

# Comparison Between Bipolar Hemiarthroplasty and Total Hip Arthroplasty in Cases of Neck Femur Fracture

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## ABSTRACT

**Background:** Femoral neck fractures pose a significant burden to the healthcare system in developed and developing countries.

**Objective:** To compare between total hip arthroplasty (THA) and bipolar hemiarthroplasty (BHA) in patients with the neck of femur fracture.

**Materials and methods:** This was a retrospective review of patients files who underwent total hip arthroplasty and bipolar hemiarthroplasty for femur neck fractures between January 2016 to December 2018. Fisher's exact test was used to detect differences between categorical variables. Significance was accepted at the  $p < 0.05$  level.

**Results:** The females were predominant (57.1%). The group BHA were (52.4%) and the group THA were (47.6%). The mean age of BHA group was  $79.4 \pm 5.1$  years and of THA group was  $71.4 \pm 3.0$  years ( $p = 0.000$ ). Comorbidities were found more in the group of BHA, ( $p > 0.05$ ). Level of activity was high in the group of THA (28.6%), ( $p = 0.001$ ). Post-operative waking after one day was found among (38.8%) of the group THA, and in the group BHA was in (4.8%) patients, ( $p = 0.002$ ). Seven (33.4%) of the group THA used the walking aids for 2 months, while the group BHA used the walking aids during the 5 months, ( $p = 0.008$ ). The operative time of the group THA was 2 hours, and of the group BHA was one hour, ( $p = 0.000$ ). Deep vein thrombosis, superficial infection and deep infection found only among patients of group BHA (9.6%), (9.6%), and (4.8%) respectively. Dislocation was found in (4.8%) patient of the group THA.

**Conclusion:** THA and BHA are the preferred treatment options for FNF, as they lead to satisfactory function and performance in the elderly. Further studies with large number of study sample are in need.

**Key words:** Neck femur fracture, comparison, bipolar hemiarthroplasty, total hip arthroplasty

## INTRODUCTION

Femoral neck fractures pose a significant burden to the healthcare system in developed and developing countries, with the annual incidence expected to increase in the coming years [1].

Over 84% of elderly patients with femoral neck fractures are reported to have underlying osteoporosis [2].

Osteoporotic or fragility femoral neck fractures result in significant morbidity and mortality. Most patients never achieve pre-fracture functional status after surgical intervention [3], and up to 33% die within the first 12 months post-operatively [4].

A femoral neck fracture is the most common hip fracture. Hip fracture is also associated with severe pain, increased risk of venous thromboembolism, avascular necrosis, and non-union. The 1-year mortality after hip fracture is 8% in women and 18% in men. Femoral neck fractures are common in developing countries. Femoral neck fracture in the elderly has become a worldwide health concern. The trend of rising in incidence with increasing age is alarming, and it is predicted that the

prevalence of femoral fracture would rise to 6.26 million per year by 2050 worldwide [5]. Treatment choices for the neck of femur fractures in elderly patients includes total hip arthroplasty (THA) and bipolar hemiarthroplasty (BHA). The treatment option should be decided by the type of fracture, the patients' condition, functional demands, medical and mental ability to cope up with the surgery [6,7].

Hip arthroplasty which may be divided into THA and hemiarthroplasty (HA) is a procedure that allows to replace damaged parts of the hip joint, such as the femoral head and neck or hip acetabulum, with artificial ones [8].

THA, due to its application in both osteoarthritis (OA) and displaced femoral neck fracture (FNF), has become a frequent orthopedic procedure worldwide. Complex medical care that prolongs patient's lifespan which leads to increased incidence of fragility hip fracture [9] makes the procedure even more commonly utilized.

FNF is characterized by poor healing which necessitates hip arthroplasty. New research shows the advantage of THA over hemiarthroplasty in FNF treatment in terms of clinical results and reoperation rate, despite a higher incidence of dislocation in THA [10]. THA remains a preferred treatment method in FNF in active elderly patients [11].

The aim of this study is to compare between BHA and THA in patients with the neck of femur fracture.

## **MATERIALS AND METHODS**

This was a retrospective, observational review of patients' files of all patients who underwent arthroplasty for neck of femur fractures between January 2016 and December 2018. The study was conducted in Alsalam private hospital in Almansoor, Aden, Yemen.

The study patients grouped according to the surgical procedures. The selected study patients were 11 (52.4%) underwent bipolar hemiarthroplasty and 10 (47.6%) underwent total hip arthroplasty.

