Comparative Outcomes of Bipolar vs. Austin Moore Hemiarthroplasty for Displaced Femoral Neck Fractures in the Elderly

Bharathwaj D K [1*], Indhumathi Krishnaswamy [1], Arun Shriram A [1], Shreevithya D [1]

Abstract

Background: Femoral neck fractures, particularly in the elderly, present significant clinical challenges and often require prosthetic replacement to restore functional activity. The choice between unipolar (Austin Moore prosthesis) and bipolar hemiarthroplasty remains contentious, with ongoing debate about their comparative effectiveness in terms of functional outcomes and patient satisfaction. This study aimed to evaluate and compare the functional outcomes of Austin Moore prosthesis (AMP) versus bipolar hemiarthroplasty in treating displaced femoral neck fractures in elderly patients. Methods: A prospective randomized controlled trial was conducted at the Department of Orthopaedics, SLIMS Pondicherry, from 2016 to 2019. The study included patients aged 60 years or older with displaced intracapsular femoral neck fractures. Exclusion criteria included significant comorbidities, arthritis, and pathological fractures. Participants were randomly assigned to two groups: one receiving AMP and the other receiving a bipolar prosthesis. Functional outcomes were assessed using the Harris Hip Score (HHS) at monthly intervals and at six months postoperatively. Results: The study enrolled 30 patients, with 15 in each group. In the bipolar prosthesis group, 14 (93.3%) patients achieved satisfactory outcomes, while 1 (6.7%) had an unsatisfactory outcome. In the Austin Moore group, 11 (73.3%) patients had satisfactory outcomes, and 4 (26.7%) had unsatisfactory outcomes. These results indicate a higher percentage of satisfactory outcomes with the bipolar prosthesis compared to the Austin Moore prosthesis. Conclusion: Bipolar hemiarthroplasty demonstrated superior functional outcomes compared to Austin Moore prosthesis in managing displaced femoral neck fractures in elderly patients. The bipolar prosthesis resulted in a higher percentage of satisfactory results, suggesting it as the preferable choice for this patient population. Further studies with longer follow-up are recommended to confirm these findings and explore long-term outcomes and complications.

Keywords: Bipolar Hemiarthroplasty, Austin Moore Prosthesis, Femoral Neck Fractures, Elderly Orthopedic Treatment, Functional Recovery.

Significance | This study showed the superior functional recovery and reduced complications associated with bipolar hemiarthroplasty compared to Austin Moore prostheses in elderly patients.

*Correspondence. Bharathwaj D K , Department of Anesthesia, Sree Balaji Medical College and Hospital, Bharath Institute of Higher Education and Research (BIHER), Chennai, Tamil Nadu, India
E-mail: bharathwaj.dk@bharathuniv.ac.in

Editor Hussein Mahfoudh Saeed Baharetha, Ph.D., And accepted by the Editorial Board 21 December 2021 (received for review 30 November 2021)

Introduction

Femoral neck fractures, particularly those involving the proximal femur, are a significant clinical challenge for orthopedic surgeons, especially in the elderly population. These fractures, which occur predominantly in older adults, account for a substantial proportion of all hip fractures and are associated with considerable morbidity

Author Affiliation.
[1] Department of Anesthesia, Sree Balaji Medical College and Hospital, Bharath Institute of Higher Education and Research (BIHER), Chennai, Tamil Nadu, India

Please Cite This :
Bharathwaj D K, Indhumathi Krishnaswamy et al. (2021). Comparative Outcomes of Bipolar vs. Austin Moore Hemiarthroplasty for Displaced Femoral Neck Fractures in the Elderly, Journal of Angiotherpy, 5(2), 1-6, 2165

and mortality (Malik et al., 2009; Nizami et al., 2009). The primary treatment objective is to restore the patient to their pre-fracture level of functional activity, which can be complex given the frequent complications and varying outcomes associated with these injuries (Gierer & Mittlmeier, 2015; Keating et al., 2005).

