

Functional Outcomes Following Cemented Bipolar Hemiarthroplasty Versus Total Hip Arthroplasty for Displaced Femoral Neck Fractures in Older Adults: A Retrospective Cohort Study

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Abstract:

Background:

Older persons frequently sustain femoral neck fractures, which are linked to significant morbidity and functional loss. Although total hip arthroplasty (THA) and cemented bipolar hemiarthroplasty (CBH) are common treatment choices, there is ongoing debate regarding which is better.

Methodology:

The Department of Orthopaedics at Arif Memorial Teaching Hospital carried out a retrospective cohort analysis. Included were eighty patients 60 years of age or older who had either THA (n = 40) or CBH (n = 40). One year following surgery, the Modified Harris Hip Score was used to evaluate the functional result. The two groups were also compared in terms of postoperative recuperation, complications, patient satisfaction, and quality of life.

Results:

Except for body weight, which was considerably higher in the THA group ($p = 0.044$), the two groups' baseline clinical and demographic parameters were similar. Postoperative ambulation, discomfort, activities of daily living, return to normal activities, and components of the Modified Harris Hip Score did not differ significantly (all $p > 0.05$). The THA group experienced greater postoperative problems than the CBH group (17.5% vs. 5.0%), but this difference was not statistically significant ($p = 0.154$).

Conclusion:

Both CBH and THA provided satisfactory functional outcomes after surgery. No differences were noted in functional recovery between the two techniques, but CBH had a slightly lower but non-significant number of postoperative complications. This study proves the importance of personalized surgical approach according to the patient's characteristics rather than a bias toward one technique.

Keywords: Hemiarthroplasty, Femoral Neck Fractures, Arthroplasty, Replacement, Hip Joint.

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Introduction:

Hip fractures, often referred to as femoral neck fractures, are among the most common fragility fractures in the elderly, contributing significantly to disability, loss of independence, and even death worldwide. Hip fractures will become a major socioeconomic issue for healthcare facilities in the coming decades due to increased longevity and osteoporosis prevalence. It has been estimated that between 15% and 30% of people die within the first

year following a hip fracture. However, many individuals are unable to regain their functional movement following surgery. For this reason, timely surgical intervention that guarantees mobility restoration is crucial. ^[1]

Because internal fixation of such fractures in older patients is associated with a high incidence of failure of union, avascular necrosis, and secondary surgery, arthroplasty is the primary treatment for intracapsular

displaced femur neck fractures. Contemporary international guidelines for the treatment of displaced femoral neck fractures by the National Institute for Health and Care Excellence (NICE) and the American Academy of Orthopaedic Surgeons (AAOS) indicate that the management of such fractures entails arthroplasty with the selection of either hemiarthroplasty or THA depending on various factors, such as patient characteristics and the expected mobility following surgery.^[2,3]

CBH continues to be one of the commonly used surgeries on older individuals as it is easier to perform, takes less surgical time, is associated with decreased blood loss during surgery, and carries a low chance of developing joint instability postoperatively. THA surgery involves the replacement of the femoral head and the acetabulum to provide better hip biomechanics and hence better quality of life. However, these potential benefits may be offset by increased operative time, greater surgical complexity, and a higher risk of postoperative dislocation. Consequently, selecting the most appropriate procedure remains an important clinical challenge.^[4] Consequently, selecting the most appropriate procedure remains an important clinical challenge, and direct comparison of patient-relevant outcomes between the two procedures in the local population is warranted.

Over the past decade, numerous randomized controlled trials, national registry studies, and systematic reviews have compared the outcomes of CBH and THA. The landmark HEALTH randomized controlled trial involving patients from multiple countries shows no clinically important difference between THA and hemiarthroplasty over 24 months in terms of functional outcomes. However, THA was linked with a slightly decreased rate of secondary procedures and a higher incidence of hip dislocation.^[5] Similarly, systematic reviews and meta-analyses have shown that while THA may provide modest improvements in hip function and patient-reported outcomes, these advantages are accompanied by longer operative duration and increased dislocation risk. In contrast, mortality, revision rates, and overall complications appear broadly comparable between the two procedures.^[6-8] This indicates that one of the procedures is not better than the other in all cases and treatment needs to be customized based on individual patients and healthcare facilities.

