# ROLE OF AUSTIN MOORE PROSTHESIS IN INTRACAPSULAR FRACTURE NECK OF FEMUR IN ELDERLY

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## TABLE OF CONTENTS


| Sl No. | Contents | Page No. |
|---|---|---|
| 1 | INTRODUCTION | 1-4 |
| 2 | OBJECTIVES | 5 |
| 3 | DESCRIPTION OF THE IMPLANT | 6-7 |
| 4 | REVIEW OF LITERATURE | 8-78 |
| 5 | MATERIAL AND METHODS | 79-98 |
| 6 | CASE REPORT | 99-104 |
| 7 | RESULTS | 105-116 |
| 8 | DISCUSSION | 117-126 |
| 9 | CONCLUSION | 127-128 |
| 10 | SUMMARY | 129-130 |
| 11 | REFERENCES | 131-142 |
| 12 | ANNEXURES | 143-153 |

## LIST OF TABLES


| Table No. | Title of The Table | Page No. |
|---|---|---|
| 1 | Age distribution of study subjects | 105 |
| 2 | Sex distribution of study subjects | 105 |
| 3 | Distribution according to side of fracture | 107 |
| 4 | Distribution of study subjects according to type of fracture. | 108 |
| 5 | Distribution of study subjects according to mode of injury | 109 |
| 6 | Distribution of co-morbid condition of study subject | 110 |
| 7 | Distribution of study subject as per the size of the prosthesis used | 112 |
| 8 | Distribution of complications among study subject | 113 |
| 9 | Distribution of average blood loss during the procedure among study subjects | 114 |
| 10 | Distribution of subject according to ambulation after surgery | 115 |
| 11 | Final Harris Hip Score and clinical result | 116 |
| 12 | Mean age of patients who underwent prosthetic replacement | 118 |
| 13 | Comparison of associated medical problem with other studies and present study | 121 |
| 14 | Mortality reports in other studies | 122 |
| 15 | Percentage of functional results following hemiarthroplasty for fracture neck of the femur | 125 |
| 16 | Distribution of the sample by limb length discrepancy | 126 |

## LIST OF FIGURES


| Figure No. | Title of the Figure | Page No. |
|---|---|---|
| 1 | Age and Sex distribution of study subjects | 106 |
| 2 | Sex distribution of study Subjects | 106 |
| 3 | Distribution according to side of fracture | 107 |
| 4 | Distribution of study subjects according to type of fracture. | 108 |
| 5 | Distribution of study subjects according to mode of injury. | 109 |
| 6 | Distribution of co-morbid condition of study subject | 111 |
| 7 | Distribution of study subject as per the size of the prosthesis used | 112 |
| 8 | Distribution of complications among study subject. | 113 |
| 9 | Distribution of average blood loss during the procedure among study subjects. | 114 |
| 10 | Distribution of subject according to ambulation after surgery | 115 |
| 11 | Harris hip score | 116 |

# LIST OF ANNEXURES


| Annexure No. | Title of the Annexure | Page No. |
|---|---|---|
| I | PROFORMA | 143-148 |
| II | INFORMATION SHEET | 149-150 |
| III | CONSENT FORM | 151 |
| IV | DATA SHEET | 152-153 |

# ABSTRACT


- **Back ground:** The fracture neck of femur is one of the oldest problems in orthopaedics and it can occur at all ages and in both sexes, but they are usually sustained by elderly persons following trivial trauma. Inspite of numerous advances in osteosynthesis, the incidence of avascular necrosis and nonunion is very high. Treatment with hemiarthoplasty using Austin Moore prosthesis can overcome the complications and help in early mobilization.
- **Objective:** To investigate the functional outcome of displaced femoral neck fractures treated with hemi replacement arthoplasty using Austin Moore prosthesis.
- **Design:** prospective clinical study.
- **Setting:** R.L.J Hospital and research centre attached to Sri Devaraj Urs Medical College, Kolar.
- **Methods:** A series of 30 patients with 30 displaced femoral neck fractures were treated with hemi replacement arthoplasty using Austin Moore prosthesis between October 2014 to October 2016.

- **Outcome measures:** Outcome was assessed by using Harris hip scoring system.
- **Results:** All the patients were followed for an average of 6 months. There were and cases each of garden type III and IV. There were 2 cases of superficial infections. Functional outcome was accessed using Harris hip score 47% had excellent results, 27 % had good results, 20% fair and 6% poor.
- **Conclusion:** Displaced femoral neck fractures in elderly patients with hemi replacement arthoplasty using Austin Moore prosthesis is ideal treatment options as the patient can be provided with painless stable hip join with early mobilization.

# INTRODUCTION

- Fracture neck of femur remains an unsolved fracture and occur mostly in elderly patients due to minor to moderate trauma while in younger patients it usually result from high energy trauma[1].

- It is a known fact that hip is a weight-bearing joint, performing many functions. A successful operation at the hip joint should provide painless, stable hip with a wide range of movements. But none of the accepted procedures have could achieve this goal fully.

- Fracture neck of the femur has been recognized since the time of Hippocrates. Various methods of treatment have been employed since ages. The prolonged immobilization in elderly will jeopardize the life span of the patient, and further complicates the problem.

There is still a dilemma over internal fixation or arthroplasty in the treatment of fracture neck of femur in the elderly age group[2]. Controversy should rest at a surgical procedure which brings about earliest pre-fall status to these elderly and infirm patients with least complications[2].

- The first efforts on treating hip fractures concentrated on alignment of fracture fragments by closed reduction and traction and maintained by long term traction, spica cast or internal fixation. However, despite the most accurate anatomic alignment and most rigid fragment fixation, many patients failed to regain normal use of their hips.

- Avascular necrosis of femoral head, nonunion of the femoral neck, non-anatomic reduction and inadequate fixation cause prolonged disability, pain, immobility and repeated surgical procedures.[3]

- This study includes uncemented unipolar hip arthroplasty with Austin Moore prosthesis for fracture neck of femur. The follow up of these cases were done to assess the end results, especially as related to our Indian patients in and around Kolar District of Karnataka.

- The blood supply to the neck and head of the femur is intricate and complicated. Healing process mainly depends on good blood supply. These further handicaps the treatment of these fractures and the healing process is always in doubt. Under such circumstances one has to decide whether the prolonged immobilization has to be employed to achieve bony union or quick ambulation by hemireplacement arthroplasty, to achieve a fair degree of function.

- There are various internal fixation devices currently in use are multiple cancellous screw fixation and dynamic hip screw fixation. These procedures rely in preserving the head of femur, but despite all operative skills, a perfect functional result from these procedures cannot always be secured and still there is a high incidence of nonunion and avascular necrosis leading to late osteoarthritis.

- These procedures are justifiable in young patients, but in elderly patients, prolonged recumbency leads to many problems such as bed sores, cardiac, respiratory problem, thromboembolism, renal problems and dementia. This led many surgeons to abandon the osteosynthesis procedure for displaced femoral neck fracture in elderly patients, in favour of primary hemireplacement arthroplasty, which has certain advantages such as early ambulation, shortening the period of hospitalization and also avoids danger of nonunion and avascular necrosis[4].

- Unipolar hemiarthroplasty with Austin Moore prosthesis is rarely 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[5].

- The objective of the present study is to assess the results of primary hemiarthroplasty for fracture neck of femur in elderly patients in our rural area by Austin Moore prosthesis. Further to provide better functional results by reduced hospital stay and early weight-bearing ambulation.

# AIMS AND OBJECTIVES

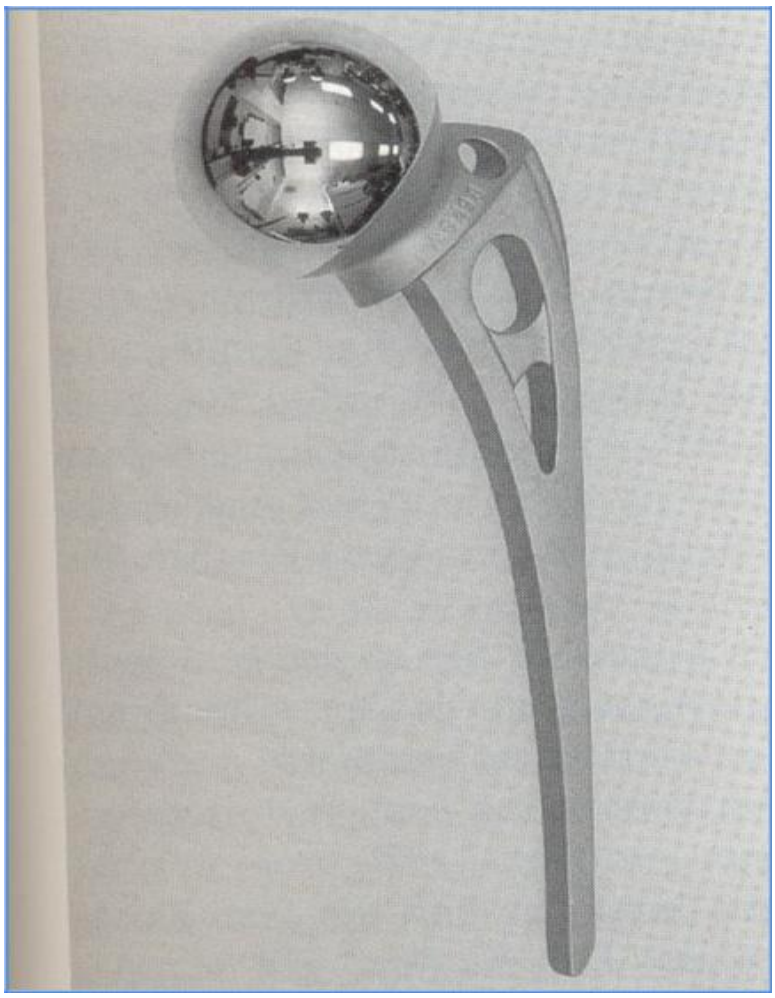
The aims and objectives of the study are:

1. To study the functional outcome following hemiarthoplasty.
2. To study the morbidity and mortality rate associated with the Austin Moore prosthesis.

# DESCRIPTION OF THE IMPLANT

- In 1943, Moore and Bohlman presented their first metallic prosthesis[6].
- Later in 1952, Moore developed '***self-locking***' vitallium hip prosthesis[7]. He incorporated a window in the stem, in the hope that would fill it and provide an anchor to the proximal femur.
- Austin Moore prosthesis is a first generation of femoral head endoprosthesis relied on interference fit between the stem and medullary canal. Cement is not required for fixation of this appliance.
- The Austin Moore prosthesis is designed for those patients in whom there is one-half to three fourth of an inch of remaining femoral neck above the lesser trochanter. The collar of Austin Moore prosthesis is transverse, a characteristic that increases the ability of the neck to receive the compression stress on it[8].
- The femoral collar of the Austin Moore prosthesis is designed to rest on the cut end of the femoral neck in the calcar area to aid in support.
- With good calcar-collar support, the stresses in the stem are small because the stem portion of the prosthesis and the bone are uncoupled and consequently, does not share resulting bending movement of the head and abductor forces. Thus decreasing the incidence of peri-prosthetic fracture of femur with Austin Moore prosthesis[9].

- Currently Austin Moore, prosthesis is made up of stainless steel AISI316L and it comes in head size from 37 to 55mm.
- A tight fixation gives mechanical stability and allow the grafts in fenestration to consolidate, making it a self-locking device. This prevents over loading of calcar no subsidence, no loosening, no failure[9].



**AUSTIN MOORE PROSTHESIS**

# REVIEW OF LITERATURE

## HISTORICAL REVIEW

- Ambrose Pare, the famous French surgeon, recognized the existence of hip fractures more than 400 years ago.
- Sir Astley Cooper (1822) was the first to delineate between fractures of the femoral neck, or intracapsular fractures and other fractures and dislocation about the hip[10].
- In 1867, Phillips introduced a technique for longitudinal and lateral traction in femoral neck fractures to eliminate shortening and deformity[11]. In 1876, Maxwell reported the successful use of this technique. In 1921, Ruth advocated closed reduction and maintenance in a '***Phillips Splint***' for 8 weeks and avoidance of weight bearing for 6-12 months after traction[12].
- Senn, in 1883, observed that the only cause of nonunion in the case of intracapsular fracture was the inability to maintain perfect coaptation and immobilization of the fragments[13].
- With the advent of X-ray, in 1902 Whitman advocated careful reduction and holding of reduced fracture in a spica cast with 30% union rate. Watson Jones subsequently estimated a union rate of 40% from this method.

- In 1911, Cotton recommended artificial impaction of fracture fragment by blows from a heavy mallet applied to the padded trochanter before cast application. In 1927 Wilkie used bilateral short leg casts with a transverse bar for fracture immobilization.

- The first to have nailed a hip fracture appears to have been Von Langenbeck, in 1850. Konig, in 1875 and Nicolaysen, in 1897, advocated the use of nails in serious cases. In 1908, Davis reported the use of ordinary wood screws for the fixation of femoral neck fracture[16]. Similar screws were used by Dacosta in 1907, Delbet in 1919 and Martin & King in 1920[14].

- In 1931, Smith-Petersen advocated reduction, impaction and internal fixation using a ***triflange nail.*** Venable and Stuck developed and standardized biocompatible metals in 1937, which increased the success rate of this technique with, the introduction of cannulated nail by Johansson in 1932[20], and Westcott in l934, Smith Peterson's technique was simplified as it allowed, the surgeon to reduce the fracture closed, and fix the fracture blindly using the cannulated nail over a guide pin[15].

- Thornton added a side plate to the tri flange nail in 1937.Jewett developed the solid nail plate in 1941. Virgin and Mac Ausland in 1945, introduced a screw that provided dynamic compression at the fracture site.
- Telescopic nails or screws, which allowed gradual impaction at the fracture site, were introduced by Schumpelick and Jantzen jin J955. Pugh, in 1955, Massie in 1958 Badgley in 1960 and Clawson in 1964[16].

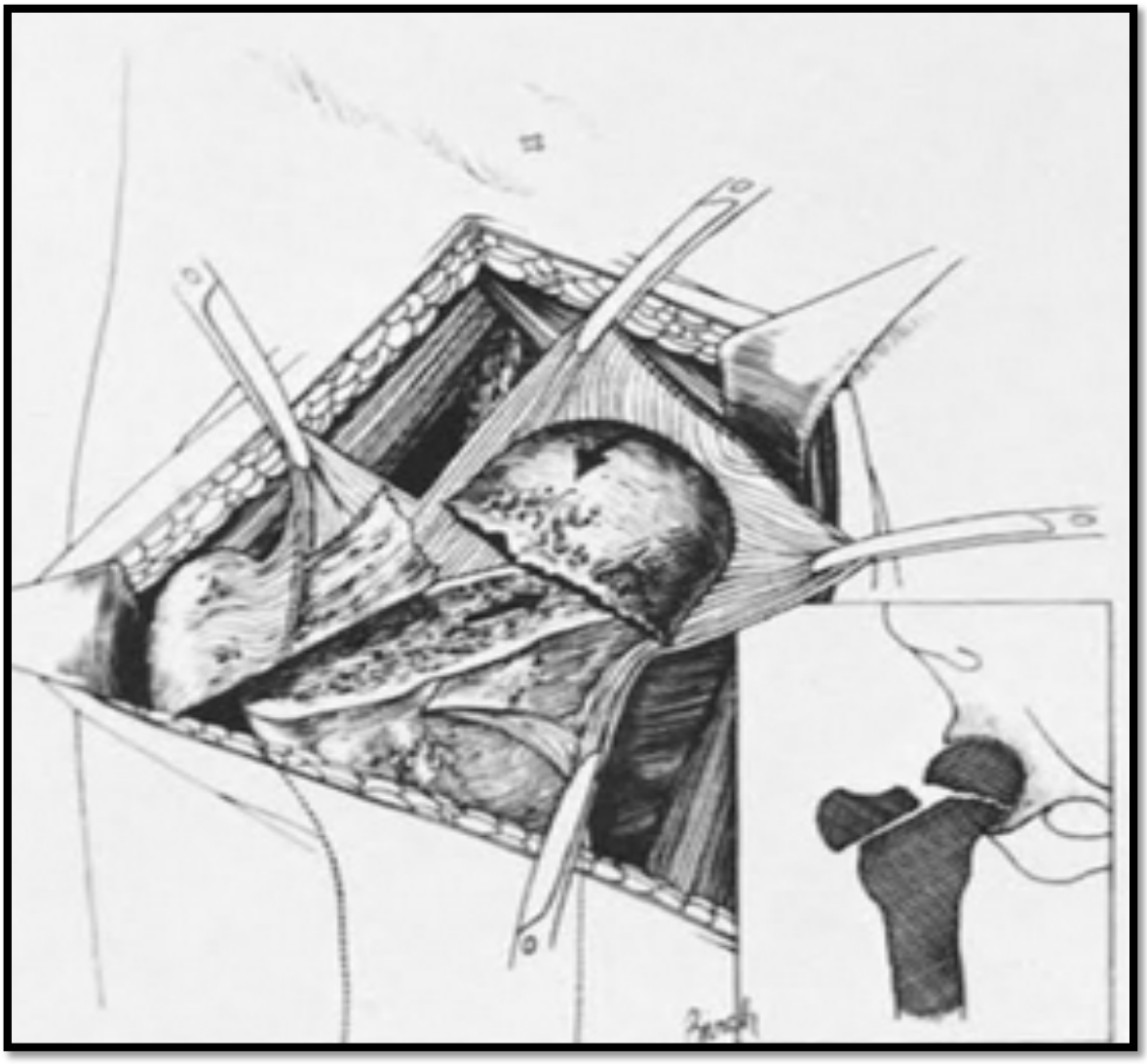
- Moore in 1934, Gaenselen in 1935, Telson and Ranshoff in 1935 and Knowles in 1936 used '***Multiple cannulated Pins***' for internal fixation of femoral neck fractures. Harmon in 1944 added a side plate to incorporate these pins[17].In 1950, Thompson developed a short stemmed metal device that came to be known as light bulb prosthesis. In 1958, Deyerle used a side plate that also acted as a template for pin insertion and allowed the sliding of multiple pins[18].
- The history of hip surgery dates back to the eighteenth century, but it was the introduction of the antiseptic method by Lister in 1865 that marked a series of innovations that, over the years, decreased postoperative infection rates and encouraged surgeons to embark on increasingly complex operations around the hip joint.

- The beginning of major surgery of hip in America was in the year 1826, when John Rhea Barton performed a femoral osteotomy between the greater and lesser trochanters to secure motion in ankylosed hip.

- In 1835 Bouvier , performed the first subtrochanteric osteotomy for the treatment of congenital dislocation of the hip, while in 1854 Langenbeck introduced subcutanious osteotomy of the femur followed by Williams and Adams in 1865. Gant became well known for subtrochanteric osteotomy in 1872.

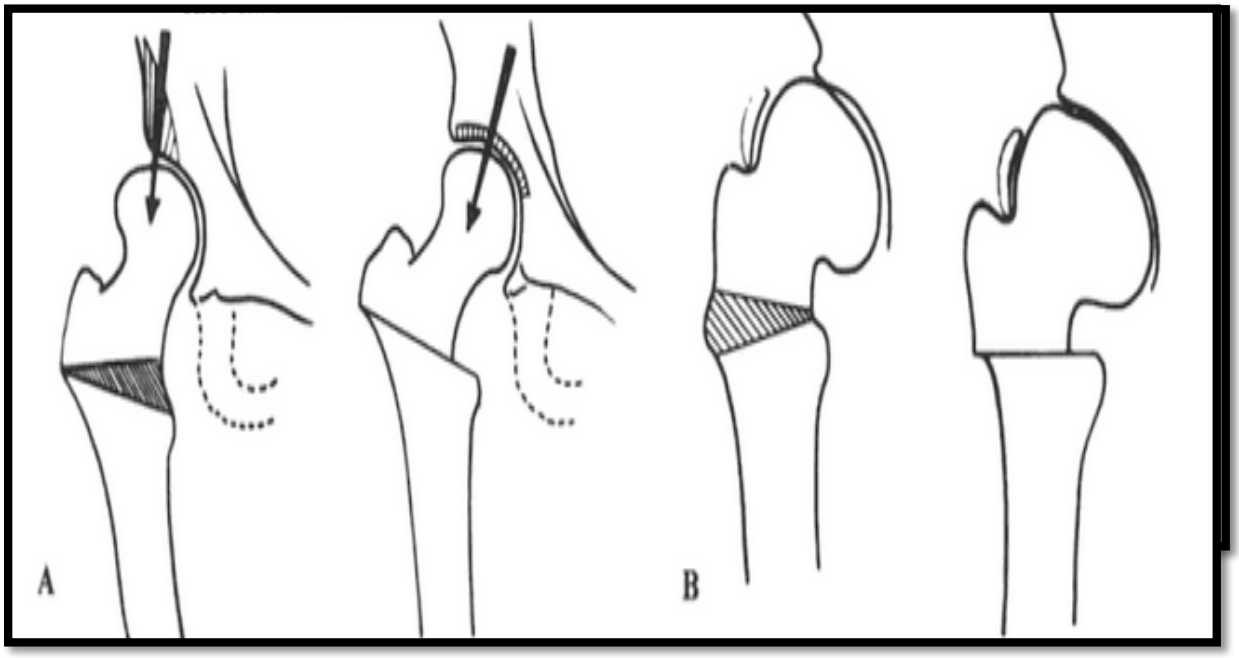
- Mc Murray in 1936 reported an oblique displaced osteotomy for untreated fracture neck of femur. Leadbetter in 1944 described a cervical axial displaced osteotomy in which an osteotomy was done in the same axial line of the neck at the junction of middle and inner thirds and the base of the greater trochanter; the lower neck and the femoral shaft were displaced medially beneath the head of a point within the lower acetabular rim.

**McMurry osteotomy**



**Leadbetter cervical-axial osteotomy**

In 1935 Pauwell described an adductor osteotomy at the intertrochanteric level and his theoretical work has been adapted by modern day's hip surgeon.

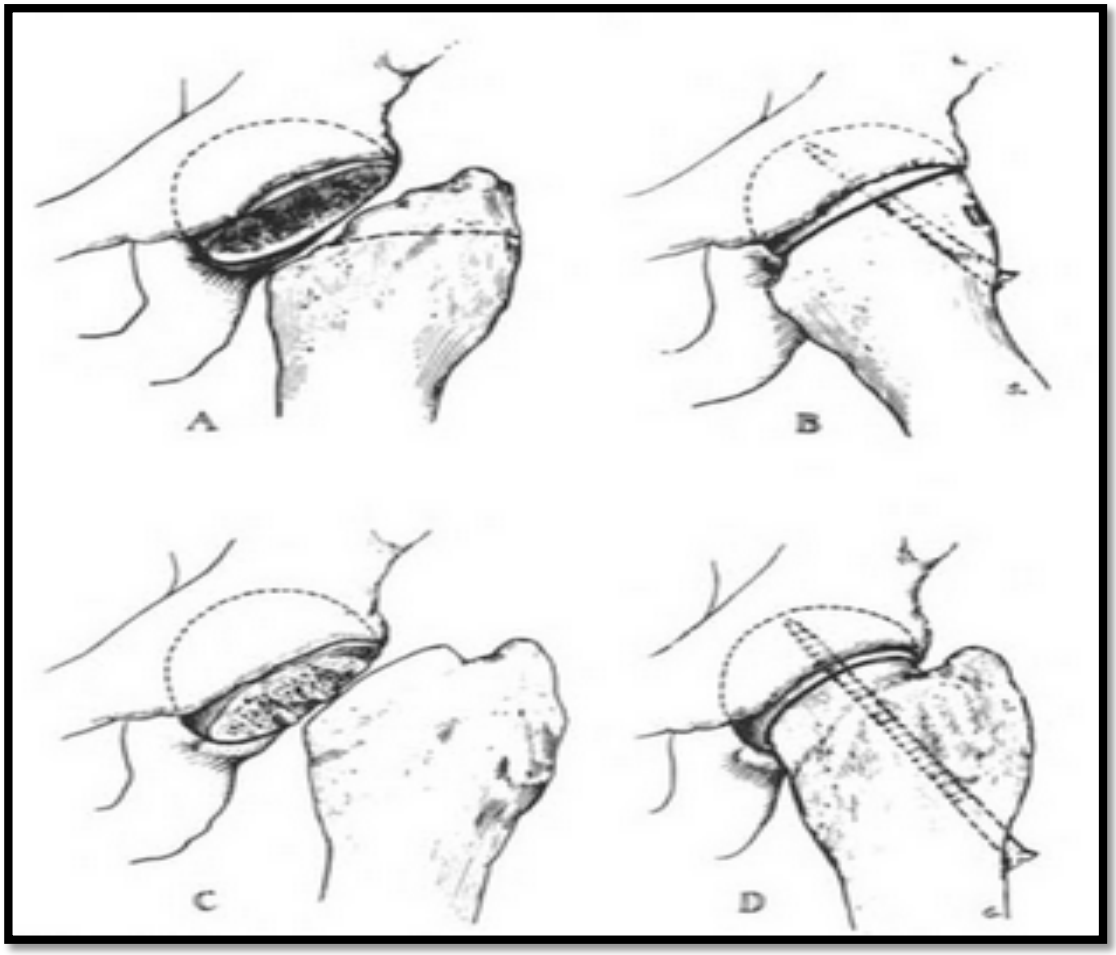



**A -** Varus the diagram shows how the weight bearing area and weight bearing axis are changed by osteotomy in coxa vara.

**B** - Valgus the diagram shows improvement in congruity of the joint surfaces produced by this osteotomy in coxa valga.

# RECONSTRUCTION SURGERY

In 1917, Brackett describe a reconstruction operation for non union of the neck the femur. Whiteman in 1921 described total removal of the head and neck.



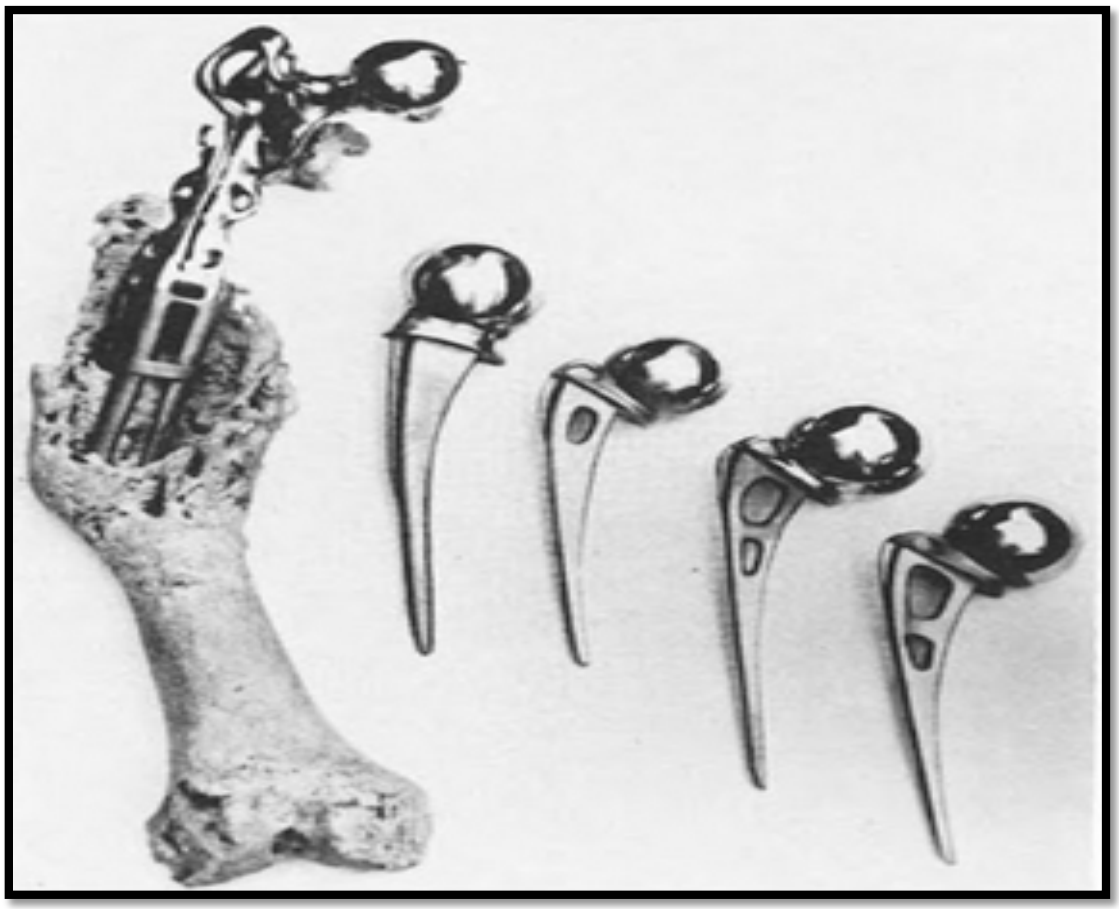

**Brackett reconstruction operation**

**A** and **B** if neck is completely absorbed, denuded trochanter is placed in excavated head. **C** and **D** if neck is well preserved, fracture surface is freshened and placed in concavity of the head of femur.

