



Original Article

A Comparative Study of Functional Outcomes and Complication Rates Between Cemented and Uncemented Bipolar Hemiarthroplasty for Displaced Fracture Neck of Femur in Elderly Patients

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ABSTRACT

Background: Displaced fracture of the neck of the femur is one of the most common osteoporotic fractures in the elderly and is associated with substantial morbidity, mortality, and functional impairment. Bipolar hemiarthroplasty remains the preferred treatment for elderly patients with limited physiological reserve. However, the optimal method for femoral stem fixation—cemented or uncemented—remains debated.

Objectives: To compare the functional outcomes and complication rates between cemented and uncemented bipolar hemiarthroplasty for displaced fracture neck of femur in elderly patients.

Materials and Methods: This prospective comparative observational study was conducted in the Department of Orthopaedics, KM Hospital, Yadgir, Karnataka, India, from January 2023 to June 2025. Thirty elderly patients with displaced intracapsular fracture neck of femur were included and equally divided into two groups: cemented bipolar hemiarthroplasty (n=15) and uncemented bipolar hemiarthroplasty (n=15). Functional outcome was assessed using the Harris Hip Score (HHS), while perioperative variables, radiological findings, and postoperative complications were compared. Statistical analysis was performed using SPSS version 26.0, with a p-value <0.05 considered statistically significant.

Results: The mean age of the patients was 71.3±6.0 years. Cemented bipolar hemiarthroplasty demonstrated significantly higher Harris Hip Scores at all follow-up intervals, with a final mean HHS of 89.7±4.6 compared to 84.5±5.2 in the uncemented group (p=0.011). Operative duration and intraoperative blood loss were significantly higher in the cemented group. Patients undergoing cemented hemiarthroplasty achieved earlier ambulation and full weight-bearing. Stem subsidence, loosening, and periprosthetic fractures occurred more frequently in the uncemented group, while infection and mortality rates were comparable.

Conclusion: Cemented bipolar hemiarthroplasty provided superior functional outcomes, earlier mobilization, and better implant stability than uncemented bipolar hemiarthroplasty in elderly patients with displaced fracture neck of femur. Although cemented procedures required longer operative time and greater blood loss, they were associated with fewer implant-related complications and better overall clinical outcomes.

Keywords: Fracture neck of femur, Bipolar hemiarthroplasty, Cemented stem, Uncemented stem, Harris Hip Score, Elderly..

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INTRODUCTION

Fracture of the neck of the femur is among the most common orthopaedic injuries in the elderly population and represents a major public health challenge due to increasing life expectancy and the rising prevalence of osteoporosis. These fractures are associated with significant morbidity, mortality, loss of independence, and substantial healthcare expenditure. Most displaced intracapsular femoral neck fractures in elderly patients require surgical intervention to restore mobility, relieve pain, and minimise complications associated with prolonged immobilisation, such as deep vein thrombosis, pressure sores, pneumonia, and muscle wasting [1].

Treatment options include internal fixation, hemiarthroplasty, and total hip arthroplasty. Internal fixation has a high incidence of nonunion and avascular necrosis in elderly osteoporotic patients because of compromised blood supply to the femoral head [2]. Consequently, hemiarthroplasty has become the preferred treatment for displaced femoral neck fractures in elderly patients with lower functional demands.

Bipolar hemiarthroplasty offers several advantages over unipolar prostheses by reducing acetabular cartilage wear through dual-bearing articulation, improving range of motion, and decreasing the risk of acetabular erosion [3]. It facilitates early mobilization, reduces postoperative pain, and provides satisfactory long-term functional outcomes.

The choice between cemented and uncemented femoral stem fixation remains controversial. Cemented hemiarthroplasty provides immediate implant stability, better load distribution, reduced postoperative thigh pain, and lower risk of prosthetic loosening, particularly in osteoporotic bone [4]. However, it is associated with longer operative time, increased blood loss, and the potential risk of bone cement implantation syndrome.

Conversely, uncemented hemiarthroplasty avoids cement-related complications, shortens operative duration, and decreases intraoperative blood loss. Nevertheless, it may be associated with higher rates of stem subsidence, intraoperative fractures, postoperative thigh pain, and delayed functional recovery due to reduced initial fixation in osteoporotic femora [5].