Despite a wealth of information that has emerged from rich countries, there is less amount of data from developing nations. Various factors, including patient demographics, co-morbidity, medical infrastructure, availability of implants and rehabilitation, could have an impact on the results after surgery.^[9] Moreover, research studies examining one-year recovery in terms of functionality using standard scoring tools like the Modified Harris Hip Score among the local community are limited. Thus, regional evidence generation is crucial in making informed decisions.^[10]

The current study attempted to compare the results of functionality and clinical outcomes in terms of cemented bipolar hemiarthroplasty and total hip arthroplasty in patients aged 60 years and above having femoral neck fractures undergoing treatment in a tertiary care hospital. Functionality was assessed using the Modified Harris Hip Score at one-year follow-up.

Methodology:

Study Design and Setting

The Department of Orthopedic Surgery at the Arif Memorial Teaching Hospital in Lahore, Pakistan, conducted this retrospective cohort research. The Institutional Review Board gave it ethical approval (IRB No. IRB/28/2025; Approval Date: June 10, 2025). The medical records of patients who underwent surgery for femur neck fractures between June 2023 and May 2025 were retrospectively reviewed, and data collection was completed between June 2025 and December 2025. The STROBE standards were followed in the conduct and reporting of this study.

Sample Size

Calculation of the sample size was carried out using G*Power software (Version 3.1). Using a medium effect size ($d = 0.50$), two-tailed significance level ($\alpha = 0.05$), statistical power ($1 - \beta = 70\%$), and allocation ratio of 1:1, the minimum sample size necessary was estimated to be 78 patients (39 people in each group).^[11] In order to create balance between the groups and increase statistical precision, 80 patients that qualified for the trial were chosen; 40 of whom were under Cemented Bipolar Hemiarthroplasty (BH), while 40 others got Total Hip Arthroplasty (THA).

Study Population

Non-probabilistic convenience sampling was used to select consecutive eligible participants. Participants who were 60 years of age or older and had undergone arthroplasty treatment for femur neck fractures were eligible. These eligible patients were categorized depending on the type of surgery they had done, which was either Cemented Bipolar Hemiarthroplasty or Total Hip Arthroplasty.

Inclusion Criteria

- Individuals over 60.
- Patients undergoing complete hip replacement or cemented bipolar hemiarthroplasty due to femur neck fractures.
- A year is the minimum postoperative follow-up.

Exclusion Criteria:

- Individuals under 60 with pathological fractures.
- Individuals who were bedridden before an injury, or have neurological conditions that impact functional evaluation or movement.
- Patients whose medical records are not complete.
- Before a year, patients were lost to follow-up.

Surgical Procedure

The choice of surgical procedure (CBH vs. THA) was not randomized and was determined by the treating consultant orthopaedic surgeon based on individual

clinical judgment. Factors commonly influencing this decision included patient pre-fracture functional status and activity level, bone quality, cognitive status, medical comorbidity burden, anesthetic fitness, and surgeon experience/preference. In general, THA was more often selected for patients who were physiologically fitter, more active pre-injury, and had good bone stock, while CBH was more often selected for older, less active, or medically frailer patients. No standardized institutional protocol governed this selection during the study period. The standard perioperative care, including prophylactic antibiotics, thromboprophylaxis, postoperative analgesia, and routine postoperative monitoring, was provided to all patients

Following surgery, all patients underwent the institution's standard physiotherapy rehabilitation protocol. Rehabilitation emphasized early mobilization, progressive weight-bearing as tolerated, gait training, hip range-of-motion exercises, and lower-limb strengthening exercises under the supervision of trained physiotherapists.

Data Collection

Information was retrospectively obtained from hospital medical records, operation records, in-patient files, out-patient follow-up records, and telephone calls if necessary. The demographic factors considered were age, gender, body mass, height, fracture side, and co-morbidity.

The clinical outcomes assessed include mobility following surgery, pain on activity, ability to perform activities of daily living, time to resume normal activities, post-operative complications, need for revision surgery, satisfaction, and quality of life.

