



ORIGINAL RESEARCH PAPER

Orthopaedics

A PROSPECTIVE STUDY IN SURGICAL MANAGEMENT OF NECK OF FEMUR FRACTURE USING CEMENTLESS MODULAR BIPOLAR PROSTHESIS

KEY WORDS: Neck of femur fractures, hemiarthroplasty, uncemented, Harris Hip Score

Devashish Mendiratta

Mohammad Rashid*

*Corresponding Author

Shakeeb Mohammed Shariff

Vanditha Muralidhar

Mohammad Rashid.

ABSTRACT

Hip fractures are one of the most common injuries, mainly seen in the elderly in the emergency setting. It can also be seen in young patients like athletics or one who met with a high energy trauma. The objective of treatment of NOF fractures in mobile elderly population is early restoration of premorbid walking ability and quality of life. The modular prosthesis allows adjustment of neck length with interchangeable stems. It can be converted to a total hip replacement easily because only the acetabular component is added. Cemented prostheses are associated with increased incidence of perioperative morbidity (like hemodynamic instability, deep vein thrombosis, cardiopulmonary complications etc.) and mortality. Cementless stems do not lead to such complications and therefore have no chance of so-called 'cement reaction' or bone cement implantation syndrome (BCIS). The purpose of this study is to assess the functional and quality of life scores in patients with intracapsular fracture of the femoral neck treated by uncemented hemiarthroplasty (UCHA) using modular bipolar prosthesis. **MATERIALS AND METHODS** Patients having femoral neck fracture were admitted to Bapuji Hospital and Chigateri General Hospital, attached to J.J.M. Medical College, Davangere, Karnataka were taken for this study after obtaining their consent. This is a prospective study from October 2018 to October 2019.

OBJECTIVES OF THE STUDY

- To assess the functional outcome of Neck of femur fractures with cementless modular bipolar prosthesis.
- To study the end results of cementless modular bipolar prosthesis with respect to pain, mobility and stability.
- To study the complications of cementless modular bipolar hemiarthroplasty.

RESULTS Data was collected based on detailed patient evaluation with respect to history, clinical examination and radiological examination. Out of the 20 cases, all patients were available for follow up till one year which was taken as a basic pre-requisite for inclusion in the study. In our study, the final Harris Hip Score calculated at the end of one year follow-up averaged 85.4 with the maximum score being 95 and the minimum score being 63. Our study data showed that 8 patients (40%) achieved Excellent result at the end of 1 year of the surgery, 7 patients (35%) achieved Good result, 3 patients (15%) achieved fair result and 2 patients (10%) achieved poor result. Overall, 75 % of the patients achieved an excellent or good result. Our results are comparable with standard studies done in context of NOF fractures treated with bipolar hemiarthroplasty. Our duration of follow-up being one year is short enough in assessing the longevity and endurance of the modular bipolar prosthesis used. **CONCLUSION** Uncemented Modular Bipolar hemiarthroplasty for femoral neck fractures in the elderly permits early return to premorbid life as it provides better range of movement, freedom from pain and is not associated with any untoward cardiac event in the perioperative period. It can be considered a treatment option in this select group.

INTRODUCTION

Hip fractures are one of the most common injuries, mainly seen in the elderly in the emergency setting. It can also be seen in young patients like athletes or one who met with a high energy trauma. Femoral neck fractures are intracapsular hip fractures. The femoral shaft is connected with the femoral head via femoral neck. The hip joint includes the articulation of the acetabulum with the femoral head. Due to the junctional location of the femoral neck, it is more prone to fracture. The blood supply of the femoral head is an essential consideration in displaced fractures as it runs along the NOF.

In elderly, NOF fractures are associated with low energy falls and in younger patients the cause is usually secondary to high-energy trauma such as a substantial height or RTA.¹⁻² Risk factors for femoral neck fractures include female gender, decreased mobility, and low bone density.³⁻⁴

The life time risk of sustaining a hip fracture is 9% for a female of the age of 50, but this rises to 12% by the age of 70 and 18% by the age of 90 years and in men 2%, 4% and 8% respectively. The neck of femur fracture occurs in two different patient populations. Young patients are included in a very small group (3% to 5%) subjected to high energy trauma. The rest occurs in elderly people and almost 90% of these injuries are due to simple fall from standing position. After the age 30 in women, age specific incidence of hip fracture doubles every 5-6 years reaching to 18 fractures per 1000 per year in women over 85.⁵

In Hemiarthroplasty(HA), femoral head is replaced and the natural acetabulum is retained. It is not a perfect substitute for the natural head, but helps in restoring the joint function and achieving the goals of treatment i.e. minimizing the mortality and morbidity of the patients with help of rehabilitation.

