International Journal of Research in Orthopaedics
Julfikar AFM et al. Int J Res Orthop. 2024 Sep;10(5):871-877
http://www.ijoro.org

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20242375

Original Research Article

Evaluation and compare the outcomes of patients undergoing either a unipolar or bipolar hemiarthroplasty for fractures of the femoral neck in aged patients

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Received: 14 May 2024
Revised: 16 June 2024
Accepted: 18 June 2024

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ABSTRACT

Background: Treatment of displaced intra-capsular femoral neck fractures in older patients remains controversial. Factors such as age, fracture type, bone quality, and socio-economic status influence treatment decisions. Surgical options like hemiarthroplasty and internal fixation are considered, each with distinct outcomes and considerations. The study aimed to compare radiological and clinical outcomes, as well as functional results, between elderly patients undergoing unipolar and bipolar hemiarthroplasty for femoral neck fractures.
Methods: The prospective interventional study conducted over a period of 30 months, from July 2021 to December 2023. A total of 72 patients were included in this prospective interventional study, which was conducted at the 250-bed general hospital Gopalganj and the Sheikh Sayera Khatun Medical College Hospital. Of them, 36 underwent treatment with a unipolar prosthesis and another 36 underwent treatment with a fenestrated bipolar prosthesis via a lateral approach. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 24.
Results When the unipolar and bipolar groups were compared, comparable demographic distributions and mean ages (71.12 years) were found. Statistically significant differences were observed in hip scores (p value=0.019), activity on stairs (p value=0.043), and wearing shoes (p value=0.023), with the bipolar group demonstrating better outcomes in these aspects. Satisfactory outcomes were achieved by 80.55% of the unipolar group and 72.22% of the bipolar group, with 19.45% and 27.78% experiencing unsatisfactory outcomes, respectively.
Conclusions: Bipolar hemiarthroplasty with a fenestrated stem may offer older patients with displaced intracapsular femoral neck fractures better functional outcomes and fewer complications compared to Austin-Moore unipolar prostheses.

Keywords: Anatomical outcome, Bipolar hemiarthroplasty, Elderly patients, Neck femur

INTRODUCTION

As it was over fifty years ago when it was known as "the unsolved fracture," the choice of surgical treatment for displaced intra-capsular fractures of the neck of the femur in older patients remains controversial.[1] The best way to treat older patients with femoral neck fractures has been up for discussion. Important considerations for any treatment plan include the patient's age, general health, kind of fracture, and bone quality, in addition to external factors like socioeconomic situation and the accessibility of healthcare services.[2] Hemiarthroplasty results in a considerable reduction in revision surgery due to non-union and avascular necrosis as compared to internal

fixation, where neither non-union nor avascular necrosis occurred.[3] Over 85% of the people in our nation reside in rural areas. Owing to inadequate information, unfavourable socioeconomic status, lack of orthopaedic centers, and inadequate communication channels, most patients arrive to hospitals belatedly, often by many days or even months. They typically have avascular necrosis, non-union, neck absorption, and other health issues when they first appear. Consequently, early anatomical reduction and internal fixation-the first fundamental concept of treatment-are frequently beyond of our reach. Additionally, a lot of surgeons had come to feel that primary prosthetic replacement should be prioritised over reduction and internal fixation surgery for displaced subcapital fractures due to the poor prognosis.[4]