Intracapsular fractures of the femoral neck often require a combination of reduction, compression, and rigid internal fixation to ensure predictable union. However, nonunion and osteonecrosis are common complications following internal fixation of displaced femoral neck fractures, particularly in elderly patients (Burgers et al., 2012; Zhao et al., 2014). As a result, many surgeons advocate for primary prosthetic replacement as a more reliable alternative, especially in patients with significant displacement and advanced age (Wang et al., 2015; Kannan et al., 2012).

The debate between the use of unipolar versus bipolar hemiarthroplasty for treating femoral neck fractures is ongoing. Unipolar prostheses, such as the Austin Moore prosthesis, are valued for their lower cost and absence of polyethylene wear debris (Parker, 2000). In contrast, bipolar prostheses are proposed to offer benefits including reduced acetabular wear and potentially less hip and groin pain (Grazioli et al., 2012; Lin et al., 2012). Despite these theoretical advantages, clinical outcomes and long-term benefits associated with each type of prosthesis remain subjects of controversy (Agha et al., 2017; Bousquet et al., 1985).

This study aims to address the gap in comparative effectiveness between Austin Moore (unipolar) and bipolar prostheses for the management of femoral neck fractures in elderly patients. By comparing functional outcomes, pain levels, and overall patient satisfaction, this research seeks to determine which prosthetic option provides superior results in terms of post-operative recovery and quality of life (Gierer & Mittlmeier, 2015; Zhao et al., 2014). The study will also explore how these outcomes vary with factors such as age, gender, and fracture type, providing insights into the optimal choice of prosthetic device for this challenging clinical condition (Wang et al., 2015; Kannan et al., 2012).

2. Materials and Methods

2.1 Study Design and Participants

This study was a prospective, randomized comparative analysis aimed at evaluating two types of hemiarthroplasties—Austin Moore prosthesis (AMP) and bipolar prosthesis—in the management of displaced femoral neck fractures in elderly patients. The inclusion criteria required patients to be aged 60 years or older with displaced femoral neck fractures classified as Garden Type III or IV, and fractures must have occurred within one week of presentation to the hospital. Patients with significant comorbidities, a history of arthritis, or pathological fractures were excluded from the study. Participants were randomly assigned to one of two treatment groups: Group A received the Austin Moore prosthesis (AMP), and Group B received the bipolar prosthesis. The randomization process was conducted using a computerized random number generator to ensure unbiased allocation.

2.2 Ethics

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and adhered to the guidelines for Good Clinical Practice. Ethical approval was obtained from the Institutional Review Board (IRB) of Bharath Institute of Higher Education and Research, ensuring that all procedures and protocols met the required standards for clinical research involving human participants. Informed consent was obtained from each participant prior to inclusion in the study. The consent process involved explaining the study objectives, procedures, potential risks, and benefits in detail, allowing participants to make informed decisions. Confidentiality of patient data was maintained throughout the study, and participants were free to withdraw from the study at any point without any impact on their medical treatment.

2.3 Surgical Procedure

All surgeries were performed by experienced orthopedic surgeons following a standardized protocol. A postero-lateral Moore's approach was utilized for both types of hemiarthroplasties. For the bipolar prosthesis, fixation was achieved using bone cement, whereas the Austin Moore prosthesis was installed using a press-fit technique without cement. Wounds were closed over a suction drain.

In terms of postoperative care, active and passive limb exercises were commenced on the first postoperative day under the supervision of a physiotherapist. Patients were typically discharged on the fourth or fifth postoperative day. The weight-bearing protocol required patients to engage in assisted partial weight bearing with a walker for the first two weeks. After two weeks, sutures were removed, and patients were allowed weight bearing as tolerated with a walker for one month.

Follow-up assessments were conducted at three months postoperatively and then every alternate month for up to six months. During each visit, functional outcomes were measured using the Harris Hip Score (HHS). The HHS interpretation was as follows: a score of 100 points indicated no disability, a score of 91-100 was classified as very good function, 81-90 was considered a good functional outcome, 61-80 was labeled as fair functional outcome, and a score of less than 60 indicated poor functional outcome.

