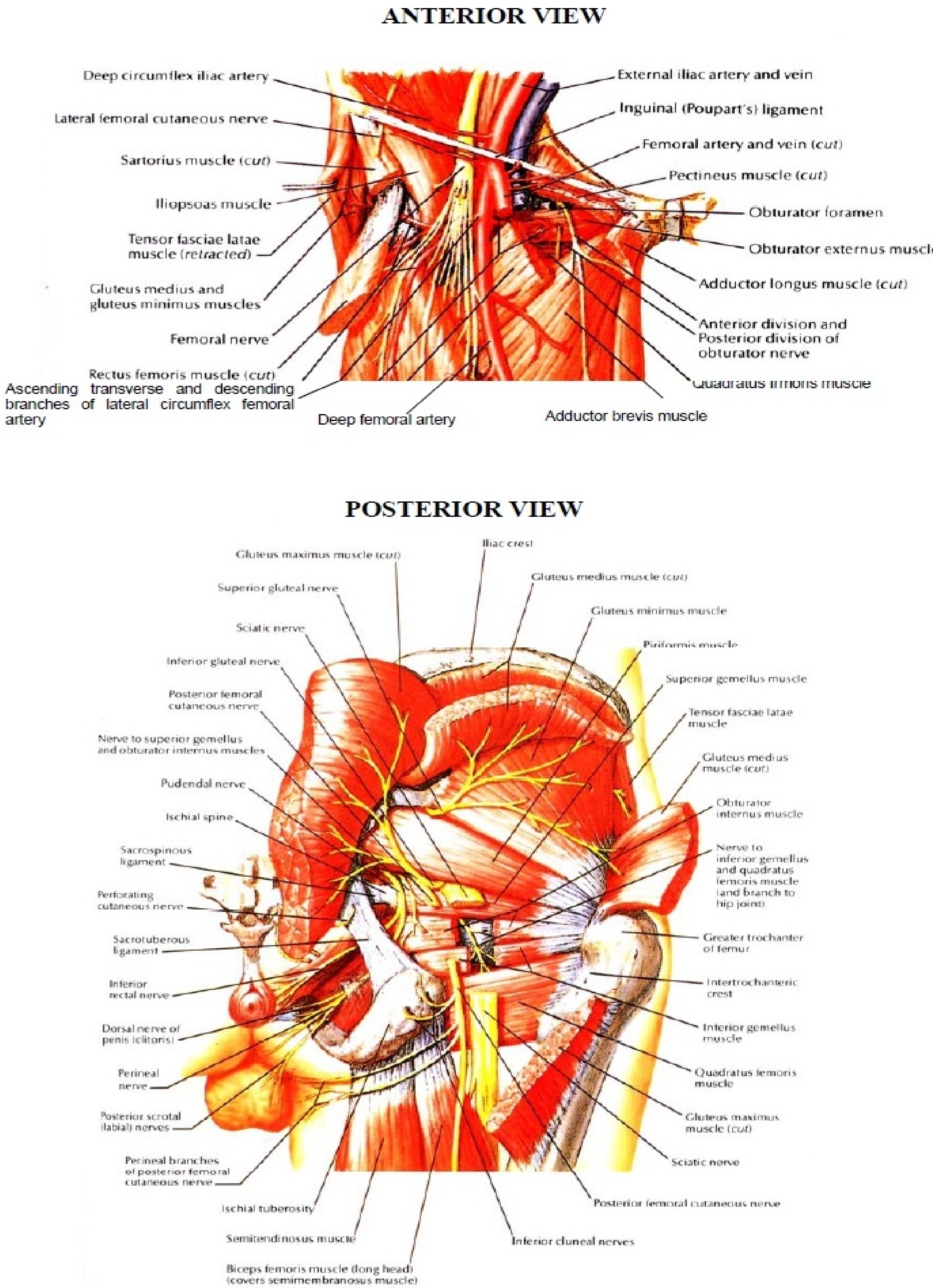


Figure 3: Relations of the Hip

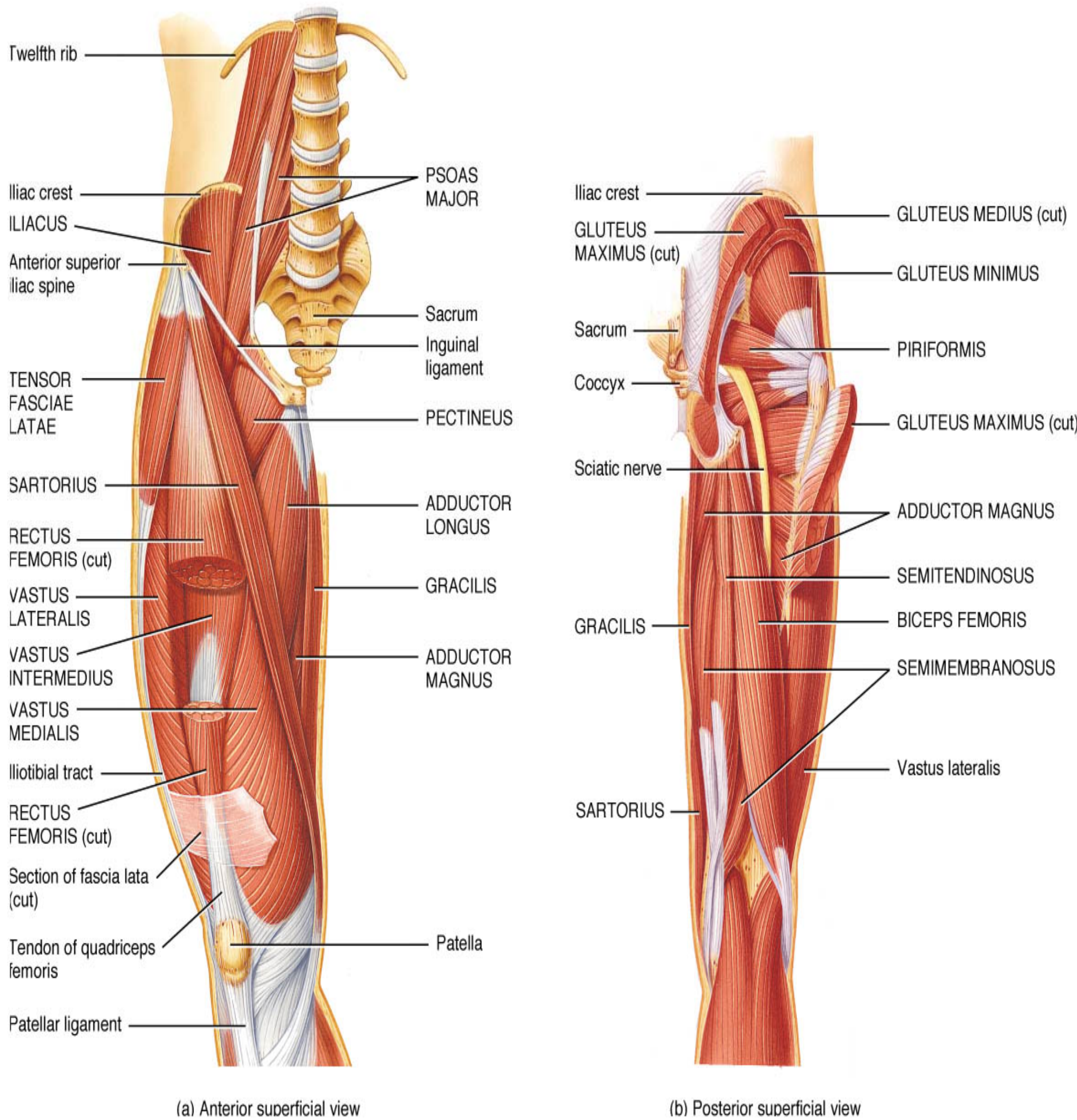


Figure 4: Muscles of the Hip.

RELATIONS OF THE HIP JOINT:

Anteriorly: From medial to lateral are:

- Pectineus, which intervenes between the most medial part of the hip and the femoral vein.
- Tendon of psoas major separated from the joint by a bursa and the iliacus muscle lateral to it.
- The femoral nerve is in the groove between iliacus and psoas major with the femoral artery anterior to the psoas tendon.
- The straight head of rectus femoris crosses the joint laterally with a deep layer of the fascial iliotibial tract.

Superiorly: The reflected head of rectus femoris contacts the capsule medially and superolaterally, the capsule blends with the gluteus minimus.

Inferiorly: It is related to the lateral fibres of pectineus and obturator externus tendon.

Posteriorly: It is related to the obturator externus tendon with an ascending branch of medial circumflex femoral artery, which separate the joint from the quadrates femoris. Tendon of obturator internus and the gemelli separate the sciatic nerve from the joint, and the nerve to quadratus femoris lies deep to the obturator internus. It is also related to the piriformis muscle.

Vascular Supply of Hip Joint: It is supplied by

• Obturator artery

• Medial circumflex femoral artery

• Superior and inferior gluteal arteries.

Nerve Supply:

Hilton's rule: The nerve that supplies a muscle acting across a joint supplies the joint itself and the skin over the joint . Thus hip joint is supplied by

• Femoral nerve or its muscular branches.

• Obturator nerve.

• Accessory obturator nerve.

• Nerve to Quadratus femoris.

• Superior gluteal nerve.

Range of Movements:

- Flexion 90°-100° with knee extended, 120° with knee flexed
- Extension 10° to 20°
- Abduction 30° to 40°
- Adduction 30° to 40°
- Medial Rotation 30°
- Lateral rotation 30° to 40°

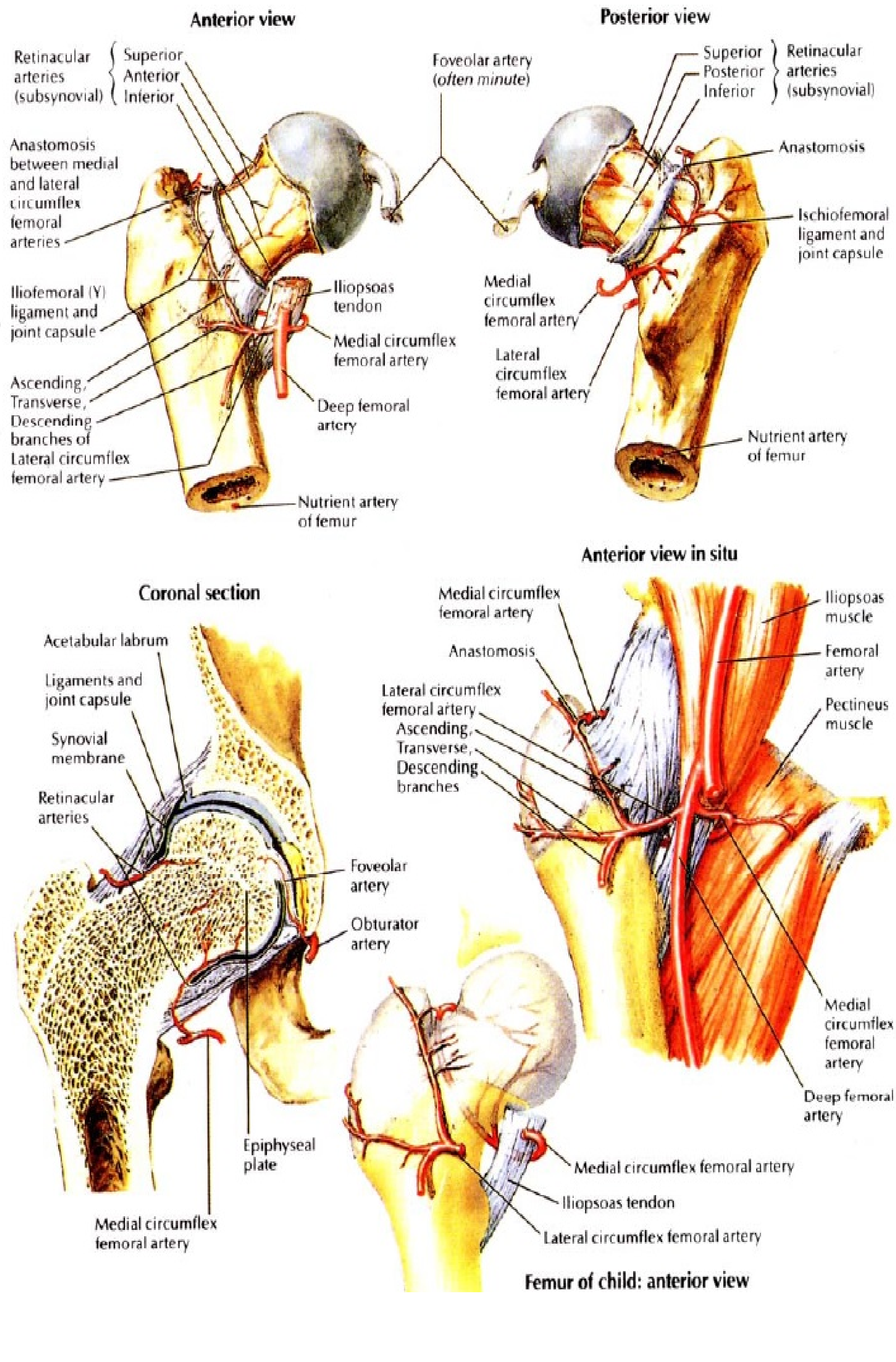


Figure 5: Vascular Supply of Femoral Head

KINESIOLOGY OF THE HIP:

Table 1

MOVEMENT	**MUSCLES** **(Prime Movers and Assisted by)**	**AXIS**
Flexion	Psoas major, Iliacus, Pectineus, Rectus femoris, Sartorius, Adductor Longus (in early flexion from full extension)	Along the centre of femoral neck (pure spin)
Extension	Gluteus maximus, Posterior hamstrings	Along the centre of femoral neck (pure spin)
Abduction	Gluteus medius and minimus Tensor fasciae latae, sartorius	Antero-posterior through femoral head
Adduction	Adductors longus, brevis and magnus, Gracilis, Pectineus	Antero-posterior through femoral head
Internal Rotation	Tensor fasciae latae and Anterior	Vertical axis through

	fibres of Gluteus, medius and minimus	centre of femoral head and lateral condyle with foot stationary on the ground.
External Rotation	Oburator Externus and Internus, Gemelli, Quadratus femorus, Assisted by Piriformis, Gluteus maximus and Sartorius.	Vertical axis through centre of femoral head and lateral condyle with foot stationary on the ground.
This mechanical axis of the hip is not dynamic relative to the femur. It is stationary during pure spins. It moves relative to its co-articular surface in chordal or arcuate paths during pure or impure wings respectively.		

Proximal End of Femur:

The Proximal end consists of a head, neck, a greater and a lesser trochanter.

Head: It is slightly more than half a sphere, it faces antero supero-medially to articulate with the acetabulum. Its smoothness is interrupted postero-inferior to its centre by a small, rough fovea.

Femoral Neck: About 5 cm long, it connects the head to the shaft at an angle of about 127° (113° to 136°)[14].This facilitates movements at the hip joint, enabling the limb to swing clear of the pelvis. The neck is also set up on at an angle of 10^0 to 15^0 anteversion. This twisting and turning presumably represents the developmental response of the femur to the upright position .

The anterior surface of the neck is flat and is marked at the junction with the shaft by a rough intertrochanteric line. The posterior surface is transversely convex and concave in its long axis; its junction with the shaft is marked by the rounded inter trochanteric crest[14].

Greater Trochanter: Large and quadrangular, it projects up from the junction of neck and shaft. Its postero-superior region projects superomedially to overhang the adjacent posterior surface of the neck, and here its medial surface presents the rough trochanteric fossa. The trochanter's proximal border is level with the center of the femoral head.

Lesser Trochanter: It is a conical postero medial projection of the shaft at the postero inferior aspect of its junction with the neck.

Internal Structure of the Proximal end: The apparently fragile but collectively strong lattices of the struts and trusses seen in trabecular bone and skeletal forms such as tubes, H-girders and ridges predate human invention by millennia. Galileo recognized the significance of trabeculation and also asserted that hollow cylinders are weight for weight, stronger than solid rods.

Calcar femorale: A thin vertical plate, the calcar femorale or as Bigelow (1900) described it as the true neck of the femur[77]. It ascends from the compact wall near the linea aspera into the trabeculae of the neck. Medially it joins the posterior wall of the neck. Laterally it continues into the greater trochanter dispersing into the general trabecular bone. It is thus in a plane anterior to the trochanteric crest and base of the lesser trochanter. The hip prosthesis, rests on the calcar, and its shoulder abuts the Calcar femorale and transmits the stress of weight bearing to the shaft via the calcar.

Wolff's Law:

Every change in the form of a bone or of its function is followed by certain definite changes in the internal architecture, which changes in accordance with mechanical loss. In essence, the law states that bony trabeculae are oriented along the line of stress, if the direction of stress changes, the orientation of the trabeculae also changes.