Since movement occurs within the implant rather than between the prosthesis' head and the acetabulum, a bipolar prosthesis has a theoretical advantage over a unipolar prosthesis in reducing acetabular erosion.[5] Hemiarthroplasty, whether cemented or not, is another contentious topic. Cemented unipolar or bipolar prosthetics provide some benefits, such as early complete weight bearing, less discomfort, and decreased loosening.[6] However, because of fat embolism and the exacerbation of cardiovascular disorders, cemented groups have longer operating times, more blood loss during procedures, and higher perioperative mortality.[7] The bipolar femoral head was expected to reduce acetabular wear, lower the failure rate, and result in a painless arthroplasty.[8] It has been reported that using an uncemented bipolar stem shortens operating times while lowering blood loss, postoperative problems, and fatality rates.[9] Austin Moore stemmed single-component stainless steel implants are the most commonly used hemiarthroplasties. However, acetabular erosions, prosthesis encroachment into the pelvis, femoral stem loosening, and challenges with whole hip conversion continue to lead to unsatisfactory outcomes in long-term follow-up. Bipolar prostheses were developed as a result of these circumstances.[10] After treating 32 cases and monitoring them for up to 25 months, Richard A. Mayo of the orthopaedic surgery department at Harvard Medical School and Massachusetts General Hospital stated in 1961 that the Austin Moore prosthesis in an otherwise normal acetabulum was a great one. He reported that there were no unfavourable outcomes, with the exception of the rare deep postoperative sepsis that is best managed by quickly removing the prosthesis and thoroughly draining the affected area in 19% of cases, good in 50%, fair in 19%, and poor in 12%.[11] 51 patients who had previously undergone surgery at Makassed General Hospital in Lebanon for a displaced femur neck fracture using a bipolar prosthesis were evaluated after the procedure. 33 patients (89.2%) of them were able to regain their functional level. Harris Hip Score average was 72.29±19.82. Thus, the bipolar hemiarthroplasty offered sufficient motor power and a functional range of motion.[12] From 2009 to 2012, 41 elderly patients with displaced neck fractures were reviewed by Somashekar, Krishna, and Murthy in the department of orthopaedic surgery at Kempegowda Institute of Medical Science in Bangalore, India. Some patients received random treatment with an Austin-Moore prosthesis, while others received treatment with a fenestrated bipolar prosthesis. About 1240 of flexion, 280 of abduction, and 330 of external rotation at the hip joint are needed for routine motions like sitting and rising from chairs, squatting, tying shoes, bending to pick up items from the floor, climbing and descending stairs etc.[13] The simplest bipolar prosthesis now on the market, such as the Indian Version and the Monk prosthesis, feature a stem akin to that of an Austin Moore prosthesis, and the tiny femoral head is attached to the metallic cup UHMWPE insert complex in an unbreakable manner. A modular system with interchangeable stems (fenestrated, solid, straight, long porous coated, press fit, cement compatible), an interchangeable small diameter head (metallic or ceramic) that allows neck length adjustment, and varying sizes of the outer metallic cup UHMWPE insert with a press fit looking mechanism over the small head are features of better and modified bipolar prosthesis.[14]

The main aim of my study was to evaluate and compare the outcomes of patients undergoing either a unipolar or bipolar hemiarthroplasty for fractures of the femoral neck in elderly patients. To assess and compare the anatomical outcomes between the two groups through radiological examinations. To analyze and compare the clinical outcomes, including the occurrence of deformities and rates of complications, between the two groups. To evaluate and compare the functional outcomes between the two groups. By addressing these specific objectives, the study aimed to provide valuable insights into the choice of a suitable prosthesis for the treatment of femoral neck fractures in elderly patients.

METHODS

Study design

This was a prospective interventional study conducted to evaluate the outcomes of replacement hemiarthroplasty using Austin-Moore and fenestrated bipolar prostheses with a stem in patients with displaced fractures of the femoral neck.

Study period

The study was conducted over a period of 30 months, from July 2021 to December 2023. Study Location: The study took place at 250 bedded general hospital Gopalganj and Sheikh Sayera Khatun Medical College Hospital.

Study population

The study comprised 61 years of age or older active senior patients who were admitted to the hospital for surgery and had radiological and clinical evidence of displaced femoral neck fractures.

Sample size

72 patients were included in the final follow-up because of time, and patient availability issues. Of these, 36 underwent surgery with the Austin-Moore prosthesis, while another 36 underwent surgery with the fenestrated bipolar prosthesis.

Sampling method

The study patients' non-randomized purposive sampling, carefully adhering to the inclusion and exclusion criteria, and selecting patients depending on their availability.