Functional outcome was assessed at one year using the Modified Harris Hip Score (MHHS), which evaluates pain, gait, functional activities, use of walking aids, stair climbing, sitting ability, ability to wear shoes and socks, limb length perception, hip deformity, and range of motion. Higher scores indicate better hip function.

Outcome Measures

The primary outcome of the study was functional outcome at one-year follow-up, assessed using the Modified Harris Hip Score.

Secondary outcomes included:

- postoperative ambulation,
- pain during movement,
- activities of daily living,
- return to routine activities,
- postoperative complications,
- revision surgery,
- patient satisfaction, and
- quality of life.

Statistical Analysis

IBM SPSS Statistics version 27.0 (IBM Corp., Armonk, NY, USA) was used to analyze the data. Descriptive statistics, such as skewness and kurtosis,

were used to evaluate the normality of continuous data. Non-normally distributed continuous variables are shown as median and interquartile range (IQR), whereas regularly distributed continuous variables are shown as mean $\pm$ standard deviation (SD).

The independent-samples t-test for normally distributed continuous variables and the Mann-Whitney U test for non-normally distributed continuous or ordinal variables were used to compare the BH and THA groups. The Chi-square test or Fisher's exact test, depending on the situation, were used to compare categorical variables, which are represented as frequencies and percentages. A p-value of less than 0.05 was deemed statistically significant, and all statistical tests were two-tailed.

Results

Eighty patients were included, 40 in each treatment group (Table 1). Mean age did not differ significantly between the CBH and THA groups (63.9 ± 13.2 vs 61.8 ± 12.2 years; $p=0.462$). Patients who underwent THA weighed more on average than those who underwent CBH (66.1 ± 10.9 vs 61.1 ± 11.0 kg; $p=0.044$); height, sex distribution, fracture side, and comorbidity pattern were comparable (all $p>0.05$).

Table 1. Baseline demographic and clinical characteristics according to treatment group

Variables	CBH (N = 40)	THA (N = 40)	P value
Age (median, IQR)	62.0 (20)	60.0 (21)	0.516
Weight (mean $\pm$ SD)	61.13 $\pm$ 10.971	66.13 $\pm$ 10.868	0.044*
Height (median, IQR)	160.00 (11)	161.50 (9)	0.177
BMI (median, IQR)	23.88 (4.22)	24.70 (4.40)	0.148
Gender			0.653
Male	17 (42.5%)	19 (47.5%)	
Female	23 (57.5%)	21 (52.5%)	
Any Chronic Illness			0.748
HTN	10 (25.0%)	11 (27.5%)	
Obesity	1 (2.5%)	2 (5.0%)	
DM	5 (12.5%)	3 (7.5%)	
HTN + Stroke	1 (2.5%)	0 (0.0%)	
DM + HTN	5 (12.5%)	8 (20.0%)	
None	18 (45.0%)	16 (40.0%)	
Laterality of Fracture			0.654

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Right Hip	20 (50.0%)	22 (55.0%)	
Left Hip	20 (50.0%)	18 (45.0%)	

CBH = cemented bipolar hemiarthroplasty; THA = total hip arthroplasty; SD = standard deviation. *Data are presented as mean $\pm$ SD, median (IQR), or n (%), as appropriate.

Statistically significant at $p < 0.05$.

Postoperative recovery outcomes (Table 2) did not differ significantly between groups: early ambulation within seven days, independent walking without support, pain during movement, independence in daily activities, and early return to routine activities were all statistically comparable (all $p > 0.05$).

Table 2. Postoperative recovery outcomes according to treatment group

Outcome	CBH (n=40)	THA (n=40)	p-value
Early ambulation (≤ 7 days), n (%)	9 (22.5)	6 (15.0)	0.568
Independent walking, n (%)	20 (50.0)	22 (55.0)	0.823
No pain, n (%)	2 (5.0)	6 (15.0)	0.211
Mild pain, n (%)	24 (60.0)	20 (50.0)	
Moderate pain, n (%)	14 (35.0)	12 (30.0)	
Severe pain, n (%)	0 (0.0)	2 (5.0)	
Fully independent ADLs, n (%)	18 (45.0)	22 (55.0)	0.553
Partially independent ADLs, n (%)	18 (45.0)	16 (40.0)	
Dependent, n (%)	4 (10.0)	2 (5.0)	
Early return to routine (≤ 3 months), n (%)	9 (22.5)	9 (22.5)	1.000

ADLs = activities of daily living. Fisher's exact test used for 2 $\times$ 2 comparisons; chi-square test for the multi-category pain and ADL comparisons.