Trabecular Pattern: The cancellous bone of the upper-end of the femur is composed of two distinct systems of trabeculae[78]. In the frontal section these trabeculae are seen to form two arches. One arising from the medial (or inner) cortex of the shaft of the femur and the other taking origin from the lateral (or outer) cortex. The trabeculae forming these arches are called compressive and tensile trabeculae respectively because they are disposed along the lines of maximum compression and tension stresses produced in the bone during weight bearing. These trabeculae have been divided into following five groups:

a) Primary compressive group: The upper most compression trabeculae extend from the medial cortex of the shaft to the upper portion of the head of the femur run in a slightly curved radial lines. Some of these are thickest and most closely packed.

b) Secondary compressive group: The rest of the compression trabeculae which arise from the medial cortex of the shaft constitute the secondary compressive group. These arise below the principle compressive group and curve upwards and laterally towards the greater trochanter and the upper portion of the neck. The trabeculae in this group are thin and widely spaced.

c) Primary tensile group: The trabeculae which spring from lateral cortex immediately below the greater trochanter group. These trabeculae are thickest among the tensile group curve upwards and inwards across the neck of the femur to end in the inferior portion of the femoral head.

d) Secondary tensile group: The trabeculae which arise from the lateral cortex below the principal tensile trabeculae . The trabeculae of this group arch upwards and medially across the upper end of the femur and more or less irregularly after crossing the midline.

e) Greater trochanter group: Some slender and poorly defined tensile trabeculae arise from the lateral cortex just below the greater trochanter and sweep upwards to end near its superior surface.

In the neck of femur, the principal compressive, the secondary compressive and primary tensile trabeculae enclose an area containing some thin and loosely arranged trabeculae . This area is called "Ward's Triangle" The trabeculae of the upper end of the femur can be studied by making roentgenograms of the hip region using an exposure sufficient to delineate the macroscopic details of the internal architecture of bones. The thick trabeculae appear as dense continuous lines while the delicate ones are not visible. Thus the areas like Ward's triangle appear empty while rest of the trabeculae are delineated depending on their density.

Singh's Index: The 'Singh's Index'[79] is the grading of the trabecular appearance in X-ray. There are six grades as follows:

Grade I: Even principal compressive trabeculae are markedly reduced.

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

Grade III: Break in the tensile trabeculae opposite the greater trochanter.

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

Grade V: Principal (Primary) tensile and compressive trabeculae are accentuated. Ward's triangle is prominent. Secondary trabeculae are absent.

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

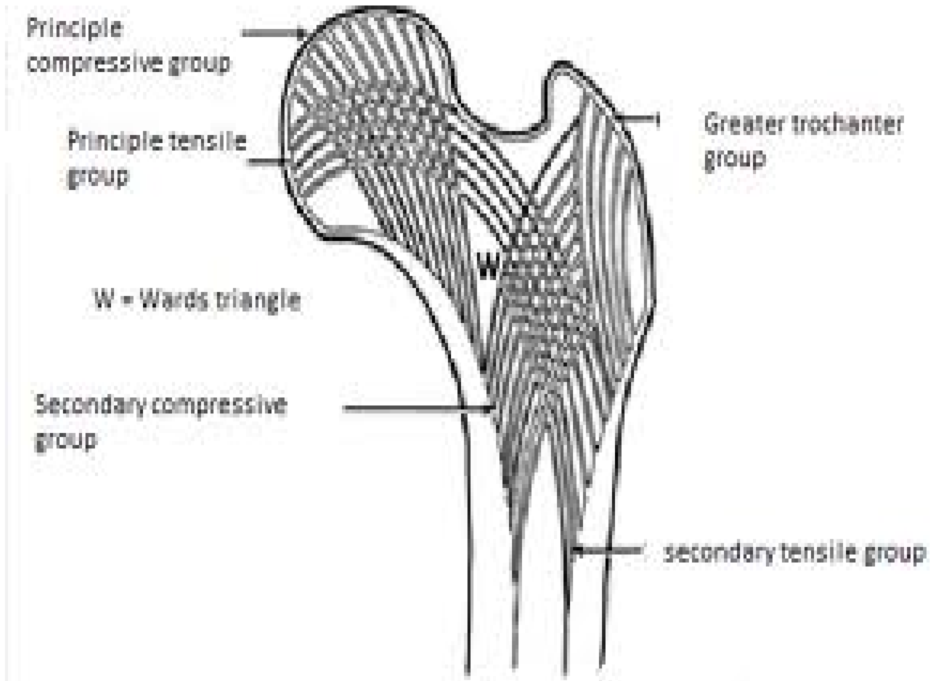


Figure 6: Trabecular Pattern of Proximal Femur

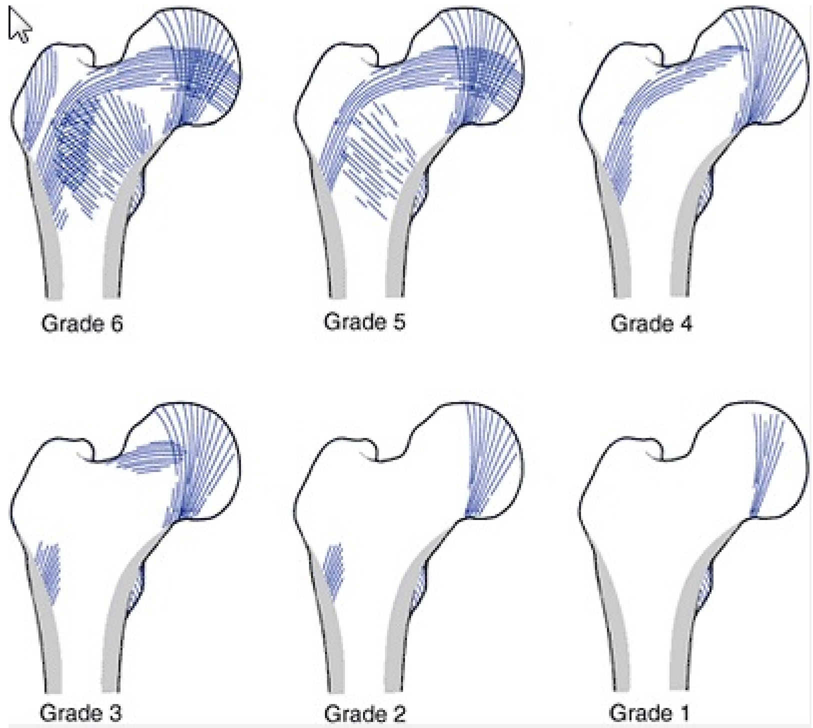


Figure 7: Singh's Index

Blood Supply of the Femoral Head: Crock described the blood supply to the proximal end of the femur[80], dividing it into three major groups.

a. An extra - capsular arterial ring at the base of the femoral neck.

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

c. Arteries of ligamentum teres.

The extra capsular ring is formed posteriorly by a large branch of the medial femoral circumflex artery and anteriorly by a branch from the lateral femoral circumflex artery[81].

The ascending cervical branches ascend on the surface of the femoral neck in anterior, posterior, medial and lateral groups. Their proximity to the neck surface makes them vulnerable to injury in femoral neck fractures. The posterior group are the most important. Injury to these vessels during surgeries on the hip via the posterior approach increases the risk of avascular necrosis of head of the femur.

As the articular margin of the femoral head is approached by the ascending cervical vessels, a second less distinct ring of vessels is formed, referred to by Chung as the subsynovial intra-articular arterial ring. It is from this ring that vessels penetrate the head and are called the epiphyseal arteries. These are joined by the superior metaphyseal vessels and vessels from the ligamentum teres, which are branches of the obturator and medial circumflex femoral arteries.

Clinical significance of vascular anatomy:

In fracture neck of femur, the intraosseous cervical vessels are disrupted. Femoral head nutrition then is dependent on remaining retinacular vessels and those functioning vessels in the ligamentum teres. The amount of the femoral head supplied by the medial epiphyseal vessels varies from a very small area just beneath the fovea to the entire head.

If the fracture occurs distal to the superior retinacular vessels and the displacement is not too great, both sources of blood supply may remain intact and prognosis is good (less chance of avascular necrosis). Abnormal degree of rotator movement of the femoral head may destroy its own blood supply as any other form of displacement.

With complete displacement of head, only medial epiphyseal vessels supply the head. In approximately 30% of cases the loss of blood supply is total, the foveolar vessels are insufficient and entire head becomes necrotic[82].

In 70% of cases, the nutrition of the femoral head is partially or wholly preserved by foveolar vessels. When avascular necrosis is partial, it usually involves a large area of the head at the upper outer portion, the region about the fovea remaining viable[83].

Applied Biomechanics of hip joint:

When the weight of the body above the lower extremities rests equally on two normal hip joints, the static force on each hip is one half of, or less than one third, the total body weight.

When, for example, the left lower extremity is lifted as in the swing phase of walking, the weight of the left lower extremity is added to that of the body weight, and the centre of body gravity, normally in the median sagittal plane, is displaced to the left. The abductor muscles exert a counter-balancing force to maintain equilibrium. The pressure exerted on the head of the right femur is the sum of these two forces. Each force is related to the relative length of levers. If the abductor lever is one third that of the lever arm from the head to the centre of gravity, the downward pull of the abductors must be three times the force of gravity to maintain balance.

Therefore, the total pressure on the head is four times the superimposed weight. The longer the abductor lever (i.e., the more laterally placed insertion of the abductors), the less the ratio between the levers, the less the abduction force required to maintain balance, and the less the pressure force on the femoral head[84,85].

The estimated load on the femoral head in the stance phase of gait and during straight leg raising is about 3 times the body weight. Crowninshield, et al.[84,85] calculated peak contact forces across the hip during gait as ranging from 3.5 to 5 times the body weight. When lifting, running or jumping the load may be upto 10 times the body weight.

The forces on the joint act not only in the coronal plane, but as the body's center of gravity (in the mid line anterior to S2 vertebral body) is posterior to the axis of the joint, they also act in the sagittal plane to bend the stem of the prosthesis posteriorly[86].

During the gait cycle, forces are directed against the prosthetic femoral head from a polar angle between 15 and 25 degrees anterior to the sagittal plane of the prosthesis. During stair climbing and straight leg raising, the resultant force is applied at a point even further anterior on the head. Such forces cause posterior deflection or retroversion of the femoral component.

Co-efficient of Friction:

The low coefficient of friction of a metallic head articulating with a polyethylene cup as a bearing is fundamental to bipolar arthroplasty. The coefficient of friction is the measure of the resistance encountered in moving one object over another[85]. It varies according to the material used, the finish of the surfaces of the materials, the temperature, and whether the device is tested in the dry state or with a specific fluid as a lubricant. Load may be another factor.

Frictional Torque force:

This is produced when the loaded hip moves through an arc of motion. It is the product of the frictional force times the length of the lever arm, that is the distance a given point on surface of the head moves during given arc of motion[87].

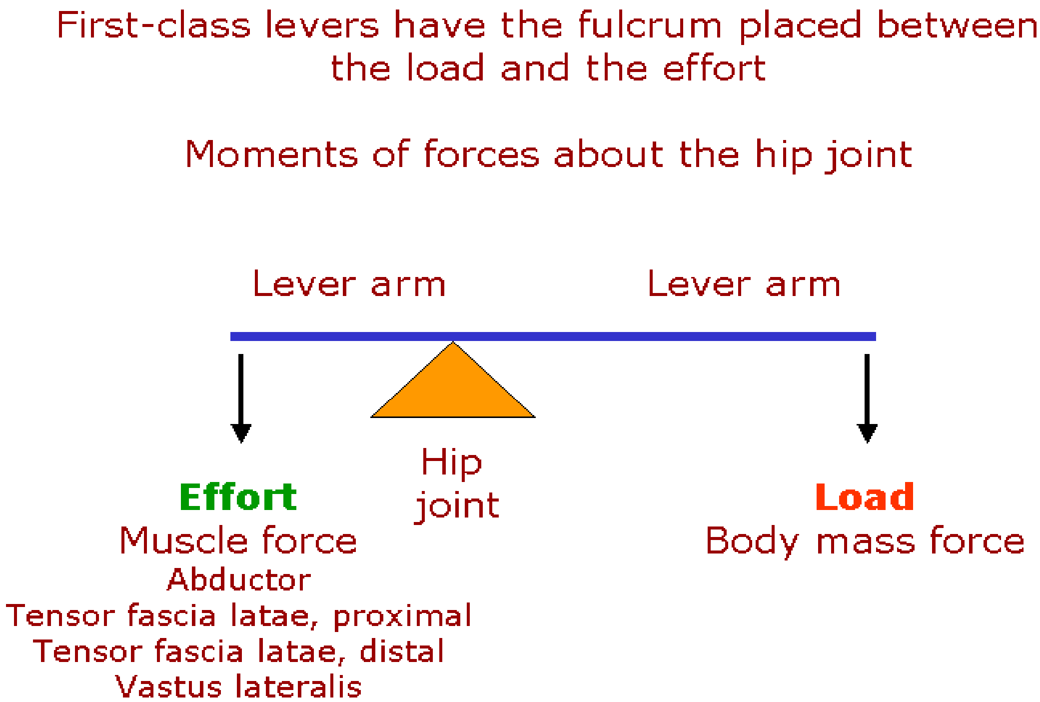


Figure 8: Biomechanics of the hip joint.

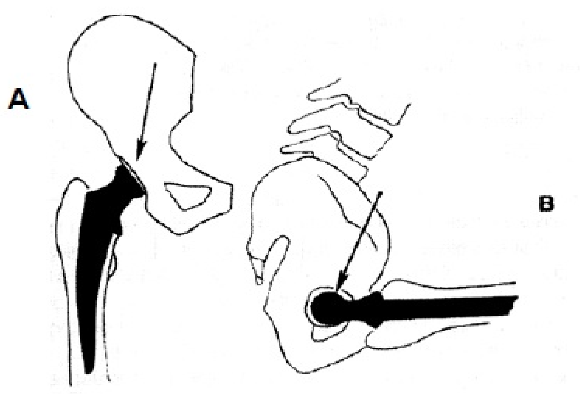


Figure 9: Forces producing torsion of the stem. Forces acting on the hip in coronal plane (A) tend to deflect the stem medially, and forces acting in the sagittal plane (B), especially with hip flexed or when lifting, tend to deflect the stem posteriorly. Combined they produce a torsion of the stem.

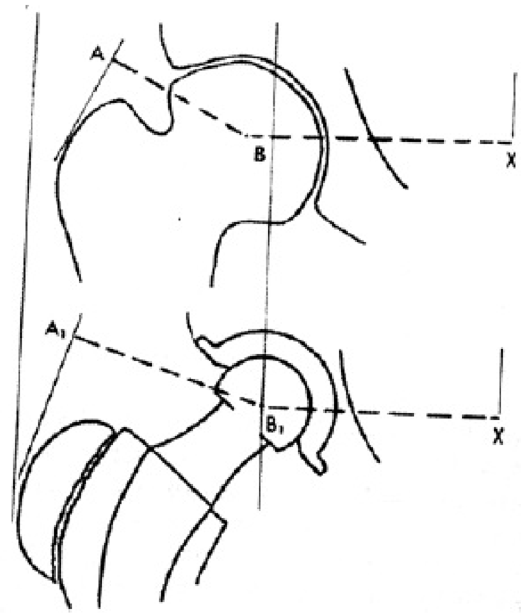


Figure 10: Lever arms acting on hip joint. Moment produced by body weight applied at body's center of gravity X, acting on the lever arm B-X, must be counterbalanced by the moment of the adducters A, acting on the short lever arm A-B. Lever arm A-B may be shorter than normal in arthritic hip. Centralization of the head shortens the arm B-X, and lateral reattachment of trochanter lengthens the arm A-B.

Neck length and offsets:

The ideal femoral reconstruction reproduces the normal centre of rotation of femoral head, this location is determined by 3 factors[85].

- Vertical height (Vertical offset) – Restoring this distance is essential to correct leg length. Using a stem with variable neck lengths provides a simple means of adjusting this distance.
- Medial offset (Horizontal offset) – Inadequate restoration of this offset shortens the moment arm of the abductor musculature and results in increased joint reaction force, limp and bony impingement which may results in dislocation.

- Version of the femoral neck (Anterior offset) – Version refers to the orientation of neck in reference to the coronal plane and is denoted as anteversion or retroversion. Retroversion of the femoral version is important in achieving stability of the prosthetic joint. The normal femur has 10 to 15 degrees of anteversion.

Description of Implant:

The hemiarthroplasty prosthesis replaces the femoral head. The prosthesis is composed of a metal stem that fits into the hollow marrow space of the thighbone (the femur). It also has a metal ball that fits into the socket of the hip joint (the acetabulum). The bipolar prosthesis has a femoral head that swivels where it attaches to the stem. The bipolar prosthesis was designed to try to reduce the wear and tear on the articular cartilage inside the acetabulum.

Figure 11: Bipolar Prosthesis

Fractures of The Femoral Neck:

The fracture neck of femur still remain in many ways the unsolved fracture as far as treatment and results are concerned. These have occurred with increasing frequency as longevity has increased[1].

Femoral neck fractures usually are entirely intracapsular, and common to all intracapsular fractures, the synovial fluid bathing the fracture may interfere with the healing process because the femoral neck has essentially no periosteal layer, all healing must be endosteal. Angiogenic inhibitory factors in synovial fluid also can inhibit fracture repair. These factors, along with the precarious blood supply to the femoral head, make healing unpredictable and non unions fairly frequent.

Risk Factors:

1. **Age :** There is steep rise in the incidence after sixth decade, especially in females. The rate of increase for women is exponential above the age of 60 years. The bodily changes associated with ageing are responsible both for increasing the chances of an individual falling and for weakening the bone to such an extent that even a minor trauma will result in a fracture. Long term physical activity has been shown to reduce the risk of fracture[1].
2. **Sex :** A preponderance of female patients is observed in all studies. The relative proportion varies between 1.7:1 (Levine et al., 1970) and 4.5:1 (Parker et al.,

1992). Use of supplemental vitamin D3 and calcium has been shown to reduce the risk of hip fracture in elderly women[1].

