

Clinical and Radiological Outcome of Bipolar Hemiarthroplasty for the Neck of Femur Fractures

Phalgun Kumar. K¹, Samiullah MD², Shaheed Abdul Arshad³, Mahesh Sagar Athinarapu⁴

¹Assistant Professor, Department of Orthopedics, Government Medical College and Hospital, Wanaparthy, Telangana State

² Assistant Professor, Department of Orthopedics, Government Medical College and Hospital, Wanaparthy, Telangana State.

³Assistant Professor, Department of Orthopedics, Government Medical College and Hospital, Wanaparthy, Telangana State.

⁴Assistant Professor, Department of Orthopedics, Government Medical College and Hospital, Wanaparthy, Telangana State.

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Corresponding Author: Dr. A. Mahesh Sagar

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Abstract:

Background: Femoral neck fractures predominantly affect elderly females and are rare in individuals under 60 years of age. This study was conducted to evaluate the functional outcomes of both cemented and uncemented bipolar hemiarthroplasty in patients aged 60 and above with intracapsular femoral neck fractures, aiming to identify factors influencing the outcomes.

Methods: This retrospective investigation focused on patients who underwent bipolar hemiarthroplasty for femoral neck fractures at Government Hospital Wanaparthy, Telangana State. The list of patients who underwent bipolar hemiarthroplasty for femoral neck fractures was obtained from the medical records department. A standardized proforma, validated by the guide, was utilized for uniform analysis of all patients during a single visit. Functional Outcome: Utilized the Modified Harris Hip Score to assess functional outcomes for all patients.

Results: A total of n=20 cases were studied during the duration of the study. In this study, the majority of cases had a transcervical type of fracture 80% followed by basicervical 15%, and the least common was subcapital fractures 5% of cases. The final Harris Hip Scores (HHS) revealed the majority of patients (65%) achieved "good" HHS scores (80-89), indicating significant improvement in hip function and quality of life. An additional 30% achieved "excellent" scores (90-100), further highlighting the positive impact of surgery on functional capacity.

Conclusion: Bipolar hemiarthroplasty for femoral neck fractures offers relief from pain and a quicker return to unassisted activity, with an acceptable rate of complications. The ultimate functional outcomes are contingent upon the associated comorbidities and effective postoperative rehabilitation. There was no discernible correlation between functional outcomes and interprosthetic movements or radiological results.

Keywords: Bipolar hemiarthroplasty, Harris Hip Scores, Fracture neck of femur, Functional outcome.

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Introduction

The femoral neck fracture is a common occurrence in the elderly and poses a persistent challenge for orthopedic surgeons. Factors contributing to the increasing prevalence include osteoporosis, diminished vision, poor neuromuscular coordination, lifestyle changes, sedentary habits, and improved life expectancy. [1] The incidence is expected to double within the next two decades and triple by 2050, resulting in a growing healthcare burden. The primary treatment goal is functional

restoration without morbidity, yet controversies persist in managing these fractures in the elderly. Open reduction and internal fixation in the elderly have a higher risk of non-union and avascular necrosis. Typically caused by low-energy falls, approximately 2-3% may result from pathologic or stress fractures without a history of trauma. Treatment objectives for femoral neck fractures aim for an early return to functional status while minimizing mortality, morbidity, and the need for re-operation [2]. Surgical options include internal

fixation, hemiarthroplasty, and total hip replacement [3]. Internal fixation, commonly using cancellous screws, has a higher non-union rate and inferior outcomes compared to hemiarthroplasty [4]. Given the increased risk of non-union and avascular necrosis with internal fixation, hip arthroplasty has emerged as the preferred treatment for early mobilization and reduced morbidity.

Orthopedic surgeons now have the choice of unipolar, bipolar, and total hip replacement for treating intracapsular fractures in the elderly. Unipolar prostheses pose challenges such as acetabular erosion and stem loosening. Introduced by James Ennis Bateman and Gilbert in 1974, bipolar hemiarthroplasty involves a self-articulating prosthesis, offering the advantage of reduced acetabulum erosion and protrusion due to dual articulation [5]. Motion occurs between the metal head and polyethylene socket (inner bearing) as well as between the metallic head and acetabulum (outer bearing). The market now offers modular prostheses, allowing for neck adjustment and easier conversion to total hip replacement in the future. Unipolar prostheses are predominantly used in developing countries and reserved for active elderly patients with limited indications. In India, bipolar prostheses are gradually replacing unipolar ones in the elderly due to advantages such as less postoperative pain, favorable outcomes, good range of movements, and cost-effectiveness. [6, 7] While primary total hip replacement is preferred in many tertiary centers in India, its adoption is limited in government hospitals due to high costs, as most patients fare well with hemiarthroplasty. Thus, bipolar hemiarthroplasty appears to be the optimal choice for the active elderly population in our country, although long-term follow-up results remain scarce in the literature. This study aims to provide a better understanding of the issues and outcomes associated with bipolar hemiarthroplasty.

