Original Article

Cemented versus Uncemented Bipolar Hemiarthroplasty for Displaced Femoral Neck Fractures in Elderly Patients: A Prospective Comparative Study

Rajashekar M[1]

[1]Professor and Unit Head, Department of Orthopaedics, Dr. B.R. Ambedkar Medical College, Bangalore, Karnataka, India.

Abstract

Background: Displaced neck fracture of the femur among the elderly patients is frequent because of osteoporosis and longer life expectancy. Although hemiarthroplasty is a more common process in order to allow early mobilization and pain relief, there is still controversy on the cemented versus uncemented types of fixation with cemented bearing more cardiopulmonary probability risks and uncemented handling more periprosthetic fractures. This paper is a comparison of clinical, surgical, and functional outcomes of bipolar hemiarthroplasty cemented and uncemented. **Material and Methods:** This was a prospective comparative study involving 30 patients aged above 55 with displaced neck fractures at the femur who were admitted to a tertiary care unit and between June 2022 and December 2024. The patients were randomly selected into 2 groups of 15 and cemented bipolar hemiarthroplasty (n=15) and uncemented bipolar hemiarthroplasty (n=15). The inclusion criteria were taken to be age over 55 years and surgical suitability; non-inclusion: medical unfitness, refusal to have surgery, and open fractures. The outcome measures were the time on the operating table, blood loss and transfusion needs, Harris Hip Score (HHS), ambulatory capacity, pain medication, residence, and complications. **Results:** The sample size was 14 men and 16 women (mean age 69 years) and the patients had comorbidities such as anemia (n=5) and type 2 diabetes mellitus (n=11). Uncemented hemiarthroplasty was less intra-operative time consuming, less intra-operative blood loss and fewer blood transfusions was adopted. There were similar results in HHS. There were no observed significant differences in the postoperative ability of walking, analgesic needs, or the place of residence. Both techniques had acceptable levels of complications. **Conclusion:** Cemented and uncemented bipolar hemiarthroplasty have positive functional results and reasonable complication scores in elderly patients with displaced neck fracture of the femur. Uncemented fixation has benefits in operating duration and blood loss; whereas cemented could be more stable in long-term fixation in a particular context. The efficacy of the technique should be assessed in larger studies to compare the methodology in diverse fracture patterns and in long-term outcome.

Keywords: Femoral neck fracture, bipolar hemiarthroplasty, cemented hemiarthroplasty, uncemented hemiarthroplasty, elderly, Harris Hip Score, prospective study.

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Introduction

The prevalence of femoral neck fractures is a significant health issue in elderly patients, and their number continues to increase as life span is getting longer and osteoporosis associated with old age is developing. These fractures are mainly related to persons above the age of 55-60 years, which are usually caused by low energy traumas, with high morbidity, impairment, and mortality rates implicated.[1] The most common surgery in dislocated fracture of the neck of the femur has been introduced to the current population of surgery, and it is the Hemiarthroplasty, which enables the affected individuals to stand on their feet early with relief from pain and regaining of hip stability to achieve free movement in the long run.[2]

The bipolar prostheses that are hemiarthropilated are cemented or uncemented. Cemented fixation offers an instant implant stability and has been the traditional choice but fears have been raised over bone cement implantation syndrome with possible causes of intraoperative hypotension, cardiopulmonary complication and perioperative death.[3] Comparatively, uncemented fixation does not experience cement-induced risks, potentially shortening the operative period and blood loss, although periprosthetic fracture, subsidence, and loosening of implant occur more frequently, especially with osteoporotic bone.[1,3]

Although many studies have been conducted, some randomized trials, and meta-analyses have been conducted, the use of cemented versus uncemented fixation is still a hot debate in terms of the functional outcomes, complications, and long-term survival, as well as some reports show better perioperative results

Address for correspondence: Dr. Rajashekar M, Professor and Unit Head, Department of Orthopaedics, Dr. B.R. Ambedkar Medical College, Bangalore, Karnataka, India.
E-mail: rajortho63@gmail.com

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of uncemented stems in weak patients.[3]

The aim of the proposed comparative study was to compare the operational conditions (operative time, blood loss, transfusion), functionality (Harris Hip Score, mobility), and the complications of the cemented and uncemented bipolar hemiarthroplasty in elderly patients (>55 years) with stellar neck displacement fracture, with the aim to determine evidence-based clinical decision making.

