

Functional Outcome of Femoral Neck Fracture Treated with Bipolar Hemiarthroplasty

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Abstract

Femoral neck fractures remain an important orthopedic challenge, especially in the elderly and subtle to displaced frail patients, where bipolar hemiarthroplasty is favored for treating displaced fractures when life expectancy is limited. A prospective, observational study was carried out in the Department of Orthopaedic Surgery of Mymensingh Medical College Hospital, Bangladesh, from January to December of 2024, to analyze the functional results of femoral neck fractures managed with bipolar hemiarthroplasty and to measure their associated complications and patient satisfaction rates.. Seventy-seven patients who underwent bipolar hemiarthroplasty for the treatment of femoral neck fractures were analyzed. Clinical outcomes were evaluated using Harris Hip Score and patients were followed for complications. The average age of the patients was 68.5±12.3 years; a female predominance was observed (64.9%). Good to excellent results were obtained in 81.8% considering Harris Hip Score. The total complication rate was 15.6% with a dislocation as the most frequent (6.5%). Mean duration of hospital stay was 8.2±3.1 days. Our data showed that the functional results of bipolar hemiarthroplasty for femoral neck fractures were satisfactory and that its complications could be tolerated, which indicates a beneficial role in suitable patients.

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Introduction

Femoral neck fractures account for 3-4% of all fractures, and they are among the most difficult orthopedic injuries with a huge impact on the elderly.¹ These fractures are associated with considerable morbidity and mortality, including estimates of up to a one-year mortality rate between 14% to 36% post hip fractures.² With the aging of the population, urbanization and extension of life expectancy, the prevalence of femoral neck fracture has been on ascending tendency, posing as a major public health problem in worldwide.³ The particular anatomic features of the femoral neck, being easily damaged to blood supply and composed largely of cancellous bone, contribute to the susceptibility of these fractures to complications such as avascular necrosis (AVN) and nonunion.⁴ Blood supply to the femoral head comes largely from the medial circumflex femoral artery and may become compromised if the fractured pieces are displaced, resulting in osteonecrosis in 10–25% of cases. The intracapsular position of these fractures makes the healing even

more problematic secondary to lack of potential hematoma and bathing effect of synovial fluid over fracture fragments, which itself washes away many healing factors.⁵ There are different treatments for femoral neck fracture, which depend on patients' age, bone quality, activeness of the daily life, cognitive status and the degree of displacement.⁶ Internal fixation remains the treatment of choice in young patients and undisplaced fractures, whereas with increasing age displaced fracture is treated by arthroplasty.⁷ The decision between total hip arthroplasty and hemiarthroplasty remains

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controversial as hemiarthroplasty is preferred in patients with low life expectancy, severe acetabular cartilage destruction, or those unsuitable for extended operation.⁸ Bipolar hemiarthroplasty has become an increasingly popular treatment option for elderly patients with displaced femoral neck fractures, providing multiple theoretical benefits compared with unipolar designs. The bipolar prosthesis anatomy and mechanics the anatomy of the bipolar hip prosthesis can be considered as a dual articulation system in which relative movement takes place at both the prosthetic head-acetabulum interface as well as within the prosthesis, possibly generating less wear on the acetabulum and greater stability. This latter design has the potential for articulation to improve cartilage of the acetabulum with less friction and wear, which would maintain joint stability due to its larger effective head size.⁹ The results of the studies have shown that bipolar hemiarthroplasty can also give favorable functional outcomes with slightly lower complication rates if used in appropriate patients.¹⁰

The present study aimed to evaluate the functional outcomes of patients with femoral neck fractures treated with bipolar hemiarthroplasty.

Methods

This prospective, observational study was conducted in the Department of Orthopaedic Surgery of Mymensingh Medical College Hospital, Bangladesh, from January to December of 2024. Our study included a total of 77 patients diagnosed with femoral neck fractures who underwent bipolar hemiarthroplasty during the study period.

