Long term functional outcome of unipolar and bipolar hemiarthroplasty in femur neck fracture among the elderly at Wahidin Sudirohusodo Hospital, Makassar, Indonesia

Muhammad Sakti¹, Muhammad Ruksal Saleh¹, Karya Triko Biakto¹, Reza Romadhona Fahlevi²

ABSTRACT

Background: Femur neck fracture has been known since Hippocrates' time and is a common orthopaedic condition among the elderly. Since the dawn of time, several treatment procedures have been used. However, the question behind the situation remains unresolved to this day. This study aims to investigate the long-term functional outcomes of unipolar Austin Moore Prosthesis (AMP) hemiarthroplasty and bipolar hemiarthroplasty in elderly patients with femur neck fracture.

Methods: A 10-year retrospective study was conducted at Wahidin Sudirohusodo General Hospital, Orthopaedic and Traumatology Department, Universitas Hasanuddin, Makassar, from January 2009 to December 2018. The study included elderly patients aged 60 and over with a displaced femoral neck fracture treated with unipolar hemiarthroplasty (Austin Moore Prosthesis) or bipolar hemiarthroplasty.

Results: 11 females (83%) and one male in total (17%). Most patients were between 64 and 85, with an average age of 75.17. With a p-value of 0.935, the unipolar group has a higher mean total score of 64.9 than the bipolar group of 59.7. Overall, females were more likely to be involved than males. There was no change in functional results in both the unipolar and bipolar groups when the modified Harris Hip Score (mHHS) was varied. There were no differences in a functional result or total hip score between the two groups using the modified Harris Hip Score.

Conclusion: The functional outcomes of patients treated with unipolar prosthesis and those treated with bipolar prosthesis are not significantly different. Hemiarthroplasty of the hip for femoral neck fractures is a valuable alternative in older patients with good long-term functional outcomes, and unipolar hemiarthroplasty and bipolar hemiarthroplasty are still relevant to utilize in the present period.

Keywords: Unipolar Hemiarthroplasty, Bipolar Hemiarthroplasty, Femur Neck, Fracture, Elderly.

INTRODUCTION

Femur neck fracture has been recognized since Hippocrates and is an orthopaedic problem in the elderly. Various methods of treatment have been employed for ages. However, the problem remains an enigma unsolved today. It occurs most frequently in elderly female patients.²,³ They are uncommon in patients younger than 60 years. It has been predicted that by 2050 the number of hip fractures will triple. Therefore, proximal femur fractures are a significant cause of morbidity and mortality in all age groups, especially the elderly.³ Various methods of treatment have been employed for ages. The prolonged immobilization in the elderly will further lead to decubitus problems and associated complications; hence, surgery was resorted to achieve early ambulation. Earlier hemi replacement arthroplasty, as popularly practiced by Austin Moore, produced reasonably good results. Nevertheless, it had limitations in stem loosening and reactions at the acetabulum. A new bipolar prosthesis overcomes these shortcomings. It had an outer head of metal that articulates with the acetabulum and a second inner small metallic head, which articulates with the high-density polyethylene (HDPE), lining the inner surface of the outer head.⁴,⁵ Vishwanath and Mummigatti, 2017, in their comparative study between the use of Austin Moore Prosthesis (AMP) and bipolar prosthesis to manage intracapsular femur neck fracture, observed that the choice between unipolar and bipolar prostheses is less clear.⁴ Their series found that bipolar prosthesis has a slight advantage over AMP in case of functional results, but the implant's cost is four times that of AMP.⁴ In a study of 47 cases with hemiarthroplasty by Austin Moore prosthesis showed it was good option in elderly patients with limited physical...
demands and mobility. Although surgical treatment is the gold standard, the best surgical treatment option is still to be determined. Hip replacement arthroplasty (partial or total) is emerging as the most viable treatment option. A broader consensus has been reached regarding its benefits, which allow immediate weight-bearing, early restoration of premorbid activity, and enhanced quality of life in elderly patients. Management of femoral neck fractures remains a significant and challenging undertaking for an orthopaedic surgeon. The pendulum swings between reduction and internal fixation with various supplementary methods, as osteosynthesis to total hip replacement.\(^5\)\(^7\)\(^8\)

In most elderly and frail patients, a cemented hemiarthroplasty (HA) is the treatment of choice for most surgeons. However, the optimal design, unipolar or bipolar head, remains unclear. The possible advantages of a bipolar HA are a better range of motion and less acetabular wear. Additionally, inadequate evidence supports the choice between unipolar HA or bipolar HA.\(^9\) Based on the background mentioned above, this study aims to investigate the long-term functional outcomes of unipolar AMP semi-arthroplasty and bipolar hemiarthroplasty in elderly patients with femur neck fracture.