- In 1932 Magnus described modified Brackett operation and in 1935 Colonna described modified Whiteman operation where the abductor muscle were transplanted down the shaft of the femur and the whole upper end of the femur with the greater trochanter placed in accetabulum.

## HIP REPLACEMENT

- In 1940, Bohlman and A.T Moore inserted a stainless-steel prosthesis for the replacement of the whole upper third of the femur,including head and neck.



**Original Moore-bohlman prosthesis on left And early model of Moore prosthesis.**

- Judet brothers in 1950 used short-stem acrylic hip prosthesis made of methylmethacrylate but later nylon and Vitallium and stainless steel were used. In 1950 Fred Thompson and in 1952 by A.T.Moore's prosthesis with fenestration in upper stem was called self locking prosthesis.

- The first total hip replacement was performed by Gluck in 1980 which consist of an ivory ball and socket joint in which cement type of material was used. In 1938 wiles describe the first stainless steel total hip replacement in London.

- Sir John charnley's contribution to total hip arthroplasty was monumental in conceiving the idea of using plastic socket for smooth, long standing articulation with the metal ball and polyethylene which remain the basic material in today's entire acetabular component.

**Charnley's low friction head with lower prosthesis and its cups.**

- Boyd, et al; (1964) published a study of 540 fractures of the femoral neck to compare internal fixation with prosthetic replacement in fresh fractures of the femoral neck. Depending upon the displacement of the fracture; he divided his cases into 3 types. He concluded that in Pauwell's Type I (impacted fractures) cases, results were excellent after internal fixation with 13% incidence of avascular necrosis. However, in type II and type III the incidence of nonunion and avascular necrosis was quite high requiring second surgery. He recommended that internal fixation should be done in younger patients, as no prosthesis is better than patients own femoral head, but prosthetic replacement was needed later more commonly in elderly patients or patients with displaced transverse fractures[19].

- Lunceford, et al; (1965) published his study on use of Moore's self-locking vitallium prosthesis in acute fractures of the femoral neck in 190 cases. He found the results of his study encouraging[20].

- Burwell, (1967) published his study on replacement of the femoral head by a prosthesis in subcapital fractures in one hundred twenty-seven patients with recent femoral neck fractures caused by trauma were performed within first 4 days. The average age was 73.8 years. Among the 93 patients (96 hips) who were followed up the results were excellent

in 24(25%), good in 35 (36.5%), fair in 25 (26%) and poor in 12(12.5%). In his series overall 61.5% of patients had excellent or good results[21].

- Riska, (1971) published his results of prosthetic replacement in the treatment of subcapital fractures of the neck of femur. His study comprised of 122 patients treated with endoprosthetic (Thompson and moore) replacement surgeries. Of these 11 were men and 111 Women. In 107 cases, endoprosthetic replacement was performed as a primary operation and in 15 cases it was performed in the secondary stage. Results were excellent in 49 patients (40.2%) and good in 26 patients (21.3%). Thus, good results were obtained in 61.5% of the operated patients. So, he recommended the use of endoprosthetic replacement as a treatment of choice[22].

- D'Arcy and Devas, (1976) presented a retrospective follow up study of 361 subcapital fractures of the femoral neck treated by primary replacement with the cemented Thompson prosthesis. One hundred fifty-six survivors were followed up, for a length of 3-6 years. The average age was 81 years, excellent results was obtained in 44% of patients, good result in 38%, fair in 10% and poor in 8%. They noted 18.7 % incidence of delayed pain and 11% incidence of acetabular erosion. Another 5% required revision surgery for femoral loosening. The authors noted heightened incidence of acetabular erosion in younger patients. They

concluded that partial replacement arthroplasty is no more dangerous than internal fixation and it permits more rapid mobilization and return to independence[23].

- Barnes, (1976) documented the results of 1503 subcapital fractures of the femur, treated by reduction and internal fixation. He concluded that nailing gave successful results in younger patients with undisplaced fractures, but in displaced fractures and elderly patients, union rate was unacceptable. Union occurred in all the Garden I & II fractures, 2/3 of Garden III and 14.5% of Garden IV fractures[24].

- Kumar, et al; (1980) studied 25 cases after prosthetic replacement of head of femur in old neglected cases of fracture neck femur and recorded excellent result in 28%, good in 36%, fair in 20% and poor in 16%. He stated that the results were very encouraging. Hemiarthroplasty is much more economical than total hip arthroplasty. Also, it permits full range of movements which is very essential in our social setup[25].

- Gupta, (1984) presented a comparative study of femoral neck fracture treated with Moore and Thompson prosthesis. He reported excellent results were almost equal in both (60 – 65%), the frequency of poor results

was more with Thompson (30%) as compared to Moore's prosthesis (15%), and fair results in Moore's group were 20% and in Thompson's group 10 %[26].

- Kuokkanen, et al; (1988) presented a study of femoral neck fracture treated with Moore's endoprosthesis. He concluded that hemiendoprosthetic replacement should be reserved for displaced fractures in patients with short life expectancy[27].
- Phillips .T. W, (1989) presented his series of 241 patients (258 hips) Sixty nine patients were treated with primary cemented Thompson hemiarthroplasty for seventy two subcapital fractures of the hip. He concluded that the factors that had the highest correlation with the severity of the acetabular erosion were the level of physical activity and the duration of follow- up. Erosion through acetabular cartilage into bone developed 34 of the 38 hips in active patients and in none of the 34 hips in inactive patients. The severity of the erosion increased with time in active patients[28].

- Jadhav, et al; (1996) presented their study of forty cases of Austin Moore replacement done for transcervical fracture of the neck of femur. They concluded that Austin Moore replacement should be done for patient more than 65 years of age and those who are less active or

debilitated because of other factors and because of increased acetabular erosion with time in younger individuals[29].

- Clayer, et al; (1997) presented their series of 154 consecutive patients who sustained a fracture of the femoral neck and were treated with Austin Moore hemiarthroplasty were followed up longitudinally for 10 years. The Harris hip score was 69 (range 4 to at 5 years and 61 (range 25 - 90) at10 years. The overall failure rate was 6.5% at 5 years and 7.7% at 10 years. The revision rate was 4.5% at 5 years and 5.2% at 10 years. Patients younger than 70 years at the time of fracture had a statistically significant-higher revision rate than did older patients[30].
- Parker, (2000) in his review article on the management of Intracapsular fracture of the neck of the femur said that the Moore and Thompson prosthesis are the most extensively used hemiarthroplasties. A bipolar hemiarthroplasty has the potential advantage of reducing the risk of acetabular wear for patients with a life expectancy of more than 5 years. For those who are inactive, the bipolar joint is probably of little benefit. This latter prosthesis has the disadvantage of being more expensive and although the rate of dislocation is similar to that for a unipolar hemiarthroplasty. Closed reduction may not be possible[31].

- Kasetti J.Ravikumar, (2000) presented their 13 year results of a prospective randomised study on internal fixation versus hemiarthroplasty versus total hip arthroplasty for displaced subcapital fractures of femur. A total of 219 patients were included in the study. The 13 yr results show that there was no statistical difference in the mortality between the three groups (81%, 85% and 91% respectively). the dislocation rate was 13% following hemiarthroplasty and 20% following THA. Average Harris hip score were 62, 55 and 80 respectively for internal fixation and hemiarthroplasty and THA groups[32].

- W.P.Yau, (2003) did the study to investigate the causes of prosthesis loosening in patients treated with Austin Moore hemiarthroplasty. Clinical and radiological outcomes were documented in a quantitative manner after 7 years follow up of 144 patients. It was concluded that the fill of Austin Moore arthroplasty within the shaft of femur should be greater than 70% to avoid early loosening[33].

- Kaldoun El-Abed, et al; (2005), did their study on comparison of outcomes following uncemented hemiarthroplasty and dynamic hip screw in the treatment of displaced subcapital hip fractures in patients aged greater than 70 years. 122 patients of which 62 patients were treated with a hemiarthroplasty and 60 patients were treated with dynamic hip screw

fixation. Patients were evaluated at a 3 year follow up. Using the Matta functional hip score, 42% of patients treated with hemiarthroplasty and 70 % of patients treated with dynamic hip screw had good to excellent results. No statistical difference between groups for revision surgery existed[34].

- Essoh J.B. Sie, et al; (2006), presented their retrospective study with Austin Moore hemiarthroplasty for displaced femoral neck fractures in patients aged 55 years and above. A total of 84 patients, 70 women and 14 men were included in the study. They concluded that Austin Moore hemiarthroplasty can yield satisfactory results in patients aged 55 years and older[35].

- Ahmad I, (2006), did his study to determine the mortality and morbidity in elderly patients with fracture neck of femur treated by hemiarthroplasty with Austin Moore prosthesis. The total no of patients was 46 with average age of 70 years. Male to female ratio was 1:2. The mortality at 2 weeks was 4.3%, 17.4% at 6 months and 26% at 1 year. 2 patients had infection and 17.4% patients had thigh pain at 1 year. The overall dislocation rate was 4.3%. They concluded that the functional assessment of the hip at 1 year was graded as excellent to good in 76.4% of patients[36].

- Dinesh Dhar, (2007), did a prospective study to determine the functional results and complications in elderly patients (>65 years) with fracture neck of femur treated by hemiarthroplasty with Austin Moore prosthesis. The total no of patients was 52 with average age of 71 years and above. Overall mortality at 15 months was 23%. Wound infection in 5.7% cases, dislocation of prosthesis in 3.8% cases and periprosthetic fracture in 3.8% cases. In surviving patients at 18 months' functional assessment was graded excellent / good in 82.7%[37].

- T.Stavrakis, et al; (2008), did their retrospective study on 375 patients with fracture neck of femur with a cementless Austin Moore prosthesis and a cemented Thompson prosthesis. Total of 382 subcapital femoral fractures, 245 patients underwent Austin Moore prosthesis surgery with average age of 77.5 years and Thompson prosthesis with an average age of 79 years. The acetabular erosion is seen in 18% of cases with Thompson group and in 6% of cases with Austin Moore group. The dislocations, all posterior, were similar in frequency in both groups. The functional outcome of the Thompson group was better than that of Austin Moore group by 9% regarding the excellent and the good results[38].

- Syed Shahid Noor, (2010), did his study on outcome of Austin Moore hemiarthroplasty in elderly patients with fracture neck of femur.

A total of 30 patients, 13 males and 17 females with a mean age of 74.4 years were included. Fall is the most common mode of injury 83%, only morbidity was in the form of acetabular erosion in one person 3%, the mortality rate was 23%. The study concluded that Austin moore in elderly patients with fracture neck of femur were excellent to good in many cases[39].

- Mishra, et al;(2013) conducted a study to analyse the outcome regarding pain, hip function, complication and acetabular erosion in patients treated with Austin Moore's or Bipolar hemiarthroplasty. The study included total of 40 patients (17males and 23 females) with intracapsular neck of femur fractures with mean age of 67 years (55-85years). There were no significant differences between the groups regarding complication.

  The Harris hip score were 81.95% in Austin Moore's hemiarthroplasty and 79.15% in Bipolar hemiarthroplasty, whereas acetabular erosion was 20.05% in Austin Moore's hemiarthroplasty and 5% in Bipolar hemiarthroplasty with no mortality. After 1 year of follow up they concluded that Austin Moore's hemiarthroplasty had better functional outcome regarding pain and hip function group compared to Bipolar hemiarthroplasty group[40].

- Anshu, et al; (2013) presented a study on 47 cases of fracture neck femur in elderly patients who were managed by cemented hemiarthroplasty with Austin Moore prosthesis with the objectives of outcome and the results using uncemented Austin Moore prosthesis, to determine if cementing the prosthesis improves clinical outcome with a minimum of two years of follow up. The patients were in the age group of 72 to 93 years with the mean age of 78.2 years. 59% of the patients were females with 88.6% of all cases sustaining the fracture following a trivial trauma. The Short term functional outcome using the Harris hip score was excellent in 43.5%, good in 38.4%, fair in 11.3% and poor in 6.8% of the cases. Cementing the prosthesis can achieve better control of thigh pain, improves mobility, allows early mobilization and lesser use of walking aids. The use of cement does not increase perioperative mortality or morbidity in patients[41].

- Amite, et al; (2014) reported a retrospective examination of the functional and ambulation outcome of patients after partial hip replacement with cementless Austin Moore prosthesis. Of 320 patients in which 84 (26.25%) were men, and 236 (73.75%) were women. All patients had a displaced femoral neck fracture, classified by Garden as Grade III and IV. They reveal that only small number (11.5%) of patients achieved good or excellent functional score, which equates to good quality of life and the

decline in ambulatory ability was significant. He concluded that hemiarthroplasty with cementless Austin Moore prosthesis is a safe operation with low incidence of perioperative and late complication. It should be reserved for elderly debilitated patients. For younger patients or patients with good functional ability an alternative treatment should recommend[42].

- Roy, (2014) in his study assessed the functional outcome of primary hemiarthroplasty of hip for displaced femoral neck fracture in the elderly patients by Austin Moore prosthesis. Fifty cases of above the age of 6o years using Moore's southern approach with a minimum of 12 months of follow up were included in his study. To substantiate the continued usefulness of Austin Moore prosthesis in modern day orthopaedic practice he assessed the results using harris hip score which shows (68.18%) cases, had excellent results, (22.72%) had good results, (6.81%) cases had fair results and only (2.13%) cases had poor results. He concluded Austin Moore prosthesis is a good option in elderly patients with displaced fracture neck of femur. The operative procedure is simple, mortality and morbidity associated with it is meagre. The complications are less disabling, weight bearing is early, and functional results are satisfactory[43].

- Dhule, et al;(2014) conducted a study to compare the efficacy of classical Moore's posterior approach to hip with that of minimally invasive posterior approach to hip that preserves short external rotators. 30 cases were followed with femoral neck fracture, treated with Austin Moore prosthesis and divided into first group with classical Moore's approach and second group with small incision surgery. Mean skin incision size was 10.4 cm (range, 8-14 cm) in group 1 and 8.6 cm (range, 6-11 cm) in group 2. Mean operative time was 58 minutes (range, 48-68minutes) in group 1 and 71 minutes (range, 41-81 minutes) in group 2. Average blood loss (186.66ml) and was significantly less in minimal incision group as compared to classical Moore's incision group (237.66ml). Mean length of hospital stay was 14days (range, 12- 23 days) in group 1 and 10 days (range, 10-22 days) in group 2. On follow up, pain was found to be significantly less in the minimal incision group; and also the range of motion was significantly more in the minimal incision group. Average Harris Hip score in minimal incision group was 80.6 and that in classical Moore's group was 73.93. He concluded that Small incision surgery for neck femur is a sound method and had the advantages of less duration of surgery, less blood loss, less post-operative pain and more range of motion than classical Moore's surgery[44].

- Costache, et al; (2014) published a retrospective study on a group of 124 Patients who sustained femoral neck fractures. Most frequent age involved was (77.5%) 60 years. The left hip has been affected in 62.5% of cases whereas the right one has been affected in 37.5% of the cases. Women (62.5%) are more affected by such fractures than men (37.5%), due to the association of the senile osteoporosis[45].

- Laghari, et al; (2014) presented a study on the outcome of Austin Moore hemiarthoplasty in 50 elderly patients with femoral neck fracture. Post operative pain was noted in the 50% of the cases and out of them severe pain was noted only in 4% of the cases. Superficial infection was seen in 4% of the cases and deep infection was not found in the cases and death was occurred in 10% of the patients. Excellent results were found in the 44.44% of the cases, with good and fair results were seen in 26.66% and 20% respectively, while poor results were seen in 8.88% of cases. They concluded that unipolar hemiarthoplasty is of the reliable procedure by use of Austin Moore prosthesis for the treatment of femoral neck fracture in elderly[46].

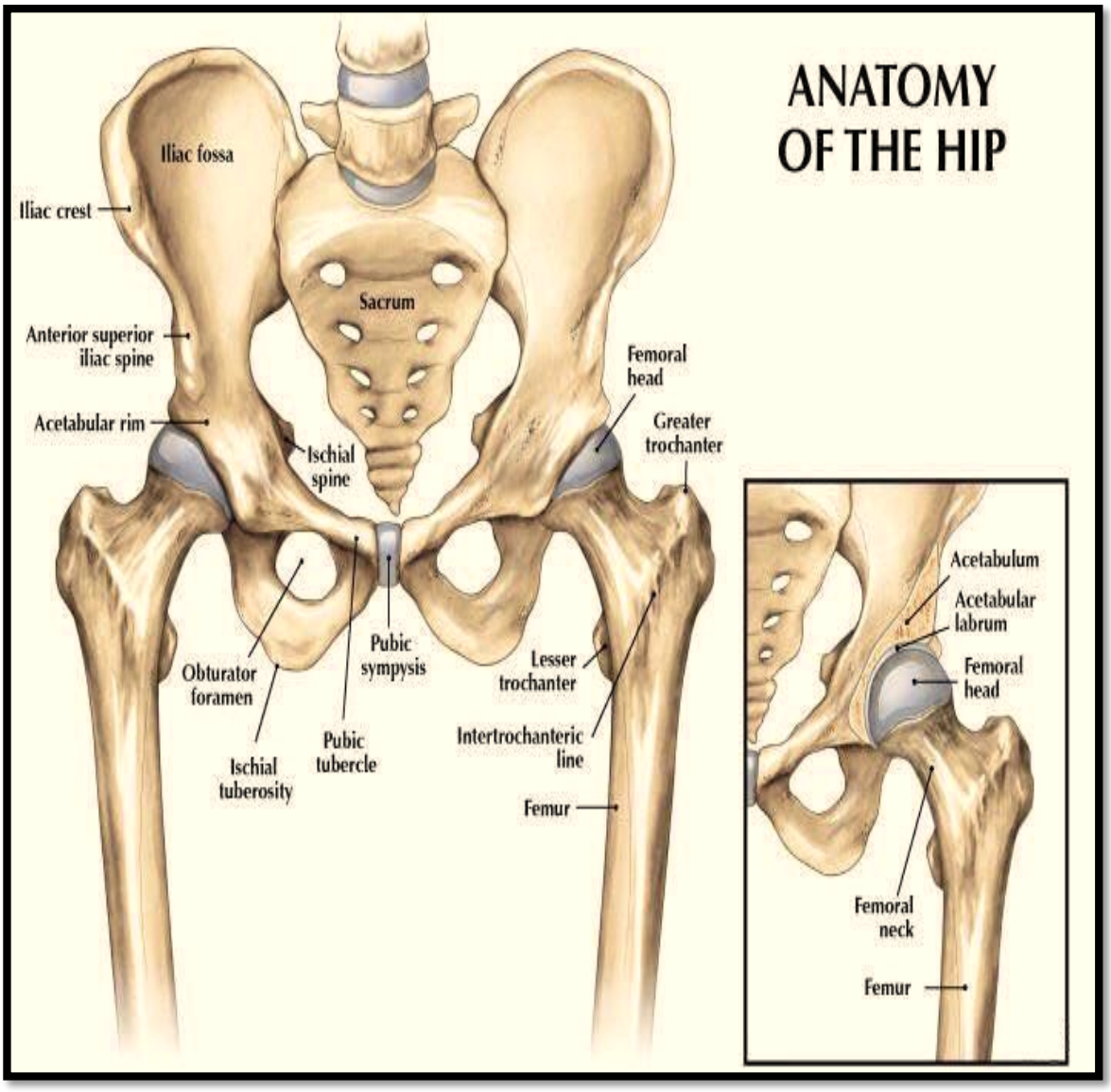
- Mue, et al; (2015) published his retrospective study on 35 elderly patients of 60 years and above with displaced intracapsular fracture neck of femur treated Austin Moore hemiarthoplasty. The predominant mechanism of

injury was trivial falls in 18 (66.7%) patients. The commonest complication was pressure sore in 2 (5.7%) patients, followed by surgical site infection in 1 (2.9%) patient and periprosthetic fracture in 1 (2.9%) patients. They concluded that the functional outcome of Austin Moore in elderly patients above 60 years with fracture neck of femur was satisfactory in most of the cases with minimal morbidity[47].

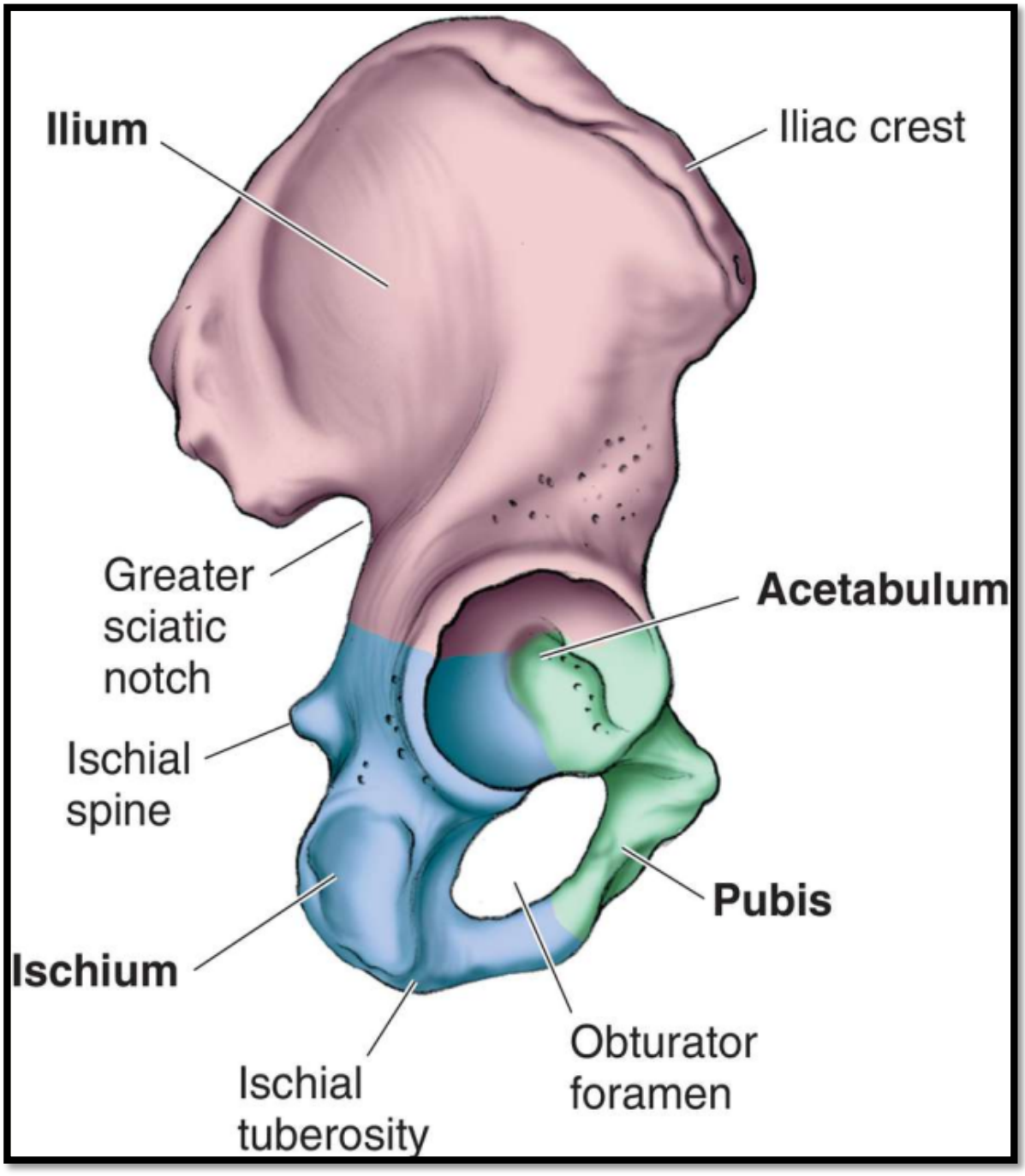
- Saeed, et al; (2015) presented their results of postoperative complications including with ambulation improvement and condition in elderly patients with fracture neck of femur treated by Austin Moore hemiarthroplasty during 6 months of follow up. A total of 100 elder patients with majority of cases were male 72%. Most common age groups (69%) were between 60-60 years of age. Fractures on the left sides presented with 55%. Majority of the cases (58%) were found with co morbidies, and post-operative wound complications problem were 21% and bed sore 11%. Excellent results were found 32.60%, good results were 42.70%, while fair and poor results were as 16.30% and 8.40% respectively. While 17%, death was recorded during 6 month of postoperative time. They concluded that Austin Moore hemiarthoplasty is the good surgical technique of the management for the fracture of the femur. It is very cost effect treatment along with very small amount of morbidity and mortality[48].

# ANATOMY

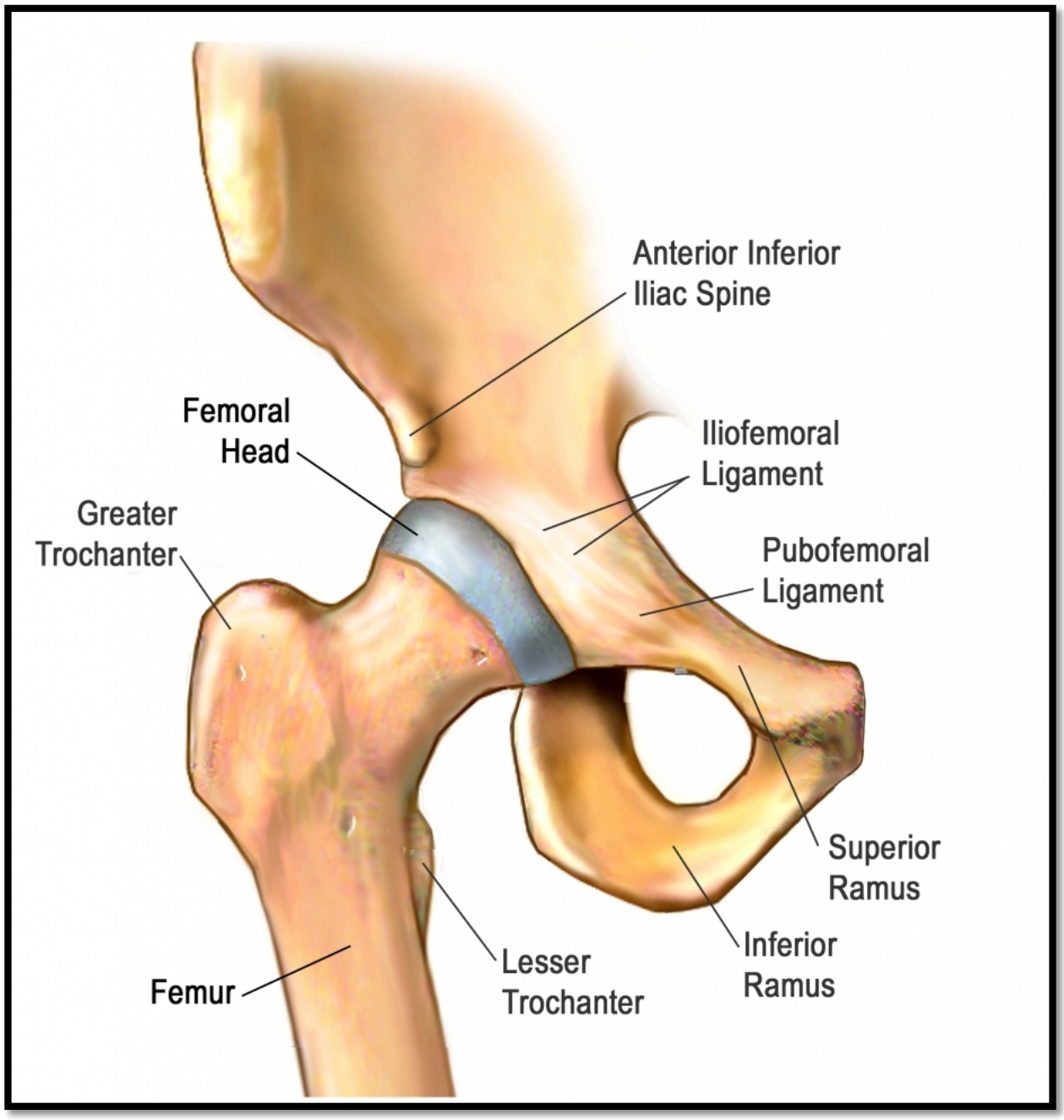
- The hip is a large synovial ball and socket joint. Its stability is associated to bony and labral anatomy of acetabulum and femoral head. The thick fibrous capsule with ligamentous condensations and the local muscular anatomy greatly supplement this stability.



