

A Comparative Study in the Treatment of Fracture Neck of Femur with Cemented and Non Cemented Bipolar Prosthetic Replacement in Rural Hospitals of Bangladesh

Dr. Md. Abul Kenan¹, Dr. Golam Mostafa², Dr. Kazi Farhana Begum³, Dr. Habibur Rahman⁴

¹Associate Professor & Head, Department of Orthopaedic Surgery, Shahid Syed Nazrul Islam Medical College, Kishoreganj, Bangladesh

²Assistant Professor, Department of Orthopaedic Surgery, President Abdul Hamid Medical College, Kishoreganj, Bangladesh

³Assistant Professor, Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh

⁴Ex-Consultant, 250 Bed District Sadar Hospital, Kishoreganj, Bangladesh

Corresponding Author: Dr. Md. Abul Kenan, Associate Professor & Head, Department of Orthopaedic Surgery, Shahid Syed Nazrul Islam Medical College, Kishoreganj, Bangladesh

Abstract

Background: The treatment of fracture neck of femur with bipolar prosthetic replacement is commonly performed using cemented and non-cemented implants. This study compares the clinical outcomes, complications, and patient satisfaction between these two methods in rural hospitals of Bangladesh.

Methods: This comparative study was conducted in rural hospitals of the Kishoreganj district, Bangladesh, from January 2023 to December 2023, to evaluate the outcomes of cemented versus non-cemented bipolar prosthetic replacement in patients with femoral neck fractures.

Results: The age range of participants was 48 to 68 years. Regarding gender distribution, 44.4% of patients in the Cemented group were male, compared to 37.0% in the Non-Cemented group. The cemented group had a mean hospital stay of 8.3 ± 2.1 days, while the non-cemented group had a slightly longer stay of 9.0 ± 2.3 days. Postoperative infection rates were higher in the cemented group (11.1%) compared to the non-cemented group (3.7%), with diabetic patients showing a higher infection risk in both groups. Patient satisfaction was 78% in the cemented group and 74% in the non-cemented group, with no significant difference between the two groups ($p > 0.05$).

Conclusion: Cemented bipolar prosthetic replacement offers the advantage of shorter hospital stays and slightly higher patient satisfaction, but at the cost of a higher infection rate, particularly among diabetic patients. Non-cemented prostheses provide comparable long-term outcomes with a lower infection risk, making them a viable option for patients with comorbid conditions.

Key words: Fracture neck of femur, Cemented bipolar prosthesis, Non-cemented bipolar prosthesis, Hip replacement, Prosthetic replacement.

I. Introduction

Fracture of the neck of the femur is a significant public health concern, particularly among the elderly population, due to its association with high morbidity, mortality, and substantial healthcare costs.¹ This condition is especially prevalent in older adults with osteoporosis and can result from minimal trauma such as a fall from standing height.² The optimal treatment approach for femoral neck fractures remains debated, with bipolar prosthetic replacement being one of the most commonly performed surgical interventions for displaced fractures in elderly patients.³ The choice between cemented and non-cemented bipolar prostheses is critical, as it significantly impacts postoperative outcomes, including recovery time, functional mobility, and complication rates.

Cemented bipolar prosthetic replacement is known for providing immediate stability and better initial fixation, which can facilitate early mobilization and reduce the risk of implant-related complications.⁴ Several studies have demonstrated that cemented prostheses are associated with improved functional outcomes, reduced pain, and lower rates of reoperation compared to non-cemented options.^{5,6} However, cemented prostheses carry risks such as bone cement implantation syndrome, which may lead to perioperative cardiovascular complications, particularly in frail patients with comorbidities such as cardiovascular disease or diabetes mellitus.^{7,8}

In contrast, non-cemented bipolar prosthetic replacement avoids the complications associated with cement use and is preferred in younger, more active patients or those with poor bone quality where cement fixation may be challenging.⁹ Non-cemented implants rely on biological fixation through bone ingrowth, which may take longer to achieve stable fixation compared to cemented implants.¹⁰ Some studies suggest that non-cemented prostheses may have higher rates of postoperative complications, such as aseptic loosening and periprosthetic fractures, particularly in the early postoperative period.¹¹ However, advances in implant design and surgical techniques have significantly improved the outcomes of non-cemented prostheses, making them a viable alternative in selected patient populations.¹²

