Section: Orthopedics

Original Research Article

A PROSPECTIVE OBSERVATIONAL STUDY OF THE FUNCTIONAL OUTCOME OF UNCEMENTED BIPOLAR HEMIARTHROPLASTY IN NECK OF FEMUR FRACTURES IN A TERTIARY CARE HOSPITAL

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Received *: 15/12/2025*
Received in revised form *: 12/01/2026*
Accepted *: 14/01/2026*

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DOI: 10.70034/ijmedph.2026.1.68

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (1); 380-386

ABSTRACT

Background: Hemiarthroplasty is the treatment for displaced femoral neck fractures in elderly patients. When compared with osteosynthesis, hemiarthroplasty results in less pain, better mobility, and improved health related quality of life and has been shown to be more effective. **Objective:** to assess the functional outcome following uncemented hemiarthroplasty using a tapered wedge shaped hydroxyapatite or titanium coated femoral component in displaced fracture neck of femur in elderly patients.

Materials and Methods: This Prospective Interventional case series was conducted in Department of Orthopaedics, Southern Railways Headquarter Hospital, Chennai. Our study included displaced fracture neck of femur patients above 60 years of age of both sex treated by uncemented bipolar hemiarthroplasty in our hospital. Duration of study was December 2017 to December 2018.

Result: Out of 22 patients 12 were females (55%) and 10 were males (45%). The mean age of the patients was 73 years with a range of 60 to 86 years. All the patients had a trivial fall and sustained the fracture. The left side hip was commonly affected in our patients. Most of our patients belonged to the ASA II and III class. 17(77%) patients in our study had multiple co-morbid conditions. Most of the patients had hypertension as the predominant co-morbidity. The mean duration of the surgery was 78 minutes with a range of 67 to 90 minute and the mean blood loss in was 174 milliliters with a range of 120 milliliters to 320 milliliters. We had one case of intra operative periprosthetic fracture which was managed with wiring. The other complications were one superficial infection and one deep infection both were managed with debridement and antibiotics. We had one case of bed sore which was managed with in bed mobilization, air mattress and dressings. The final Harris hip score at six months follow up was 81 with a range of 58 to 94. There were 5 patients with excellent outcome, 10 patients with good outcome, 6 patients with fair outcome and one patient with poor outcome due to acetabular erosion.

Conclusion: In our study the Harris hip score improved with increasing periods of follow up. The final functional outcome in our study at 6 months is comparable with various studies. The complications are also lower in our study. This suggests that modern uncemented bipolar hemiarthroplasty prosthesis can provide a satisfactory result and can be used for treatment of displaced neck of femur patients.

Keywords: Functional Outcome, Uncemented Bipolar Hemiarthroplasty, Neck of Femur Fractures.

INTRODUCTION

The Neck of femur fracture in elderly is a common osteoporotic fracture seen in an orthopaedic trauma unit. At present life expectancy is increasing and so the incidence of this osteoporotic fracture is expected to increase to 6.20 million in 2050. It is associated with impaired mobility, increased morbidity and mortality and hence a major health concern.

Hemiarthroplasty is a common surgical procedure done for the treatment of displaced fracture neck of femur in elderly,[1] Hemiarthroplasty can be done using unipolar or bipolar prosthesis and the fixation can be cemented or uncemented. Bipolar prosthesis provides the advantage of movement at the inner bearing in addition to the movement at the prosthesis and acetabulum interface. Bipolar hemiarthroplasty was done in this study for the patients.[2-3]

The cementation of the prosthesis in the elderly patients with co-morbidities has the risk of emboli of fat and bone marrow with resulting intra-operative hypotension and mortality. We have lost patients due to the bone cement implantation syndrome in the hospital hence uncemented hemiarthroplasty is being done for patients.[4]

The recent literature has reported satisfactory reports with the use of modern uncemented tapered wedge shaped femoral component due to its improvement in design and surface coating technology.[5-7] Only a few studies have shown the use of these modern uncemented hydroxyapatite or titanium coated tapered wedge stem in fracture neck of femur patients in Indian population.

