PROSPECTIVE STUDY IN SURGICAL MANAGEMENT OF FEMUR NECK FRACTURE WITH HEMIARTHROPLASTY USING MODULAR BIPOLAR PROSTHESIS

BY

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LIST OF ABBREVIATIONS USED

AMP	Austin Moore Prosthesis
CBR	Canal Bone Ratio
BHU	Banaras Hindu University
DM	Diabetes Mellitus
DVT	Deep Vein Thrombosis
ECG	Electrocardiogram
HTN	Hypertension
HRA	HemireplacementArthroplasty
LMWH	Low Molecular Weight Heparin
MHHS	Modified Harris Hip Score
PMMA	Polymethyl Methacrylate
THR	Total Hip Replacement

ABSTRACT

BACKGROUND AND OBJECTIVE:

Femoral injuries are one of the most devastating injuries occurring in a life on an individual. Present study. To study the functional outcome of intracapsular fracture of femoral neck withmodular bipolar prosthesis and to study the end results of modular bipolar prosthesis with respect to pain, mobility and stability.

METHODS:

33 patients aged more than 60 years, who sustained Femur Neck fracture, were treated by hemiarthroplasty using Modular Bipolar prosthesis, Patients having Femur Neck fracture, who are admitted In Shri B. M. Patil Medical College Hospital & Research Centre Vijayapur betweenoctober 2016 to march 2018.The patients were followed up for a minimum of one year. Short term functional outcome was evaluated using the modified Harris hip scoring system.

RESULTS :

In our study the patients were in above the age group of 60 years with the mean age of 63.9 years. 64% of the patients were females with 75.8% of all cases sustaining the fracture following a trivial trauma. The functional outcome using the Modified Harris hip score was excellent in 19.4%, Good in 71%, and poor in 9.7% of cases.

CONCLUSION :

Hemiarthroplasty with Modular Bipolar prosthesis is a good option in elderly patients with limited physical demands and early mobility. Considering the good result achieved in the short term.

KEY WORDS:

Femur Neck fracture; Modular Bipolar Prosthesis;Hemiarthrioplasty.

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INTRODUCTION

INTRODUCTION

The frequency of Femur Neck fracture, one of the most common traumatic injuries in the elderly increases continuously due to the ageing of population on the planet[1]. It has been predicted that by 2050, the number of hip fractures would triple. As a consequence, proximal femur fractures are a significant cause of morbidity and mortality in all age group especially in elderly[2].

At present leading cause of hospital admissions in elderly age group is Femur Neck fracture, because of increased longevity, osteoporosis and sedentary habits. Non- operative methods of treatment is not acceptable because it results in nonunion with unstable hip and restricted hip movement as well as complications of prolonged immobilization like bed sores, deep vein thrombosis and respiratory infections [3].

The introduction of a unipolar metal prosthesis by Thomson in 1954 and Austin Moore in 1957, to replace the head of femur in the era of hemiarthroplasty of the hip as a treatment for these fractures. The last four decades has shown that hip arthroplasty is the best treatment for intracapsular Femur Neck fracture in elderly in terms of both short-term and long-term results[4].Currently, surgeons can choose between monopolar hemiarthroplasty, bipolar hemiarthroplasty and total hip arthroplasty in the treatment of intracapsular fractures of the neck of femur in the elderly.[5]

Modular bipolar is an intermediate between the more type and total hip replacement, the Bipolar prosthesis which has mobile head element and has additional head surface to allow movement within the acetabulum. This led to reduced wear of acetabular surface and hence reduced occurrence of pain and acetabular protrusion because motion is present between the metal head and the polyethylene socket (Inner bearing) as well as between the metallic head and acetabulum (Outer bearing).

The primary goal of treatment of in the active elderly population is early restoration of premorbid walking ability and excellence of life. There are high chances and increased failure rates of using Internal fixation by dynamic hip screw or proximal femoral nail (avascular necrosis, nonunion, and repeat surgical procedures) . Hemi- or total hip arthroplasty is an accepted treatment of femur neck fracture in the elderly. Cemented prostheses have been used with high success rates.[5]

Unipolar hemiarthroplasty with an Austin Moore prosthesis or Thompson prosthesis is no longer employed in the developed countries though it is very commonly used in developing countries like India. It should ideally be reserved for very limited or non-ambulatory patients.[7]

Because of superior benefits and attractive pricing, Bipolar prosthesis is slowly replaced with the conventional unipolar prosthesis.[8,9] Bipolar prosthesis over monopolar prosthesis have higher percentage of satisfactory results, less post-operative pain, greater range of movements, more rapid return to noramal routine and reduced frequency of acetabular erosion.[9,10]

Primary Total Hip Replacement (THR) is being offered at many centres as a treatment option for these fractures With the superiority of prosthetic replacement over internal fixation being well established. Total hip arthroplasty is still not popular as a treatment modality for FEMUR NECK FRACTURE in our country because majority of the patients do well with hemiarthroplasty and also due to the high costs involved. It also has a higher occurrence of dislocations and higher morbidity associated with the procedure.[11]

The goal of the current study is to assess the functional and quality of lifescores in patients treated with modular bipolar prosthesis for fracture of femoral neck considering good number of neck of femur fractures encountered in our hospital

, I intend to do this clinical study and results will be evaluated in comparision with Modified harris hip score.

OBJECTIVES

0BJECTIVES

1. To evaluate the functional outcome of modular bipolar hemiarthroplasty for displaced femur neck fracture in elderly patients.
2. To study the time duration taken to achieve the desire functional level.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Ambrose pare, the famous French surgeon recognized the existence of hipfractures more than 400 years ago.[12]

Sir Astley Cooper, was the first to delineate between fractures of femoralneck or intracapsular fractures and other fractures and dislocation about the hip.[13]

In 1867, Philips presented a technique for longitudinal and lateral traction in FEMUR NECK FRACTURE to eliminate shortening and deformity.[14]In 1921, Ruth advocated closed reduction and maintenance in a "Philips splint" for 8 weeks.[15]

With advent of X-ray in 1902, Whitman advocated careful reduction and holding of reduced fractures in a spica cast with 30% union rate.[16,17,18]Watson Jones subsequently estimated a union rate of about 40% from this method.[19]In 1927, Wilkie used bilateral short-leg casts with a transverse bar for fracture immobilization.[19]In 1911, Cotton recommended artificial impaction of fracture fragment by blows from a heavy mallet applied to the padded trochanter before cast application.[20]

The first to have nailed a hip fracture appears to have been Von Lagenbeck in 1850.[21]Nicolaysenin1897 advocated the use of nails in serious cases.[22] In, 1908, Davis reported the use of ordinary wood screws for fixation of FEMUR NECK FRACTURE [23]andMartinandKing in1920.[24]

In 1931, Smith Peterson advocated reduction, impaction and internal fixation using a triflange nail. VeneableandStuck developed and standardized biocompatible metals in 1937 which increased the success rate ofthis technique.[25,26,27,28,29]with introduction of cannulated nail by Johannson in 1932 andWestcot in 1934[30].SmithPeterson's technique was simplified as in allowed the surgeon to reduce the fractureclosed and fix the fracture blindly using the cannulated nail over a guide pin.

Thornton added a side plate to the triflange nail in 1937[31], Jewett developedthe solid nail plate in 1941[32]. VirginandMac Ausland in 1945 presented screw that provides dynamic compression at the fracture site.[33] Telescoping nails or screws which allowed gradual impaction at fracture site, were presented by SchumpelickandJantzen in 1955[34], Pugh in 1955[35], Massie in 1958[36], Badgley in 1960[37]andclawson in 1964[38].

Moore in 1934[39], and Gaenslen in 1935[40], Telson and Ranshoff in 1935[41]and Knowles in 1936[42], used multiple pins for the internal stabilization of FEMUR NECK FRACTURE. Harmon in 1944 added a side plate to incorporate this pins.[43]

In 1958, Deyerele used a side plate that also acted as a template for pin insertion and allowed the sliding of multiple pins.[44]

The history of hip arthroplasty may be considered in five major steps:

1. Osteotomy Arthroplasty,
2. Inter Positioning Arthroplasty,
3. Recozstructive Arthroplasty,
4. Partial Replacement Arthroplasty and
5. Total Replacement Arthroplasty.

A. Osteotomy Arthroplasty

A. White	1822
J.R. Barton	1826
Bouvi	1835
Langenbeck	1854
Sayre	1863

Brodhurst	1865
W.Adams	1869
Gant	1872
Pauwell	1935
Mc Murray’s	1936
Blount	1943
Moore	1944
Dickson	1947

B. Interpositional Arthroplasty

1. Tissue interpositioning Arthroplasty

Ollier	1885 soft tissue ,	
Murphy	1902	Tensor facialata ,
Lexer	1908	Tensor facialata
Payr	1910	Tensor facialata,
Loewe	1913	Skin,
Baer	1918	Pigs bladder
Robert Jones	1921	Gold foil
Putti	1921,	
Campbell	1926,	
Mc. Ausland	1929,	
Kallio	1957	Skin.

2. Mold (cup) Arthroplasty

Smith – Petersen	1923	Glass ,
Smith – Petersen	1933	Pyrex,
Smith – Petersen	1937	Bakelite,
Smith – Petersen	1938	Vitallium,
Aufranc	1957	Vitallium

C. Reconstructive Arthroplasty

Brackett	1917
Whitman	1921
Jones	1921
Magnuson	1932
Colonna	1935
Girdlestone	1945

D. Femoral Replacement Arthroplasty

Delbet	1919	Reinforced rubber,
Hey – Groves	1927 Ivory,	
Bohlman	1940	Metallic,
Judet and Judet	1943 acrylic,	
Thompson	1950	Metallic,
A.T.Moore	1952	Metallic (Fenestrated stem)

E. Total Replacement Arthroplasty

In order to achieve early weight bearing and ambulation, use of an endoprosthesis remains the only viable alternate in elderly persons. Prostheses designed by Austin Mooreand Thompson have been used extensively during the last 40 years and results have been gratifying in older, more sedentary individuals who do not stress their hips excessively. But slightly younger and physically active patients tend to develop problems. While few problems occur on the femoral side, Constant friction of the metallic prostheses erodes the acetabular cartilage down to the subchondral bone and pain develops. In some cases, acetabular erosion may be severe as to lead to protrusion and proximal migration of the prosthesis.

A bipolar prosthesis was originally devised for the use in case of femoral neck fracture to overcome the long term complications of Moore and Thompson type of endoprostheses.

The bipolar prosthesis was first presented be James E. BatemanandGiliberty in 1974. Other commonly known versions of bipolar prostheses areMonk Duo Pleet (monk 1976), Hastings bipolar prosthesis (Biotechnic,France) and bipolar endoprostheses (INOR, India.).

The bipolar prostheses have 2 layers of movement with an inner lower friction bearing, where a small metallic head articulates with Ultra High Molecular Poly Ethylene (UHMWPE) insert, and an outer stainless steel or vitallium shell covering polyethylene insert which articulates with the acetabulum. A frictional differential thus exists at the two planes of movement so that most of the motion tends to occur at the inner bearing, andtorquerequired to move the inner bearing is less. 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 laterally rather than medially, and thus avoids impingement of the head on the edge of the cup which causes fracture of the polyethylene-bearing insert and dislocation (intrinsic stability) life span of the prostheses.

Due to size and geometry of inner bearing the rim of polyethylene insert impinges on the metallic neck of prostheses after a certain arc of adduction, movement occurs between acetabulum and outer metallic cup of prostheses (increased range of movement).

Bipolar prosthesis was designed primarily with the aim of reducing the frictional stresses and thereby decreasing acetabular erosion and stem loosening.[45,46,47] Shock absorbing character of UHMWPE insert also reduces the impact load on the acetabulum during weight bearing (increase in the life span of the prostheses).

Description of the implant

The bipolar prosthesis is an intermediate of Austin Moore's and total hip replacement. Because of a completely mobile head element and the addition of another head surface for motion in the acetabulum create a compound system. This provides a greater distribution of weight bearing forces thus minimizing wear and tear changes both on the implant and on the Containing tissue.

The bipolar prosthesis (SMP type) has got a stem length of157mm, thickness of 10mm and the material used for the stem is stainless steel ASIS 316.

It has got vertical shoulder which fits snugly on the calcar femoral, hasa long neck measuring 35mm the neck shaft angle is 135° and the diameter of the neck is 19mm. The size of the femoral head are -4, 0, +4. The head articulates with the inner surface of the acetabular cup made up of High DensityPolyethylene (HDPE) and the outer surface is made up of stainless steel AISI-316. The size of the acetabular cup varies from 39 to 51mm.

Simplest of the current available bipolar prosthesis like Indian version and the Monk prosthesis have an Austin –Moore type stem and the small femoral head cannot be detached from the outer metallic cup- High Molecular Poly Ethylene (UHMWPE) insert complex. Better and modified versions of the bipolar prosthesis have a modular system with interchangeable stems [Fenestrated, Solid, Straight, Long porous coated, Press fit, Cement compatable], interchangeable small diameter head [Metallic, Ceramic] which allows adjustment of neck length and different sizes of outer metallic cup-High Molecular Poly Ethylene (UHMWPE) insert with press fit locking mechanism over small head [Biotechnic, France].[48]

Modular version of bipolar prosthesis can be easily converted into totalhip replacement in case of any complication occurring on acetabular side. In the last 20 years, good clinical results have been reported with the use of bipolar hemiarthroplasty and its indications have been expanded to include not only femur neck fracture also for primary treatment of hip degeneration, ankylosed hip, dysplastic hips and failed total hip replacement.[49]

Indications for Bipolar hemiarthroplasty are grouped as[50]

Stronger Indications

1. A fracture neck femur with posterior communition.
2. FEMUR NECK FRACTURE that lose fixation several weeks after operation.
3. Some preexisting lesions of the hip - patients with avascular necrosis of the head of the femur, severe rheumatoid or degenerative arthritis of thehip.
4. Malignancy - pathological fracture is best treated with a prosthesis.
5. Neurologic disorders- severe uncontrolled parkinsonism

6. Old, undiagnosed fractures of the femoral neck
7. Fracture of the neck of the femur with complete dislocation of the femoral head.
8. A patient who probably cannot withstand two operations.
9. Patients with psychoses or mental deterioration.

Relative Indications for Hemiarthroplasty

1. Advanced physiological age.
2. Fracture-dislocation of the hip in an older individual.

Bipolar prosthesis is preferred to conventional Moore’s prosthesis because ofthe following reasons:

1. Wide range of movements
2. Intrinsic stability – at the extremes of flexion when joint tends to dislocate, the outer bearing moves in the opposite direction and prevents it
3. Prevents loosening of stem and acetabular erosion
4. Increased life span.

A study in 1978 reported about the stability of Giliberty bipolar hip inthree cases. These patients sustained significant skeletal trauma subsequent to surgery and none of them dislocated. They thought the potential for cup movement acts as safety valve in absorbing force that might otherwise dislocate the hip or cause fractures of the femur or the pelvis.[50]

Another study in 1979 reported 65 Gilberty bipolar hip units followed for an average of 19 months showing excellent short- term results clinically.[51]

Another study in 1979 compared 101 Bateman hemiarthroplasties with160 cemented Thompson hemiarthroplasties and found no significant difference in the results. They also studied the motion at the inner bearing by video roentgenography in thirteen Bateman arthroplasties in nine patients with osteonecrosis of the femoral head following renal transplantation. Although some inner bearing motion did occur in some implants, it was less than predicted, and in several cases it decreased even more between 2 and 4 years post- operatively and conditions of weight bearing.[52]

A study in 1980 used Bateman universal proximal femoral endoprosthesis in acute fractures of the femoral neck and followed 156patients with an average age of 79 years for 29 months and found no demonstrable advantages over the Moore prosthesis.[53]

A study in 1982 used Bateman bipolar prosthesis in 161 hips and found decreased protrusion and they stated that if significant protrusion is noted infection must be suspected.[54]

Verberne(1983) radiologically studied the movements of the two componentsof bipolar prosthesis and found that the built-in joint soon lost mobility and at three months was almost completely stiff.[55]

A study in 1983 published their series of 200 patients in whom bipolar endoprosthesis was used. 92% has satisfactory results with a mean Harris hip rating of 87 points and 8% had poor results. The morbidity and mortality rateswere also low.[56]

Another study in 1983, used bipolar prosthesis in 161 fractured necks offemur and found no acetabular erosion with a four year follow up.[57]

Another study in 1986, in their series of 44 cases followed for 22 months had mean Modified Harris hip score of 84.2% and with 93.2% patients having minimal or no pain. The range of motion was excellent and morbidity waslow.[58]

Another study in 1986 revised three failed hip surface replacement arthroplasties with a bipolar prosthesis and found good clinical function andacceptable radiological appearance. They advocated that this rather straightforward surgical conversion may have a role to play in the interim management of some of this patients.[59]

Another study in 1987, followed 77 FEMUR NECK FRACTURE treated with bipolar endoprosthesis for an average of 51 months post-operatively and found75% excellent good results with decreased acetabular erosion and protrusion.[60]

Another study in 1987 developed a ceramic bipolar prosthesis composed of bio-inert fine alumina ceramic rather than metal head and used it in FEMUR NECK FRACTURE , femoral head necrosis and osteoarthritic hips with good results.[61]

A study in 1987 compared 682 fixed head prosthesis with 319 bipolar prosthesis and found decreased occurrence of acetabular erosion and revision. They stated that bipolar prosthesis can be used in younger more active patients whereas fixed head design can be used in older patients.[62]

A study done in 1988 compared internal fixation and bipolar endoprosthesis in displaced FEMUR NECK FRACTURE in 34 elderly patients followed for two years and found better functional results in cemented hemiarthroplasty group.[63]

Another study in 1988, radiologically assessed 23 patients treated with Charnley-Hasting bipolar prosthesis for acute displacement of sub capital fracture and found interprosthetic movement in abduction in 82.6% patients.[64]

In 1988 another study followed 90 patients for two years for femur neck fracture treated with bipolar hemiarthroplasty and found 92% excellent to good results weight bearing roentgenograms showing motion at both bearing surfaces.[65]