The choice between cemented and non-cemented prostheses is further complicated in low-resource settings, such as rural hospitals in Bangladesh, where factors like limited access to specialized surgical care, varying surgeon expertise, and financial constraints play crucial roles in treatment decisions. Despite the global increase in the use of bipolar prosthetic replacement for femoral neck fractures, there is limited data on its comparative outcomes in rural settings, particularly in low- and middle-income countries (LMICs).^{13,14} The lack of robust data from such settings makes it challenging to establish clear clinical guidelines tailored to these environments.¹⁵

This study aims to compare the clinical outcomes of cemented versus non-cemented bipolar prosthetic replacement in the treatment of femoral neck fractures in rural hospitals of Bangladesh. By focusing on this specific patient population, the study seeks to provide evidence on the safety, efficacy, and overall impact of both treatment options in a real-world rural setting. Understanding these differences is crucial for optimizing surgical management and improving patient outcomes in resource-constrained environments.

II. Methodology & Materials

This comparative study was conducted in rural hospitals of the Kishorganj district, Bangladesh, from January 2023 to December 2023, to evaluate the outcomes of cemented versus non-cemented bipolar prosthetic replacement in patients with femoral neck fractures. A total of 54 patients, aged 48 to 68 years, were included in the study, with 27 patients in each group (cemented and non-cemented). The sample consisted of 22 males and 32 females, with 6 patients having diabetes mellitus (DM). Participants were selected based on inclusion criteria, which involved patients with femoral neck fractures suitable for bipolar prosthetic replacement and who consented to participate in the study. Radiological assessments revealed that patients in the non-cemented group typically had strong bone mass, which made them ideal candidates for non-cemented bipolar prosthetic replacement due to the sufficient bone quality to support the prosthesis without additional fixation. Conversely, patients in the cemented group exhibited less thick and weaker bone mass, necessitating the use of cemented prostheses to provide additional stability and support, compensating for the compromised bone integrity. Exclusion criteria included patients with previous hip surgeries, pathological fractures, and those unfit for surgery due to severe comorbidities. The surgical procedures were performed by experienced orthopedic surgeons using standard techniques for both cemented and non-cemented bipolar prostheses. Postoperative management included early mobilization, pain control, and physiotherapy tailored to each patient's condition. Data were collected on demographic characteristics, clinical outcomes, and complications, including infection rates, length of hospital stay, and patient satisfaction. Postoperative infections were identified based on clinical signs and confirmed by laboratory investigations. Functional recovery was assessed through the length of hospital stay and patient satisfaction surveys conducted at discharge. Statistical analysis was performed using SPSS software, with continuous variables expressed as mean \pm standard deviation and categorical variables as frequencies and percentages. A p-value of <0.05 was considered statistically significant. Ethical approval was obtained from the respective hospital ethics committees, and informed consent was secured from all participants.

III. Results

Table 1: Demographic Characteristics of Patients (N = 54)

Characteristics	Cemented Group (n = 27)	Non-Cemented Group (n = 27)	Total (N = 54)
Age (years)			
Mean \pm SD	58.4 \pm 5.7	59.1 \pm 6.2	58.8 \pm 5.9
Gender			
Male	12 (44.4%)	10 (37.0%)	22 (40.7%)
Female	15 (55.6%)	17 (63.0%)	32 (59.3%)

Diabetes Mellitus			
Present	4 (14.8%)	2 (7.4%)	6 (11.1%)
Absent	23 (85.2%)	25 (92.6%)	48 (88.9%)

Table 1 presents the demographic characteristics of the 54 patients included in the study, divided into two groups: Cemented (n = 27) and Non-Cemented (n = 27). The mean age of patients in the Cemented group was 58.4 ± 5.7 years, while in the Non-Cemented group, it was 59.1 ± 6.2 years, with an overall mean age of 58.8 ± 5.9 years. The age range for both groups was 48 to 68 years. Regarding gender distribution, 44.4% of patients in the Cemented group were male, compared to 37.0% in the Non-Cemented group. Females constituted 55.6% of the Cemented group and 63.0% of the Non-Cemented group, with an overall female representation of 59.3%. The prevalence of diabetes mellitus was higher in the Cemented group, with 14.8% of patients affected, compared to 7.4% in the Non-Cemented group. Overall, 11.1% of the study population had diabetes, while 88.9% were non-diabetic.

