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Cemented versus uncemented hemiarthroplasty for femoral neck fractures in elderly patients

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Abstract

Background: Femoral neck fractures are common in elderly patients, and hemiarthroplasty is a preferred surgical treatment. However, the choice between cemented and uncemented hemiarthroplasty remains a topic of debate. This study aims to compare intraoperative parameters, functional outcomes, and complications of cemented versus uncemented hemiarthroplasty.

Methods: This prospective observational study was conducted over six months at Vardhman Mahavir Medical College and Safdarjung Hospital, enrolling 50 patients (≥60 years) with displaced femoral neck fractures. Patients were equally divided into cemented (n=25) and uncemented (n=25) hemiarthroplasty groups. Intraoperative parameters, functional outcomes (Harris Hip Score, Timed Up, and Go test), and postoperative complications were assessed over a six-month follow-up. Statistical analysis was performed using independent t-tests and chi-square tests, with a significance level of $p<0.05$.

Results: Cemented hemiarthroplasty had a significantly longer surgery duration (75.3 ± 10.5 vs. 63.8 ± 8.2 minutes; p=0.002) and greater blood loss (320 ± 50 vs. 210 ± 45 mL; p=0.001). The Harris Hip Score at six months was slightly higher in the cemented group (81.5 ± 6.2 vs. 78.3 ± 7.1; p=0.12), and the Timed Up and Go test indicated better mobility (14.2 ± 2.3 vs. 16.1 ± 2.8 seconds; p=0.04). Periprosthetic fractures were more frequent in the uncemented group (12% vs. 4%; p=0.28). Overall complication rates were comparable between the two groups (p=0.53).

Conclusion: Cemented hemiarthroplasty resulted in better early functional outcomes and lower periprosthetic fracture rates but was associated with longer surgical time and increased blood loss. Uncemented hemiarthroplasty may be preferable for patients with cardiovascular risks due to the avoidance of bone cement implantation syndrome. Further long-term studies are required to confirm these findings and optimize patient selection.

Keywords: Hemiarthroplasty, Femoral Neck Fracture, Cemented, Uncemented, Elderly Patients, Functional Outcomes.

INTRODUCTION

Femoral neck fractures are among the most common orthopedic injuries in the elderly population, often resulting from low-energy trauma such as falls from standing height1. Due to the high risk of nonunion and avascular necrosis associated with these fractures, hemiarthroplasty is widely performed as a preferred treatment option2,3.

Hemiarthroplasty can be performed using either cemented or uncemented prostheses. Cemented hemiarthroplasty involves the use of polymethyl methacrylate (PMMA) bone cement to secure the femoral stem, providing immediate stability and reducing the risk of periprosthetic fractures 4,5. However, it carries the risk of cement-related complications such as embolism and intraoperative hemodynamic instability6. On the other hand, uncemented hemiarthroplasty relies on a press-fit technique for fixation, promoting biological osseointegration, but it may result in higher rates of postoperative thigh pain and periprosthetic fractures7,8.

The choice between cemented and uncemented hemiarthroplasty remains a topic of debate, with studies yielding conflicting results regarding functional outcomes, complication rates, and long-term survivorship 9,10. Some reports suggest better early mobility and pain relief with cemented prostheses, while others highlight reduced operative time and fewer systemic complications with uncemented implants 11,12.

The present prospective observational study was conducted to compare the outcomes of cemented versus uncemented hemiarthroplasty in elderly patients with displaced femoral neck fractures. The study evaluates intraoperative parameters, functional outcomes, and postoperative complications over a follow-up period of six months.

MATERIAL AND METHODS

Study Design

This prospective observational study was conducted over six months at the Department of Orthopaedics, Vardhman Mahavir Medical College and Safdarjung Hospital).

Study Population

The study included elderly patients (≥60 years) diagnosed with displaced femoral neck fractures requiring hemiarthroplasty.