METHODS

**Research Design**

This was a 10-year retrospective study from January 2009 to December 2018, conducted at Wahidin Sudirohusodo General Hospital, Orthopaedic and Traumatology Department, Universitas Hasanuddin, Makassar. Elderly patients aged 60 years and above with displaced femur neck fracture operated on using unipolar hemiarthroplasty (Austin Moore Prosthesis) and bipolar hemiarthroplasty were included in the study.

**Population and Samples**

The population included in this study were all patients with femur neck fracture in elderly patients above the age of 60 years, irrespective of sex, treated by unipolar hemiarthroplasty and bipolar hemiarthroplasty from January 2009 - December 2018 at Wahidin Sudirohusodo General Hospital, Makassar. All patients were at the age of above 60 years. The patients with pathological fracture, stress fracture, and open injury were excluded. There were no patients with Parkinsonism, hemiplegia, or other neurological disease. Patients were treated with cementless bipolar prosthesis and treated with un cemented AMP. The sampling method was total sampling, with all samples that met inclusion and exclusion criteria from medical record as secondary data, contacted by phone number and met for an interview and physical examination as primary data and processed the data with the application SPSS for windows version 25.

**Data Collection**

Patients identified with neck femur fractures were treated with unipolar and bipolar hemiarthroplasty from medical records and registered from January 2009 until December 2018 at Wahidin Sudirohusodo Hospital Makassar as secondary data. Patients who meet the research criteria undergo interview procedures (name, age, occupation) and fill out a clinical function assessment questionnaire according to the Harris Hip Score (HHS) as primary data to obtain clinical outcome data. Perform statistical analysis using the independent Mann-Whitney test. The results were collected, recorded, and analysed, then discussion and conclusion were drawn from the procedure.

**RESULTS**

This was a single-centre, retrospective study of patients treated between 2009 and 2018. All patients ≥60 years of age who underwent hemiarthroplasty because of a femoral neck fracture were included. A total of 80 hip hemiarthroplasties were performed in patients with femoral neck fractures, in the Orthopaedic Department of the referral centre Province Hospital in Wahidin Sudirohusodo between 2009 and 2018. Medical records with clinical data were available for 43 patients, excluding 37 patients. A total of 31 patients (12 AMP, 19 bipolar) lost to follow-up. Eligible patients for follow-up are 12 patients (5 AMP, 7 bipolar).

Eleven females (83%) against one male (17%). Most of the patients belonged to the age group 64 - 85 years, with a mean age of 75.17 years old. The majority of 12 (100%) patients had minimal trauma. Most slipped and fell on flat ground or in the bathroom and could not stand or walk immediately after the fall. All patients were not operating on a new case; the time between trivial fall and operation ranged from 5 - 344 days after injury, which means 51 days. The minimum follow-up for all 12 patients was three years. A maximum of 1 patient was eligible for three years assessment, six patients at four years, two patients at five years, and three patients at seven years. We used the modified Harris Hip Scoring (mHHS) method for the assessment. We evaluated the following points: (1) pain (2) limp (3) use of support (4) walking distance (5) climbing of stairs (6) ability to put on socks and shoes (7) sitting on chairs. maximal score was 100, >90 excellent, 80-89 good result, 70-79 fair result, <70 poor results.