Table 2: Clinical Outcomes and Complications in Cemented and Non-Cemented Groups

Outcome	Cemented Group (n = 27)	Non-Cemented Group (n = 27)
Postoperative Infection		
Total Infections	3 (11.1%)	1 (3.7%)
Infections in Patients with DM	2 (7.4%)	1 (3.7%)
Infections in Non-DM Patients	1 (3.7%)	0 (0%)
Functional Recovery		
Length of Hospital Stay (days)	8.3 ± 2.1	9.0 ± 2.3
Patient Satisfaction (%)	21 (78%)	20 (74%)
Follow-up at 14 Days		
Patient Satisfaction (%)	19 (70.4%)	18 (66.7%)

Table 2 presents the clinical outcomes and complications for patients treated with cemented and non-cemented bipolar prosthetic replacements for femoral neck fractures. The cemented group experienced a higher total infection rate, with 3 patients (11.1%) affected, compared to 1 patient (3.7%) in the non-cemented group. Among patients with diabetes mellitus, infections were more prevalent in the cemented group (7.4%) than in the non-cemented group (3.7%). In non-diabetic patients, infections occurred only in the cemented group (3.7%), with no infections reported in the non-cemented group. The mean length of hospital stay was slightly shorter for the cemented group (8.3 ± 2.1 days) compared to the non-cemented group (9.0 ± 2.3 days), suggesting marginally quicker recovery with cemented prostheses. Initial patient satisfaction rates were similar, with 78% in the cemented group and 74% in the non-cemented group. However, at the 14-day follow-up, satisfaction declined slightly in both groups, to 70.4% in the cemented group and 66.7% in the non-cemented group. Overall, the data indicates that while both groups had comparable satisfaction rates initially, the cemented group showed a higher rate of infections, particularly among diabetic patients, and a slightly better early functional recovery.

Table 3: Comparative Analysis of Outcomes between Cemented and Non-Cemented Groups

Variables	Cemented Group (n = 27)	Non-Cemented Group (n = 27)	p-value
Length of Hospital Stay	8.3 ± 2.1	9.0 ± 2.3	0.249
Infection Rate (%)	3 (11.1%)	1 (3.7%)	0.304
Patient Satisfaction (%)	21 (78%)	20 (74%)	0.733

Table 3 presents the comparative analysis of clinical outcomes between the Cemented and Non-Cemented groups. The average length of hospital stay was 8.3 ± 2.1 days in the Cemented group and 9.0 ± 2.3 days in the Non-Cemented group, with a p-value of 0.249, indicating no statistically significant difference between the groups. The infection rate was slightly higher in the Cemented group (11.1%) compared to the Non-

Cemented group (3.7%), with a p-value of 0.304, showing that this difference was not statistically significant. Patient satisfaction was 78% in the cemented group and 74% in the non-cemented group, with no significant difference between the two groups ($p > 0.05$). These results suggest that there were no significant differences between the cemented and non-cemented bipolar prosthetic replacement groups in terms of length of hospital stay, infection rate and patient satisfaction.

IV. Discussion

This comparative study assessed clinical outcomes between cemented and non-cemented bipolar prosthetic replacements for treating fracture neck of femur among patients in rural hospitals of Bangladesh. The results were compared with findings from other studies to provide a broader perspective on the effectiveness, complications, and patient outcomes associated with these two techniques.

The overall infection rate in the cemented group was 11.1%, compared to 3.7% in the non-cemented group. Among patients with diabetes mellitus (DM), infections occurred in 7.4% of cemented cases and 3.7% of non-cemented cases. These findings are consistent with reports from other studies where cemented prostheses often show a slightly higher infection risk due to factors like cement implantation syndrome and microfractures caused by thermal necrosis. For instance, Rogmark et al. reported infection rates of 8-12% for cemented implants, closely aligning with our observed 11.1% infection rate in the cemented group.¹⁶ Conversely, infection rates in non-cemented implants have generally been reported to be lower, around 2-5%, which is in line with our study's findings of 3.7%.¹⁷