A study done in 1989 followed 54 hips for an average of 33 months treated with Charnley-Hastings bipolar hemiarthroplasty in displaced subcapital fractures and found 64.8% good or excellent result. The fair or poor results wereseen mainly in patients with poor pre-operative mobility and multiple medical problems.[66]

In 1990 another study performed distraction arthroplasty of 18 hips with advanced secondary osteoarthritis with bicentric femoral head prosthesis. Postoperative long axis traction was applied and active assisted movements carried out for 4 weeks. Wide range of painless hip movements were regained and the acetabulum was remodeled domed shape covered by a narrow radiolucent zone backed with dense bone plate.[67]

Another study in 1990 performed 496 bipolar arthroplasties over a period for proximal femoral fractures and compared with a series that used internal fixation and one piece conventional prosthesis. There was significant improvement over internal fixation in reducing morbidity and mortality. It also offered advantages over the one piece prosthesis in terms of fit, decreased acetabular erosion and improved function.[68]

A study done in 1990, performed cemented Batemen bipolar hemiarthroplasty in 128 patients and followed 49 cases for an average of 7years 5 months. None of the patients developed acetabular protrusion and 88% had no or slight pain.[69]

Another study in 1990 performed bipolar Bateman hip endoprosthesis in 88 patients with an average age of 75 years and found excellent mobility in86% and good function in 66% and no visible protrusion or socket wear radiologically.[70]

In 1990 another study used straight long stem Bateman bipolar model 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 fixations within the shaft and biological in growth through the fenestration in the proximal neck without stress shielding of the calcar.[71]

Another study in 1990 used Bateman bipolar prosthesis in 47 hips with femoral head osteonecrosis. Modified Harris hip scores improved from 24.7 preoperatively to 84.5 post–operatively. Cine-roentgenographically they confirmed that in unloaded mode, inner and outer-bearing motion increased significantly.[72]

In 1990 another study performed bipolar arthroplasty in 1213 hipsincluding a group of 760 osteoarthritic hips. They showed healthy bonepreservation of the acetabulum even 15 years after surgery. They also identified a process of floor reinforcement in certain states.[73]

Another study in 1990 assessed 100 patients treated with bipolar hemiarthroplasty for degenerative arthritis and found mean Modified Harris hip score of78.8 with good to excellent results in 75.8%. Anterior thigh pain was attributed to femoral component loosening.[74]

In 1990 a study 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%.[75]

Another study in 1990 replaced 478 hips with Bateman bipolar prosthesis and selected 19 cases with postoperative acetabular changes randomly for evaluation. Of the 11 cases with protusio, 6 showed thickening of acetabular wall and 5 showed no changes. In the five patients with subchondral bone also decreased gradually. They suggested that acetabulum tolerates the implant well even with some damage at the time of surgery.[76]

A study in 1990 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 eight. All grafts united with no resorbtion or migration.[77]

In 1990 another study used bipolar components for severe periacetabular bone loss around 27 failed total hip arthroplasties with satisfactory functional results in all patients and bone grafts becoming consolidated into the host pelvis.[78]

Another study in 1990 used bipolar hip arthroplasty in 37 hips with acetabular deficiency including dysplastic osteoarthritis, revision of failed arthroplasty, reconstruction of malunited bony ankylosis and rheumatoid arthritis after bone grafting, confirmed the usefulness of expanded application of bipolar hip arthroplasty.[79]

In 1990 a study reconstructed deficient acetabulum using the bipolar socket in 47 cases with acceptable levels of pain relief and functional gain and mean Modified Harris hip score of 86.[80]

A study in 1991 compared 27 cemented and 26 uncemented bipolar hemiarthroplasties in active patients with displaced subcapital fractures of femoral neck found better results in the cemented group.[81]

A study in 1991 used bipolar prosthesis in femur neck fracture in 182 geriatric patients and in a retrospective study of 67 surviving patients 25months post-operatively found results comparable to total hip replacement according to the Modified Harris hip score and the fracture trauma itself often appeared to be a result of the patients pre-existing bad health.[82]

Another study in 1991 studied risk factors influencing mortality after bipolar hemiarthroplasty in the treatment of fractures of femoral neck and found that age, time delay from the admission to surgery, mode of anaesthesia and cerebrovascular diseases had no significant influence on mortality and medical conditions were the most important determinants of survival.[83]

One more study in 1992 used bipolar prosthetic replacement for the treatment of avascular necrosis of the femoral head and satisfactory results in71 of 83 hips for more than 5 years.[84]

A study in 1992 followed 30 cases of bipolar hip prosthesis for 3 years and found motion at both bearing surfaces in all cases without reduction in the range of motion with time.[85]

Another study in 1992 compared 32 bipolar with 38 Austin Moore's prosthesis for FEMUR NECK FRACTURE followed for 46 months and found 90.6% excellent to good results in bipolar and 77.8% in Austin Moore group with bipolar prosthesis giving better stability permitting early and easy recovery of hip movement ant weight bearing more rapid rehabilitation and decreased complications especially on the acetabular side.[86]

A study in 1992 performed bipolar hemiarthroplasty in tubercular hips and followed for more than 2 years with gratifying clinical results from the point of abolition of pain, restoration of improved range of useful hip movements and walking capacity with no evidence of recurrence of tubercular infection.[86]

Another study in 1992 treated 9 patients with ipsilateral hip and knee deformities in advanced rheumatoid arthritis with bipolar arthroplasty and soft tissue releases at knee with follow up of 2 years with gratifying functional results in 8 patients with no increase in acatabular erosion or protrusion with gradual obliteration of subchondral cysts and development of sclerotic area around bipolar metallic cup.[86]

A study in 1992 performed bipolar arthroplasty in 19 hips in ankylosing spondylytis and found that with mean follow up of 33 months the Modified Harris hip score was 82.6 with relief of pain, improved posture and gait and regained useful range of movements.[86]

In 1993 a study performed massive resection in bipolar mega prosthesis for metastasis of trochanteric and subtrochanteric region in 17 ceases total hiparthroplasty in 11 cases with pain relief and post-operative walking ability comparable with both groups but significantly lower dislocation rate with bipolar arthroplasty.[87]

Another study in 1993 compared the effect of femoral component head sizes 22 and 32mm on movement of the 2 component hemiarthroplasty and found predominantly intra-prosthetic movement in the 22mm group.[88]

In 1993 a study compared a hydroxyapatite coated bipolar hemiarthroplasty and uncemented bipolar prosthesis for displaced subcapital fractures and found significantly superior results in the hydroxyapatite group with distal stem fixation and proximal stress shielding.[89]

In 1994 another study performed bipolar arthroplasty in 20 patients with fracture neck femur, avascular necrosis of femoral head, osteoarthritis, protusioacetabuli and Perthes disease with excellent results in 85%. They encouraged squatting within 3 to 4 weeks and have not found any detrimental effects in terms of disassembly or dislocation.[90]

Another study in 1994 treated 8 patients for unstable total hip arthroplasty for recurrent prosthetic dislocation using large inside diameter acetabular cup and bipolar femoral head sized to approximation of the diameter of the normal hip. Joint stability was achieved in all patients at an average of 4.2 years with this bipolar hip.[91]

In 1995, a group studied abduction joint motion in 117 bipolar femoral prosthesis underweight bearing loads. 101 prosthesis used in dysplastic osteoarthritic, rheumatoid revised failed total hip arthroplasty patient’s moved81.8% at the inner bearing and 18.2%at the outer bearing while 16 prosthesis used in FEMUR NECK FRACTURE and oseteonecrosis of the femoral head patients moved 49.7% at inner bearing and 50.3% at the outer bearing.[92]

In 2005, study conducted to measure outcome of bipolar hip arthroplasty in atraumatic hip disorders. 38 patients, 16 patients suffering from rheumatoid arthritis, 14 patients avascular necrosis of femoral head and 8 patients osteoarthritis they noticed the final outcome of bipolar arthroplasty is comparable to total arthroplasty. Added advantage is of low cost, simplicity of procedure and easy future revision.[93]

In 2006, study group evaluated evaluated the relationship between the radiological indices that assessed the proximal femoral morphology and the degree of osteoporosis in 45 Chinese cadaveric femora. Canal bone ratio showed a strong correlation with the T score ($r = -0.71$, $P < .001$) and the best overall performance in diagnosing osteoporosis with receiver operating characteristic curve analysis. The proximal femur was likely to be osteoporotic if the canal bone ratio was 0.49 or higher.[94]

GROSS ANATOMY OF THE HIP JOINT[97]

The hip joint is an enarthrodial or ball-and-socket joint, formed by the reception of the head of the femur into the cup-shaped cavity of the acetabulum. The ball-and-socket type of architecture provides it a high degree of the stability as well as a good range of movement. The articular cartilage on the head of the femur, thicker at the centre than at the circumference, covers the entire surface with the exception of the fovea, to which the ligamentumteres is attached. The articular cartilage on the acetabulum forms an incomplete marginal ring, the lunate surface. Weight bearing occurs in the upper part of the acetabulum where the cartilagenous strip is widest. Within the lunate surface there is a circular depression devoid of cartilage, occupied in the fresh state by a mass of fat and covered by synovial membrane.

The articular capsule is strong and dense. Above, it is attached to the margin of the acetabulum 5 to 6 mm beyond the glenoidallabrum posteriorly and anteriorly it is attached to the outer margin of the labrum. It surrounds the neck of the femur, and is attached, in front, to the intertrochanteric line and the base of the neck anteriorly and posteriorly to the neck, about 1.25 cm above the intertrochanteric crest. From its femoral attachment some of the fibres are reflected upward along the neck as longitudinal bands, termed retinacula. The capsule is much thicker at the superior and anterior part of the joint where the greatest amount of resistance is required. However, the capsule is thin and loose inferiorly and posteriorly. The thickened outer longitudinal fibres of the capsule form three strong ligaments around the hip joint

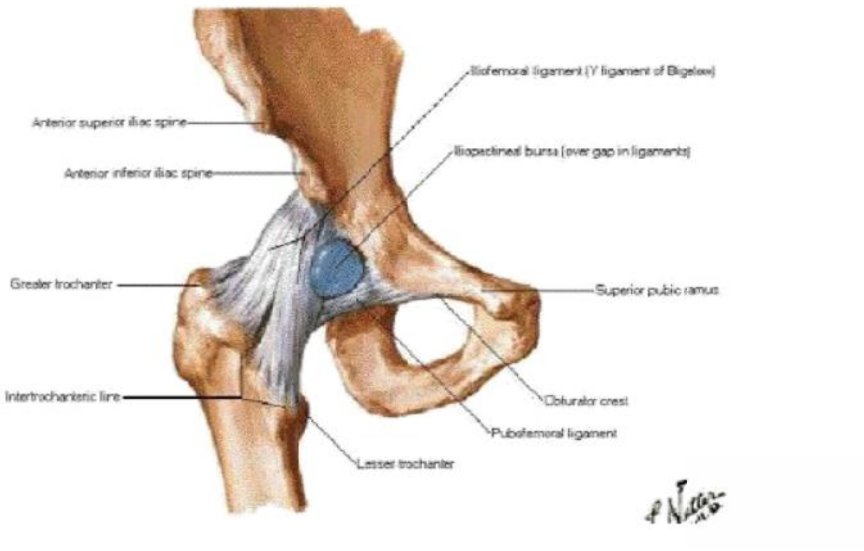


Fig 1: HIP JOINT – ANTERIOR VIEW

The ilio-femoral ligament/ Y-shaped ligament of Bigelow is the strongest ligament in the body and lies in front of the joint. It is intimately connected with the capsule, and serves to strengthen it in this situation. It is attached, above, to the lower part of the anterior inferior iliac spine; below, it divides into two bands, one of which passes downward and is fixed to the lower part of the intertrochanteric line; the other is directed downward and lateral ward and is attached to the upper part of the same line. In some cases there is no division, and the ligament spreads out into a flat triangular band which is attached to the whole length of the intertrochanteric line.

The pubo-femoral ligament is attached, above, to the obturator crest and the superior ramus of the pubis. Below, it blends with the capsule and with the deep surface of the vertical band of the ilio-femoral ligament.

The Ischio-femoral ligament/ligament of Bertin consists of a triangular band of strong fibres which spring from the ischium below and behind the acetabulum and blend with the circular fibres of the capsule.

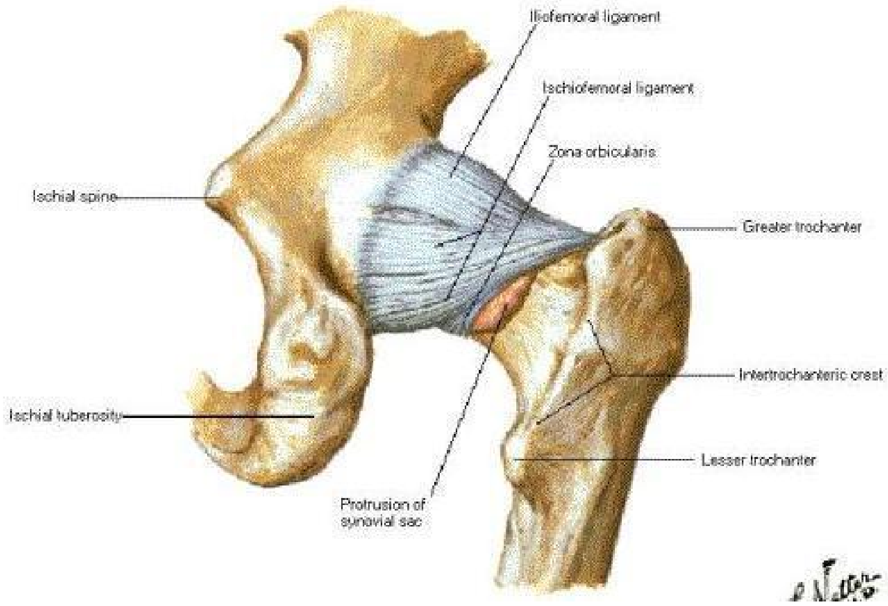


Fig 2: HIP JOINT – POSTERIOR VIEW

The Ligamentum Teres Femoris is a triangular, somewhat flattened band implanted by its apex into the antero-superior part of the fovea on the head of femur. Its base is attached by two bands, one into either side of the acetabular notch, and between these bony attachments it blends with the transverse ligament. It is ensheathed by the synovial membrane varies greatly in strength in different individuals. The ligament is made tense when the hip is semi flexed, adducted and externally rotated. It is relaxed when the limb is abducted.

The Glenoidal Labrum is a fibro cartilaginous rim attached to the margin of the acetabulum, the cavity of which it deepens. It also protects the edge of the bone, and fills up the inequalities of its surface. It bridges over the notch as the transverse ligament, and thus forms a complete circle, which closely surrounds the head of the femur and assists in holding it in its place. It is triangular on section, its base being attached to the margin of the acetabulum, while its opposite edge is free and sharp. Its two surfaces are invested by synovial membrane, the external one being in contact with the capsule, the internal one being inclined inward so as to narrow the acetabulum, and embrace the cartilaginous surface of the head of the femur.

The Transverse Acetabular Ligament is in reality a portion of the glenoidal labrum, though differing from it in having no cartilage cells among its fibres. It consists of strong, flattened fibres, which cross the acetabular notch, and convert it into a foramen through which the nutrient vessels enter the joint.[97]

MUSCLES AROUND THE HIP[970]

A. MUSCLES IN FRONT OF THE THIGH

Muscle	**Origin**	**Insertion**	**Nerve supply**	**Action**
Psoas Major	Lateral surfaces of T12-L5 vertebrae and discs between them;transverse process of all lumbar vertebrae	Lesser trochanter of femur	Ventral rami of lumbar nerves (L1, L2 and L3)	Flexion of hip
Iliacus	Iliac crest, iliac fossa , ala of sacrum, and anterior surface of sacroiliac joint	Tendon of psoas major, lesser trochanter	Femoral nerve (L2 and L3)	Flexion of hip joint
Tensor fascia latae	Anterior superior iliac spine and anterior part of iliac crest	Ilio-tibial tract that attaches to lateral condyle of tibia	Superior gluteal (L4 and L5)	Abducts , medially rotate and flexes the hip; helps to keep knee extended
Sartorius	Anterior superior iliac spine	Superior part of medial surface of tibia	Femoral nerve (L2 and L3)	Flexes, abducts, andlaterally rotates hip joint; flexes knee joint
QUADRICEPS FEMORIS				
Rectus Femoris	Anteror inferior iliac spine and ilium superior to acetabulum	Base of patella and by patellar ligament to tibial tuberosity	Femoral nerve (L2,L3, and L4)	Extension of knee joint, rectus femoris also steadies hip joint and helps iliopsos to flex the hip
Vastus lateralis	Greater trochanter and lateral lip of linea aspera of femur			
Vastus medialis	Intertrochantric line and medial lip of linea aspera of femur			

Vastus intermedius	Anterior and lateral surfaces of shaft of femur			

B. MUSCLES OF THE GLUTEAL REGION

Muscle	Origin	Insertion	Nerve supply	Action
Gluteus maximus	Surface of ilium, posterior to posterior gluteal line, dorsal surface of sacrum and coccyx and sacrotuberous ligament	Most fibres end in iliotibial tract that inserts lateryl condyle of tibia, some fibres inserts on gluteal tuberosity of femur	Inferior gluteal nerve (L5, S1 and S2)	Extension and lateral roattion of hip, steadies hip and assists in raising trunk from flexed position
Gluteus medius	External surface of ilium between anterior and posterior gluteal line	Lateral surface of greater trochanter of femur	Superior gluteal nerve (L5 and S1)	Abduction and medial rotation of hip, steadies pelvis on lower limb when opposite leg is raised
Gluteus minimus	External surface of ilium between anterior and inferior gluteal line			
Obturator internus	Anterior surface of sacrum and sacrotuberus ligament	Superior border of greater trochanter of femur	Nerve to obturator internus (L5 and S1)	External rotators of hip
Superior andinferior gemeilli	Pelvic surface of obturator membrane and surrounding bones	Medial surface of greater trochanter of femur	Superior gameillus – nerve to obturator internus Inferior gameillus – nerve to quadratus femoris	
Quadrratus femoris	Lateral border of ischial tuberosity	Qudrat tubercle on inter trochanteric	Nerve to quadratus femoris (L5	

		crest of femur and inferior to it	and S1)	

C. MUSCLES POSTERIOR TO THE HIP

Muscle	**Origin**	**Insertion**	**Nerver supply**	**Action**
Semitendinous	Ischial tuberosity	Medial surface of superior part of tibia	Tibial division os saciatic nerve (L5,S1 and S2)	Extension of hip, flexion of knee and medial rotation of knee
Semimembranosus	Ischial tuberosity	Posterior part of medial condyle of tibia		
Biceps femoris	Ischial tuberosity: linea aspera and lateral supracondylar line of femur	Lateral side of fibular head	Sciatic nerve (L5,S1 and S2)	Extension of hip , flexion and lateral rotation of knee

D.MEDIAL HIP MUSCLES

Muscle	**Origin**	**Insertion**	**Nerve supply**	**Action**
Pectineus	Superior ramus of pubis	Pectineal line of femur , just inferior to lessar trochanter	Femoral nerve (L2 andL3); may receive a branch from obturator nerve	Adducts, flexes andmedially rotates the hip
Adductor longus	Body of pubis , inferior to pubic rest	Middle third of linea aspera of femur	Anterior branch of obturator nerve (L2, L3and L4)	Adducts the hip
Adductor brevis	Body and inferior ramus of pubis	Pectineal line and proximal part of linea aspera of femur	Obturator nerve (L2, L3and L4)	Adducts the hip, and some extent flexes the hip
Adductor magnus	Inferior ramus of pubis, ramus of ischium , adductor part from ischial tuberosity	Adductor part – gluteal tuberosity, linea aspera, medial supracondylar line Hamstring part – adductor	Adductor part – obturator nerve (L2, L3and L4) Hamstring part – tibial part od sciatic nerve (L4)	Adducts the hip Adductor part also flexes hip and hamstring part extend the hip

		tubercle of femur		
Gracillis	Body and inferior ramus of pubis	Superior part of medial surface of tibia	obturator nerve (L2, L3)	Adducts the hip, flexes the hip and its hamstring part extend the hip
Obtrurator externus	Margings of obturator and obturator membrane	Trochanteric fossa of femur	obturator nerve (L3and L4)	Laterally rotates hip, steadies head of femur in acetabulum

MOVEMENTS OF THE HIP[98]

The hip joint, being a ball and socket type of joint allows movements in a multidirectional pattern. Grossly the movements are as follows:

Flexion	-	Anteriorly
Extension	-	Posteriorly
Abduction and adduction	-	Laterally
Rotations and combination of the above	-	Circumduction.