Inclusion Criteria:

1) Patients aged 50 years and above with displaced femoral neck fractures (Garden III and IV)

- 2) Patients with undisplaced fractures who failed conservative management or internal fixation
- 3) Patients who underwent bipolar hemiarthroplasty within 7 days of injury
- 4) Patients with adequate cognitive function to participate in rehabilitation programs
- 5) Patients with pre-injury ambulatory status (with or without walking aids)
- 6) Patients providing informed written consent for participation in the study

Exclusion criteria:

- 1) Patients with pathological fractures due to malignancy or metabolic bone disease
- 2) Patients with multiple trauma or polytrauma cases
- 3) Patients with severe medical comorbidities precluding surgical intervention
- 4) Patients with previous hip surgery on the affected side
- 5) Patients with active infection at the surgical site
- 6) Patients lost to follow-up within the first 6 months postoperatively
- 7) Patients with incomplete medical records or missing essential data

A preformed structured data collection sheet was used having demographic data and clinical presentation, specific details of surgery, and outcome measures. Preoperative workup included history taking, physical examination, imaging reports i.e., plain x-ray, and comorbidity assessment using standardized scoring system. Intraoperative data recorded consisted of surgical approach, implant dimension, operating time, intraoperative complications and blood loss. Postoperative follow-up was at 6 weeks, 3 months, 6 months and 12 months in terms of functional outcomes with HHS (Harris hip Score), radiological assessment and complications.

Quality of life and patient satisfaction was determined by a structured questionnaire at each follow-up. Statistical analysis was using 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as the mean±standard deviation, and categorical variables were described as frequencies with percentages. The functional results were defined as excellent (90-100) good (80-89), fair (70-79) and poor (<70), according to the Harris Hip Score. Comparison was done using Chi-square test. A p-value of <0.05 were considered statistically significant, and the relevant parameters with 95% confidence intervals (CI) were established.

The study was approved by the Institutional Review board of Mymensingh Medical College, Mymensingh, Bangladesh.

Results

The study cohort comprised 77 patients with a mean age of 68.5±12.3 years (range: 52–89 years). Female patients predominated (64.9%). The majority of fractures resulted from low-energy trauma, with domestic falls being the most common mechanism of injury in 62 cases (80.5%), followed by road traffic accidents in 12 cases (15.6%) and other causes in 3 cases (3.9%). Garden classification revealed that 45 patients (58.4%) had Garden IV fractures, while 32 patients (41.6%) had Garden III fractures. At the final follow-up (12 months), functional assessment using Harris Hip Score demonstrated excellent outcomes (90–100) in 31 patients (40.3%), good outcomes (80–89) in 32 patients (41.6%), fair outcomes (70–79) in 10 patients (13.0%), and poor outcomes (<70) in 4 patients (5.2%) (Table-I). The overall satisfaction rate was high, with 71 patients (92.2%) expressing satisfaction with their surgical outcomes.

Complications occurred in 12 patients (15.6%), with dislocation being the most frequent complication in 5 cases (6.5%), followed by superficial wound infection in 3 cases (3.9%), deep vein thrombosis in 2 cases (2.6%), pulmonary embolism in 1 case (1.3%), and prosthetic loosening in 1 case (1.3%) (Table-II). The mean hospital stay was 8.2±3.1 days, and the average time to full weight-bearing was 6.8±2.4 weeks (Table-III). Long-term follow-up revealed that 68 patients (88.3%) achieved independent ambulation, while 9 patients (11.7%) required walking aids for mobility. Pain assessment using the Visual Analog Scale (VAS) showed significant improvement from preoperative scores of 8.2±1.4 to postoperative scores of 2.1±1.8 at final follow-up. Range of motion measurements demonstrated mean hip flexion of 95.6±18.2 degrees, with most patients achieving functional range of motion for activities of daily living (Table-III). Return to pre-injury activity levels was achieved in 58 patients (75.3%), while 19 patients (24.7%) experienced some limitation in their functional capacity compared to pre-injury status. Age <70 years was a significant factor to predict better outcome ($p<0.001$) (Table-IV).