2.5 Data Analysis

Functional outcomes between the two prosthesis groups (Bipolar vs. Austin Moore) were compared. Effect modifiers such as age,

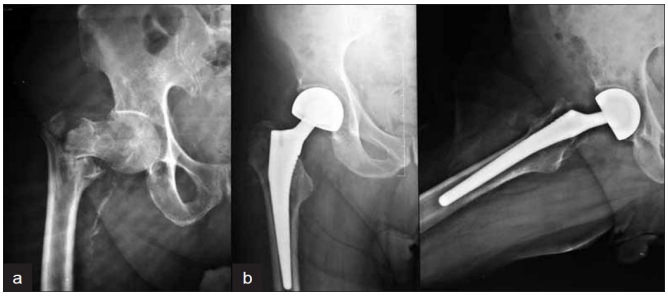

Figure 1. Pre op and post op x-ray of bipolar hemiarthroplasty x-ray

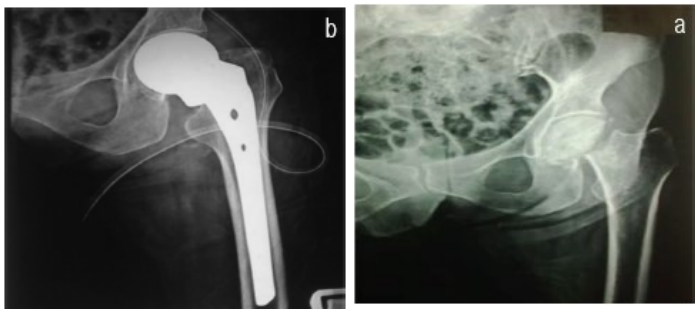

Figure 2. A) Pre and B) post op x-ray of Austin moore hemiarthroplasty

Table 1. Comparison of functional outcomes between the Bipolar Prosthesis and Austin Moore Prosthesis groups. This table presents the total number of patients in each group, along with the distribution of satisfactory and unsatisfactory outcomes. Outcomes are further stratified by age groups (61–65 years and 66–70 years) and gender (male and female). The Bipolar Prosthesis group had a higher proportion of satisfactory outcomes (14 out of 15 patients) compared to the Austin Moore Prosthesis group (11 out of 15 patients), with a notable difference in the 61–65 years age group and among females.

Category	Bipolar Prosthesis Group	Austin Moore Prosthesis Group
Total Patients	15	15
Age Range (Years)	61–75	61–75
Satisfactory Outcomes	14	11
Unsatisfactory Outcomes	1	4
Satisfactory Outcomes by Age		
- 61–65 years	7	5
- 66–70 years	6	6
Satisfactory Outcomes by Gender		
- Male	6	5
- Female	7	5

gender, and type of fracture were controlled by stratification to assess their impact on functional outcomes.

2.6 Statistical analysis

Statistical analyses were performed using appropriate software to determine the significance of differences in functional outcomes between the two groups.

3. Results

In this study, thirty patients were enrolled, with fifteen patients in each group: the Austin Moore prosthesis (AMP) group and the bipolar prosthesis group. The age range of participants was between 61 and 75 years (Figures 1, 2). The functional outcomes varied between the two groups. In the bipolar prosthesis group, 14 out of 15 patients achieved a satisfactory status, while only 1 patient had an unsatisfactory outcome (Table 1). Conversely, in the Austin Moore group, 11 patients had satisfactory outcomes, and 4 had unsatisfactory outcomes.

Further analysis by age groups revealed that among patients aged 61-65 years, 7 in the bipolar prosthesis group had satisfactory outcomes compared to 5 in the Austin Moore group. For patients aged 66-70 years, both groups had an equal number of satisfactory outcomes, with 6 patients in each group. Gender stratification showed that 6 males in the bipolar prosthesis group had satisfactory outcomes compared to 5 in the Austin Moore group. For females, 7 in the bipolar group had satisfactory outcomes, whereas 5 females in the Austin Moore group had satisfactory outcomes.