Complications, revision surgery, satisfaction, and quality of life are summarized in Table 3. Overall

postoperative complications were less frequent after CBH than after THA (5.0% vs 17.5%; RR 0.29, 95% CI 0.06–1.29; $p = 0.154$), as was revision surgery (2.5% vs 7.5%; RR 0.33, 95% CI 0.04–3.07; $p = 0.615$); neither difference reached statistical significance. Patient satisfaction and quality-of-life ratings were similarly comparable between groups ($p = 0.746$ and $p = 0.288$, respectively).

Table 3. Postoperative complications and patient-reported outcomes

Outcome	CBH (n=40)	THA (n=40)	RR (95% CI)	p-value
Overall complications, n (%)	2 (5.0)	7 (17.5)	0.29 (0.06–1.29)	0.154
Revision surgery, n (%)	1 (2.5)	3 (7.5)	0.33 (0.04–3.07)	0.615
Patient satisfaction (favorable), n (%)	36 (90.0)	38 (95.0)	—	0.746
Improved quality of life (favorable), n (%)	36 (90.0)	37 (92.5)	—	0.288

Data are presented as number (%). Favorable patient satisfaction includes participants reporting "Very satisfied" or "Satisfied." Favorable quality of life includes participants reporting "Greatly improved" or "Slightly improved." RR = relative risk; CI = confidence interval.

Table 4 presents the Modified Harris Hip Score results. Mean total MHHS was 59.75 ± 17.33 in the CBH group (95% CI 54.21–65.29) and 59.88 ± 19.28 in the THA group (95% CI 53.71–66.04); the mean difference was -0.12 points (95% CI -8.29 to 8.04 ; $p = 0.976$). None of the five MHHS domains — pain, gait/function, functional activities, absence of deformity, or range of motion — differed significantly between groups (all $p > 0.05$).

Table 4. Modified Harris Hip Score by domain, one year postoperatively

Domain	CBH (n=40)	THA (n=40)	p-value
Total MHHS (0–100)	59.75 $\pm$ 17.33	59.88 $\pm$ 19.28	0.976

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Pain (0–44)	30.30 ± 8.60	29.50 ± 9.96	0.702
Gait/function (0–33)	15.80 ± 6.95	17.27 ± 8.17	0.387
Functional activities (0–14)	6.10 ± 3.25	6.42 ± 3.10	0.649
Absence of deformity (0–4)	2.80 ± 1.86	2.30 ± 2.00	0.250
Range of motion (0–5)	4.75 ± 1.10	4.38 ± 1.67	0.241

MHHS = Modified Harris Hip Score. Values are mean ± SD; independent-samples t-test.

Discussion:

Despite advancements in arthroplasty techniques, the treatment of displaced femoral neck fractures in elderly patients remains controversial. In this study, total hip arthroplasty (THA) and cemented bipolar hemiarthroplasty (CBH) are compared. After a year of follow-up, we showed comparable functional outcomes comparing the two surgeries. The overall modified Harris Hip Score (MHHS), postoperative healing, satisfaction, quality of life, and revision surgery did not differ statistically significantly. Even though CBH patients experienced fewer postoperative problems, this finding did not seem to be statistically significant. These findings show that the efficacy of both treatments depends on the patient's choice.