3. **Life style:** Sedentary life style has increased the incidence of hip fractures as evidenced by increased incidence in urban than rural population. According to Boyce and Vessey physical activity among people between the ages of 15 and 45 years who sustained hip fracture was less than the control group. The most elderly and infirm group of population are often encouraged to become more immobile which increases the risk of falling by exacerbating muscle weakness.
4. **Race:** Incidence in Negroes is half that among white population. Mexican Americans have risk of one-third of white Americans[88] (Bauer et al.). The studies indicate genetic predisposition to fracture neck femur. The highest incidence is seen in caucasian race (Makin and Solomon). All though bone mass has been shown to the greater in black people a lower rate of falling probably more important in the explanation of different relative frequency of fracture hip in black & white.
5. **Season:** A seasonal risk of falling that is higher in summer in Korea and higher in winter in Scandinavia[88].
6. **Old fracture:** The risk of second fracture hip is twice the risk of first fracture because of the increased likely hood of falling[88].
7. **Geographical variation:** Considerable variation in incidence around the world is related to environmental factors such as climate, diet, life style and degree of industrialisation apart from hereditary factors.

8. **Nutrition:** Patients who sustain hip fracture have been reported to have reduced skin fold thickness compared with age matched controls and reduced upper arm circumference and low body weight. According to Boston et al. thinner patients are more likely to develop hypothermia in cold weather and this would result in impaired co-ordination and increased tendency to fall.
9. Smoking and Alcohol are known risk factors.
10. **Medications:** Patients with some medications that may affect bone strength sustain a hip fracture. Corticosteroids reduce bone strength on prolonged use. Thyroxine increases bone turnover and causes osteoporosis. Sedatives, tranquillizers, anticonvulsants and antihypertensive drugs are also known risk factors.
11. **Medical conditions :** Many medical conditions have been associated with increased risk of falls, bone weakness and hip fracture. Few examples are cardiac arrhythmias, CCF, Parkinsonism, CVA, anemia, malignancy, Paget's disease, etc.

Aetiology:

The intracapsular fracture is due to interplay of three factors.

a) Pre-existing diseases, which may either influence the chances of falling or contribute to bone weakness.

b) The fall itself,

c) The age of the patient which influences the degree of bone loss and tendency to fall.

d) The aetiology of fracture neck femur is multifactorial.

The most common situation is an episode of minor trauma in an ageing patient whose bones have been weakened by a combination of post-menopausal and senile osteoporosis.

The aetiology appears to be related to the risk of falling, protective neuromuscular responses to fall and bone strength apart from genetic factors. The tendency to fall increases with age and is dependent on many factors such as poor vision, decreased muscle power leading onto sluggish reflexes, vascular diseases and co-existing musculoskeletal pathology.

According to Alffram, 79% of fractures were caused by trivial or no trauma. In the presence of severe osteoporosis or other bone weakness spontaneous fracture may occur[89] (Sloan and Holloway). Hip fractures are rare in road traffic accidents, dislocations being more common.

Normal protective mechanisms to fall such as putting out one's arms is impaired by degenerative changes in elderly leading to reduced pace of neuromuscular transmission.

Bone Factors:

Studies suggest that femoral neck fractures should be considered as fractures through pathological bone secondary to either osteomalacia or osteoporosis[90,91]. Osteoporosis is the single most important aetiological factor in femoral neck fractures. Cummings in a prospective study of over 9,000 females found an association between reduced bone density and increased risk of fracture. Atkin in 1984 demonstrated that 84% of patients with femoral neck fractures had mild to severe osteoporosis[92].

Patients with hip fractures have bone that is more osteoporotic than age and sex controls as documented by iliac bone biopsy, metacarpal index, Singh's index and lumbar spine radiographs[93].

Not only does osteoporosis play a role in the aetiology of femoral neck fractures, it also plays an important role in their treatment. Porotic bone leads to marked comminution of posterior cortex and decreased quality of internal fixation secondary to inability of the bone to hold internal fixation devices hence greater incidence of non-union (Arnold et al)[94].

Other Bone Factors:

In addition to osteoporosis and osteomalacia many other factors have been implicated in the aetiology. Ferris et al.[93] (1989) suggested that the site of fracture is related to the length of femoral neck. A shorter femoral neck is associated with extracapsular fracture, whereas a longer femoral neck is associated with intracapsular fracture and osteoarthritis of hip.

Kent et al[91,93] (1983) found large hydroxyapatite crystals at the site of fracture. The inference was that the development of these crystals at the site of greatest shear may predispose to fracture independent of bone density. Dodds et al.[93] (1990) have found depressed enzyme activity in cortical osteoblasts, suggesting that local factors may be important in rendering the femoral neck prone to fracture.

Mechanism of Injury:

- The type of trauma that is associated with most fracture neck of femur (more than 90%) is a fall from a standing position[88]. The exact relationship between the fall and the fracture is a matter of some debate even today. In his treatise on proximal femoral fractures, Sir Astley Cooper gave clear description of how these injuries can be caused. "The most frequent cause of intracapsular fractures is slipping on the edge of pavement and the force is transmitted perpendicularly with the femoral neck as a lever. The fall is the consequence of the fracture not its true cause". This description of a torsional strain on a loaded femur is quoted by Stebbing (1926). Under the torsional strain the axially loaded femur will always break at its weakest point and where it will be under greatest strain, i.e. that point running almost horizontally to the neck of femur. This description is valid even today.
- Vehicular trauma or fall from a substantial height is less common. These fractures are thought to be due to axial loading of the thigh while the hip is abducted. Loading from this high energy trauma fractures a femoral neck of normal density.

- Neuromuscular conditions except for Parkinson's disease are more frequently associated with intertrochanteric fractures than femoral neck fractures.

Kocher suggested two mechanisms. The first is a fall producing a direct blow over the greater trochanter. This mechanism was confirmed by Linton (1949). The second mechanism is lateral rotation of the extremity as described by Cooper. In this mechanism head is fixed by anterior capsule and iliofemoral ligament while neck rotates posteriorly. Posterior cortex impinges on the acetabulm resulting in buckling. Urovitz et al. [95](1977) have suggested cyclical loading which produces micro and macro fractures. Forces within physiological limits have been shown to produce fractures in osteoporotic bone. It is suggested that a stress fracture of this type becomes complete following minor torsional injury that precedes the fall that the patient identifies with the fracture.

Classification:

Any system of classification of fractures is useful only if it considers the severity of bony lesion and serves as a basis for determining the type of treatment used, the chance of achieving a stable rigid surgical fixation and the likely outcome of treatment. In intracapsular fracture neck of femur, classification system should aid in prediction of the risks of nonunion and avascular necrosis.

Anatomical classification: The first anatomical classification of fracture neck of femur was done by Sir Astely Cooper in 1823[91].

He classified them into-

a) Intracapsular and

b) Extracapsular fractures

Intracapsular fracture are again classified as

1) Subcapital fracture : Fracture line immediately beneath the head along the old epiphyseal plate.

2) Transcervical fractures : Fracture line passing across the femoral neck between the femoral head and the greater trochanter.

3) Basicervical fractures: Fracture lines passes through the base of the neck.

Before the advent of effective internal fixation, impaction was the most important prognostic factor, whether occurring at the time of injury or being produced subsequently by the attending clinician. Consequently early systems of classification stressed the presence of impaction or displacement of intracapsular fracture. This is best exemplified by Waldenstrom[96] in 1924, who classified them into

1. Impacted abduction fracture (valgus)
2. Impacted adduction fracture (varus) and
3. Non-impacted fractures.

Pauwel's classification: Based on the fracture line and the angle of inclination with horizontal plane. Pauwels[96] (1937) classified subcapital fractures into three types.

Type I - Fracture line is less than 30° from the horizontal.

Type II - Fracture line is between 30°-70° from the horizontal

Type III - Fracture line is > 70° to the horizontal

As a fracture progresses from type I to type III, the obliquity of the fracture line increases and theoretically the shear forces at the fracture site also increase.

Garden's Classification: He believed that the various types of femoral neck fractures represent different stages of the same displacing movement. In his classification, the direction of medial or compression trabeculae rising superiorly into the weight bearing dome of the

femoral head is used to indicate the degree of rotation of the fracture in the anteroposterior radiograph[96,97].

Garden Stage 1 = The fracture is incomplete, with the head tilted in posterolateral direction. This is an impacted fracture.

Garden Stage 2 = The fracture is complete, but there is no displacement.

Garden Stage 3 = The fractures are complete and partially displaced.

Garden Stage 4 = Fracture fragments are completely displaced and the trabecule of the femoral head realign themselves with the trabeculae within the acetabulum.

A.O. Classification: A.O. classification of fracture neck of femur is based on modification of Pauwel's grading with further subdivision into subcapital, transcervical, basicervical and midcervical[85].

In this system the fractures of the femoral neck are classified as

Type B1. Subcapital with no or minimal displacement.

Type B2. Transcervical.

Type B3. Displaced sub capital fracture.

Each of these types is further identified.

Tvpe B1:

Type B1.1 impacted in valgus of 15 degrees or more.

Type B1.2 impacted in valgus of less than 15 degrees.

Type B1.3 non-impacted.

Type B2:

Type B2.1 Basicervical

Type B2.2. Midcervical with adduction

Type B2.3 Midcervical with shear

Type B3:

Type B3.1 moderately displaced in varus and external rotation

Type B3.2 moderately displaced with vertical translation and external rotation

Type B3.3 markedly displaced

Type B3 have the worst prognosis.

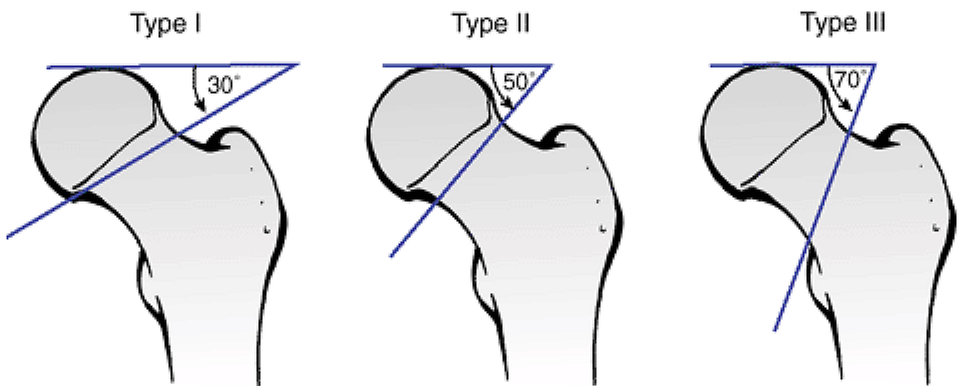


Figure 12: Pauwel's Classification

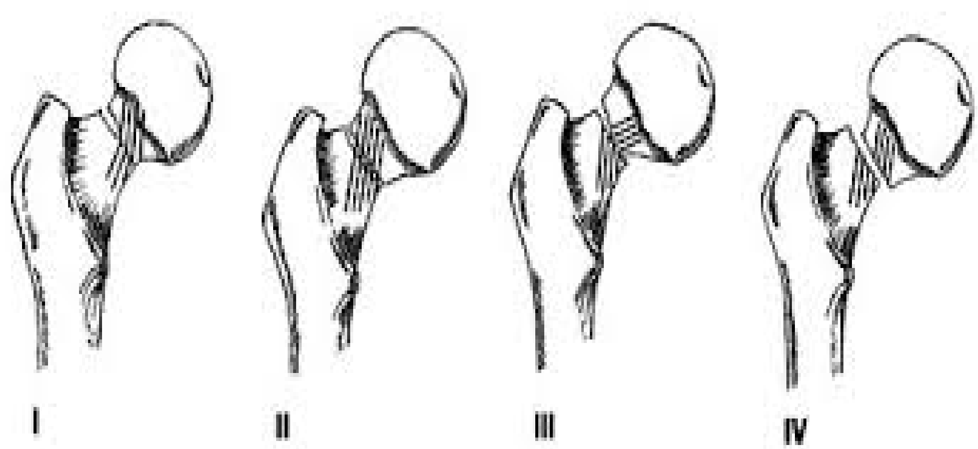


Figure 13: Garden's Classification

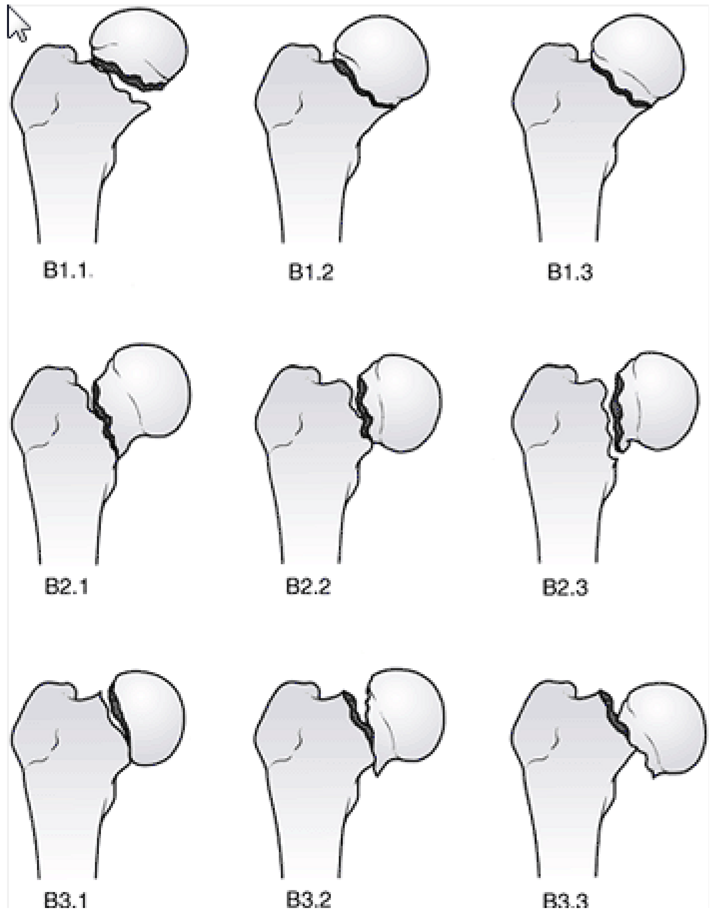


Figure 14: OTA Classification

Complications

The complications of femoral neck fractures[78] are classified as follows:

1. Early complications-
    - Mortality- It is a known complication in the elderly with various reports mentioning different rates of mortality. It is highest during the perioperative period and depends upon the various patient factors such as age, gender and co-morbidities.
    - Infection- With the use of peri-operative antibiotics, the incidence of infections have reduced significantly. In cases which infection occur, early incision and drainage with appropriate antibiotic coverage can still help salvage the joint. If the joint is affected, replacement surgery needs to be done. It is important to recognize this complication early and treat it accordingly.
    - Deep vein Thrombosis- This is a dreaded complication as it can lead to pulmonary embolism and be fatal. Controversy exists whether prophylaxis is necessary to prevent DVT but studies have shown no difference in the results with or without prophylaxis and the prophylaxis can be given in cases of high risk patients.
    - Dislocation- It occurs in the early period and prompt recognization and reduction does not alter the end result significantly.

2. Late complications-

Non-union:

Non-union is reported to be true after undisplaced fracture, but occurs in 20- 30% of displaced fractures. As age advances the rate of non-union increases sharply. Factors that have been incriminated as causes of non-union are:

1. Vascular anatomy and fracture anatomy,
2. Intracapsular nature of fracture,
3. Absence of cambium layer of periosteum,
4. Poor surgical technique,
5. Comminution of posterior cortex due to osteoporosis,
6. Age of the patient.,
7. difficulty in reduction of fracture and maintaining reduction.

In displaced fracture of neck of femur retinacular vessels are damaged in addition to disruption of intramedullary supply and proximal fragment will be devoid of blood supply. Since the shearing stresses act in fractures with a vertical inclination fractures fails to unite.

Phemister emphasized that lack of cambium layer of periosteum in femoral neck makes it vulnerable for non-union. Union has to depend entirely on endocallus and creeping substitution. Synovial fluid bathes the fracture site and hematoma does not form. Also synovial fluid contains angiogenesis inhibiting factor which prevents neovascularisation across the fracture. Inadequate reduction or poor internal fixation technique was the cause of nonunion in a series reported by Fielding et al. Barnes et al, reported increased incidence of non-union in elderly with severe osteoporosis. More than

60% of patients with posterior cortical comminution developed non-union in a series reported by Banks.

Posterior cortical comminution associated with varus leads to 100% non-union.

Avascular necrosis:

Aseptic necrosis is one of the two important complications of femoral neck fracture. Aseptic necrosis is the actual death of bone secondary to ischemia, an early phenomenon after fracture neck femur and is a microscopic event. Late segmental collapse is the collapse of the subchondral bone and articular cartilage that overlies the infracted bone. This collapse results in articular incongruity, pain and degenerative joint disease. The collapse occurs late in the sequence of the ischemic event and is recognised as a clinical entity. Not all patients with aseptic necrosis go for late segmental collapse.

Late segmental fracture can occur as late as 17 years after the fracture. In 80% patients it is evident within two years radiographically. Incidence of late segmental collapse varies from 7% to 27%. It occurs in 10-20% of undisplaced fractures and in 15-35% of displaced fractures. Barnes et al. have reported increased frequency in women than in men. The tender vascular buds during revascularisation of fracture can be repeatedly torn if there is persistent motion at the fracture site owing to poor stabilisation.