Hence our objective of the study was to assess the functional outcome following uncemented hemiarthroplasty using a tapered wedge shaped hydroxyapatite or titanium coated femoral component in displaced fracture neck of femur in elderly patients.

MATERIALS AND METHODS

This Prospective Interventional case series was conducted in Department of Orthopaedics, Southern Railways Headquarter Hospital, Chennai. Our study included displaced fracture neck of femur patients above 60 years of age of both sex treated by uncemented bipolar hemiarthroplasty in our hospital. Duration of study was December 2017 to December 2018.

Inclusion Criteria

- All patients with x-ray proven fracture neck of femur in age group 60 years and above.
- Patients willing and motivated for surgery and life style changes required post operativel

Exclusion Criteria

- Patients with X-ray proven fracture neck of femur treated with other methods of fixation of fracture.
- Patients not willing for participation in the study.

Sample size

Sample size was calculated assuming mean HHS score in the post-operative period as 75.82±6.37, as per the study by Jain V et al3. The other parameters considered for sample size calculation include the null value of HHS score of 70.82 ,90% power of study and 5% alpha error. The following formula, as recommended by Kirkwood BR et al for assessment of single mean was used.

$$N = \frac{(u + v)^2 \sigma^2}{(\mu - \mu_0)^2}$$

N	Sample Size
μ–	Difference between the means, μ_1 and null
μ_0	hypothesis value $\mu_{0\ (75.82\ and\ 70.82)}$
σ	Standard deviation= 6.37
U	one-sided percentage point of the normal distribution corresponding to 100 % – the power, for power = 90 %, u = 1.28
V	Percentage point of the normal distribution corresponding to the (two-sided) significance level , for significance level = 5%, v = 1.96

After substituting the above-mentioned values in the equation, the required sample size was 17 subjects. To account for a loss to follow up of 10% another two subjects were added, making the total sample size requirement to 19 subjects. Our study included 22 patients with 10 males and 12 females. The age ranged from 60 years to 84 years

Methodology

Patients falling within the criteria were admitted at Railway Hospital Perambur. The general condition of the patient including his physical and mental status, general medical condition and ability to withstand the surgery was evaluated. Informed consent was obtained. After obtaining anaesthetic fitness for surgery patient were taken up for surgery.

Implants

We used hydroxyapatite coated femoral stem in 6 patients and titanium plasma spray coated femoral stems in 16 patients. Our institution is a Central Government Institution, we used initially hydroxyapatite coated stems which were sanctioned earlier; later titanium plasma spray coated femoral stems were sanctioned, which forced the department to switch over and use titanium coated femoral stems.

Surgical procedure:

Preparation of patient

The patients were prepared the day before surgery with chlorhexidine scrub.

Prophylactic antibiotic is given on the table. A second generation cephalosporin, injection cefazolin was administered IV. All patients received

tranexamic acid injection 1 gm IV prior to incision routinely.

Anesthesia used and positioning

Regional or General anaesthesia is usually employed. Lateral position with the patient lying on the unaffected side. The skin over the hip was scrubbed with povidone-iodine. The lower extremity from the groin to the toes was draped in sterile drapes separately to enable easy manipulation of the limb during surgery.

Approach:

For all our patients posterolateral approach was used.