The femoral head forms approximately two third of sphere and situated on the femoral neck approximately three quarters the diameter of the femoral head. This allows the femoral head, to be deeply seated within its acetabular socket without compromising either stability, or range of motion.

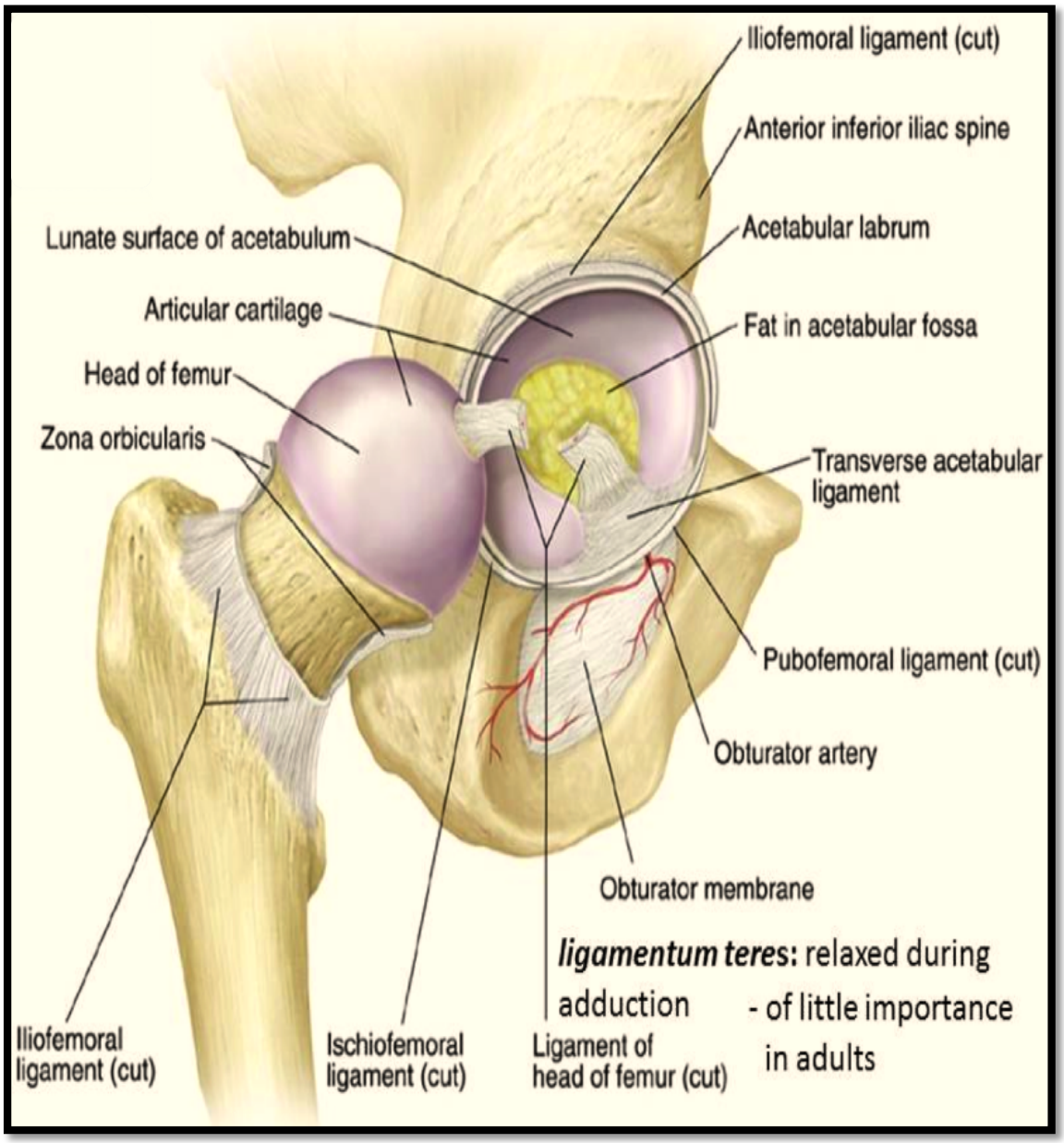


- The femoral neck projects superiorly, anteriorly and medially from the upper femoral shaft, medial to the origin of the **greater trochanter.** The latter quadrilateral-shaped eminence arises from the upper femur and gives attachment to the gluteus medius, minimus and to the short rotators.




- The **lesser trochanter** is a conical projection of bone located posteromedialy at a point where the neck arises from the femoral diaphysis. The psoas inserts partially on the lesser trochanter. Posteriorly a ridge of bone, the intertrochanteric crest, bridges the trochanters. The

femoral neck is broader at its base laterally and narrower just below and lateral to the origin of the femoral head. It is flattened in the anteroposterior plane. Vascular foramina are present on the anterior inferior aspect of the neck.



- In the case of the femoral neck, the relationship to the femur and hip joint is characterized by **anteversion** of the femoral neck in the transverse plane and the femoral neck shaft angle in the coronal plane. The femoral neck subtends an angle with the femoral shaft of between 130 and 135 degrees in the normal hip. An angle less than this are referred to as ***Coxa vara*** and an increased angle is termed ***Coxa valga*.**

- The hip **axis** length and femoral neck width have also been shown to have an influence on the risk of femoral neck fracture. The **hip axis length** is the distance from the lateral aspect of the trochanteric region along the axis of the femoral neck to the inner table of the pelvis. An increase in hip axis length and femoral neck width and lower neck shaft angles are associated with an increased risk of femoral neck fracture[49].

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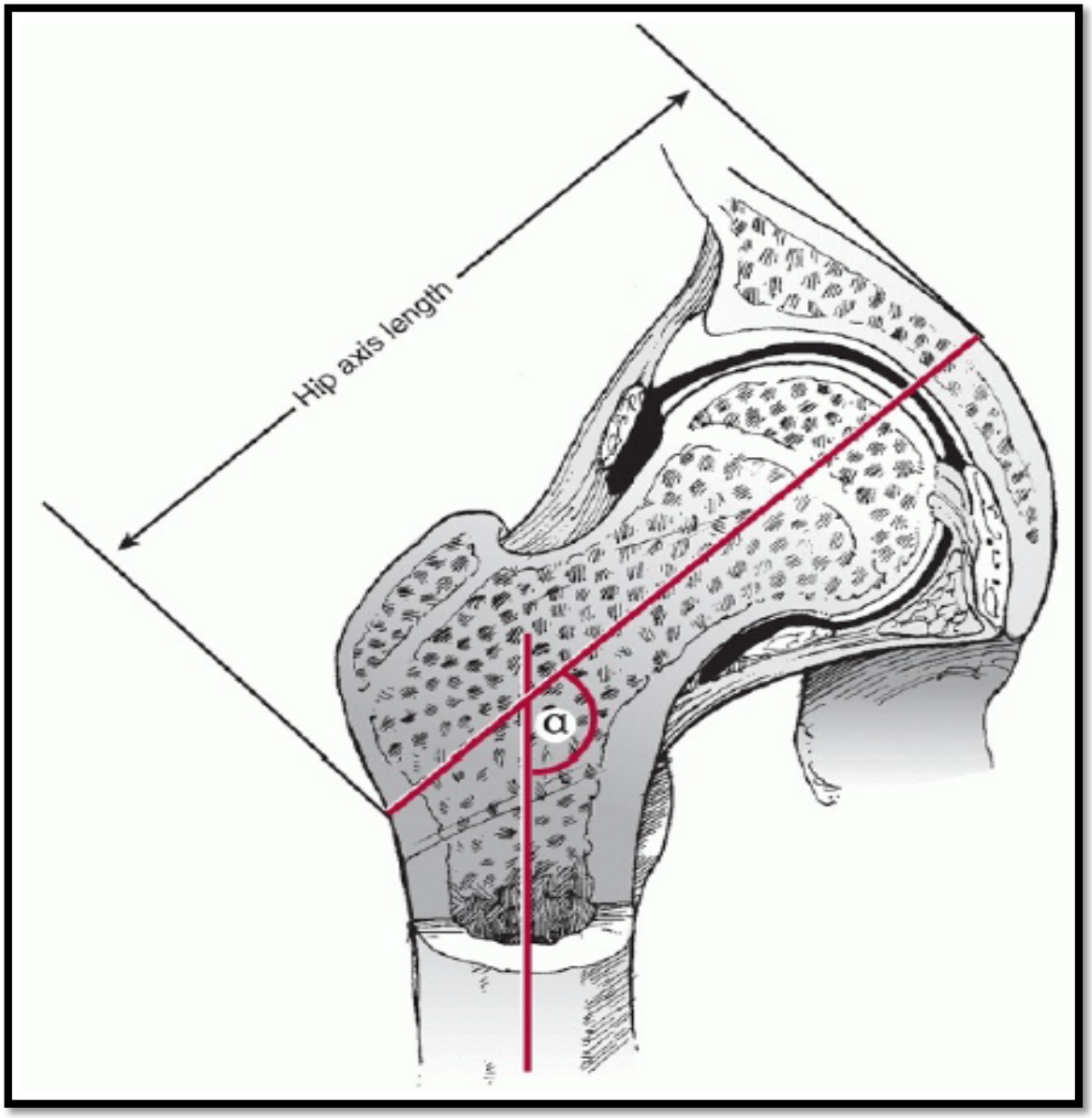
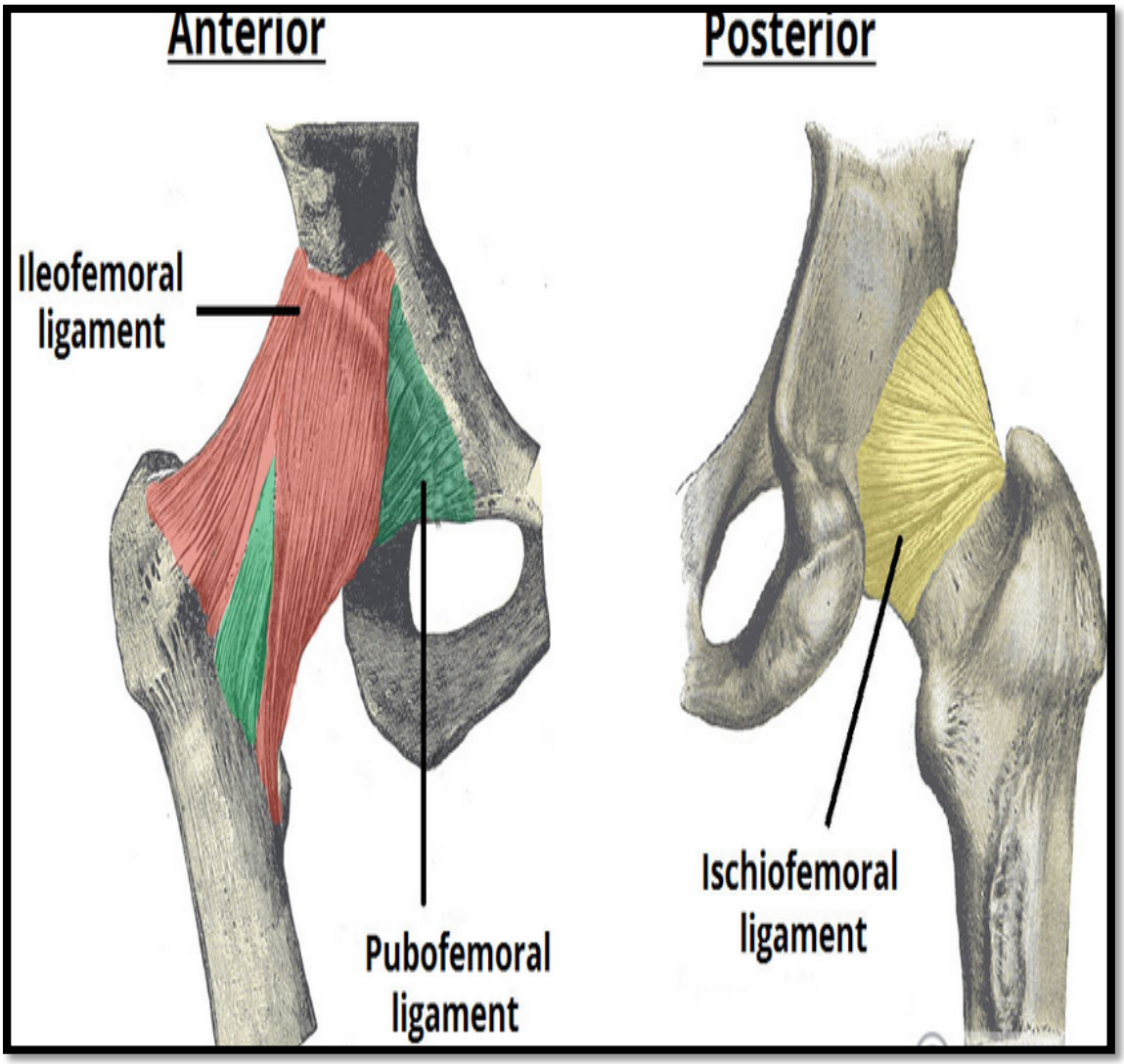


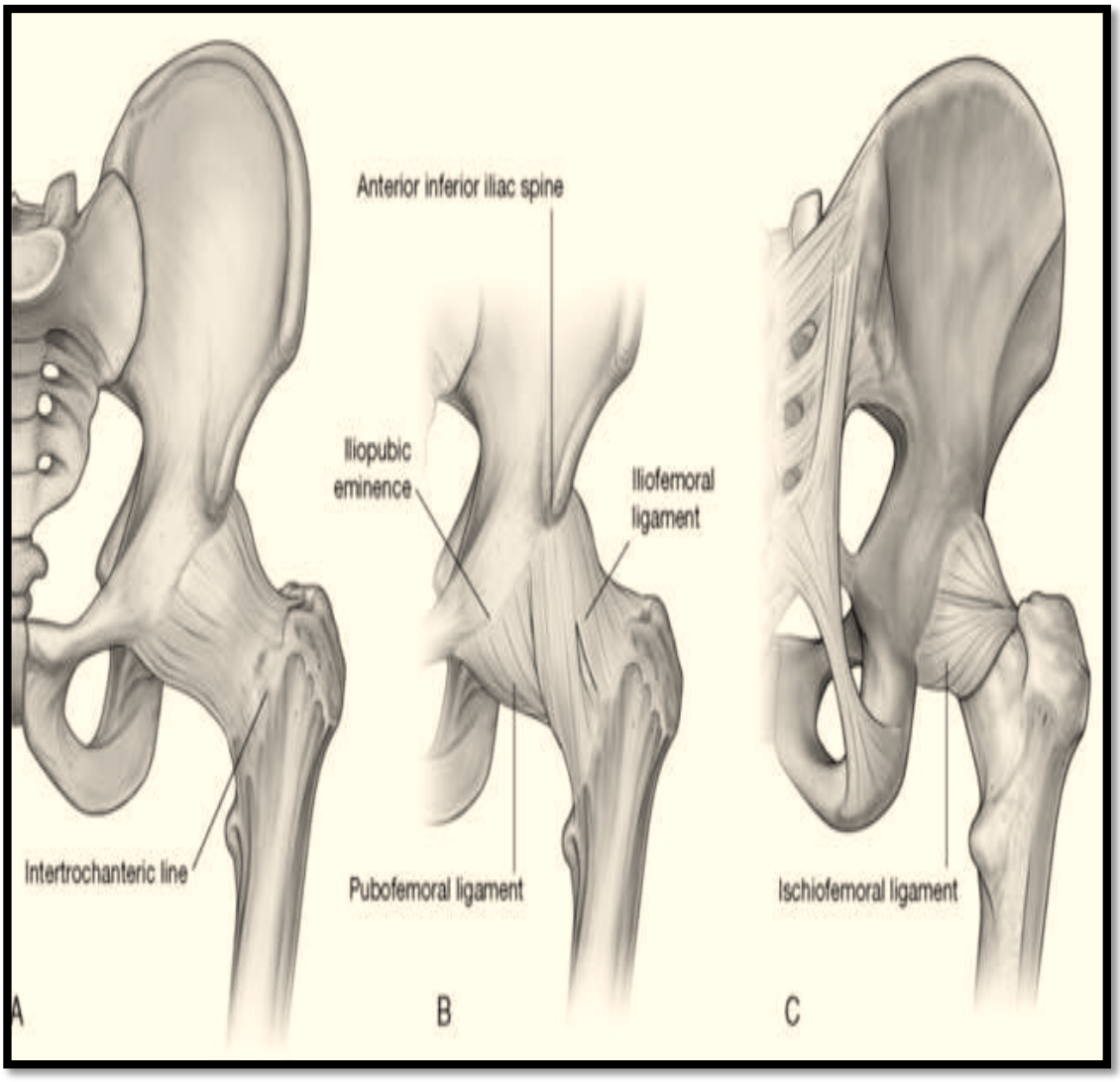

Hip axis length and neck shaft angle (α). A longer **hip axis length** is associated with a greater lever arm and greater force being applied to the femoral neck during a fall. A lower neck shaft angle is seen in coxa vara and will also increase the risk of femoral neck fracture.

# Ligaments

- The hip joint capsule extends down to the intertrochanteric line over the anterior aspect of the femoral neck, but posteriorly the lateral half of the femoral neck is extracapsular. Three important condensations of the hip joint capsule are considered ligamentous stabilizers of the hip.

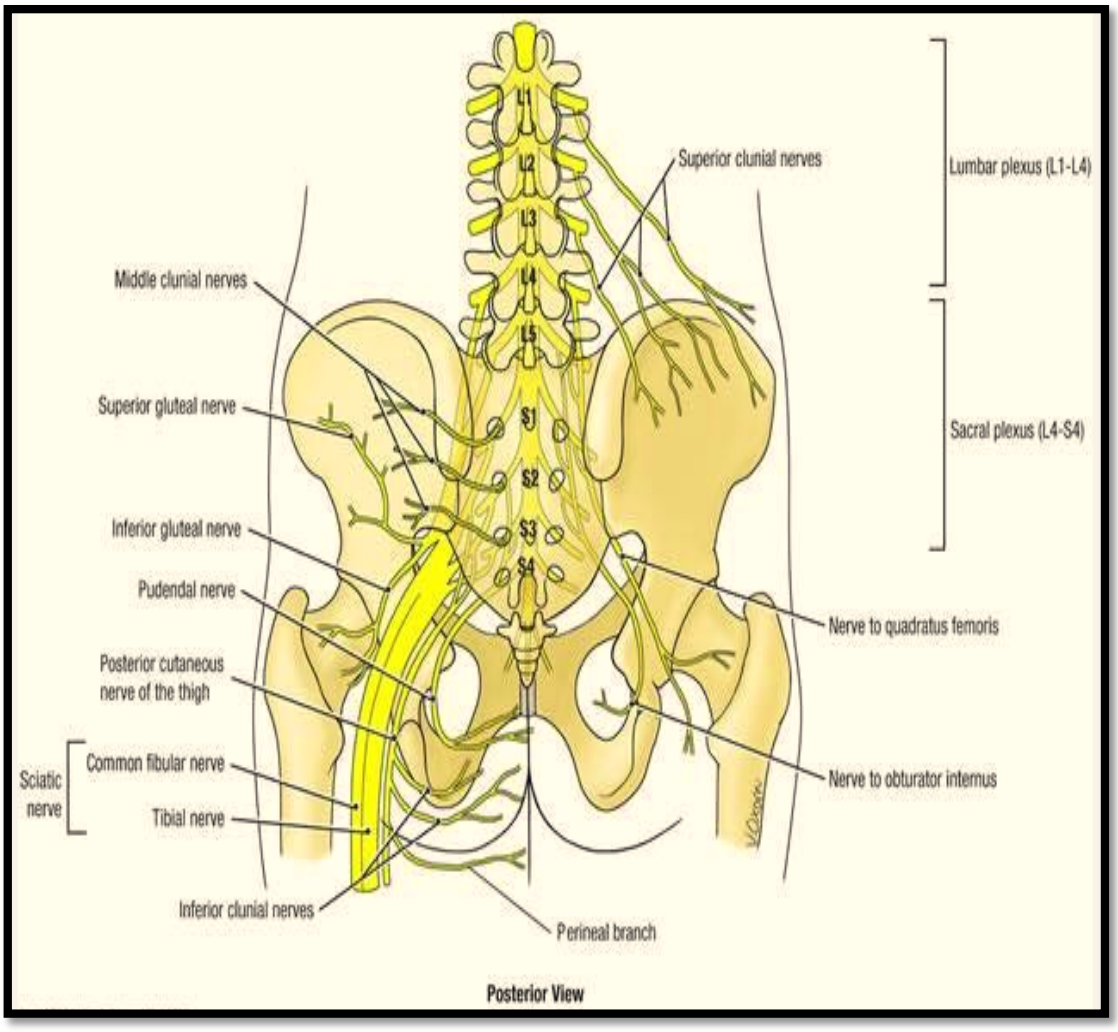


- The ischiofemoral ligament controls internal rotation in flexion and extension. The lateral arm of the iliofemoral ligament has dual control of external rotation in flexion and both internal and external rotation in extension.
- The pubofemoral ligament controls external rotation in extension with contributions from the medial and lateral arms of the iliofemoral ligament[50].

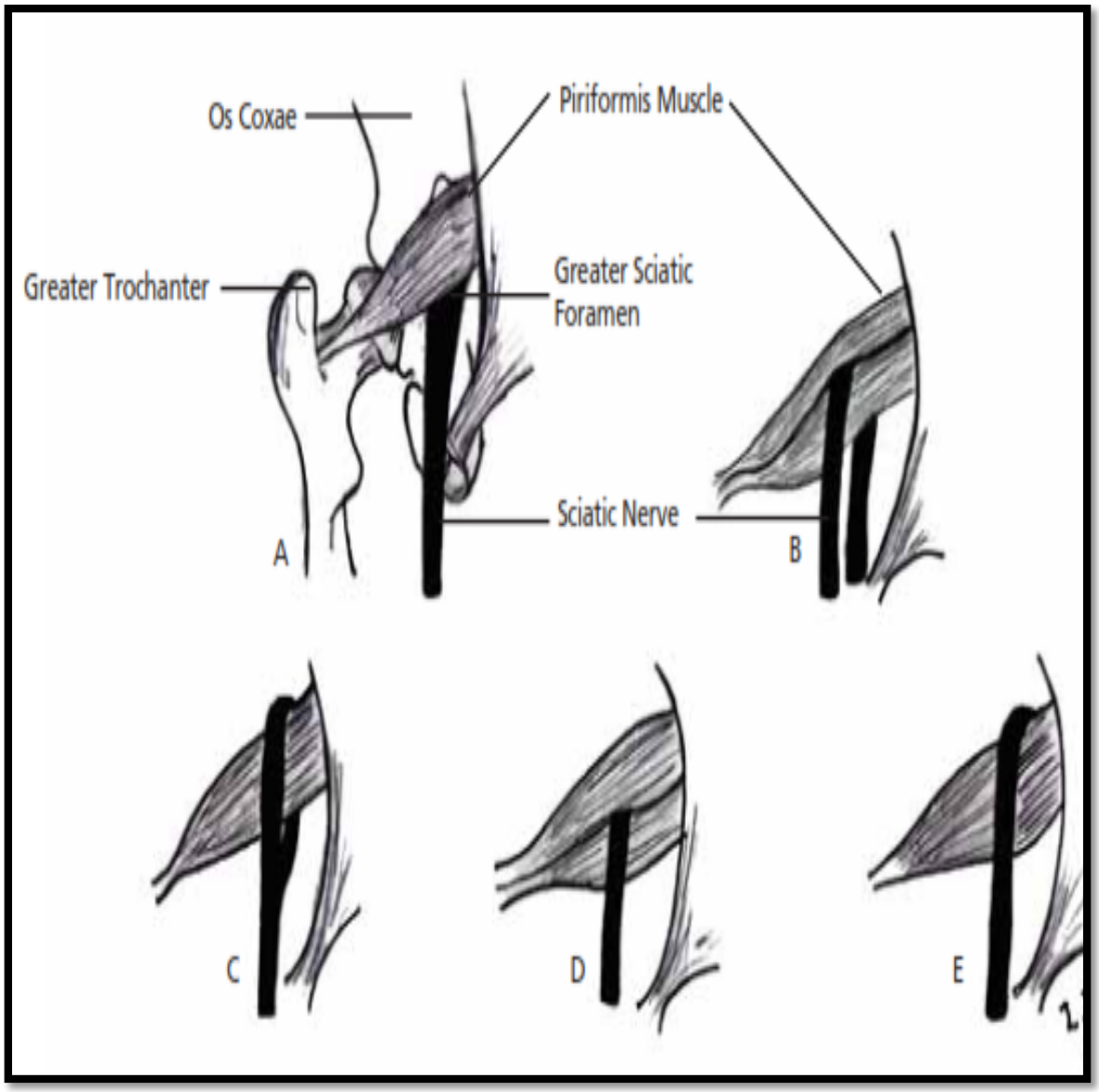


# SENSORY SUPPLY

- The hip joint derives sensation from the obturator, femoral, sciatic, and superior gluteal nerves.
- The **anteromedial** part of the joint is supplied by the obturator nerve. The **anterior** capsule receives sensory innervation from the femoral nerve. The **posterior** aspect of the joint is supplied by the sciatic nerve and there is a contribution to the posterolateral capsule from the superior gluteal nerve.



## Variations in the relationship of the sciatic nerve to the piriformis muscle:




**A)** the sciatic nerve exiting the greater sciatic foramen along the inferior surface of the piriformis muscle; the sciatic nerve splitting as it passes through the piriformis muscle with the tibial branch passing

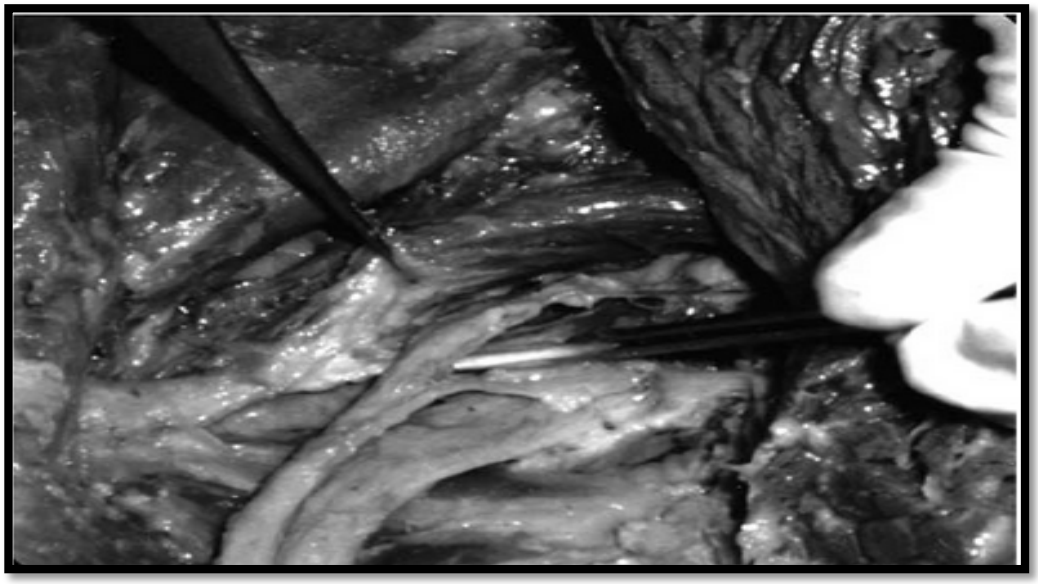
(**B**) inferiorly or (**C**) superiorly; (**D**) the entire sciatic nerve passing through the muscle belly; (**E**) the sciatic nerve exiting the greater sciatic foramen along the superior surface of the piriformis muscle. The nerve may also divide proximally, where the nerve or a division of the nerve may pass through the belly of the muscle, through its tendons or between the part of a congenitally bifid muscle.