Moore demonstrated that in a poor reduction the surface area for blood vessels to grow up the remaining neck is decreased so that the incidence of aseptic necrosis and late segmental collapse is increased when the fracture is poorly reduced.

Smith demostrated that excessive rotation about the longitudinal axis or excessive valgus at the time of reduction may obstruct the remaining blood supply in the ligamentum teres. Fielding and Lowell mention that insertion of a screw for fixation may rotate the femoral head fragment, thereby obstructing the remaining blood supply in the capsule and ligamentum teres. A nail placed superiorly and laterally in the femoral head may disrupt the lateral epiphyseal vessels and therefore increase the risk of AVN. According to Boyd and George all patients with late segmental collapse develop arthritic changes if the patients bear weight long enough.

Treatment

There are various modalities of treatment for femoral neck fractures which depend upon fracture pattern and patient condition. These include

I. **Non-opeative treatment-** This is done only in cases where the general condition of the patient poses an excessively high risk for the procedure. These patient should be allowed bed to chair mobilization as soon as pain permits to prevent complications of prolonged bed rest.

II. **Operative treatment-** Operative management consisting of fracture reduction and stabilization, which permits early patient mobilization and minimizes many of the complications of prolonged bedrest, has become the treatment of choice for most femoral neck fractures. These include internal fixation with the help of cannulated cancellous screws, sliding hip screw, hemiarthroplasty or total hip replacement and depends on the fracture type, needs of the patient and various patient factors.

- **Treatment of Undisplaced fractures of femoral neck:** Internal fixation with multiple cannulated screws or with a compression hip screw with a small side plate and accessory screws in cases with communition of lateral cortex[85].

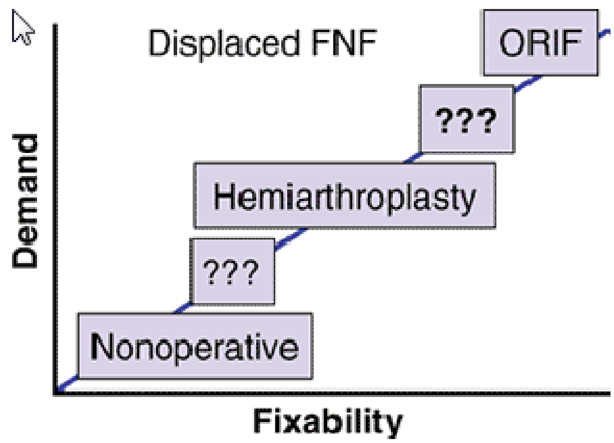


Figure 15: Treatment Protocol for management of displaced fracture neck femur.

- **Treatment of displaced Intracapsular fractures of femur:** Indications for prosthetic replacement of the femoral head in Intracapsular fractures of femoral neck[85]:

Relative Indications:

a) Advanced physiological age: Patient should be 65 years or older with life expectancy of not more than 10 to 15 years.

b) Acutely oblique fracture or Pauwel's type III fractures: These are known for non-union, if head is preserved.

c) Fracture-dislocation of the hip: when the superior weight bearing surfaces is fractured, prosthetic replacement is preferred.

d) Severe osteporosis: where internal fixation results in collapse of the head and loss of position of fixation.

Absolute Indications:

a) A fracture that cannot be satisfactorily reduced or securely nailed.

b) Failed internal fixation several weeks later.

c) Some pre existing lesion in the head - such as avascular necrosis where fracture has precipitated the need for replacement arthroplasty.

d) Old undiagnosed fractures of femoral neck - Untreated, unreduced, unimpacted fracture more than 3 weeks old is better managed with a prosthesis.

e) Pathological fractures of femoral neck with short life expactancy.

f) Fracture neck of the femur with complete dislocation of the head.

g) Patients who are psychotics or mentally ill, who will not cooperate after internal fixation.

h) A patient who probably can not with stand two operations.

i) Malignancy.

j) Neurologic disorders such as patients with uncontrolled epileptic seizures and with uncontrolled Parkinson’s disease .

Contra indications:

1) Preexisting sepsis is an absolute contraindication for prosthetic insertion.

2) Active young patient with fracture neck of femur.

3) Garden stage I and II fractures.

4) Nonambulatory senile patients.

Complications of Hemiarthroplasty

Early Complications:

1) Nerve injuries: The sciatic, femoral, obturator and peroneal nerves can be injured by direct surgical trauma, traction, pressure from retractors, extremity positioning, limb lengthening and thermal or pressure injuries from cement. The incidence of nerve injury has been reported to be 0.7% to 3.5% in primary arthroplasties[85].

2) Vascular injuries are rare however they can pose a threat to the survival of the limb and the patient.

3) Haemorrhage and Haematoma formation : It is common in case of familial bleeding tendency, recent salicylate use, anti coagulant therapy, liver disease, paget's disease, gaucher's disease and hemophilia. More common with posterior approach.

4) Bladder injuries and urinary tract complications.

5) Limb length discrepancy: Most often the limb that is operated on is lengthened. Lengthening may result from insufficient resection of bone from the neck, use of a prosthesis with a neck that is too long, or from changing the centre of rotation of the acetabulum.

6) Dislocation and Subluxation : Factors contributing are

i) Previous hip surgery.

ii) Posterior approach.

iii) faulty positioning of implant.

iv) Impingement of the femur on the pelvis.

v) Inadequate soft tissue tension .

vi) Weak abductor muscles.

vii) Extremity positioning in postoperative period.

viii) soft tissue interposition.

7) Fractures : Fractures of femur can occur during insertion of implant. Post operative femoral fractures may be due to stress fractures caused by increased use of limb after surgery, stress raisers and trauma.

8) Infection: Risk factors are diabetes, rheumatoid arthritis, sickle cell anaemia, urinary tract infections and prolonged operative time. Infection rate was almost 3 times higher in the posterior approach than the anterior approach .

9) Thromboembolism this is the most serious complication of hemiarthroplasty. Risk factors are previous episode, venous surgery and varicose veins, prior orthopaedic operations, advanced age, malignancy and heart failure.

Late complications:

1) Heterotopic ossification: It is more commonly associated with excessive bone resection and soft tissue dissection[97].

2) Implant loosening: It is the most serious long term complication.

3) Acetabular protrusion: This is assessed by measuring medialisation of acetabular line compare with normal or immediate post operative radiograph.

4) Acetabular erosion : It is determined by measuring the change in the thickness of acetabular cartilage .

5) Painful prosthesis : Salvatti[98,99] (1972) and Coates (1975) feel that the principle late complication of endoprosthetic replacement is pain. Gringras[100] (1980) and Whittaker[101] (1974) report that the hip pain may be present with prosthetic loosening or with distal or proximal migration of the prosthesis.

MATERIALS AND METHODS

SOURCE OF DATA:

Our study was conducted between the period of October 2011 to May 2013 in B.L.D.E University, Shri. B. M. Patil Medical College and Research Centre, Bijapur. 66 patients with diagnosis of intracapsular neck femur fracture were treated with cemented bipolar prosthesis. The patients will be informed about study in all respects and informed written consent will be obtained. Ethical Clearance for this study was obtained from the committee.

Inclusion Criteria:

- Patients more than age of 40 years.
- Patients who have been diagnosed as having intracapsular fracture neck of femur.
- Patients who are fit for surgery.

Exclusion Criteria:

- Patients below the age of 40 years.
- Patients who are unfit for surgery.
- Patients who are admitted for reoperation.
- Polytrauma/ Bilateral intracapsular fracture.

Sample Size:

- In an audit published in 2009, the incidence of hip fractures in India was calculated by addition of age-wise distribution to be 74%[102]. At confidence interval of 95% and permissible error of 10%, the sample size is calculated using the formula as below

$$n = (1.96)^2 p(1-p)/L^2$$

$$n = 135.$$

- Since intracapsular fracture of femur neck is half of total hip fractures[103].

The number of cases included in the study = 65.

Once the patient was admitted to the hospital, all the essential information was recorded in the proforma prepared for this study. They were observed regularly during their hospital stay till they get discharged.

Pre-operative Assessment:

Patients were admitted to the ward. Detailed history was taken with particular emphasis on mode of injury and associated medical illness. In depth, clinical assessment was carried out in each case.

In all patients preoperatively Buck's traction with appropriate weight was applied, to the fractured lower limb, with the aim of relieving pain preventing shortening and to reduce unnecessary movements of the injured limb.

Oral or parental NSAIDs were given to relieve the pain. Anteroposterior radiographs of pelvis with both hips were taken for all the patients, keeping the fractured limb in 15 degrees internal rotation to bring the neck parallel to X-ray film. The fracture was classified using Garden's classification. The offset of the prosthesis was measured and on the radiograph calculations were done to assess the amount of neck to be nibbled to maintain length of the limb.

Routine blood investigations, blood grouping and typing, urine routine, RBS, serum urea, creatinine, HbsAg, HIV, chest x-ray, ECG, were done in all cases. Necessary and adequate treatment was given for those associated with medical problems such as anaemia, diabetes, hypertension, IHD, COPD, asthma, etc. were evaluated and treated before taking them to surgery.

Certain therapeutic exercises were taught preoperatively to the patients which had to be continued postoperatively, such as deep breathing exercises, static quadriceps exercises, ankle movements. Patients as well as the attenders were explained about the surgery and its risk factors and written consent for the surgery was taken for all patients. Intravenous antibiotics and tetanus immunisation were given an hour before the surgery. The limb was prepared from nipple to knee including perineum and back.

Surgical Procedure

All surgeries were performed on an elective basis using standard aseptic precautions under spinal anaesthesia.

Position of the patient:

Lateral position with the patient lying on the unaffected side. The skin over the hip was scrubbed with povidone-iodine. The lower extremity from the groin to the toes was drapped in sterile towels separately to enable easy manipulation of the limb during surgery.

Approach: For all patients posterior approach(Moore's Approach) was used in our series .

Moore's Approach (Southern exposure)

From a point 10 cm distal to posterior superior iliac spine and extended distally and laterally parallel to the fibres of gluteus maximus to the posterior margin of the greater trochanter and then directed about 8 cm parallel to the femoral shaft. Deep fascia was exposed and divided in the line with the skin incision as also was the fascia over gluteus maximus, which was then split in the direction of its fibres using blunt dissection. By retracting the proximal fibres of the muscle proximally, the greater trochanter was exposed. Distal fibres are retracted distally and partly divided at their insertion into the linea-aspera in line with the distal part of the incision. The sciatic nerve was usually not exposed. It is protected with finger in the medial part of the wound and was gently retracted out of the way.

The gemelli, obturator internus and the piriformis tendon were divided at their insertions after tagging them for easier identification and reattachment. The posterior part of the capsule thus exposed was incised from distal to proximal along the line of neck of femur and at right angle to it, thus making a T shaped opening in the capsule. The fractured head and neck of the femur was levered out of the acetabulum and size measured using femoral head guage. The size was confirmed using a trial Austin-

Moore's prosthesis by its suction fit in the acetabulum. The acetabulum was prepared by excising remaining ligamenturn teres and soft tissue whenever neccessary.

The femoral shaft was rasped using a broach (rasp) and prepared for the insertion of the prosthesis. Femoral neck if long was nibbled as calculated by the pre-operative radiographic assessment. The Calcar portion of the femur was not removed in any of the cases.

Standard cementing techniques were used. The medullary cavity of the femur was lavaged, cleaned and dried. The cement was inserted by hand due to inavaliability of a cement gun. The prosthesis was then inserted into the femoral shaft in about $10\text{-}15^0$ of anteversion and impacted into the femur. The reduction of the prosthesis was then done using gentle traction of the thigh. Absolute haemostasis was obtained. The capsule and the rotators were closed as a single unit and was attached to the greater trochanter through two drill holes. The wound was closed in layers over a suction drain, which was removed at the first change of dressing after 48 hours.

Postoperative Management

In case of spinal anaesthesia, foot end elevation was given depending on the patients postoperative blood pressure. Every half an hour blood pressure, pulse rate, temperature, and respiratory rate were monitored for the first 24 hours.

Whenever necessary, postoperative blood transfusion was given. Intramuscular analgesics were given as per patients compliance, intravenous antibiotics were continued for 5 days and then switched over to oral.

The limbs kept abducted with the help of pillows Suction drainage was removed after 48 hours at the time of the first dressing.

Static quadriceps were started on the first post-operative day. Active quadriceps and hip flexion exercises were started on the 2^{rd} and 3^{th} post operative day respectively and according to the tolerance level of the patient. Dressing was done on 2^{nd}, 5^{th} and 8^{th} post operative day. Sutures removal was done on the 12^{th} post operative day.

Check radiograph was taken after 48 hours. Patients were made to sit up on the second day, standup with support (walker), on the third day, and were allowed to full weight bear and walk with the help of a walker on the fourth postoperative day depending on his/her pain tolerance and were encouraged to walk thereafter. Sitting cross-legged and squatting were not allowed.

The patients were assessed for any shortening or deformities if any and discharged from the hospital. Patients who had infection and bedsores were treated accordingly before discharging them from the hospital.

Patients were followed up at an interval of 6 weeks, 3 months, and 6 months and functional outcome was analysed by modified harris hip scoring system. At each follow up radiograph of the hip was taken for radiological analysis.

Follow Up

At the time of discharge the patients were asked to come for follow up after 6 weeks and for further follow up at 3 months and 6 months. The patients who turned for follow up were finally taken up for the assessment of functional results. At follow up, detailed clinical examination was done systematically.

Patients were evaluated according to Harris hip scoring system for pain, limp, the use of support, walking distance, ability to climb stairs, ability to put on shoes and socks (in our study for some patients ability to cut toenail was enquired) sitting on chair, ability to enter public transportation, deformities, leg length discrepancy and movements. All the details were recorded in the follow up chart. The radiograph of the operated hip was taken at regular intervals, at each follow up.

ANNEXURE 1

CRITERIA FOR EVALUATION AND RESULTS [HARRIS HIP RATING[7]]

The functional results of the patients were evaluated as follows.

1. Pain (44 possible)
    a. None or ignores it (44)
    b. Slight, occasional, no compromise in activities (40)
    c. Mild pain, no effect on average activities, rarely moderate pain with unusual activity; may take aspirin (30)
    d. Moderate Pain, tolerable but makes concession to pain, some limitation of ordinary activity or work, May require occasional pain medication stronger than aspirin (20)
    e. Marked pain, serious limitation of activities (10)
    f. Totally disabled, crippled, pain in bed, bedridden (0)
2. Gait (33 possible)
    a. Limp
        - None (11)
        - Slight (8)
        - Moderate (5)
        - Severe (0)
    b. Support
        - None (11)
        - Cane for long walks (7)

- Cane most of time (5)
- One crutch (3)
- Two canes (2)
- Two crutches or not able to walk (0)

c. Distance Walked

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

3. Activities (14 possible)

a. Stairs

i. Normally without using a railing (4)
ii. Normally using a railing (2)
iii. In any manner (1)
iv. Unable to do stairs (0)

b. Shoes and socks

i. With ease (4)
ii. With difficulty (2)
iii. Unable (0)

c. Sitting

i. Comfortably in ordinary chair for one hour (5)
ii. On a high chair for 30 minutes (3)

iii. Unable to sit comfortably in any chair (0)

d. Enter public transport (1)

4. Absence of deformity – (4 points are given if patient demonstrates)

   a. Less than 30° fixed flexion contracture

   b. Less than 10° fixed abduction

   c. Less than 10° fixed internal rotation in extension

   d. Limb length discrepancy less than 3.2 cm

5. Range of motion (5 points possible)

   (Index values are determined by multiplying the degrees of motion possible in each are by the appropriate index)

A. Flexion

			(max possible)
0-45^{o}	x	01	45
45-90^{o}	x	0.6	27
90-100^{0}	x	0.3	06
>100^{o}	x	00	00

B. Abduction

0-15^{o}	x	0.8	12
15-20^{o}	x	0.3	1.5
>20^{o}	x	00	00

C. External rotation in extension

0-15^0	x	0.4	06
Over 15^0	x	00	00

D. Internal rotation in extension

Any	x	00	00

E. Adduction

0-15^o	x	0.2	03
Over 15^o	x	00	00

F. Extension

Any	x	00	00
		Total -	100.5 pts

To determine the overall rating for the range of motion, multiply the sum of the index values by 0.05. Maximum points possible = 100.5 x 0.05 = 5 points

Maximum points possible - 100

- EXCELLENT 90- 100
- GOOD 80-89
- FAIR 70-79
- POOR < 70

OBSERVATION AND RESULTS

In our study, 66 patients with diagnosis of intracapsular neck femur fracture were treated with cemented bipolar prosthesis was conducted between the period of October 2011 to May 2013.