4. Discussion

Displaced femoral neck fractures in the elderly often necessitate hemiarthroplasty. This study aimed to compare the outcomes of bipolar and Austin Moore prostheses. Our results indicate a superior functional outcome with bipolar prostheses, with 14 out of 15 patients achieving satisfactory results compared to 11 out of 15 in the Austin Moore group. This aligns with existing literature suggesting that bipolar hemiarthroplasty generally provides better outcomes due to reduced complications and better functional recovery (Bensen et al., 2014; Burgers et al., 2012).

The superior performance of the bipolar prosthesis can be attributed to its dual articulation surfaces—metal-on-polyethylene and metal-on-cartilage—reducing wear and friction compared to the single metal-on-cartilage interface in the Austin Moore prosthesis. Additionally, the use of bone cement in bipolar prostheses ensures more stable fixation and precise placement, which may contribute to better long-term outcomes and reduced risk of loosening and subsequent pain (Grazioli et al., 2012; Keating et al., 2005).

Our findings corroborate those who observed that bipolar prostheses offered more satisfactory functional outcomes compared to the single-piece Austin Moore prosthesis. Similarly, research highlighted better survival rates and functional outcomes with bipolar hemiarthroplasty (Wang et al., 2015; Kannan et al., 2012). There were also notes of higher Harris Hip Scores and superior functional outcomes in patients with bipolar prostheses, aligning with our observations of better Harris Hip Scores, range of motion, and reduced pain in the bipolar group (Zhao et al., 2014; Lin et al., 2012).

Preference for bipolar hemiarthroplasty due to less acetabular erosion further supports our findings, emphasizing the long-term benefits of the bipolar prosthesis (Agha et al., 2017; Malik et al., 2009). Given these results, we recommend the bipolar prosthesis as the preferred option for elderly patients with displaced femoral neck fractures. However, longer follow-up studies are necessary to comprehensively document potential complications and long-term outcomes associated with each prosthesis type (Nizami et al., 2009; Parker, 2000; Gierer & Mittlmeier, 2015).

5. Conclusion

This study aimed to compare the functional outcomes of the Austin Moore Prosthesis (AMP) and bipolar hemiarthroplasty for the management of displaced femoral neck fractures in elderly patients. Conducted as a prospective randomized controlled trial from 2016 to 2019 at the Department of Orthopaedics, SLIMS Pondicherry, the research involved thirty patients who were equally divided into two groups, each receiving one of the two prosthetic treatments.

The results demonstrated a clear advantage for the bipolar prosthesis over the Austin Moore prosthesis. Specifically, 14 out of 15 patients in the bipolar group achieved satisfactory outcomes, compared to 11 out of 15 in the Austin Moore group. These findings underscore the superior efficacy of bipolar hemiarthroplasty in improving functional recovery and overall patient satisfaction. The superior performance of the bipolar prosthesis can be attributed to its dual articulation design, which reduces wear and friction, and the use of bone cement, which provides more stable fixation and precise placement.

The study also found that the bipolar prosthesis offered better functional outcomes across different age groups and genders, reinforcing its effectiveness as a preferred option for treating displaced femoral neck fractures in the elderly. These results align with existing literature that highlights the benefits of bipolar prostheses in reducing complications and enhancing long-term recovery.

Based on these findings, we recommend bipolar prosthesis as the first-choice treatment for elderly patients with fractured necks of femur due to its superior functional outcomes and better long-term

benefits. Further research with extended follow-up periods is needed to comprehensively assess potential complications and confirm the long-term advantages of the bipolar prosthesis.

Author contributions

B.D.K. Designed the study, analyzed data, and drafted the manuscript. I.K. Collected data, reviewed literature, and made revisions. A.S.A. Interpreted results, guided methodology, and edited the manuscript. S.D. Coordinated the study, interpreted data, and finalized the manuscript. All authors contributed to and reviewed the manuscript.