Sciatic nerve palsy after hip hemiarthroplasty is an uncommon. It may be caused by direct injury, compression from a retractor, traction, due to limb lengthening, thermal injury from bone cement or cautery, or hematoma formation. Rarely; it can be a complication of hematoma formation in the lumbar spine subsequent to traumatic insertion of an epidural catheter or a continuous lumbar plexus block.

Hip Replacement Surgery related sciatic neuropathies are most frequent cause of traumatically induced iatrogenic sciatic neuropathies. Functional loss, discomfort and persistence pain of causalgia are quite distressing to the patients and lead to neurological complication following are well documented. These iatrogenic neuropathies often result in severe and debilitating loss of motor and/or sensory function, are often associated with severe neuropathic pain syndromes and regularly lead to medico-legal claims. Potential intraoperative mechanisms are direct sharp or blunt

trauma, compression by surgical material (e.g. clips, wires, sutures, or extrusion of cement) or by intraneural or perineural hematoma, vascular compromise, stretching through excessive lengthening of the leg, or heat of polymerizing cement may injure the sciatic nerve.[78]

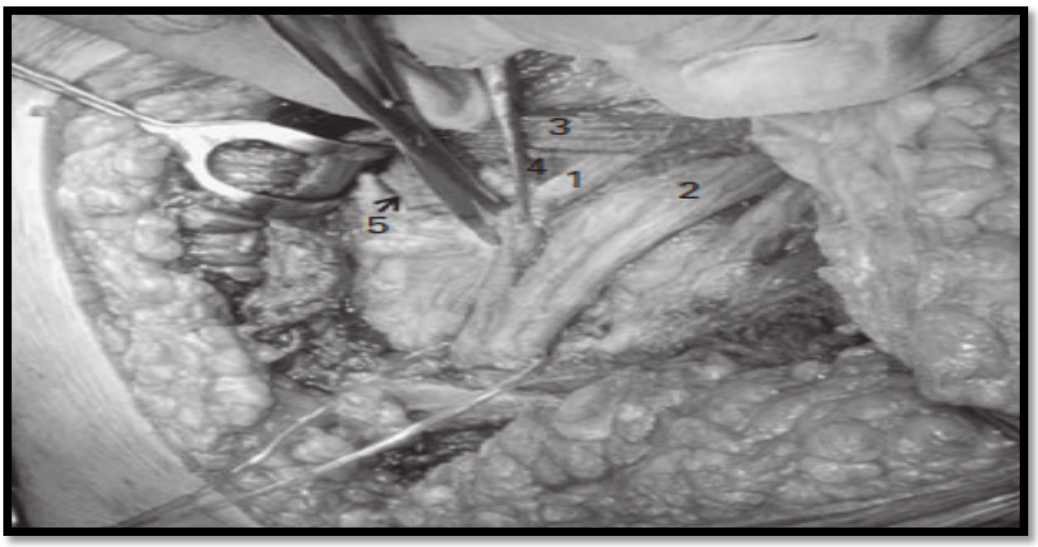
Variants of the normal relationship between the piriformis muscle and the sciatic nerve, involving the penetration of the muscle either by the lateral part or the whole nerve occur in about 15% of cadavers. This report is concerned with the most common variant.



**A Dissection of a sciatic variant. The forceps grasp the upper and lower parts of the piriformis muscle. The sciatic nerve passes partly through and partly below the muscle**

Currently inexplicable sciatic nerve palsies after THR the piriformis tendon may have been divided at operation and in the presence of an

anatomical variant involving the penetration of piriformis by the whole sciatic nerve, or only its lateral fibres, the subsequent medial retraction of the piriformis muscle may drag the penetrating part of the nerve with it, damaging the nerve in the process.[79]




**Intra operative photograph of the hip ( 1, lateral part of sciatic nerve; 2, medial part of sciatic nerve; 3, upper part of piriformis muscle; 4, lower part of sciatic nerve; 5,the line of piriformis tenotomy performed during primary THA)**

Sciatic nerve injury can occur at the time of anaesthesia and may be caused by intraneural injection, lumbar plexus, or psoas compartment block. The intraoperative causes include significant leg lengthening, improper retractor placement, cement extravasation, cement-related thermal damage, patient positioning, manipulation, and postoperative hematoma.

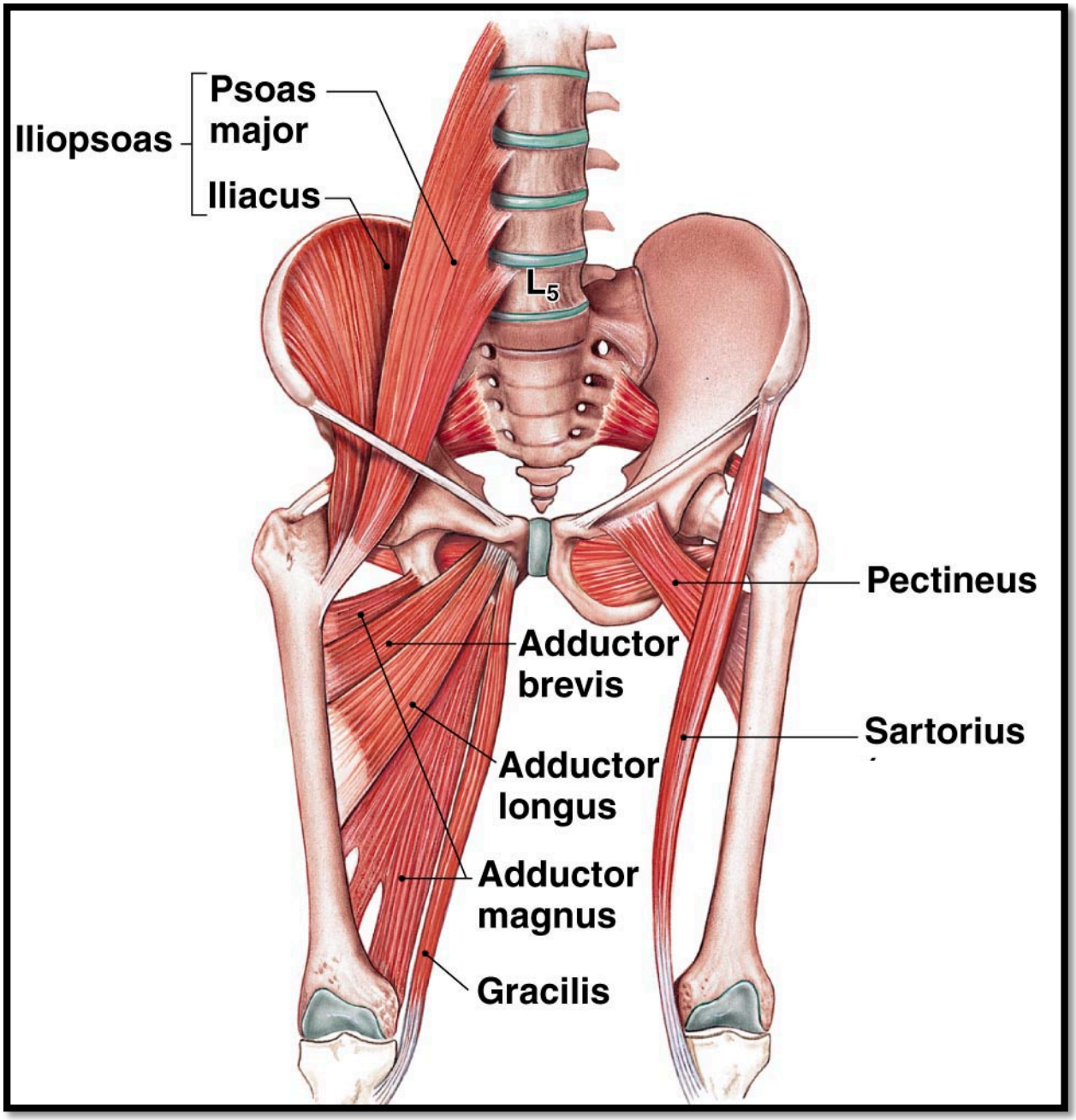
Pandey P.K et al; (2015) in a case report of sixty years old female presented with a 4 weeks old right neck of femur fracture underwent hemiarthoplasty.

Immediate post operatively sciatic nerve palsy occurred and it result from stitching of sciatic nerve. The clinical suspicion of a hematoma compressing the sciatic nerve should always be ruled out. The study concluded in a case of long standing fracture neck femur planning for hemiarthroplasty, sciatic nerve should always be explored and kept in vision during closure of hip joint capsule to avoid sciatic nerve palsy. This complication occurs because of deranged local soft tissue surroundings in long standing fracture neck femur cases especially in females[51].

## MUSCLES

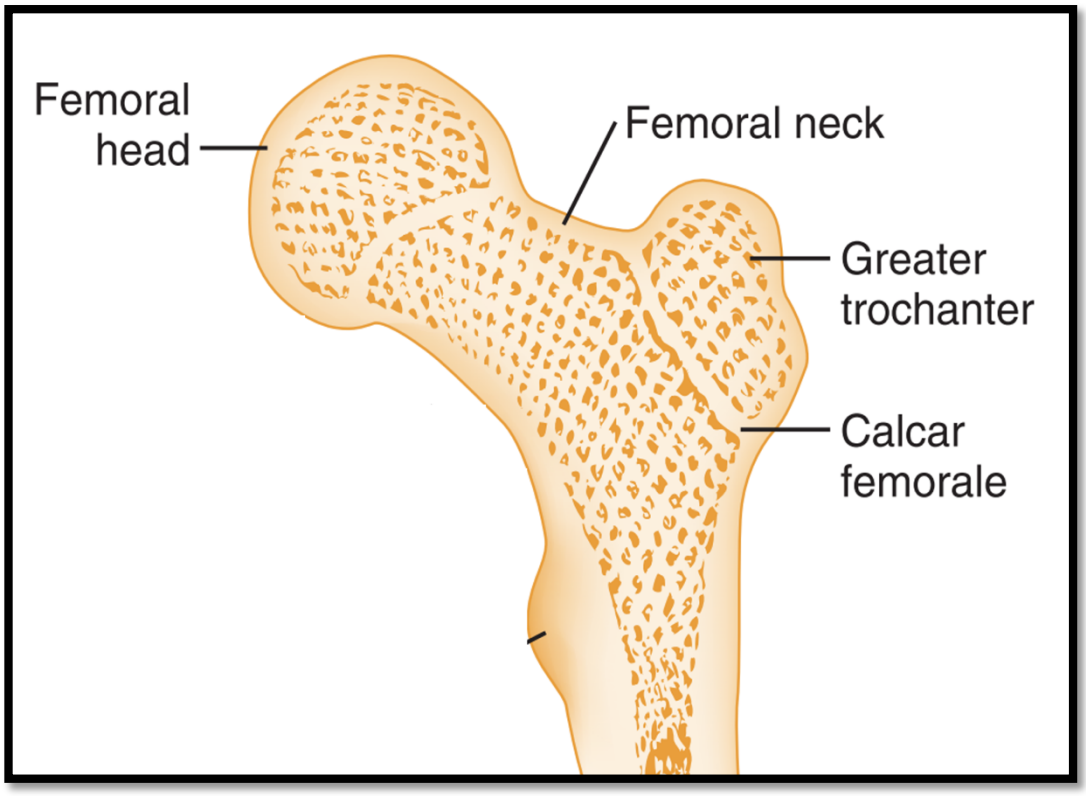
- **Hip flexion** is produced by the iliopsoas, which inserts into the lesser trochanter. When the femoral neck is intact, contraction of this muscle also produces internal rotation. **External rotation** of the hip is also caused by the action of piriformis, the gemelli and obturator internus.

- **Abduction** is produced by the gluteal muscles, which are supplied by the superior gluteal nerve. **Adduction** of the hip is produced by the muscles in the adductor compartment. These include adductor longus, adductor magnus, and adductor brevis.



- The motions occur at hip joint include **extension** (from a prone position) of $20^{o}$ to $30^{o}$, **flexion** of 120° to 135°, **abduction** of 45° to $50^{o}$, **adduction** of $20^{o}$ to $30^{o}$, and **internal** (medial) and **external** (lateral) rotation of 45° each. Definite individual variability is seen, and rotational measurements will differ if the rotation is tested in hip extension or hip flexion.

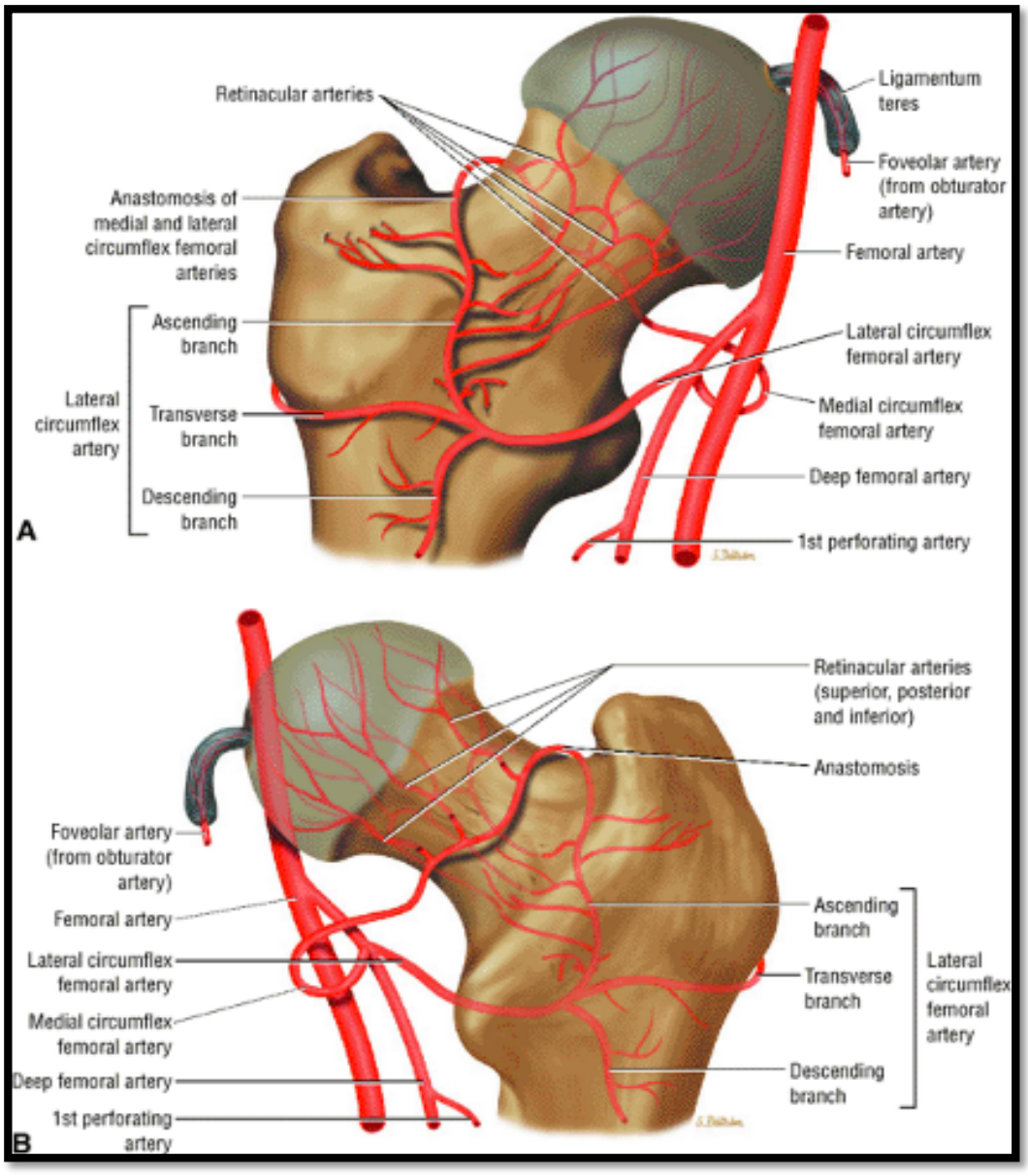
- The **calcar femorale** is a vertical plate of dense bone that projects from the posteromedial cortex of the femur deep to the lesser trochanter and proximally blends with the posterior cortex of the femoral neck. It is a continuation of the cylindrical cortex of the shaft and its function is to strengthen the proximal femur around lesser trochanter.




**Calcar femorale**

# VASCULAR ANATOMY

- The blood supply of the hip joint is of particular relevance when considering intracapsular hip fractures. There are three sources: capsular vessels, intramedullary vessels, and a contribution from the ligamentum teres.



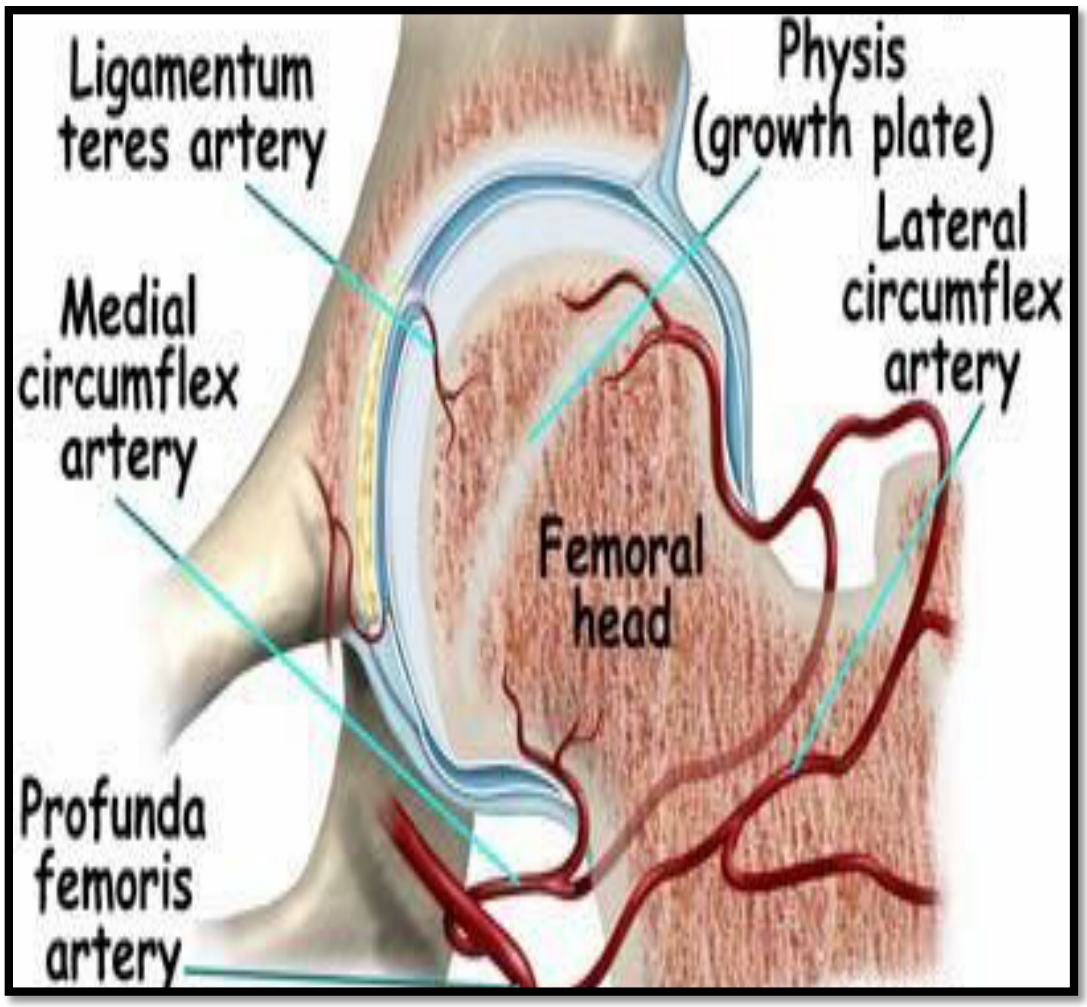
- In the adult the most important source of femoral head blood supply is derived from the capsular vessels. These vessels arise from the medial and lateral circumflex femoral arteries. These are in turn branches of the **profunda femoris** in 79% of patients. In 20% of patients one or other of these vessels arises from the femoral artery, and in the remaining 1% both vessels arise from the femoral artery[52].

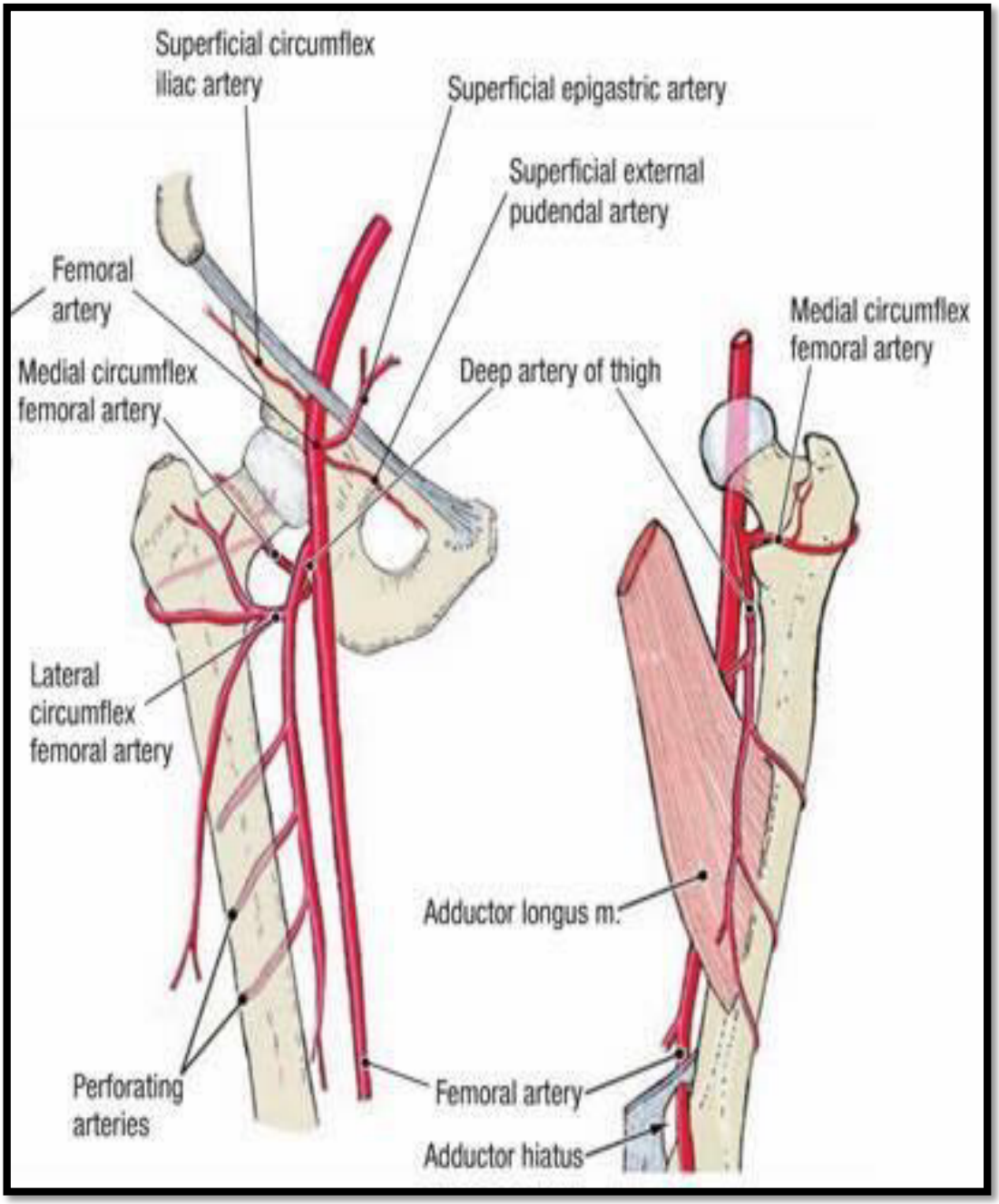
- The medial and lateral femoral circumflex arteries form an **extracapsular circular anastomosis** at the base of the femoral neck, and the ascending cervical capsular vessels arise from this. They penetrate the anterior capsule at the base of the neck at the level of the intertrochanteric line.

- On the posterior aspect of the neck they pass beneath the orbicular fibers of the capsule to run up the neck under the synovial reflection to reach the articular surface. Within the capsule these are referred to as ***retinacular vessels.*** There are four main groups (anterior, medial, lateral, and posterior), of which the lateral group is the largest contributor to femoral head blood supply.

- The most important retinacular vessels arise from the deep branch of the medial femoral circumflex artery[53,54,55]. These vessels supply the main weight-bearing area of the femoral head.

- At the junction of the articular surface of the head with the femoral neck there is a second ring anastomosis termed the ***subsynovial intra-articular ring***[56]. The terminal branches of the deep branch of the medial femoral circumflex artery penetrate the femoral head 2 to 4 mm proximal to the articular surface on its postero-superior aspect[57]. These capsular vessels enter the femoral head just below the articular margin.





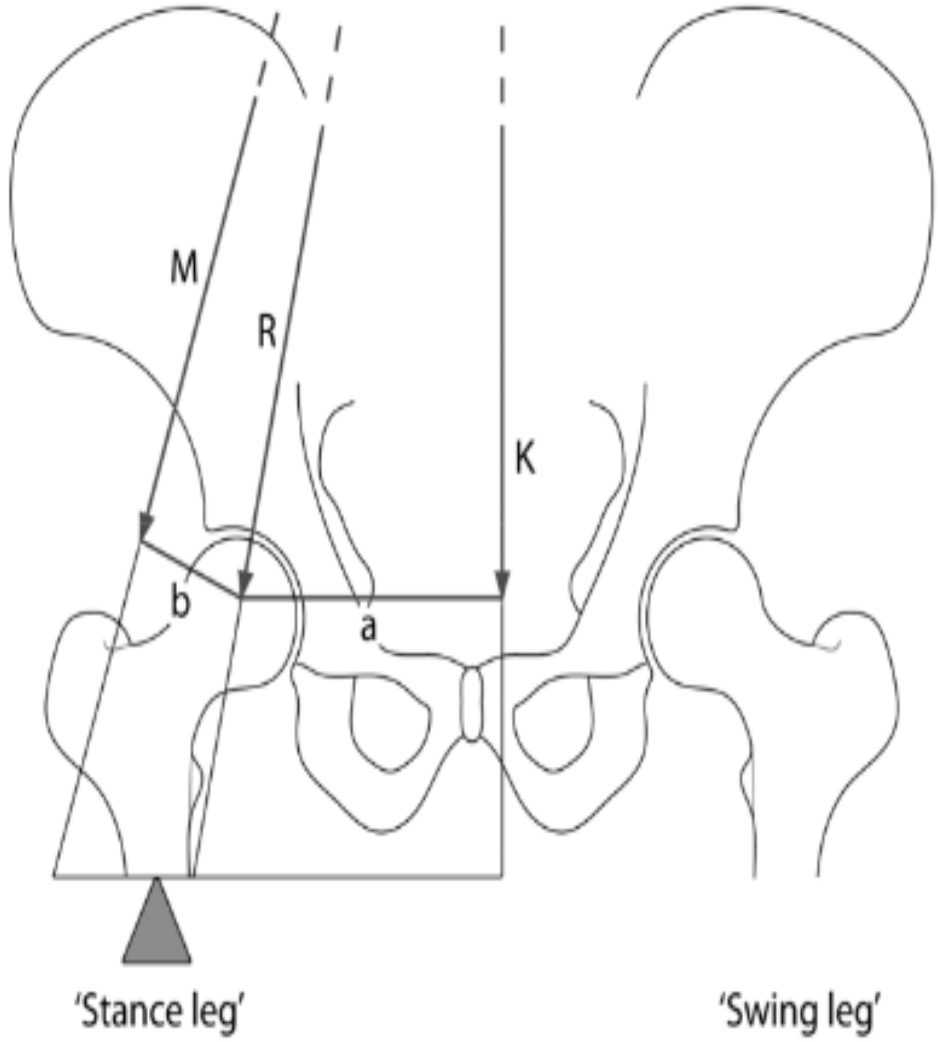

- Displacement of the femoral head because of a fracture in this area will damage these vessels, jeopardizing the blood supply to the femoral head and resulting in an increased risk of avascular necrosis if the head is retained[58].