Postero-lateral Approach

From a point 10 cm distal to posterior superior iliac spine and extended distally and laterally parallel to the fibers of gluteus maximus to the posterior margin of the greater trochanter and then directed about 10 cm parallel to the femoral shaft. Deep fascia was exposed and divided in the line with the skin incision as also was the fascia over gluteus maximus, which was then split in the direction of its fibers using blunt dissection. By retracting the proximal fibers of the muscle proximally, the greater trochanter was exposed. Distal fibers are retracted distally and partly divided at their insertion into the linea-aspera in line in the distal part of the incision. The sciatic nerve was usually not exposed. It is protected with finger in the medial part of the wound and was gently retracted out of the way. The gemelli, obturator internus and the piriformis tendon were divided at their insertions after tagging them for easier identification and reattachment

The posterior part of the capsule thus exposed was incised from distal to proximal along the line of neck of femur and at right angle to it, thus making a T shaped opening in the capsule. The fractured head and neck of the femur was levered out of the acetabulum and size measured using femoral head gauge. The acetabulum was prepared by excising remaining ligamenturn teres and soft tissue. The femoral shaft was rasped using a broach (rasp) and prepared for the insertion of the prosthesis. Femoral neck if long was shortened using an oscillating saw to keep 2 cms of calcar above the lesser trochanter.

The prosthesis was then inserted into the femoral shaft and impacted into the femur. The reduction of the prosthesis was then done using gentle traction of the thigh. After suturing the capsule the external rotators were sutured, the wound was closed in layers. The suction drain was not used routinely.

Figure 1: Insertion of hydroxyapatite femoral stem

Figure 2: Insertion of titanium plasma spray stem

Figure 3: Bipolar head

Figure 4: Joint reduction

Among the study population, 7(31.82%) participants were aged in between 60-69, 10(45.45%) participants were aged in between 70-79 and remaining 5(22.73%) participants were aged in between 80-89. Among the study population, 10(45.45%) participants were male remaining 12(54.55%) participants were female.

Among the study population, 3(13.64%) participants had single co-morbid condition, and 17(77.27%) participants had multiple co-morbid conditions.

Among the study population, 13(59.09%) participants had left side injury and 9(40.91%) participants had right side injury.

RESULTS

Table 1: Descriptive analysis of ASA grade in study population

ASA grade	Frequency	Percentage
1	1	4.55%
2	7	31.82%
3	10	45.45%
4	4	18.18%

Among the study population 1(4.55%) participant was with ASA grade1, the proportion of participants with 2,3 and 4 ASA grade was 7(31.82%), 10(45.45%) and 4(18.18%) respectively.

Table 2: Comparison of HHS grade with ASA grade

ASA grade	HHS Grade			
	Poor	Fair	Good	Excellent
ASA grade 1 & 2	1 (12.5%)	1 (12.5%)	3 (37.5%)	3 (37.5%)
ASA grade 3 & 4	0 (0%)	5 (35.7%)	7 (50%)	2 (14.3%)

The association between ASA and outcome is as follows. Patients with poorer general status as shown by ASA 3 and 4 also had excellent and good outcomes.

The mean Duration of surgery was 78 ± 8.065 in the study population, ranging 67 to 90 (95% CI 74.42 to 81.58).

The mean of blood loss was 174.7 ± 61.99 in the study population, ranging 120 to 320 (95% CI 147.28 to 202.26).

Table 3: Descriptive analysis of Complications in study population

Complications	Frequency	Percentages
Superficial infection	1	4.55%
Deep infection, Periprosthetic fracture	1	4.55%
Nil	20	90.91%

Among the study population, 1(4.55%) participant had superficial infection, and 1(4.55%) participant had Deep infection and Periprosthetic fracture.

Table 4: Descriptive analysis for Modified Harris hip score at 6 months in study population

Parameter	Mean ±STD	Median	Min	Max	95% C.I. for EXP(B)	
					Lower	Upper
Modified Harris hip score at 6 months	81.77 ± 8.445	82.00	58.00	94.00	78.03	85.52

The mean Modified Harris hip score at 6 months was 81.77 ± 8.445in the study population, range between 58.00to 94.00. (95% CI 78.03 to 85.52).

Table 5: Descriptive analysis of HHS Grade in study population

HHS Grade	Frequency	Percentage
Poor	1	4.55%
Fair	6	27.27%
Good	10	45.45%
Excellent	5	22.73%

Among the study population 1(4.55%) participant was poor in HHS grade, the proportion of participants with fair, good and excellent in HHS grade was 6 (27.27%), 10(45.45%) and 5(22.73%) respectively.

