Original Article

A Comparative Analysis of Cemented and Non-Cemented Hemiarthroplasty in Hip Joint Reconstruction

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Abstract

Background: *Hip fractures, particularly femoral neck fractures, are a major public health concern because of their high morbidity and mortality, particularly in elderly patients. Hemiarthroplasty is a widely used treatment, with cemented and non-cemented techniques as the primary treatment options. This study compared the surgical outcomes, functional recovery, and postoperative complications between cemented and non-cemented hemiarthroplasty in hip joint reconstruction.*

Methods: *This comparative observational study was conducted at Department of Orthopedic, Bangabandhu Sheikh Mujib Medical University (BSMMU), Holy Family Red Crescent Medical College Hospital, Dhaka and National Institute of Traumatology and Orthopedic rehabilitation (NITOR), Dhaka Bangladesh from January 2022 to December 2024 on 150 patients, divided equally into cemented and non-cemented hemiarthroplasty groups. Preoperative characteristics, intraoperative parameters, and postoperative outcomes were recorded. Functional recovery was assessed using the Harris Hip Score and Visual Analog Scale (VAS) for pain. Statistical analysis was performed using SPSS, with statistical significance set at $P < 0.05$.*

Results: *Cemented hemiarthroplasty had a shorter operative time (72.5 ± 8.2 vs. 85.1 ± 10.5 minutes; $p<0.001$) but resulted in greater blood loss (305 ± 53 vs. 254 ± 66 ml; $p<0.001$). Early ambulation was significantly better in the cemented group (3.4 ± 1.0 vs. 4.3 ± 1.2 days; $p<0.001$). Functional recovery was superior in the cemented group (Harris Hip Score: 85.8 ± 6.5 vs. 81.2 ± 7.1; $p<0.001$), while complication rates were comparable.*

Conclusion: *Cemented hemiarthroplasty offers better early functional recovery and faster mobility, whereas non-cemented fixation reduces the intraoperative risk. Patient selection should be individualized for optimal outcomes.*

Keywords: *Hemiarthroplasty, Cemented fixation, non-cemented fixation, Hip fracture*

Introduction

The incidence of hip fractures, especially femoral neck fractures is a major public health problem due to their high incidence and the consequent high degree of morbidity and mortality. Since the subject population tends to be elderly, which in turn results in a growing aging population and many hip fractures, effective surgical interventions are required for restoring function and improving quality of life. The widely utilized treatment of displaced femoral neck fractures in elderly patients is hemiarthroplasty, with cemented and non-cemented fixation being the two predominant techniques [1].

The major benefit of cemented hemiarthroplasty has been its ability to give prompt implant stability that permits early weight-bearing and more favorable initial pain relief. This technique helps decrease risk of periprosthetic fractures and micro motion at the bone – implant interface with early improved functional outcomes. But there have been these intraoperative risks of cement application, which is embolism, hypotension, risk of perioperative mortality, especially in frail elderly patients [2, 3].

As an alternative to the cementation, the limits of the risks were mitigated with hemiarthroplasty without cementation. The technique is based on biological fixation by osseointegration, believed to offer this stability for long term implanting. It also eliminates the risk of cement related complications and is a preferable treatment in patients with cardiovascular comorbidity. The initial instability of non-cemented prostheses can however result in increased postoperative pain, delayed ambulation, and a higher incidence of periprosthetic fractures [4, 5].

Altogether, factors such as patient age, bone quality, comorbid conditions and surgeon preference influence which fixation method requires is selected. In patient populations with risk for cement-related risks, non-cemented implants may be more preferred as they achieve better immediate fixation and offer lower early revision rates than cemented implants [6, 7].

The purpose of this study was to evaluate the outcomes of cemented versus non-cemented hemiarthroplasty in hip joint reconstruction, focusing on operative parameters, functional recovery, and postoperative complications. This study seeks to provide evidence that may assist in optimizing surgical decision-making and improving patient outcomes.

Methodology & Materials

This comparative observational study conducted at Department of Orthopedic, Bangabandhu Sheikh Mujib Medical University (BSMMU), Holy Family Red Crescent Medical College Hospital, Dhaka and National Institute of Traumatology and Orthopedic rehabilitation (NITOR), Dhaka Bangladesh from January 2022 to December 2024. Data of 150 patients who underwent cemented or non-cemented hemiarthroplasty for hip joint reconstruction collected retrospectively and included in this study.