The mean total score in the unipolar group was higher (64.9), compared to the bipolar group (59.7) (p-value=0.935). Mean pain score higher in the unipolar group was 34.8 compare to bipolar group 27.1 (p-value=0.271). Mean support score higher in bipolar group 7.3 compared to unipolar group 6.0 (p-value=0.662). The mean limp score higher in the bipolar group was 7.7 compared to the unipolar group 6.4 (p-value=0.612). Mean distance score higher in the bipolar group was 5.4 compared to unipolar group 3.8 (p-value=0.661). Mean stairs score was higher in unipolar group (2.2) compared to bipolar group (1.6) (p-value=0.556). Mean shoes score was higher in the unipolar group (2.4) compared to the bipolar group (1.4) (p-value=0.261). The mean sitting score was higher in the bipolar group (3.4) compares to the unipolar group (3.7) (p-value=0.416).
Table 1. Variable score comparison.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sample Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain score</td>
<td>Unipolar</td>
<td>5</td>
<td>34.80</td>
<td>9.80</td>
<td>0.271</td>
</tr>
<tr>
<td></td>
<td>Bipolar</td>
<td>7</td>
<td>27.10</td>
<td>13.80</td>
<td></td>
</tr>
<tr>
<td>Support score</td>
<td>Unipolar</td>
<td>5</td>
<td>6.00</td>
<td>4.90</td>
<td>0.662</td>
</tr>
<tr>
<td></td>
<td>Bipolar</td>
<td>7</td>
<td>7.30</td>
<td>5.20</td>
<td></td>
</tr>
<tr>
<td>Limp score</td>
<td>Unipolar</td>
<td>5</td>
<td>6.40</td>
<td>4.70</td>
<td>0.612</td>
</tr>
<tr>
<td></td>
<td>Bipolar</td>
<td>7</td>
<td>7.70</td>
<td>3.70</td>
<td></td>
</tr>
<tr>
<td>Distance score</td>
<td>Unipolar</td>
<td>5</td>
<td>3.80</td>
<td>1.60</td>
<td>0.661</td>
</tr>
<tr>
<td></td>
<td>Bipolar</td>
<td>7</td>
<td>5.40</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>Stairs score</td>
<td>Unipolar</td>
<td>5</td>
<td>2.20</td>
<td>1.80</td>
<td>0.556</td>
</tr>
<tr>
<td></td>
<td>Bipolar</td>
<td>7</td>
<td>1.60</td>
<td>1.30</td>
<td></td>
</tr>
<tr>
<td>Shoes score</td>
<td>Unipolar</td>
<td>5</td>
<td>2.40</td>
<td>0.90</td>
<td>0.261</td>
</tr>
<tr>
<td></td>
<td>Bipolar</td>
<td>7</td>
<td>1.40</td>
<td>1.90</td>
<td></td>
</tr>
<tr>
<td>Sitting score</td>
<td>Unipolar</td>
<td>5</td>
<td>3.40</td>
<td>0.90</td>
<td>0.416</td>
</tr>
<tr>
<td></td>
<td>Bipolar</td>
<td>7</td>
<td>3.70</td>
<td>1.90</td>
<td></td>
</tr>
</tbody>
</table>

*p-statistical analysis using the independent Mann-Whitney test

Figure 1. Comparison of mean pain score.

DISCUSSION

The geriatric population is increasing worldwide, and femoral neck fractures have become a significant public health concern. Contemporary evidence from RCTs is compelling and indicates that the treatment of choice for a displaced fracture of the femoral neck in an elderly patient is arthroplasty. Hemiarthroplasty is a procedure in which the head and neck of the femur are replaced with a prosthesis, but the acetabulum is not modified. When using an HA, there are two types of articulations of the prosthesis and the patient’s acetabulum: unipolar or bipolar. Whereas the unipolar head has a single articulation between the prosthesis and the acetabulum, the bipolar head offers a second articulation between an inner smaller head and the polyethylene liner of the giant outer head. The choice of a prosthesis in HA is controversial. The patient’s average age was 64–85 years, with a mean age of 75.17 years old. The majority of the patients were between 60-70 years. In our study, the mean delay in surgery was 51 days, ranging from 5 to 344 days. The delays were likely caused by late presentation at the hospital, neglected patients, and economic problems. All patients from the unipolar and bipolar groups were operated on late. Mean delay in surgery for the unipolar and bipolar group was 11 days and 13.87 days. In study of Antoni et al., 2020 the time from injury to surgery ranged from 2 to 14 days with an average of 5.6 days. There was a significant correlation between the timing of the surgery with the results of the pain score and a significant correlation between the timing of the operation with the results of clinical function grading using the Salvati Wilson Score. Especially the elderly who have decreased muscle strength will be at risk of walking problems after hemiarthroplasty surgery.

