

Is there a significant difference in surgery and outcomes between unipolar and bipolar hip hemiarthroplasty? - A Prospective Study

Mohammad Faisal^{*1} and Prithviraj Nistane²

¹(MS Orth), Associate Professor and Head of Unit, Department of Orthopaedics, Indira Gandhi Govt. Medical College, CA Road, Nagpur, Maharashtra, India

²(MS, DNB orth), Assistant Professor, Department of Orthopaedics, Indira Gandhi Govt. Medical College, CA Road, Nagpur, Maharashtra, India

***Correspondence Info:**

Dr. Mohammad Faisal, (MS Orth)

Prime Nursing Home, 25,

Ahabab Colony, in front of Anant Nagar Bus Stop,

Behind Police Line Takli, Nagpur-13

E-mail: drfaisalm@yahoo.com

Abstract

Fracture neck of femur remains an unsolved problem till today and is a common orthopaedic problem in old age. Various methods of treatment have been employ but without a universally accepted procedure. In our study the outcomes of cemented Bipolar Hemi Arthroplasty (BHA) over the Austin Moors Prosthesis Arthroplasty (AMP) were compared. Our study was conducted from May 2014 to April 2016 at a tertiary care centre. 30 patients with intra capsular fracture neck of the femur were treated with AMP and 30 patients were treated with BHA. Clinical and radiological follow up was done.

In results the mean follow up was two years (range six months - two and half years). At latest follow up, the Harris Hip Score in AMP group was 76.4 (range 74 - 86) and in BHA it was 92 (range 80 - 96). Hip and groin pain was reported in 2 patients in uncemented BHA and 6 patients in AMP but did not limit activity in both the groups. Subsidence of the prosthesis less than 5mm was seen in 8 cases in AMP and none in BHA. Two cases of protrusio acetabuli were reported in AMP group. In conclusion, the patients with fracture intracapsular neck of the femur treated by cemented BHA have better outcomes as compared to patients treated with AMP.

Keywords: Austin Moors Prosthesis, Bipolar Hemi Arthroplasty, Protrusio Acetabuli and Subsidence of the stem.

1. Introduction

Femoral neck fractures are a common insufficiency fracture in the elderly. Management of the Fracture neck of femur is challenging for orthopaedic surgeons for the years all over the world. Various methods of treatment have been employed but without an universally accepted procedure. Hip hemiarthroplasty is associated with better functional outcomes than internal fixation in the treatment of displaced fractures of the femoral neck in elderly patients [1]. Thus, femoral head replacement surgery is preferred in the elderly for displaced fracture neck femur. Some controversy surrounds which prosthesis (unipolar versus bipolar) is better in the management of these fractures. The bipolar hip prosthesis has theoretical advantages in that it is modular and has two articulating surfaces, with a reportedly lower incidence of perioperative complication of dislocation. However, it is also more expensive and technically demanding. Use of cement can cause intra-

operative problems as well as difficulties in revision surgery. BHA is often a versatile and durable solution for fracture neck of the femur providing rapid return of function with a pain free hip. In addition it is less expensive and easy to perform than Total Hip Arthroplasty [2,3]. The objective of this study is to evaluate the functional outcome of fracture neck of the femur managed by AMP in comparison with BHA.

In BHA acetabular wear is diminished through reduction of total amount of motion that occurs between the acetabular cartilage and metallic outer shell by a second low friction inner bearing within the implant. Because of compound bearing surface, bipolar designs provide overall range of motion than either unipolar designs or conventional Total Hip Arthroplasty.[4,5] The unique self centering feature of BHA reduces the chances of dislocation of prosthesis at the extremes of motion and fracture of poly ethylene bearing. BHA rests on the calcar

