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Bipolar hemiarthroplasty for fracture of femoral neck: Clinical review with Special emphasis on prosthetic motion by radiological evaluation

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Abstract

Aim: To assess Bipolar hemiarthroplasty for fracture of femoral neck: clinical review with special emphasis on prosthetic motion by radiological evaluation.

Material and method: All the patients were assessed post-operative radiologically at 1 ½, 3 and 6 months follow up period. All patients were evaluated with a detailed history especially whether there were any medical conditions associated with the occurrence of the injury like epilepsy, stroke, diabetic mellitus, cardiac ailments etc. Any external wounds were noted. Diagnosis was established clinically and confirmed by radiographs. Through local and systemic clinical examinations was carried out and skin traction was applied to affected extremity haemodynamic status of patients was assessed and treated accordingly. Diabetic and hypertensive status was noted and brought under control before surgery.

Result: Motion between inner and outer component also occurred during initial and late phase but comparatively less than expected. Taking all these findings into consideration we have come to the conclusion that though theoretically it was expected that the motion between inner and outer component should be more than outer component and the acetabulum.

Conclusion: In contrast, the outer joint, which consists of a horseshoe-shaped acetabulum and a round acetabular cup, is not perfectly congruent and can contain some synovial fluid. Thus, the outer joint is more lubricated than the inner joint, and motion is more likely to occur at the outer joint.

Keywords: parathyroid insufficiency, thyroid swellings

Introduction

Fracture Neck Femur in elderly patient is still an unsolved problem. The problem of fractures is one of the oldest in orthopaedics. Despite numerous technical advances the goal to return all patients to full function has remained elusive. The marked improvement in socioeconomic conditions and quality of life has resulted improvement in life expectancy and so increased incidence of fracture neck femur and other hip disorders like senile osteoarthritis. Though an array of implants and prosthesis are currently available the dilemma or right choice of treatment for right patient remains.

It has been estimated that 1.3 million hip fractures occurred in 1990 worldwide a figure that is expected to double by 2025 and increase to 4.5 million by 2050. Approximately half of these fractures will be intracapsular, and occur in patients aged approximately 80 years, of whom 75% affected will be female. The management of displaced intracapsular femoral neck fracture in physiologically active patients remains a matter of hot debate, and thus is called 'unresolved fracture'.

Prosthetic replacement of the femoral head and neck is now almost always the treatment of choice for displaced intracapsular fractures in elderly patient. Hemiarthroplasty of hip was ushered into wide spread use in 1943 by Moore and Bohlman. Since then primary prosthetic replacement has gone along way evolving in terms of different prosthetic designs as well as indications for replacement. In 1960 a Burmese orthopaedic surgeon, Dr. San Baw, pioneered the use of ivory hip prostheses to replace ununited fractures of the neck of femur ("hip bones"), when he first used an ivory prosthesis to replace the fractured hip bone of an 83 year old Burmese Buddhist nun. Originally this prosthesis had three components to be assembled at time of surgery. The inner head diameter was 22 mm.

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Different fits of stem were available. Biomechanically this prosthesis was more perfect, in sense that it had cup rotating along with outer cup in the acetabulum. The essence of arthroplasty is to restore function of a joint. In our country, indigenous bipolar prosthesis was made in early 80's. This was then marketed as an alternative to Austin – Moore prosthesis. Since their development a decade ago, bipolar replacements of the femoral head have gained popularity for the treatment of fractures of the femoral neck. Bipolar prostheses were originally designed to give an increased range of motion (ROM) and a decreased risk of dislocation compared to unipolar prostheses. It was hoped that the bipolar femoral head would diminish acetabular wear, decrease the rate of failure, and produce a painless arthroplasty. In addition, since most of the arc of motion was expected to occur at the inner articulation, where the coefficient of friction was lowest, the incidence of dislocation was expected to diminish.

The unipolar prostheses were generally satisfactory, but with time, some caused pain, which was attributed to wear of the acetabular cartilage; some became loose; and sometimes progressive protrusio acetabuli developed. A polyethylene bearing UHHWPE insert articulates with the head, and the insert is covered with a metal bearing surface that articulates with the acetabulum. This design is intended to distribute the forces at the site of the inner articulation (between the metal femoral head and the polyethylene insert) and at the site of the outer articulation (between the outer metal surface of the insert and the acetabulum).

Material and Method

The study was conducted at Krishna institute of medical sciences, Karad in department of orthopaedics from 1st September 2008 to 28th February 2010. Cases were selected with fracture neck femur, attending OPD of Krishna institute of medical sciences, Karad.

All the patients were assessed post-operative radiologically at 1 ½, 3 and 6 months follow up period. All patients were evaluated with a detailed history especially whether there were any medical conditions associated with the occurrence of the injury like epilepsy, stroke, diabetic mellitus, cardiac ailments etc. Any external wounds were noted. Diagnosis was established clinically and confirmed by radiographs. Through local and systemic clinical examinations was carried out and skin traction was applied to affected extremity haemodynamic status of patients was assessed and treated accordingly. Diabetic and hypertensive status was noted and brought under control before surgery.

X – ray with both hips AP view and lateral view of affected side were taken to evaluate the type of fracture neck femur, to evaluate the calcar size and to evaluate the osteoporotic condition of the bone and the medullary canal size to decide whether patient will need cementing or not. Selected cases – CT scan for head injury and complete cardiac checkup was a routine protocol for known patients with heart problems. Patient is made to stand on the dice in front of the x- ray film with the ray tube in front of the pelvis, keeping the foot scale between two legs for abduction films. At first patient is made to stand in neutral position with both toes touching each other and patella facing forwards. Thirdly patient was made to abduct his/her normal limb to 40 degrees with full weight bearing. Fourthly patient was made to adduct the operated limb to the affected side at 20 degrees. The inner cortex diameter 10 cm below the most medial aspect of lesser trochanter is divided by the inner cortex diameter at the most medial aspect of lesser trochanter. This gives Door's ratio. The ratio is approximately 50 % in normal patient. The CC

ratio greater than 75 % has been recommended to be a relative contraindication to non-cemented hemiarthroplasty.