Table-I: Functional outcomes (based on Harris Hip Score) (N=77)

Harris Hip Score	Frequency	Percentage	Mean Score
Excellent (90-100)	31	40.3	94.2±3.1
Good (80-89)	32	41.6	84.7±2.8
Fair (70-79)	10	13.0	74.5±3.2
Poor (<70)	4	5.2	62.8±5.4
Overall Mean	77	100	85.3±12.7

Table-II: Postoperative complications and adverse events (N=77)

Complications	Frequency	Percentage	Time of Occurrence
Dislocation	5	6.5	2-8 weeks
Superficial wound infection	3	3.9	1-2 weeks
Deep vein thrombosis	2	2.6	3-5 days
Pulmonary embolism	1	1.3	7 days
Prosthetic loosening	1	1.3	8 months
Total Complications	12	15.6	-
No Complications	65	84.4	-

Table-III: Postoperative recovery parameters

Parameter	Mean±SD	Range	95% CI
Hospital stays (days)	8.2 ±3.1	5–18	7.5–8.9
Time to full weight bearing (weeks)	6.8 ±2.4	4–12	6.3–7.3
Hip flexion (degrees)	95.6±18.2	60–120	91.5–99.7
Pain score (VAS) at 12 months	2.1±1.8	0–7	1.7–2.5
Follow-up duration (months)	14.2±3.8	12–18	13.4–15.0

Table-IV: Factors associated with functional outcomes

Factors	Good-Excellent Outcome	Fair-Poor Outcome	p-value	OR (95% CI)
Age <70 years	45 (89.1%)	4 (28.6%)	<0.001	8.4 (2.1–33.6)
Female gender	40 (79.2%)	10 (71.4%)	0.542	1.5 (0.4–5.8)
Garden III fracture	28 (55.4%)	4 (28.6%)	0.068	3.1 (0.9–10.8)
No comorbidities	17 (33.7%)	2 (14.3%)	0.149	3.1 (0.6–15.2)
Early surgery (<24h)	38 (75.2%)	7 (50.0%)	0.071	3.0 (0.9–10.1)

Discussion

The findings of the present study suggest that there are acceptable functional results with bipolar hemiarthroplasty in femoral neck fractures, 81.9% having good to excellent results according to Harris Hip Score criteria. These results are in agreement with other studies from abroad that have reported comparable success rates between 75% and 85%.

The mean Harris Hip Score of 85.3 ± 12.7 in our patients is similar to other studies, highlighting the role of bipolar hemiarthroplasty in allowing these elderly displaced intra-capsular femoral neck fracture patients regain their routine work capacity.^{11,12} The overall patient satisfaction rate of 92.2% in our cohort indicates the high quality of life and functional independence and the benefit gained from surgical

intervention.¹¹ Age was a strong predictor of the functional outcome and patients younger than 70 years had significantly better outcomes than their older counterparts. This result is compatible with previous studies, which have reported that younger patients have stronger bones, muscle tissues and rehabilitation levels of function that could help to a better postoperative recovery. In our series female patients were predominant (64.9%;) and this is in accordance with the epidemiology of femoral neck fracture, a condition that has enjthyigh prevalence rates among postmenopausal females who are more likely to have osteoporosis and also more likely to suffer falls. Garden classification also revealed a better prognosis in Garden III fractures as opposed to Garden IV fractures (though this was not statistically significant from our results, it could be due to the lack of power in subgroup analysis).¹²

