

Original Research Article

Functional outcome of hip hemiarthroplasty done through modified Hardinge approach in femoral neck fractures: a prospective study of 50 cases

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ABSTRACT

Background: Femoral neck fractures are common injuries in older adults and are associated with substantial morbidity and mortality. Arthroplasty is widely used for displaced intracapsular femoral neck fractures in older patients, while the choice of surgical approach and implant fixation remains an important part of perioperative decision-making.

Methods: This prospective study included 50 patients with femoral neck fractures treated between March 2023 and February 2025. Patients were followed for 6 months to 1 year. Functional outcomes were assessed using the Harris hip score (HHS).

Results: The mean age was 72±8.16 years. Women comprised 60% of the cohort and men 40%. Left-sided fractures accounted for 52% and right-sided fractures for 48%. Most injuries followed low-energy trauma. Uncemented implants were used in 47 patients (94%) and cemented implants in 3 (6%). The mean interval from injury to surgery was 5.5 days. At final follow-up, 72% of patients had good, 18% excellent, 8% fair, and 2% poor functional outcomes. Overall, complications occurred in 20% of patients.

Conclusions: Hip hemiarthroplasty through the modified Hardinge approach was associated with favorable functional outcomes in this prospective cohort, with most patients achieving good-to-excellent HHS and a relatively low frequency of major complications.

Keywords: Femoral neck fracture, Hip hemiarthroplasty, Modified Hardinge approach, HHS

INTRODUCTION

Proximal femoral fractures are common injuries in older adults and represent an important public health problem. Femoral neck fractures occur predominantly in the elderly and are frequently associated with osteoporosis and low-energy falls. Their incidence increases with advancing age and is higher among women.¹

Disruption of the blood supply to the femoral head in displaced intracapsular femoral neck fractures contributes to complications such as nonunion and avascular necrosis.

Hip fractures are also associated with substantial morbidity and mortality despite advances in perioperative care.² Treatment options include internal fixation, hemiarthroplasty, and total hip arthroplasty. In older adults with displaced intracapsular femoral neck fractures, arthroplasty is generally preferred, with the choice between hemiarthroplasty and total hip arthroplasty individualized according to pre-fracture functional status, comorbidities, mobility, and expected activity level.³

The management of femoral neck fractures has evolved considerably, progressing from conservative treatment and internal fixation to prosthetic replacement.

Early reconstructive techniques and the subsequent development of prosthetic designs laid the foundation for modern hip arthroplasty.⁴ Smith-Petersen's mold arthroplasty and subsequent developments in femoral-head prostheses represented important milestones in the evolution of hip replacement surgery.

Hemiarthroplasty remains an established treatment for displaced femoral neck fractures in older adults. Several surgical approaches have been described for hip arthroplasty, including the lateral, posterior, and anterior approaches. The modified Hardinge approach is a direct lateral approach that provides satisfactory exposure of the hip while preserving the posterior soft-tissue structures and is associated with a low risk of postoperative dislocation.⁵

The present study was undertaken to evaluate the functional outcome of bipolar hemiarthroplasty performed through the modified Hardinge approach in patients with displaced femoral neck fractures, with particular emphasis on postoperative functional recovery and clinical outcomes.

Aim and objectives

This study was conducted to evaluate the clinical and functional outcomes of hip hemiarthroplasty performed through the modified Hardinge approach in elderly patients with femoral neck fractures.

METHODS

Study design and procedure

This prospective study was conducted in the department of orthopaedics, Sheth L. G. Hospital, Ahmedabad. Fifty patients with displaced femoral neck fractures underwent bipolar hemiarthroplasty between March 2023 and February 2025. All procedures were performed through the modified Hardinge approach. Patients were followed up for 6 months to 1 year.

Patient selection

Patients older than 60 years with femoral neck fractures were eligible for inclusion. Patients who were medically unfit for surgery, did not provide consent, or had pathological femoral neck fractures were excluded. A non-probability purposive sampling technique was used to recruit 50 patients.

Preoperative assessment

Patients underwent clinical and radiological assessment before surgery. Fractures were classified according to the Garden classification. Proximal femoral morphology was assessed using the Dorr classification to assist with implant selection and the choice between cemented and uncemented fixation. Demographic variables, fracture

side, mechanism of injury and interval from injury to surgery were recorded.