# BIOMECHANICS OF THE HUMAN HIP

The hip joint is the **pivot** upon which the human body is balanced in gait. The static loading of the hip joint has been frequently approximated with a simplified, two-dimensional analysis performed in the frontal plane.

When the weight of the body is being borne on both legs, the centre of gravity is centered between the two hips and its force is exerted equally on both hips. Under these loading conditions, the weight of the body minus the weight of both legs is supported equally on the femoral heads, and the resultant vectors are vertical.

In a single leg stance, the effective centre of gravity moves distally and away from the supporting leg since the non supporting leg is now calculated as part of the body mass acting upon the weight-bearing hip.

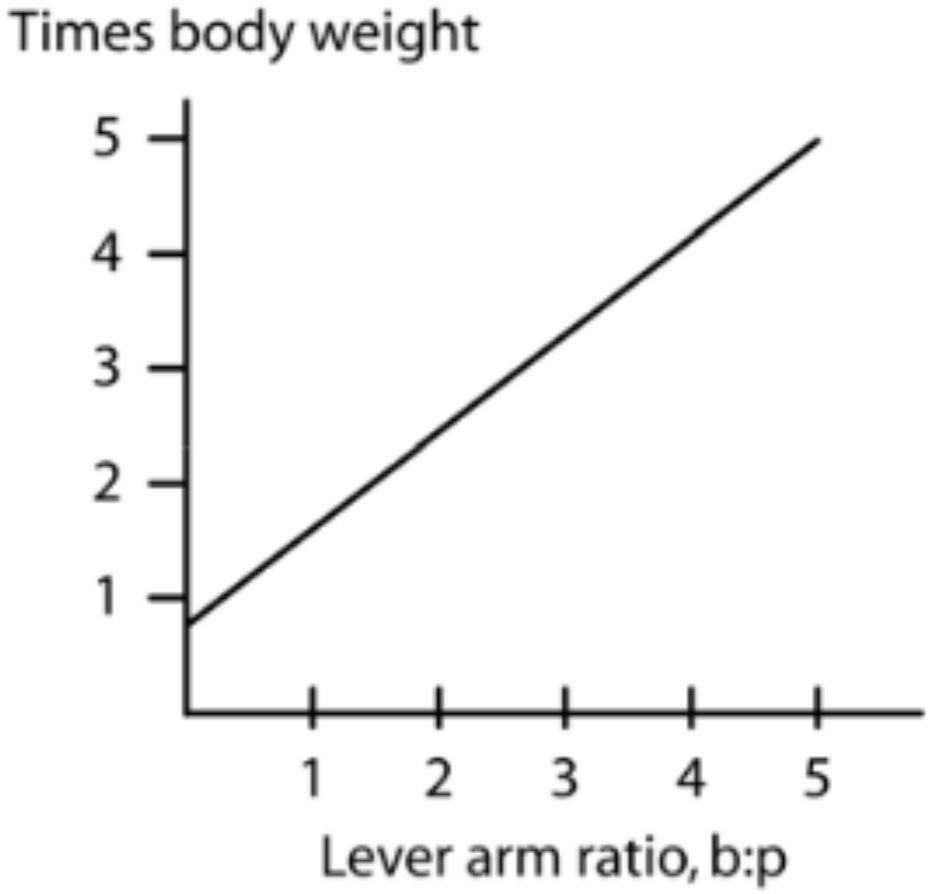



Free- body diagram for the calculation of the hip joint force while walking, where **K** is the body weight (minus the weight bearing leg), **M** is the abductor muscle force, and **R** is the joint reaction force.

This downward force exerts a turning motion around the centre of the femoral head – the moment is created by the body weight, K, and its moment arm, a (distance from femur to the centre of gravity). The muscles that resist this movement are offset by the combined abductor muscles, M. This group of muscles includes the upper fibres of the gluteus maximus, the tensor fascia lata, the gluteus medius and minimus, and the piriformis and obturator internus.

The force of the abductor muscles also creates a moment around the centre of the femoral head; however, this moment arm is considerably shorter than the effective lever arm of body weight. Therefore, the combined force of the abductors must be a multiple of body weight.

The magnitude of the forces depends critically on the lever arm ratio, which is that ratio between the body weight moment arm and the abductor muscle moment arm (a:b)[59]. Typical levels for single leg stance are three times bodyweight, corresponding to a level ratio of 2.5. Thus, anything that increases the lever arm ratio also increases the abductor muscle force required for gait and consequently the force on the head of the femur as well



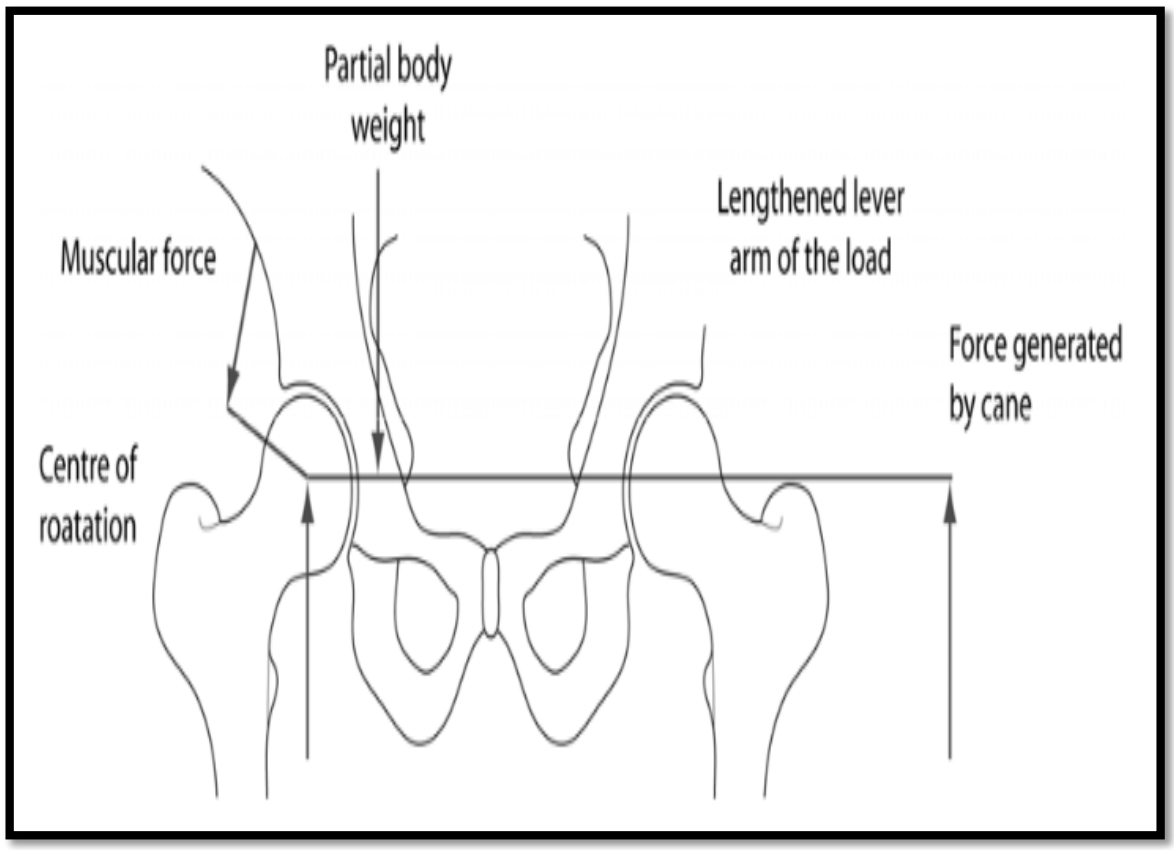

**Effect of lever arm ratio on hip joint reaction force.**

People with short femoral necks have higher hip forces, other things being equal. More significantly people with a wide pelvis also have larger hip forces. This tendency means that women have larger hip forces than men because their pelvis must accommodate a birth canal[59]. This fact may be one reason that women have relatively more hip fractures and hip.

Normally the tissues and bones of the hip joint function without causing pain, but various diseases and injuries can damage the tissues so that the deformations associated with loading are painful[59]. Management of painful hip disorders aims to reduce the joint reaction force. Bearing in mind the basic principles outlined above, this can be achieved by reducing the body weight or its moment arm, or helping the abductor force or its moment arm. Increases in body weight will have a particularly harmful effect on the total compressive forces applied to the joint. The effective loading of the joint can be significantly reduced by bringing the centre of gravity closer to the centre of the femoral head (decrease the moment arm b).

This can be accomplished by limping, however the lateral movements required take a considerable amount of energy and is a much less efficient means of ambulation. Another strategy to reduce joint reaction force involves using a cane or walking stick in the opposite hand.

The moment produced from both the cane and abductor muscles together produce a moment equal and opposite to that produced by the effective body weight.




Use of cane on the unaffected side. While this lengthens the level arm of the load (the partial body weight), it also provides a force (the cane) which counteracts the body load at the end of that level arm

The two-dimensional static analysis indicates that the joint reaction force can be reduced by 50% (from 3 times body weight to 1.5 times body weight) when approximately 15% body weight is applied to the cane .

The substantial reduction in the joint reaction force, predicted when a cane is used for support arises because the cane-ground reaction force acts at a much larger distance from the centre of the hip than the abductor muscles. Thus, even when a relatively small load is applied to the cane, the contribution it makes to the moment opposing body weight is large enough to significantly decrease the demand placed on the abductor muscles[59].

# MECHANISM OF INJURY

- The usual cause is a simple fall with an applied force being transmitted to the femoral neck via the greater trochanter, resulting in the fracture[60].

- An alternative mechanism is external rotation of the leg with increasing tension in the anterior capsule and iliofemoral ligaments. As the neck rotates, the head remains fixed and a fracture occurs. This mechanism accounts for the posterior neck comminution observed in many of these fractures.

- The usual site of the fracture is in the weakest part of the femoral neck, located just below the articular surface.

- Quantitative computed tomography (CT) has confirmed site-specific bone loss within the femoral head and neck with maximal bone loss in the more proximal and superolateral areas, which accounts for the site of fracture[61].

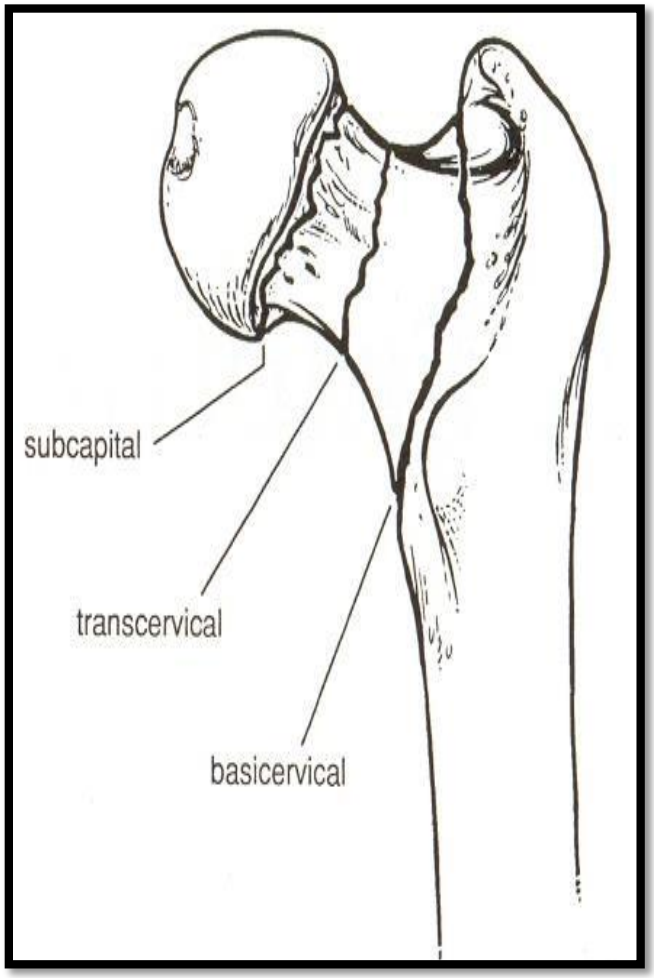
- More rarely the fracture occurs as a result of higher energy trauma. These injuries are more common in younger patients, in whom much greater forceis required to cause the fracture[62].

- Head-on vehicle collisions may be responsible. The use of clipless pedals on bikes has become popular, and these hamper the ability to quickly disengage the foot in the event of an accident, making a fall on the trochanter, and a hip fracture, more likely.

- Finally the femoral neck is a well-recognized site for stress fractures, and these occur as a result of repetitive cyclical loading, which eventually exceeds the strength of normal bone[63].

# CLASSIFICATION OF FRACTURE NECK OF FEMUR

Any sensible classification for fractures neck of femur must include criteria that are crucial to determining the treatment of these fractures. A number of classification systems have been devised for femoral neck fractures. Some authors have distinguished the fractures based on their anatomic location, dividing intracapsular fractures into subcapital and transcervical types[64].



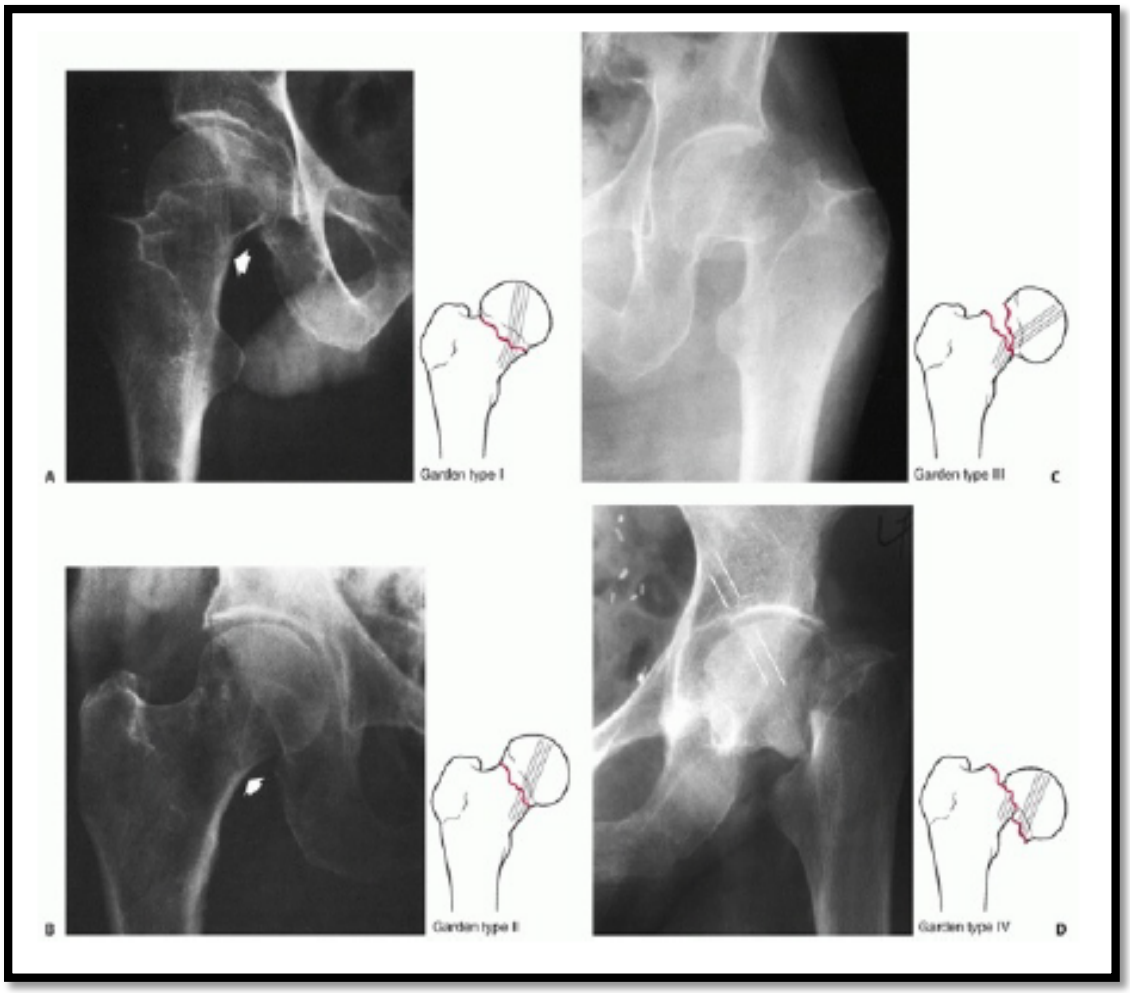

**Anatomical Location**

- However, the bone in the transcervical region is much stronger than that in the subcapital region, and it is doubtful if many fractures actually occur in the transcervical region[65,66].

- Also the exact location of the fracture is difficult to determine on the basis of plain radiographs[67,68]. The majority of fractures undoubtedly occur in the subcapital region.

- The degree of displacement is the more important consideration and this is the basis of the more commonly used classification systems.

# Garden Classification




- The Garden classification was described in 1961[69]. It divides femoral neck fractures into four groups.

- The divisions are based on the degree of displacement, which is judged on the anteroposterior radiograph by determining the relationship of the trabecular lines in the femoral head to those in the acetabulum.

- In the nonfractured hip, the trabecular lines in the femoral head are in the same orientation as those of the acetabulum

- The 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.

- In the 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.

- Finally, 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 has lost contact with the head and rotates

externally, so the trabecular lines in the neck are not colinear with those in the head.

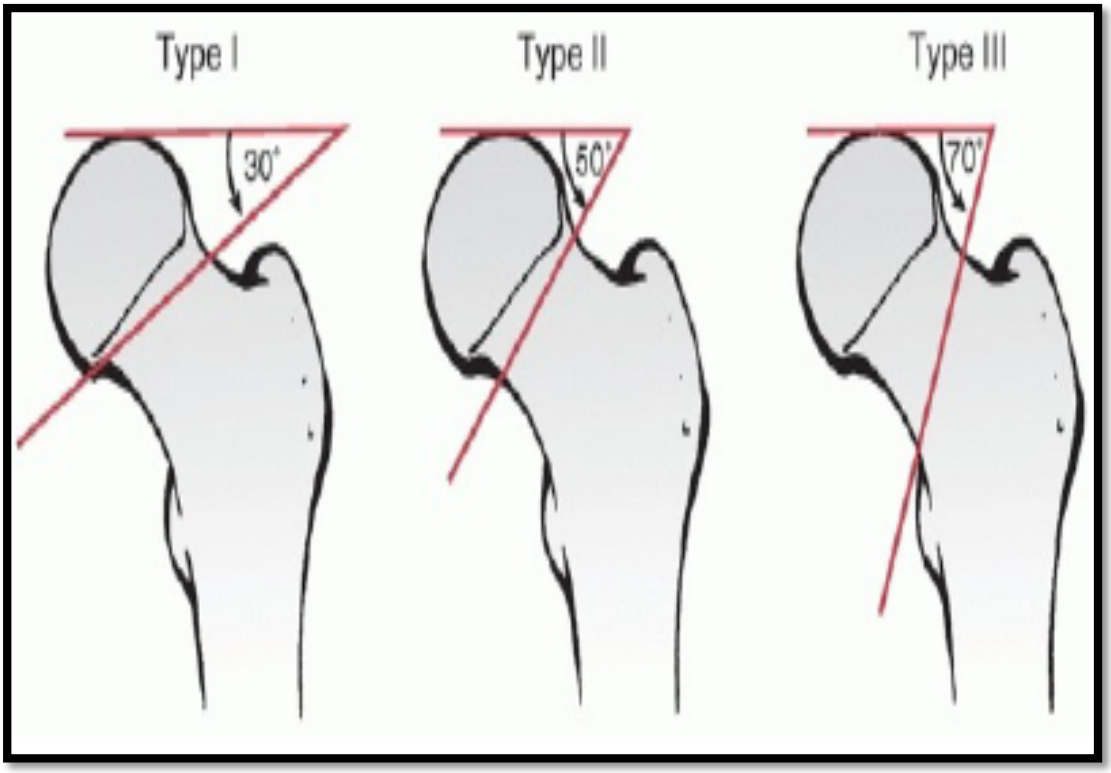
- The Garden classification has been widely used and is probably the most frequently utilized classification system in the orthopaedic literature pertaining to femoral neck fractures[70].

Leonhart N.Z et al; presented a retrospective survey on19 patients for profile radiograph (lateral view) imaging for Garden type I and type II femoral neck fractures and found to be identified with posterior displacement in 79% of the patients. The study concluded that most of the femoral neck fractures classified as Garden grades I and II exhibit some degree of posterior displacement in the lateral x-ray. This finding, coupled with the significant rate of synthesis material failure in these patients, should be considered in choosing the treatment method and the mandatory need for profile lateral view radiograph[71].

# Pauwels Classification

The Pauwels classification, which was introduced in 1935, was the first biomechanical classification for femoral neck fractures.

The classification of Pauwels is based on the plane of the neck fracture.




The Pauwell's classification of femoral neck fractures is based on the angle the fracture forms with the horizontal plane. As fracture type progresses from type I to type III, the obliquity of the fracture line increases and, theoretically, the shear forces at the fracture site also increase.

He described three separate fracture types based on whether the fracture plane was vertical, oblique, or transverse. It was proposed that the classification would be predictive of fixation failure or non-union with an increasing angle of fracture.

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

Type II fractures are between 30 and 50 degrees.

Type III fractures are greater than 50 degrees.

This classification has been evaluated in a number of clinical studies and has not been shown to be reliable either in describing the fracture or predicting outcome[72,73].

When the Pauwels classification was first published in 1935 in a German literature, a series of misinterpretations mainly related to the angle of inclination for different types of fracture sprung up. The common mistake was considering the classification standard to be 30° and 70°. The main reason for such mistake was probably authors citing a secondary source that misinterpreted the original one.

The lack of a unified standard for measuring the Pauwels angle may make the Pauwels classification unreliable. The Pauwels angle, which consists

of two lines (the horizontal line and the fracture line of the distal fragment), could be easily changed when the preoperative radiographs were taken because of the different positions of the leg, such as rotation and abduction.

Another criticism of femoral neck fracture classifications is that they don't consider the second plane. This is true of the Pauwels Classification which doesn't use the lateral plane.

Nowakowski A.M et al; proposed a simplified version of the Pauwels Classification system for femoral neck fractures based on mechanical considerations[74].

Grade I fractures are those impacted in valgus.

Grade II are fractures without free torque.

Grade III are fractures with free torque.

This classification can be used for borderline cases, definitively, in the operating room. Moreover, an enhancement of the mechanical constellation can be obtained using valgisation of the fracture. Whether this modified classification is sufficient to predict the development of

malunion and nonunion and/or femoral head necrosis, and therefore the need for fixation versus hemiarthroplasty, remains to be seen.

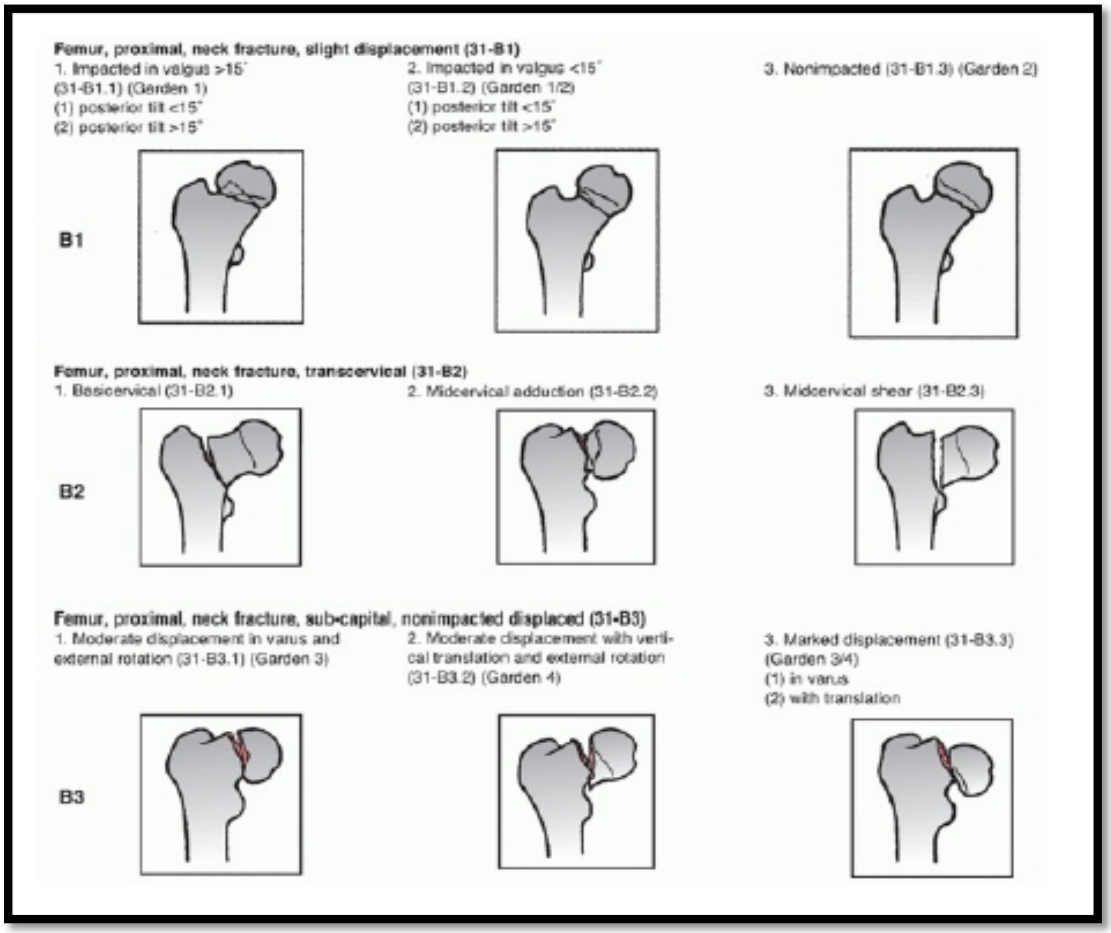
## AO/OTA Classification

This comprehensive classification of long bone fractures is an alphanumeric system based on the bone, the location of the fracture, and the fracture morphology.

The B1 group describes undisplaced femoral neck fractures, the B2 group contains transcervical fractures, and the B3 group describes displaced subcapital fractures.

Although this system of classification provides a comprehensive method of classifying fractures in general, it has not proved to be popular for femoral neck fractures. Its complexity limits its usefulness in routine clinical practice. Although it has been proposed to be a useful tool for research purposes, it has not stood up to scrutiny for this use.

Moreover it was not found to be useful in selecting treatment, nor was it predictive of outcome.




The B1 group fracture contains nondisplaced to minimally displaced subcapital fractures. The B2 group includes transcervical fractures through the middle or base of the neck.
B3 group includes all displaced nonimpacted subcapital fractures.

The AO classification of intracapsular fractures of the hip is at present the most complex method devised. It is based on a combination of the level of the fracture, the degree of displacement and the angle of the fracture

line. It includes basicervical or basal fractures within the intracapsular system.

This lack of agreement occurs because the fracture line crosses the anatomical boundaries of the hip capsule.

Blundell C.M[75] et assessed the predictive radiographic value of the AO classification in a study group of 415 patients shows that AO classification of intracapsular hip fractures has an extremely poor intra and inter observer reliability. The system is too complex and thus a simplified system is necessary in which fractures are grouped as displaced, undisplaced or basal, which gives excellent intra or inter observer reliability.