Result

In our study we used series of x rays in neutral, abduction 20 degrees abduction 40 degrees and adduction 20 degrees. All the patients were assessed post-operative radiologically at 1 ½, 3 and 6 months. Results were graded by measuring the angles between inner and outer component and the outer component and acetabulum as described before. In our study, there were 25 patients with transcervical fracture neck femur and 5 with subcapital fracture neck femur. We came only with complication of dislocation in 2 patients out of 30 patients. 25 patients were discharged on 11th day post-operative. While 5 patients were discharged on 14th day post-operatively.

We studied the frictional behaviour of bipolar prosthesis and the motion of the bipolar prosthesis for fracture neck femur in elderly patients above 60 yrs of age. It was seen that maximum motion occurs between the outer component and acetabulum even in extreme range of motions. It has been postulated that most hip motion occurs at the inner bearing in bipolar hip prosthesis. However, radiography analyses have shown that the inner bearing is not always the primary articulation. Most of the motion during mid abduction, full abduction, adduction occurred more in the acetabulum and outer cup, during initial phase and also in the late phase. Motion between inner and outer component also occurred during initial and late phase but comparatively less than expected. Taking all these findings into consideration we have come to the conclusion that though theoretically it was expected that the motion between inner and outer component should be more than outer component and the acetabulum. In our study it was shown that motion between outer component and the acetabulum supercedes the motion between inner and outer component and this pattern was followed upto 6 months of postoperative period.

Discussion

The aim of the present study is to study the component motion in bipolar prosthesis in elderly patients with intracapsular fracture neck femur. The intracapsular fracture of neck of femur is common fracture in osteoporotic elderly patients. Treatment of these fractures evolved over period of time from conservative treatment to reduction and internal fixation to partial or total replacement of hip joint.

Historically these fractures were treated longitudinal and lateral traction for 6-8 weeks followed by non – weight bearing for next 6-12 months. Withman introduced, closed reduction and spica cast. Both these methods associated high rate malunion and non-union and especially fatal complications like pulmonary embolism secondary to DVT especially in elderly patients and bad bed sores. Open reduction and internal fixation with pins and screws in elderly patients also gave poor results mainly due to osteoporosis and vicarious blood supply of femoral neck. It produced complications like malunion and avascular necrosis.

Fenestrated bipolar prosthesis were used in this study. All prostheses have fixed size stem and variable head size from 37mm to 51mm with neck shaft angle of 135°. All of our patients were from low or middle socio – economic status. The aim of the surgery was to restore the anatomy of proximal femur as regards to horizontal, vertical offset and neck shaft angle as close to normal as possible to lend as an almost normal hip functions. This study attempts to evaluate the motion between the acetabulum and the outer cup and between inner component and the outer cup. At an average

follow upto 6 months the motions were evaluated radiologically. Around 85% of patients were in their 5th and 6th decades. This is significant because of the relatively higher level of activities and greater functional demands of these patients as compared to 8th and 9th decade who were not that active, were fragile and less demanding.

The average age in our study was 65 years. This is comparable to population studied by other workers like vezquez-vela *et al*, Cornell CN *et al.*, Mc Corville *et al*. The mean duration of hospitalization in our study was 11 days. If patient was doing fine and no problem was anticipated, patient was discharged 10 days after surgery. In our study right side predominates i.e various hip pathology are right sided in 19 patient and left sided in 11 patients with one patient was having bilateral hip affection.

In our series, the rate of dislocation is 0.6 %. This rate is comparable with the rates of Bednarek *et al.* and Bowmann A.J *et al.* series. This significantly lower rate of dislocation can be attributed to the inherent stability of the prosthesis and specific technique and post – operative protocol strictly followed. It has been shown that use of knee brace in post-operative period in patients in whom posterior approach is used has shown to reduce rate of dislocation probably the routine use of knee brace in this study has reduced the rate of dislocation. During hospital stay, post-operatively patients were made to walk using walkers. Quadriceps and hip abduction exercises were also given extensively to strengthen lower limb musculature. One patients had 11 days of average hospital stay which is good in way they go back to their normal level of activities.

The maximum and minimum degrees of motion observed in the patients in adduction 20 degrees in frequent follow ups, between inner and outer component and outer component and acetabulum. The maximum and minimum degrees of motion observed in the patients in abduction 20 degrees in frequent follow ups, between inner and outer component and outer component and acetabulum. The maximum and minimum degrees of motion observed in the patients in abduction 20 degrees in frequent follow ups, between inner and outer component and outer component and acetabulum. In our study 2 patient had dislocation of prosthesis. All these are fairly comparable with any standard studies mentioned earlier.

Conclusion

To our knowledge, the causative factors have not yet been clearly defined. Two factors can be suggested to cause the preponderance of outer motion. We found that outer motion was induced by an impingement of the femoral neck on the liner. Structural differences between the inner and outer joint also caused a preponderance of outer joint motion. When weight is applied, all the synovial fluid will be pressed out to the synovial pocket and the frictional torque of the inner joint becomes greater than that of the outer joint. In contrast, the outer joint, which consists of a horseshoe-shaped acetabulum and a round acetabular cup, is not perfectly congruent and can contain some synovial fluid. Thus, the outer joint is more lubricated than the inner joint, and motion is more likely to occur at the outer joint.

Conflict of Interest: No conflict of interest

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