Pain following hemiarthroplasty should not be the cause for condemning the procedure. Following causes for pain: infection, improper prosthetic seating, metallic corrosion and tissue reaction, improper sized femoral head, contractures, periarticular ossification, toggle or acetabular wandering, and redundant ligamentum teres. In our series, mHHS score 27.1% of bipolar and 34.8% of AMP had pain. The distribution of pain is less in the bipolar group, and the difference was statistically not significant p = 0.271. Limping is a common consequence of hemiarthroplasty in adults. The exact cause cannot be attributed to this. Alteration in the abductor mechanism due to excision of a little more neck is the most probable cause. All the patients were asked to use a walker regularly. This decreases the load on the prosthetic head. Once the patient got enough endurance, they were advised to discard the walker. A study of forty cases of Austin Moore replacement done for femoral neck fractures over an average follow-up period of 26 months. Silva et al., 2020 reported that a limp was seen in 35 cases (87.5%) due to pain, shortening, or abductor muscle weakness.

Acetabular erosion after hemiarthroplasty usually begins at three years, and once it begins, erosion appears to progress at a steady rate. Nevertheless, in our study, we cannot find any complications such as dislocation. It still cannot be determined for acetabular erosion because patients cannot do the control X-ray post-operative due to living in another province. Patients undergoing bipolar exhibited higher hip scores and lowered acetabular erosion rates than unipolar patients. Our study, patients with unipolar have a higher total modified
The limitation of this study was a retrospective design that limited the acquisition of some data. The sample size was small because many samples were lost to follow-up, which caused a lack of power to identify the risk factors for failure in each group. Although widely spread, the mHHS might be debatable because of the suggested ceiling effect of this score. In some patients, their radiological follow-up was not done as they could not report to the hospital at the time of follow-up. The strength of this study was that there were no surgical complications such as a dislocation, periprosthetic fracture, or surgical site infection requiring surgical revision in our sample, blinded observer for the functional follow-up. This study was conducted at a single-centre, three senior surgeons did the surgeries, so the bias involved with good functional results in the hands of a single surgeon is nullified, the patients were adequately followed-up at appropriate periods to a minimum of 36 months, and the results were analysed by appropriate statistical analysis.

CONCLUSION

This was a single-centre, retrospective study of patients treated between 2009 and 2018 conducted at Wahidin Sudirohusodo General Hospital, Orthopaedic and Traumatology Department, Universitas Hasanuddin, Makassar showed most patients were elderly between the age group of 64-85 years, followed up at three to 7 years. Operation delay ranges 5-344 days. Females were involved overall more commonly than males. There was no difference in functional outcomes in different variable modified Harris Hip Score in both unipolar and bipolar groups. There was no difference in functional outcome or total hip score in both groups using the modified Harris Hip Score. Considering the above results of our study, the null hypothesis is accepted; there is no significant difference in functional outcome results between the patients treated with Unipolar prosthesis and those treated with bipolar prosthesis. Hemiarthroplasty of the hip for femoral neck fractures is a good option in elderly patients with good long-term functional outcomes. Unipolar is still relevant in the modern era to use besides bipolar.
CONFLICT OF INTEREST

The authors affirm that there are no conflicts of interest in this study.

FUNDING

The authors are responsible for all research funding without obtaining financial support.

ETHICAL CLEARANCE

Ethical approval has been obtained from the Ethics Committee of Faculty of Medicine, Universitas Hasanudin, Makassar, Indonesia.

AUTHOR CONTRIBUTIONS

All authors contributed equally in this research and publication of this manuscript.

REFERENCES


42. Tan WL, Shi YX, Zhang JY, Tang CR, Guan QB, Tan JJ. Bipolar Hemiarthroplasty should not be selected as the primary option for intertrochanteric fractures in elderly patients aged 85 years or more. Medicine (Baltimore). 2020;99(37):e21862.