Hemiarthroplasty with cemented implant is associated with increased mortality compared to uncemented hemiarthroplasty.⁶

In modular bipolar prosthesis the primary articulation is at the inner bearing of the prosthesis and not at prosthesis-cartilage interface, hence decreasing the amount of acetabular erosion and pain that the patient encountered and better range of motion (ROM).⁷

The purpose of this study is to assess the functional and quality of life scores in patients with intracapsular fracture of the femoral neck treated by uncemented hemiarthroplasty (UCHA) using modular bipolar prosthesis.

MATERIALS AND METHODS

Source of data : Patients having femoral neck fracture were admitted to Bapuji Hospital and Chigateri General Hospital, attached to J.J.M. Medical College, Davangere were taken for this study after obtaining their consent. This is a prospective study from October 2018 to October 2020 .

Sample size : 20 cases.

Follow-up was taken at 6wks, 6 months and 1 year.

Inclusion criteria :

- Age of patient > 23 years.
- Patients willing and fit for surgery.
- Displaced fractures of the femoral neck. (Garden type III & IV)
- Dorr femoral bone classification type A & B.
- Nonunion, Avascular necrosis of femoral head secondary to fracture of the femoral neck without acetabular involvements.
- Previous failed internal fixations of the neck of femur fractures /unstable intertrochanteric fractures.

Exclusion criteria :

- Patients less than 23 years.
- Patients with arthritic changes involving acetabulum.
- Patients not willing for surgery
- Patients medically unfit for surgery
- Pathological fractures

OPERATIVE PROCEDURE

- **Position :** After induction of either spinal or epidural anaesthesia the patient was placed on the lateral position on the operative table with the affected side facing up.
- **Operative procedure :** A curved incision is taken from 8 cm distal to the posterior superior iliac spine, extended distally and laterally, parallel with fibres of gluteus maximus muscle to the posterior margin of the greater trochanter. The incision is then directed distally 5 -8 cms along the femoral shaft. The deep fascia is exposed and divided in line with the skin incision. By blunt dissection the fibres of the gluteus maximus are separated taking care not to disturb the superior gluteal vessels in the proximal part of the exposure. The gluteus maximum muscle is split and short external rotators are exposed. Stay sutures are applied to the short external rotators, and a tenotomy of the short external rotators is done close to their insertion on the inner surface of the Greater trochanter. The short external rotators are retracted to protect the sciatic nerve and expose the posterior hip capsule. The capsule is incised by a T-shaped incision, and the hip flexed, adducted and internally rotated to dislocate the hip joint. Using a head extractor and bone levers, head is delivered out of the acetabulum and the acetabulum is cleared of debris. The size of the extracted head is measured by using measuring gauze, and the size of prosthesis is selected. Then preparation of proximal femur is done and appropriate sized trial implants are placed. The neck is trimmed leaving 1cm medial calcar,

on which the shoulder of the prosthesis sits. The femoral canal is reamed with increasing sizes of the reamers. The proximal femur was reamed with a rasp, the length of the rasp depends upon to the size of the prosthetic stem to be used. After cortical reaming is done, broaches are placed precisely. The fit of the broach within the canal is assessed. Adequate axial and rotational stability is tested with no motion of the broach in the canal. The direction of the insertion of the rasp and trial implants was ascertained by using the lesser trochanter as a guide to achieve correct seating of the prosthesis in 10-15° anteversion. Then appropriate size of femoral head and bipolar head trial implants was fitted over the trial stem and whole assembly was reduced, and stability and limb length was checked. Once the reduction was satisfactory, the trial implants are replaced with original prostheses. The appropriate sized prosthesis (as measured from trial implants) is inserted into the reamed canal taking care to place it in 10-15° of anteversion. The final seating of the stem is by gentle blows. Adequate seating of the prosthesis on the calcar is visualized directly. Femoral and bipolar heads of same size as trial component is fixed to the stem. The hip joint is reduced by gentle traction with external rotation of the hip and simultaneous manipulation of the head of the prosthesis into the acetabulum. The range of movement in all directions is checked by taking the joint through the whole range of movements. The stability of the prosthesis and its tendency to dislocate is checked by flexing and adducting the hip. The limb is kept in slight abduction and external rotation for suturing of the posterior capsule and anatomical reattachment of the short external rotators. Layer by layer closure is done and a suction drain is placed beneath the gluteus maximus. Haemostasis is maintained throughout the procedure. Skin closure was done with help of staples.

- **Physiotherapy :** All the patients were kept in supine position with the involved lower limb in 20-30° abduction and slight external rotation. The patients were discharged from the hospital on an average of 19 days, minimum being 11 days. Ankle pump and quadriceps exercises were advised for a period of 6 weeks postoperatively.