Table 6: Comparison of mean Modified Harris hip score at 6 months across study groups

Time lag between injury and surgery	Modified Harris hip score at 6 months (Mean ± SD)	Mean difference	95% Confidence Interval for Mean		P value
			Lower Bound	Upper Bound	
<7 Days	86.6 ± 8.820				
7-14 Days	79.90 ± 8.711	6.6909	-2.8304	16.2123	0.157
15-30 Days	78.75 ± 7.804	7.849	-3.9920	19.6920	0.181
>1 Month	86 ± 4.242	0.599	-14.169	15.3696	0.93

Mean of Modified Harris hip score at 6 months during <7 days time lag between injury and surgery was 86.6, it was 79.90 in 7-14 days, 78.75 in 15-30 days and 86 in >1 month time. Taking <7 days time lag as base line, Mean difference between other timings was statistically not significant (P value>0.05).

Table 7: Descriptive analysis of Time lag between injury and surgery in study population

Time lag between injury and surgery	Frequency	Percentage
<7 Days	5	22.73%
7-14 Days	11	50.00%
15-30 Days	4	18.18%
>1 Month	2	9.09%

Among the study population, 5(22.73%) participants had <7days time lag between injury and surgery, 11(50.00%) participants had 7-14days time lag between injury and surgery, 4 (18.18%) participants had 15-30days time lag between injury and surgery and 2(9.09%) participants had >1month time lag between injury and surgery.

78 years male with final harris hip score 94

Figure 5a: Pre-Operative Radiograph

Figure 5b: Post-Operative Radiograph

Figure 5c: Radiograph at Final Follow Up

Figure 5d: Flexion

DISCUSSION

Our study was conducted to study the functional outcome of uncemented bipolar hemiarthroplasty using modular prosthesis for displaced fracture neck of femur patients aged above 60 years. The study has 22 patients. The results were analyzed and the observations were made. The study was also compared with studies conducted by other authors.

The average age of the patients in our series was 73 years with a range of 60 to 86 years. The majority of the patients were in the age group of 70 to 79 years. Our study has low mean age when compared to the western population since our longevity is low compared to the western population. The mean age will improve in the future as the longevity increases.[8,9]

In our series the displaced fracture neck of femur was found to be more common in females 12 0f 22(55%). The elderly females are more prone to fracture neck of femur due to osteoporosis. Female preponderance had been reported in several series.[10,11]

There is equal male to female affection in age less than 70 years but there is more female patients seen in age above 70 years. This is due to the increased life expectancy and osteoporosis in females.

Venkateshwar Rao et al,[4] and Yerkula Ramana et al in their studies found most elderly patients sustain neck of femur fractures due to trivial fall and is mainly caused due to osteoporosis. In our study also all the patients had minimal trauma with most of them had fallen from standing height.

The medical conditions associated with the patients were diabetes mellitus, hypertension, ischemic heart disease, cerebro vascular disease, Parkinsonism, epilepsy and bronchial asthma. 17 patients (77%) had more than one of the medical conditions.

The hemi paresis patients did not have any deficit at the time of fracture presentation. They all had recovered from paresis before the injury. Hypertension was the most predominant co-morbidity in our study.

In our patients left side hip was commonly affected. Thirteen (59%) out of 22 patients had left side displaced neck of femur fracture.

In our study 10 (45%) patients belonged to ASA grade 3 and 7 patients were in ASA grade 2. Combined together ASA 2 and 3 patients were the majority in our study which is in accordance with study of S. Zuhair Nawaz et al.[10]

We compared the outcome between ASA 1 and 2 patients with ASA 3 and 4 patients. In the first group there were 8 patients and in the second group there were 14 patients. 6 patients in the first group had good to excellent outcome. 9 patients in second group had good to excellent outcome. From our study there is no difference in the outcome between the groups. Our limitation in the study is small number of patients and shorter follow up.