Operative procedure

Bipolar hip hemiarthroplasty was performed through the modified Hardinge approach. After exposure of the hip joint, the fractured femoral head was removed. The femoral neck and proximal femur were prepared for prosthetic replacement and the acetabulum was assessed. The femoral canal was prepared and an appropriately sized femoral stem was selected according to femoral morphology and intraoperative assessment. Dorr classification was used to guide the choice of femoral fixation. In the study cohort, 47 patients (94%) received uncemented implants and 3 patients (6%) received cemented implants. Following implantation, the hip was reduced and assessed for stability and limb length before closure.

Postoperative management and follow-up

Patients were monitored post-operatively for surgical and prosthesis-related complications, including infection, dislocation, limb-length discrepancy and revision surgery. Patients were followed up for 6 months to 1 year. Functional outcome was assessed using the Harris hip score (HHS) and categorized as excellent, good, fair or poor.

Statistical Analysis

Data was entered into Microsoft excel and analyzed using international business machines (IBM) statistical package for the social (SPSS) statistics. Continuous variables were summarized as mean $\pm$ standard deviation and categorical variables were presented as frequencies and percentages. Descriptive analyses were performed for demographic characteristics, fracture classification, implant selection, complications and functional outcomes. A p value <0.05 was considered statistically significant.

RESULTS

The demographic profile, clinical characteristics and outcome of study participants are summarized in tables and figures below. In our study, 25 patients (50%) were in age group 61-69 years, 16 patients were in age group of 70-79 years and only 9 patients were aged above 80 years (Table 1).

Table 1: Age group distribution.

Age group (years)	Number of patients	Percentage (%)
61-69	25	50
70-79	16	32
>80	9	18
Total	50	100

In our study, 30 patients (60%) were female and 20 patients (40%) were male (Table 2).

Table 2: Sex distribution.

Gender	No. of patients	Percentage (%)
Female	30	60
Male	20	40
Total	50	100

Domestic falls were the most common mechanism of injury, accounting for 40 cases (80%), while road-traffic accidents accounted for 10 cases (20%) (Table 3).

Table 3: Mechanism of injury.

Mode of injury	No. of patients	Percentage (%)
Road traffic accident	10	20
Domestic fall	40	80
Total	50	100

According to the garden classification, 25 patients (50%) had type III fractures and 17 (34%) had type IV fractures; the remaining patients had type I or II fractures (Table 4).

Table 4: Distribution of patients according to Garden classification.

Classification	No. of patients	Percentage (%)
Type 1	2	4
Type 2	6	12
Type 3	25	50
Type 4	17	34

Thirty-six patients (72%) had Dorr type B morphology, 11 (22%) had type A morphology and 3 (6%) had type C morphology (Table 5).

Table 5: Distribution of patients according to Dorr classification.

Classification	No. of patients	Percentage (%)
Type A	11	22
Type B	36	72
Type C	3	6
total	50	100

Table 6: Distribution of patients according to HHS.

Score	No. of patients	Percentage (%)
Excellent	9	18
Good	36	72
Fair	4	8
Poor	1	2
Total	50	100

Thirty-six patients (72%) achieved a good functional outcome according to the HHS, 9 (18%) had an excellent outcome, 4 (8%) had a fair outcome and 1 (2%) had a poor outcome. Overall, most patients demonstrated good-to-excellent postoperative recovery (Table 6).

Clinical case

A 77-year-old woman with a right femoral neck fracture was treated with bipolar hip hemiarthroplasty and had excellent outcome as shown in Figures 1 and 2.

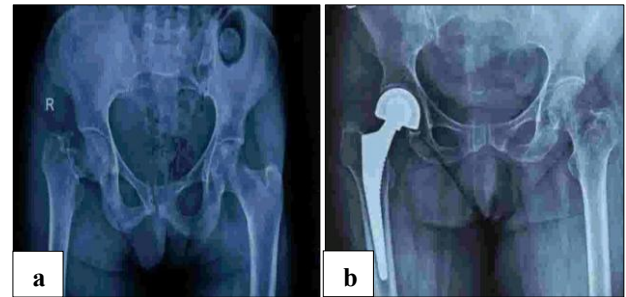


Figure 1: (a) Preop X-ray and (b) final follow-up X-ray.



Figure 2: Clinical images of final follow-up at 1 year.