FLEXION

When the thigh is flexed upon the trunk, the head of femur rotates about the transverse axis that passes through both acetabulae, the muscles that bring about this motion are iliopsoas - supported by Rectus femoris, sartorius and pectineus. Flexion gets arrested when the thigh is on the trunk and by the hamstrings when knee is in extension.Normal flexion is about 120° - 130^0.[98]

EXTENSION

This is the opposite of flexion, carried out by the Gluteus maximus. The motion is limited by tension of ileo-femoral ligament.Normal range is 5° - 20°.[98]

ADDUCTION

Adduction of the thigh produces similar movements in the femoral shaft and neck. The femoral head rotates in the acetabulum over an anteroposterior axis.

Movements are brought about by- Pectineus, adductors, gracilis. It is limited when the thigh rests upon the opposite one or if the latter is kept abducted, the tension in the gluteus medius and minimus limits the adduction.Normal range 25^0 – 35^0.[98]

ABDUCTION

This is the opposite of abduction and is brought about by gluteus medius and minimus assists by piriformis. It is limited by tension on the adductors andpubo-femoral ligament.Normal range 40° - 45°.[98]

EXTERNAL ROTATION

This is carried out by flexing the hip and knee to 90 and rotating the foot towards the opposite side. Gluteus maximus is the major lateralrotator. The gluteus medius, minimus, piriformis, obturator internus, gemeilli and quadrates femoris serve as stabilisers of the hip.Normal range is about 40-45° as measured in both extension and flexion of the hip.[98]

INTERNAL ROTATION

With the hip and knee flexed to 90^0, the leg being rotated away from the midline of the body produces medial rotation at the hip and is brought by anterior fibres of gluteus medius and minimus.Normal range is $40°-45^0$ in flexion and 30^0-35^0 in extension.[98]

BLOOD SUPPLY OF HEAD and NECK OF THE FEMUR

Avascular necrosis of femoral head is one of the most serious complication following Femur Neck fracture , which have all the problems associated with healing of intracapsular fractures elsewhere in the body. Femoral head and its neck is enclosed by strong fibrous capsule. That portion of neck which is intracapsular has no cambium layer to participate in peripheral callus formation. Because of endosteal blood supply femur neck is dependendent on it for union alone.

Arterial supply of hip joint is been studied extensively. Crock described arteries of proximal end of femur into 3 groups and provided a definitive anatomical nomenclature to these vessels thus avoiding ambiguity.[99]

a. At the base of femoral neck extra-capsular arterial ring is located .
b. On the surface of the femoral neck ascending cervical branches of extra-capsular arterial ring.
c. Round ligament arteries.

Posteriorl by a large branch of medial circumflex femoral artery and anteriorly by branches of lateral circumflex femoral artery with the superior and inferior gluteal arteries having minor contributions to this ring forms extra capsular arterial ring.

Extracapsular arterial ring gives rise to ascending cervical branches. Penetrating the hip joint capsule at the intertrochanteric line anteriorly and pass beneath orbicular fibres of the capsule posteriorly. The ascending cervical branches demarcates femoral head from its neck by passing upward under the synovial reflections and fibrous prolongations of capsule towards the articular cartilage which are called retinacular arteries described initially by Weitbrecht.[100] Femur Neck fracture is at high risk because of retinacular arteries during injury. Arteries from the ascending cervical send small branches to metaphysis .[100]

The extracapsular arterial ring and anastomoses with intramedullary branches of the superior nutrient artery system, branches of the ascending cervical arteries, and the subsynovial intra-articular ring gives additional blood supply. In the adult, there is communication through the epiphyseal scar between the metaphyseal and epiphyseal vessels when the femoral neck is intact.[100] leading to avascular changes in the femoral neck as opposed to the head.

Based on their relation to the neck of femur The ascending cervical arteries is divided into four groups - anterior, posterior, medial and lateral. Of these the lateral providing most of the supply to femoral head and neck. At the margin of articular cartilage on the surface of the neck of femur, these vessels form a second ring – the subsynovial intra-articular ring described by Chung, which can be complete or incomplete, the complete rings being more common in male specimens.[101]

Head of femur give rise to the subsynovial intra -articular ring - epiphyseal arterial branches. Interference of this blood supply leads to avascular necrosis. As Once the arteries from subsynovial arterial ring penetrate femoral head they are termed as epiphyseal arteries. Claffey demonstrated that in all Femur Neck fracture that communicated with the point of entry of the lateral epiphyseal vessels, aseptic necrosis occurred.[102]

The medial circumflex femoral artery gives branch to ligament teres artery causing decreased nourishment to the femoral head. Howe, et al found that after neck of femur fracture the vessels of the ligamentum teres vascularity to the femoral head, was often inadequate for major nourishment .[103]Claffey also stated the ligamentum teres blood supply to femoral head did not keep vascular during neck of femur fracture were blood supply was interupted.[102]

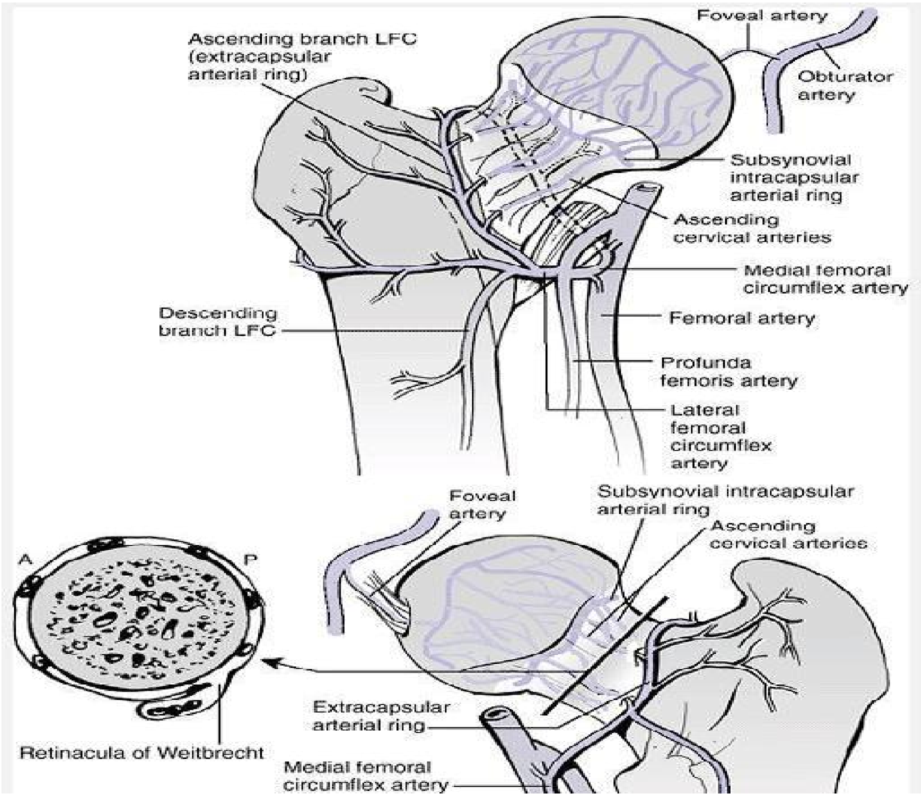


Fig 3: BLOOD SUPPLY TO THE HEAD and NECK OF FEMUR

VENOUS DRAINAGE OF HEAD and NECK OF THE FEMUR

The venous outflow from femoral head and neck is by lamina capsular veins which may be double or single and pass infero-medially along the trochanteric line and towards the obturator foramen to drain into the obturator vein. The circumflex group is found as diffuse plexus in the basal part of the neck and greater trochanter and passes medially to leave the femur at the level or just proximal to the lesser trochanter and enter the common femoral vein. Groups of veins arising from the posterior aspect of the neck and greater trochanter pass to the plexuses in the region of ischial tuberosity and greater sciatic notch. There is no venous drainage through the ligamentum teres.

CLINICAL CONSEQUENCE OF VASCULAR ANATOMY

Femoral head circulation arises, therefore, from three sources:

(a) below the marrow space intra-osseous cervical vessels that cross;

(b) ligamentum teres artery (medial epiphyseal vessels); and

(c) beneath the synovium along the femoral neck are retinacular vessels, which are branches of the extracapsular arterial ring,

In femoral neck fractures blood supply from the intraosseous cervical vessels are disrupted; which makes retinacular and ligamentum tere artery as prominent nutition to femoral head.[104]Sevitt and Thompson reported that blood supply is not sufficient from the anastomoses between the subfoveal vessels and other.[105,106] hence, remaining blood supply should be preserved to the femoral head after fracture.

BIO-MECHANICS OF THE HIP IN RELATION TO HIP FRACTURES

The hip is a ball and socket joint and thus has inherent structural bony stability relying less on the ligaments and muscles as in other joints. The ball and socket configuration provides multi-axial freedom of movement which in some measure provides protection from sudden stresses. The advantage of the bony constraint is the stability gained for walking and transferring from a standing to a sitting posture.

A fracture of the neck of femur disrupts the supporting structure and therefore negates the functional efficiency of the hip joint. The aim of treatment of FEMUR NECK FRACTURE is to provide support and anatomical realignment of bone fragments during healing to restore the function.

BASIC STRUCTURE

Bone has a vital role to play in providing the essential supporting framework and locations for muscle attachments. It consists of cortical and cancellous parts with their respective distinct mechanical properties. The cortical bone is more solid and rigid structure and it is anisotropic, a feature which makes the analysis of physical properties difficult.

In 1867 Von Meyer and Culmann, an anatomist and an engineer, compared the trabecular arrangement of the cancellous bone within the neck of the femur to a fair bairin crane and from this developed the stress trajectorial theory of bone formation. There are differing proportions of cortical and cancellous bone in the trochanteric region compared with the neck region. It is generally regarded that 95% of bone tissue in the neck is of cortical variety, whereas the ratio is reversed in the trochanteric region.

The work of Paul on the calculations of the direction and magnitude of forces passing through the femoral head during walking using standard gait analysis techniques and the more direct measurement of an instrumented Austin Moore prosthesis by Rydell, [107] which produced similar figures, determined for the first time, that the trabecular pattern within the head and neck of the femur did correspond to the calculated loadings. The medial trabecular system has always been regarded as a compression system in response to the maximum resultant compressive load. The lateral trabecular system was originally thought to have been laid down in accordance with Wolff's Law (1870) as a result of tensile stresses. However the more recent work shows that the cortical shell of femoral neck is in fact entirely in compression, the maximum compression being on the medial aspect with the tapering low compressive stresses on the lateral aspect of the femoral cortical neck.[108]

Under the normal physiological conditions, there is no tension on the femoral neck, and the original neutral axis of the neck of femur as proposed by Koch does not exist.[109] Only loading of the head and neck is in an unphysiological position produces an element of tension occurring in the lateral and superior aspect of femoral neck. Thus compression is the major loading configuration of the bone of the upper end of the femur with tension only in abnormal situations. Because of the multi-axial freedom in a low friction system within the joint, torsion of the femoral neck is negligible.

ARTICULAR CARTILAGE

Cartilage is important in load transmission and energy absorption through the joint and in lubrication. Greenwald demonstrated the contact areas/weight bearing areas of the hip joint.[110] The importance of incongruence between the articularsurfaces and its effect on wear and tear of the artificial joints has been stressed by Bullough et al.[111]The coefficient of friction between two bearing articular surfaces is in the range of 0.005-0.01 (Linn 1967). In order to achieve this most advantageous level, which reduces wear to an absolute minimum, a number of theories have been put forward. The low friction between the bearing surface means that little energy can be absorbed here and this will increase the demand for energy absorption in the bone itself.

MUSCLE and LIGAMENTS

The complex arrangements of the muscles and ligaments around the hip joint besides providing voluntary movements have a very important function in preventing abnormal movements, providing proprioceptive information and absorbing energy after a fall.

HIP JOINT FORCES

There are two forces acting on the hip joint, i.e., the weight of the body on the hip itself and the muscles acting across the joint. The movements produced by the muscle action during normal activities such as walking are quite considerable and provide a large magnification factor to the body weight applied directly on the joint. Rydell, showed forces acting in hip join by using a femoral prosthesis with a strain gauge. He stated that in one leg support a force of 2.5 body weight acts on that hip and whereas in one-leg support with cane in normal side showed forces was reduced. During rest with both leg support forces were equally divided. He also stated that forces were 5 times while running and 1.5 times in supine with lifting the leg across the hip joint. [107]

MECHANISM OF INJURY

Femur Neck fracture is rare in young people with good quality of bone and in some races were osteoporosis is uncommon, like black Americans and South African Bantu.[112] Femur Neck fracture are much more common in elderly women.[113]By the age of 65, 50 percent of women have osteoporosis and by 85 yrs fracture threshold reduced 100% of womens threshold is below the required bone mineral content.[114]

Most patients suffering from FEMUR NECK FRACTURE have trivial or minor injuries. Only few injuries involve major trauma.[108]

Emil Theodor Kocher suggested two modes of injury in Femur Neck fracture .[100] linton in 1955 stated direct blow or trauma to the greater trochanter during fall. Next protzman in 1976 alternative mechanism is external rotation of the leg, with increasing tension in the anterior capsule and iliofemoral ligaments. Cuclical loading is other mechanism producing micro- and macro-fractures.[108] Forces within physiologic limits have been shown to produce fractures in osteoporotic bone. It has been suggested that a stress fracture of this type becomes complete after a minor torsional injury preceding the fall which the patient identifies with the fracture. Muscle forces have been shown to produce an axial load along the longitudinal axis of the femoral neck and, coupled with external pressure, help to determine the fracture pattern.[115]

MECHANISM OF BONE FAILURE

A structure will fail if it suffers from overloading. Such a situation would arise if the system is unable to absorb the energy applied to it. In the hip joint this overloading can occur as a result of number of independent but often inter related factors. The following factors are important:

A. The influence of falls
B. Impairment of energy absorbing mechanisms
C. Bone weakness

A. THE INFLUENCE OF FALLS

In standing, the body possesses a considerable amount of potential energy. In falling, the potential energy converts to kinetic energy, which upon impact with the floor must be absorbed by the structures of the body, if a fracture not to occur. In an average sized human the amount of potential energy to be absorbed in a fall would be approximately 4000 kg/cm and the energy absorbing capacity of the upper end of the femur is only about 50 kg/cm. Thus if a bony injury is not to occur energy absorbing mechanisms must operate.

B. IMPAIRMENT OF ENERGY ABSORBING MECHANISMS

The principle dissipation of energy is done by the active muscle contraction. This dissipation requires time and in the event of high speed trauma, there is not sufficient period for muscle contraction to absorb energy before overloading of the bone has occurs and bone fails. In the elderly the neuromuscular coordination may be slower and thus the energy absorption may not be rapid enough to prevent a fracture. In the elderly the normal protective muscle contraction in the event of a slip rather than a fall may lead to an uninhibited muscle contraction around the hip and produce sufficient force to fracture the neck of femur.

C. BONE WEAKNESS

In the presence of osteoporosis or osteomalacia there is a reduction in the bone strength to approximately to three fourths of the normal healthy young bone and a lower energy absorbing capacity leads to failure.[108] Aitkin, in 1984, demonstrated that 84% of patients with femoral neck fracture had either mild or severe osteoporosis.[116]Dorne and Lander have used the term insufficiency fracture to describe FEMUR NECK FRACTURE in elderly individuals with osteoporosis. These authors described a group of patients who sustained FEMUR NECK FRACTURE spontaneously without apparent traumatic cause.[117]Griffiths et al showed that fatigue fractures can occur in elderly if the neck of the femur is cyclically loaded with in the physiological range, senile subcapital fractures in the osteoporotic bone due to fatigue, preceded by an accumulation of isolated trabecular fatigue fractures have been demonstrated by Freeman et al.[118] Thus fatigue of an elderly bone can occur without a fall.