The total complication rate of 15.6% in our study falls within the acceptable range also reported in modern literature for hemiarthroplasty ranging usually from 10 to 25%.¹³ Dislocation, found in 6.5% of cases, as most of the others complications was not higher than previously published rates (4-10%). Most dislocations happened within 8 weeks of surgery and have clearly showed the need to educate patients properly on their hip precautions and slow mobilization protocols.¹⁴ All dislocation cases in our series were treated successfully with closed reduction, and none of the patients had to undergo revision surgery for recurrent instability. One derivative is a superficial facial wound, which occurred in 3.9% of patients and was treated with appropriate antibiotics and wound care measures. This infection rate is similar to that found in studies of analogous scope, indicating the relevance of prophylactic perioperative antibiotics and sterile surgical techniques.¹⁵ Deep vein thrombosis occurred in 2.6% of the cases, even with prophylaxis with low-

molecular-weight heparin as given routinely, indicating an intrinsic thrombotic risk for hip fracture surgery in the elderly. The sole instance of pulmonary embolism resolved with anticoagulation and without residual morbidity. One patient experienced loosening of the prosthesis that developed at 8 months postoperative intervention and required revision to total hip arthroplasty, resulting in an acceptably low rate compared with historical controls.¹⁶

The rehabilitation programme in our study would have accounted for this as it was focused on early mobilisation and gradually increasing the weight bearing. An average time to full weight-bearing of 6.8 weeks (SD=2.4) falls well within the current recommendations for bipolar hemiarthroplasty and permits appropriate soft tissue healing without incurring excessive risks associated with prolonged immobilization. The fact that 88.3% of the patients achieved independent walking is a testimonial to the efficacy of structured rehabilitation packages in maximizing functional recovery after hip arthroplasty.¹⁷ The pain relief in our group was remarkable, as evidenced by decrease in VAS score from preoperative value of 8.2 ± 1.4 to end follow-up of 2.1 ± 1.8 and is clinically significant improvement with a better quality-of-life and functional status achieved for all patients included this proton beam series at mean follow up of 13 months (range: 3–51 months). Our patients had a mean hip flexion of $95.6^\circ \pm 18.2^\circ$, which is sufficient for most of daily living activities (sitting, stair climbing and walking).¹⁸ Return to pre-injury activity level was observed in 75.3% of patients compared well with previously reported results for patients with similar activities and operated on by the same method.¹⁹

The present study has several limitations that need to be considered when interpreting the results. Firstly, the single-center study and relatively small sample

size might imply that findings may not be generalized. The study was performed in a tertiary, teaching hospital with extensive experience in hip replacement surgery which may not be generalizable to the results that could be attained at community or less experienced specialist hip arthroplasty units. Secondly, the treatment efficacy of bipolar hemiarthroplasty not compared with other management methods such as total hip arthroplasty or internal fixation in an observational study design without a control group does not allow us to conclude that this is the best surgical approach. The lack of randomization and potential selection bias by both the surgeon and patient with respect to treatment choices may have affected the results seen in this study. Furthermore, the follow-up period of 12-18 months may be sufficient to evaluate short and medium-term results but, in any case, too short to observe long term complications like acetabular wear or late prosthetic loosening or revision surgery after a few life years. Lastly, detailed cost-effectiveness or resource utilization comparison, being the key issue for health policy making in resource constraint countries such as Bangladesh, was not included within the scope of this study.

Conclusion

The current prospective observation study suggests that bipolar hemiarthroplasty is an efficient surgical intervention for elderly patients with femoral neck fractures, yielding good to excellent functional results in 81.9% of individuals with an acceptable complication rate of 15.6%. With a mean Harris Hip Score of 85.3 ± 12.7 and a high patient satisfaction rate with a value of 87%, this operation restores patients' ability to function and quality of life in the vast majority of cases. A younger age under 70 was identified as a strong independent predictor of

excellent functional results, and the confirmed overall low complication rate in this high-risk population supports the safety profile of bipolar hemiarthroplasty when used by high-volume users in selected patients. The results of the present study seem to justify maintaining primary hemiarthroplasty by bipolar head as an alternative for elderly patients suffering displaced femoral neck fractures in general, and in particular for those with poor expectation of life and a good pre-injury functional condition.