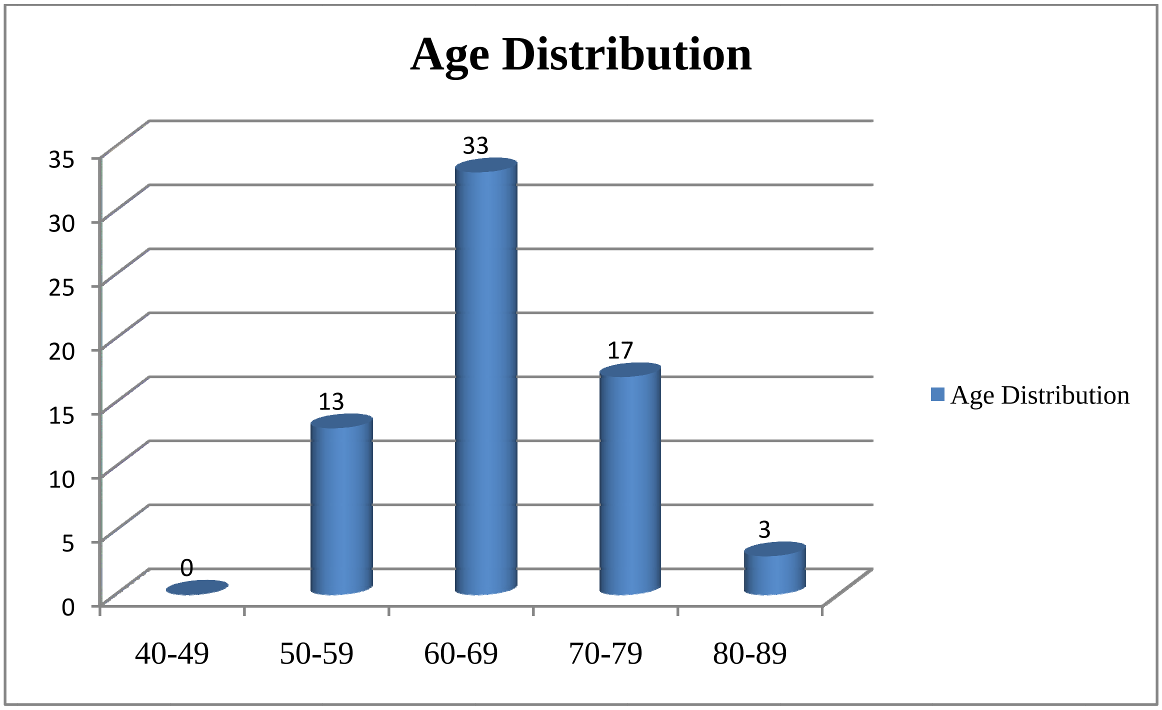
Age Incidence:

The average age of the patients in our study was 64.65 years with a range of 53-86 years.

Table 2

Age (in years)	No. of Patients	Percentage %
40-49	0	0
50-59	13	19.69
60-69	33	50
70-79	17	25.76
80-89	3	4.55

Graph 1



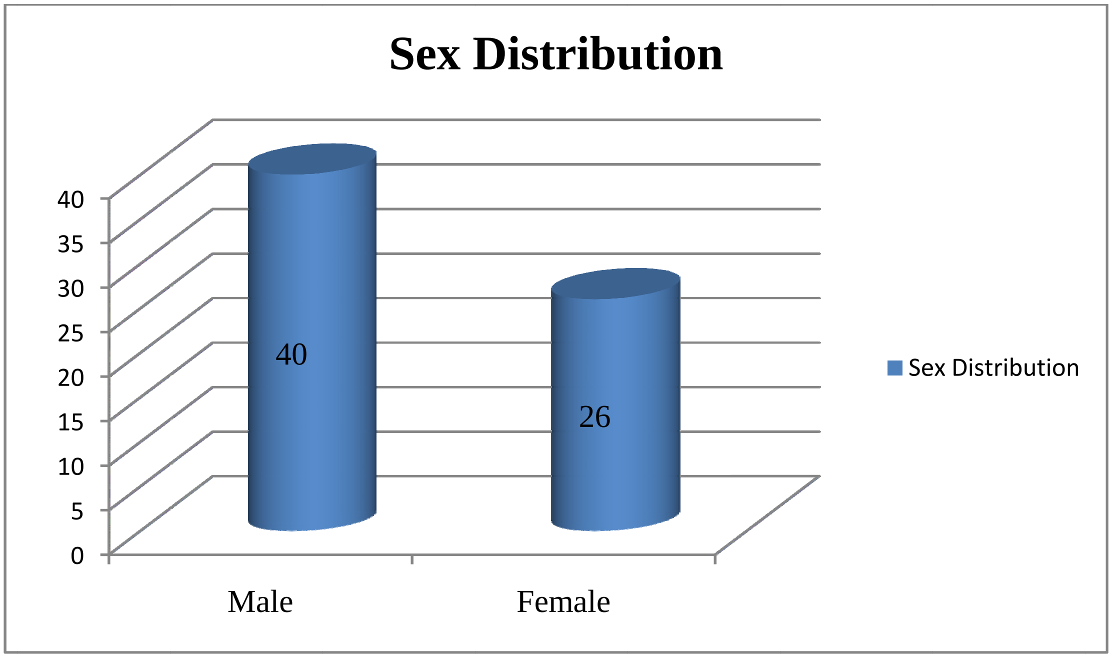
Sex Incidence:

In our study, majority (40 patients) of the subjects were male.

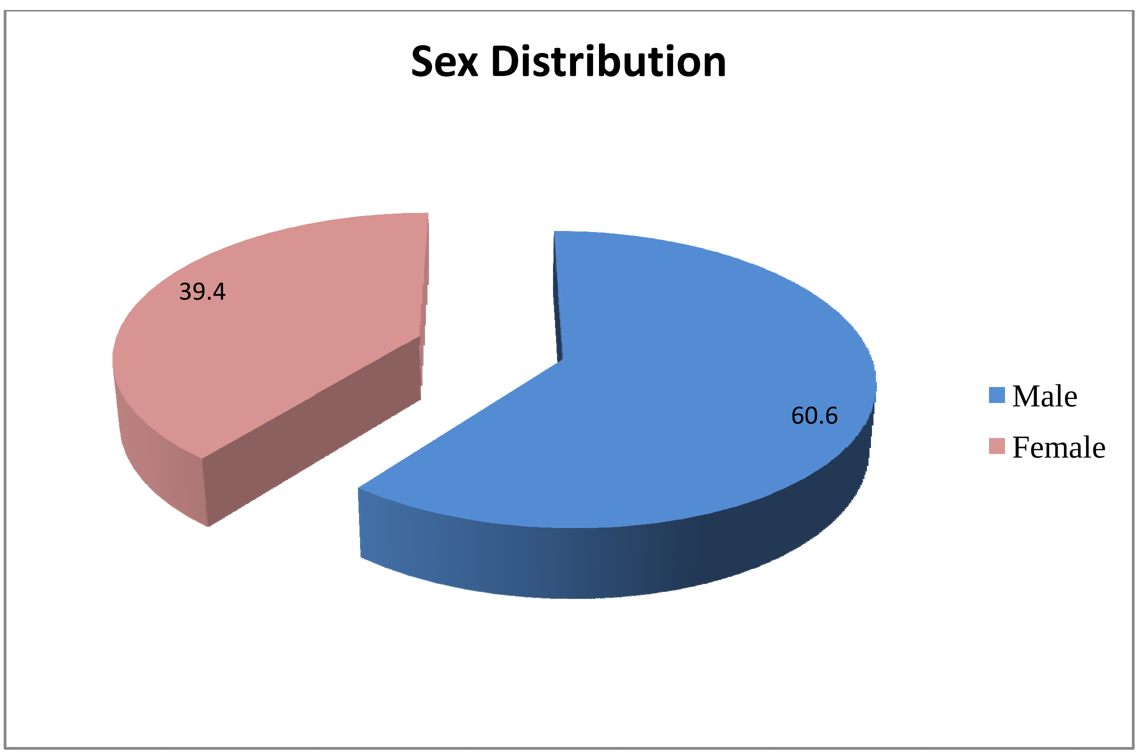
Table 3

Sex	No. of Patients	Percentage %
Male	40	60.60
Female	26	39.40

Graph 2-A



Graph 2-B



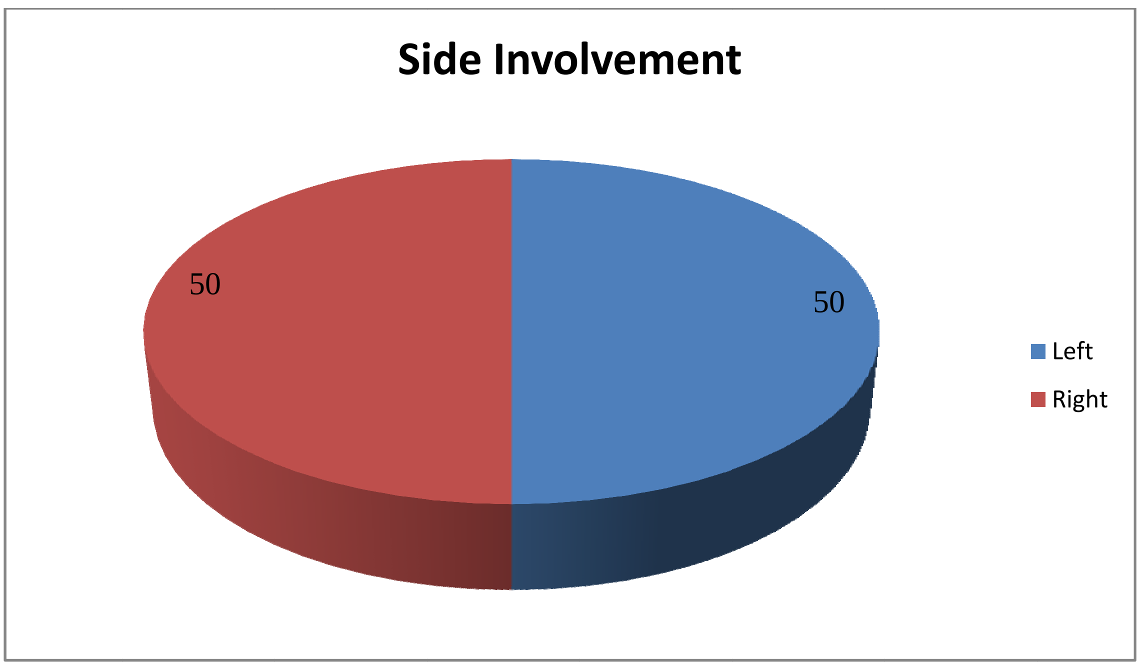
Side Involvement:

In our study, we had an equal number of patients with left and right involvement.

Table 4

Side involvement	No. of Patients	Percentage %
Right	33	50
Left	33	50

Graph 3

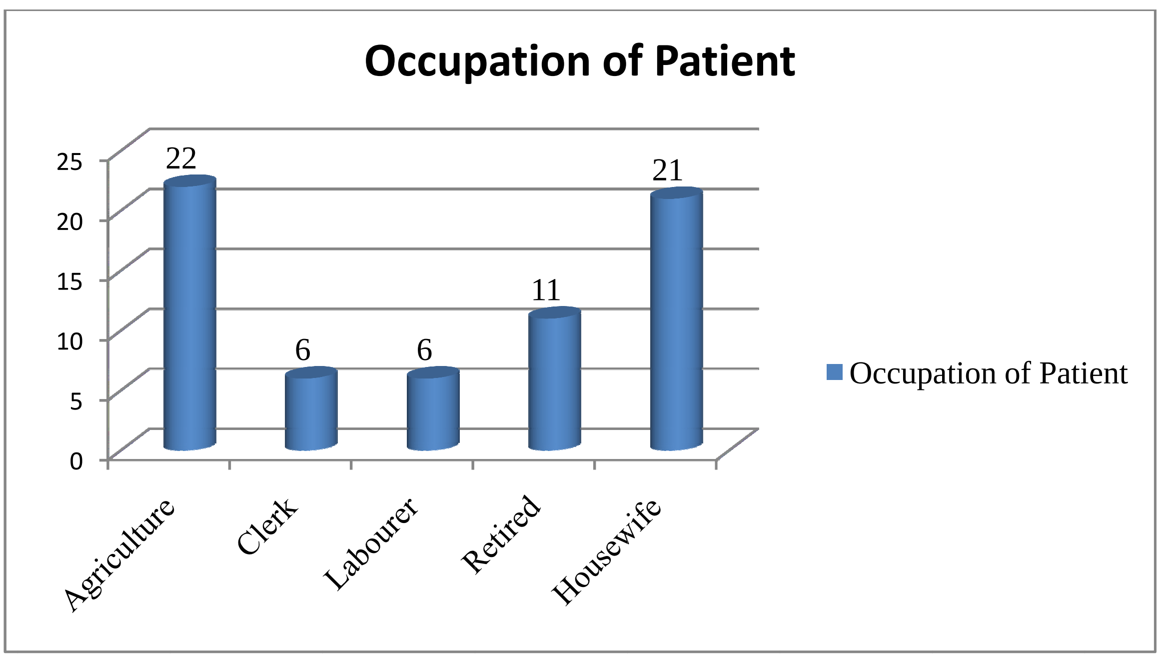


Occupation of the Patient:

Table 5

Occupation	No. of Patients	Percentage %
Agriculture worker	22	33.33
Clerk	6	9.1
Labourer	6	9.1
Retired	11	16.67
Housewife	21	31.9

Graph 4



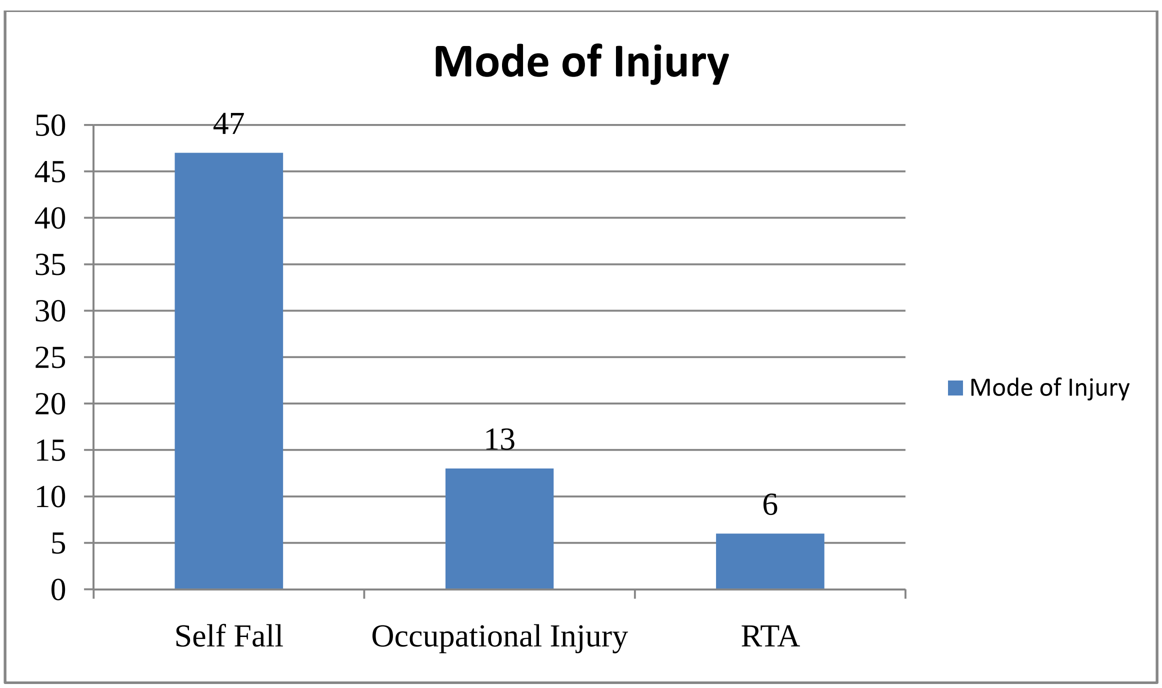
Mode of Injury:

In our study, most patients had a history of self fall, most of them at home with the other patients having fractures due to RTA's or occupational falls.

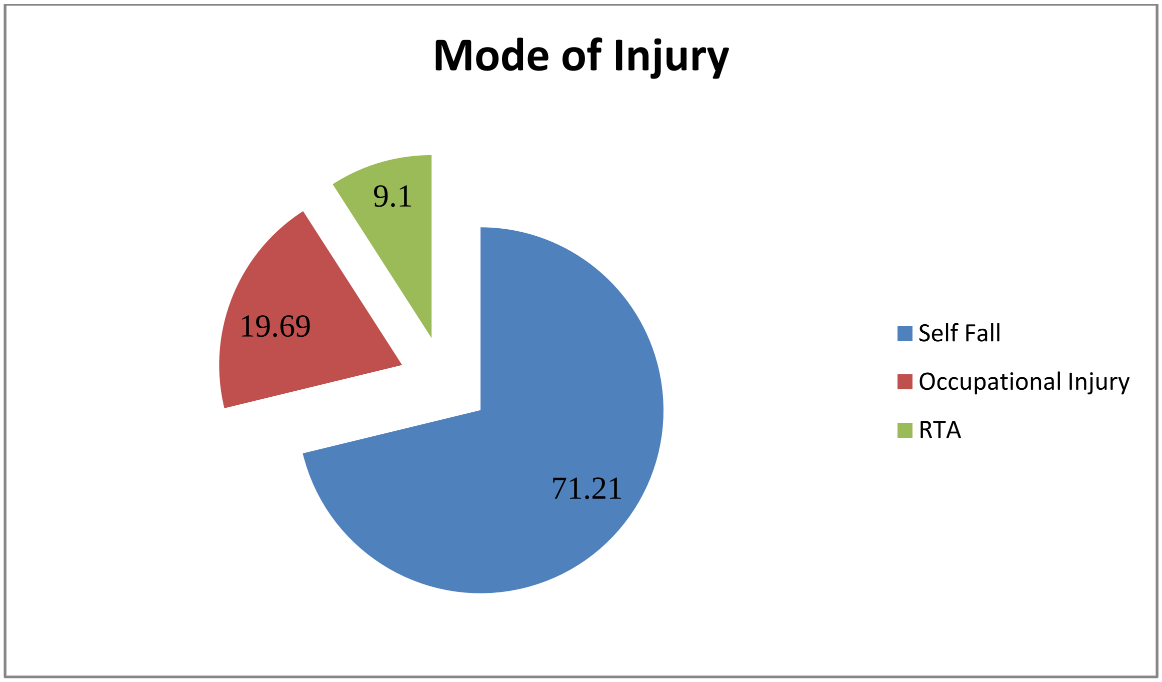
Table 6

Mode of injury	No. of patients	Percentage %
Self Fall	47	71.21
Occupational injury	13	19.69
RTA	6	9.1

Graph 5- A



Graph 5- B


Mode of Injury
9.1
19.69
71.21
Self Fall
Occupational Injury
RTA

Associated Diseases:

In our study, none of the patients had any associated fractures but systemic illness such as Diabetes and Hypertension were present in some of the patients.