The baseline parameters in the two groups were comparable and thus minimized the possibility that different demographics may contribute to the results observed. The only baseline parameter that varied significantly was body weight. This single finding is unlikely to influence postoperative recovery and functional outcome. Similar baseline comparability was shown in the work by Luo et al., where they didn't find any significant differences in the age, sex, body mass index and other demographic factors between the patients treated with THA and hemiarthroplasty.^[12]

Both groups recovered similarly after surgery. Independent ambulation, independent walking, pain with movement, activities of daily living, and resuming normal activities did not differ statistically significantly in both groups. Even though the THA group had a slightly higher percentage of independent walking, the difference was small and probably insignificant. Our results are in agreement with Onggo et al., where it was shown that THA provides a slight functional benefit for carefully selected active elderly patients but does not make much difference in early rehabilitation.^[13]

Functional recovery assessed using the modified Harris Hip Score also demonstrated no significant difference between the treatment groups. The total MHHS and all individual domains—including pain, gait, functional activities, absence of deformity, and range of motion—were comparable at one year. Importantly, the 95% confidence interval for the mean difference in total MHHS crossed zero, indicating no evidence of a clinically meaningful difference between the procedures. Although our absolute MHHS values were lower than those reported in some randomized trials, this may reflect differences in patient characteristics, pre-fracture mobility, rehabilitation adherence, comorbidity burden, and the realities of routine clinical practice in a resource-limited healthcare setting. Similar observations have been reported by Choudhari et al., who found no statistically significant difference in hip function despite slightly higher functional scores following THA.^[14]

The reduced incidence of postoperative complications after CBH was one of the study's most notable findings. Overall, 5.0% of patients treated with CBH experienced problems, compared to 17.5% in the THA group; this represents a relative risk of 0.29. Given the limited number of occurrences (n=9 total), this conclusion should be viewed as hypothesis-generating rather than definitive because the confidence interval crossed unity and the difference was not statistically significant. The precise causes of this discrepancy cannot be ascertained from our data since this study did not stratify problems by type (e.g., dislocation, infection, periprosthetic fracture). The trend seen here may be explained by the fact that THA is linked to a higher frequency of instability and dislocation than hemiarthroplasty, according to earlier meta-analyses where complications were described in greater detail.^[7,15]

The results of patient satisfaction were positive irrespective of the type of surgery. More than 90 per cent of the subjects from both groups were positively satisfied, and most of them also witnessed a quality-of-life improvement post-surgery. The results indicate that mobility restoration and pain relief can be achieved by using either type of procedure if proper post-operative care is ensured. Previously, such positive results of patient satisfaction and quality-of-life have been observed in similar comparative studies of displaced femoral neck fractures.^[16]

There are significant clinical implications of the results obtained from the current study, especially with regard to healthcare systems where resources are scarce. Although total hip arthroplasty has been favored in the past due to its supposed mechanical advantages, results from this study show that cemented bipolar hemiarthroplasty produced equally good functional outcomes in the short run and no inferiority was found in terms of patient-reported outcomes. Previous studies have shown that compared to THA, CBH entails less surgical difficulty and lower-cost

implants. ^[15,17] While these factors could not be measured directly in the current study, these too could justify why CBH can be considered a good choice for many elderly patients, especially those suffering from other comorbid conditions.

The strengths of the study include its use of a head-to-head comparison of two commonly performed types of the arthroplasty, a well-validated instrument to assess functional outcomes, and patient-centered outcomes such as satisfaction and quality of life.

But there are some restrictions that need to be noted. For instance, because treatment groups are assigned based on surgeon preferences rather than randomization, the study's methodology (retrospective cohort design) is susceptible to selection bias. Furthermore, the study's poor statistical power (70%) and somewhat small sample size may have reduced the likelihood of finding clinically relevant but statistically inconsequential changes, particularly those pertaining to uncommon occurrences like complications or revisions. The findings may not apply to other institutions because the study was conducted at a single location. Another limitation is the fact that some information about follow-up was obtained via phone calls, which may introduce a risk of recall bias. Furthermore, a one-year follow-up period is not enough to assess implant survival, acetabular erosion, and late revisions.

Conclusion:

In a group of older patients with femur neck fractures, cemented bipolar hemiarthroplasty and total hip arthroplasty produced comparable functional results, postoperative courses, patient satisfaction, and quality of life at one year. Because of the sample size, there were no statistically significant differences in the frequency of complications and the requirement for revision surgery after CBH compared to THA. CBH is still a viable surgical strategy with comparable outcomes to THA in resource-constrained situations; the choice of method should be based on the patient's activity, co-morbidity, bone quality, and the surgeon's expertise. Larger, prospective, multicenter studies with longer follow-up and standardized measurement of hip range of motion and gait are needed to confirm the complication trend observed here.

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