DISCUSSION

The present prospective study evaluated the functional outcome of bipolar hemiarthroplasty performed through the modified Hardinge approach in 50 patients with femoral neck fractures. The principal finding was that the majority of patients achieved satisfactory postoperative function, with a mean HHS of 83. Mukka et al in a prospective cohort study of 185 patients, reported mean HHS value of 71 at one year following direct lateral approach, which is comparable to our present study.⁶

Overall, 72% of patients achieved a good outcome and 18% achieved an excellent outcome, resulting in 90% of patients having good-to-excellent functional results at final follow-up. These findings suggest that bipolar hemiarthroplasty through the modified Hardinge approach can provide satisfactory functional recovery in appropriately selected patients with femoral neck fractures.

In our study, the mean age was 72 ± 8.16 years, 60% of patients were women, and 80% of fractures resulted from domestic falls. Selvam et al in an Indian study of femoral neck fractures, reported a slight female predominance, with a mean age of 75 years among males and 72 years among females. Domestic falls were the commonest mechanism of injury, accounting for 88.35% of cases, while road traffic accidents accounted for 9.71%.⁷ These findings are closely comparable with the present study and support the predominance of low-energy domestic falls as the mechanism of femoral neck fractures in elderly patients.

The demographic profile of the present cohort is also broadly comparable with that of the large international HEALTH randomized controlled trial. In that study, 70.1% of participants were women and 80.2% were aged 70 years or older.⁸

Garden type III fractures accounted for 50% of cases and type IV fractures for 34%, indicating that 84% of patients had displaced intracapsular fractures. Evidence from randomized trials supports hemiarthroplasty as an effective treatment for displaced femoral neck fractures in older adults. Frihagen et al, in a randomized controlled trial of 222 patients, reported that the mean HHS at 12 months was 6.7 points higher following hemiarthroplasty than internal fixation, with better health-related quality of life and independence in the hemiarthroplasty group.⁹

The favorable functional outcome observed in the present study is also consistent with studies specifically evaluating the modified Hardinge approach. Jadhav et al in a prospective comparative study of 50 patients, reported better HHS following cemented hemiarthroplasty through the modified Hardinge approach compared with the conventional posterior approach, together with fewer complications and no dislocations in the modified Hardinge group.¹⁰ The present study similarly demonstrated favorable functional recovery, with 90% of patients achieving good-to-excellent HHS outcomes. Rogmark et al in an analysis of 33,205 hemiarthroplasties from the Norwegian and Swedish national registries, reported that both posterior approach and uncemented stems were associated with increased risk of reoperation.¹¹

Evidence from systematic reviews has generally suggested advantages of cemented fixation in terms of postoperative pain, mobility, and revision risk, although cemented fixation may be associated with increased operative time and blood loss.^{12,13} A more recent systematic review and meta-analysis of randomized controlled trials also found clinically relevant differences between cemented and uncemented hemiarthroplasty, although the choice of fixation should be individualized according to patient characteristics and surgeon preference.¹⁴

Liang et al in a network meta-analysis of randomized controlled trials involving 1781 elderly patients, compared total hip arthroplasty, hemiarthroplasty, internal fixation,

and artificial femoral-head replacement using HHS as an outcome measure.¹⁵ Their findings demonstrated that functional outcomes vary according to the surgical method and patient characteristics, emphasizing the importance of individualized treatment selection.

The 2025 Cochrane review by Morrell et al evaluated randomized evidence concerning anterior, lateral, and posterior approaches for hemiarthroplasty following hip fracture. The authors concluded that the evidence remains very uncertain regarding the effects of surgical approach on activities of daily living and pain, while there was little or no evidence of differences in health-related quality of life, functional status, or mortality.¹⁶ Thus, although the present study demonstrated favorable functional outcomes and a low dislocation rate with the modified Hardinge approach, current high-level evidence does not establish that the lateral approach is universally superior to anterior or posterior approaches. Total hip arthroplasty produced modestly better functional outcomes but was associated with a higher rate of hip instability or dislocation.¹⁷

Limitations

Several limitations of the present study should be acknowledged. First, the relatively small sample size limited the statistical power and the ability to detect uncommon complications. Second, the follow-up period of 6 months to 1 year was insufficient to evaluate long-term outcomes such as implant survival, acetabular erosion, late dislocation, aseptic loosening, and revision surgery. Third, the single-center design may limit the generalizability of the findings to other patient populations and clinical settings.