and its shoulder abuts the calcar femorale and transmits the stress of weight bearing to the shaft via the calcar. Cement less insertion generally produces strains in the bone that are more physiological than those caused by fully cemented stems, depending on the stem size and the extent of porous coating. Dislocation of the prosthesis is very rare with BHA compared to Unipolar prosthesis (AMP) or Total Hip Replacement. Too long neck, excessive antiversion or retroversion and varus can cause pain. These can be prevented by precise technique in selecting, seating and placing of the prosthesis. The single assembly in BHA is safer system with the implant encasing a multiple bearing insert locked in place. BHA may be used as cemented or cementless arthroplasty. The large contact area and the two planes of rotation reduce the wear and tear at acetabular surface and preserve the native acetabulum and acetabular cartilage. The positive eccentricity of centre of rotation in BHA corrects the alignment. The advantage of BHA is self locking action i.e. the fenestrations in the prosthesis permit ingrowth of bone over time which enhances the fixation. There is little data available comparing unipolar (Austin Moore Prosthesis – AMP) and bipolar hip hemiarthroplasties (BHA). The objective of this study was to find out whether the outcomes in patients of fracture neck of femur managed with cemented BHA are better than those treated with uncemented AMP.

2. Materials and Methods

An observational prospective study was conducted on the patients with displaced intra-capsular neck femur fractures admitted in the orthopedics department. Ethical clearance was obtained from the institutional ethics committee. The study period was 2 year from May 2014 to April 2016. The study was conducted among the study population after obtaining written informed consent. Our study population consisted of 60 patients (30 in each group). Out of 60 cases, 50 were treated cemented BHA and rest 30 by AMP.

2.1 Inclusion criteria

- 1) Patients above 60 years of age with displaced intracapsular fracture neck of femur
- 2) Sub capital and Trans cervical fractures
- 3) Garden types 3 and 4, Pauwells type 1 and 2, AO types B1 - B3,

2.2 Exclusion criteria

- 1) Patients unfit for the surgery
- 2) Pathological/ bilateral fractures
- 3) Patients who had less than 2 years of follow-up
- 4) Pre-existing hip/femoral deformity
- 5) Basicervical fractures

Pre operatively, a skin traction was applied with 3 kgs of weight with aim of relieving pain and preventing

proximal migration. Oral / parenteral NSAIDS were given to relieve pain. Necessary pre-operative investigations and optimization was done. Associated medical illnesses like DM, HTN, IHD, COPD etc were managed. Certain exercises like deep breathing exercises, static quadriceps exercises, ankle movement and hip exercises were started pre-operatively.

2.3 Operative Method

Prophylactic antibiotics given one hour prior to incision. All surgeries were performed in joint replacement OT using standard aseptic precautions. The surgical approach we used is Moore's / Southern in lateral position, patient lying on unaffected side. At least one finger breadth of calcar was left behind. A bipolar prosthesis was fixed with use of cement (Figure 1 and 2) whereas AMP was used in uncemented manner (Figure 3 and 4). Joint capsule and short external rotators were sutured before closing the wound in layers with suction drain. In old cases, adductor tenotomy was done.



Figure 1: Intra-capsular fracture neck femur



Figure 2: Bipolar hemiarthroplasty



Figure 3: Intra-capsular fracture neck femur



Figure 4: AMP hemiarthroplasty

2.4 Post-Operative Care

To prevent DVT, as prophylaxis, chemical and mechanical methods were used. Surgical site suction drain was removed after 24 hr. The wound was inspected on the 3rd and 6th post-operative day. Stitches were removed on the 11th-13th day. From third post-operative day patients are allowed weight bearing depending on their pain tolerance and encouraged to walk thereafter. Sitting cross legged and squatting were not allowed for 3 to 4 months. All patients were followed up at 6 weeks, 3 months, 6 months and 1 year.

The outcome was calculated on Harris hip score as follows -

- <70 Points - Poor
- 70-79 Points – Fair
- 80-89 Points - Good
- 90-100 Points - Excellent

3. Observations and Results

Average follow up in our study was 36.5 weeks (range 6 - 40 weeks). Out of 60 cases, all patients in the study returned for clinical and radiological examination at regular intervals. They were reviewed at 6 weeks, 3 months, 6 months and 1 year. Of these 60 cases, 28 were grade III Garden, 32 were grade IV Garden. Of these, 8 patients were between 50 - 60 years, 40 patients were between 61 - 70 years and 12 patients were between 71 - 80 years. The mechanism of injury causing femoral neck fracture was trivial trauma in most cases (80%), few cases (20%) are due to RTA.