Several randomized controlled trials and meta-analyses have compared cemented and uncemented hemiarthroplasty. Although many studies report superior functional outcomes and lower implant-related complications with cemented fixation, others have demonstrated comparable long-term outcomes between the two techniques [6–8]. Therefore, the ideal fixation method remains a subject of ongoing debate.

The present prospective comparative study was undertaken to evaluate the functional outcomes and complication rates between cemented and uncemented bipolar hemiarthroplasty in elderly patients with displaced fracture neck of femur treated at KM Hospital, Yadgir.

MATERIALS AND METHODS

Study Design and Setting

This prospective comparative observational study was conducted in the Department of Orthopaedics, KM Hospital, Yadgir, Karnataka, India, over a period of 2.5 years from January 2023 to June 2025. The study aimed to compare the functional outcomes and complication rates between cemented and uncemented bipolar hemiarthroplasty in elderly patients with displaced fracture neck of femur. The study protocol was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants before enrollment. Similar prospective comparative methodologies have been employed in previous studies evaluating cemented and uncemented hemiarthroplasty.

Study Population

A total of 30 consecutive elderly patients diagnosed with displaced intracapsular fracture neck of femur were included in the study. Patients were allocated into two treatment groups based on the implant fixation technique used:

- Group A: Cemented Bipolar Hemiarthroplasty (n = 15)
- Group B: Uncemented Bipolar Hemiarthroplasty (n = 15)

The choice of implant fixation was determined by the operating surgeon after considering the patient's bone quality, age, physiological status, and intraoperative findings.

Inclusion Criteria

- Patients aged 60 years and above.
- Displaced intracapsular fracture neck of femur (Garden Grade III or IV).
- Ambulatory before sustaining the injury.
- Patients medically fit for surgery.
- Patients willing to participate and provide written informed consent.

Exclusion Criteria

- Age below 60 years.
- Pathological fractures.
- Polytrauma patients.
- Previous surgery on the affected hip.
- Open fractures.
- Patients with active local or systemic infection.
- Patients with severe neurological disorders affecting gait.
- Patients unwilling or unable to complete follow-up.

Preoperative Assessment

All patients underwent detailed clinical evaluation, including history, physical examination, and assessment of pre-injury ambulatory status. Routine laboratory investigations included complete blood count, renal function tests, liver function tests, blood glucose, serum electrolytes, coagulation profile, blood grouping, ECG, chest radiograph, and physician/anesthetist fitness for surgery. Standard anteroposterior pelvis and lateral hip radiographs were obtained for fracture classification and preoperative planning.

Surgical Technique

All procedures were performed under spinal or combined spinal-epidural anaesthesia by experienced orthopaedic surgeons using a standard posterior (Moore's) approach.

In the cemented group, the femoral canal was prepared, and polymethylmethacrylate (PMMA) bone cement was used for stem fixation before insertion of the bipolar prosthesis.

In the uncemented group, a press-fit hydroxyapatite-coated or porous-coated femoral stem was implanted without cement after sequential broaching to achieve adequate primary stability.

The appropriate bipolar head size was selected intraoperatively following trial reduction. Wound closure was performed in layers after thorough irrigation and placement of a suction drain when required.

Postoperative Management

All patients received standardized postoperative care, including intravenous antibiotics for 24–48 hours, thromboprophylaxis according to institutional protocol, adequate analgesia, and physiotherapy. Static quadriceps exercises and ankle pump exercises were initiated on the first postoperative day. Weight-bearing was commenced as tolerated depending on implant stability and patient condition. Patients were discharged after achieving independent ambulation with walker support and satisfactory wound healing.

Follow-up

Patients were followed at:

- 6 weeks
- 3 months
- 6 months
- 12 months

During each follow-up visit, patients underwent clinical examination and radiographic evaluation.

Outcome Measures

The primary outcome was:

- Functional outcome assessed using the Harris Hip Score (HHS).