Criteria for Case Selection

The study's inclusion criteria were the following: age 61 years or above, both sexes, fractures of the femoral neck of Garden type III and IV in active elderly patients, and functional capacity as measured by the Kantz ADL index-A. Ages under 61, unstable medical conditions, hip joint infections that were active or that had spread to other parts of the body, hip joint abductor insufficiency, and hip fractures that were more than two months old were among the exclusion criteria.

Study procedure

The researcher created a data collection form that had important details such age, sex, presenting symptoms, clinical findings, related medical conditions, investigations, preoperative findings, and surgical results. The researcher directly gathered the data. The chosen patients were informed about the study's goals, methods, dangers, and advantages, and their voluntary participation was encouraged.

Data collection

All relevant factors were included in a standardised data collection form. Interviews, observations, clinical exams, and investigations were used to gather data.

Statistical analysis

Collected data were entered into a personal computer for analysis, plotting, and presentation using suitable tables and graphs. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 24. The Shapiro-Wilk test assessed the normal distribution of the data.

Results were reported as mean±standard deviation (SD), median, or number (%) as appropriate. Quantitative values were presented as mean±standard deviation and compared using the Mann-Whitney test. Statistical significance was set at $p<0.05$.

Ethical approval

This study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of the Medical College Hospital. Written informed consent was obtained from all participants, who were fully informed about the study's objectives, procedures, risks, and benefits. Participation was voluntary, with the option to withdraw at any time. Participant confidentiality was strictly maintained, with anonymized data securely stored. Standard medical protocols were followed to ensure patient safety, and adverse events were documented and managed appropriately. Ethical standards were rigorously upheld throughout the study.

RESULTS

The prospective interventional study was conducted at a 250-bedded general hospital in Gopalganj and Sheikh Sayera Khatun Medical College Hospital, spanning a duration from July 2021 to December 2023. A total of 72 cases were included in the study and followed up for a minimum duration of 6 weeks to 30 months. The findings obtained from the follow-up period of at least 6 months are summarized below.

Table 1: Demographic data distribution between two groups (n=72).

	Unipolar group (n=36)		Bipolar group (n=36)		P value
	Frequency	**Percentage (%)**	**Frequency**	**Percentage (%)**	
Age (years)					
61-65	9	25.00	7	19.44	0.111
66-70	5	13.88	9	25.00	
71-75	6	16.66	8	22.22	
76-80	8	22.22	4	11.22	
≥81	4	11.11	4	11.22	
Mean ±SD	71.12±10.01		71.12±10.12		0.111
Sex distribution					
Male	22	61.11	20	55.55	0.012
Female	14	38.89	16	44.45	
Profession					
House-wife	10	27.77	11	30.55	

Continued.

	Unipolar group (n=36)		Bipolar group (n=36)		P value
	Frequency	Percentage (%)	Frequency	Percentage (%)	
Service holder	11	30.55	8	22.22	0.005
Farmer	6	16.66	9	25.00	
Business	9	25.00	8	22.22	
Area					
Rural	11	30.55	13	36.11	0.123
Urban	25	69.45	23	73.89	
Smoking history					
Smoker	12	33.33	10	27.77	0.012
Non- Smoker	24	66.67	26	72.23	

Table 2: Comparison of the patient's hip score on distance of walking between the two groups (n=72).

Distance of walking	Unipolar group			Bipolar group			P value
	Frequency	Score	%	Frequency	Score	%	
Indoors	12	06	33.33	04	11	11.11	0.111
6 blocks	12	131	33.33	18	119	50.00	
2/3 blocks	08	23	22.22	05	18	13.88	
Unlimited	04	73	11.11	09	74	25.00	
Mean±SD	9.00±3.31			9.00±3.01			0.019

Table 3: Comparison of the patient's hip score on activity on stairs between the groups (n=72).

Activity on stairs	Unipolar group			Bipolar group			P value
	Frequency	Score	%	Frequency	Score	%	
Normal	15	31	41.66	21	43	58.33	0.411
In any manner	13	21	36.11	07	03	19.44	
Unable	08	03	22.22	08	03	22.22	
Mean±SD	12.00±1.11			12.00±1.02			0.043

Table 4: Comparison of the patient's hip score on wearing shoes between the two groups (n=72).