In our study, in BHA group, of 30 cases, 22 patients (73%) had excellent results, 6 patients had good results (20%) and 2 patients had fair results (7%). In AMP group, excellent result was seen in 14 cases (47%), good in 10 cases (33%) and fair 6 cases (20%). None of our patients had poor result. (Table 1)

Table 1: Harris hip scores at latest follow up

Harris Hip score	BHA group	AMP group
Excellent	73 %	47 %
Good	06 %	33 %
Fair	07%	20 %
Poor	Nil	Nil

The average Harris hip score for all pts in our study is 87.65. In BHA group, maximum Harris hip score was 94 and minimum Harris hip score was 86 and in AMP group average Harris hip score was 77, maximum being 84 and minimum 72. There was 1 case with superficial infection which subsided with IT antibiotics and local debridement. There was no deep infection, dislocation or protrusio acetabuli. It was observed that cemented stems in BHA prevented the chances of fracture in osteoporotic bones, subsidence and delay in full weight bearing as compared to AMP. Clinical and radiological assessment was done about the limb length discrepancy, loosening of the prosthesis, varus, deformity, acetabular protrusio and subsidence of the stem. The average Harris hip score in our study is 87.65.

4. Discussion

In an observational study published by Pasco, it was noted that the management of hip fractures continued to generate significant costs throughout the year.[6] The prevailing numbers of hip fractures at present and the expected rise in number in the future due to aging population indicates that the control of costs of care for femoral neck fractures is a serious challenge for clinicians and healthcare administrators alike. Orthopaedics surgeons must choose the optimal procedure and implant for each patient, bearing in mind costs, pre-morbid ambulatory status, rehabilitative potential, quality of life, and life expectancy. The choice of unipolar or bipolar hip prosthesis should therefore be tailored to the needs of the patient and the availability of financial resources. The development of the bipolar hemiarthroplasty was based in part on clinical experience with the unipolar model. Austin Moore developed the stainless steel monopolar arthroplasty in 1942 and in 1952 Thompson introduced a similar implant made of cobalt chrome alloy. Both prostheses are still in common use today. Modularity of the bipolar implant ensures a better fit in leg length and femur size compared to “two sizes fit all” in the unipolar model. Bipolar design also dissipates joint forces through the inner bearing surfaces thereby decreasing the rate of superior acetabular erosion and the incidence of pain. In addition, the combined arc of motion of the bipolar implant reduces the incidence of dislocation.

Lastly, the bipolar choice allows for an easier conversion to a total hip arthroplasty as the femoral component is then already in place.[7] Calder compared the unipolar and bipolar prosthesis for displaced intracapsular fracture in octogenarians and the results did not favour the use of the more expensive bipolar in patients more than 80 years old; further, there was no statistical difference between the rate of complications in the two groups two years after operation. The degree of return to the pre-injury state was also significantly greater when using the unipolar prosthesis.[8]

Other studies suggest the use of unipolar prosthesis is advised in elderly patients due to the low demand on the implant, and that there is no difference in functional hip scores between the two prosthesis.[9,10] Owing to the limited life expectancy of elderly patients, the mortality rate associated with hip fracture as well as cost of the bipolar implant is skewed depending on which outcome measurement was used. The mortality rate in previous studies averages to 6.8% and this has not changed significantly in the past 10 years when compared with previous local studies. [11]

Lee *et al* followed up a group of 70 patients with a hip fracture for one year and reported 25.4% mortality for surgical patients.[10] The overall hip dislocation, superficial wound infection and implant infection rates in our study are 2%, 2% and 1% respectively, results that are comparable with other published studies [9]. There are several limitations in our study including the facts that this was a non randomised prospective study and there was no algorithm used in choosing an implant (unipolar or bipolar hip hemiarthroplasty) for each patient. The 24-month followup period is also short. The difference in complication rates of aseptic loosening and acetabular protrusion between these two groups is likely to increase with longer term follow-up.

The concept of dual bearing surfaces offers considerable advantages. It results in sharing of motion at the two surfaces and hence, reduction of net wears and tears at either surface, thus reducing the erosion at the acetabular joint surface. In addition the total range of movement at the joint is increased. Mean Harris hip score for bipolar prosthesis in our study was 87.5 and in unipolar arthroplasty it was 77. There was no deterioration of results over the period of the study during which we have found no incidence of protrusion acetabuli.