PATTERNS OF FEMUR NECK FRACTURE

Pattern of FEMUR NECK FRACTURE is influenced by the resultant of force which is applied at the moment prior to fracture. If the normal resultant line of force under physiological conditions is considered, it can be seen that this force can be resolved into one perpendicular to the axis of femur neck and the one in the line of axis of the femoral neck. If the resultant line of force acting at the moment before fracture is altered from the physiological position, then the relative size of these two components will be altered.

Frankel in 1950 has shown experimentally that if the bending component is increased relative to the compressive component (a ratio of 1.6) then a transverse fracture is likely. If the bending component is reduced relative to the compressive component (a ratio of 1.7) a subcapital fracture with a spike and finally a subcapital fracture is produced.

CLASSIFICATION OF FEMUR NECK FRACTURE

1. Anatomical classification based on anatomical location of fracture

Some authors classify intra-capsular fractures of femoral neck into subcapital, transcervical. The so called basal fractures are intra-capsular anteriorly and extra-capsular posteriorly.[119]

Sub capital fractures are fractures that occur immediately beneath the articular surface of femoral head along the old epiphyseal plate.[120]Transcervical fractures are fractures passing across femoral neck between femoral head and greater trochanter.[120]Baylis and Davidson demonstrated that there was no functional difference in subcapital and transcervical fractures.[121]

Banks divided FEMUR NECK FRACTURE , anatomically into 4 types: Classic subcapital fracture, wedge subcapital fracture, inferior beak fracture and mid neck fracture.[120, 122]

2. Pauwels classification based on fracture angle

Pauwels divided FEMUR NECK FRACTURE based on the plane of the neck fracture.

The Type I fracture subtends an angle of 30 degrees or less.

Type II fractures are between 30 and 50 degrees, and

Type III fractures are greater than 50 degrees

The classification relates the prognosis to the angle of the fracture plane—as the angle increases the fracture instability increases and complications of fracture healing and fixation are more likely. However, the reliability of this classification has also been tested in a study evaluating interobserver levels of agreement

3. Garden classification based on displacement of fracture fragments

Garden proposed a classification system based based on the degree of displacement, which is judged on the AP radiograph by determining the relationship of the trabecular lines in the femoral head to those in the acetabulum

Garden I fracture is a valgus-impacted subcapital fracture. The fracture is incomplete with a lateral fracture line that does not breach the medial cortex. The trabecular lines in the femoral head therefore form an angle with those in the acetabulum.

Garden II fracture, the fracture is complete but undisplaced and the trabecular lines in the head are colinear with those in the acetabulum and the femoral neck distal to the fracture.

Garden III subcapital fractures are incompletely displaced fractures. The femoral head has not lost contact with the femoral neck, but the head is varus and extended, resulting in angulation of the trabecular lines. The angulation is in the opposite direction to that described for Garden I fractures. the Garden IV fracture is completely displaced and the trabecular lines line up as the femoral head returns to a neutral position within the acetabulum. The femoral neck loses contact with the head and externally rotates, so the trabecular lines in the neck are not colinear with those in the head.

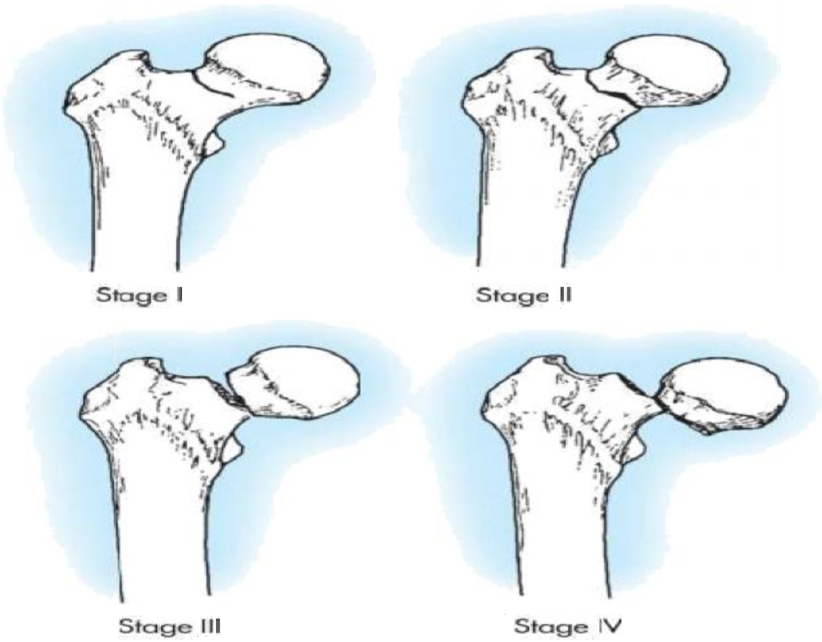


Fig 4: GARDEN CLASSIFICATION

Eliasson-Eiskjaer and Ostgard[126]and, recently, Kreder[127] demonstrated that classification and neck displacement does not alter treatment or outcome in Garden stage I compared with stage II fractures or in Garden stage III fractures as compared with stage IV fractures. Because of these findings, they recommended simply distinguishing between undisplaced (Garden I and II) and displaced (Garden III and

IV) FEMUR NECK FRACTURE .[126, 127]

4. The AO/Orthopaedic Trauma Association (OTA) classification[128]

The comprehensive classification of long bone fractures is an alphanumeric system based on the bone, the location of the fracture, and the fracture morphology. The femoral neck is designated 31B .

The B1 group describes undisplaced femoral neck fractures,

The B2 transcervical fractures, and

The B3 category describes displaced subcapital fractures

31-B1 - Subcapital fracture with slight displacement

31-B1.1 - Impacted in valgus

>/=15° posterior tilt < 15°

posterior tilt > 15°

31-B1.2 - Impacted in valgus <

15° posterior tilt < 15°

posterior tilt > 15°

31-B1.3 – Nonimpacted

31-B2 – Transcervical fracture

31-B2.1 - Basicervical

31-B2.2 - Midcervical adduction

31-B2.3 - Midcervical shear

31-B3 - Displaced, non-impacted subcapital fractures.

31-B3.1 - Moderate displacement in varus and external rotation

31-B3.2 - Moderate displacement with vertical translation and external rotation

31-B3.3 - Marked displacement In varus With translation

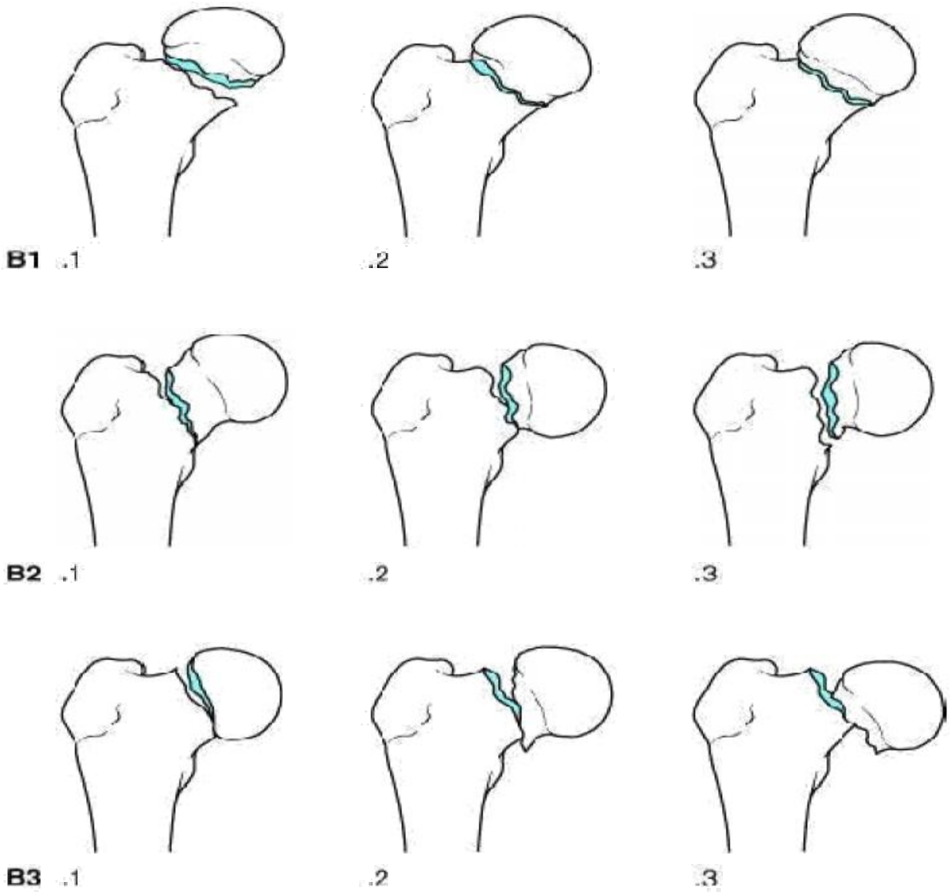


Fig 5: AO-OTA CLASSIFICATION

CLINICAL FEATURES and DIAGNOSIS OF INTRACAPSULAR FRACTURE NECK OF THE FEMUR[164]

A classical picture is of an elderly female lying with the injured leg shortened and externally rotated extremely painful on the slightest movement and unable to raise the leg from the bed. The patient complains of groin pain which referred to the inner aspect the thigh and knee. Movement of the leg and weight bearing are restricted by pain and muscle spasms or almost impossible.

In impacted Femur Neck fracture sometime it is possible for the patient to move the hip or even to walk despite the injury. Quite often, the only clinical sign that is obvious is slight lateral rotation deformity and a provisional diagnosis should be made on this basis alone.

On examination, in an unimpacted fracture the patient is unable to lift the limb and the limb may be slightly shortened and externally rotated moderately. There will be partially intact capsule so the patients will not have extreme deformity as seen in hip dislocation or intertrochantric .[129]Tenderness is present in the groin. Greater trochanter is migrated upwards on moving the hip sometimes the crepitus is felt and pain in the groin increase. We should not perform hip range of. In xray we can be able to diagnose the displaced fractures.

ROENTGENOGRAPHY OF THE HIP REGION

Initial evaluation of the patient include x ray of pelvis with both hip in AP, a true AP view of the hip with the maximum degree of internal rotation possible, and a cross-table lateral x-ray.[130] The hip joint is usually radiographed in an AP view with the heel slightly separated and the toe symmetrically directed forwards and medially. In this position the femur is rotated medially, the femoral neck is parallel to the film. The shadow of the upper end of the femur and the acetabular region of the hip are clearly seen. A curved white line of cortical bone delineates the superior and medial edge of the acetabulum and the cortex of the head of the femur also appear as a white line. The width of joint space (occupied by joint) is measured as the gap between the white line of the cortex of the head of the femur and that of the acetabulum. Normally the joint space on either side is of the same width (i.e., in adults 4-7 mm). A small depression, the fovea centralis is frequently visible on the head of the femur at the site of attachment of the round ligament. The appearance of the neck, greater trochanter and lesser trochanter of the femur are greatly altered by the rotation of the thigh. When the foot is directed slightly medially,the neck lies in the transverse plane of the body and its full length is shown. When however, the foot is directed anteriorly, the greater trochanter of the femur lies in the plane somewhat posterior to the head of the femur. If the foot is directed outwards the greater trochanter is still more posterior and its shadow may overlap that of the head and the neck of the femur then appears greatly shortened. The angle between the neck and shaft is best seen when x-ray is taken with the foot directed slightly medially with an internal rotation of 15^0. The angle is usually 120-140 deg.

CALCAR FEMORALE

According to Harty[131]and Griffin[132], the calcarfemorale is a dense vertical plate of bone extending from the postero-medial portion of the femoral shaft under the lesser trochanter and radiating lateral to the greater trochanter, reinforcing the femoral neck posteroinferiorly. The calcar femorale is thicker medially and gradually thins as it passes laterally.[131, 132]The presence and adequacy of Calcar femorale can be best appreciated by an AP view of the hip taken in 15^0 internal rotation.

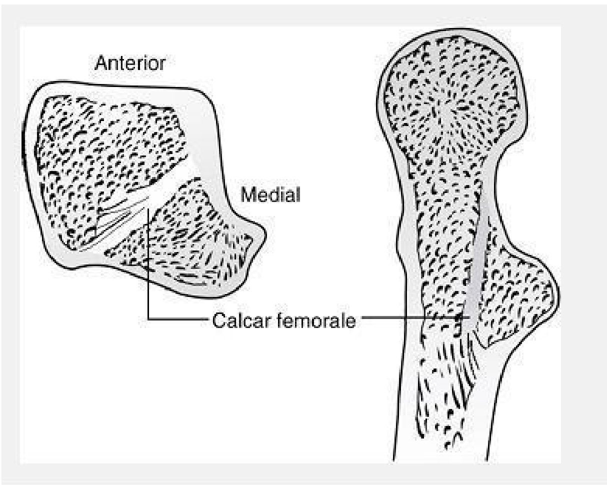


Fig 6: CALCAR FEMORALE

Shenton's line

In the normal individual the line of the upper margin of the obturator foramen follows the same curve that of the under surface of the neck and the medial side of the shaft of the femur. The continuity of this curve is unaffected by small difference in position of the hip joint. Shenton's line is broken in FEMUR NECK FRACTURE.

Assessment of quality of bone in the femoral neck and head by Singh's index[133]

Many patients with hip fracture have markedly porotic bone. The quality of fixation and the stresses which can be tolerated post operatively are related to the severity of the osteoporosis.

In 1838, way before the discovery of roentgenography, the internal trabecular system of the femoral head was described by Ward.[2] The orientation of the trabeculae is along lines of stress, and thicker lines come from the calcar and rise superiorly into the weight-bearing dome of the femoral head. Forces acting in this arcade are largely compressive. Lesser trabecular patterns extend from the inferior region of the foveal area across the head and superior portion of the femoral neck into the trochanter and lateral cortex. Ward's triangle is the triangle bounded by primary compressive trabeculae, primary tensile trabeculae and secondary compressive trabeculae.

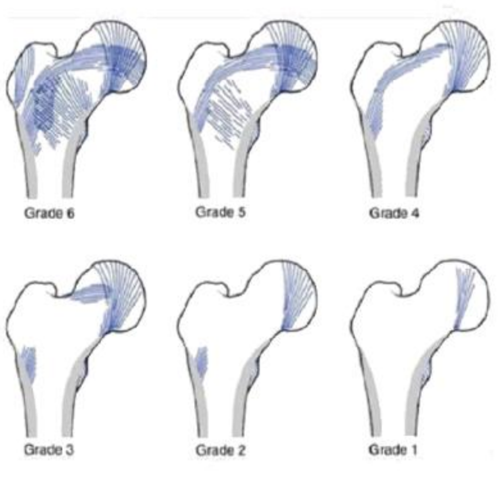


Fig 7: SINGH'S INDEX OF OSTEOPOROSIS

Singh et al used the trabecular pattern seen on x-rays of the upper end of the femur as an index for the diagnosis and grade of osteoporosis. This system is based on the presence or absence of the five normal groups of trabeculae in the proximal femur, as described by Ward.[133]

Grade - 6: Normal trabecular pattern with primary compression and tensile trabeculae and secondary compression and tensile trabeculae.

Grade - 5: Decrease in secondary trabecular pattern and ward's triangle becomes prominent.

Grade - 4: Secondary trabecular pattern is absent and primary trabecular pattern decreases.

Grade - 3: A break occurs in tensile trabeculae.

Grade - 2: Loss of primary tensile trabeculae is complete, marked reduction in compression trabeculae.

Grade -1: Only a few compression trabeculae seen.

Grade 3 and below indicate significant osteoporosis. Examination of this index against more technologically advanced methods has demonstrated a fairly high sensitivity (90%), but a low specificity (35%) for the identification of osteoporosis.[133]

METHODOLOGY

SOURCE OF DATA:

Patients having Femur Neck fracture, who are admitted in SHRI B. M. PATIL MEDICAL COLLEGE HOSPITAL and RESEARCH CENTRE VIJAYAPUR – 586103 were taken for the studer under their concent.

This is a prospective study from october 2016 to march 2018

INCLUSION CRITERIA :

- Intracapsular Femur Neck fractures
- Age of the patient >60 years
- Failed internal fixation
- Avascular necrosis of femoral head secondary to Femur Neck fracture
- Non union Femur Neck fracture

EXCLUSION CRITERIA :

- Patient medically not fit for surgery
- Patient not willing for surgery
- Patient below age of 60 yrs
- Pathological hip fractures
- Patients with acetabular fractures
- Patients with hip arthritis

DATA COLLECTION

Patients having Femur Neck fracture and satisfying above inclusion criteria, requiring surgical intervention, were worked up clinically and radiologically. According to protocol, associated injuries, if any were noted and further investigations were carried out in order to evaluate fitness for surgery patients were examined.

PREOPERATIVE PROTOCOL

Patients were admitted through outpatient and from casualty. Diagnosis will be confirmed by radiograph. Assessment of canal bone ratio was done using digital plain AP Radiograph of pelvis with both hips. Adequate medical management of associated co-morbid conditions like Diabetes Mellitus, Systemic Hypertension, Chronic Obstructive Pulmonary Disease and Heart Diseases were initialized to optimize patient’s fitness for anaesthesia. An informed written consent for the procedure as per the guidelines of the institution and consent for inclusion of the patient for the present study was taken. The involved lower limb was prepared from nipple to ankle on the day before surgery. The per-operative antibiotic used was Cefuroxime given 1.5 g intra-venous at the induction of anaesthesia and continued for 2 days postoperatively.