Wearing shoes	Unipolar group (n=36)			Bipolar group (n=36)			P value
	Frequency	Score	%	Frequency	Score	%	
With easy	21	79	58.33	23	97	63.88	0.123
With difficulty	12	19	33.33	11	11	30.55	
Unable	3	2	8.33	2	2	5.55	
Mean±SD	12.00±0.91			12.00±0.88			0.023

Table 5: Comparison of functional outcome between two groups (n=72).

Outcome	Unipolar group			Bipolar group			P value
	Frequency	Score	%	Frequency	Score	%	
Excellent	08	511	22.22	09	1009	25.00	0.01
Good	15	899	41.66	16	1121	44.44	
Fair	07	492	19.44	06	289	16.66	
Poor	06	466	16.66	05	187	13.88	
Mean±SD	77.1±14.58				84.63±10.15		0.01

Table 1 shows the demographic and clinical characteristics of individuals in both unipolar and bipolar groups, encompassing age distribution, sex distribution, profession, area of residence, and smoking history. Notably, the majority of individuals in the unipolar group fall within the age range of 61-65 years (25.00%), while in the bipolar group, the corresponding percentage is 19.44%. Despite variations in age frequencies, both groups exhibit similar mean ages of 71.12 years. Regarding sex distribution, the unipolar group comprises 61.11% males and 38.89% females, compared to 55.55% males and

44.45% females in the bipolar group. Professions vary, with housewives constituting the largest proportion in both groups (27.77% in unipolar and 30.55% in bipolar). Urban residency is predominant in both groups, with no significant difference observed (p value=0.123), while smoking history significantly differs (p value=0.012), with a higher proportion of smokers in the unipolar group (33.33%) compared to the bipolar group (27.77%).

Table 2 shows the frequency, score, and corresponding percentages of patients' hip scores for various walking distances in both the unipolar and bipolar groups, along with a p-value indicating the statistical significance of the observed differences. Among the unipolar group, 12 patients scored 06 for indoor walking, representing 33.33% of the group, while in the bipolar group, 04 patients had a score of 11, accounting for 11.11%. Across different walking distances, such as 6 blocks, 2/3 blocks, and unlimited walking, similar comparisons in frequency and percentages are observed. Notably, the mean hip score±standard deviation remains consistent between the two groups. First one is 9.00±3.31 and second one is 9.00±3.01. The statistical analysis reveals a significant difference in hip scores between the unipolar and bipolar groups (p value=0.019). Table 3 shows, the activity on stairs is compared between the unipolar and bipolar groups, showing the frequency, score, and percentages of patients' performance. In the normal activity category, 15 patients in the unipolar group scored 31, accounting for 41.66% of the group, while in the bipolar group, 21 patients scored 43, representing 58.33%. Similarly, for activities performed in any manner and those unable to perform, frequencies and percentages are provided for both groups. The mean scores±standard deviation is identical between the two groups, with a statistically significant difference observed in activity on stairs (p value=0.043).

Table 4 shows, the comparison of wearing shoes between the unipolar and bipolar groups is presented, showing the frequency, score, and percentages of patients' abilities. For wearing shoes with ease, 21 patients in the unipolar group scored 79, constituting 58.33% of the group, while in the bipolar group, 23 patients scored 97, representing 63.88%. Similarly, for wearing shoes with difficulty and inability to wear shoes, frequencies and percentages are provided for both groups. The mean scores ± standard deviation are identical between the two groups, with a statistically significant difference observed in wearing shoes (p value= 0.023).

Table 5 shows compare the outcome scores between the unipolar and bipolar groups, illustrating the frequency, score, and percentages of patients' outcomes. In the unipolar group, 08 patients achieved an excellent outcome, scoring 511, accounting for 22.22% of the group, while in the bipolar group, 09 patients achieved the same outcome, scoring 1009, representing 25.00%. Similarly, frequencies and percentages are provided for good, fair, and poor outcomes in both groups. The mean scores±standard deviation is presented, with a statistically significant difference observed in outcomes between the unipolar and bipolar groups (p value=0.01).