Materials and Methods

This is a proposed comparative descriptive study, which was decided to take place at the Department of Orthopaedics at Dr. B.R. Ambedkar Medical College and Hospital, Bangalore, India, between June 2022 and December 2024. The institutional ethics committee gave ethical advice, and all participants were given written informed consent and pre-enrolled.

They were included in patients above 55 years old that had displaced fractures of the neck of the femur (Garden type III or IV),[4] and were considered fit to undergo hemiarthroplasty. Eligibility criteria consisted of patients being medically unfit to undergo surgery (e.g., comorbidities with severe and uncontrollable conditions contraindicating anesthesia), patients uncomfortable with undergoing surgery, open fractures, pathological fractures (but not osteoporotic), pre-existing hip arthritis or deformity, non-ambulatory, or impossible to follow-up due to cognitive impairment.

The eligible patients were recruited in groups of 30 consecutive patients and separated into two equal groups of 15 each; that is, cemented bipolar hemiarthroplasty (CH group) and uncemented bipolar hemiarthroplasty (UCH group). They could be allocated at the discretion of surgeon, availability of implants, and bone quality (e.g., uncemented preferred in patients with sufficient cortical thickness to minimise the risk of subsidence whereas cemented was used in severe osteoporosis to ensure short-term stability), instead of being randomised, as occurs in the real world of clinical practice with limited resources.

All of them were done by professional orthopaedic surgeons and under either spinal or general anesthesia and via either a standard posterolateral or lateral approach. After reduction and preparation of the femur canal bipolar prostheses (modular designs of standard manufacturers) were placed. Third-generation cementing methods were used in the cemented group, such as canal lavage, pressurization and distal plugging, in order to reduce the number of complications related to cements.[5] In uncemented, biological fixation was realized by the press-fit stems with and without hydroxyapatite coating on them. Intraoperative information, such as the time of operation (since marring of the skin), and approximated amount of blood loss (during the operation weighing by the use of the swab and volume of suction) and any immediate complication were noted.

All patients were given standard postoperative treatment and care, such as prophylactic antibiotics, thromboprophylaxis (low-molecular-weight heparin) and multimodal analgesia (where not contraindicated) pain management with NSAIDs or another analgesic mode, and early full weight-bearing mobilisation under physiotherapy supervision, which usually starts on postoperative day-1 or -2. Blood transfusions were done owing to clinical necessity (hemoglobin lesser than 8g/dL or symptomatic anemia).

The periods of follow-up assessment were 6 weeks, 3 months, 6 months and 12 months after the operation (as necessary, there were more visits). The main outputs were surgical (operative time, blood loss, transfusion needs), and functional (Harris Hip Score, HHS which is a valid instrument with 44 points, 47 points, 4 points and 5 points) evaluation. The secondary outcomes included walking ability (independent, aided and non-ambulatory), analgesic needs, place of residence (home vs. institutionalized), and complications (e.g., periprosthetic fracture, dislocation, infection, deep vein thrombosis, cardiopulmonary events, mortality).

The data were compared with help of descriptive statistics, and the comparisons between the groups were conducted with help of the suitable parameters tests of the parameters (e.g., Student t-test in case of continuous variables such as operating time and HHS, and chi-square in case of categorical outcomes). The cut off point that was regarded as significant was 0.05.

Results

This prospective comparative study of 30 geriatric patients (>55 years old) with a displaced femoral neck fracture using either cemented bipolar (CH, n=15) or uncemented bipolar (UCH, n=15) hemiarthroplasty is reported in the results. The sample comprised of 14 males and 16 females whose average age was 69 years (range around 56-85 years). There were 5 patients with comorbid anemia and 11 patients with comorbid type 2 diabetes mellitus. Patients who attended at least 12 months of follow-ups were included, and at 6 weeks, 3 months, 6 months and 12 months postoperative, the patients were evaluated.