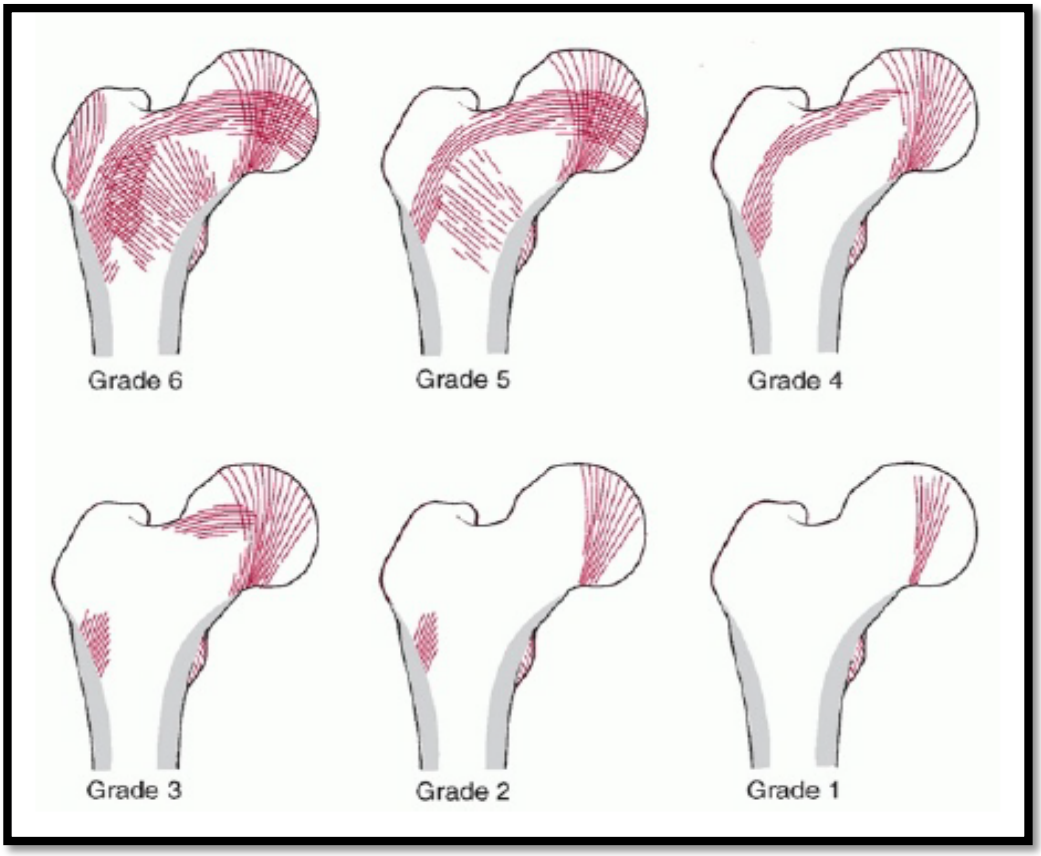
## Singh Classification

Another classification occasionally used in patients with intracapsular hip fractures is the Singh index, which is a method of estimating the degree of osteoporosis by fitting the pattern of proximal femoral trabecular lines into six separate categories.

Several studies have evaluated the usefulness of this classification[76] and found it unreliable. It shows poor interobserver and intraobserver levels of agreement. More importantly, it does not correlate with bone mineral

density as measured by DEXA scans. It is of little practical value in modern orthopaedic clinical practice.

The grade is determined from a true AP projection of an intact proximal femur.




Singh Index grades osteopenia from normal (grade 6; all trabecular groups are visible) to definite (grade 3; thinned trabeculae with a break in the principal tensile group) to severe (grade 1; only the primary compressive trabeculae are visible, and they are reduced) based on the ordered reduction in trochanteric, tensile, and ultimately primary compressive trabeculae.[76]

# MATERIALS AND METHODS

In this study, hemireplacement arthroplasty of the hip was done in 30 patients with fracture neck of femur using Austin Moore prosthesis who were admitted in the Department of Orthopaedics in R.L Jalappa Hospital, Kolar from October 2014 to October 2016.

## INCLUSION CRITERIA:

- Intra capsular fracture neck of femur in patients of age 60 years and above.

- All types of fracture under Gardens classification are considered.

## EXCLUSION CRITERIA:

1. Patients below 60 years of age.
2. Patients who were non ambulatory, prior to the fracture.
3. Patients with dementia.
4. Pathological fractures.

## TYPE OF STUDY

Study is a hospital based, prospective, non-randomized study and duration from October 2014 to October 2016

Patients who met the inclusion and exclusion criteria was selected from attending OPD and casualty department were admitted.

## PRE-OPERATIVE EVALUATION

As soon as these patients were admitted in the hospital, history was recorded and detailed clinical examination was done.

- **NAME:**

- **AGE: -** Age is, an important factor to be noted, to select the type of procedure to be done. There is a difference between the chronological and physiological age. Usually fracture neck of femur occurs at an older age. In the elderly, bone is usually osteoporotic and osteosynthesis may fail due to poor regenerative osteogenic potential of bone. Many a time,

it is ideal to replace head and mobilize the patient early to prevent the complications of prolonged immobilization.

- **SEX: -** Fracture neck is common in an elderly females due to hormonal imbalance in the post-menopausal age and associated osteoporosis.

- **OCCUPATION**: - Occupation has a vital role in selecting hemi replacement arthroplasty. It has got its own limitation as the patient is advised not to squat or sit cross legged. Patients who lead an inactive life and who have lower functional demands are advised hemireplacement arthroplasty for management of femoral neck fracture.

- **ADDRESS: -** Address was noted to communicate with the patients and for further follow up.

- **HISTORY OF PRESENT ILLNESS:** The patient usually presented with a trivial injury following which She/he had-pain and was unable to walk.

## ➢ PAST HISTORY:

- Whether the patient had any disease like Hypertension; ischemic heart disease, diabetic mellitus, tuberculosis or stroke.
- History of major cardiac or pulmonary problems were noted, if any
- History of previous anaesthesia and the details and adverse reaction, if any. History of previous operation on hip, with any evidence of infection noted.

- History of abnormal gait due to insufficient abductor musculature or neuropathic joint or progressive neurological disease.
- History of drug intake like aspirin anticoagulants or steroids. Aspirin and anticoagulants were stopped prior to surgery, but patients who were dependant on steroids continued drugs and booster was given during surgery to avoid crisis.
- History of fever and burning micturition if present was treated before undergoing the operation. History of familial bleeding tendencies like hemophilia was noted.

## ➢ PERSONAL HISTORY

- Whether the patient was a smoker, alcoholic, having vegetarian or non-vegetarian food with a normal or altered bladder and bowel function.
- Whether the patient used Western style or Indian style of toilet was also noted. (there is a high bleeding tendency in alcoholics so liver profile should be looked for) Menstrual history was also noted in females.

## ➢ GENERAL EXAMINATION

- Detailed clinical examination was done regarding the built, nutrition, pallor, cyanosis, icterus, pedal edema, lymphadenopathy, physiological age, physiological status, intelligence, willingness to undergo surgery and post-operative cooperation of the patient. The temperature, pulse, blood pressure and respiratory rate were also noted.,

- A thorough examination of the hip was done, deformities, weakness, and limb length discrepancies if any were noted. A detailed systemic clinical examination of Cardiovascular System, Respiratory System, Central Nervous System, per abdomen and Genitourinary system was done and

if there was anything significant, it was noted and treatment was instituted.

- Condition of the skin around the hip was noted. Height and weight of the patient was also noted.
- A detailed clinical examination of the spine, knee and ankle was done to rule out any deformities or contractures. (A flexion contracture of the ipsilateral knee or equinus deformity of the foot may require correction before hemiarthroplasty of the hip).
- True hip pain must be differentiated from sacroiliac pain, and lumbar pain, trochanteric bursitis, pubic ramus fracture or intra-abdominal problem by clinical examination.

## ➢ INVESTIGATIONS

- X-ray of the pelvis with both hips, anteroposterior view was taken with both the limbs in 15 of internal rotation.

- Thickness of the cortex of the femur, width and shape of medullary canal, bone stock, type of fracture (GARDEN'S classification), amount of calcar present, level of femoral neck cut to be made, pre-operative size of the head (magnification deducted) and bone stock of acetabulum was noted.

- Chest X-ray and ECG were done. A complete blood analysis including HB %, TC, DC, ESR, RBS, FBS, PPBS, blood urea, Creatinine, serology, blood grouping and typing, bleeding and clotting time were done. Urine analysis was done and urine culture done if required. Cardiac evaluation, Liver function tests and renal function tests were done if required.

## ➢ PRE-OPERATIVE TREATMENT

- For fresh fractures skin traction with 3 - 4 kg weight was applied to relieve the pain and muscle spasm.

- The part was prepared 24 hours before surgery, taking care to prevent abrasions. Preoperative anesthetic assessment was done.

- The following training was given to the patients preoperatively so that the same could be carried out post-operatively like,

    - ✓ Deep breathing exercise.

    - ✓ Static Quadriceps exercises.

    - ✓ Ankle and toe movements

- A written consent of the patient and relatives was taken.

- Injection Ceftriaxone 1 gm IV was administered intravenously 20 minutes prior to surgery.

## PROCEDURE

With a patient in spinal or epidural anesthesia, patient in true lateral position, the affected hip upper most. The part was scrubbed with 7.5% povidone iodine scrub (betadine scrub) and then painted with 5% povidine iodine solution (betadine solution), surgical spirit and then draped.

Posterior approach (Southern's) was used. Making a 10 to 15cm curved incision centering the posterior aspect of greater trochanter extending 6 to 8cm above and posterior to the posterior aspect of greater trochanter, curve the incision across the buttock and continue down along the shaft of the femur. Incise the fascia lata on lateral aspect of femur to uncover the vastus lateralis. Lengthen the fascial incision superiorly in line with skin incision bluntly split the maximus fibers.

The sciatic nerve was then identified and retracted. The short external rotators, viz; from below upward, the quadratus femoris, the obturator internus; gemelli and the piriformis were exposed. The Obturator internus and gemelli and if necessary the piriformis we divided close to their insertion, and reflected backwards. Thus, posterior part of capsule was well exposed. A T-shaped incision was made in the hip capsule, in line

with the femoral neck and across its base. The capsule was retracted and labrum was preserved.

Then the thigh and knee were flexed up to 90°, adducted and, internally rotated thus dislocating the hip posteriorly. The femoral head was extracted using bone levers or corks screw. The remnant of ligamentum teres was excised and any loose pieces of bone (of the comminuted neck) in the acetabulum removed, the cartilage of the acetabulum inspected for any degenerative changes.

The femoral neck was cut using a oscillating motor saw or osteotome in such a way that enough of the calcar (minimum 0.5 inch) remained to, support the medial aspect of the prosthesis.

The size of the femoral head removed from the acetabulum was measured using a head gauge and trial or definitive prosthesis was checked for fit. The head size should be neither too loose nor too tight. Then an awl or straight currete was inserted in line with the femoral shaft to aid in entering the diaphyseal medullary canal. Then with an appropriate broach or rasp, medullary canal was enlarged in valgus and 10°- 15° of anteversion relative to the plane in which the knee joint axis lies. Then the appropriate size of the prosthesis was seated in the

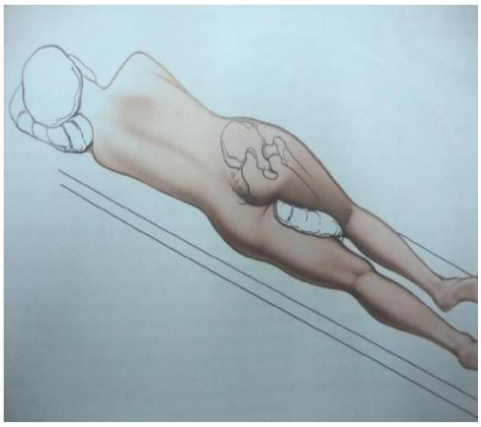
prepared medullary canal with 10-15°of anteversion and a valgus position. The prosthesis was impacted with gentle blows into the medullary canal. Then prosthesis was reduced gently into the acetabulum.

Muller noted that the center of the head of the prosthesis should be slightly superior to the level of the upper edge of the greater trochanter. If it is too high riding, some more neck should be osteotomised to enable easy reduction of prosthesis and prevent post-operative limb lengthening.

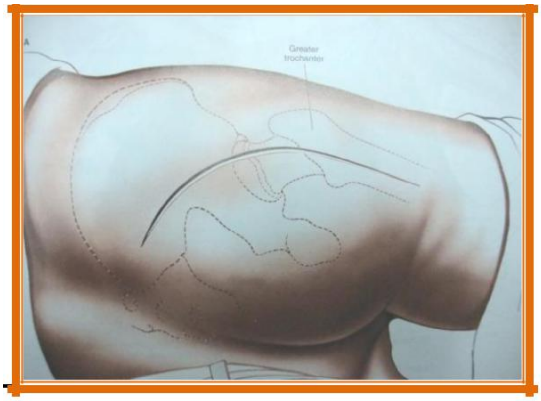
The hip was tested for full range of movements and stability intra operatively. Short external rotators were repaired with anchoring technique.

The wound was closed meticulously in layers over a suction drain in situ and sterile dressing was applied. Blood loss was assessed and blood transfusion carried out if required.

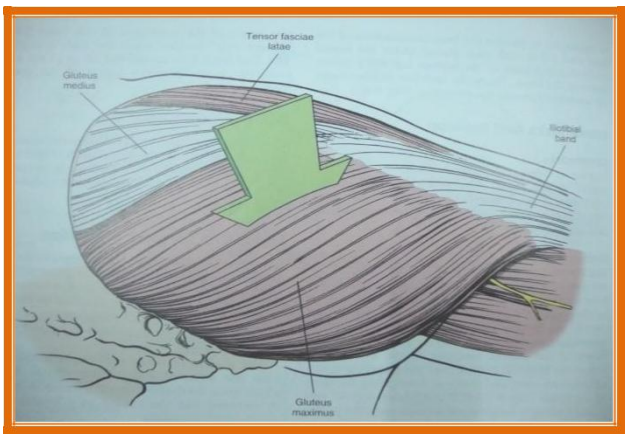
**INSTRUMENTATION**



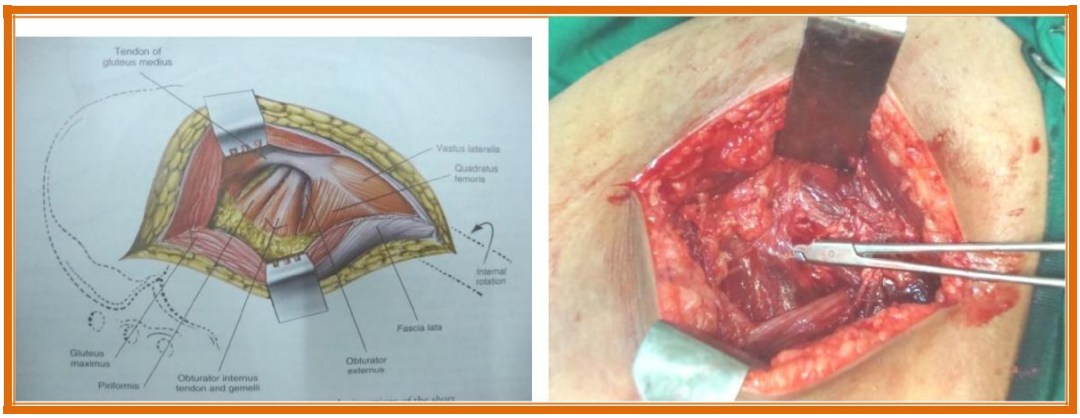
**POSITION OF THE PATIENT**



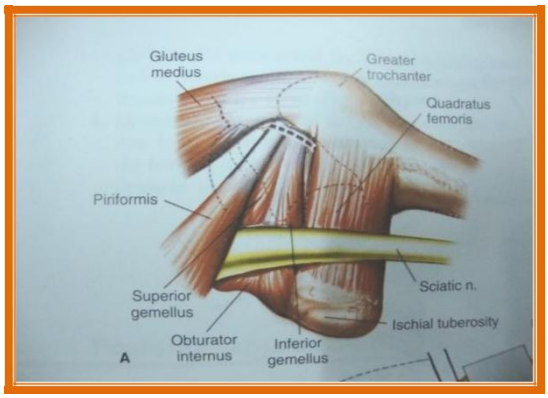

**SKIN INCISION**



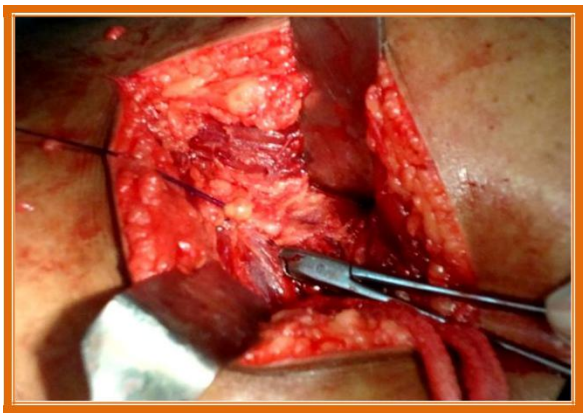

**SPLITTING OF GLUTEUS MAXIMUS**



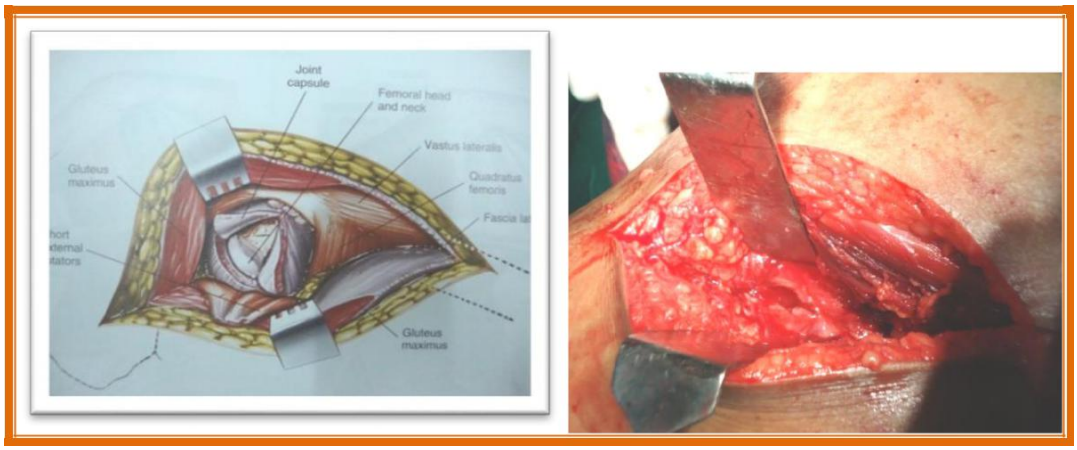

## SHORT EXTERNAL ROTATORS



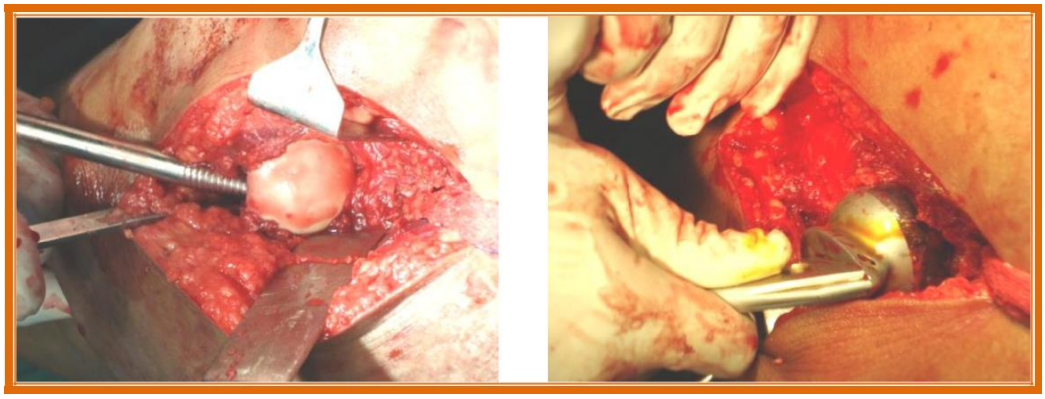

## RELATIONSHIP OF SCIATIC NERVE TO EXTERNAL ROTATORS



## STAY SUTURES TO SHORT EXTERNAL ROTATORS BEFORE CUTTING




**CAPSULE OF HIP JOINT T- SHAPED INCISION TO THE CAPSULE**



**EXTRACTION OF THE FEMORAL HEAD TRIAL PROTHESIS**

## POST - OPERATIVE MANAGEMENT

A pillow was kept in between both the legs so that the leg was in abduction. Foot end of the bed was elevated and regular half hourly T.P.R. and blood pressure charts were maintained for initial 24 hours.

**Antibiotics** in the form of parenteral ceftriaxone 1gm twice a day was given for the first three days and later shifted to oral antibiotics.

Analgesics in the form of parentral piroxicam 40mg were administered in first 24 hrs and then shifted to oral analgesics.

The drain was removed depending on the amount of collection at 48 to 72 hours. Static quadriceps exercises were advised to all the patients as soon as they recovered from anaesthesia.

All the patients were advised to sit up with back rest from the 2nd post operative day. As patients are elderly, considering osteoporotic bone supplemented with calcium supplements.

A post-operative check X-ray was taken and the valgus seating with 10°-15° of anteversion was confirmed. Any limb length discrepancy was noted.

Knee flexion, isotonic quadriceps exercises and hip abduction, flexion and extension exercises were started on 3rd postoperative day and patient was mobilized with walkers with partial weight bearing as tolerated. Sutures were removed on 10th day and patient discharged with a cane in the opposite hand (which was discarded after 6 weeks).

The patient was advised to use a straight high chair with arms to facilitate getting out of the chair and avoid using a sofa. The patient was advised not to sit cross legged or squat on the floor or squat for Indian style of toilet and patient was advised to use elevated toilet seat. The patient was advised not to adduct or flex the hip excessively or involve in activities that place heavy load or stresses on the hip.

| | |
|---|---|
| **THE HARRIS HIP SCORE[77]** | |
| Maximum points possible – 100 | |
| **1. Pain (44 possible)** | |
| a) None or ignores it | 44 points |
| b) Slight, occasional, no compromise in activities | 40 points |
| c) Mild pains, no effect on average activities, rarely moderate pain with unusual activity, may take aspirin | 30points |
| d) Moderate pain, tolerable but makes concessions to pain some limitation of ordinary activity or work | 20 points |
| e) Marked pain, serious limitation of activities | 10 points |
| f) Totally disabled, crippled, pain in bed, bed ridden | 0 points |
| **1. Function (47 possible)**<br>**A) Gait (33 possible)** | |
| i) Limp | |
| a)None | 11 points |
| b) Slight | 8 points |
| c) Moderate | 5 points |
| d) Severe | 0 points |
| ii) Support | |
| a)None | 11 Points |
| b) Cane for long walk | 7 Points |

| | |
|---|---|
| c) Cane most of the time | 5 Points |
| d) One crutch | 3 Points |
| e) Two canes | 2 Points |
| f) Two crutches | 0 Points |
| g) Not able to walk (Specify reason) | 0 Points |
| iii) Distance walked | |
| a) Unlimited | 11 points |
| b) About 5000 meters | 8 Points |
| c) About 1000 meters | 5 Points |
| d) Indoors only | 2 Points |
| e) Bed and chair | 0 Points |
| **B) Activities (14 possible points)**<br><br>i) Stairs (4 maximum) | |
| Foot over foot without use of railings | 4 Points |
| Foot over foot using railings | 2 Points |
| Stairs in any manner | 1 Points |
| Unable to do stairs | 0 Points |
| ii) Shoes and socks (4 maximum) | |
| With ease | 4 Points |
| With difficulty | 2 Points |
| Unable | 0 Points |

| | |
|---|---|
| iii) Sitting | |
| Comfortably in ordinary chair for one hour | 5 points |
| On a high chair for half an hour | 3 points |
| Unable to sit comfortably in any chair | 1 points |
| iv) Ability to enter public transportation | 3 points |
| **3) Absence of deformity** | |
| Points (4) are given if the patient demonstrates. | |
| a) Less than $30^0$ fixed flexion contracture | |
| b) Less than $10^0$ fixed adduction | |
| c) Less than $10^0$ fixed internal rotation in extension | |
| d) Limb length discrepancy less than 3.2 cm | |
| **4) Range of motion (5 points possible)** | |
| Flexion | $0^o$-$140^o$ |
| Abduction | $0^o$-$40^o$ |
| Adduction | $0^o$-$40^o$ |
| External rotation | $0^o$-$40^o$ |
| Internal rotation | $0^o$-$40^o$ |
| **Range of motion scale:** | |
| $211^o$ – $300^o$ (5) | |
| $161^o$ – $210^o$ (4) | |
| $101^o$ – $160^o$ (3) | |

| | |
|---|---|
| $61^o$ – $100^o$ (2) | |
| $31^o$ – $60^o$ (1) | |
| $0^o$ – $30^o$ (0) | |

Though Harris Hip score is evaluated at every visit, the final Harris Hip Score calculated at 6 months is taken to determine the result of the procedure in the present study. Results are rated as

Excellent: 90-100

Good: 80-89

Fair: 70-79

Poor: <70

**CASE REPORT- 1**

Name: Chinnamma Age/Sex: 80/F

Occupation: Housewife Address: Kaivara

**PRE-OPERATIVE RADIOLOGICAL EVALUATION**

X-Ray pelvis with both hips: INTRACAPSULAR FRACTURE NECK OF RIGHT FEMUR

**Classification:** GARDEN TYPE III

**Co morbid conditions**: Patient is HTN

**OPERATION:** Austin Moore's Hemiarthroplasty of right hip.

**APPROACH:** Posterior approach Size of prosthesis: 41 mm

**POST-OPERATIVE PERIOD:** Drain removal done after 48hrs. Suture removal done on the 10th post-operative day No evidence of post-operative wound infection, ambulation from the 3-postoperative day.

| Follow up | Flexion/Extension | Abduction/Adduction | Int/Ext.rotation |
|---|---|---|---|
| 6 weeks | 90°/0° | 20°/20° | 20°/20° |
| 3rd month | 100°/0° | 30°/30° | 30°/30° |
| 6th month | 110°/10° | 30°/30° | 30°/30° |

**Harris hip score – Excellent**

**PRE-OP**



**FOLLOW UP**

**CASE REPORT- 2**

Name: Venkatamma Age/Sex:60/F

Occupation: Housewife Address: Mulbagal

**PRE-OPERATIVE RADIOLOGICAL EVALUATION.**

X-Ray pelvis with both hips: INTRACAPSULAR FRACTURE NECK OF LEFT FEMUR

**Classification**: GARDENS TYPE III.

Co morbid conditions: NILL

**OPERATION**: Austin Moore's Hemiarthroplasty of left hip.

**APPROACH**: Posterior approach Size of prosthesis: 45 mm

**IMMEDIATE POST-OPERATIVE PERIOD**: Uneventful

**POST-OPERATIVE PERIOD**: Drain removal done after 48hrs. Suture removal done on the 10th post-operative day No evidence of post-operative wound infection, ambulation from the 5th postoperative day.

| Follow up | Flexion/Extension | Abduction/Adduction | Int/Ext.rotation |
|---|---|---|---|
| 6 weeks | 100°/0° | 20°/20° | 20°/20° |
| 3rd month | 110°/0° | 20°/25° | 20°/20° |
| 6th month | 110°/10° | 20°/25° | 30°/30° |

**Harris hip score: fair**

**PRE-OP**


**POST-OP**


**FOLLOW UP**

**CASE REPORT - 3**

Name: Vasu Age/Sex: 62/M

Occupation: BUSINESS Address: Jayanagar,

**PRE-OPERATIVE RADIOLOGICAL EVALUATION**

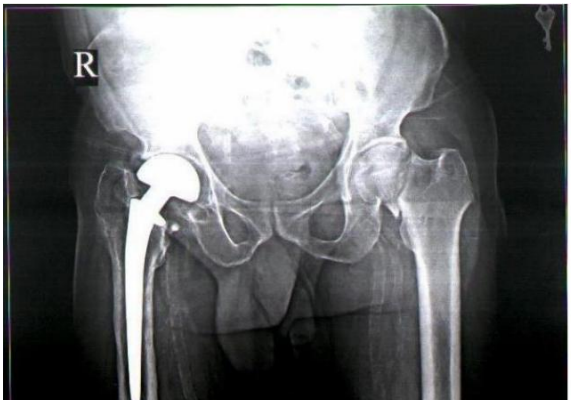
X-Ray pelvis with both hips: INTRACAPSULAR FRACTURE NECK OF LEFT FEMUR.