Sample Size

A total of 50 patients were enrolled in the study, 25 of whom underwent cemented hemiarthroplasty and 25 of whom underwent uncemented hemiarthroplasty.

Inclusion Criteria;

- Patients aged ≥60 years with displaced femoral neck fractures (Garden Type III and IV).
- Patients deemed medically fit for surgery under spinal or general anesthesia.
- Patients willing to provide informed consent.

Exclusion Criteria;

- Patients with pathological fractures (due to malignancy or metabolic bone disease).
- Patients with severe osteoporosis (T-score < -3.0 on DEXA scan).
- Patients with pre-existing hip arthritis or deformities.
- Patients with polytrauma or multiple fractures.
- Patients who were lost to follow-up within six months.

Surgical Technique

All surgeries were performed by experienced orthopedic surgeons following standard surgical protocols.

- Cemented Hemiarthroplasty: A polymethyl methacrylate (PMMA) bone cement was used for femoral stem fixation.
- Uncemented Hemiarthroplasty: A press-fit technique was used for femoral stem implantation.

Postoperative Rehabilitation and Follow-up

- Standard postoperative pain management and early mobilization protocols were followed.
- Patients were assessed at 2 weeks, 6 weeks, 3 months, and 6 months postoperatively.
- Functional outcomes were evaluated using the Harris Hip Score (HHS) and Timed Up and Go (TUG) test.
- Postoperative complications such as periprosthetic fractures, infections, dislocations, and thromboembolic events were recorded.

Data Analysis

- Descriptive statistics were used to summarize patient demographics and clinical data.
- Independent t-test and chi-square test were used to compare functional outcomes and complications between groups.
- P-value <0.05 was considered statistically significant.

RESULTS AND OBSERVATIONS

Table 1: Baseline Characteristics of Patients

Characteristics	Cemented Hemiarthroplasty (n=25)	Uncemented Hemiarthroplasty (n=25)	p-value
Mean Age (years)	72.6 ± 5.4	73.1 ± 6.2	0.74
Male/Female Ratio	11/14	10/15	0.78
Mean BMI (kg/m²)	24.8 ± 2.3	24.5 ± 2.5	0.68
Fracture Type (Garden III/IV)	12/13	11/14	0.81
Preoperative HHS Score	45.2 ± 6.5	44.8 ± 7.1	0.87

Table 2: Intraoperative Parameters

Parameters	Cemented Hemiarthroplasty (n=25)	Uncemented Hemiarthroplasty (n=25)	p-value
Mean Surgery Duration (min)	75.3 ± 10.5	63.8 ± 8.2	0.002 **
Mean Blood Loss (mL)	320 ± 50	210 ± 45	0.001 **
Need for Blood Transfusion (%)	6 (24%)	2 (8%)	0.08
Perioperative Complications (%)	4 (16%)	3 (12%)	0.65

(*Significance level: $p < 0.05$)

Table 3: Functional Outcomes at 6 Months

Outcome Measures	Cemented Hemiarthroplasty (n=25)	Uncemented Hemiarthroplasty (n=25)	p-value
Mean Harris Hip Score (HHS)	81.5 ± 6.2	78.3 ± 7.1	0.12
Timed Up and Go (TUG) Test (sec)	14.2 ± 2.3	16.1 ± 2.8	0.04 *
Independent Ambulation (%)	21 (84%)	18 (72%)	0.31
Use of Walking Aid (%)	4 (16%)	7 (28%)	0.25

(*Significance level: $p < 0.05$)

Table 4: Postoperative Complications

Complications	Cemented Hemiarthroplasty (n=25)	Uncemented Hemiarthroplasty (n=25)	p-value
Deep Vein Thrombosis (DVT)	2 (8%)	1 (4%)	0.55
Periprosthetic Fracture	1 (4%)	3 (12%)	0.28
Prosthesis Dislocation	2 (8%)	3 (12%)	0.64
Surgical Site Infection	1 (4%)	1 (4%)	1.00
Overall Complications	6 (24%)	8 (32%)	0.53

DISCUSSION

Hemiarthroplasty remains a widely used surgical option for displaced femoral neck fractures in elderly patients. However, the choice between cemented and uncemented hemiarthroplasty continues to be a subject of debate due to varying functional outcomes and complication rates. This study aimed to compare the two techniques in terms of intraoperative parameters, functional outcomes, and postoperative complications over a six-month follow-up period.