The population and baseline factors did not have any significant difference, and there was not much difference between the groups in terms of age, sex distribution, or comorbidities ($p > 0.05$). With regard to surgical parameters, there were significant changes in the mean operative time and absence of intraoperative blood loss in the uncemented group than in the cemented group, fewer blood transfusion were made in the UCH group. These perioperative benefits are in line with reports that cementing methods lengthen the surgical time and add to blood loss because of canal preparation and pressurization.[1,5]

The two groups had no significant difference in functional outcomes assessed mainly using Harris Hip Score (HHS) at all follow up periods including 12 months. There were no major disparities in the postoperative walking performance (most patients attained independent or assisted walking at 3-6 months), analgesics, or place of residence (most patients went back to their previous pre-injury residence). The rate of complications in both groups was rare and not very high, and there were no significant differences in relation to infection, dislocation, and deep vein thrombosis, and death rates during observation. The short-term follow-up did not mention any cases of periprosthetic fracture or major subsidence.

Generally, cemented and uncemented bipolar hemiarthroplasty showed good clinical outcomes, but the uncemented method has the perioperative advantage in the efficacy of operation and

blood-saving, whereas the functionality of recovery and complication rates were similar.

Table 1: Demographic and Baseline Characteristics

Characteristic	Cemented Group (n=15)	Uncemented Group (n=15)	Total (n=30)	p-value
Mean age (years)	69.2 ± 7.1	68.8 ± 6.9	69.0 ± 7.0	>0.05
Male:Female	7:8	7:8	14:16	>0.05
Anemia (n)	3	2	5	>0.05
Type 2 Diabetes Mellitus (n)	6	5	11	>0.05

[Table 1] summarizes patient demographics and key comorbidities at baseline. Groups were well-matched, with no statistically significant differences.

Table 2: Intraoperative and Perioperative Parameters

Parameter	Cemented Group (n=15)	Uncemented Group (n=15)	p-value
Mean operative time (minutes)	92 ± 12	68 ± 10	<0.05
Mean blood loss (mL)	320 ± 85	240 ± 70	<0.05
Blood transfusions (units, mean)	1.2 ± 0.8	0.5 ± 0.6	<0.05

[Table 2] compares key surgical parameters. The uncemented group exhibited significantly shorter operative duration, reduced blood loss, and lower transfusion needs, consistent with literature trends favoring uncemented fixation perioperatively.[1,5]

Table 3: Harris Hip Score (HHS) at Follow-up

Time Point	Cemented Group (mean ± SD)	Uncemented Group (mean ± SD)	p-value
6 weeks	62 ± 8	60 ± 9	>0.05
3 months	78 ± 7	76 ± 8	>0.05
6 months	85 ± 6	84 ± 7	>0.05
12 months	88 ± 5	87 ± 6	>0.05

[Table 3] shows functional outcomes via HHS (higher scores indicate better function). Scores improved progressively in both groups with no significant intergroup differences at any time point, indicating equivalent long-term hip function.

Table 4: Postoperative Functional and Living Status at 12 Months

Parameter	Cemented Group (n=15)	Uncemented Group (n=15)	Total (n=30)
Independent walking (%)	80%	73%	77%
Aided walking (%)	13%	20%	17%
Analgesic use (regular) (%)	7%	7%	7%
Returned to pre-injury residence (%)	87%	80%	83%

[Table 4] outlines mobility, pain management, and residence outcomes at final follow-up. No meaningful differences were noted between groups, supporting comparable recovery profiles.

Table 5: Complications (Intra- and Postoperative)

Complication	Cemented Group (n)	Uncemented Group (n)	Total (n)
Infection	1	0	1
Dislocation	0	1	1
DVT	1	0	1
Periprosthetic fracture	0	0	0
Mortality (within 12 months)	1	1	2
Other (e.g., cardiopulmonary)	0	0	0

[Table 5] lists observed complications. Rates were low and comparable in both groups, remaining within acceptable limits for this patient population with no statistically significant differences.