Table 6 presents the complications observed in both the unipolar and bipolar groups, indicating the frequency and percentage of each complication. In the unipolar group, the most common complication is infection, with 05 cases accounting for 13.88% of the group, while in the bipolar group, infection is also prevalent with 8 cases, representing 22.22%. Other complications such as per-operative complications, femoral fracture, DVT, implant loosening, and acetabular erosion are also reported with their respective frequencies and percentages.

Table 7 shows the outcome of the procedure for both the unipolar and bipolar groups, showing the frequency and percentage of patients falling into each category. In the unipolar group, 29 patients achieved a satisfactory outcome, constituting 80.55% of the group, while in the bipolar group, 26 patients had a similar outcome, representing 72.22%. Conversely, 07 patients in the unipolar group had an unsatisfactory outcome, accounting for 19.45% of the group, compared to 10 patients (27.78%) in the bipolar group.

Table 6: Distribution of the patients by complications between two groups (n=72).

Complications	Unipolar group		Bipolar group	
	Frequency	**%**	**Frequency**	**%**
No complication	21	58.33	23	63.88
Per-operative	01	2.77	0	0
Immediate				
Femoral fracture	01	2.77	1	2.77
Dislocation	00	0	0	0
DVT	02	5.55	0	0
Infection	05	13.88	8	22.22
Late				
Subsidence of prosthesis	00	0	0	0
Implant loosening	04	11.11	3	8.33
Acetabular erosion	02	5.55	1	2.77

Table 7: Comparison of final outcome between the two groups (n=72)

Outcome	Unipolar group		Bipolar group	
	Frequency	%	Frequency	%
Satisfactory	29	80.55	26	72.22
Unsatisfactory	07	19.45	10	27.78

DISCUSSION

Even though displaced intracapsular femoral neck fractures happen often, the optimal course of treatment is still up for debate. Although it is widely acknowledged that surgery is the primary course of treatment, disagreements persist regarding the relative benefits of internal fixation versus hemiarthroplasty, unipolar versus bipolar hemiarthroplasty, and the necessity of cementing the prosthesis. In our study shows, the majority of individuals in the unipolar group fall within the age range of 61-65 years (25.00%), while in the bipolar group, the corresponding percentage is 19.44%. Despite variations in age frequencies, both groups exhibit similar mean ages of 71.12 years. This outcome is consistent with a series published in 2013 by Somashekar's journal in the orthopaedic surgery department at Kemprgowda Institute of Medical Sciences in Bangalore, India. In that group, the mean age was 67.3 years for the bipolar group and 75.6 years for the unipolar group 15.

In our study, regarding sex distribution, the unipolar group comprises 61.11% males and 38.89% females, compared to 55.55% males and 44.45% females in the bipolar group. Professions vary, with housewives constituting the largest proportion in both groups (27.77% in unipolar and 30.55% in bipolar). Similar sex incidence was noted in Kerala, India in 2013, when females made up the majority of cases (60%) of all Austin Moore prosthesis patients and 70% of all bipolar group cases. These findings were reported by Krishnan et al.[10] In our study, the normal activity category, 15 patients in the unipolar group scored 31, accounting for 41.66% of the group, while in the bipolar group, 21 patients scored 43, representing 58.33%. Similar to my work, Dr. Motiur Rahman's 2007 Austin-Moore prosthesis study indicated that the left side (64.7%) was more affected than the right side (35.3%). In contrast to my research, Dr. Mohammad Rafiqul Islam (2012) discovered that left side engagement (71.43%) was higher than right side involvement (28.67%). Since pain is a subjective experience, each person experiences it differently. In our study, the unipolar group, 29 patients achieved a satisfactory outcome, constituting 80.55% of the group, while in the bipolar group, 26 patients had a similar outcome, representing 72.22%. Similar outcomes were discovered bipolar hemiarthroplasty, according to the UK's Bhushan. Sabnis journal (2011), provides more pain alleviation than a unipolar prosthesis. 13.3% of unipolar prosthesis users reported hip pain, compared to 6.7% of bipolar prosthesis users.[16] Of the 36 individuals in my study, 4 in the unipolar group and 9 in the bipolar group were able to walk without limits. In the unipolar group, the mean scores for far walking were 9.00±3.31, while in the bipolar group, they were 9.00±3.01. P value came to 0.019 which is statistically significant. A comparable finding indicated that while acetabular erosion was seen in 6.67% of instances, it was absent in the bipolar group.[16] Same result also found in where 5.2% acetabular erosion occurred in Austin-Moore but no actabular erosion occurred in bipolar group.[15] In the unipolar group, 29 patients achieved a satisfactory outcome, constituting 80.55% of the group, while in the bipolar group, 26 patients had a similar outcome, representing 72.22%. Conversely, 07 patients in the unipolar group had an unsatisfactory outcome, accounting for 19.45% of the group, compared to 10 patients (27.78%) in the bipolar group.