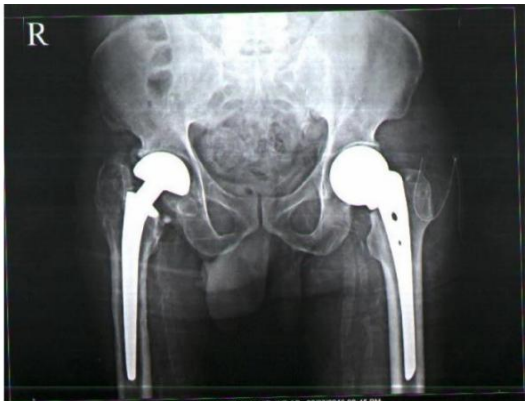
**POST-OPERATIVE PERIOD**: Drain removal done after 48hrs. Suture removal done on the 10th post-operative day No evidence of post-operative wound infection, ambulation from the 5$^{th}$ post operative day.

| Follow up | Flexion/Extension | Abduction/Adduction | Int/Ext.rotation |
|---|---|---|---|
| 6 weeks | 100°/0° | 20°/20° | 20°/20° |
| 3rd month | 110°/0° | 25°/30° | 25°/30° |
| 6th month | 110°/10° | 25°/30° | 25°/30° |

**HHS – Harris hip score: Good**

**PRE-OP** **POST-OP**




**FOLLOW UP**

# OBSERVATIONS AND RESULTS

After average 6 months follow up of elderly patients who had undergone hemiarthroplasty using Austin Moore's Prosthesis, following observations were made from the data collected.

**Age and sex distribution**:

The study involved patients above 60 years of age. The eldest patient to undergo hemiarthroplasty was 85 years old. Mean age of patients was 69.43 years. Our study showed 14 male and 16 female patients.

*Table 1: Age distribution of study subjects*

| Age in Years | No. of Patients | Percentage |
|---|---|---|
| 60-69 | 13 | 43% |
| 70-79 | 14 | 47% |
| 80-89 | 03 | 10% |
| **Total** | **30** | **100%** |

*Table 2: Sex distribution of study subjects*

| Sex | No. of Patients | Percentage |
|---|---|---|
| Male | 14 | 47% |
| Female | 16 | 53% |
| **Total** | **30** | **100%** |

*Figure 1: Age and Sex distribution of study subjects*

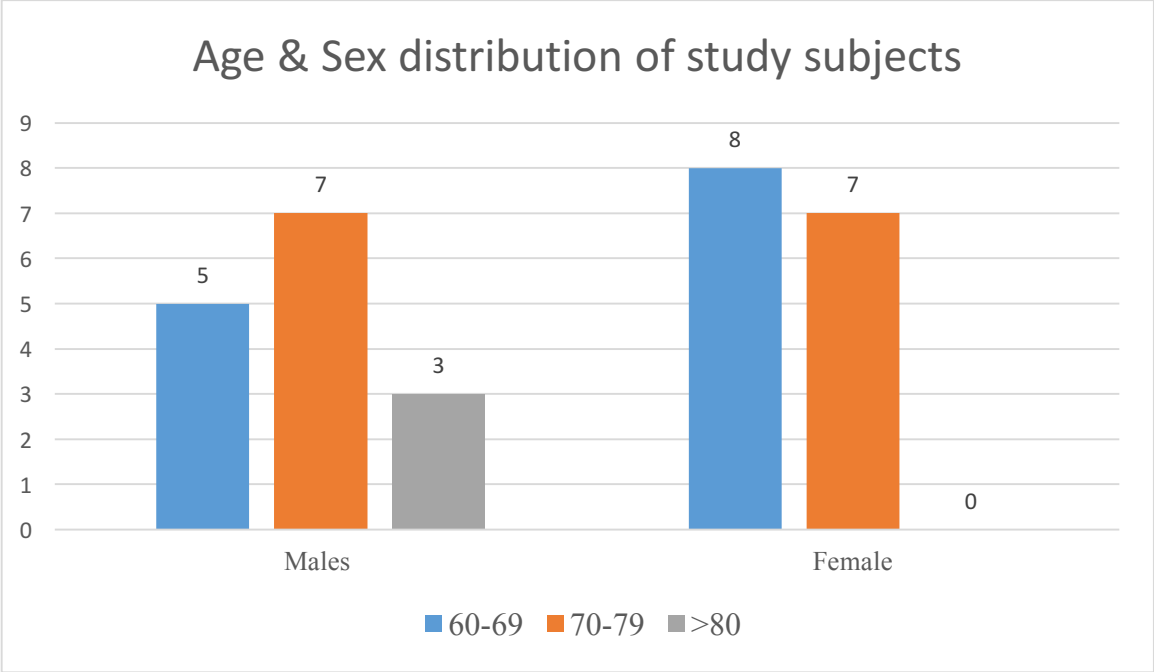
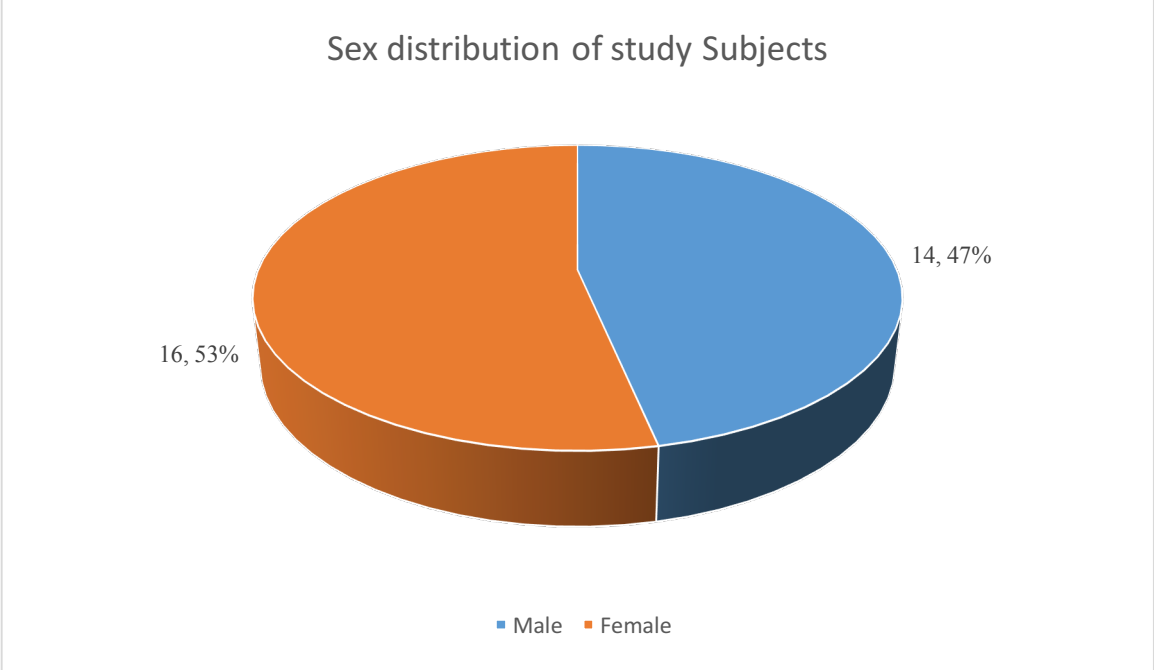



*Figure 2: Sex distribution of study Subjects*



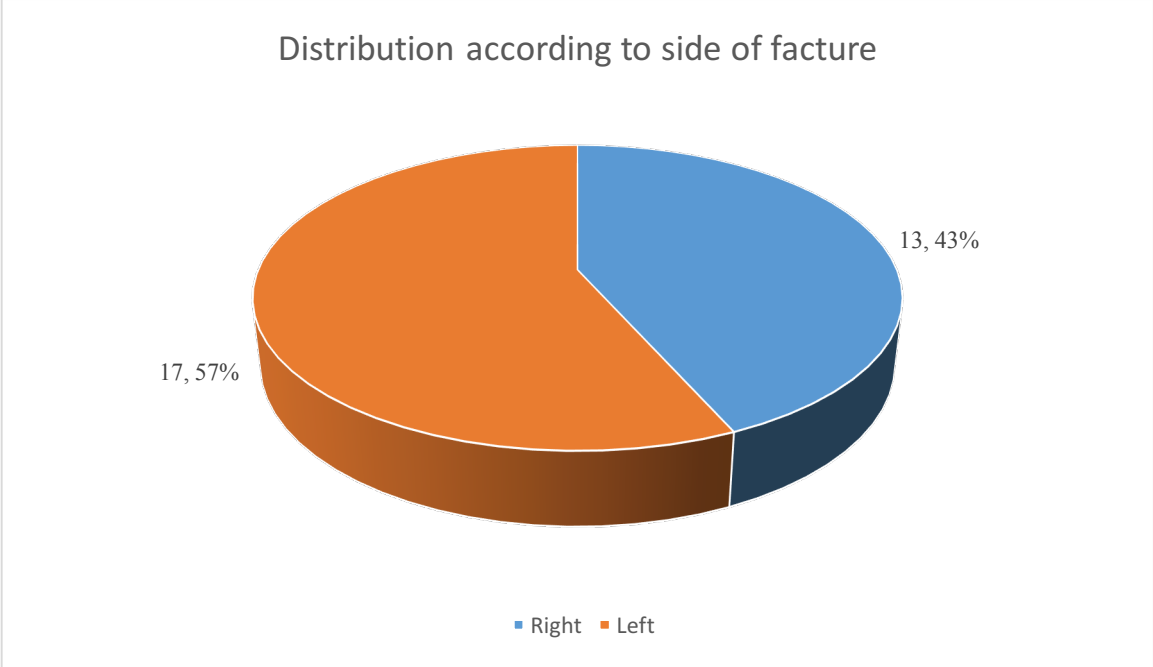
**Side of fracture:**

Left side was more affected than right side. There were 17 patients with left sided fracture and 13 patients suffered fracture on right side.

*Table 3: Distribution according to side of facture.*

| Side of Fracture | Frequency | Percentage |
|---|---|---|
| Right | 13 | 43% |
| Left | 17 | 57% |
| **Total** | **30** | **100** |

*Figure 3:Distribution according to side of facture*



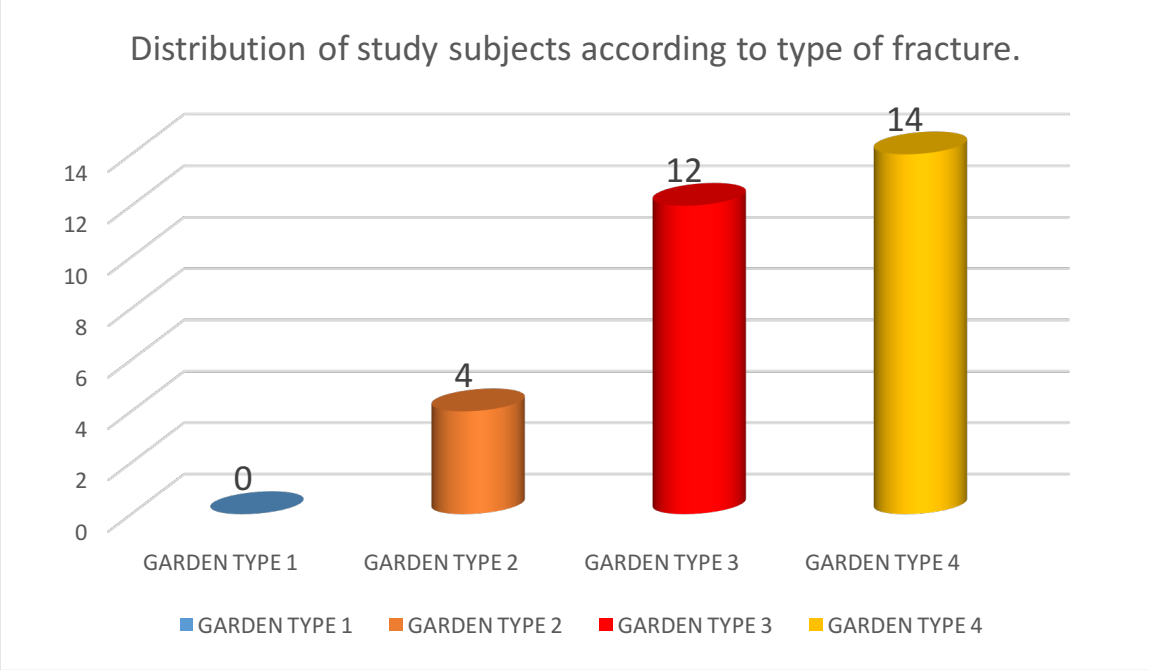
**Type of fracture:**

On radiological examination

*Table 4: Distribution of study subjects according to type of fracture.*

| Radiological Type | No. of Patients | Percentage |
|---|---|---|
| GARDEN TYPE 1 | 0 | 0 |
| GARDEN TYPE 2 | 4 | 13.3 |
| GARDEN TYPE 3 | 12 | 40 |
| GARDEN TYPE 4 | 14 | 46.7 |

*Figure 4:Distribution of study subjects according to type of fracture.*



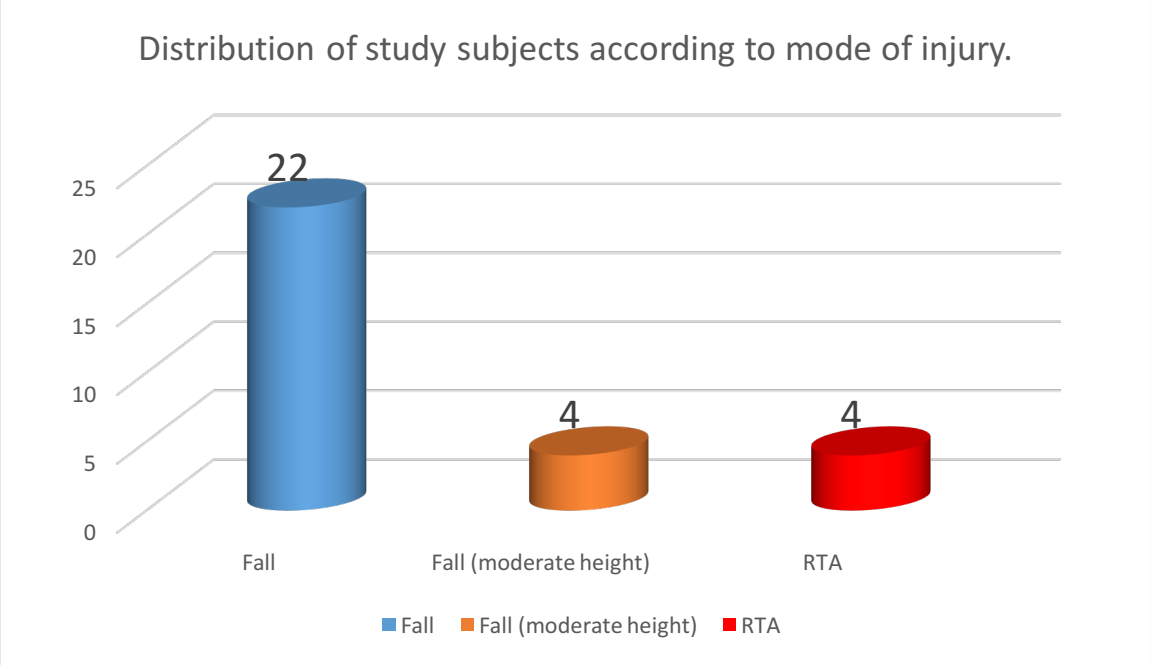
## Mode of injury:

73.4 % of patients suffered fracture following household fall. 13.3% of patients had a fall from moderate height while 13.3% of patients suffered fracture after being involved in RTA.

*Table 5: Distribution of study subjects according to mode of injury*

| Mode of Injury | Frequency | Percent |
|---|---|---|
| Fall | 22 | 73.4 |
| Fall (moderate height) | 4 | 13.3 |
| RTA | 4 | 13.3 |
| **Total** | **30** | **100** |

*Figure 5: Distribution of study subjects according to mode of injury.*



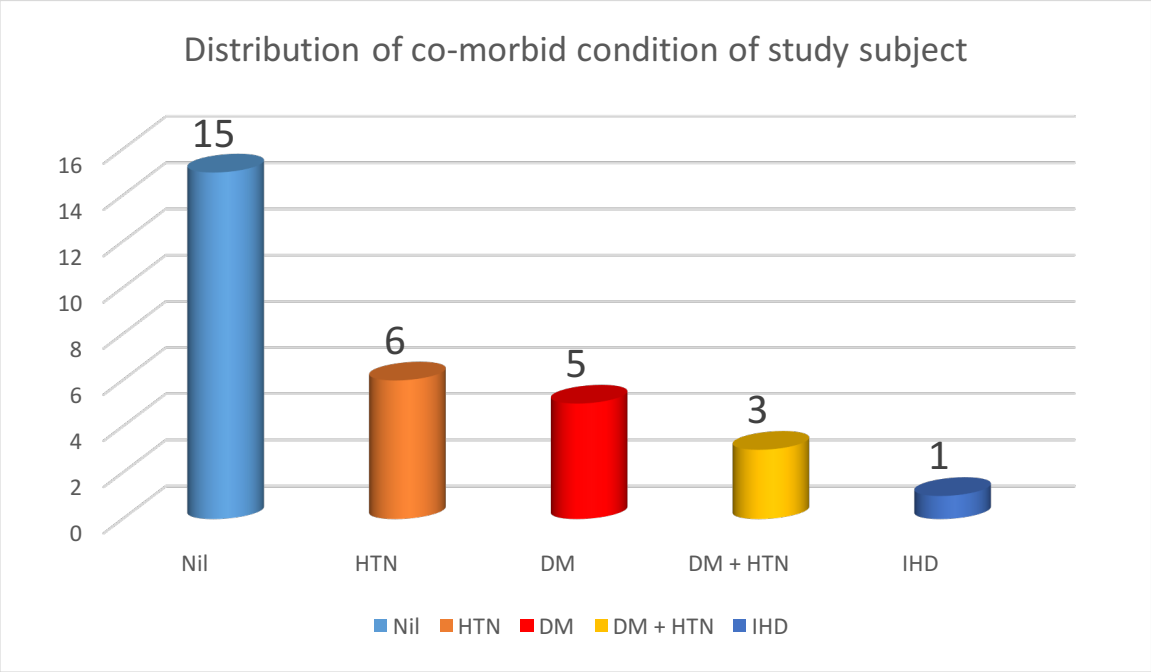
**Associated diseases**:

A total of 50% of patients were suffering from various medical conditions like hypertension, diabetes mellitus, IHD. These patients were given necessary treatment before surgery and taken up for the procedure after they were medically fit.

*Table 6: Distribution of co-morbid condition of study subject*

| Associated disease | Frequency | Percent |
|---|---|---|
| Nil | 15 | 50 |
| HTN | 6 | 20 |
| DM | 5 | 16.7 |
| DM + HTN | 3 | 10 |
| IHD | 1 | 3.3 |
| **Total** | **30** | **100** |

*Figure 6: Distribution of co-morbid condition of study subject*




**Total stay in hospital:**

The minimum duration of hospital stay amongst the study patients was 10 days and maximum duration was 18 days with the average being 14 days.

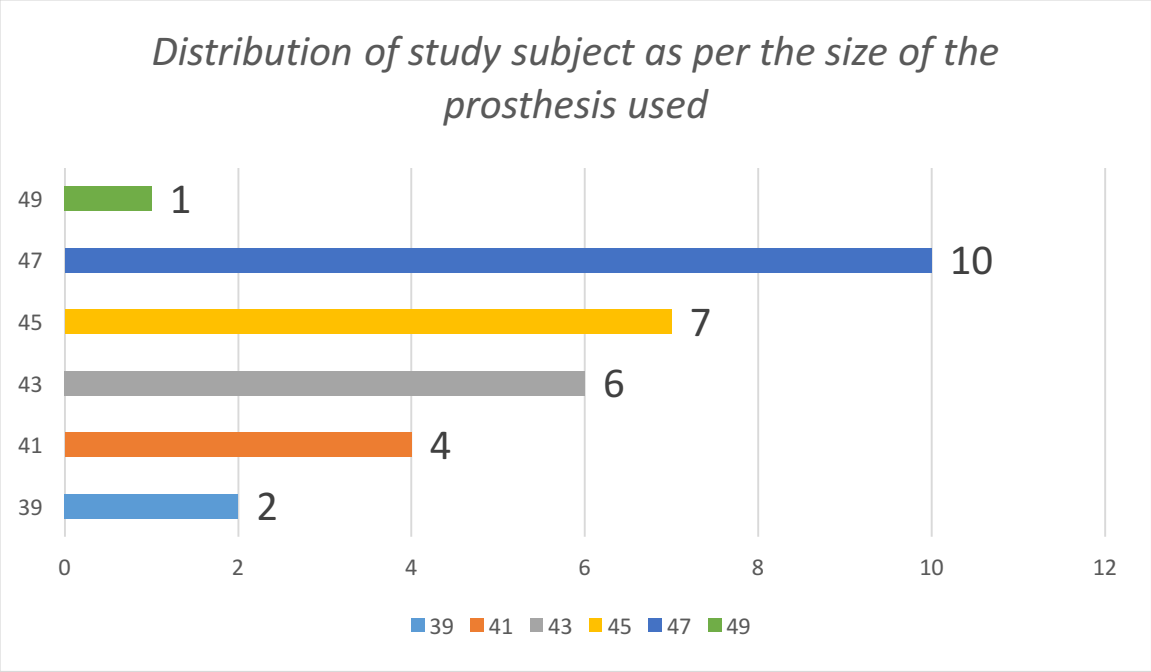
**Size of prosthesis:**

The size of the prosthesis used ranged from 39-55 most commonly used are 45 and 47 as per the study. 47 size in males and 41 size in females commonly used in present series.

*Table 7: Distribution of study subject as per the size of the prosthesis used*

| Head Size In Mm | No of Patients | Percentage |
|---|---|---|
| 39 | 2 | 6.7 |
| 41 | 4 | 13.3 |
| 43 | 6 | 20 |
| 45 | 7 | 23.5 |
| 47 | 10 | 35 |
| 49 | 1 | 3.5 |

*Figure 7: Distribution of study subject as per the size of the prosthesis used*



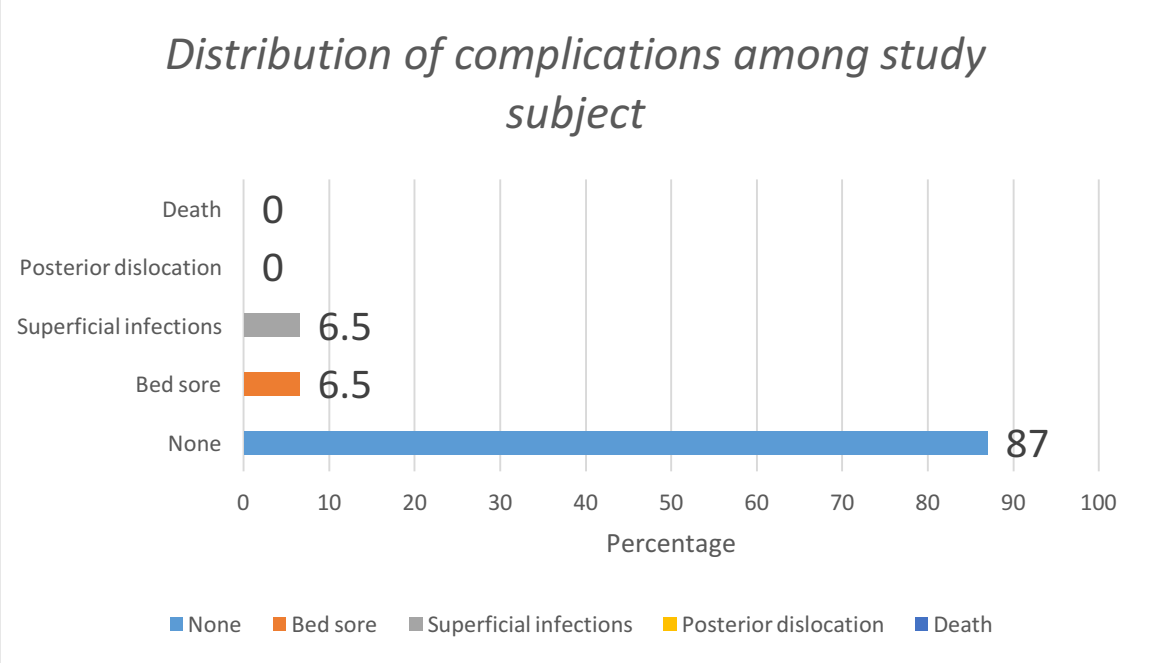
**Complications:**

Two cases had superficial infections and bed sores which are treated with regular dressings and antibiotics. No cases have been recorded with periprosthetic fractures and posterior dislocation

*Table 8: Distribution of complications among study subject*

| COMPLICATIONS | NO OF PATIENTS | PERCENTAGE |
|---|---|---|
| None | 26 | 87 |
| Bed sore | 2 | 6.5 |
| Superficial infections | 2 | 6.5 |
| Posterior dislocation | 0 | 0 |
| Death | 0 | 0 |

*Figure 8: Distribution of complications among study subject*

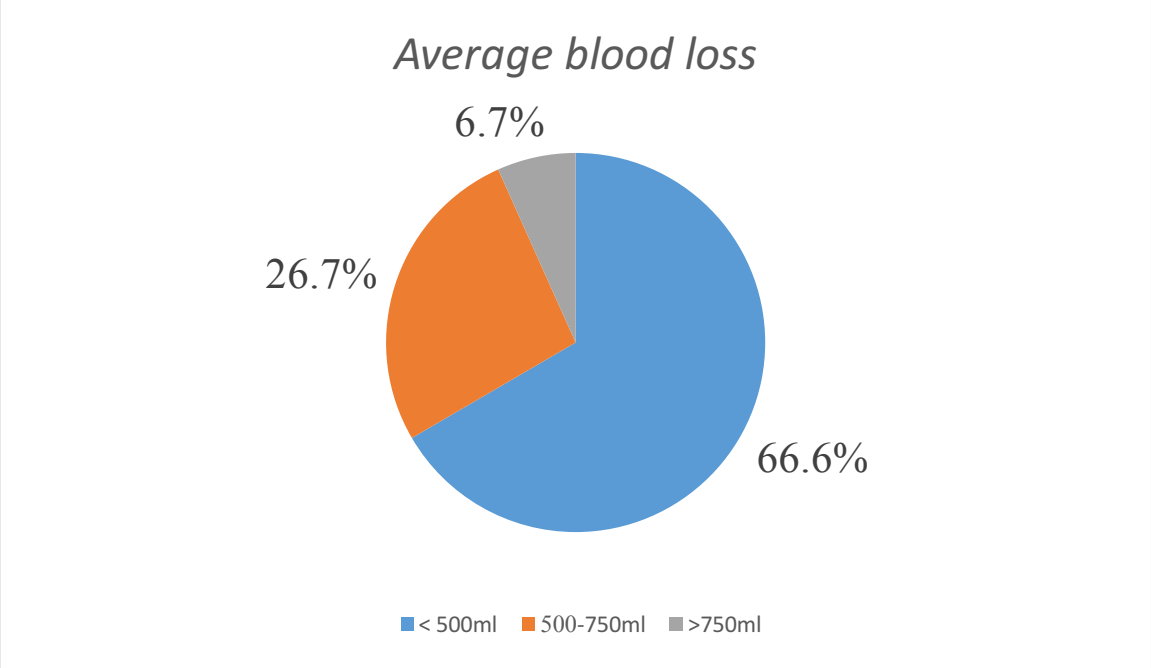


**Blood loss:**

*Table 9: Distribution of average blood loss during the procedure among study subjects.*

| Average Blood Loss | No. of patients | Percentage |
|---|---|---|
| < 500ml | 20 | 66.6 |
| 500-750ml | 8 | 26.7 |
| >750ml | 2 | 6.7 |

*Figure 9: Distribution of average blood loss during the procedure among study subjects.*



**TIMING OF SURGERY:**

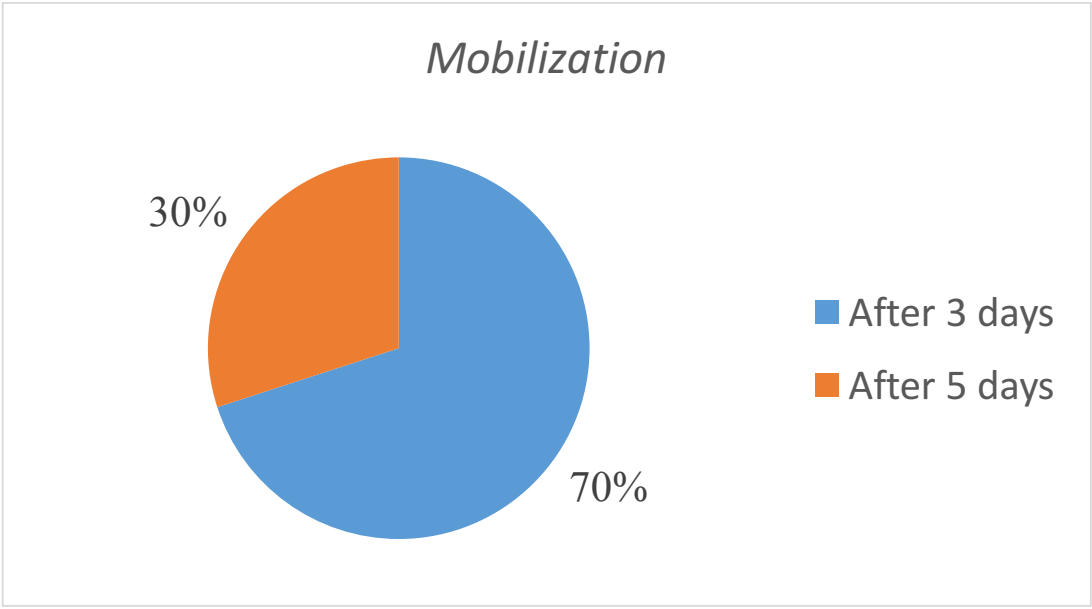
All the study patients were taken up for the surgical procedure between the 3rd and 7th day after the presentation, the average delay to surgery being 5days.