DESCRIPTION OF THE IMPLANT

The prosthesis used in this study is a SMP Modular bipolar prosthesis manufactured by Biorad Medisys Pvt. Ltd., Pune, India. The technical specifications of this prosthesis are:

The stems are available in four sizes – Small, Medium, Large and Extra Large, with separate femoral heads. The stem allows optimal fit in the femur. Collar of femoral stem sits over the calcar femorale, the strongest portion of bone and thus prevents subsidence. Stems are Corundum blasted stem for uncemented fixation (for increased osseous integration). Femoral stem has got 3planer taper which narrows distally which gives better fit in metaphyseal area and tip remains in centre of medullary canal, preventing anterior thigh pain.

Modularity helps to get exact reproduction of anatomy and biomechanics. Circumferential collar gets locked in the neck imparting rotational stability.

Material: Stainless Steel AIS 316 L

Head diameters: 37 mm to 53mm

Degree of device: 135 degrees

Fig 9: SMP MODULAR BIPOLAR PROSTHESIS

SURGICAL PROCEDURE

All cases were done under regional anaesthesia which included spinal or epidural anaesthesia on combined. The choice of the anaesthesia was according to the discretion of the anaesthetist.

Surgical Approach – Moore's posterior approach to the hip[134]

After induction of either spinal or epidural anaesthesia the patient was placed on the lateral position on the operative table with the affected side facing up. A curved incision is taken from 8 cm distal to the posterior superior iliac spine, extended distally and laterally, parallel with fibres of gluteus maximus muscle to the posterior margin of the greater trochanter. The incision is then directed distally 5-8 cms along the femoral shaft. The deep fascia is exposed and divided in line with the skin incision. By blunt dissection the fibres of the gluteus maximus are separated taking care not to injure the superior gluteal vessels in the proximal part of the exposure. The gluteus maximum muscle is split and short external rotators are exposed. Stay sutures are applied to the short external rotators, and a tenotomy is done close to their insertion on the inner surface of the greater trochanter. The short external rotators are retracted to protect the sciatic nerve and expose the posterior hip capsule. The capsule is incised by a T-shaped incision, and the hip flexed, adducted and internally rotated to dislocate the hip joint. Using a head extractor and bone levers, head is delivered out of the acetabulum and the acetabulum is cleared of debris. The size of theextracted head is measured by using measuring gauze, and the size of prosthesis isselected. The head of the prosthesis is inserted into the acetabulum to confirm the correct size selection.

Preparation of proximal femur

The neck is trimmed leaving 1cm medial calcar, on which the shoulder of the prosthesis would eventually sit. Lateral pert of the neck was cut with a box osteotome to create a lateral entry into the medullary canal. The proximal femur was broached with rasp, the length and thickness of the rasp corresponding to the stem of the prosthesis. The direction of the insertion of the rasp for was ascertained by using the lesser trochanter as a guide to achieve correct seating of the prosthesis in 10-15^0anteversion. Wash was given to the wound and hemostasis achieved thoroughly.

Preparation and insertion of the bone cement

The acetabulum was covered with a mop. A normal saline soaked ribbon gauge was inserted along with suction drain pipe into the canal to dry it. 40 g bone cement (Simplex® P, Stryker®Howmedica Osteonics Corp., NJ, USA) was used in the study. The cement packet was opened and two components were mixed in a bowl in open air. On reaching doughy state, the gauze and suction from the canal were removed and cement was inserted by finger packing.

Insertion of the Modular bipolar prosthesis

The appropriate sized prosthesis is inserted into the canal taking care to place it in 10-15^0 of anteversion immediately after all the cement is packed. The final seating of the prosthesis is by gentle blows with the help of a mallet and the impactor. Adequate seating of the prosthesis on the calcar is visualized directly. The prosthesis is held in this position till the cement sets completely. The acetabulum and neck area is thoroughly checked to remove extruded cement. The hip joint is reduced by gentle traction with external rotation of the hip and simultaneous manipulation of the head of the prosthesis into the acetabulum with a Murphy's skid. The range of movement in all directions is checked by taking the joint through the whole range of movements. The stability of the prosthesis and its tendency to dislocate is checked by flexing and adducting the hip. The limb is kept in slight abduction and external rotation for suturing the wound. Great care is taken to achieve adequate closure of the posterior capsule and anatomical reattachment of the short external rotators. The rest of the wound is closed in layers over a 16 G suction drain placed beneath the gluteus maximus. Haemostasis is maintained throughout the procedure. Sterile dressing is applied.

POSTOPERATIVE PROTOCOL

All the patients who were operated were kept in supine position with the involved lower limb in 20-30^0 abduction. Regular half hour TPR and blood pressure chart was maintained for initial 6 hours followed by two hourly monitoring for 24 hours.The drain was removed between 24-48 hours depending on the amount of collection. Peri-operative prophylaxis of Cefuroxime given 1.5 g 12th hourly intravenous was continued for the first 2 days. X Rays of pelvis of both hips were taken to assess any technical errors. The wound was inspected at the time of drain removal and at the time of suture removal. If however, there was soakage of the dressing or if patient had high fever the wound was inspected accordingly and dressing changed.

All the patients were advised to sit with back rest from the 2nd post operativeday and advised deep breathing exercises. Mobilization with a walker was started between third and fifth post-operative day. Patients were initially advised toe-touch weight bearing and later advised progress to full weight bearing as tolerated. The sutures were removed between 10-14 days. The study patients were discharged from the hospital on an average of 22 days, the maximum hospital stay being 40 days and the minimum being 12 days.

The patients were examined before discharge for the evidence of anyinfection at operated site. Abduction and static quadriceps exercises were advised for a period of 6 weeks.

FOLLOW UP

Regular follow up of all cases was done at 6 weeks, 3 months, 6 months, and one year. At each follow up, patients were evaluated clinically using the Modified Harris Hip Score and radiologically with appropriate X-rays.

OPERATIVE PHOTOGRAPHS

1: INSTRUMENTS

1. CHARNLEY’S RETRACTOR
2. CORK SCREW FOR HEAD EXTRACTION
3. RING CALLIPER
4. BOX OSTEOTOME
5. REAMER
6. TRIAL STEMS
7. IMPACTOR
8. MURPHY’S SKID
9. BIPOLAR HEAD and FEMORAL HEAD
10. BONE CEMENT (POWDER + LIQUID)

PROCEDURE OF MODULAR BIPOLAR

HEMIARTHROPLASTY

PAINTING and DRAPPING **INCISION**

EXPOSURE OF SHORT EXTERNAL HEAD EXTRACTEDROTATORS

MEASURING HEAD SIZE WITH GAUZE

INSERTION OF MODULAR BIPOLAR PROSTHESIS

IMPACTING THE PROSTHESIS SHORT EXTERNAL ROTATORS

SKIN CLOSURE

RESULTS

RESULTS

During the period between September 2016 to march 2018, 33 patients were treated hemiarthroplasty with Modular Bipolar prosthesis for FEMUR NECK FRACTURE at the SRI B M PATIL MEDICAL COLLEGE and RESEARCH CENTER HOSPITAL VIJAYPURA.

Data was collected based on detailed patient evaluation with respect to history, clinical examination and radiological examination. The postoperative evaluation was done both clinically andradiologically. Out of the 33 cases, all patients were available for follow up till one year which was taken as a basic pre-requisite for inclusion in the study.

TABLE – 1

AGE DISTRIBUTION

Age	Frequency	Percentage %
60 – 69	23	70.0
70-79	8	24.0
>80	2	06.0

Table : 1shows the age distribution pattern of the patients. The average age was noted to be 67.9years. The youngest patient in the study was 60 and oldest was 88 years. Mean age is 63.9 years.

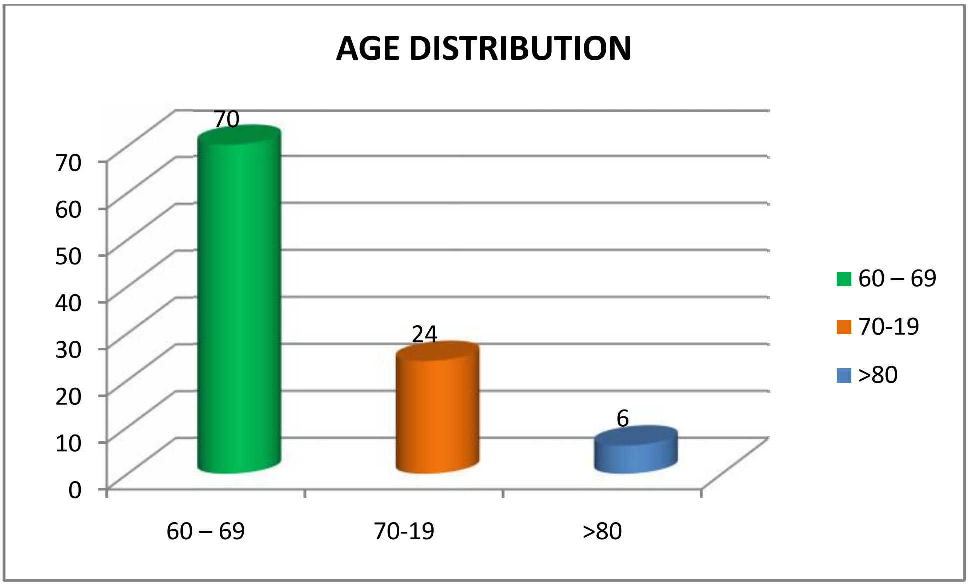


TABLE – 2

SEX DISTRIBUTION

	Frequency	Percentage %
Male	12	36.4
Female	21	63.6

Table : 2 Shows the sex distribution pattern of the study patients. Most of the patients were found to be women (64%).

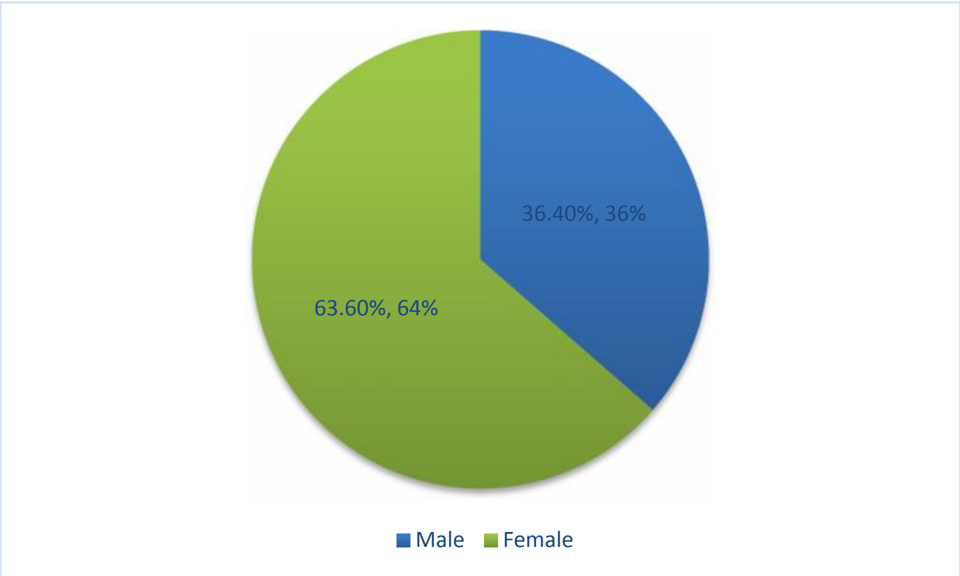


TABLE – 3

LATERALITY

	Frequency	Percentage %
Right	20	60.6
Left	13	39.4

Table : 3 Shows the laterality pattern of the study patients with RIGHT side being affected in 60.6% of the patients.

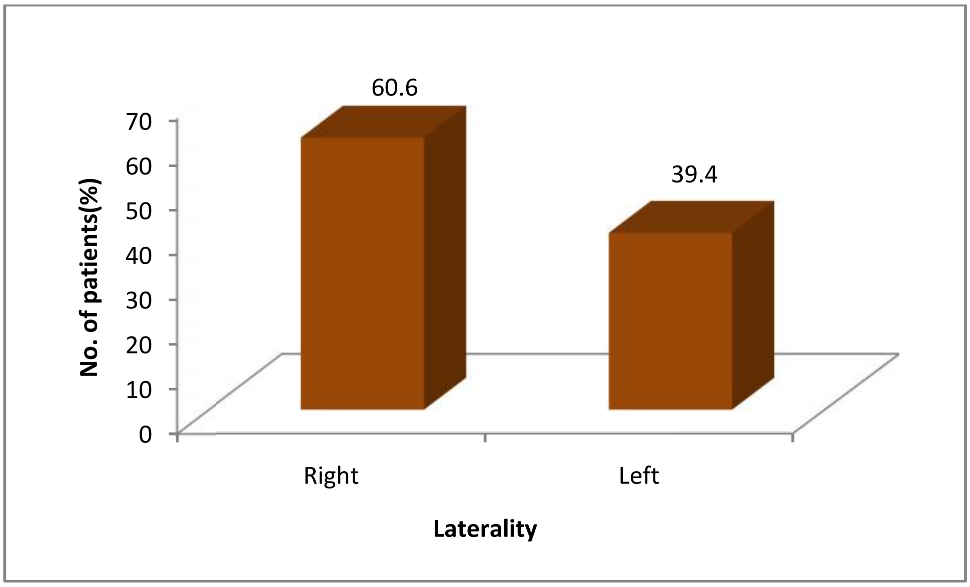


TABLE – 4

MODE OF INJURY

	Frequency	Percentage %
Slip and fall	25	75.8
Missed a step	2	06.0
Fall from vehicle	6	18.2

Table : 4 Depicts the mode of injury causing the femoral neck fracture. 75.8% of the patients sustained injury by slip and fall and 18.2% due to fall from vehicle.

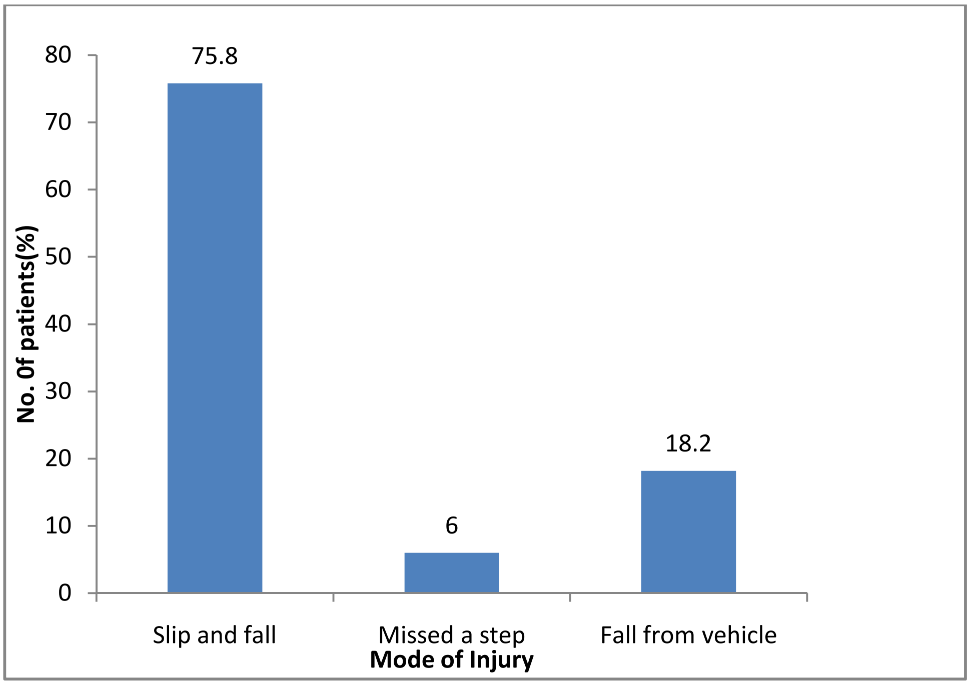


TABLE – 5

TIME OF PRESENTATION

Days	Frequency	Percentage %
<7	08	24.2
7 – 14	20	60.6
>14	05	15.2

Table : 5 Shows the time of presentation after injury. 24.2% presented within 7 days, 60.6% presented between 7 – 14 days, and 15.2% presented after 14 days.

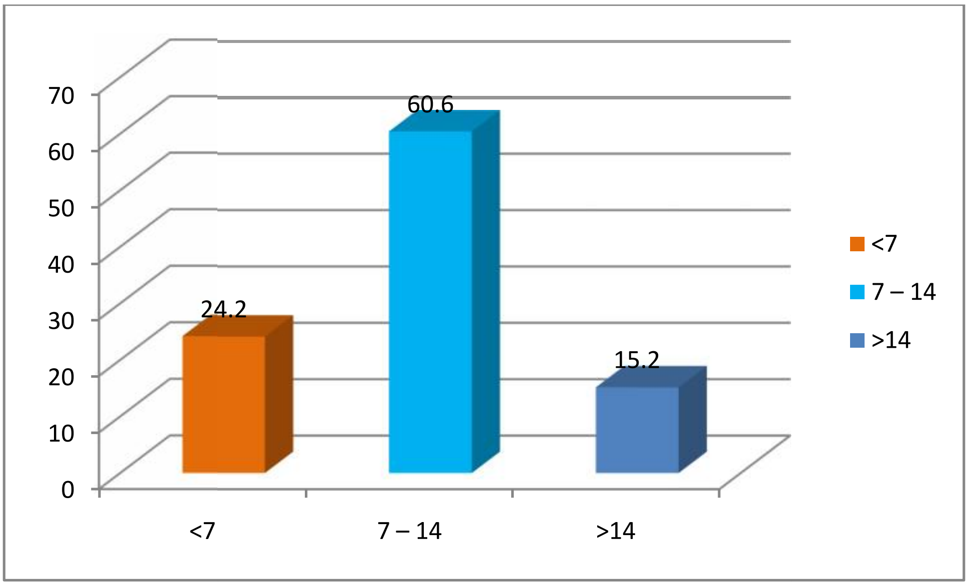


TABLE – 6

TYPE OF FRACTURE

Garden Classification	Frequency	Percentage %
Type I	01	03.0
Type II	04	12.1
Type III	22	66.7
Type IV	06	18.2

Table : 6 Shows that majority of study patients (66.7%) had Gardens type III fracture and 18.2% patients had garden type IV fracture.