Material and Methods

This Retrospective study was conducted in the Department of Orthopedics, Government Medical College and Hospital, Wanaparthy, Telangana State. Institutional Ethical approval was obtained for the study. Written consent was obtained from all the participants of the study after explaining the nature of the study in the vernacular language.

Inclusion Criteria

1. Intracapsular Femoral Neck Fractures.
2. Aged more than 60 years.
3. Unstable Fractures.
4. Pre-existing Hip Arthritis.
5. Failed Conservative Management.

Exclusion Criteria

1. Aged less than 60.
2. Active infections at the site.
3. Patients unfit for surgery.
4. Non-ambulatory patients.

This retrospective investigation focused on patients who underwent bipolar hemiarthroplasty for femoral neck fractures at Government Hospital Wanaparthy, Telangana State. The list of patients who underwent bipolar hemiarthroplasty for femoral neck fractures was obtained from the medical records department. A standardized and validated proforma was utilized for uniform analysis of all patients during the visit. Functional Outcome: Utilized the Modified Harris Hip Score to assess functional outcomes for all patients.

Radiological Assessment: Anteroposterior X-rays with internal rotation (15–20 degrees) were taken for radiological analysis. Parameters included joint space, subluxation, and acetabular changes, forming the basis for grading. Patients were taken to the theatre for fluoroscopy examination without anesthesia. Initial static images were obtained with the hip in neutral, flexion, abduction, adduction, and various rotator movements. Continuous fluoroscopy recorded and analyzed all movements for interprosthetic mobility. Interprosthetic movements were considered present when there was a range of more than 15° degrees in at least two planes. Patients were categorized based on the number of years of follow-up. This comprehensive approach allowed for a thorough examination of functional, and radiological providing valuable insights into the outcomes of bipolar hemiarthroplasty for femoral neck fractures.

Results

A total of 20 cases were included in the study. Table 1 presents the age distribution of patients who underwent bipolar hemiarthroplasty for neck of femur fractures. The range of age was from 61 – 83 years and the mean age was 69.55 ± 5.5 years.

Table 1: Age-wise distribution of cases of neck of femur fractures in the study

Age distribution in years	Frequency	Percentage
61-70	15	75%
71-80	4	20%
>80	1	5%
Total	20	100%

Table 2 provides information about the characteristics of the 20 patients who underwent bipolar hemiarthroplasty for neck of femur fractures included in the study. The majority of patients (65%) who underwent surgery were male. Right side slightly more than half of the fractures (55%) occurred on the right side of the femur.

Mode of Injury: Slipping/Tripping 65.0%. The most common cause of the fractures (65%) was slipping or tripping. Road Traffic Accidents 20.0% Road traffic accidents were responsible for 20% of the fractures. Fall from height 15.0% Falls from height accounted for the remaining 15% of the fractures.

Table 2: Age-wise distribution of cases of bipolar hemiarthroplasty for neck of femur fractures included in the study

Variable	Frequency	Percentage
Sex		
Male	13	65.0
Female	7	35.0
Laterality of involvement		
Right side	11	55.0
Left side	9	45.0
Mode of injury		
Slipping/Tripping	13	65.0
Road Traffic Accidents	4	20.0
Fall from height	3	15.0

Table 3: Radiological Type of neck of femur Fracture treated with hemiarthroplasty

Radiological Type	Frequency	Percentage
Trans-cervical	16	80.0
Basicervical	3	15.0
Sub-capital	1	5.0

In this study, the majority of cases had transcervical type of fractures followed by basicervical, and least common were subcapital fractures depicted in Table 3.