The collected data were sex, age, body mass index (BMI), comorbidities, operative time, blood transfusion, level of activity, post operation walking in days, walking aids in months and the variables of the outcome. The variables of the outcome were deep vein thrombosis, superficial infection, deep infections, dislocation, and leg length discrepancy. The data were analyzed using SPSS version 22.

Demographic data were presented as means with standard deviations and categorical data were presented as frequencies. Fisher's exact test was used to detect differences between categorical variables. Significance was accepted at the  $p < 0.05$  level.

## **RESULTS**

In this retrospective study, 21 patients diagnosed with femur neck fracture and underwent surgical treatment (THA and BHA) were selected for this study. They were 12 (57.1%) females and 9 (42.9%) males.

The total patients whom operated by BHA were 11 (52.4%) and the total patients whom operated by THA were 10 (47.6%) as shown in Table 1, and Figure 1.

The mean age of BHA group at surgery was  $79.4 \pm 5.1$  years with age range 67 – 85 years. The mean age of THA group was  $71.4 \pm 3.0$  years and the age range was 68 – 78 years. The relation between the means of both groups was statistically highly significant ( $p = 0.000$ ). The mean of BMI seemed to be equally in both groups  $25 \pm 4.6 \text{ kg/m}^2$  and  $25 \pm 3.9 \text{ kg/m}^2$  ( $p > 0.05$ ). Comorbidities were found more in the group of BHA, ( $p > 0.05$ ).

**Table 1: Distribution of demographic variables related to type of surgical procedures (n=21)**

Variables	Type of surgical procedures		Total		p-value
	Bipolar hemiarthroplasty No (%)	Total hip arthroplasty No (%)	No	(%)	
<i>Sex:</i>					
Female	5 (23.8)	7 (33.3)	12	(57.1)	0.245
Male	6 (28.6)	3 (14.3)	9	(42.9)	
<i>Age (years):</i>					
Mean age	79.4 ± 5.1	71.4 ± 3.0	75.6 ± 5.8		0.000
Age range	67 – 85	68 – 78	67 – 85		
<i>BMI:</i>					
Mean of BMI	25 ± 4.6	25 ± 3.9	25 ± 4.1		1.000
BMI range	19 – 31	18 – 30	18 – 31		
<i>Comorbidity:</i>					
AHT	2 (9.5)	3 (14.3)	5	(23.8)	0.408
DM	1 (4.8)	1 (4.8)	2	(9.6)	
DM + AHT	3 (14.3)	0 (0.0)	3	(14.3)	
IHD	1 (4.8)	0 (0.0)	1	(4.8)	
None	4 (19.0)	6 (28.6)	10	(47.6)	

**Figure 1: Percentage of study patients related to sex**

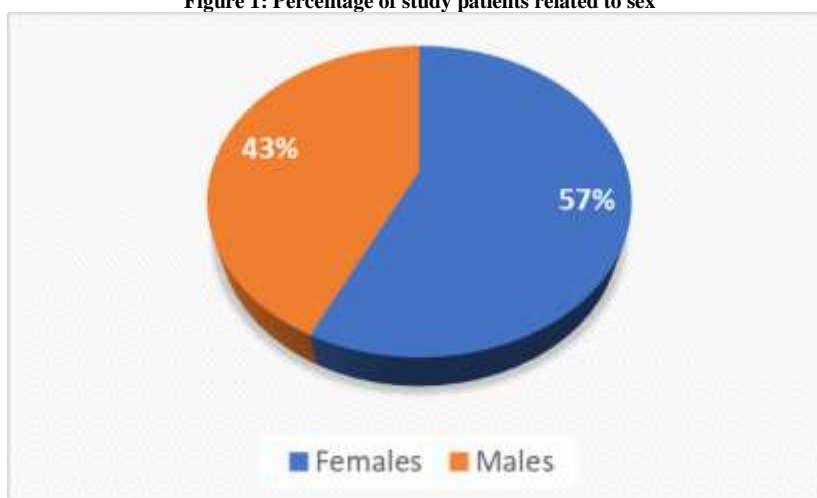


Table 2 and Figure 2 revealed the distribution of the following variables level of activity, post-operative waking, walking aids, operative time, and blood transfusion related to type of surgical procedure.

Level of activity was high in the group THA (28.6%) and not found in the group BHA. The relation between the values showed statistically highly significant ( $p = 0.001$ ).

Post-operative waking after one day was found among 8 (38.8%) of the group THA. The rest 2 (9.6%) of the patients of this group were able to walk after 2 days, while in the group BHA was found only in 1 (4.8%) patient after one day of surgery and the rest of patients were able to walk after 2 days 6 (28.6%) and after 3 days 4 (19.0%) patients. The difference between values of both groups showed highly significant ( $p = 0.002$ ).