Table 7

Disease	No. of patients	Percentage %
Diabetes	7	10.6
Hypertension	9	13.6
Diabetes and Hypertension	2	3.03

These patients were treated appropriately with Insulin and Anti-Hypertensives. Physician fitness was taken in these cases and then the patients were operated.

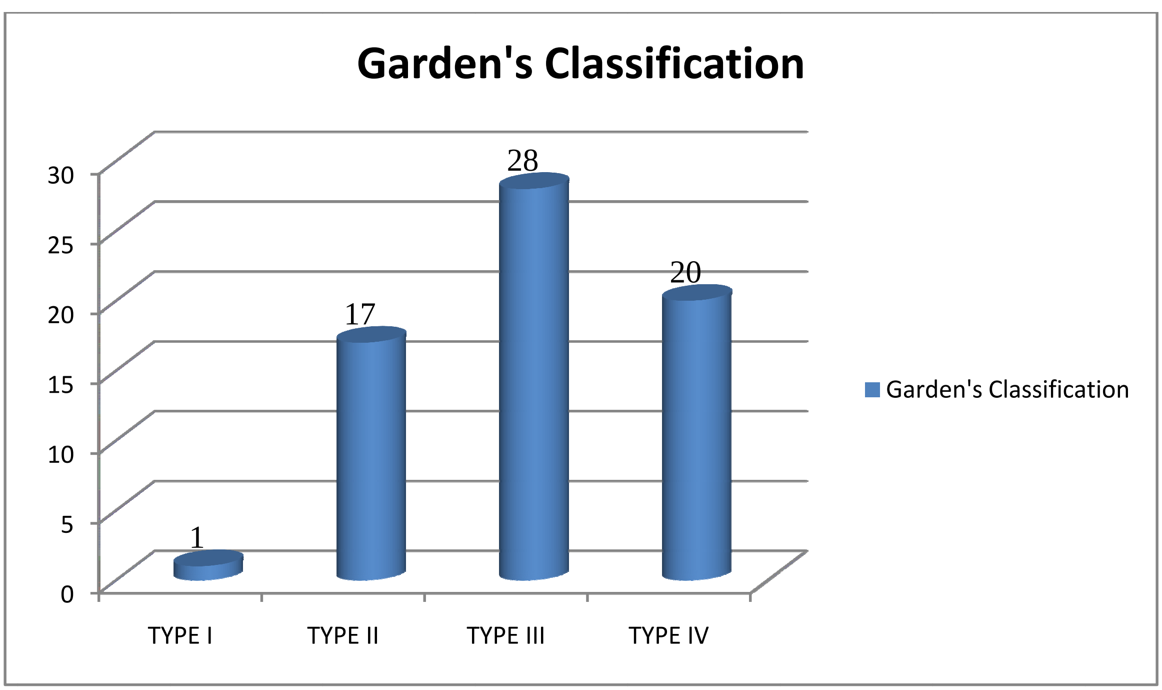
Type of Fracture:

The fractures were classified according to Gartland's Classification. All fracture types were seen with type 3 being the most prevelant with 28 patients.

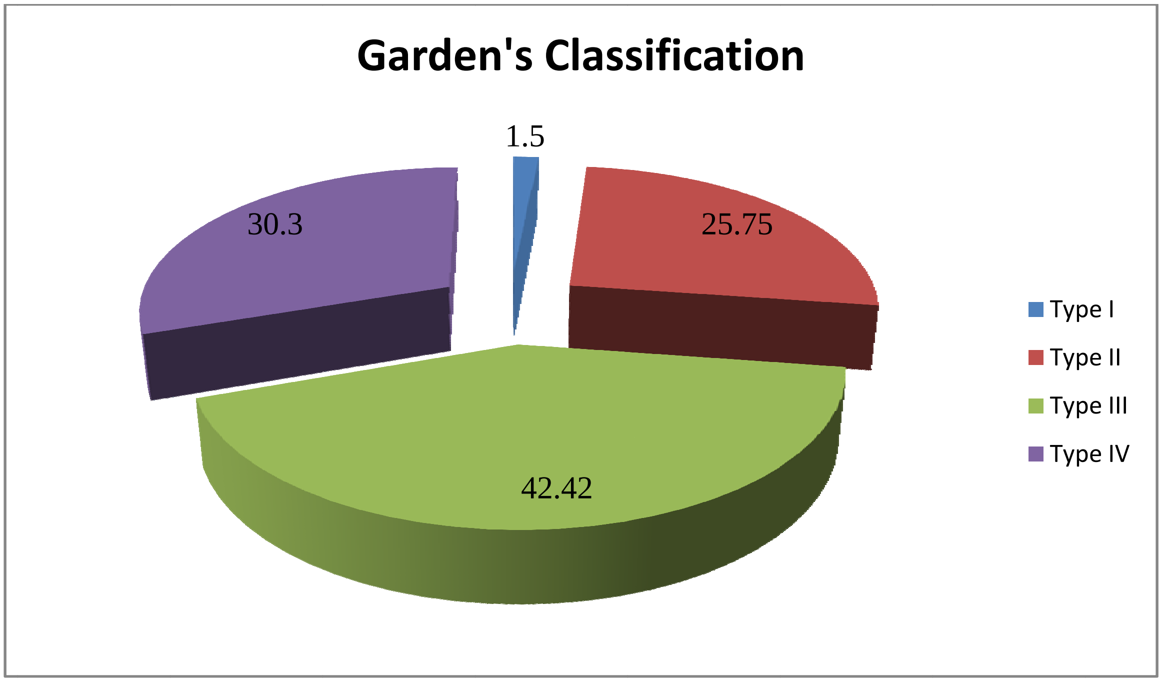
Table 8

Type of Fracture	No. of Patients	Percentage %
I	1	1.5
II	17	25.75
III	28	42.42
IV	20	30.3

Graph 6- A



Graph 6-B



Follow up:

The patients were followed up for a minimum period of 6 months. The maximum follow up in our serious was 13 months. The average follow up in our study was 7.8 months.

Prosthetic size:

The size of the femoral head used in this study ranged from 41 – 49 with 43 being the most commonly used prosthetic size with 29 patients (43.9%).

Table 9

Prosthetic size	No. of Patients	Percentage %
41	3	4.55
43	29	43.9
45	23	34.85
47	9	13.6
49	2	3

The most common prosthesis used in females were size 43 and that in males was size 45.

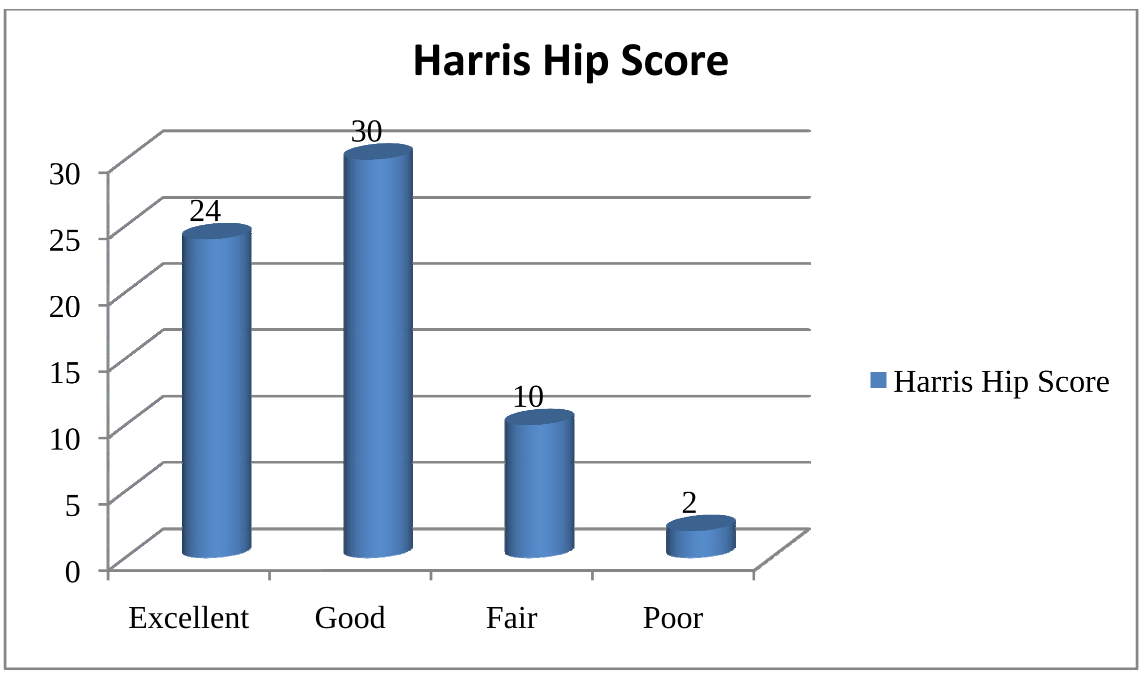
Results:

The final results were calculated using the modified Harris Hip Score[7]. In our study we had good to excellent results in 54 of the 66 patients(81.81%), while poor result was noted in only 2(3%) patients. The poor results were seen due to pain, old age of the patients requiring walking aids and reduced ROM. The average HHS in our study was 86.5.

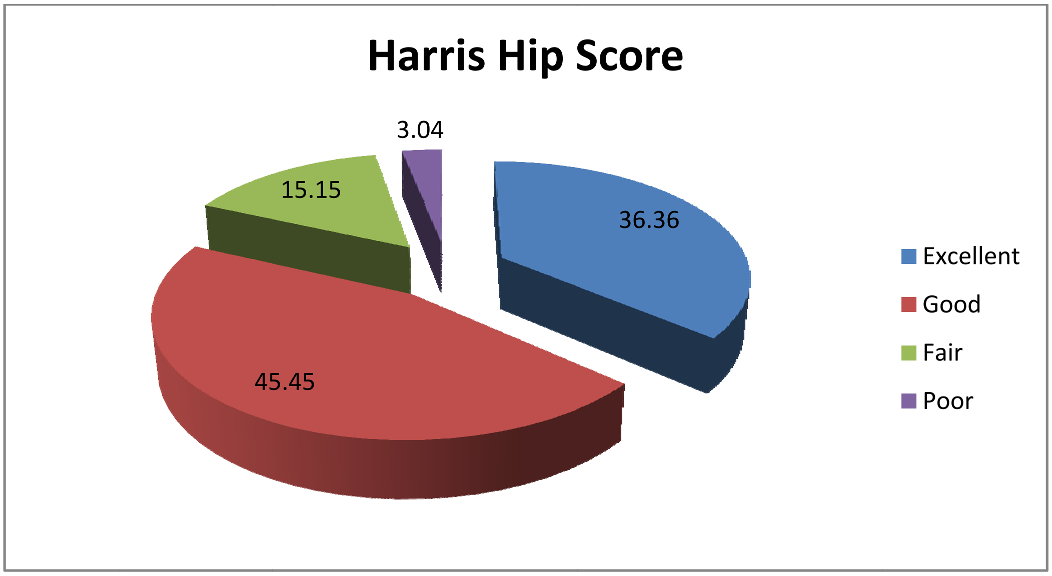
Table 10

Harris Hip Score	No. of Patients	Percentage %
Excellent	**24**	**36.36**
Good	**30**	**45.45**
Fair	**10**	**15.15**
Poor	**2**	**3.03**

Graph 7-A



Graph 7-B



Complications:

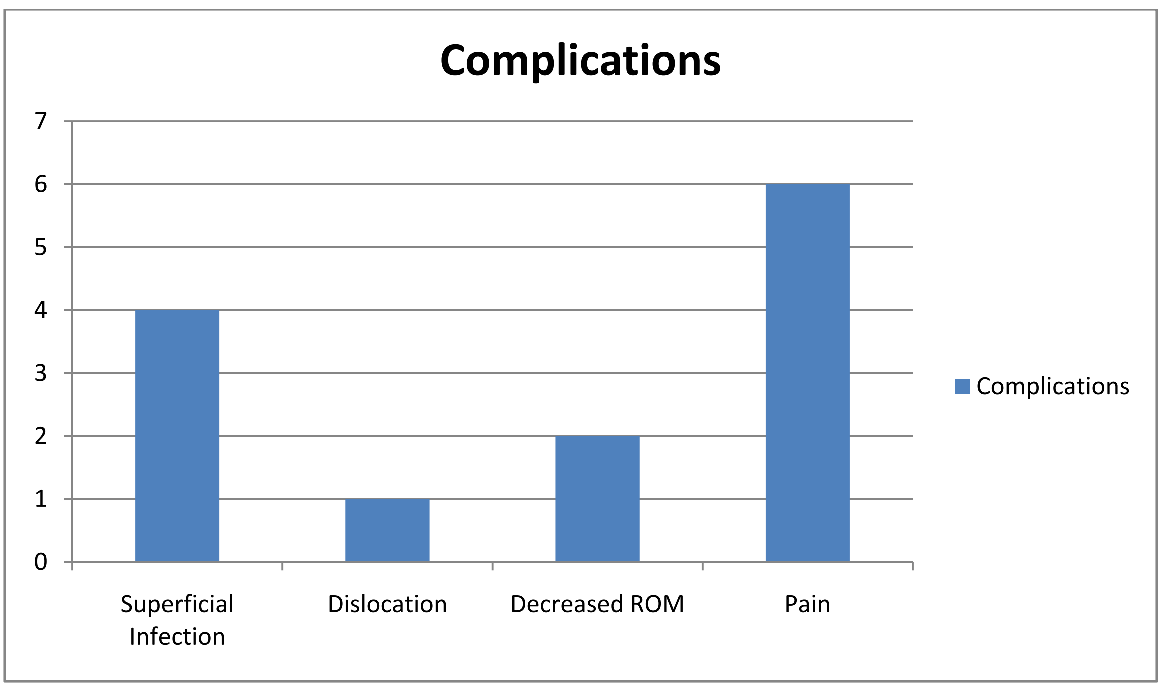
In our study, we had 2 patients with 0.25 cm shortening, 7 patients with 0.5 cm, and 3 patients with 1cm shortening. These patients were given appropriate shoe raises and according to Harris Hip Score the shortening was not significant. There were no patients with lengthening in our series. The shortening may be due to the fact that the cement was inserted by hand after preparation of the neck.

Superficial infection was seen in four patients and was treated appropriately with antibiotics. No cases of deep infection were seen. One patient with infection also had slight pain during walking. Reduced Range of motion was seen in 2 patients, one of them was secondary to dislocation of the hip after a history of fall 4 months post surgery. No fractures were seen in the patient and the hip joint was promptly reduced. 4 patients used canes for walking out of which 2 of them used secondary to pain. Six patients had pain post surgery ranging from slight to mild.