Selection Criteria

Inclusion Criteria:

- Patients diagnosed with femoral neck fractures requiring hemiarthroplasty.
- Patients who underwent either cemented or non-cemented hemiarthroplasty.
- Availability of complete medical records and follow-up data.

Exclusion Criteria:

- Patients with pathological fractures.
- Patients with previous hip surgeries.
- Severe comorbidities contraindicating surgery.
- Incomplete medical records or loss to follow-up.

Data collection: This study included patients undergoing cemented or non-cemented hemiarthroplasty at Department of Orthopedic, Bangabandhu Sheikh Mujib Medical University (BSMMU) and Holy Family Red Crescent Medical College Hospital, Dhaka Bangladesh from January 2022 to December 2024. All participants were given informed consent. Demographic and comorbidities were recorded preoperatively. Operative time and blood loss were also documented. These were assessed in terms of hospital stay, ambulation time, functional recovery (Harris Hip Score and VAS), and of complications postoperatively. Structured forms were used to collect data and analyzed securely.

Statistical analysis of data: Data were analyzed using SPSS. We presented continuous variables as mean ± standard deviation and compared them using independent t-test. The chi square test was used for analysis of categorical variables with percentages. Statistical significance was considered to be a p- value <0.05. These results were compared against results of surgical parameters, functional outcomes and postoperative complications for cemented and non-cemented hemiarthroplasty groups.

Results

Table I: Baseline characteristics of the respondents (n=150)

Variables	Cemented (n=75)	Non -cemented (n=75)	P-value
Average age	72.6±6.5	73.1±5.8	0.619
Male (%)	47 (62.67)	45 (60.0)	0.737
Female (%)	28 (37.33)	30 (40.0)	0.737
Diabetes (%)	21 (28.0)	23 (30.67)	0.720
Hypertension (%)	36 (48.0)	31 (41.33)	0.412

Table 1 shows the demographic and clinical characteristics of patients who undergo cemented or no cemented hemiarthroplasty. The mean age was 72.6 ± 6.5 and 73.1 ± 5.8 years in the cemented and non-cemented group respectively. Diabetes and hypertension distribution (28.0 % vs. 30.67 % and 48.0 % vs. 41.33 % respectively) was not statistically significant (p > 0.05).

Table II: Surgical Outcomes (n=150)

Outcomes	Cemented (n=75)	Non -cemented (n=75)	P-value
Mean operative time (minutes)	72.5±8.2	85.1±10.5	<0.001
Blood loss (ml)	305±53	254±66	<0.001
Length of hospital stay (days)	5.2±1.5	4.6±1.7	0.023
Time of first ambulation (days)	3.4±1.0	4.3±1.2	<0.001

Surgical outcomes were shows in table 2. Operative time was shorter for cemented hemiarthroplasty (72.5 ± 8.2 minutes vs. 85.1 ± 10.5 minutes; p<0.001) but blood loss was more (305 ± 53 ml vs. 254 ± 66 ml; p<0.001). However, hospital stay was slightly longer (5.2 ± 1.5 vs. 4.6 ± 1.7 days; p= 0.023) and ambulation occurred earlier (3.4 ± 1.0 vs. 4.3 ± 1.2 days; p< 0.001).

Table III: Functional Outcomes (n=150)

Parameter	Cemented (n=75)	Non -cemented (n=75)	P-value
Pain score (VAS)	2.0±0.5	2.7±0.7	<0.001
Harris Hip Score	85.8±6.5	81.2±7.1	<0.001
Walking independly (%)	67 (89.33)	59 (78.67)	0.076

Functional outcomes show in table 3. The cemented group had lower pain (VAS: 2.0 ± 0.5 vs. 2.7 ± 0.7; p<0.001) and better functional recovery (Harris Hip Score: 85.8 ± 6.5 vs. 81.2 ± 7.1; p<0.001). Patients also returned more to independent walking (89.33% vs. 78.67%; p=0.076).

Table IV: Postoperative Complications (n=150)

Complications	Cemented (n=75)	Non -cemented (n=75)	P-value
Deep Vein Thrombosis	4 (5.33)	7 (9.33)	0.348
Prosthetic Dislocation	2 (2.67)	5 (6.67)	0.247
Periprosthetic Fracture	2 (2.67)	4 (5.33)	0.407
Surgical Site Infection	2 (2.67)	3 (4.0)	0.651

Differences in complication rates between the non-cemented and cemented groups were not significant. There were no significant difference between non-cemented cases and cemented cases for deep vein thrombosis (5.33% vs. 9.33%), prosthetic dislocations (2.67% vs. 6.67%) and periprosthetic fractures (2.67% vs. 5.33%) (p>0.05).