CONCLUSION

The modified Hardinge approach was associated with favorable functional outcomes in this prospective cohort of older patients with displaced femoral neck fractures. Most patients achieved good-to-excellent HHS and the observed complications were generally manageable. These findings support the use of hemiarthroplasty as an established treatment option for appropriately selected older patients with displaced femoral neck fractures. However, the absence of a comparator group means that this study cannot establish superiority of the modified Hardinge approach over other surgical approaches or treatment strategies.

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REFERENCES

1. Kannus P, Parkkari J, Sievänen H, Heinonen A, Vuori I, Järvinen M. Epidemiology of hip fractures. *Bone*. 1996;18(1):S57-S63.

2. National Institute for Health and Care Excellence. Hip fracture: management. NICE guideline CG124. London: NICE; 2011.
3. Bhandari M, Einhorn TA, Guyatt G, Schemitsch EH, Zura RD, Sprague S, et al. Total hip arthroplasty or hemiarthroplasty for hip fracture. *N Engl J Med.* 2019;381(23):2199-208.
4. Learmonth ID, Young C, Rorabeck C. The operation of the century: total hip replacement. *Lancet.* 2007;370(9597):1508-19.
5. Hardinge K. The direct lateral approach to the hip. *J Bone Joint Surg Br.* 1982;64(1):17-9.
6. Mukka S, Lindqvist J, Peyda S, Brodén C, Mahmood S, Hassany H, et al. Dislocation of bipolar hip hemiarthroplasty through a postero-lateral approach for femoral neck fractures: a cohort study. *Int Orthop.* 2015;39(7):1277-82.
7. Selvam P, Soundarapandian S, Soundarapandian R, Senguttuvan C. Preoperative factors influencing decision between hemiarthroplasty and total hip arthroplasty in femoral neck fractures in Indian patients—retrospective single-center study. *Geriatr Orthop Surg Rehabil.* 2017;8(3):145-50.
8. HEALTH Investigators; Bhandari M, Einhorn TA, Guyatt G, Schemitsch EH, Zura RD, Sprague S, et al. Total hip arthroplasty or hemiarthroplasty for hip fracture. *N Engl J Med.* 2019;381(23):2199-208.
9. Frihagen F, Nordsletten L, Madsen JE. Hemiarthroplasty or internal fixation for intracapsular displaced femoral neck fractures: randomised controlled trial. *BMJ.* 2007;335(7632):1251.
10. Jadhav SV, Murkute KG, Swamy AP, Badgujar O. Prospective study comparing early functional outcome and gait analysis in femoral neck fracture treated by cemented hemiarthroplasty using modified Hardinge approach and conventional posterior approach. *Int J Res Orthop.* 2023;9(1):66-70.
11. Rogmark C, Fenstad AM, Leonardsson O, Engesæter LB, Kärrholm J, Furnes O, et al. Posterior approach and uncemented stems increase the risk of reoperation after hemiarthroplasties in elderly hip fracture patients: an analysis of 33,205 procedures in the Norwegian and Swedish national registries. *Acta Orthop.* 2014;85(1):18-25.
12. Khan RJ, MacDowell A, Crossman P, Keene GS. Cemented or uncemented hemiarthroplasty for displaced intracapsular fractures of the hip—a systematic review. *Injury.* 2002;33(1):13-7.
13. Azegami S, Gurusamy KS, Parker MJ. Cemented versus uncemented hemiarthroplasty for hip fractures: a systematic review of randomised controlled trials. *Hip Int.* 2011;21(5):509-17.
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. *Orthop Surg.* 2023;15:1719-29.
15. Liang C, Yang F, Lin W, Fan Y. Efficacies of surgical treatments based on Harris hip score in elderly patients with femoral neck fracture. *Int J Clin Exp Med.* 2015;8(5):6784- 93.
16. Morrell AT, Lindsay SE, Schabel K, Parker MJ, Griffin XL. Surgical approaches for inserting hemiarthroplasty of the hip in people with hip fractures. *Cochrane Database Syst Rev.* 2025;(6):CD016031.
17. HEALTH Investigators; Bhandari M, Einhorn TA, Guyatt G, Schemitsch EH, Zura RD, Sprague S, et al. Total hip arthroplasty or hemiarthroplasty for hip fracture. *N Engl J Med.* 2019;381(23):2199-208.

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