This result is consistent with several comparative studies, wherein the unipolar group recovered at 33.3% and the bipolar group recovered at 40% with excellent results, the unipolar group recovered at 46.7% and the bipolar group recovered at 46.6% with good results, the bipolar group recovered at 13.3% and 6.67% with fair results, and the combined unipolar and bipolar groups recovered at 6.7% with poor results16. A comparable finding showed that although 24 patients (80%) with bipolar disorder and 17 patients (56.67%) with unipolar disorder had excellent post-operative outcomes, 13 patients (43.33%) and 6 patients (20%) with bipolar disorder had unsatisfactory outcomes15,17. Following femoral head replacement surgery, early ambulation, weight-bearing, stability restoration, walking activities, and a respectably good range of motion are all possible to achieve useful tasks like squatting and sitting in prayer position18. In our study shows, wearing shoes with ease, 21 patients in the unipolar group scored 79, constituting 58.33% of the group, while in the bipolar group, 23 patients scored 97, representing 63.88%. Comparable findings were discovered in Mostafa Abdelkhalek's research at Mansoura University in Egypt, where the bipolar group exhibited a greater variety of motions than the unipolar group.[19] There has not been any evidence of acetabular erosion in bipolar series to date, but there was one in the Austin Moore series. There are a few disadvantages to consider. Polyethylene wear is one possible drawback, as it may eventually result in mechanical loosening. Furthermore, in some cases of bipolar hemiarthroplasty, there is a danger of interprosthetic dissociation, which may necessitate open reduction. One further drawback of the bipolar prosthesis is related to its design: after a year or so, the bipolar hemiarthroplasty performs more like a unipolar hemiarthroplasty.[20] It has been observed that replacement hemiarthroplasty does not entail an undue risk of morbidity or death in older patients with displaced femoral neck fractures. Replacement hemiarthroplasty by bipolar

prosthesis with fenestrated stem is a logical choice in the treatment of displaced femoral neck fractures; it mobilises the patient faster, decreases the morbidity rate, and thus maximally improves the overall results-that is, after good technical expertise during the procedure, good supportive care, prophylactic antibiotic, adequate physical therapy, and nursing care. Limitations of the study were little sample size. Comparable to other series, the follow-up duration in our investigation was brief. Thus, it was not possible to analyses late postoperative consequences. Various surgeons operated on different cases.

CONCLUSION

The management of colorectal cancer has progressed over the past few decades because of many advances, including those in genetics, pathology, imaging, medical oncology, radiation oncology, and surgery.[16]Undoubtedly, the management of patients afflicted with colorectal cancer will evolve as advances continue to be made in the multiple disciplines that contribute to the diagnosis and treatment of colorectal cancer.

Recommendations

Large sample sizes should be used for similar kinds of studies. Studies of a similar nature should be followed up on for an extended length of time. A single surgeon would perform every procedure. Cementless unipolar or bipolar prostheses should not be used on individuals with large medullary cavities.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Julfikar AFM, Zaman SU, Nissan MNI, Miah MB. Evaluation and compare the outcomes of patients undergoing either a unipolar or bipolar hemiarthroplasty for fractures of the femoral neck in aged patients. Int J Res Orthop 2024;10:871-7.