The patients were monitored for infection, Periprosthetic fracture and dislocation. The various complications are discussed below.

Periprosthetic fracture

Eschen et al,[12] observed one intra-operative periprosthetic fracture in his series of 47 fracture neck of femur patients treated with uncemented hydroxyapatite coated hemiarthroplasty in a one year follow up. Rivera et al,[11] had three periprosthetic fractures in his study of 244 fracture neck of femur patients treated with uncemented arthroplasty followed for a period of 2 years and all the three were managed by trochanteric cable fixation. In our study we have a single case (4.5%) of periprosthetic fracture. The fracture was identified intra operatively and fixed with wiring and post operatively the patient was started on delayed weight bearing and eventually the fracture healed and the patient walked at the time of discharge. We broach the proximal femur till we get the good fit. The axial and rotational stability is assessed with no motion of the broach in the canal. If we try to fill the proximal femur it can lead to periprosthetic fracture.

A hip fracture in elderly is a known high-risk factor for development of pressure sores. Haleem et al; reported 3.8% of their patients developed pressure sores. Patient factors that increased the risk of pressure sores were increased age, diabetes mellitus,

a lower mental test score, a higher ASA score, lower admission hemoglobin and an intra-operative drop in blood pressure. Lefaivre et al showed that when the surgery was delayed for more than 24 hours, it was significantly increased pressure sore. Grimes et al showed that the risk of decubitus ulcer increased when the surgery was delayed for more than 96 hours.

In our group 5 (22%) patients got operated within 7 days of injury; 11 (50%) patients got operated between 7-14 days of injury and six patients got operated after 14 days. The reason for the delay was delayed presentation due to native treatment, associated morbidity especially multiple co morbidities leading to longer period of pre-operative evaluation and optimization. Novack et al showed the length of surgery delay had a gradual effect on increasing mortality of both short-term and long-term. Similar finding were also reported from casaletto and Gatt, zuckermzn et al, and Elliottet el.

Evidence also exits to suggest that the early surgery does not affect mortality rates in the univariate analysis from the Scottish hip fracture audit which collected information prospectively relating 18,817 patients, no significant relationship was found between the time from admission to surgery and early post-operative mortality. Verbeek et al found that a delay of hip fracture surgery was not associated with increased 1year mortality, based on univariate regression method.

Evidence in the literature regarding the effect of delay in surgery on the mortality rate is conflicting and there is no conclusive evidence. Although there is no solid evidence that the early surgery wound improve the mortality, there is widespread evidence that other outcomes including, morbidity, the incidence of pressure sores and the length of hospital stay could be improved by shortening the waiting time of hip surgery. Early surgery can also bring better pain relief. Hence it is still advisable for surgeons to treat these patients as soon as patients meet the basic anesthetic requirements.

The mean duration of surgery in our study was 78 minutes and the mean blood loss was 174 milliliters. The mean blood loss and duration of surgery in other studies.[8,9]

The mean Harris Hip score in our study is 81.77. Five patients (22%) had excellent outcome, ten patients (45%) had good outcome and six patients had fair outcome. One patient had poor outcome since he developed acetabulum erosion at 6 months follow up. The mean Harris Hip score in various studies have shown to be comparable with our study.

CONCLUSION

The primary aim of hemiarthroplasty in a displaced neck of femur fracture is to allow early mobilization and return to normal activity.

In our study the Harris hip score improved with increasing periods of follow up. The final functional outcome in our study at 6 months is comparable with various studies. The complications are also lower in our study. This suggests that modern uncemented bipolar hemiarthroplasty prosthesis can provide a satisfactory result and can be used for treatment of displaced neck of femur patients.

The limitations of our study are the change in the type of implant, short follow up and the smaller numbers. Hence further follow up and evaluation is needed to come to a conclusion.

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