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References

1. Johnell O, Kanis JA. An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. *Osteoporos Int.* 2006;17(12):1726-33.
2. Kanis JA, Odén A, McCloskey EV, Johansson H, Wahl DA, Cooper C; IOF Working Group on Epidemiology and Quality of Life. A systematic review of hip fracture incidence and probability of fracture worldwide. *Osteoporos Int.* 2012;23(9):2239-56.
3. Roche JJ, Wenn RT, Sahota O, Moran CG. Effect of comorbidities and postoperative complications on mortality after hip fracture in elderly people: prospective observational cohort study. *BMJ.* 2005;331(7529):1374.
4. Zhang YL, Chen S, Ai ZS, Gao YS, Mei J, Zhang CQ. Osteonecrosis of the femoral head, nonunion and potential risk factors in Pauwels grade-3 femoral neck fractures: A retrospective cohort study. *Medicine (Baltimore).* 2016;95(24):e3706.

5. Cooper C, Campion G, Melton LJ 3rd. Hip fractures in the elderly: a world-wide projection. *Osteoporos Int.* 1992;2(6):285-9.
6. Gullberg B, Johnell O, Kanis JA. World-wide projections for hip fracture. *Osteoporos Int.* 1997;7(5):407-13.
7. Garden RS. Low-angle fixation in fractures of the femoral neck. *J Bone joint Surg Br.* 1961;43(4):647-63.
8. Swiontkowski MF, Winkquist RA, Hansen ST Jr. Fractures of the femoral neck in patients between the ages of twelve and forty-nine years. *J Bone Joint Surg Am.* 1984;66(6):837-46.
9. Catto M. A histological study of avascular necrosis of the femoral head after transcervical fracture. *J Bone Joint Surg Br.* 1965;47(4):749-76.
10. Bhandari M, Devereaux PJ, Tornetta P 3rd, Swiontkowski MF, Berry DJ, Haidukewych G, et al. Operative management of displaced femoral neck fractures in elderly patients. An international survey. *J Bone Joint Surg Am.* 2005;87(9):2122-30.
11. Mahomed NN, Arndt DC, McGrory BJ, Harris WH. The Harris hip score: comparison of patient self-report with surgeon assessment. *J Arthroplasty.* 2001;16(5):575-80.
12. Masson M, Parker MJ, Fleischer S. Internal fixation versus arthroplasty for intracapsular proximal femoral fractures in adults. *Cochrane Database Syst Rev.* 2003;(2):CD001708.
13. Blomfeldt R, Törnkvist H, Eriksson K, Söderqvist A, Ponzer S, Tidermark J. A randomised controlled trial comparing bipolar hemiarthroplasty with total hip replacement for displaced intracapsular fractures of the femoral neck in elderly patients. *J Bone Joint Surg Br.* 2007;89(2):160-5.
14. Rogmark C, Johnell O. Primary arthroplasty is better than internal fixation of displaced femoral neck fractures: a meta-analysis of 14 randomized studies with 2,289 patients. *Acta Orthop.* 2006;77(3):359-67.
15. Keating JF, Grant A, Masson M, Scott NW, Forbes JF. Randomized comparison of reduction and fixation, bipolar hemiarthroplasty, and total hip arthroplasty. Treatment of displaced intracapsular hip fractures in healthy older patients. *J Bone Joint Surg Am.* 2006;88(2):249-60.
16. Baker RP, Squires B, Gargan MF, Bannister GC. Total hip arthroplasty and hemiarthroplasty in mobile, independent patients with a displaced intracapsular fracture of the femoral neck. A randomized, controlled trial. *J Bone Joint Surg Am.* 2006;88(12):2583-9.
17. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty. An end-result study using a new method of result evaluation. *J Bone Joint Surg Am.* 1969;51(4):737-55.
18. Calder SJ, Anderson GH, Jagger C, Harper WM, Gregg PJ. Unipolar or bipolar prosthesis for displaced intracapsular hip fracture in octogenarians: a randomised prospective study. *J Bone Joint Surg Br.* 1996;78(3):391-4.
19. Shah SWA, Bakhsh K, Ahmed N. Cemented bipolar hemiarthroplasty better than Austin Moore hemiarthroplasty for treatment of fracture neck of femur – is this true? *Pak J Med Health Sci.* 2019;13(3):751-3.