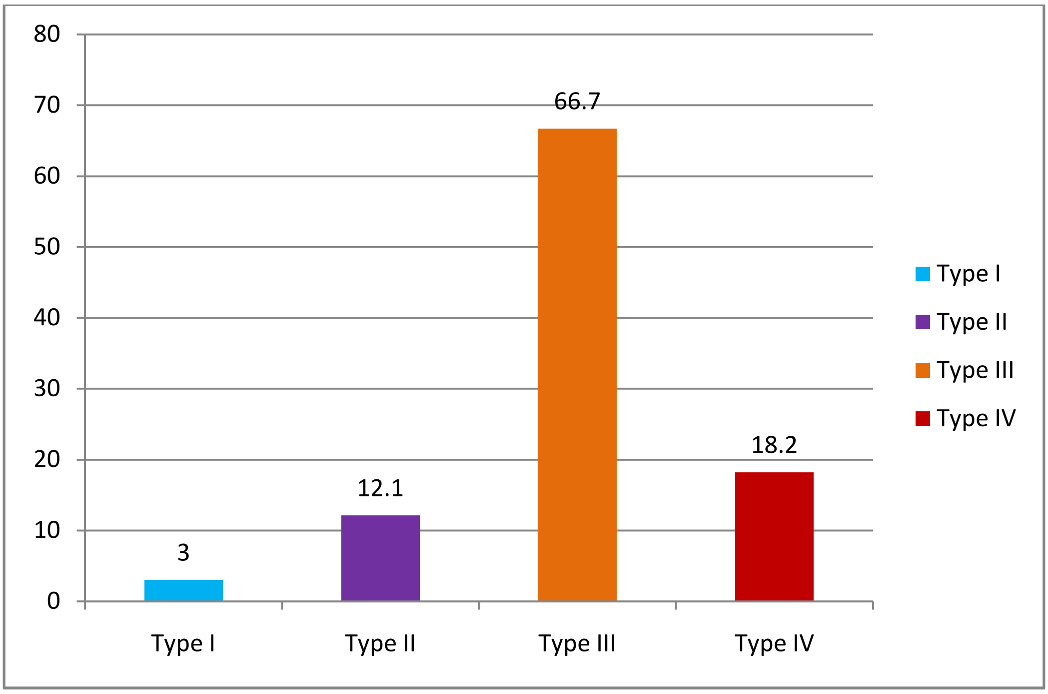
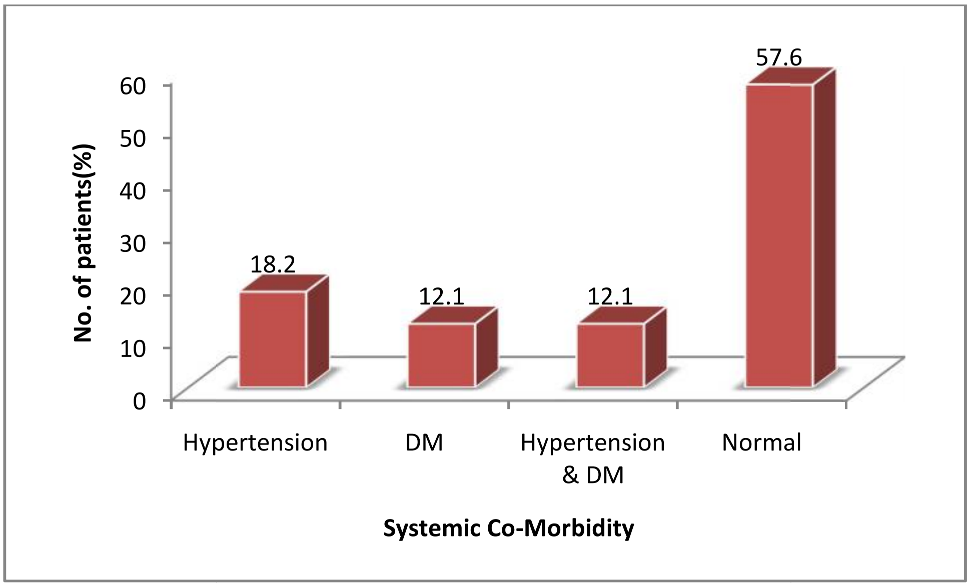


TABLE – 7

SYSTEMIC CO-MORBIDITY

	Frequency	Percentage %
HYPERTENSION	06	18.2
DM	04	12.1
HTN and DM	04	12.1
NORMAL	19	57.6

Table : 7 depicts that 18.2% of study patients had hypertension, 12.1% had both HTN and DM, and 12.1% patient had DM.



TIMING OF SURGERY

All the study patients were taken up for the surgical procedure between the 3rd and 15th day after the trauma, the average delay to surgery being 20 days.

TYPE OF ANAESTHESIA, POSITION and APPROACH

All the surgeries were performed under spinal or epidural anaesthesia after a thorough pre anaesthetic evaluation and preparation. The choice of the type of anaesthesia was as per the anaesthetist's discretion and all patients were administered spinal anaesthesia or combined epidural and spinal anaesthesia.

All patients were operated after being put into lateral decubitus position with affected side up, by the posterior approach of Moore.

TABLE – 8

SIZE OF PROSTHESIS

Bipolar head size	Frequency	Percent %
39.00	01	03.0
41.00	09	27.3
43.00	10	30.3
45.00	06	18.2
47.00	04	12.1
49.00	01	03.0
51.00	02	06.1

Table : 8 depicts that the most commonly used prosthesis was 43mm followed by 41mm and 45mm.

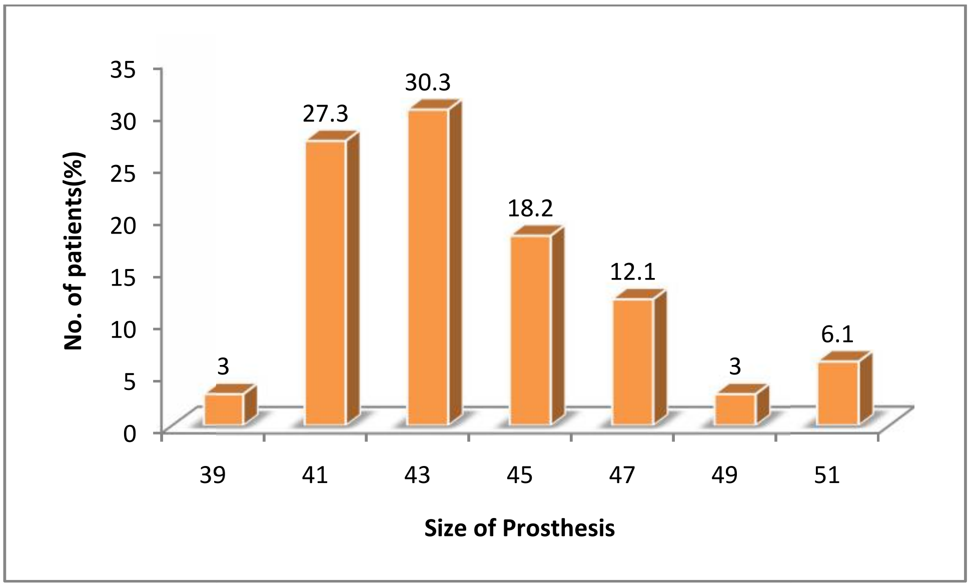


TABLE – 9

TYPE OF PROSTHESIS

Type of prosthesis	No
Uncemented	04
Cemented	29

Table : 9shows that most common prosthesis used in the study was cemented bipolar prosthesis, in 4 patientsuncemented prosthesis was used and in 29 patients cemented prosthesis was used.

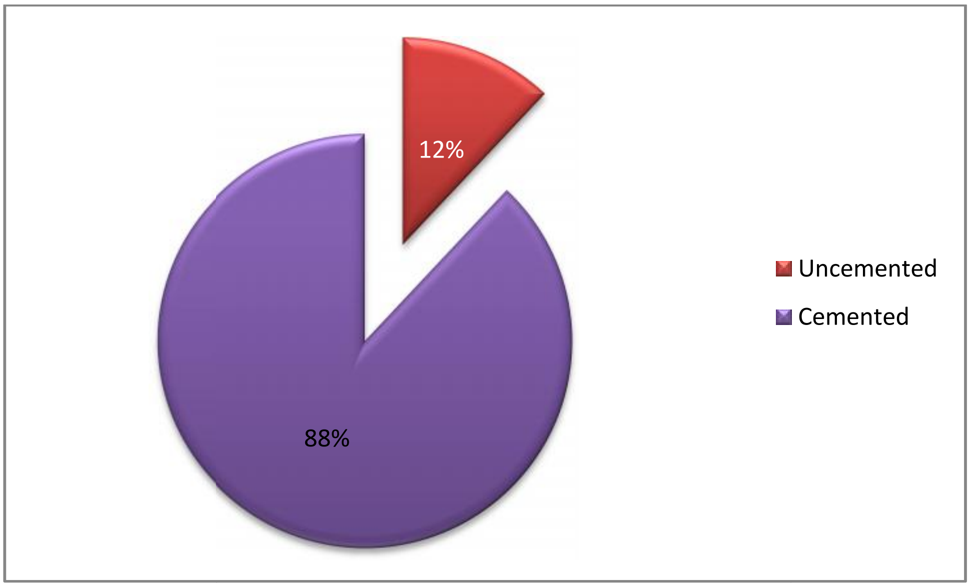


TABLE – 10

BLOOD LOSS

Millilitres	Frequency	Percent %
120.00	1	3.0
130.00	1	3.0
150.00	6	18.2
160.00	7	21.2
170.00	7	21.2
180.00	2	6.2
200.00	6	18.2
220.00	1	3.0
250.00	1	3.0
300.00	1	3.0

Table : 10Depicts the blood loss during the procedure. Majority of the patients had a blood loss of 150- 170ml.

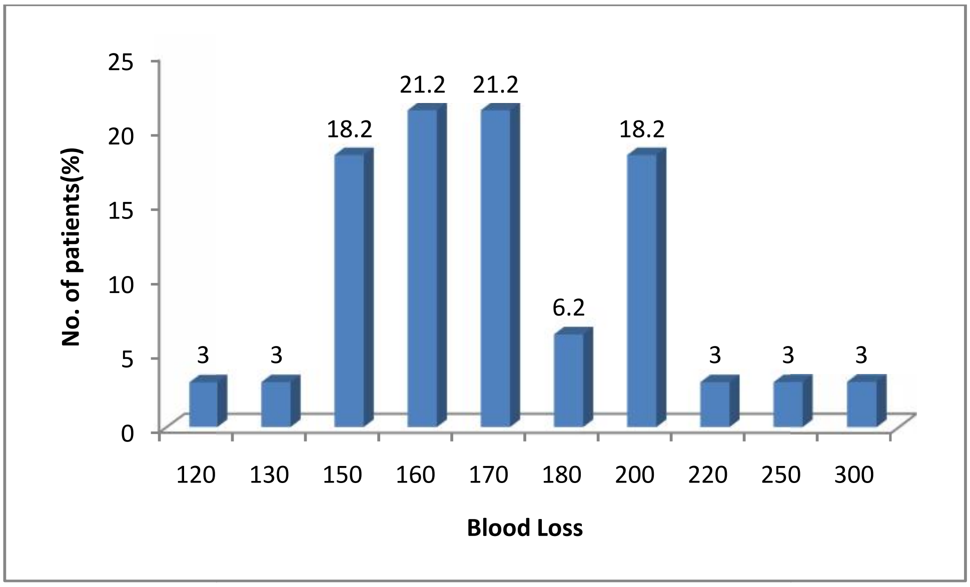


TABLE – 11

PER OPERATIVE COMPLICATIONS

	Frequency	Percent %
HYPOTENSION	12	36.3
DISLOCATION/FRACTURE	0	0.0

Table: 11Depicts that the most commonly encountered peri- operative problem was post-operative hypotension. This was managed by blood transfusion, administration of colloids and crystalloids.

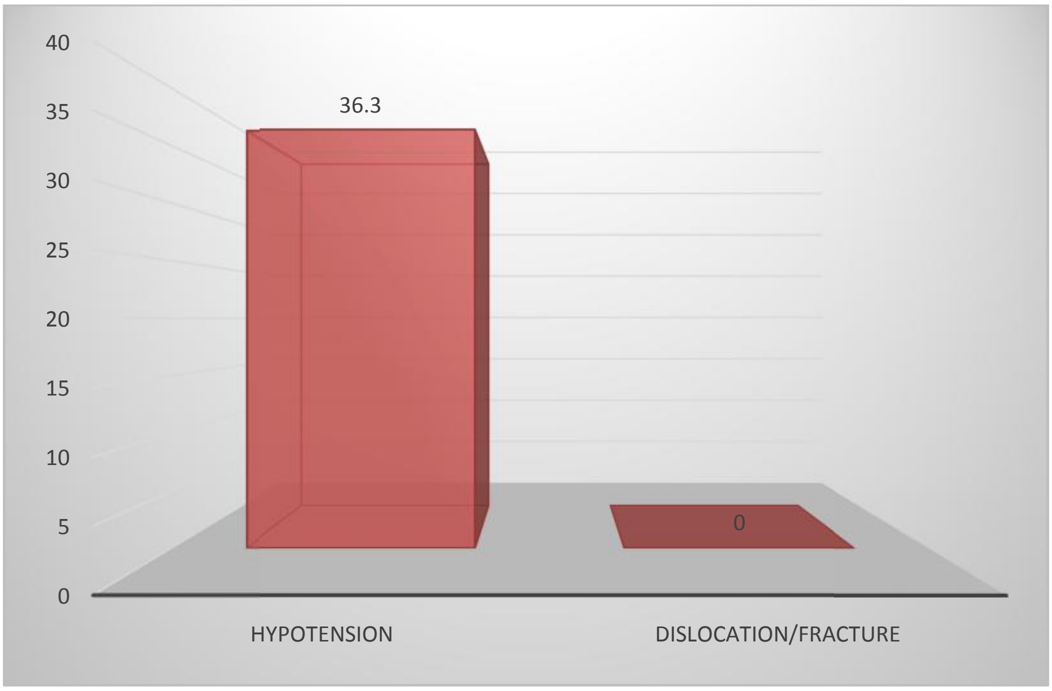


TABLE – 12

EARLY COMPLICATION

	Frequency	Percent
SUPERFICIALINFECTION	5	15.2
DVT	1	3.0
NORMAL	27	81.8

Table : 12 Shows 5 patient had superficial infection who were treated conservatively with IV antibiotics. Another patient developed DVT post operatively which required anticoagulants.

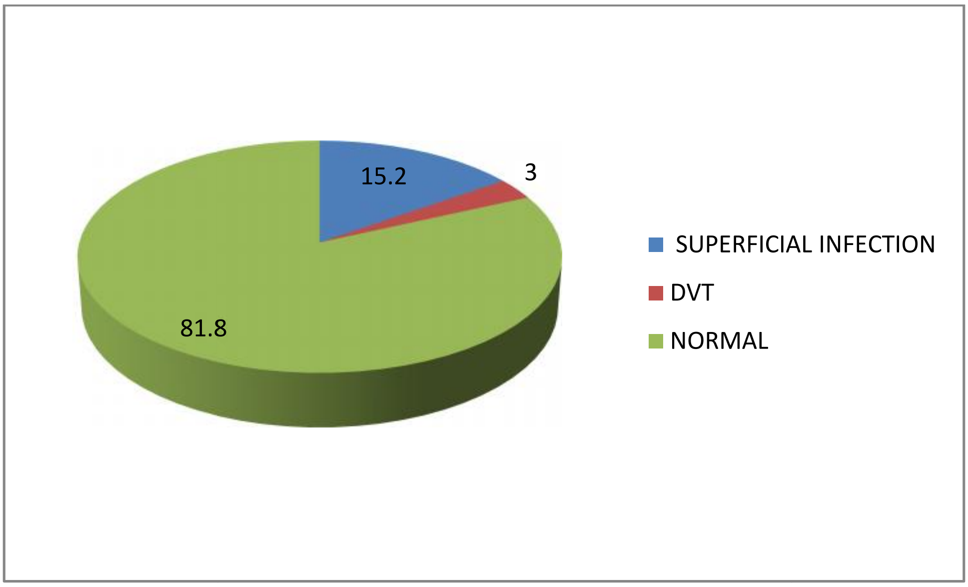


TABLE -13

DELAYED COMPLICATION

	Frequency	Percent
LOOSENING OF IMPLANT	1	3.0
NORMAL	32	97.0

Table : 13shows loosening of implant in 1 patients. One patient had DM and associated infection which at a later date implant was removed.