Table 4: Size of Prosthesis cases of bipolar hemiarthroplasty for the neck of femur fractures

Size of the prosthesis	No. of patients	Percentage
39 mm	1	5.0
41 mm	3	15.0
43 mm	5	25.0
45 mm	6	30.0
47 mm	3	15.0
49 mm	1	5.0
51 mm	1	5.0
Total	20	100

Table 4 shows the distribution of prosthetic head sizes used in the 20 cases of bipolar hemiarthroplasty for neck of femur fractures treated in the study. One patient received the smallest prosthesis because the fractured bone was smaller. The most common prosthesis size used was 45mm (6 patients, 30%). it is the preferred choice for a significant portion of patients in this study, due to its suitability for the average range of femoral head sizes. Five patients (25%) received a 43mm

prosthesis, making it the third most common size. This was considered a mid-range option suitable for many patients with typical bone dimensions. The other details are depicted in table 4. One patient (5%) experienced limb lengthening of less than 1 cm, while three patients (15.0%) encountered limb shortening exceeding 2 cm in the postoperative period. This shortening resulted from technical errors, specifically the prosthesis sitting prominently above the calcar.

Table 5: Outcome evaluation of patients of bipolar hemiarthroplasty for the neck of femur fractures

Variable	Frequency	Percentage
Pain		
Mild pain	16	80.00
Moderate pain	3	15.00
Severe pain	1	5.00
Limp		
Mild	15	75.00
Moderate	3	15.00

No limp	2	10.00
Ambulation		
Without support	17	56.66
With support	13	43.33
Climbing stairs		
Without support	4	20.00
With support	15	75.00
Not able to climb	1	5.00
Ability to sit		
>1 hour	11	55.00
< 1/2 hour	9	45.00

Pain: The majority of patients (80%) reported mild pain after surgery, suggesting a good pain management strategy and successful pain relief. **Limp:** Most patients (75%) experienced a mild limp, which is common after surgery and can be expected to improve with time and rehabilitation. **Moderate limp:** A smaller group of patients (15%) had a moderate limp, with a slower recovery or potentially underlying factors contributing to gait instability. **Ambulation:** Over half of the patients (56.66%) were able to walk without support, showcasing significant improvement in mobility

after surgery. **Climbing stairs:** Without support a small proportion of patients (20%) were able to climb stairs without support, indicating that this activity might be more challenging after surgery. **Ability to sit for 1 hour:** Over half of the patients (55%) were able to sit for more than an hour, indicating good tolerance to sitting and improved comfort levels (depicted in Table 5). The majority of patients experienced positive outcomes after bipolar hemiarthroplasty, with significant improvement in pain levels, ability to walk, and overall mobility.

Table 6: Final Harris Hip Score and Clinical Results of Patients

Grade	Harris Hip Score	Frequency	Percentage
Excellent	90-100	6	30.00
Good	80-89	13	65.00
Fair	70-79	2	10.00
Poor	<70	1	5.00

Table 6 presents the final Harris Hip Scores (HHS) and overall clinical outcomes of the 20 patients who underwent bipolar hemiarthroplasty for neck of femur fractures in the study. It provides an overview of their functional status after surgery. Majority with good or excellent outcomes: The majority of patients (65%) achieved "good" HHS scores (80-89), indicating significant improvement in hip function and quality of life. An additional 30% achieved "excellent" scores (90-100), further highlighting the positive impact of surgery on functional capacity. Smaller proportion with fair or poor outcomes: A small number of patients (10%) had "fair" scores (70-79), and only one patient (5%) had a "poor" score (<70). This suggests that while most patients experience successful outcomes, some may require additional support or face persistent limitations. Radiological parameters were assessed through anteroposterior view X-rays of the pelvis with the hip in 15 degrees of internal rotation. The findings revealed that 75 percent of patients showed good results, while 25 percent exhibited excellent results. There was one case of acetabular erosion and no occurrences of stem subsidence, acetabular protrusion, or heterotopic ossification were observed in any of the patients throughout the follow-up period.

Discussion

Femoral neck fracture replacement surgery aims to facilitate a swift return to daily activities, which is especially crucial for preventing complications in the elderly population. In this study, the mean patient age was 69.55 ± 5.5 years. Evaluating age is essential for estimating the patient's mean survival time and capacity to adhere to the rehabilitation protocol. In similar studies by Rodop et al. [8] Kesemenli et al. [9] and George et al. [10] the mean ages were 75.6 years, 78 years, and 78 years, respectively. Kayali et al. [11] conducted a comparison involving 42 patients with a mean age of 73 years who underwent cone hemiarthroplasty using a cementless press-fit through a standard posterior approach. The mean age of the patients in this study was comparable to that of similar studies. In this study, the majority of patients (65%) achieved "good" HHS scores (80-89), indicating significant improvement in hip function and quality of life. An additional 30% of patients achieved "excellent" scores (90-100), further highlighting the positive impact of surgery on functional capacity. Kayali et al. [11] reported excellent functional outcomes in 19% of patients, good outcomes in 38%, fair outcomes in 14%, and poor outcomes in 4%, with a mortality rate of 10% in the hemiarthroplasty