Seven (33.4%) of the patients from the group THA used the walking aids for 2 months and 3 (14.3%) patients used the walking aids for 3 months. While the group of BHA used the walking aids during the 5 months. The difference between values of the two groups showed statistically significant ( $p = 0.008$ ).

The operative time for all patients of the group THA was 2 hours for each surgery procedure, while the operative time of each surgery procedure for the group BHA was only one hour. There was statistically highly significant between the values of the two groups ( $p = 0.000$ ).

Blood transfusion was given for 3 patients of the group BHA and for 4 patients of the group THA; ( $p > 0.05$ ).

**Table 2: Distribution of various variables related to type of surgical procedures (n=21)**

Variables	Type of surgical procedures		Total No (%)	p-value
	Bipolar No	hemiarthroplasty (%)		
<i>Level of activity:</i>				
High	0	(0.0)	6 (28.6)	0.001
Less	7	(33.4)	0 (0.0)	
Moderate	4	(19.0)	4 (19.0)	
<i>Post-op waking (days):</i>				
1 day	1	(4.8)	8 (38.0)	0.002
2 days	6	(28.6)	2 (9.6)	
3 days	4	(19.0)	0 (0.0)	
<i>Walking aids (months):</i>				
2 months	1	(4.8)	7 (33.4)	0.008
3 months	4	(19.0)	3 (14.3)	
4 months	5	(23.8)	0 (0.0)	
5 months	1	(4.8)	0 (0.0)	
<i>Operative time (Hs):</i>				
1 hour	11	(52.4)	0 (0.0)	0.000
2 hours	0	(0.0)	10 (47.6)	
<i>Blood transfusion:</i>				
Yes	3	(14.3)	4 (19.0)	0.438
None	8	(38.1)	6 (28.6)	

Hs = hours

**Figure 2: Proportions of various variables related to type of surgical procedures**

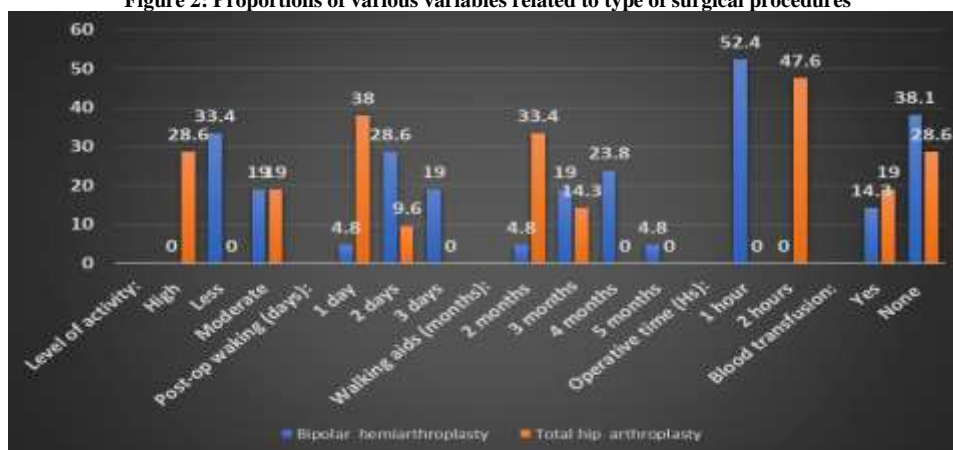


Table 3 showed the distribution of outcome variables related to type of surgical procedures.

Deep vein thrombosis, superficial infection and deep infection found among patients of group BHA 2 (9.6%), 2 (9.6%), and 1

(4.8%) respectively, and not found among patients of the THA.

Dislocation was found in 1 (4.8%) patient of the group THA. In addition, leg length discrepancy was found in 3 (14.3%) patients of the group THA.

**Table 3: Distribution of outcome variables related to type of surgical procedures (n=21)**

Variables	Type of surgical procedures		Total No (%)	p-value
	Bipolar hemiarthroplasty No	Total hip arthroplasty (%)		
<i>Deep vein thrombosis:</i>				
Yes	2	(9.6)	0 (0.0)	0.262
None	9	(42.9)	10 (47.6)	
<i>Superficial infection:</i>				
Yes	2	(9.6)	0 (0.0)	0.262
None	9	(42.9)	10 (47.6)	
<i>Deep infection:</i>				
Yes	1	(4.8)	0 (0.0)	0.524
None	10	(47.6)	10 (47.6)	
<i>Dislocation:</i>				
Yes	0	(0.0)	1 (4.8)	0.476
None	11	(52.4)	9 (42.9)	
<i>Leg length discrepancy:</i>				
Yes	0	(0.0)	3 (14.3)	0.090
None	11	(52.4)	7 (33.3)	

## DISCUSSION

Femoral neck fractures are among the most frequently encountered injuries facing orthopaedic surgeons [12]. The usual presentation is that of a fragility fracture in an elderly individual [13,14].