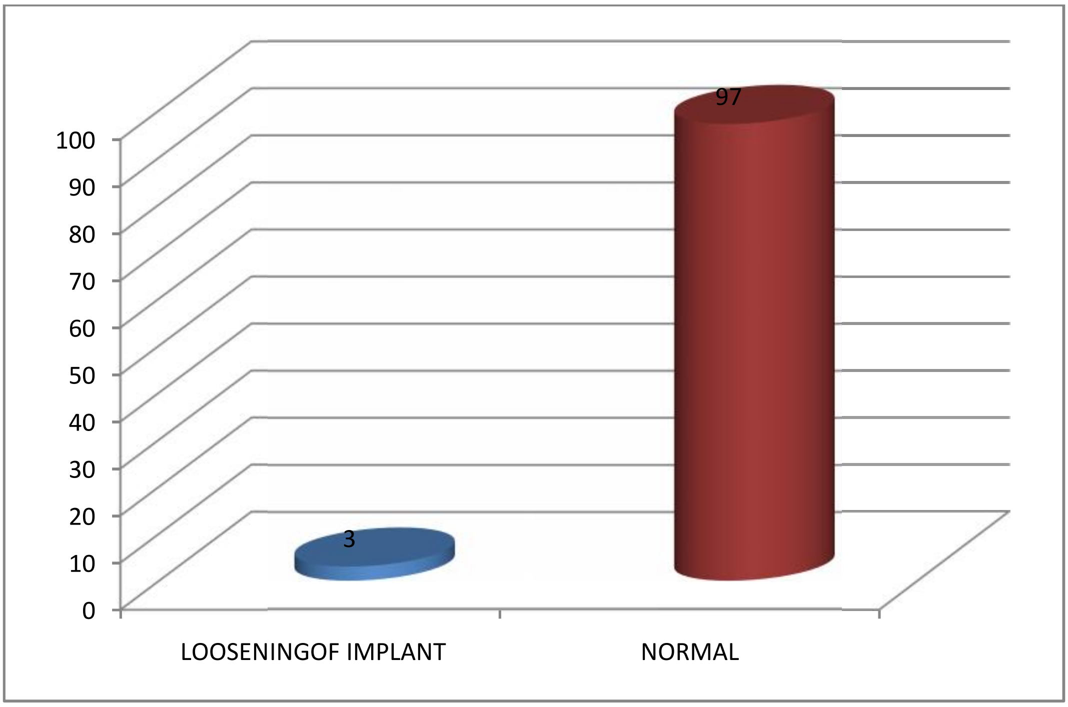


TABLE 14

MODIFIEDHARRIS HIP SCORE

MHHS	**N**	**Minimum**	**Maximum**	**Mean**
6 Weeks	33	30.00	80.00	70.00
3 Month	33	30.00	100.00	78.06
6 Month	31	70.00	100.00	80.86
12 Month	30	75.00	100.00	81.96

Table: 14 shows the modified harris hip score where by the end of one year there is 81.9% of good functional outcome.During study period 3 (9.7%) of the patients died due to medical conditions unrelated to surgical cause.

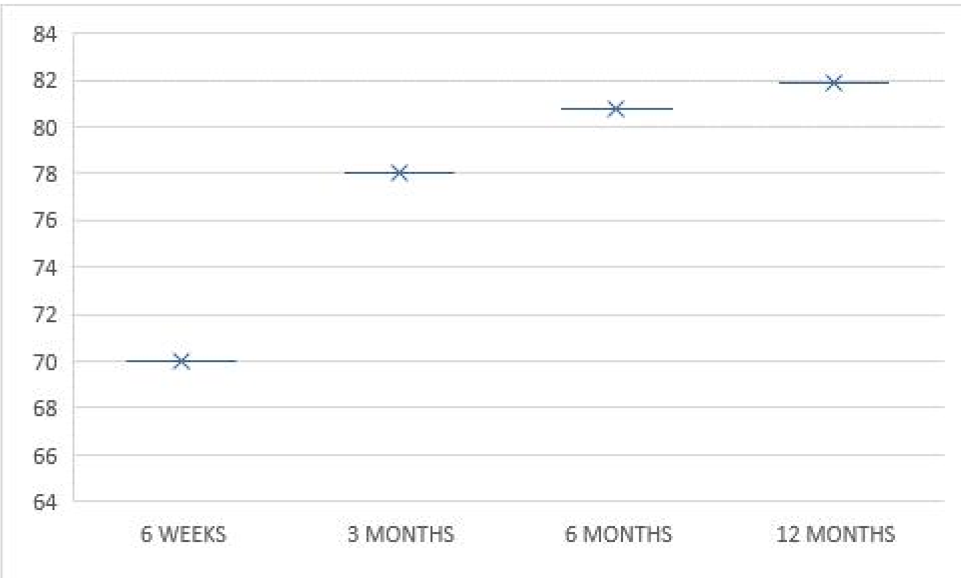
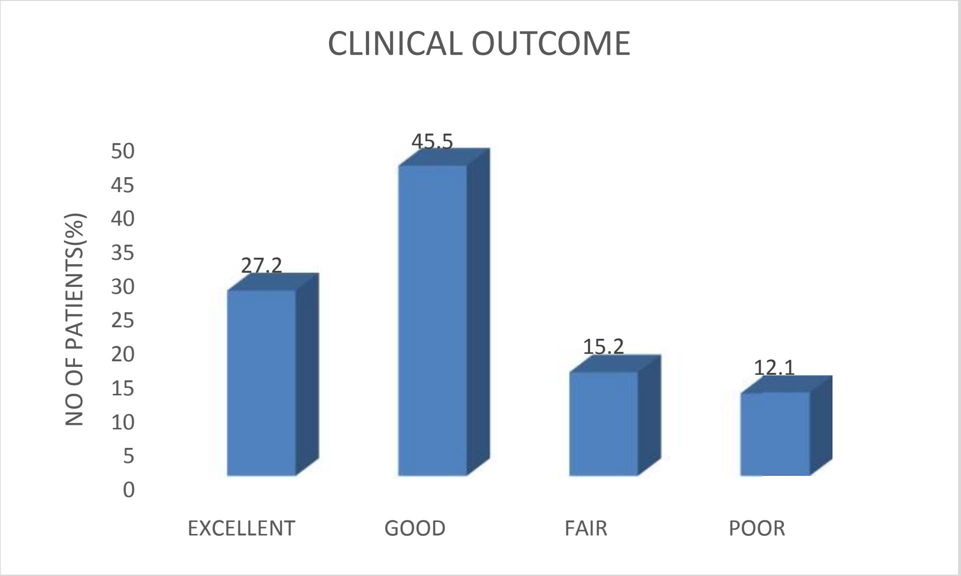


TABLE – 15

CLINICAL OUTCOME

	Frequency	Percentage
Excellent	9	27.2
Good	15	45.5
Fair	5	15.2
Poor	4	12.1
Total	31	100.0

Table : 15 Shows the clinical outcome where in 27.2% had Excellent results, 45.5% had Good results and 12.1% had poor results. In our study we noticed that 4 of the patients were able to sit crossed leg and squat.



RADIOLOGICAL
and
CLINICAL
PHOTOGRAPHS

CASE NO 1

PRE OPERATIVE X - RAYS

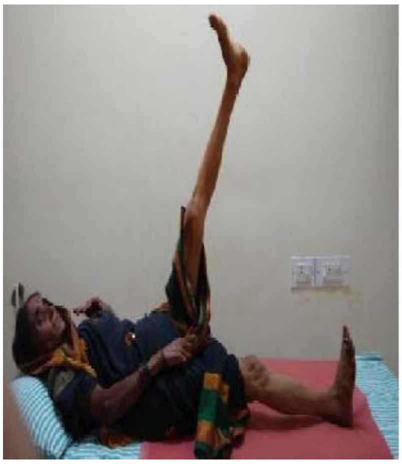
AP VIEW **LATERAL VIEW**

POST OPERATIVE X – RAYS

AP VIEW **LATERAL VIEW**

CLINICAL PHOTOGRAPHS

1 YEAR FOLLOW UP



STRAIGHT LEG RAISING

ABDUCTION

ADDUCTION

SQUATTING

SITTING CROSS LEG

CLIMBING STAIRCASE

CASE NO 2

PRE OPERATIVE X – RAYS

AP VIEW

LATERAL VIEW

POST OPERATIVE X – RAYS

1 YEAR FOLLOW UP

AP VIEW

LATERAL VIEW

CLINICAL PHOTOGRAPHS

AT 1 YEAR FOLOW UP

SITTING

STRAIGHT LEG RISING

ABDUCTION

ADDUCTION

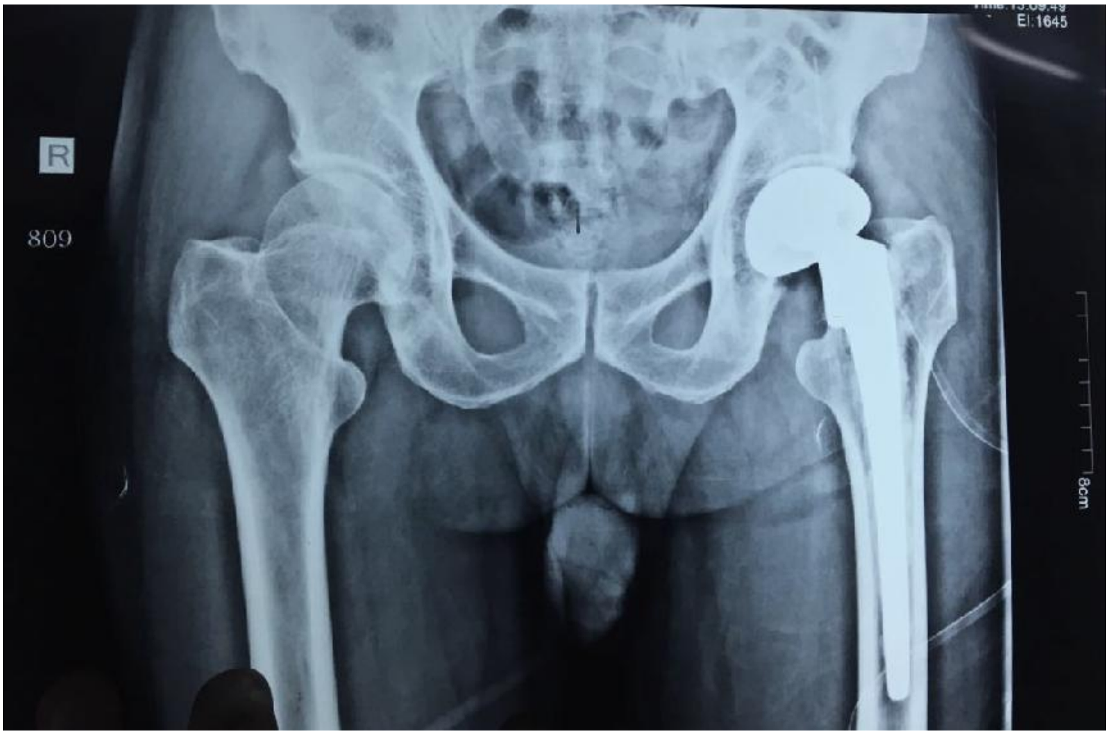
SQUATTING

SITTING CROSS LEG

CLIMBING STAIRCASE

CASE NO 3

PREOPERATIVE



POSTOPERATIVE

CASE NO 4

PREOPERATIVE

POSTOPERATIVE

DISCUSSION

DISCUSSION

The aim of replacement surgery in fracture neck femur is early return to daily activities and pre fall levels. This is particularly applicable to the elderly age group where complications related to prolonged immobilization need to be prevented.

The mean age of the patients in the present study was 63.9 years. The aim of assessing age is to estimate the patient's mean survival time and their ability to comply with rehabilitation protocol. Some authors have advocated hemiarthroplasty in patients over 70 years of age[121,140]. The average age of patients in our series is lower to those reported in Western literature viz. - 77.2 years [140], 81 years [137], 79 years [148], but higher than other Indian series viz. 65.7 years [141], and 66.3 years [149].This can be explained on the basis of a lower life expectancy amongst the Indian population as compared with the Western population with hip fractures .These patients have an increased mortality rate during the first year after fracture but after one year the mortality rate is comparable to that of the general population. Bipolar hemiarthroplasty is reserved for elderly patients with minimal functional demands and is done primarily for pain relief rather than function**.**

As in other standard studies,the present study also had ahigher number of females. This is due to the lower peak bone mass and postmenopausal bone loss in women. [150] Women have a skeleton that adapts less well to ageing by periosteal apposition. More women have bone size and volumetric BMD reduced to below a critical level at which the loads on the bone are near to, or greater than, the bone's structural ability to tolerate them.[151, 152]

The right side (60.6%) was more commonly affected than the left. There is less subject of discussion in very few studies. Boyd and Salvatore had 55% patients with left side fractures in their series. The left side was involved in 55.4% patients in the series by D'Acry and Devas. The cause for left side preponderance is not known.[137]

Majority in our study patients (75.8%) sustained the injury due to a trivial trauma like slipping. This is in accordance with the series by Evans (1973) [153], Ingalhikar (1987)[154]. Falls are a common event, particularly among the elderly. Modest changes in balance function have been described in fit older subjects as a result of normal aging. Subtle deficits in sensory systems, attention, and motor reaction time contribute to the risk, and environmental hazards abound. Epidemiologic studies have identified a number of risk factors for this like weakness, balance deficit, gait disorder, visual deficit, etc.[150]. Most of such injuries can be classified as "indirect" trauma. six patients (18.2%) sustained the fracture secondary to a fall from a vehicle.

A little more than one fourth of our study patients were brought to the hospital within seven days of sustaining the injury. 60.6 of the patients were brought to the hospital 7 – 14 days of the injury and another 15.2% presented for treatment after 14 days. This is a common scenario in our country where patients present to a doctor much late given the seriousness of the condition or seek treatment from osteopaths and then come to an orthopaedician only after no relief is obtained. Difficulty in post-operative rehabilitation was particularly noticed in the subset who presented after 1 week.

Many of our study patients had a displaced fracture of the neck of femur. Majority of the patients (66.7%) had Garden's type III and 18.2% had Type IV fracture. The anatomical type of fracture and the displacement are not considered when choosing hemiarthroplasty for management of fracture neck femur. This decision is based on the age of the and patient and time since injury[121,]

Hypertension was found to be the most common co-morbidity seen in 18.2% of the study patients. Another 12.1 % patients had only DM and both HTN and DM. One patient had Type II Diabetes and was on oral hypoglycemic agents. Patient was shifted to insulin pre-operatively and blood sugar values optimized before taking up for surgery.It was observed that the post-operative rehabilitation of patients was significantly affected by the presence of the above co-morbidities. This also had an effect on the final functional result of the procedure. Similar observations have been made by Koval et al and Bath.[155, 156]

All the study patients were taken up for the surgical procedure between the 3rd and 30th day after the trauma, the average delay to surgery being 12 days. Delay in taking up for surgery was usually for optimizing the medical condition of the patient. All cases were performed on an elective basis and were scheduled as the first surgery in the morning.

All the surgeries were performed under spinal or epidural anaesthesia after a thorough pre anaesthetic evaluation and preparation. The choice of the type of anaesthesia was as per the anaesthetist's discretion.

All patients were operated after being put into lateral decubitus position by the posterior approach of Moore. The posterior approach was preferred because of the familiarity of most of the surgeons at our institution with the approach. Though the dislocation rate is reported to be more with the posterior approach, none of our study patients had a post-operative dislocation of the prosthesis. [156, 157]This was because meticulous attention was given to insertion of prosthesis in 15-20degrees anteversion, valgus positioning, suturing the posterior capsule and the short external rotators andkeeping the limb in slight abduction after the procedure. Patients were also explained in the immediate pre-operative period about the risk of dislocation with excessive flexion or adduction and internal rotation of the hip. They were advised not to squat or sit cross leg, though 4 of our patients demonstrated squatting and sitting cross leg on follow up.

In 10 patients 43 mm prostheses were used. cemented stems were used in 29 cases and Uncemented in 4 cases. This frequency of prosthesis size used was 41mm (9 cases),45 mm (7 cases), 47 mm (4 cases),51mm (2cases), 39mm (1 case) and 49 mm (1 case). The commonly used sizes in the series by Jadhav et al was also 43 mm and 41 mm.[101] This is because of the preponderance of female patients and the small build of Indian patients. The rasps used for broaching the canal were part of the instrumentation that came with the prosthesis. The advantage was that the rasp corresponded to the exact length and width of the prosthesis which prevented any additional broaching of the canal and subsequent loose seating of the prosthesis or fractures of the femur. The medullary canal was washed with normal saline. Cement was prepared and finger packing into the canal was done. The prosthesis was then inserted and hammered in carefully maintaining correct anteversion.

In 7 cases each, the blood loss was 160ml and 170ml for the whole procedure and in 6 each cases it was 150ml and 180ml. 36.0% of cases had a blood loss of >200 ml leading to hypotension requiring blood transfusion. It has been reported in literature that the average blood loss with hip hemiarthroplasty is less in the anterior approach as compared to the posterior approach.[136, 137] Most of the surgeries were completed between 90-120 minutes of starting the procedure. Similar duration of the procedure has been reported by Haidukewych, et al[138]and Emery et al[139],Figved et al [96], Parker et al (2010)[144], and Fraser Taylor et al (2012)[146] found increased surgery duration and blood loss in the cemented groups but none of the findings were statistically significant. Neither the intra-operative blood loss nor the duration of the procedure had any effect on final function.

Most of our study patients were mobilized in bed on day one of surgery and with weight bearing as tolerated using a walker, within the 72 hours postoperative period. Delay if at all was due to medical reasons.

Superficial infection in the form of a wound dehiscence was seen in five patient (15.2%) who were a diabetic or hypertension and diabetic. Patient was with adequate control of the diabetic status and appropriate intravenous antibiotics based on pus culture-sensitivity results. The infection resolved with sequelae in late, reactivation of the same and loosening of implant which was removed at later date. Infection rates reported in other series have ranged from 4.5% by D'Arcy[137], 4.7% by Jensen and Holstein[140] to 5.7% by Dhar[142]. Parker et al reported no increase in infection rates in the cemented hemiarthroplasty group.[144]Thus, our series has a similar infection rate.

One patient had a DVT post-operatively, confirmed by colour Doppler. This was managed with low-molecular weight heparin (Enoxaparin 40 mg twice daily subcutaneously) for 5 days followed by oral anticoagulants (Warfarin 5 mg, titrated as per PT-INR values).

There was no case of any cement related complication like hypotension, pulmonary embolism or cardiac arrest. The rationale for avoiding the use of cement comes from previous studies linking cementing to perioperative death and cardiopulmonary complications.[159, 160, 161.] Studies by Figved et al (2009)[96], Parker et al (2010)[144], Costa et al(2011)[146]and Taylor et al (2012)[147] have conclusively proven that cementing a hemiarthroplasty stem does not lead to a significant rise in cardiopulmonary complications or death in carefully selected patients. As suggested By Donaldson et.al[145], the surgical risk reduction for bone cement implantation syndrome in this study by thorough wash of the medullary canal, meticulous hemostasis and no pressurization. Also, none of the patients in the study population had severe cardiopulmonary compromise.