Secondary outcome measures included:

- Operative duration (minutes)
- Intraoperative blood loss (mL)
- Length of hospital stay (days)
- Time to independent ambulation
- Postoperative pain
- Limb length discrepancy
- Prosthesis-related complications
- Superficial and deep infection
- Dislocation

- Periprosthetic fracture
- Stem subsidence or loosening
- Deep vein thrombosis
- Mortality during follow-up
- Requirement for revision surgery

Radiological evaluation included assessment of implant position, stem alignment, loosening, subsidence, heterotopic ossification, and periprosthetic fractures on serial anteroposterior and lateral radiographs.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages. The Independent Student's *t*-test was used to compare continuous variables between groups, whereas the Chi-square test or Fisher's exact test was used for categorical variables. A *p*-value <0.05 was considered statistically significant.

RESULTS AND OBSERVATIONS

A total of 30 elderly patients with displaced fracture neck of femur were included in the study. Fifteen patients underwent cemented bipolar hemiarthroplasty, while fifteen underwent uncemented bipolar hemiarthroplasty. The mean follow-up period was 12 months.

Table 1. Demographic Characteristics

Variable	Cemented (n=15)	Uncemented (n=15)	p-value
Mean age (years)	71.8 $\pm$ 6.2	70.9 $\pm$ 5.8	0.682
Male	8 (53.3%)	9 (60.0%)	0.713
Female	7 (46.7%)	6 (40.0%)	

Observation: Both groups were comparable in age and gender distribution.

Table 2. Mechanism of Injury

Mechanism	Cemented (n=15)	Uncemented (n=15)	Total (%)
Fall from standing height	12	11	23 (76.7)
Road traffic accident	3	4	7 (23.3)

Observation: Fall from standing height was the commonest mechanism of injury.

Table 3. Operative Parameters

Parameter	Cemented	Uncemented	p-value
Operative time (minutes)	89.5 $\pm$ 9.2	74.6 $\pm$ 8.5	<0.001
Blood loss (mL)	322 $\pm$ 58	248 $\pm$ 46	<0.001
Hospital stay (days)	8.6 $\pm$ 1.7	9.1 $\pm$ 1.8	0.428

Observation: Cemented hemiarthroplasty required significantly longer operative time and resulted in greater blood loss. Hospital stay was comparable.

Table 4. Harris Hip Score During Follow-up

Follow-up	Cemented	Uncemented	p-value
6 weeks	63.2 $\pm$ 5.8	58.6 $\pm$ 6.1	0.041
3 months	74.5 $\pm$ 5.4	69.2 $\pm$ 5.9	0.019
6 months	82.8 $\pm$ 4.9	78.4 $\pm$ 5.3	0.028
12 months	89.7 $\pm$ 4.6	84.5 $\pm$ 5.2	0.011

Observation: Harris Hip Score was significantly better in the cemented group throughout follow-up.

Table 5. Functional Outcome at Final Follow-up (Harris Hip Score)

Outcome	Cemented (n=15)	Uncemented (n=15)
Excellent (90–100)	8 (53.3%)	5 (33.3%)
Good (80–89)	5 (33.3%)	6 (40.0%)
Fair (70–79)	2 (13.4%)	3 (20.0%)
Poor (<70)	0	1 (6.7%)

Observation: Excellent functional outcomes were more frequent in the cemented group.

Table 6. Postoperative Complications

Complication	Cemented (n=15)	Uncemented (n=15)	p-value
Superficial infection	1	1	1.000
Deep infection	0	0	—
Dislocation	0	1	0.309
Periprosthetic fracture	0	1	0.309
Stem subsidence	0	2	0.143
Limb length discrepancy	1	2	0.543
Deep vein thrombosis	0	0	—

Observation: Stem subsidence and periprosthetic fractures were observed only in the uncemented group, although the difference was not statistically significant due to the small sample size.

Table 7. Time to Full Weight-bearing and Ambulation

Parameter	Cemented	Uncemented	p-value
Time to walker-assisted ambulation (days)	2.3 ± 0.7	3.1 ± 0.9	0.014
Time to full weight-bearing (weeks)	3.8 ± 0.9	5.1 ± 1.2	0.003

Observation: Patients in the cemented group achieved earlier ambulation and full weight-bearing.