Table 11

Complication	No. of Patients	Percentage %
Superficial Infection	4	6.06
Dislocation	1	1.5
Decreased ROM	2	3.03
Pain	6	9.09

Graph 8



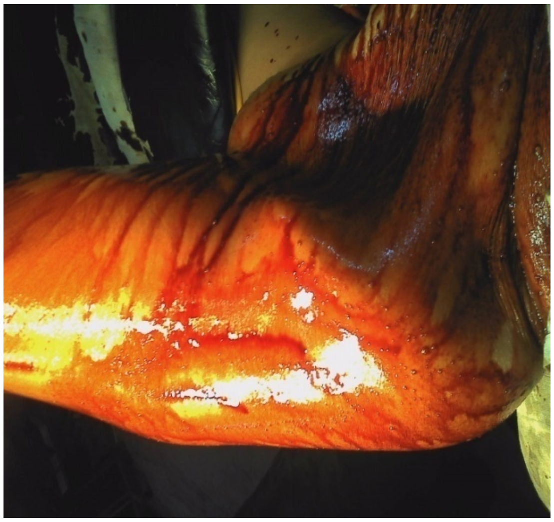
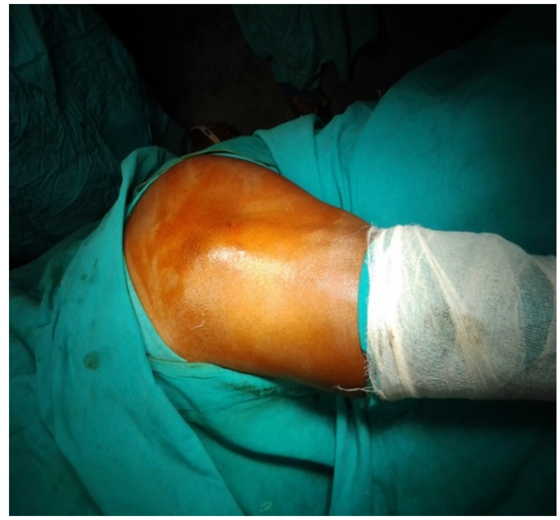
Pre- Operative Clinical Photographs

Pre-operative photograph showing LLD

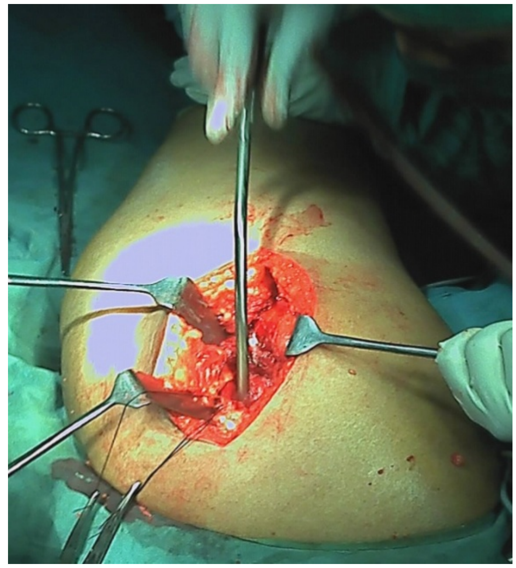
Pre operative Positioning of the Patient

Operative Photographs

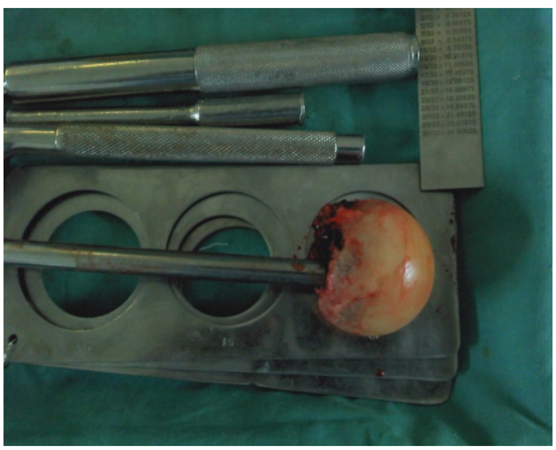
Painting and Draping of the Patient.

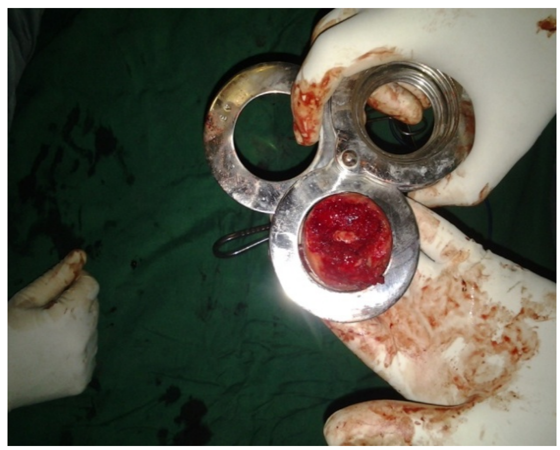



Instruments Used during Surgery

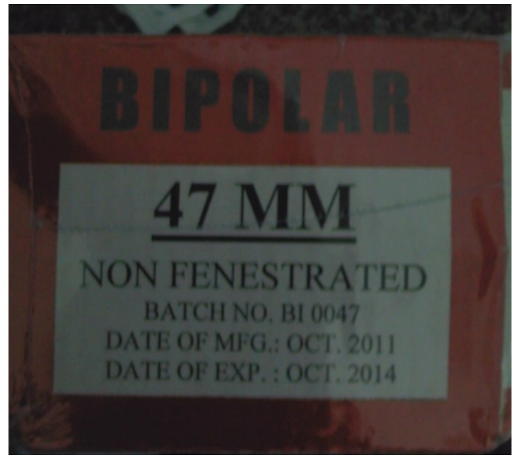


Incision for Procedure **Dissection to expose the joint**

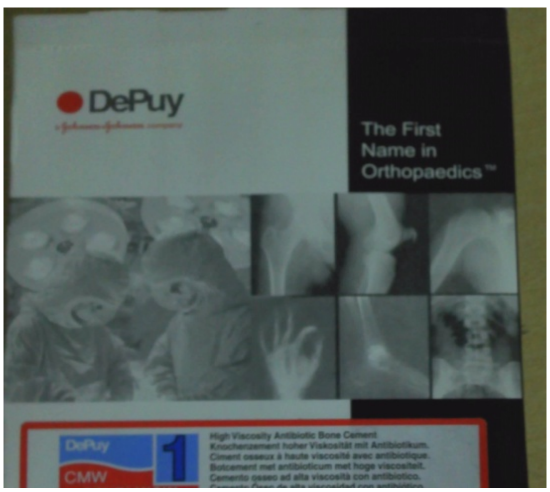


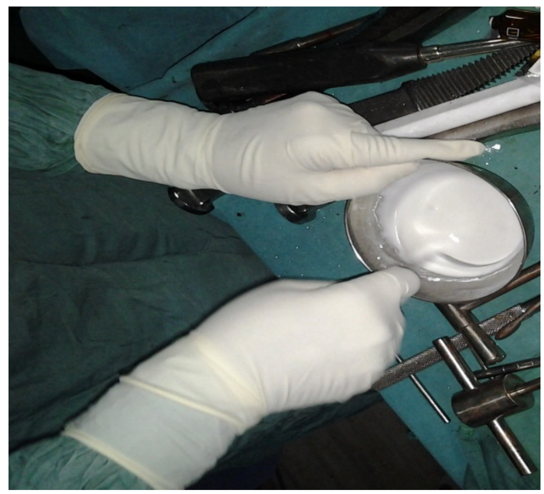


Head Extraction **Measurement of head size**

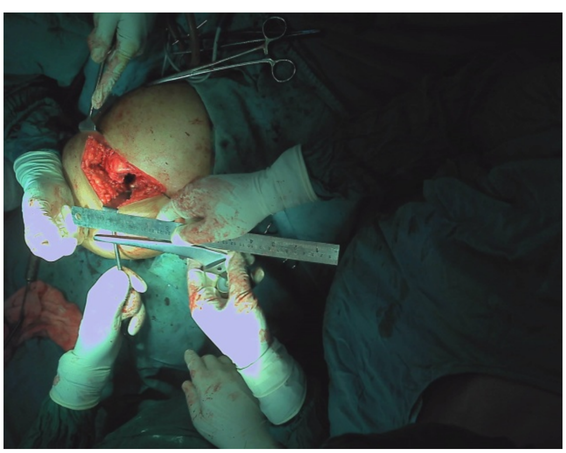


Implants used for hemiarthroplasty

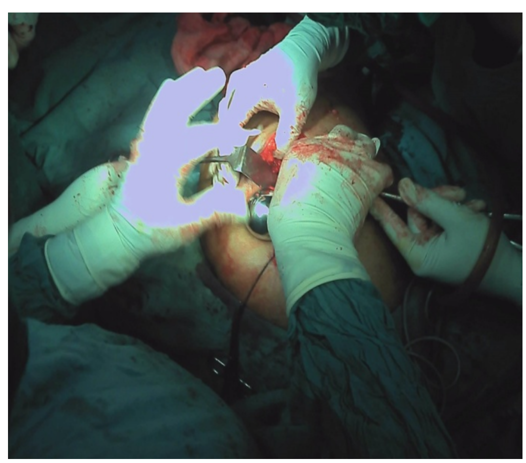




Cement Used and Preparation of the Cement



Scale used to measure offset

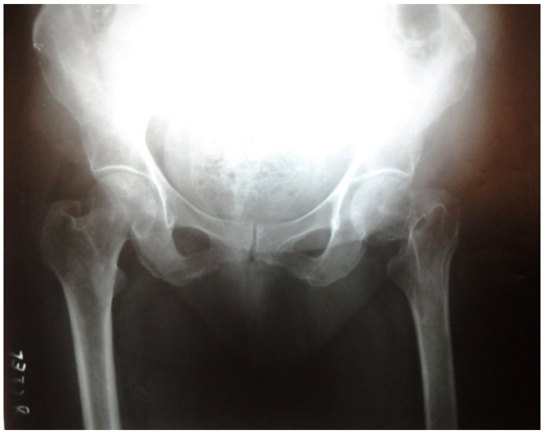


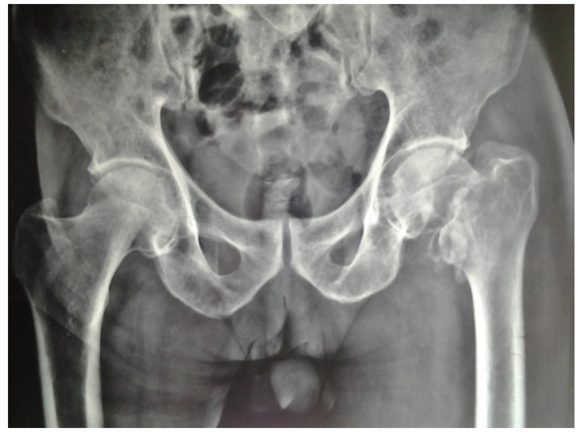
Insertion of implant after cementation

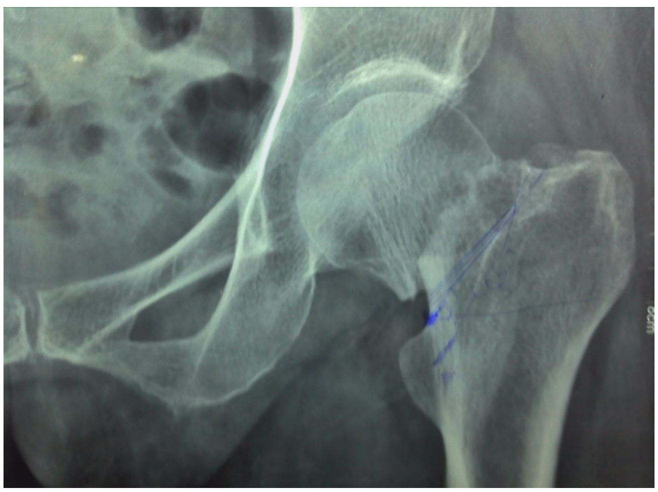
Final Closure with Drain **Suture Removal on 12th Post-op day**

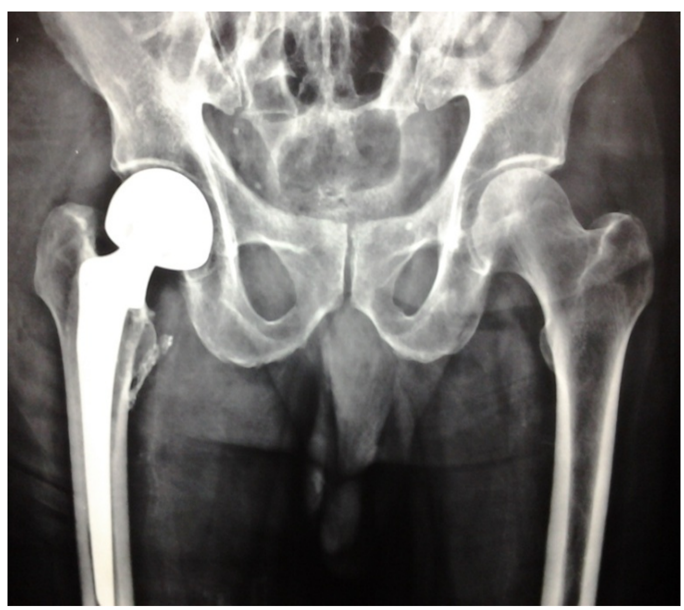
Mobilization of Patient with the help of walker

Pre- operative and Post-operative Radiographs









Post-Operative

Flexion -Lt Hip

Rt. Hip

Abduction – Rt Hip

Rt Hip

Adduction Lt Hip

Rt Hip

Internal Rotation- Lt Hip **External rotation- Rt. Hip**

Healed Incision Site

Post operative photograph showing limb lengths

Patient walking without aids **Patient walking with aids**

Discussion

In our study, 66 patients with diagnosis of intracapsular neck femur fracture were treated with cemented bipolar prosthesis in patients of both the sex. The observations were made and results were analysed. The study was also compared with studies of other authors. Various aspects of the procedure have been observed and discussed in detail.

Age incidence:

The average age in our series was 64.65 years with a range of 53-86 years, with most patients (33 in no.) being in the age group of 60-69 years. In a series done by Gupta et al[75], the reported average age was 54 years while a series done by Tomonori Baba et al[104], the average age in their series was 76.7 years. The average age reported in some other series are 72 years in La Bella et al[58], 84 years in Anders Enocson et al[105] and 77.43 years in Sakr Mazen et al[106].

Sex Incidence:

In our study we had 40 males and 26 females. The proportion of male patients(60.6%) was higher than the females(39.4). The literature review of this states more female patients compared due male due to post menopausal osteoporosis as seen in series by Rogmark et al[107] which had a female patient percentage of 79, 73.4% in Anders Enocson et al[105], 74% in series by Figved et al[108]. The difference between the literature and our study can be attributed to the psycosocial dynamics in rural population that give preference to male population for treatment.

Associated Conditions:

In our study, 10.6% patients had diabetes, 13.6% had hypertension and 3.03% had both of these conditions. In a study by Mazen et al[106], 27.4% had hypertension, 5.8% had diabetes, and 19.6% had both of these. The reduced percentages in our study may be related to age of the patient.

Complications:

In our study we had 12 patients with 1cm or less shortening with 58.3% of the patients having a limb length discrepancy of 0.5 cm. We had a 6.06% rate of superficial infection and no cases of deep infection while Figved et al[108] had a 0.9% and 2.7%, Enoscon et al[105] had a rate of 0% and 1.7%, Wetherell et al[109] had a rate of 1.8% and 0.8% of superficial and deep infections respectively.

We had dislocation in only one patient(1.5%). The results reported in other series include 4.5% in Figved et al[108], 3% in Enoscon et al[105], 2.9% in Wetherdal et al[109], 4.2% in Frihagen et al[110], 1.1% in Schielmann et al[111]. Our results were slightly less than the reported series which might have been due to the short time of follow up in our series.

We had no cases of Periprosthetic Fractures while the reported rates are 1.3% in Enoscon[105] series, 0.6% in Wetherdal[109] series and 1.6% in a series by Krishnan et al[72].

Table 12

Study	Complications in %				
	Superficial Infection	Deep Infection	Dislocation	Periprosthetic Fracture	Pain
Our Study	6.06	0	1.5	0	9.09
Figved et al[108]	0.9	2.7	4.5		
Enoscon et al[105]	0	1.7	3	1.3	
Wetherdal et al[109]	1.8	0.8	2.9	0.6	
Frihagen et al[110]	0	0.5	4.2		
Schliemann et al[111]		1.1	3.5		
Krishnan et al[72]				1.6	2.5

Reduced ROM was seen in 2 patients (3.03%) probably related to the advanced age of the patient and less motivation of the elderly for rehabilitation. Pain seen in our series (9.09%) was of the mild variety related to the age of the patient and secondary knee osteoarthritis of the patients.

Results:

In our study of 66 cases of fracture neck femur treated by cemented bipolar prosthesis, we had excellent results in 24(36.36%), good in 30(45.45%), fair in 10(15.15%) and poor results in 2(3.03%) patients. The average score according to Harris

Hip Score was 86.5. In a series by Atlay et al[73] done on 76 patients, they had excellent results in 26(34.21%), good results in 40(60.60%), fair in 6(7.89%) and poor in 4(5.21%).

We got excellent to good results in 54(81.81%) of patients. Lausten et al[48] found excellent to good results in 75% of patients, Bochner et al[56] in 92%, Lestrange[57] in 70.8% of patients, Surya Bhan[112] in 90.6% and Gupta et al[75] in 85% of patients.

The table below shows the mean Harris Hip Score between various studies.

Table 13

Study	**Mean HHS**
Our study	**86.5**
Giliberty[6]	**87**
Mannarino[52]	**84.7**
Figved[108]	**78.9**
Altay[73]	**85.1**
Krishnan[72]	**74.7**
Mazen[106]	**72.2**
Frihagen[110]	**70.6**

As shown in the table above, our results in this series were comparable to other series conducted world-wide.

SUMMARY

Fractures of the femoral neck are a common problem in the eldery after a trivial fall due to osteoporosis and more common in females than males due to post menopausal osteoporosis. The problem of these fractures is increasing due to the increase in life expectancy related to advances in the medical field. The fractures will cause a considerable financial burden and the treatment of the fractures has been evolving from the simple Austin-Moore prosthesis to the complicated total hip replacement. A thorough understanding of the needs of the patient, together with the financial aspect of the surgeries can help the orthopaedician chose the appropriate procedure for the patient.

In our study, 66 patients were treated with an average age of 64.65 and the range from 53-86 years. The majority of the patients were male i.e. 40 (60.6%) and we had 39.4%(26) female patients in the study. Both sides were equally involved with 50% each.

The most common cause of these fractures was trivial fall seen in 71.21% of the patients followed by occupational injuries in 19.69% and RTA in 9.1%. Due to the advanced age in our study, 10.6% patients had diabetes, 13.6% had hypertension and 3.03% had both of these conditions.

The fractures in these patients were classified according to Garden's Classification. We had all four classes with type 3 being the most prevelant with 28(42.42%) patients

The average follow up in our study was 7.8 months with a range of 6-13 months.