The minimum duration of hospital stay amongst the study patients was 12 days and maximum duration was 25 days with the average being 20 days, because patient required optimization of the co morbid conditions. Average hospital stay of 18 days reported by Hanet al[162]. In the series by Emery et al, the cemented group had an average stay of 21.8 days whereas it was 19.5 days in the uncemented group.[138]Parker et al found that hospital stay was mean 4 days shorter in those treated with a cemented prosthesis.[144]

In our study post-operative follow up 1 patients had loosening of implant which resulted in anterior thigh pain. There were no late postoperative complications like dislocation, erosion, subsidence, protrusioacetabuli or periprosthetic fracture. We are unable to comment upon long term acetabular erosion due to relative short follow up.

All patients were followed up regularly at 6wks, 3 months, 6 months, and one year. Only the patients who completed a minimum one year follow-up were included in the final analysis. The maximum follow up was for one year ten months and minimum of one year. The Modified Harris Hip Scores were recorded at each follow-up visit.

As Indian population needs to squat and sit cross leg for their daily living. In our study, we have used the Modified Harris Hip Score for the evaluation of the study subjects which includes squatting and sitting crossleg.[95]In our study using

Modified harris hip score as evaluated at one year follow-up averaged 81.96 with the maximum score being 100and the minimum score being 75. Overall, 6 patients (19.4%) achieved Excellent result, 22 patients (71%) achieved Good result, and 3 patients (9.7%) achieved poor result. Overall, 77.27% of the patients achieved an excellent or good result.

Our results seem to suggest that uncemented stem of Modular Bipolar prosthesis gives a better functional, lesser pain and improved gait function outcome by providing better primary anchorage of the prosthesis. This is especially important in the osteoporotic femur with weak calcar. A good stable fit allows early mobilization of patients. Though it is against the common practice of inserting the AMP without cement, this might need a change, because this prosthesis in now used in the very elderly patients with limited demands and mobility, due to better outcome with bipolar hemiarthroplasty in physiologically younger patients. Due to the limited life expectancy of these patients, revision is not a major issue. Lesser pain, better mobility and early mobilization is what is important and these goals are better achieved when the Uncemented stem of Modular Bipolar prosthesis in place.

There was one patient (4.5%) with peri prosthetic fracture.There were no errors in selecting prosthesis of the correct head size. These results are less compared to those of Weinrauch P. where the author had studied intra-operative errors during Austin Moore hemiarthroplasty (uncemented) in 147 patients. In that study, there was inadequate length of neck remnant in 27% cases, inadequate calcar seating in 22% cases and intra operative periprosthetic fracture in 14% cases. [163]

CONCLUSION

CONCLUSION

Hemiarthroplasty using Modular Bipolar prosthesis for fractures of the femoral neck provides freedom from pain, better range of movement and more rapid return to unassisted activity with an acceptable complication rate. Though conventionally done in an uncemented fashion, providing a good primary anchorage, especially in the osteoporotic femur is of paramount importance. The canal bone ratio is helpful in predicting the use of prosthesis i.e. uncemented or cemented preoperatively. This step helps reduce thigh pain and achieve better functional outcomes in terms of better mobility and lesser use of walking aids. The end functional results also depend on the associated co-morbidity and optimum post-operative rehabilitation. Throughout the purview of the present study, our experience with uncemented Modular bipolar prosthesis has been better. The long term results using Modular bipolar prosthesis needs further study fora longer period in a larger sample with a direct comparison between the cemented versus uncemented groups. However, considering the good result achieved in the short term, it seems reasonable to use canal bone ratio in bipolar hemiarthroplasty as pre-operative template.

SUMMARY

SUMMARY

During the period between october 2016 and march 2018, 33 patients were treated with Modular Bipolar hemiarthroplasty for FEMUR NECK FRACTURE at the shri B M PATIL MEDICAL COLLEGE VIJAYAPURA.

Out of the 33 cases treated in this manner, all cases were available for the follow up for minimum of one year.

Patients with age 60 years and above were with acute FEMUR NECK FRACTURE were included in the study.

The average age of the study patients was 63.9 years with 74% females and involvement of the left side in 65%.

All the patients were operated under spinal or epidural anaesthesia, in lateral decubitus position by the posterior approach of Moore.

There was one case of intra operative periprosthetic fracture, two cases of superficial infection, one case of DVT. Two cases had implant loosening and thigh pain.

At final one year follow-up by Modified Harris Hip scoring system, 19.4% had excellent result, 71% had good results, and 9.09 % had poor results.

The results of our study are compares favorably with standard studies of bipolar hemiarthroplasty performed for FEMUR NECK FRACTURE.

Thus, Canal Bone Ratio can be used as template in pre-operative setting in deciding the type of prosthesis i.e. cemented or uncemented. Modular Bipolar prosthesis can be safely undertaken in patients to achieve better functional outcome.

Considering the limited number of cemented bipolar prosthesis large numbers are required to reinforce the conclusion.

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ANNEXURES

ANNEXURE-I

ETHICAL CLERANCE CERTIFICATE

61/2016
06/10/16

B.L.D.E. UNIVERSITY'S
SHRI.B.M.PATIL MEDICAL COLLEGE, BIJAPUR-586 103
INSTITUTIONAL ETHICAL COMMITTEE

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this college met on 04/10/2016 *at* 3-00pm *to scrutinize the Synopsis of Postgraduate Students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected & revised version synopsis of the Thesis has been accorded Ethical Clearance.*

Title Evaluation of hemiarthroplasty using modular bipolar prosthesis in fracture neck femur in elderly patients a prospective study

Name of P.G. student Sharanprasad A H.
Dept of orthopaedics

Name of Guide/Co-investigator Dr O. B. Pattanashetty
Professor and HOD in orthopaedics

DR.TEJASWINI. VALLABHA
CHAIRMAN
INSTITUTIONAL ETHICAL COMMITTEE
BLDEU'S, SHRI.B.M.PATIL
MEDICAL COLLEGE, BIJAPUR.

Following documents were placed before E.C. for Scrutinization
1) Copy of Synopsis/Research project.
2) Copy of informed consent form
3) Any other relevant documents.

ANNEXURE-II

INFORMED CONSENT FORM

BLDE SHRI B. M. PATIL MEDICAL COLLEGE HOSPITAL and RESEARCH CENTRE, VIJAYAPURA-586 103

TITLE OF RESEARCH	**:**	**PROSPECTIVE STUDY IN SURGICAL MANAGEMENT OF FEMUR NECK FRACTURE WITH HEMIARTHROPLASTY USING MODULAR BIPOLAR PROSTHESES.**
Principle Investigator	:	DR. SHARANPRASAD A H
P.G. Guide Name	:	DR. O.B.PATTANASHETTY M.S ORTHOPAEDICS PROFESSOR and HOD

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

I, the undersigned,________________ , S/O D/O W/O _________________, aged _____years, ordinarily resident of _____________ do hereby state/declare that Dr SHARANPRASAD A H of Shri. B. M. Patil Mdical College Hospital and Research Centre has examined me thoroughly on _______________ at _______________ (place) and it has been explained to me in my own language that I am suffering from _________________ disease (condition) and this disease/condition mimic following diseases. Further Dr SHARANPRASAD A H informed me that he/she is conducting dissertation/research titled “A Clinical Study Of Fractures Of Patella Treated With Modified Tension Band Wiring” under the guidance of DR O. B. PATTANASHETTY requesting my participation in the study. Apart from routine treatment procedure, the pre-operative, operative, post-operative and follow-up observations will be utilized for the study as reference data.

Doctor has also informed me that during conduct of this procedure like adverse results may be encountered. Among the above complications most of them are treatable but are not anticipated hence there is chance of aggravation of my condition and in rare circumstances it may prove fatal in spite of anticipated diagnosis and best treatment made available. Further Doctor has informed me that my participation in this study help in evaluation of the results of the study which is useful reference to treatment of other similar cases in near future, and also I may be benefited in getting relieved of suffering or cure of the disease I am suffering.

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

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

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

Signature of patient: Signature of doctor:

Witness: 1. 2.

Date:

Place

ANNEXURE – III

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

PROFORMA

CASE NO. :

NAME :

AGE/SEX :

I P NO :

Date of admission :

Date of surgery :

Date of discharge :

Occupation :

Residence :

Presenting complaints with duration :

History of presenting complaints :

Family History :

Personal History :

Past History :

General Physical Examination

Pallor	:	Present/Absent
Icterus	:	Present/Absent
Clubbing	:	Present/Absent
Generalized Lymphadenopathy	:	Present/Absent
Built	:	Poor/Moderate/Well
Nourishment	:	Poor/Moderate/Well

Vitals

PR:

BP: TEMP:

Other Systemic Examination

CARDIOVASCULAR SYSTEM :

RESPERATORY SYSTEM :

PER ABDOMEN :

CENTRAL NERVOUS SYSTEM :

Local examination

Gait:

- ✓ Inspection:

a) Attitude/ deformity

b) Abnormal swelling

- Site
- Size
- Shape
- Extent

a) Shortening

b) Discharge

e) Skin

f) Compound injury if any

✓ Palpation:

a) Local tenderness

b) Bony irregularity

c) Abnormal movement

d) Pain elicited by manipulation

e) Transmitted movements

f) Swelling

g) Instability

✓ Movements:

	Active	Passive
Flexion		
Extension		
Abduction		
Adduction		

External rotation

Internal rotation

- ✓ MERASUREMENTS

	Normal	diseased
A length of the limb		
Apparent length		
Total length		
Thigh segment		
Leg segment		
Girth of the limb		

B shortening above the greater trochanter

	Normal	Abnormal
Bryant's triangle		
Nelaton's line		
Chinese lines		
Shoemakers line		

- ✓ TESTS FOR INSTABILITY

A Telescopic test

B Trendelenberg test

ANY ASSOCIATED INJURIES/FRACTURES

MANAGMENT :

INVESTIGATIONS:

- X-ray of knee joint Antero-posterior view and lateral view.
- Complete blood count.
- Bleeding time, Clotting time.
- Urine- Albumin, sugar and Microscopy.
- Random blood sugar, Blood urea and Serum creatinine.
- HIV and Hbs Ag.
- Blood grouping and Rh- typing.
- ECG.
- Chest X-ray- Postero-anterior view.
- Computed-tomography scan if necessary.
- MRI if necessary.
- Other specific investigations whichever needed.

Final Diagnosis:

TREATMENT:

- Aproposed surgery of HEMIARTHROPLASTY with MODULAR BIPOLAR.
-

POST-OPERATIVE MANAGEMENT:

- Intravenous antibiotics will be continued for first **three TO five days**and then shifted to oral.
- Check X-RAY on 2rd post-operative day.
- Dressing will be done on 2nd, 5thand 8th post-operative day.
- Sutures will be removed on 12th post-operative day .
- Progressive quardriceps exercises and HIP range of motion as tolerated by patients.
- **Mobilization**
  - Date of mobilization of hip
  - Date of patient sitting
  - Date of weight bearing
- **Complications**
  - Infection
  - Change in position of implant
  - Loss of reduction
  - Nerve palsy
- **Date of discharge**

CONDITION AT DISCHARGE

- **Clinical**
  - Shortening if any
  - Complications if any

- Deformity
- Flexion
- Adduction
- Rotational

o Range of movements

- Active
- Passive
- Flexion
- Adduction
- Abduction
- Internal rotation
- External rotation

FOLLOW-UP:

Duration after surgery : After 6 weeks, 12 weeks and 24 weeks.

Radiological evaluation – Check X-RAY HIP JOINT antero posterior and lateral view.

Patient Will Be Followed Up Using **MODIFIED HARRIS HIP SCORE** scores:

MODIFIED HARRIS HIP SCORE

(A) HIP ASSESSMENT **(B) PATIENT FUNCTION**

Pain	**Points**	**Walking Aids**	**Point**
None	25	None	20
Occasion	10	01 Stick	15
Moderate	05	02 Stick/Frame	10
Severe	0	Immobile	0
Range of Motion		**Sitting Cross Legged**	
Normal	15	Squatting	10
Moderate Reduction	10	Cannot Sit Cross Leg	0
Severe Reduction	0	cannot squat	0
Positive Trendelenberg -15		**Patient Satisfaction**	
Very Good	20	Good	10
Fair	05	Poor	0
Maximum Total	**40**	**Maximum Total**	**60**

I	PAIN	44
1	Totally disabled, crippled, pain in bed, bedridden	00
2	Marked pain, serious limitation of activities	10
3	Moderate plain, tolerable but makes concession to plain	20
4	Mild pain, no effect on average activities	30
5	Slight, occasional, no compromise in activity	40
6	None, or ignores it	44
Total		

II	Function	47
A	Distance walked	
1	Bed and chair only	00
2	Two or three blocks	05
3	Six blocks	08
4	Unlimited	11
B	Activities	
Shoes and Socks		
1	Unable to fit or tie	00
2	With difficulty	02
3	With ease	04
Public transportation		
1	Unable to use public transportation (bus)	00
2	Able to use transportation (bus)	01
Limp		
1	Severe or unable to walk	00
2	Moderate	05
3	Slight	08
4	None	11
Support		
1	Two crutches or not able to walk	00
2	Two canes	02
3	One crutch	03
4	Cane most of the time	05

5	Cane for long walks	07
6	None	11
Stairs		
1	Unable to do stairs	00
2	In any manner	01
3	Normally using a railing	02
4	Normally without using a railing	04
Sitting		
1	Unable to sit in any chair comfortably	00
2	On a high chair for 30 min	03
3	Comfortably on a ordinary chair for one hour	05
Total		
III	Motions Flexion+ Abduction + Adduction+ External rotation + internal rotation=	05
1	00 to 29°	00
2	30 to 59°	01
3	60 to 99°	02
4	100 to 159°	03
5	160 to 209°	04
6	210 to 300°	05
Total		
IV	Deformity	04
1	Flexion deformity 30° of more	00

2	Flexion deformity less than 30°	01
1	Fixed adduction 10° more	00
2	Fixed adduction less than 10°	01
1	Fixed internal rotation(in extension) 10°or more	00
2	Fixed internal rotation(inextension) less than 10°	0
1	Limb length discrepancy more than or equal to 3.2 cms	00
2	Limb length discrepancy less than 3.2cms	01
	Total	
	Total of I+II+III+IV	100

Clinical Grade

Excellent 81 - 100

Good 61 -80

Fair 41 - 60

Poor <40

MASTER CHART

SL No	Name	IP No	Sex	Age	Number of days	Mode of injury	Side	Co-morbidity	Activity Pre Fall	Type of fracture	Size head bipolar	prosthesis	date of discharge	Blood loss	Complication per operative	Complication Early	Clinical Outcome
1	gangamma	22795	F	60	8	2	R	1	3	3	45	cemented	12	150	nil	nil	good
2	malingappa	27876	M	65	5	1	R	3	1	3	43	cemented	12	200	nil	nil	fair
3	shantabe	26030	F	75	10	1	L	4	1	3	41	cemented	10	250	hypo	nil	good
4	fatime	29721	F	64	4	3	R	4	1	4	39	uncemented	12	160	nil	nil	excellent
5	dundawwa	33641	F	73	18	1	L	4	1	3	45	cemented	15	170	nil	superficial infection	good
6	monappa	34915	M	71	12	1	R	1	1	3	43	cemented	15	150	nil	nil	fair
7	mallappa	34949	M	65	10	1	R	4	1	4	41	cemented	12	200	hupo	nil	good
8	shankrappa	37671	M	62	2	2	R	4	3	3	43	cemented	14	170	hypo	nil	good
9	laxmibai	38052	F	75	15	1	L	4	3	3	41	cemented	18	180	nil	superficial infection	good
10	satawwa	5425	F	73	12	1	R	2	1	1	43	cemented	12	200	nil	nil	excellent
11	saidabe	11475	F	60	10	1	L	4	1	3	47	cemented	12	160	nil	nil	fair
12	sidappa	15332	M	65	14	1	R	4	1	4	51	uncemented	12	170	nil	nil	good
13	madiwalappa	20952	M	68	9	3	L	4	1	2	45	cemented	14	160	nil	nil	good
14	satawaa	20961	F	83	3	1	R	3	3	3	41	cemented	22	130	hypo	dvt	poor
15	danabai	23736	F	69	16	1	R	1	1	3	43	cemented	12	150	nil	nil	excellent
16	bhimrai	26452	M	65	14	3	L	4	1	4	45	cemented	12	220	hypo	nil	good
17	rudramma	20073	F	61	14	1	R	2	2	3	47	cemented	10	200	nil	nil	good
18	jateppa	27768	M	60	15	1	R	4	1	2	41	cemented	11	160	hypo	nil	excellent
19	nagamma	27881	F	63	8	1	L	4	1	3	45	cemented	10	180	hypo	superficial infection	good
20	kamanna	28027	M	88	10	1	R	3	1	3	41	uncemented	11	170	nil	nil	poor
21	laxmibai	29529	F	65	12	1	R	2	1	3	43	cemented	12	160	nil	nil	fair
22	gangabai	33247	F	69	20	1	R	4	3	4	47	cemented	12	150	nil	nil	excellent
23	neelambika	36087	F	61	7	3	L	4	1	3	41	cemented	12	300	hypo	nil	good
24	nagappa	39562	M	68	12	1	L	4	1	3	43	cemented	12	200	nil	nil	good
25	parvatamma	40222	F	65	10	1	R	1	1	3	45	cemented	12	160	nil	nil	excellent
26	bimbai	43833	F	76	10	1	L	3	1	2	47	cemented	13	170	nil	superficial infection	fair
27	chandrappa	4464	M	75	2	3	L	4	1	3	51	cemented	12	150	hypo	nil	good
28	bhimawwa	4809	F	66	10	1	R	4	2	4	41	uncemented	12	120	nil	nil	excellent
29	chandamma	9558	F	61	9	1	R	4	1	3	43	cemented	12	200	hypo	nil	poor
30	shivabasappa	13268	M	63	13	1	L	2	1	3	43	cemented	14	170	hypo	superficial infection	good
31	mahadevi	13297	F	69	15	3	R	4	1	2	41	cemented	12	160	nil	nil	excellent
32	lachawwa	20880	F	77	12	1	L	3	1	3	49	cemented	12	170	hypo	nil	excellent
33	laxmibai	21990	F	61	12	1	R	4	3	3	43	cemented	12	150	nil	superficial infection	poor