Table 8. Radiological Outcomes

Radiological Finding	Cemented (n=15)	Uncemented (n=15)
Stable implant	15 (100%)	13 (86.7%)
Stem subsidence	0	2 (13.3%)
Loosening	0	1 (6.7%)
Periprosthetic fracture	0	1 (6.7%)

Observation: Radiological stability was excellent in the cemented group. Stem subsidence and loosening were observed only in the uncemented group.

Table 9. Overall Clinical Outcome

Variable	Cemented	Uncemented	p-value
Overall complication rate	2 (13.3%)	5 (33.3%)	0.196
Revision surgery	0	1 (6.7%)	0.309
Mortality during follow-up	1 (6.7%)	1 (6.7%)	1.000

Observation: The uncemented group showed a higher complication and revision rate, while mortality was similar between groups.

DISCUSSION

The management of displaced fracture neck of femur in elderly patients continues to evolve with the primary objective of restoring mobility, minimizing complications, and improving quality of life. Bipolar hemiarthroplasty remains a widely accepted treatment modality, while the choice of cemented versus uncemented femoral stem fixation remains controversial.

In the present study, the mean age of the patients was approximately 71 years, with a slight male predominance. These findings are consistent with the demographic characteristics reported by Parker et al. [1] and Rogmark et al. [6], who observed that most displaced femoral neck fractures occur in elderly individuals due to osteoporosis and low-energy falls. Low-energy falls constituted the predominant mechanism of injury in our study, accounting for over three-fourths of all cases. Similar findings have been reported by Bhandari et al. [7], emphasizing osteoporosis and reduced balance as major contributors to femoral neck fractures in elderly individuals.

Operative time and intraoperative blood loss were significantly greater in the cemented hemiarthroplasty group. This observation is in agreement with the findings of Figved et al. [8], who demonstrated that cementation increases surgical duration because of canal preparation, cement mixing, and stem insertion while also contributing to increased blood loss. Despite longer operative time, patients in the cemented group demonstrated significantly better functional recovery throughout the follow-up period. The mean Harris Hip Score at one year was significantly higher than that of the uncemented group. Similar improvements in functional outcome have been reported by Taylor et al. [9], Langslet et al. [10], and the WHiTE5 trial conducted by Costa et al. [11], all of whom concluded that cemented stems provide superior postoperative mobility and reduced pain.

Earlier ambulation and full weight-bearing observed in the cemented group can be attributed to immediate mechanical stability provided by cement fixation. Better initial stability allows patients to mobilize confidently, thereby reducing

complications associated with prolonged recumbency. Similar observations have been reported in several systematic reviews and randomized controlled trials [7,11].

The overall complication rate was higher among patients undergoing uncemented hemiarthroplasty. Stem subsidence, periprosthetic fracture, and implant loosening occurred exclusively in the uncemented group, reflecting the challenges of achieving secure fixation in osteoporotic bone. Comparable findings have been described by Parker et al. [1] and Rogmark et al. [6], who reported higher rates of implant-related complications with uncemented stems.

The incidence of superficial infection, deep vein thrombosis, and mortality was low and comparable between both groups. These findings are consistent with previous studies indicating that mortality is influenced primarily by age, comorbidities, and physiological status rather than the method of stem fixation [3,11].

Overall, the findings of the present study support the growing evidence favouring cemented bipolar hemiarthroplasty in elderly patients with a displaced fracture neck of femur. Cemented fixation offers superior functional outcomes, earlier mobilisation, and improved implant stability despite slightly longer operative duration and increased intraoperative blood loss.

The limitations of the present study include a relatively small sample size, single-centre design, and short follow-up period of one year. Larger multicenter randomised studies with long-term follow-up are required to further establish the superiority of one fixation method over the other.

CONCLUSION

Cemented bipolar hemiarthroplasty demonstrated superior functional outcomes, earlier mobilization, and better implant stability compared with uncemented bipolar hemiarthroplasty in elderly patients with displaced fracture neck of femur. Although cemented fixation was associated with longer operative time and greater intraoperative blood loss, it resulted in fewer implant-related complications and higher Harris Hip Scores. Cemented bipolar hemiarthroplasty can therefore be considered the preferred treatment option for elderly patients with osteoporotic displaced femoral neck fractures.

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