The patients were evaluated using the Harris Hip Score[7]. The results were excellent in 24(36.36%), good in 30(45.45%), fair in 10(15.15%) and poor results in 2(3.03%) patients. We got excellent to good results in 54(81.81%) of patients. The poor results were seen due to pain, old age of the patients requiring walking aids and reduced ROM. The average HHS in our study was 86.5.

In our study we had 12 patients with 1cm or less shortening with 58.3% of the patients having a limb length discrepancy of 0.5 cm. We had a 6.06% rate of superficial infection and no cases of deep infection. . Reduced Range of motion was seen in 2 patients, one of them was secondary to dislocation of the hip after a history of fall 4 months post surgery. Six patients had pain post surgery ranging from slight to mild.

As per our results, we conclude that hemiarthroplasty using cemented bipolar prosthesis is a good procedure for the elderly and provides early rehabilitation.

CONCLUSION

After treating 66 patients with intracapsular fracture neck of femur, with Bipolar Prosthesis, we conclude that hemiarthroplasty with Cemented Bipolar Prosthesis has proved to be an acceptable method for the management of intracapsular femoral neck fractures. Prosthetic replacement in individuals of waning years for displaced intracapsular femoral neck fractures is a rationale step as period of hospitalization is reduced, early mobilization, weight bearing and return to independence is possible. It avoids the difficult problem of non-union and avascular necrosis.

It is a cost effective procedure and a poor man’s total hip replacement. Because of the bipolar nature of the prosthesis, it provides the theoretical advantage of squatting that is needed in rural areas for using the toilet. Although we had advised patients to avoid such activities to prevent early wear, no effect in the results were seen of the patients that performed it.

Our early and short term results are encouraging and promising and long term results are awaited.

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ANNEXURE 2

Proforma

Name:	I P No:
Age/Sex:	DOA:
Occupation:	DOS:
Residence:	DOD:

Presenting complaints with duration:

History of presenting complaints:

Family History:

Personal History:

Past History:

General Physical Examination

Pallor:	present/absent
Icterus:	present/absent
Clubbing:	present/absent
Generalized Lymphadenopathy:	present/absent
Build:	Poor/Moderate /Well
Nourishment:	Poor / Moderate / Well

Vitals

PR:	RR:
BP:	TEMP:

Other Systemic Examination:

- Respiratory System
- Cardiovascular System
- Central Nervous System
- Per Abdomen

Local examination

Gait:

<u>Inspection</u>:

- Attitude
- Anterior Superior Iliac Spine – same level/ raised/ lowered
- Lumbar lordosis
- Shortening and Deformity
- Swelling
- Skin
- Muscle Wasting

- Wounds, if any
- Other fractures ,if any

Palpation:

- Tenderness
- Local rise of temperature – yes / no
- Broadening/ migration of greater trochanter – yes/ no
- Crepitus – yes / no
- Swelling

Movements :

	Active	Passive
Hip : Flexion		
Extension		
Internal rotation		
External rotation		
Adduction		
Abduction		
Knee : Flexion		
Extension		

Measurements : Apparent length : Xiphisternum to Medial malleolus

True length : Anterior superior iliac spine to Medial malleolus

Anterior superior iliac spine to Medial Joint Line of Knee Joint

Medial joint line of knee joint to medial malleolus

Girth of the Limb.

Bryant's triangle

Nelaton's line

Shoemaker's line

Stability test : Telescopic Test

Tredlenburg's test

Abnormal Mobility

Transmitted movements

INVESTIGATION:

Blood:

Hb%

TC

DC

ESR

BT

CT

Blood urea

Serum creatinine

RBS

Urine:

Microscopy

Sugar

Albumin

X-Ray : Chest PA view

Bilateral hip with proximal femur – AP view

ECG:

Final Diagnosis:

Details of Surgery:

- Stability on operating table
- Intraoperative complications ,if any
- Blood Loss

Post operative Management:

- o Mobilization:
- o Wound healing and suture removal
- o Complications:

Date of Discharge:

Condition at discharge:

- ➢ Clinical:
  - o Shortening if any
  - o Complications if any
  - o Deformity
    - Flexion
    - Adduction/Abduction
    - Rotational
  - o Range of movements:

	Active	Passive
Flexion		
Adduction		
Abduction		
Internal rotation		
External rotation		

Follow up(4-6 weeks using Harris Hip Score)

- ➢ Clinical

- Patient complaints
    1. Pain
    2. Limp.
    3. Gait.
    4. Activities.
    5. Any other.
- Deformity -
- Movements Active Passive

  1.Flexion

  2.Adduction

  3.Abduction

  4.Rotation
- Quadriceps

  1.Wasting

  2.Power
- Tredlenburg's test
- Shortening

Radiological:

- Position of implants

FOLLOW UP:(After 8-10 weeks using Harris Hip Score)

- Clinical
    - Patient complaints
        1. Pain
        2. Limp
        3. Gait
        4. Activities.
        5. Any other.
    - Deformity -
    - Movements Active Passive

      1.Flexion

2.Adduction

3.Abduction

4.Rotation

- Quadriceps
    - Wasting
    - Power
- Tredlenburg's test
- Shortening compensation if any

- Job resumed
    - Date of resuming duty
- Radiological
    - Position of implant

ANNEXURE 3

CONSENT FORM

INFORMED CONSENT FORM

BLDEU'S SHRI B. M. PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTRE, BIJAPUR- 586103**.**

TITLE OF THE PROJECT - **A prospective clinical study of surgical management of intracapsular fracture neck femur using hemiarthroplasty with cemented bipolar prosthesis.**

PRINCIPAL INVESTIGATOR - DR. BAMI MONISH SOMNATH
P.G.GUIDE NAME - DR. ASHOK.R.NAYAK
PROFESSOR OF ORTHOPAEDICS

All aspects of this consent form are explained to the patient in the language understood by him/her.

I) INFORMED PART

1) PURPOSE OF RESEARCH:

I have been informed that this study is a surgical management of intracapsular fracture neck of femur using cemented bipolar prosthesis. I have also been given a free choice of participation in this study. This method requires hospitalization.

2) PROCEDURE:

I am aware that in addition to routine care received, I will be asked series of questions by the investigator. I have been asked to undergo the necessary investigations and treatment, which will help the investigator in this study.

3) RISK AND DISCOMFORTS:

I understand that I may experience some pain and discomfort during the examination or during my treatment. This is mainly the result of my condition and the procedure of this study is not expected to exaggerate these feelings that are associated with the usual course of treatment.

4) BENEFITS:

I understand that my participation in this study will help to study the results of Cemented Bipolar Prosthesis in the management of intracapsular fracture neck of femur.

5) CONFIDENTIALITY:

I understand that the medical information produced by this study will become a part of Hospital records and will be subject to the confidentiality and privacy regulation. Information of a sensitive personal nature will not be a part of the medical records, but will be stored in the investigator's research file and identified only by a code number. The code-key connecting name to numbers will be kept in a separate location.

If the data are used for publication in the medical literature or for teaching purpose, no name will be used and other identifiers such as photographs and audio or videotapes will be used only with my special written permission. I understand that I may see the photographs and videotapes and hear the audiotapes before giving this permission.

6) REQUEST FOR MORE INFORMATION:

I understand that I may ask more questions about the study at anytime. Dr. Bami Monish is available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during the course of the study, which might influence my continued participation.

If during the study, or later, I wish to discuss my participation in or concerns regarding this study with a person not directly involved, I am aware that the social worker of the hospital is available to talk with me. A copy of this consent form will be given to me to keep for careful reading.

7) REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary and that I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice to my present or future care at this hospital. I also understand that Dr. Bami Monish may terminate my participation in the study after he has explained the reasons for doing so and has helped arrange for my continued care by my own physician or physical therapist, if this is appropriate.

8) INJURY STATEMENT:

I understand that in the unlikely event of injury to me resulting directly from my participation in this study, if such injury were reported promptly, the appropriate treatment would be available to me, but no further compensation would be provided. I understand that by my agreement to participate in this study I am not waiving any of my legal rights.

I have explained to ______________________________the purpose of the research, the procedures required and the possible risks and benefits to the best of my ability in patient's own language.

______________________ ______________________

Dr. Bami Monish Date

(Investigator)

II) **STUDY SUBJECT CONSENT STATEMENT:**

I, the undersigned have been explained by Dr. ASHOK NAYAK in the language understood by me. The purpose of research, the details or procedure that will be implemented on me. The possible risks and discomforts of surgery and anaesthesia have been understood by me. I have also been explained that participation in this medical research is solely the matter of my will and also that I have the right to withdraw from this participation at any time in due course of the medical research.

_____________________________ _________________________

Participant / Guardian Date

_____________________________ _______________________

Signature of Witness Date

ANNEXURE -4

Key to Master Chart

Ip. No.	-	Inpatient Number
M	-	Male
F	-	Female
R	-	Right
L	-	Left
Agri	-	Agricultural Worker
Retd.	-	Retired
H/W	-	Housewife
MOI	-	Mode of Injury
S/F	-	Self Fall
RTA	-	Road Traffic Accident
O/I	-	Occupational Injury
AD	-	Associated Conditions
HTN	-	Hypertension
DM	-	Diabetes Mellitus
N	-	Normal
Gart.	-	Gartland’s Classification
PS	-	Prosthesis size

Sup. Inf. - Superficial Infection

Red. ROM - Reduced Range of Motion

WA - Walking Aids

FO - Follow – up

LLD - Limb Length Discrepancy

S - Shortening

HHS - Harris Hip Score

EX - Excellent

GD - Good

FR - Fair

PR - Poor

MASTER CHART

sr. no.	name	age	sex	i.p. no.	Occupation	Side	MOI	AD	GART	PS	Complication	FO	LLD	HHS at 6	Result
1	Panduranga	57	M	17092	AGRI	R	S/F	N	III	47	none	9	N	89	GD
2	Gauribai Pare	65	F	17072	H/W	L	S/F	DM/HTN	III	43	none	11	N	93	EX
3	Shivappa	65	M	15790	AGRI	L	S/F	N	III	43	sup. Inf.	7	N	90	EX
4	Shivappa Parit	65	M	18026	RETD.	L	S/F	N	IV	45	none	8	N	87	GD
5	Ravi Goudar	54	M	18153	AGRI	R	O/I	N	II	47	none	6	N	88	GD
6	Gangawwa	60	F	21602	H/W	R	S/F	N	II	43	none	8	N	90	EX
7	Bhagirathi	70	F	23381	H/W	L	S/F	DM	III	45	none	9	N	91	EX
8	Zakhir	67	M	21633	RETD.	L	S/F	HTN	IV	45	none	7	N	82	GD
9	Shantabai	62	F	22654	AGRI	L	S/F	N	II	43	pain	13	N	79	FR
10	Guruballaya	85	M	23631	RETD.	L	S/F	DM	II	43	pain, sup. Inf.	8	N	76	FR
11	Vithalbai	65	F	26747	H/W	L	S/F	N	III	43	none	9	0.25S	87	GD
12	Sanjay Patil	58	M	27300	CLERK	R	S/F	N	III	47	none	6	O.5S	89	GD
13	Channawa Gunjal	70	F	2204	H/W	R	S/F	N	IV	43	none	11	N	86	GD
14	Bapu Sangapura	74	M	2292	AGRI	R	O/I	N	IV	45	none	8	N	91	EX
15	Rudra Biradar	60	M	4698	AGRI	L	O/I	HTN	IV	45	none	7	N	94	EX
16	Sidappa Biradar	60	M	3396	AGRI	L	O/I	DM	IV	45	none	10	N	95	EX
17	Pandu Rajput	58	M	6941	LABOURER	L	O/I	N	III	49	none	6	N	87	GD
18	Siddappa Kalma	56	M	7823	LABOURER	R	O/I	N	II	45	none	6	N	94	EX
19	Shantabai Rathod	60	F	8239	H/W	R	S/F	N	III	47	WA	6	0.5S	78	FR
20	Sonabai Jadhav	60	F	7824	H/W	L	S/F	N	II	45	none	8	0.5S	95	EX
21	Kamlabai Motegi	66	F	9053	AGRI	R	S/F	N	II	43	none	9	1S	86	GD
22	Saibai	65	F	9057	H/W	L	S/F	HTN	III	47	none	10	1S	87	GD
23	Bhimasingh	70	M	27282	RETD.	L	S/F	DM/HTN	II	49	none	6	N	92	EX
24	Shantappa	72	M	277	RETD.	R	S/F	DM	III	43	pain, WA	6	N	68	PR

25	Rudrawwa Hadimari	53	F	3796	LABOURER	L	S/F	N	III	45	sup. Inf.	7	N	79	FR
26	Neelawwa Rathod	59	F	2646	H/W	R	S/F	N	III	43	none	8	N	88	GD
27	Asha Kumbar	60	F	7031	H/W	R	S/F	N	IV	45	none	8	N	89	GD
28	Mallapa Patil	72	M	10585	RETD.	R	S/F	N	II	45	none	9	N	87	GD
29	Sidappa Biradar	58	M	11741	CLERK	R	O/I	N	II	45	none	6	N	92	EX
30	Ramesh Patil	56	M	11669	CLERK	R	O/I	N	II	45	none	6	N	91	EX
31	Kamlawwa Hadimani	65	F	12543	H/W	L	S/F	N	III	43	none	12	N	94	EX
32	Sangappa Hadimani	58	M	12004	AGRI	R	RTA	N	III	47	none	8	0.25S	95	EX
33	Neelappa Tikoti	55	M	12406	LABOURER	R	RTA	N	IV	43	none	8	N	85	GD
34	Sidawwa Biradar	63	F	12244	AGRI	L	S/F	N	IV	43	none	7	N	89	GD
35	Ratan Chawan	60	M	28799	AGRI	R	O/I	HTN	III	43	none	7	N	82	GD
36	Sangawwa Inamdar	65	F	2115	H/W	L	S/F	HTN	III	43	pain, WA	9	N	75	FR
37	Sharanappa Patter	60	M	3050	AGRI	L	RTA	N	III	45	none	9	0.5S	85	GD
38	Lala Mohan	60	M	5194	CLERK	R	RTA	N	III	45	none	6	0.5S	89	GD
39	Basappa Kumber	63	M	9309	AGRI	L	O/I	N	III	45	none	6	N	81	GD
40	Devraj Yellur	73	M	9039	AGRI	L	S/F	DM	IV	47	Red. ROM	11	N	79	FR
41	Ravi Kotennavar	71	M	10785	AGRI	L	S/F	DM	III	45	WA	13	N	72	FR
42	Shanta Kulkarni	64	F	11914	H/W	R	S/F	HTN	IV	41	none	7	N	93	EX
43	Manjula Hatti	65	F	13761	H/W	R	S/F	N	II	43	none	9	N	91	EX
44	Putlabai Badudri	60	F	17424	H/W	L	RTA	N	IV	43	none	8	1S	94	EX
45	Basamma Alur	65	F	20497	AGRI	L	O/I	N	II	43	none	8	N	85	GD
46	Rukmini Tadalagi	72	F	2128	H/W	R	S/F	N	III	43	none	10	N	83	GD
47	Paramavva Pujeri	70	F	22885	H/W	L	S/F	N	IV	43	none	10	N	87	GD
48	Saraswati Patil	66	F	23511	H/W	R	S/F	N	III	41	none	9	N	91	EX
49	Yallappa Salunke	80	M	22880	RETD.	L	S/F	N	III	45	none	8	N	92	EX
50	Dywvaramma	70	F	24359	H/W	L	S/F	N	III	41	none	6	N	95	EX

	Dharji														
51	Ramawwa Biradar	55	M	24983	LABOURER	L	S/F	N	IV	45	none	7	N	86	GD
52	Shivappa Bijapur	61	M	29543	AGRI	R	S/F	N	IV	43	none	8	N	89	GD
53	Shantappa Kumbar	62	M	30636	AGRI	L	S/F	N	II	47	none	7	0.5S	85	GD
54	Sidappa Bidri	57	M	7980	AGRI	L	S/F	N	III	45	none	7	N	90	EX
55	Darunappa Madhavpur	72	M	6681	RETD.	R	S/F	N	II	43	none	8	N	89	GD
56	Ningangouda Bagirath	72	M	10564	AGRI	R	S/F	N	IV	43	none	6	N	89	GD
57	Ningangouda Patil	78	M	11143	AGRI	R	S/F	N	II	43	Dislocation, pain, Red. Rom	6	N	66	PR
58	Saibanna Aiyar	70	M	12223	RETD.	R	S/F	N	IV	43	none	8	N	93	EX
59	Rukmabai M.N.	60	F	25268	H/W	R	S/F	HTN	III	43	none	9	N	97	EX
60	Pundalik Jadhav	62	M	25548	CLERK	L	O/I	DM	IV	43	none	6	N	92	EX
61	Prabhugouda Patil	86	M	12425	RETD.	R	S/F	HTN	II	43	sup. Inf.	6	N	73	FR
62	Ningangouda Biradar	60	M	12213	LABOURER	R	S/F	N	III	47	pain	6	N	77	FR
63	Channawa Alayali	72	F	13504	H/W	R	S/F	HTN	I	43	none	6	0.5S	83	GD
64	Devendra Waliker	61	M	12324	AGRI	R	RTA	N	IV	45	none	6	N	81	GD
65	Suresh Panchivati	62	M	12880	CLERK	L	O/I	N	III	45	none	6	N	84	GD
66	Saibgouda Biradar	70	M	13254	RETD.	L	S/F	N	IV	45	none	6	N	79	FR