Discussion

This study compares outcomes of cemented and non-cemented hemiarthroplasty for hip joint reconstruction with operative parameters, functional outcomes and postoperative complications. Cemented hemiarthroplasty resulted in significantly shorter operative time, increased blood loss, and longer hospital stay compared to non-cemented hemiarthroplasty, whereas, non-cemented hemiarthroplasty is associated with delayed ambulation and slightly inferior functional scores.

This is consistent with the findings by Li et al. (2020), who found cemented hemiarthroplasty significantly reduces time to full weight bearing and better early mobility outcomes when compared to non-cements implants [6]. A similar finding was also made by Parker and Cawley (2020) in which patients who underwent cemented hemiarthroplasty had better Harris Hip Scores (HHS) at 3 months after operation [7]. We also found HHS was higher in the cemented group (85.8 ± 6.5) compared with the non-cemented group (81.2 ± 7.1), in line with previous studies [6, 7].

In our study prosthesis cementation was significantly shorter (72.5 ± 8.2 minutes) than for non- cemented prosthesis (85.1 ± 10.5 minutes), similar to other studies by Langslet et al. (2014) and due to the need for more surgical adjustments on non-cemented prosthesis[8]. Nevertheless, the lower intraoperative blood loss in the group without cementation (254 ± 66 ml vs. 305 ± 53 ml in the cemented group) agrees with Figved et al. (2009) who found that cementation causes greater intraoperative bleeding [9].

Our study showed patients with cemented hemiarthroplasty mobilized earlier (3.4 ± 1.0 days) than those with non-cemented implants (4.3 ± 1.2 days). Similar to De Angelis et al. (2012), cemented prostheses were reported to improve early postoperative mobility and reduce rehabilitation duration [10]. However, in comparison, Taylor et al. (2012) report no statistically significant differences in ambulation time between groups indicating that the protocol of individual rehabilitation may influence outcomes [11].

However, slightly more postoperative complications occurred in the non-cemented group, which was not statistically significant. The rates of deep vein thrombosis (DVT) (5.33 vs. 9.33%) and prosthetic dislocation (2.67 vs. 6.67%) were comparable to those reported by Ning et al. (2014) who found a slightly higher dislocation rate in non-cemented prostheses [12]. The Moerman et al. (2017) reported that periprosthetic fractures were also more common in non-cemented group (5.33% vs. 2.67%), which they attributed to lack of cement fixation permitting the presence of the micro-movement of the bone- implant interface[13].

Our study found low surgical site infection rates in both groups (2.67% in cemented vs. 4.0% in non- cemented) which were consistent with findings of He et al. (2023) who report no difference in infection rates between fixation methods[14]. Okike et al. (2020) however suggested that cemented prostheses could have marginal advantage in the infection reduction since they are better isolated in the initial position and provide lower micro motion[15].

The major advantage of non-cemented hemiarthroplasty is decreased risk for cement related complications, including cement embolism and intra operative hypotension. Additionally, Costain et al. (2011) reported that cemented procedures had slightly higher perioperative mortality risk due to cardiovascular risk of the application of cement[16].

In summary, these findings support the existing literature regarding cemented hemiarthroplasty, demonstrating superior early functional outcomes, faster ambulation and better pain relief. Despite this, non-cemented hemiarthroplasty remains an acceptable option specifically in those at higher risk of developing complications around cementing. Definitive guidelines to select the optimal patients for clinical trials will only be determined by further multicenter randomized trials with longer follow-up.

Conclusion

Early functional recovery, lower pain scores, and faster ambulation were shown for cemented hemiarthroplasty, but this treatment was also accompanied by higher blood loss and longer hospital stay. However, non-cemented hemiarthroplasty had less intraoperative risk but high delayed mobility. The complication rates were similar between both techniques. Patient factors and surgical considerations should be taken into account in a selection that will provide optimal outcomes.

References

1. Ono T, Watanabe N, Hayakawa K, Kainuma S, Yamada H, Waseda Y, Kanda Y, Fukuoka M, Tokuda H, Murakami H, Kuroyanagi G. Comparative outcomes of cemented versus cementless stems in bipolar hemiarthroplasty for femoral neck fractures. Medicine. 2024 Oct 11;103(41):e39946.