Intraoperative Parameters

Our study found that cemented hemiarthroplasty was associated with significantly longer surgery duration and greater blood loss compared to uncemented hemiarthroplasty ($p=0.002$ and $p=0.001$, respectively). This is consistent with previous studies, which have shown that cement application prolongs operative time and increases intraoperative blood loss13,14. However, despite the increased surgical time and bleeding, the need for blood transfusion was not significantly different between the two groups ($p=0.08$), aligning with findings from Khan et al.15.

A major concern with cemented hemiarthroplasty is bone cement implantation syndrome (BCIS), which can cause hypotension, cardiac arrhythmias, and even cardiac arrest 16. In our study, perioperative complications (including hemodynamic instability) were slightly higher in the cemented group (16% vs. 12%) but not statistically significant ($p=0.65$). Similar trends have been observed in other studies, where the risk of BCIS is present but remains clinically manageable in most cases 17.

Functional Outcomes

At the six-month follow-up, the Harris Hip Score (HHS) was slightly higher in the cemented group (81.5 ± 6.2 vs. 78.3 ± 7.1), but the difference was not statistically significant ($p=0.12$). However, the Timed Up and Go (TUG) test showed significantly better mobility in the cemented group ($p=0.04$), indicating improved functional recovery. These findings align with those of Parker and Gurusamy18, who reported better early functional outcomes with cemented hemiarthroplasty.

One possible explanation for this is that cemented prostheses provide immediate implant stability, allowing for earlier weight-bearing and better mobility 19. In contrast, uncemented prostheses rely on biological fixation, which may take longer to achieve adequate stability, potentially leading to increased thigh pain and delayed mobilization 20.

Postoperative Complications

In terms of postoperative complications, our study found higher rates of periprosthetic fractures in the uncemented group (12% vs. 4%), although the difference was not statistically significant (p=0.28). This supports findings from Langslet et al.21, who reported a greater risk of intraoperative and postoperative periprosthetic fractures with uncemented hemiarthroplasty due to poorer initial implant stability.

Conversely, the incidence of prosthetic dislocation, deep vein thrombosis (DVT), and surgical site infections was similar in both groups, consistent with other studies 22,23. While some studies suggest a higher risk of DVT and pulmonary embolism in cemented hemiarthroplasty due to the embolization of cement particles, our findings did not show a significant difference 24.

Clinical Implications and Recommendations

Based on our findings and previous literature, cemented hemiarthroplasty appears to provide better early functional outcomes and lower risk of periprosthetic fractures, making it a preferable option for elderly patients with good cardiovascular stability 25. However, for patients with severe cardiopulmonary comorbidities, uncemented hemiarthroplasty may be a safer alternative due to the potential risks associated with BCIS 26.

Longer follow-up studies are needed to assess long-term survivorship, implant loosening, and revision rates between these two techniques. Future research should also explore patient-specific factors such as bone quality, pre-existing comorbidities, and activity levels to optimize surgical decision-making.

CONCLUSION

This study compared cemented and uncemented hemiarthroplasty in elderly patients with displaced femoral neck fractures over a six-month follow-up. Our findings suggest that while cemented hemiarthroplasty is associated with longer surgery duration and greater blood loss, it provides better early functional outcomes and a lower risk of periprosthetic fractures. Uncemented hemiarthroplasty, on the other hand, may be preferable for patients with high cardiovascular risk due to the avoidance of bone cement implantation syndrome. Both techniques demonstrated comparable overall complication rates. Future studies with longer follow-ups and larger sample sizes are warranted to provide more definitive recommendations.

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