**Ambulation after surgery:**

*Table 10: Distribution of subject according to ambulation after surgery*

| | No of Patients | Percentage |
|---|---|---|
| Patients who ambulated 3days after surgery | 21 | 70% |
| Patients who ambulated 5 days after surgery | 9 | 30% |

*Figure 10:Distribution of subject according to ambulation after surgery*



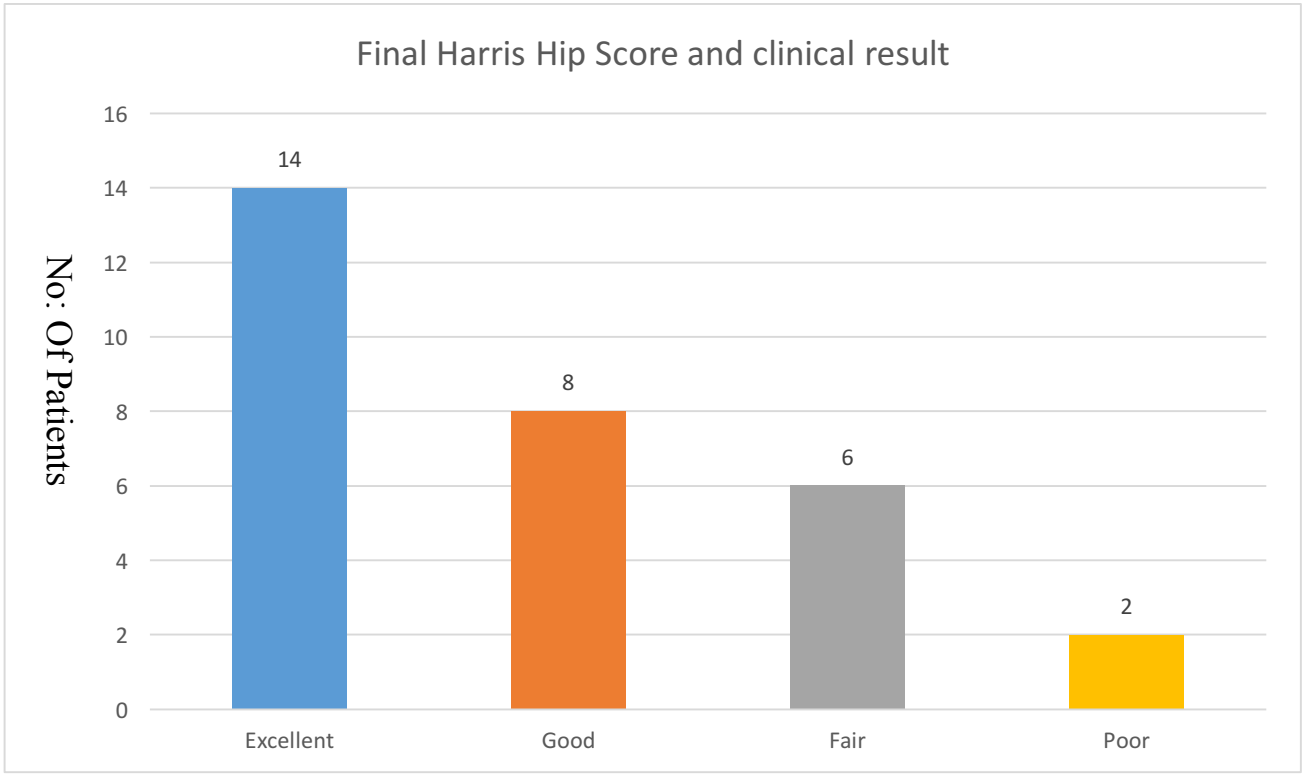
## HARRIS HIP SCORE

## FINAL HARRIS HIP SCORE AND CLINICAL RESULT

*Table 11: Final Harris Hip Score and clinical result*

| | Harris Hip Score | No. of patients | Percentage |
|---|---|---|---|
| Excellent | 90-100 | 14 | 46.7 |
| Good | 80-89 | 8 | 26.7 |
| Fair | 70-79 | 6 | 20 |
| Poor | <70 | 2 | 6.6 |

*Figure 11 Harris hip score and clinical results*



# DISCUSSION

Fracture neck of femur is still an unsolved enigma for an orthopaedic surgeon. Results have been variable with various modalities of treatment which includes osteosynthesis, hemireplacement and total hip replacement. Since osteosynthesis is not a very good idea for elderly population, as secondary procedure may be required on its failure and elderly patients may not be able to tolerate effects of second surgery, prosthetic replacement has become a popular choice among surgeons. Also in a developing country like ours, total hip arthroplasty is not preferred as primary procedure as it is technically more demanding and expensive. Hence hemireplacement procedure continues to be a favoured option.

With this as an idea we undertook the present study to evaluate the immediate results of hemiarthroplasty in fracture neck of the femur using Austin Moore Prosthesis keeping in view of living condition of an average Indian.

## Age Distribution

The average age of present series was 69.43. Majority of the patients were between 65-75 years.

*Table 12: Mean age of patients who underwent prosthetic replacement*

| Authors | Mean Age |
|---|---|
| Salvatti et al. (1973)[38] | 59 years |
| AK Mishra(2013)[40] | 67years |
| Anshu S(2013)[41] | 78.2 years |
| Kishore Roy(2014)[43] | 72.5 years |
| Anil B.Dhule(2014)[44] | 67 years |
| Laghari M(2014)[46] | 65 years |
| Mau Daniel (2015)[47] | 70 years |
| Shah SA,(2015)[48] | 69 years |
| **Present study** | **69.43 years** |

**Sex Incidence**

In present study, the intracapsular fracture of femoral neck were found to be more common in females. The elderly females are more prone to fracture neck of femur due to osteoporosis. **Female predominance** has been reported in several series. Essoh J.B (2006)[35]: 83.3%, Syed Shahid Noor (2010)[39]: 56.7%; AK Mishra(2013)[40]: 57.5%; Anshu S (2013)[41]: 59%; Keren Amit (2014)[42]: 73.75%; Anil B. Dhule (2014)[44] : 60%, C.Costache (12014)[45]: 62%. **Male predominence** reported in few series: D'Acry and Devas (1976)[23]: 91.4%; Kishore Roy(2014)[43]: 52%; Saeed Ali Shah (2015)[48]: 72%; Mue Daniel (2015)[47]: 65.71%. In our series 57% of the patients were females.

**Side of Fracture**

The left sided hip was fractured in 17 patients (53%) of present series. This has been a subject of limited studies. D'Acry and Devas (1976)[23]: 55.4% on left side. Kishore Roy (2014)[43:] 68% fractures on left side. Saeed Ali Shan (2015)[48] found 55% fracture in left hip of their patients.

**Type of Fracture**

Most of all fractures in present series belonged to displaced fractures of Garden type III and IV. Depending on the anteroposterior radiographs available, we could group 4 patients Garden type II (13.3%), 12 patients (40%) into type III, 14 patients (46.7%) into Garden type IV.

Saeed Ali Shah (2015)[48] with total cases of 100 reported as type III (65%) and type IV (35%). Karen Amit (2014)[42] reported 30% Garden type III and 62.5% Garden type IV. Essoh J.B(2006)[35] reported as 27(32.1%) grade III and 57(67.9%) grade IV.

**Associated Medical Problems**

The common associated problem in present series were hypertension, diabetes mellitus and IHD. 50% of our patients had one or more problems. Ischemic heart diseases are common in western series, which are not found so common in present series. The patients with ischaemic heart disease most of the time do not agree for anaesthetic risk. On the present study one patient has taken up to surgery on high risk consent. The mild ischaemia in hypertensive old patients was not grouped separately. Hypertension, diabetes mellitus was commonly detected during the examination with fracture neck of femur.

*Table 13: Comparison of associated medical problem with other studies and present study*

| No. | Associated Medical Problem | Mau Daniel (2015)[47] | D'Acry & Devas(1976)[23] | Keren Amit (2014)[42] | Present Series |
|---|---|---|---|---|---|
| 1. | Cardiovascular | | 14.6% | 13.5% | |
| 2. | Hypertension | 28.6 % | 5.5 % | 33% | 20 % |
| 3. | Ischemic heart Disease | | 5.5 % | 11.4% | 3.3% |
| 4. | Hypertension + Diabetes mellitus | 11.4% | 4.4 % | 15 % | |
| 5. | Diabetes mellitus | 2.9 % | 4.4 % | 11.4% | 16.7 % |

**Size of Prosthesis:**

The size of the prosthesis used ranged from 39-49 most commonly used are 45 and 47 as per the study. 41 is size common in females and 47 is size common in males in present series. Mau Daniel (2015), most frequency used size were (44-46 mm) with 52.8% cumulative use. Majority (85.8%) patients of the smaller sized prosthesis (42-45) were used by women while (80%) patients men used the larger sizes (46-52 mm) [73, 74].

**Hospital Stay:**

In present series hospital stay ranges from 10 days to 18 days with a mean average of 14days. Mau Daniel (2015)[47]: the mean duration was 16 (13-

34) days. No case was operated as an emergency and all were thoroughly prepared before surgery. Fifty percent of our patients who had various medical problems. Patients with various medical illness were treated for their respective condition and then taken up for surgery. Patients who developed complications such as infection, bedsore etc., in the post-operative period had to stay longer in the hospital Early ambulation and comparatively less hospital stay following hemiarthroplasty has also been reported in other series.

**Mortality**

No operative deaths in present series. Ak Mishra (2013)[40] in their series noted 4% of mortality due to bed sore with sepsis. The mortality reported in various series are shown in table.

*Table 14: mortality reports in other studies*

| Investigator | No. of patients | Mean Age | Time | Percentage |
|---|---|---|---|---|
| Moore1957 | 153 | 60-70 | operative | 1.9 |
| | | | 6 months | 16.6 |
| Stinchfield and Cooperman (1957) | 14 | 72 | 1 year | 22.2 |
| Addison (1959) | 54 | 79 | 6 weeks | 30 |
| Dinesh Dhar (2007)[37] | 52 | | 15 months | 23 |
| Saeed Ali Shah (2015)[48] | 100 | 69 | 6 months | 19 |
| Essoh J.B(2006)[35] | 84 | | 6 months | 8.3 |

In the Indian series, available death rate is not very high. The mortality rate in present series is nil which is comparable to that of others. Low mortality is probably due to proper selection of cases. When majority of the deaths in western series were due to cardiac problems, we had only one case with established ischaemic heart disease who underwent hemiarthroplasty. Low death rate may be also due to proper management of the associated medical problems preoperatively, use of antibiotics routinely and early mobilization.

**Sepsis:**

In present series, only 2 patients (6.5%) had superficial wound infection. The patient was diabetic and non-hypertensive. She developed signs of infection in the first week of operation. She was treated with proper antibiotics and dressings. There were no cases of deep infection in present series. All these infections were found when the patients were still in the hospital and this resulted in prolongation of their hospital stay.

Superficial infection is due to urinary tract infection which was treated and discharged. Superficial infection could be successfully treated with antibiotics, local measures and drainage. Deep infections most of the time need removal of the prosthesis. Early deep infections may present as an

acute, potentially fatal clinical course with septic shock to mild low grade pain in the thigh or groin. Ayub Lahari (2014)[46], have reported extremely high mortality following infection of the prosthesis.

**Dislocation of the Prosthesis**

In present series, there was no case of posterior dislocation of the prosthesis. Salvatti et al. (1974)[38] believed that excessive postoperative flexion or rotation with hip adducted is the main cause for dislocation of the prosthesis and they also observed that dislocation was commonly caused while shifting the patients from the operation theatre to the ward.

| **Investigator** | **Percentage** |
|---|---|
| Salvatti et al (1973) | 2.8 |
| Saraf & Saxena (1978) | 2.4 |
| Stavrakis (2008)[38] | 2.5% |
| Karen Amit(2014)[42] | 1.25% |
| Saeed Ali Shah (2015)[48] | 5% |
| Present study | Nil |

**Total functional results**

Various criteria were used to assess the functional results following hemiarthroplasty. Assessment should include how the patient has attained the pre-fracture state. Indian population need more range of motions at hip when compared to western population as there is need for squatting or sitting cross legged for various purposes.

The results at average of 6 months after hemiarthroplasty in present series was analysed by modified Harris hip scoring system. The results are compared with the available western and Indian series where hemiarthroplasty was done for the treatment of fracture neck of femur in elderly patients.

*Table 15: Percentage of functional results following hemiarthroplasty for fracture neck of the femur*

| **Investigator** | **No. of patients** | **Excellent** | **Good** | **Fair** | **Poor** |
|---|---|---|---|---|---|
| Salvatti et al (1964)[38] | 251 | 31 | 26 | 25 | 8 |
| Anshu S (2013)[41] | 47 | 43.5 | 38.4 | 11.3 | 6.8 |
| Kishore Roy (2014)[43] | 44 | 68.18 | 22.72 | 6.81 | 4 |
| Ayub Laghari (2014)[46] | 50 | 44.44 | 26.66 | 20 | 8.88 |
| Mue Daniel (2015)[47] | 35 | 46 | 31 | 17 | 6 |
| Saeed Ali Shan (2015)[48] | 100 | 32.5 | 42.70 | 16.30 | 8.40 |
| **Present series** | **30** | **46.7** | **26.7** | **20** | **6.6** |

The difference between excellent and good results are minimal and therefore they can be grouped together as good results. In the series above they are: Salvatti et al[38]:57%; Anshu S (2013)[41] 81.9 Kishore Roy (2014)[43]: 91%; Ayub Laghari (2014)[46]: 71.70%; Mue Daniel (2015)[47]: 77%, and in our series 73.44%. Present results are comparable with other series.

**Limb–length discrepancy**

Observations made regarding leg length discrepancy are shown in table below. It was ranging from 0.5 – 1.5 cms and corrected by shoe raising.

*Table 16: Distribution of the study objects by limb length discrepancy*

| Limb length discrepancy (in cms) | Frequency | Percent |
|---|---|---|
| Nil | 19 | 63.3 |
| 0.5 | 4 | 13.3 |
| 1.0 | 5 | 16.7 |
| 1.5 | 2 | 6.7 |
| **Total** | 30 | 100.0 |

# CONCLUSION

Thirty cases of fracture neck of femur in elderly patients above the age of 60 years treated by hemiarthroplasty using either Austin Moore's prosthesis in the Department of Orthopaedics at R L JALAPPA HOSPITAL AND RESEARCH CENTRE between October 2014 to October 2016. The cases were followed up for 6 months and the short term functional results were analysed by using modified Harris hip scoring system.

At the end of 6 months, the functional results are analysed in 30 cases. The patients were in the age group of 60 to 85 years with average age of 69.43 years. Females were predominant. Majority of the fractures were Garden type III and IV. There were 46.7% excellent results and 26.7% good results, fair results were seen in another 20%. Poor results were seen in 6% of cases. The poor results (6%) were due to moderate to marked pain in the hip or thigh after hemiarthroplasty.

The success of hemiarthroplasty no doubt depends on preoperative planning and proper attention to surgical details to achieve the optimum biomechanical stability.

We conclude that hemiarthroplasty for fracture neck of femur is a good option in elderly patients. The mortality and morbidity are not high, operative procedure is simple, complications are less disabling. Early functional results are satisfactory. The complications are less disabling, weight bearing is early, early functional results are satisfactory and second operation is less frequently required. This study included 30 patients which may be a small number to give a statistically significant opinion. The cases were studied with a follow-up ranging from 3 weeks to 6 months only.

Our early and short term results are encouraging and promising, long term results will be studied in future and compared with other long term follow up studies.

# SUMMARY


- 30 cases of displaced intracapsular fracture neck of femur treated with Austin Moore hemiarthroplasty were studied.
- Average age of the patient was 69.43 years.
- Incidence of femoral neck fracture was higher in females (53%)
- Left side was more commonly involved in 57%.
- Trivial trauma was found to be the commonest cause of injury due to senile osteoporosis.
- Average hospital stay was 14 days.
- Early post-operative complications included superficial infections and bed sore in 2 cases
- Average follow-up was 11 months with a range of 4 weeks to 22 months.
- Excellent to good results were found in 73.4, fair in 20 % and poor in 6.6%.
- Early mobilization and weight bearing is possible.

- Prosthetic replacement avoids the problem of avascular necrosis and non-union.

- Austin Moore prosthesis is cost effective procedure, simple and provides good results

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# PROFORMA

## ROLE OF AUSTIN MOORE PROSTHESIS IN INTRACAPSULAR FRACTURE NECK OF FEMUR IN ELDERLY

NAME

AGE SEX HOSPITAL NO

OCCUPATION

ADDRESS

MOBILE NO

I. COMPLAINTS

1. Pain in the hip- Right / Left
2. Inability to walk after the injury
3. History of trauma and duration
4. Any other complaint

II. History of present illness

Pain

a. Site

b. On set- sudden / gradual

c. Nature – continuous / intermittent

d. Radiating to knee – Yes / No

e. Relation with movement – increase / no change

Ability to walk

a. Not able to walk
b. Able to walk- with support / without support

Mechanism of injury Trivial

a. Falling on a slippery floor
b. Missing a step and falling
c. Fall from a bicycle

Violent

a. Road traffic accident
b. Fall from height

Treatment received before coming to the hospital and method of first aid given.

III. PAST HISTORY

a. Hypertension
b. Diabetes Mellitus
c. Pulmonary Tuberculosis
d. Ischemic heart disease
e. Any other disease

IV. FAMILY AND PERSONAL HISTORY

a. Married / unmarried
b. Smoker/ non-smoker
c. Alcoholic / Non-alcoholic
d. Vegetarian / Non-vegetarian / Mixed

e. Bladder and Bowel functions : Normal / Altered

f. Nature of work

g. Menstrual history

V. GENERAL PHYSICAL EXAMINATION

Built – well / moderate / poor

Nourishment – well / moderate / poor

Height-

Weight-

Anaemia, clubbing, lymphadenopathy, cyanosis

Temperature – febrile / afebrile

Pulse-rate, volume, rhythm, blood pressure-

Respiratory rate.

VI. SYSTEMIC EXAMINATION

1. Cardio –vascular system
2. Respiratory system
3. Per-Abdomen
4. Central nervous System

VII. LOCAL EXAMINATION

1. GAIT
2. INSPECTION
   a. Anterior superior iliac spine-same level / raised /
   b. Lumbar lordosis yes / no

c. Attitude of limb
d. Apparent shortening- yes/no
e. Swelling around the hip yes/no
f. Muscular wasting yes/no
g. Skin changes scar—

3. PALPATION

a. Tenderness--- yes/no
b. Local rise of temperature--- yes/no
c. Broadening/migration of greater trochanter --- yes/no
d. Swelling
e. Vascular sign of Narth – yes/no
f. Crepitus- yes/no
g. Transmitted movement- yes/no

4. MOVEMENT

Active

Passive

a. Flexion
b. Extension
c. Adduction
d. Abduction
e. External rotation
f. Internal rotation

5. MEASUREMENT

I. Length of the limb Normal Diseased

a. Apparent length
b. Total length(true)
c. Thigh segment
d. Leg segment
e. Girth of the limb

II. Shortening above the greater trochanter

Normal Diseased

a. Bryant's triangle
b. Nelalon's line
c. Chiene's line
d. Shoemaker's line

VIII. INVESTIGATION

1. X-RAY hip Anterio-posterio and lateral view (Garden's type)
2. Chest x-ray posterio- anterio view.
3. ECG
4. Blood routine
    a. RBS
    b. Blood urea
    c. Serum creatinine
    d. Blood grouping and typing
    e. Bleeding time
    f. Clothing time
5. Urine routine

6. Specific investigation (if required)

Liver function test

Renal function test

IX. DIAGNOSIS

X. INDICATION FOR SURGERY

XI. SIZE OF AUSTIN MOORE PROSTHESIS USED.

XII. APPROACH USED

XIII. ANESTHESIA USED --------- SPINAL/ GENERAL

XIV. INTRAOPERATIVE PROBLEMS

XV. POST- OPERATIVE MANAGEMENT

XVI. COMPLICATIONS

XVII. FOLLOW UP

1. Weeks

6 Weeks

12 Weeks

16 Weeks

24 Weeks

# PATIENT INFORMATION SHEET

## STUDY TITLE:

A PROSPECTIVE STUDY for investigating the functional outcome of intracapsular fracture neck of femur treated with hemiarthoplasty using Austin Moore prosthesis.

**STUDY SITE:** R.L Jalappa hospital, Tamaka, Kolar.

## AIM-

To document the functional outcome following surgical management of fractures neck of femur treated with Austin Moore prosthesis in patients of age 60 years and above at the Department of Orthopaedic, in R L J hospital using Harris Hip Score criteria as excellent/ satisfactory / poor.

Subjective and objective study of clinical parameters like pain, comfort to the patients, early mobilization, operative techniques, , stages of weight bearing till complete recovery and any associated complications by using Austin Moore prosthesis.

Patient with fracture neck of femur above 60 years of age will be selected.

Please read the following information and discuss with your family members. You can ask any questions regarding the study. If you agree to participate in this study, we will collect information (as per proforma) from you. Routine (CBC, CRP, Urine Routine) and Relevant blood investigations, radiological investigation will be carried out if required. This information collected will be used for dissertation and publication only.

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

For any further clarification you can contact the study investigator:

**Dr. Mizanur Rahaman**

**Mobile no: 9008930768**

**E-mail id: miza007@yahoo.co.in**

# CONSENT

I…….....aged …… unreservedly and in my full senses here by give my consent to take part in above mentioned study which include undergoing a procedure (surgery) Hemiarthoplasty with Austin Moore prosthetic and screening for x-ray of hip and femur pre operatively and post operatively during follow up visits.

The nature and risks involved in the procedures surgical and anaesthetic have been explained to me in my own understandable language, to my satisfaction. For academic and scientific purpose, the operation/procedure may be photographed or telecasted or used for statistical measurements. I am willing to pay for the investigations required for the procedure and anaesthesia.

I hereby give my consent for the same.

Signature of the subject

Date:

# MASTER CHART

| Sl No | NAME | Hospital no | Age | Sex | Side of fracture | Mode Of Injury | GARDEN CLASSIFICATION | SIZE OF AMP | Co - morbidity | Complications | Results |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Narayanamma | 61806 | 70 | Female | Left | RTA | IV | 47 | Nil | Nil | Excellent |
| 2 | Noor Ahmed | 234126 | 70 | Male | Right | Slippery | III | 45 | Nil | NIl | Fair |
| 3 | Venkatamma | 135523 | 60 | Female | Right | Slippery | IV | 43 | Nil | Nil | Good |
| 4 | Hanumappa | 29806 | 85 | Male | Left | Fall | III | 47 | HTN | Bed sore | Poor |
| 5 | Kavitamma | 125453 | 78 | Female | Right | Slippery | IV | 39 | Nil | Nil | Excellent |
| 6 | Venkataranamappa | 123120 | 78 | Male | Left | Fall | IV | 47 | Nil | Nil | Excellent |
| 7 | Thayanaamma | 43284 | 70 | Female | Right | RTA | IV | 47 | DM | Nil | Excellent |
| 8 | Muniyappa | 161516 | 71 | Male | Left | Fall | III | 43 | Nil | Nil | Excellent |
| 9 | Narasamma | 133294 | 77 | Female | Right | Fall | III | 39 | IHD | Nil | Good |
| 10 | Mumtaj begum | 140728 | 65 | Female | Left | RTA | II | 41 | Nil | Nil | Excellent |
| 11 | Chinamma | 120546 | 80 | Female | Left | Slippery | IV | 47 | HTN | Nil | Fair |
| 12 | Anitha | 67376 | 70 | Female | Left | Fall | II | 45 | DM | Nil | Fair |
| 13 | Venkathamma | 135523 | 60 | Female | Right | Fall | IV | 47 | Nil | Nil | Excellent |
| 14 | Narayanamma | 29892 | 60 | Female | Right | Fall | IV | 47 | Nil | Nil | Fair |
| 15 | Mudamma | 62692 | 78 | Female | Right | RTA | II | 45 | HTN | Nil | Excellent |
| 16 | Sulachanamma | 86278 | 85 | Female | left | Fall | IV | 47 | HTN | Bed sore | Poor |
| 17 | Muniyamma | 221161 | 70 | Female | Left | Fall | III | 45 | DM + HTN | Superficial infection | Good |
| 18 | Vasu | 30157 | 62 | Male | left | Fall | III | 47 | Nil | Nil | Good |
| 19 | Shravan | 809321 | 65 | Male | Left | Fall | IV | 45 | Nil | Nil | Excellent |
| 20 | Syed abdul basher | 215452 | 63 | Male | Left | Fall | IV | 41 | Nil | Nil | Excellent |
| 21 | Munivenkatanna | 264121 | 60 | Female | Left | Fall | IV | 45 | Nil | Nil | Excellent |
| 22 | Lokhnath | 457833 | 64 | Male | Right | Fall | III | 45 | DM | Nil | Excellent |
| 23 | Lakshman | 375551 | 65 | Male | Right | Fall | IV | 43 | DM + HTN | Superficial infection | Good |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | Chinnamma | 326281 | 67 | Female | Left | Fall | IV | 47 | DM | Nil | Good |
| 25 | Krishnappa | 327580 | 60 | Male | Right | Fall | III | 41 | Nil | Nil | Excellent |
| 26 | Anjanamma | 318817 | 75 | Female | Left | Fall | II | 41 | HTN | Nil | Good |
| 27 | Muniswamappa | 131813 | 65 | Male | Right | Fall | III | 43 | Nil | Nil | Excellent |
| 28 | Venkateshappa | 283707 | 78 | Male | Left | Fall | III | 49 | DM + HTN | Nil | Fair |
| 29 | Ramani | 24872 | 70 | Female | Left | Fall | III | 43 | | Nil | Fair |
| 30 | Govindappa | 250890 | 76 | Male | Right | Fall | III | 43 | HTN | Nil | Good |