group. They concluded that the functional outcomes were comparable between internal fixation and hemiarthroplasty, but hemiarthroplasty facilitated earlier mobilization. Green et al. [12] study, which reviewed 20 patients undergoing primary bipolar hemiarthroplasty for unstable intertrochanteric fractures in the elderly age group, found that 35% had excellent results, 55% had good results, 35% had fair results, and 25% had poor results, with three patients experiencing mortality. The study concluded that primary bipolar hemiarthroplasty in elderly patients allowed for early mobilization and improved physical rehabilitation.

In a similar study, Haentjens et al. [13] reviewed 37 patients and reported excellent results in 18.9%, good results in 29.7%, fair results in 18.9%, poor results in 13.5%, and a mortality rate of 8%. The study concluded that primary bipolar hemiarthroplasty for previously ambulatory patients older than 70 years allowed earlier full weight-bearing and reduced complications associated with prolonged recumbency, such as pneumonia, decubitus ulcers, and atelectasis. In the study by Rosenfeld et al. [14], elderly patients with unstable intertrochanteric fractures underwent primary hemiarthroplasty. Of the 72 patients, excellent results were reported in 46%, good results in 29%, fair results in 15%, poor results in 3%, and mortality rate in 7%. The study concluded that primary hemiarthroplasty in elderly patients with unstable intertrochanteric fractures facilitates early ambulation and reduces complications. Chan et al. [15] investigated 55 patients with intertrochanteric fractures who underwent primary cemented bipolar hemiarthroplasty. They reported excellent results in 19 cases, good results in 8 cases, and mortality in 12 cases in the series. They concluded that primary cemented bipolar hemiarthroplasty for intertrochanteric fractures allowed immediate mobilization and full weight bearing without the risk of complications associated with sliding screw devices, such as implant failure and excessive collapse.

Leighton et al. [16] recommend a prosthetic replacement for femoral neck fractures in patients aged over 60. The use of unipolar or bipolar (cemented) hemiarthroplasty has demonstrated reliable and predictable outcomes. Uncemented stems are considered for patients with significant cardiovascular risks and those requiring total hip arthroplasty in the "active elderly," while unipolar prostheses (Moore or Thompson) are reserved for minimally ambulatory patients. Parker MJ et al. [17] confirmed that patients with cemented bipolar hemiarthroplasty experienced minimal pain, improved mobility, and comparable complications to those with uncemented bipolar hemiarthroplasty. In our investigation, only one case of acetabular erosion was identified. The comparatively shorter follow-up duration in our study could account for the low-

er incidence of acetabular erosion. Acetabular erosion, a common long-term complication following hemiarthroplasty, typically manifests months to years post-surgery and can result in severe pain, hindering functional outcomes and potentially necessitating revision surgery [18]. The precise etiology remains unclear, but potential factors include direct trauma during the initial injury and wear of the native cartilage against a non-anatomic bearing surface. This complication has been associated with increased activity levels and an extended period after surgery [19]. Hedbeck et al. [20] demonstrated a 20% versus 5% rate of acetabular erosion in unipolar versus bipolar hemiarthroplasty. Additionally, Baker et al. [21] reported a 66% rate of acetabular erosion following unipolar arthroplasty with a mean follow-up of 39 months. All patients underwent an assessment of their satisfaction with the procedure and their ability to regain pre-fracture activity levels. Results showed that 45.0% were 'very satisfied,' 45.0% were 'fairly satisfied,' and 10.0% were 'not satisfied.' Notably, the subjective measure of satisfaction did not align closely with the objective Harris Hip Score assessment.

Conclusion

Bipolar hemiarthroplasty for femoral neck fractures offers relief from pain and a quicker return to unassisted activity, with an acceptable rate of complications. The ultimate functional outcomes are contingent upon the associated comorbidities and effective postoperative rehabilitation. There was no discernible correlation between functional outcomes and interprosthetic movements or radiological results. Our study indicated favorable radiological outcomes with notable interprosthetic movements, suggesting that bipolar hemiarthroplasty is a cost-effective prosthesis for active elderly individuals.

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