Instruments used and Intra-Operative Images



Instruments



Painting



Draping



Moore's approach to the hip



Exposure of the fracture site



Extraction of femoral head and measuring head size with the gauge



Rasping of femoral cavity



Placement of the trial components



Original bipolar head



Bipolar head with modular femoral head insert



Modular bipolar head ready for placement



Placement of modular bipolar head over the femoral stem (1)

RESULTS

Age Distribution

The most common age group in our study was 66-75 years which contribute to 50% of the study population with overall mean age of 65.8 years.

Age group (Years)	Number of patients	Percentage (%)
23-50	1	5
50-65	5	25
66-75	12	60
75 and above	2	10

Sex Distribution

Out of 20 patients, 8 patients (40%) were male and 12 were females (60%). This shows females are more affected with neck of femur fracture as compared to males. It shows a female preponderance with a ratio being F:M 3:2

Sex	Number of patients	Percentage (%)
Male	8	40
Female	12	60

Side Distribution

SIDE	NUMBER OF PATIENTS	PERCENTAGE (%)
Right	8	40
Left	12	60

Mode of Injury

In our study, the most common mode of injury is trivial fall i.e. mostly fall at home and includes 13 patients (65%) out of 20, rest 5 patients (25%) sustained injury from fall from height and 2 patients (10%) met with a road traffic accident

Mode of injury	Number of patients	Percentage (%)
Trivial fall	13	65
Fall	5	25
RTA	2	10

Time of presentation after injury

Time of presentation	Number of patients	Percentage (%)
<24 hours	4	20
24hrs-72hrs	12	60
72hrs-1week	2	10
1-3weeks	0	0
>3weeks	2	10

Type of fracture

In the study majority of patients (75%) had a trans-cervical type of fracture with 4 patients having a basicervical and 1 with sub-capital fracture.

Type of fracture	Number of patients	Percentage (%)
Trans cervical	15	75
Basi cervical	4	20
Subcapital	1	5

In our study it was observed that 2 patients (10 %) had heart disease, 4 patients (20%) had diabetes, 3 patients (15%) had COPD, 4 patients (20%) had hypertension and 7 patients (35%) did not have any comorbidity.

Peri operative complications

Complications	Number of patients	Percentage (%)
Technical difficulty	4	20
Intra-op hypotension	0	0
Post-op hypotension	2	10
Fat embolism	0	0

Early post operative complications

Complication	Number of patients	Percentage (%)
Superficial infection	1	5
Limb shortening	2	10

Limb shortening (1-1.5cm) was seen in two patients (10%) one was in old basicervical NOF fracture with failed internal fixation (DHS) and other was an old neglected non-union neck of femur case with gross(4-5 cm) preoperative shortening. These cases were managed with shoe heel risers. Superficial infection in the form of a wound dehiscence was seen in one patient who was a diabetic. Wound debridement and secondary suturing was done along with adequate control of the diabetic status and appropriate antibiotics based on culture-sensitivity results.

Late postoperative complication includes aseptic loosening of implant after one year of surgery which was reported in one patient i.e. 5% of the study group and one patient got periprosthetic fracture after 4 months of initial hemireplacement surgery due to fall at home.

HARRIS HIP SCORE

Grade	Harris hip score	No of patients	Percentage
Excellent	90-100	8	40
Good	80-89	7	35
Fair	70-79	3	15
Poor	<70	2	10

The final Harris Hip Score in this study was evaluated at one year follow-up. The average score being 85.4, with the maximum score of 95 and the minimum score being 63. Overall, 8 patients (40%) achieved Excellent result, 7 patients (35%) achieved Good result, 3 patients (15%) achieved fair result and 2 patients (10%) achieved poor result. 75% of the patients achieved an excellent or good result. The results obtained in our study are comparable with the standard studies.

Case 1

PRE OPERATIVE X RAY : IMMEDIATE POST OP X RAY :