2. Jayaram G, Sudhakar MV, Kumar RA, Jijulal CU. Study of outcomes of cemented hemiarthroplasty for comminuted intertrochanteric fractures in the elderly. Journal of Orthopaedics. 2023 Jul 1;41:67-72.

3. Kumar S, Kumar A, Bramesh AH, Teja KC, Razek MR, Kumar R. Outcome of Cemented Hemiarthroplasty of Hip in Elderly Patients Operated for Neck of Femur Fracture. Journal of Orthopaedic Diseases and Traumatology. 2022 May 1;5(2):78-82.

4. Bolbocean C, Hattab Z, O'Neill S, Costa ML. Are there patients with an intracapsular fracture of the hip who may benefit from an uncemented hemiarthroplasty? a causal forest analysis of the WHiTE 5 randomized clinical trial. The Bone & Joint Journal. 2024 Jul 1;106(7):656-61.

5. Leitner L, Schitz F, Sadoghi P, Puchwein P, Holinka J, Leithner A, Kalcher E. Treatment of femoral neck fractures using actis stem: complication rate in 188 uncemented hemiarthroplasties. Archives of Orthopaedic and Trauma Surgery. 2024 May 9:1-8.

6. Li N, Zhong L, Wang C, Xu M, Li W. Cemented versus uncemented hemi-arthroplasty for femoral neck fractures in elderly patients: a systematic review and meta-analysis of randomized controlled trials. Medicine. 2020 Feb 1;99(8):e19039.

7. Parker MJ, Cawley S. Cemented or uncemented hemiarthroplasty for displaced intracapsular fractures of the hip: a randomized trial of 400 patients. The bone & joint journal. 2020 Jan 1;102(1):11-6.

8. Langslet E, Frihagen F, Opland V, Madsen JE, Nordsletten L, Figved W. Cemented versus uncemented hemiarthroplasty for displaced femoral neck fractures: 5-year followup of a randomized trial. Clinical Orthopedics and Related Research®. 2014 Apr; 472:1291-9.

9. Figved W, Opland V, Frihagen F, Jervidalo T, Madsen JE, Nordsletten L. Cemented versus uncemented hemiarthroplasty for displaced femoral neck fractures. Clinical Orthopedics and Related Research®. 2009 Sep;467(9):2426-35.

10. DeAngelis JP, Ademi A, Staff I, Lewis CG. Cemented versus uncemented hemiarthroplasty for displaced femoral neck fractures: a prospective randomized trial with early follow-up. Journal of orthopedic trauma. 2012 Mar 1;26(3):135-40.

11. Taylor F, Wright M, Zhu M. Hemiarthroplasty of the hip with and without cement: a randomized clinical trial. JBJS. 2012 Apr 4;94(7):577-83.

12. Ning GZ, Li YL, Wu Q, Feng SQ, Li Y, Wu QL. Cemented versus uncemented hemiarthroplasty for displaced femoral neck fractures: an updated meta-analysis. European Journal of Orthopedic Surgery & Traumatology. 2014 Jan; 24:7-14.

13. Moerman S, Mathijssen NM, Niesten DD, Riedijk R, Rijnberg WJ, Koëter S, Kremers van de Hei K, Tuinebreijer WE, Molenaar TL, Nelissen RG, Vochteloo AJ. More complications in uncemented compared to cemented hemiarthroplasty for displaced femoral neck fractures: a randomized controlled trial of 201 patients, with one year follow-up. BMC musculoskeletal disorders. 2017 Dec;18:1-9.

14. He Y, Tang X, Liao Y, Liu S, Li L, Li P. The Comparison between Cemented and Uncemented Hemiarthroplasty in Patients with Femoral Neck Fractures: A Systematic Review and Meta-analysis of Randomized Controlled Trials. Orthopedic Surgery. 2023 Jul;15(7):1719-29.

15. Okike K, Chan PH, Prentice HA, Paxton EW, Burri RA. Association between uncemented vs cemented hemiarthroplasty and revision surgery among patients with hip fracture. Jama. 2020 Mar 17;323(11):1077-84.

16. Costain DJ, Whitehouse SL, Pratt NL, Graves SE, Ryan P, Crawford RW. Perioperative mortality after hemiarthroplasty related to fixation method: a study based on the Australian orthopedic association national joint replacement registry. Acta orthopaedical. 2011 Jun 1;82(3):275-81.