The cemented group in our study had a mean hospital stay of 8.3 ± 2.1 days, slightly shorter than the 9.0 ± 2.3 days observed in the non-cemented group. This aligns with findings from a study by Parker et al., which noted that cemented implants tend to allow earlier mobilization and reduced hospital stay compared to non-cemented options. In their study, patients with cemented implants had an average hospital stay of 7.5 to 8.5 days, while non-cemented implants ranged from 8.5 to 9.5 days.¹⁸ The slightly longer stay for non-cemented implants is often attributed to the initial instability requiring more cautious postoperative management until adequate biological fixation occurs.¹⁹

Initial patient satisfaction in our study was relatively high, with 78% in the cemented group and 74% in the non-cemented group. These results are comparable to the satisfaction levels reported by other studies, such as the work of Blomfeldt et al., which found satisfaction rates of 80-85% for cemented implants and around 70-75% for non-cemented implants.²⁰ The immediate stability and functional recovery offered by cemented implants are often cited as key factors contributing to higher satisfaction. However, the difference in satisfaction between cemented and non-cemented implants in various studies, including ours, is generally not statistically significant, indicating that both approaches can achieve comparable patient-reported outcomes when appropriately selected.²¹

Patient satisfaction in this study was evaluated based on several key factors, including pain relief, improvement in mobility, and overall comfort with the prosthesis post-surgery. A standardized satisfaction questionnaire was administered at discharge and again at the 14-day follow-up. This questionnaire assessed the patients' ability to perform daily activities, the level of pain during movement, and their overall perception of the surgery's success. Satisfaction was further influenced by the pace of recovery, ease of rehabilitation, and the absence of complications such as infections. Prosthesis stability was also a critical component of satisfaction; importantly, at the 14-day follow-up, no patients in either the cemented or non-cemented groups experienced prosthetic dislocation, positively impacting the satisfaction levels. While initial satisfaction rates were high, at the 14-day follow-up, there was a slight decline, with satisfaction rates dropping to 70.4% in the cemented group and 66.7% in the non-cemented group. These factors collectively offered a comprehensive assessment of patient satisfaction with their respective treatments.

When comparing functional outcomes, our study showed that cemented prostheses are slightly more favorable in terms of quicker recovery, allowing for earlier mobilization and reduced pain. Studies by Lieberman et al. support this, demonstrating that patients with cemented prostheses often achieve better early postoperative function due to the immediate fixation provided by the cement.²² However, over the long term, non-cemented implants can perform equally well as they rely on the body's natural bone growth to secure the prosthesis, leading to similar functional outcomes after the initial recovery phase.²³

Our study highlighted the increased infection rates among patients with DM receiving cemented implants (7.4% versus 3.7% in non-cemented). This aligns with findings from a meta-analysis by Carli et al., which indicated that cemented implants in diabetic patients carry an additional risk due to the increased susceptibility to infections associated with diabetes.²⁴ In contrast, the non-cemented approach reduces exposure to such risks by avoiding the additional trauma and thermal effects of cement application, making it a preferable choice in patients with comorbid conditions.²⁵

The non-cemented group's infection rates (3.7%) and functional outcomes are consistent with other studies, such as the work by Espehaug et al., where non-cemented implants showed infection rates between 2-

4%, especially in healthier and younger patients.²⁶ The biological fixation in non-cemented implants has been found to be particularly effective in patients with good bone quality, allowing these patients to eventually achieve comparable functional results without the immediate stability of cemented implants.²⁷

Limitations of the study

The study included only 54 patients, limiting the generalizability of the results. A larger sample size would provide more robust data to confirm the findings. The study was conducted in hospitals within the Kishorganj district, which may not represent the broader population of Bangladesh, especially urban or more developed regions with different healthcare facilities and expertise. A longer follow-up period is necessary to evaluate long-term complications, prosthesis survival rates, and overall functional recovery.

V. Conclusion

Overall, our findings resonate with existing literature, confirming that cemented bipolar prosthetic replacements provide the advantage of immediate stability and early mobilization, albeit with a slightly higher infection risk, particularly in diabetic patients. Non-cemented replacements, while requiring a longer initial recovery phase, pose a lower infection risk and eventually offer comparable functional outcomes. These comparative insights reinforce the need for individualized patient assessment when choosing the appropriate prosthetic technique, taking into account factors such as age, comorbid conditions, and overall bone health.

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Conflicts of interest

There are no conflicts of interest.

Ethical approval

The study was approved by the Institutional Ethics Committee.

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