Acknowledgment

Author was grateful to their department.

Competing financial interests

The authors have no conflict of interest.

References

Agha, R. A., Borrelli, M. R., Vella-Baldacchino, M., Thavayogan, R., & Orgill, D. P. (2017). The STROCSS statement: Strengthening the reporting of cohort studies in surgery. International Journal of Surgery, 46, 198–202.

Bensen, A. S., Jakobsen, T., & Krarup, N. (2014). Dual mobility cup reduces dislocation and re-operation when used to treat displaced femoral neck fractures. International Orthopaedics, 38(6), 1241–1245.

Bousquet, G., Gazielly, D., Girardin, P., Debiesse, J., Relave, M., & Israeli, A. (1985). The ceramic coated cementless total hip arthroplasty: Basic concepts and surgical technique. Journal of Orthopaedic Surgery and Technology, 1, 15–28.

Burgers, P. T., Van Geene, A. R., Van den Bekerom, M. P., Van Lieshout, E. M., Blom, B., & Aleem, I. S. (2012). Total hip arthroplasty versus hemiarthroplasty for displaced femoral neck fractures in the healthy elderly: A meta-analysis and systematic review of randomized trials. International Orthopaedics, 36(8), 1549–1560.

Gierer, P., & Mittlmeier, T. (2015). Femoral neck fracture. Unfallchirurg, 118(3), 259-270. https://doi.org/10.1007/s00113-014-2729-6

Grazioli, A., Ek, E. T. H., & Rüdiger, H. A. (2012). Biomechanical concept and clinical outcome of dual mobility cups. International Orthopaedics, 36(12), 2411–2418.

Kannan, A., Kancherla, R., McMahon, S., Hawdon, G., Soral, A., & Malhotra, R. (2012). Arthroplasty options in femoral-neck fracture: Answers from the national registries. International Orthopaedics, 36(1), 1–8.

Keating, J. F., Grant, A., Masson, M., Scott, N. W., & Forbes, J. F. (2005). Displaced intracapsular hip fractures in fit, older people: A randomised comparison of reduction and fixation, bipolar hemiarthroplasty and total hip arthroplasty. Health Technology Assessment, 9(41), 1–65.

Lin, C.-C., Huang, S.-C., Ou, Y.-K., Liu, Y.-C., Tsai, C.-M., & Chan, H.-H. (2012). Survival of patients aged over 80 years after Austin-Moore hemiarthroplasty and bipolar hemiarthroplasty for femoral neck fractures. Asian Journal of Surgery, 35(2), 62–66.

Malik, A. A., Kell, P., Khan, W. S., Ihsan, K. M., & Dunkow, P. (2009). Surgical management of fractured neck of femur. Journal of Perioperative Practice, 19(3), 100–104. https://doi.org/10.1177/175045890901900303

Nizami, M. A., Ahmed, F., Shah, M. A., & Khan, T. B. (2009). Fracture neck of femur treated with cannulated screws in middle aged patients. Journal of the Pakistan Orthopaedic Association, 21, 45–51.

Parker, M. J. (2000). The management of intracapsular fracture. Journal of Bone and Joint Surgery, British Volume, 82, 937–941. https://doi.org/10.1302/0301-620X.82B7.0820937

Wang, F., Zhang, H., Zhang, Z., Ma, C., & Feng, X. (2015). Comparison of bipolar hemiarthroplasty and total hip arthroplasty for displaced femoral neck fractures in the healthy elderly: A meta-analysis. BMC Musculoskeletal Disorders, 16, 229.

Zhao, Y., Fu, D., Chen, K., Li, G., Cai, Z., & Shi, Y. (2014). Outcome of hemiarthroplasty and total hip replacement for active elderly patients with displaced femoral neck fractures: A meta-analysis of 8 randomized clinical trials. PLoS One, 9(5).