Discussion

The current research revealed comparable functional results as indicated by similar Harris Hip Scores (HHS) at all the follow-up periods (e.g., 88 C 5 in CH and 87 C 6 in UCH at 12 months) and walking ability, analgesic needs, and place of residence. UCH group experienced perioperative benefits such as much less operative time (68 ± 10 vs. 92 ± 12 minutes) and less blood loss (240 ± 70 vs. 320 ± 85 mL), which resulted in fewer transfusion. The incidence of complications was also similar and low in each group with no significant differences in terms of infection, dislocation, deep vein thrombosis (DVT) and mortality.

These findings are consistent with multiple previous reports of the importance of uncemented fixation in the perioperative period. As an example, systematic review and meta-analysis have continued to report reduced operative time and intraoperative blood loss with uncemented bipolar hemiarthroplasty than with

cemented methods due to evasion of cement pressurization and canal preparation.[1,6] In a 2021 meta-analysis of 13 studies (n=1561), uncemented bipolar hemiarthroplasty was associated with significantly reduced blood loss and operative duration, alongside lower risks of infection and heterotopic ossification.[6] Similarly, our findings of reduced blood loss and transfusions in the UCH group mirror these trends, supporting uncemented fixation as advantageous in frail elderly patients where minimizing surgical stress and transfusion needs is critical.

However, functional equivalence in HHS observed here contrasts with some evidence favoring cemented fixation for superior long-term hip function and pain relief. Multiple meta-analyses have indicated better postoperative hip scores and reduced residual pain with cemented hemiarthroplasty.[2,7,8] For example, a 2020 PRISMA-compliant meta-analysis of 15 RCTs (n=3790) found cemented procedures yielded lower pain (OR 0.48) and fewer implant-related complications (OR 0.20).[2] A meta-analysis of bipolar hemiarthroplasty in patients over 60 years stated no significant differences between the functional scores but reported benefits in cemented groups in terms of decreasing periprosthetic fractures and reoperations.[1] Our short-term (12-month) data, however, did not find any intergroup-differences in either HHS or mobility, perhaps because the sample is relatively small, the design of using bipolar forms of rehabilitation is consistent, and standardised rehabilitation treatment has the potential to minimise early differences.

The main strength of our work is that it provided the evidence of the low complication rates in both groups and that there were no cases of periprosthetic fractures. This is compared to the higher risks of periprosthetic fractures (OR 0.24 in favor of cemented) and aseptic loosening (OR 0.20) in uncemented studies reported in literature,[1,3] with exceptionally large density of registry data, e.g., the Norwegian Hip Fracture Register. The lack of these cases in our UCH group might indicate selective admission of patients (e.g., they should have sufficient bone quality to press-fit), new design of implants covered with hydroxyapatite, and a low follow-up period. There were similar results in mortality (one death per group in 12 months) as with the majority of meta-analyses that evidence no long-term survival difference,[1,2,10] although some have identified temporary perioperative mortality risk with cement following bone cement implantation syndrome.

The similarity in walking independence, analgesic use, and residence status indicates the possible suitability of both the techniques in restoring the function and independence of the elderly patients with displaced femur neck fractures. This is in line with randomized trials such as the WHiTE 5 study (NEJM 2022) that did not find significant differences in the quality of life or in significant mortality differences with cemented fixation, but utilizing uncemented has increased periprosthetic fracture risk. We find the same benefits of uncemented fixation in perioperative issues, as may happen in resource-limited conditions or in patients with decapacitated patients; that shorter surgery and reduced blood loss is of more essence than issues with the implants in the long term.

Shortcomings such as small sample size (n=30), non-randomized assignment (surgeon preference and bone quality based), and rather short follow-up (12 months) may fail to represent late complications such as subsidence or loosening that are more prevalent in uncemented stems across different populations.

Finally, cemented and uncemented bipolar hemiarthroplasty offer desirable results in terms of acceptable complication rates in elderly patients having lost their necks through femoral neck fracture. Uncemented has apparent perioperative advantages of operative efficiency and blood saving, whereas among the short term there is no difference in functional recovery. These findings contribute to the ongoing debate, suggesting individualized selection based on patient frailty, bone quality, and surgical context.

Conclusion

The present study results may be helpful in displaced neck fracture of the femur among the elderly patients.

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Conflicts of interest

There are no conflicts of interest.

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