According to McConville *et al* [11] anterior thigh pain attributed to the femoral component loosening would be decreased by the use of proportionately sized femoral components and use of cement when indicated especially in DORR type C femoral canals. In our study we have not found any case of persistent anterior thigh pain or evidence of loosening of the prosthesis or subsidence of

stem in cemented ones. Infection rate in other series was 2.63 %. We had one case of superficial infection. There was no mortality in our study. Other complications like fracture of endoprosthetic stem or fracture of the polyethylene cup have not occurred in our series.

5. Conclusion

The study concludes that bipolar hip prosthesis offers a long term solution in old age and in patients with neglected, displaced intra-capsular neck femur fracture compared to Austin Moor's prosthesis.

The procedure has the following advantages -

- 1) It offers excellent, pain less mobility and ease of rehabilitation and return to early function.
- 2) These achievements surpass the result of other methods of treatment for intra-capsular neck femur fracture in the elderly and in neglected cases of physiologically younger patients.
- 3) The surgery is relatively easy to perform, takes less operating time with less blood loss, hence safer.
- 4) The bipolar hip prosthesis in our study had excellent results.
- 5) The durability of the implant and potential for preservation of acetabular cartilage allow this prosthesis to be used in physiological younger and more active patients.
- 6) The low rate of complication when compared to unipolar prosthesis indicates the superiority of the implant.
- 7) The potential for its use in varied indications and in different age groups show the versatility of the implants.

As the acetabular erosion and protrusion appear to have been reduced to some extent, the bipolar hip prosthesis is a good alternative to conventional unipolar prosthesis in intra-capsular neck femur fracture in the elderly. Patients who underwent bipolar replacement with cemented prosthesis had better pain relief and function than patients who had uncemented unipolar prosthesis (AMP) at a minimum of 24 months after surgery.

References

- [1] Wong M K, Arjandas K S, Ching L K *et al*. Osteoporotic hip fractures in Singapore – costs and patient's outcome, *Ann Acad Med Singapore* 2002; 31(1): 3-7.
- [2] Lestrange N R. Bipolar arthroplasty for 496 hip fractures, *Clin Orthop Relat Res*1990; (251): 7-19.
- [3] Gilbert M S, Capozzi J K. Unipolar or bipolar prosthesis for the displaced intracapsular hip fracture? An unanswered question, *Clin Orthop Relat Res* 1998; (353): 81-5

- [4] Dorr L D, Glousman R H, Hoy A L, Vanis R, Chandler R. Treatment of femoral neck fractures with total hip replacement versus cemented and noncemented hemioarthroplasty, *J Arthroplasty* 1986; 1:21-8.
- [5] Raia F J, Chapman C B, Herrera M F, Schweppe M W, Michelsen C B, Rosenwasser M P. Unipolar or bipolar hemiarthroplasty for femoral neck fractures in the elderly?, *Clin Orthop Relat Res* 2003; 4(14): 259-65.
- [6] Pasco J A, Sanders K M, Hoekstra F M, Henry M J, Nicholson G C, Kotowicz M A. The human cost of fracture, *Osteoporos Int* 2005; 16(12): 2046-52.
- [7] Cornell C N, Levine D, O'Doherty J, Lyden J. Unipolar versus bipolar hemiarthroplasty for the treatment of femoral neck fractures in the elderly. *Clin Orthop Relat Res* 1998; 4(14): 67-71.
- [8] Calder S J, Anderson G H, Jagger C, Harper W M, Gregg P J. Unipolar or Bipolar Prosthesis for displaced intracapsular hip fracture in octogenarians: a randomized prospective study, *J Bone Joint Surg [Br]* 1996; 78(3): 391-4.
- [9] Ong B C, Maurer S G, Aharonoff G B, Zuckerman J D, Koval K J. Unipolar versus bipolar hemiarthroplasty: functional outcome after femoral neck fracture at a minimum of thirty six months of follow up, *J Orthop Trauma* 2002; 16(5): 317-22.
- [10] Lee K H, Lim Y W, Wu Y J, Lam K S. Mortality after proximal hip fracture in the Singapore population, *Hip International* 2005; 15:166-70.
- [11] McConville O R, Bowman A J, Kilfoyle R M, McConville J F, Mayo R A. Bipolar Hemiarthroplasty in Degenerative Arthritis of the Hip 100 Consecutive Cases, *Clin Orthop Relat Res* 1990; 251: 67-74.