6 WEEKS FOLLOW UP X RAY

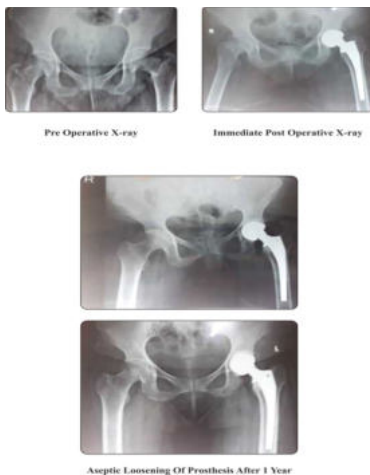


1 YEAR FOLLOW UP X RAY

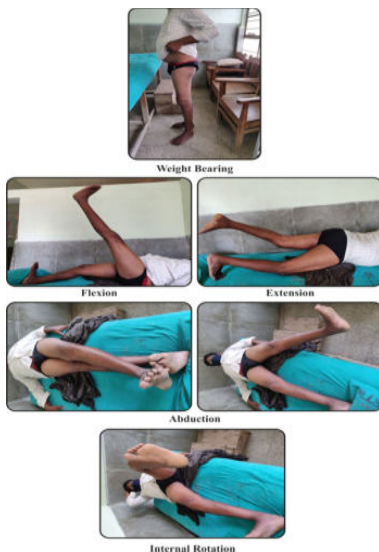
Clinical Pictures



Case 2



Clinical Pictures



DISCUSSION

Fracture neck of femur is a challenge to operate for an orthopaedic surgeon due to variable results when different modalities of treatment are used such as osteosynthesis or hemireplacement. As osteosynthesis is not a good option for elderly population, therefore prosthetic replacement with modular bipolar prosthesis has become a procedure of choice among surgeons especially in old neglected neck of femur fracture without acetabular changes or patient who have life expectancy of more than 10-15 years so that it can easily be converted into total hip arthroplasty. The aim of replacement surgery is early return to daily activities. In this study the mean age of the patients was 65.8 years. The age was recorded to estimate the patient's mean survival time and their ability to comply with rehabilitation protocol. Our study showed that age of the patient had minimal or no influence on the final clinical result. In this study more number of females were seen with the left side more commonly affected than the right. In other studies as mentioned below, left side was more commonly involved.

In our study, the final Harris Hip Score calculated at the end of one year follow-up averaged 85.4 with the maximum score being 95 and the minimum score being 63. Our study data showed that 8 patients (40%) achieved excellent result at the end of 1 year of the surgery, 7 patients (35%) achieved good result, 3 patients (15%) achieved fair result and 2 patients (10%) achieved poor result. Overall, 75 % of the patients achieved an excellent or good result. Our results are comparable with standard studies done in context of NOF fractures treated with bipolar hemiarthroplasty. Our duration of follow-up being one year is short enough in assessing the longevity and endurance of the modular bipolar prosthesis used and hence cannot come to a definitive conclusions. Also we cannot calculate the degree of motion at the inner bearing of the prosthesis i.e. between the bipolar and modular femoral head components. Intra-prosthetic movement assessment is important because there are studies which claim that the motion at the inner bearing reduces over time and after a certain duration most of the bipolar prostheses behave as unipolar prostheses.

CONCLUSION :

Uncemented Modular Bipolar hemiarthroplasty for femoral neck fractures in the elderly permits early return to pre-morbid life as it provides better range of movement, freedom from pain and is not associated with any untoward cardiac event in the perioperative period. It can be considered a treatment option in this select group. Cementless surgeries are safe and can be done in patients with cardiopulmonary complications without risking the harmful effects of cementing. The final functional results depend on the age of the patient, associated comorbidity and optimum post-operative rehabilitation. The advantage of the system is in the modularity obtained from the different sized stems and neck which is available in different sizes which help in obtaining appropriate limb length and the ease with which the system can be convert into total hip arthroplasty without replacing the femoral stem. Uncemented modular hemiarthroplasties had a shorter duration of surgery and thereby lowering the risk of implant infection. The long term results using modular bipolar hemiarthroplasty needs further study for a longer period in a larger sample.

REFERENCES

- 1) Protzman RR, Burkhalter WE. Femoral-neck fractures in young adults. JBJS. 1976 Jul 1;58(6):889-95.
- 2) Johnell O, Kanis JA. An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. Osteoporosis international. 2006 Dec 1;17(12):1726-33.
- 3) Cummings SR, Browner W, Black DM, Nevitt MC, Genant HK, Cauley J, Ensrud K, Scott J, Vogt TM. Bone density at various sites for prediction of hip fractures. The Lancet. 1993 Jan 9;341(8837):72-5.
- 4) Lakstein D, Hendel D, Haimovich Y, Feldbrin Z. Changes in the pattern of fractures of the hip in patients 60 years of age and older between 2001 and 2010: A radiological review. The bone & joint journal. 2013 Sep;95(9):1250-4.

- 5) Robert WB, James DH. Rock wood Green's Fracture in Adults. 5th Edition. LippincotWilliams &Wilkins, 2001.
- 6) Bhat TA, Ali Z, Gulzar A, Mirza F. Cementless bipolar hemiarthroplasty for displaced fracture neck of femur with modular hydroxyapatite coated stem in elderly with cardiopulmonary co-morbidities. International Journal of Research in Medical Sciences. 2017 May;5(5):1862.
- 7) Marya SK, Thukral R, Hasan R, Tripathi M. Cementless bipolar hemiarthroplasty in femoral neck fractures in elderly. Indian journal of orthopaedics. 2011 Jun;45:236-42.