Whereas consensus has generally been reached on the management of femoral neck fractures in elderly patients, the same is not true for the management of these injuries in patients younger than 65 years [15].

Displaced and unstable FNFs are most common, and require early surgical intervention with either a total hip arthroplasty (THA), unipolar hemiarthroplasty (UHA), or bipolar hemiarthroplasty (BHA) [16,17].

Surgery in these patients undertaken to facilitate nursing, and provide timely pain relief, rapid mobilization, and accelerated rehabilitation [18].

Hemiarthroplasty is the preferred treatment option for displaced FNF, as it is faster and leads to satisfactory function and performance in the elderly [19].

Kim et al [20] reported that FNFs will bring baneful influences to patients due to its high morbidity, disability rate, economic burden, and mortality, and the rate is rapidly growing because of the increasing number of the elderly.

Arthroplasty is commonly recommended for displaced FNFs (67% of all types FNFs in the elderly (age > 65 years) and can be categorized as THA and hemiarthroplasty (HA) [21].

In this retrospective study, 21 patients diagnosed with neck femur fracture and underwent surgical treatment (arthroplasty) were selected for this study. They were 12 (57.1%) females and 9 (42.9%) males. The total patients whom operated by bipolar hemiarthroplasty were 11 (52.4%) and the total patients whom operated by total hip arthroplasty were 10 (47.6%).

In our current study, the mean age of bipolar group at surgery was  $79.4 \pm 5.1$  years with age range 67 – 85 years. The mean age of total hip group was  $71.4 \pm 3.0$  years and the age range was 68 – 78 years. The relation

between the means of both groups was statistically highly significant ( $p = 0.000$ ).

Saker et al [22] reported that 51 patients were enrolled in their study. All patients had hip fracture after falling from standing position to ground level. The mean age of the patients was ( $77.43 \pm 7.66$ ) years, all patients were at least 60 years old. Thirty-five patients (68.6%) were females. These findings were similar to our findings.

Takahisa et al [23] reported in their published study that the mean age of their study patients who underwent arthroplasty was  $81.7 \pm 8.40$  years. The patients who underwent BHA were (98.2%), and who underwent THA were (1.8%). The women in their study were (77.9%).

They added that, compared to patients undergoing BHA, patients undergoing THA were younger, the mean age of BHA group was  $81.8 \pm 8.32$  years versus to THA group, the mean age was  $73.6 \pm 8.72$  years. These findings were in agreement with our results.

Chatterji et al [24] reported in their study that the study patients were 40 patients, out of which 20 patients underwent BHA and 20 patients underwent THR. In their study, all the patients in both groups were more than 60 years of age. The mean age of the patients in the BHA group was 68.50 years, and in the THR group, it was 70.38 years. They found, females constituted 60% and males constituted 40% of total patients.

In our current study, we found comorbidities were more in the group of BHA (33.4%) patients, while in the THA group they were in 4 (19.1%), ( $p > 0.05$ ).

In a previous study [23], reported that most of the patients had comorbidities such as diabetes mellitus, hypertension, cardiovascular problems, and pulmonary diseases. They added that these comorbidities can have an adverse effect on the functional outcome, and they mentioned that there was no significant difference in the number of comorbidities between the two groups.

In our current study, we found variables in the second table, which illustrated the variables level of activity, post-operative

waking and walking aids related to type of surgical procedures tended positively to the THA group. The level of activity was high in the THA (28.6%) and not found in the group of BHA. The relation between the values showed statistically highly significant ( $p = 0.001$ ).

Additionally, we found post-operation waking after one day was found among (38.8%) of the patients of the group THA. The rest (9.6%) of the patients of this group were able to walk after 2 days, while in the group BHA was found only in (4.8%) patient after one day of surgery and the rest of patients were able to walk after 2 days (62.8.6%) and after 3 days (19.0%) patients. The difference between values of both groups showed highly significant ( $p = 0.002$ ).

Seven (33.4%) of the patients from the group THA used the walking aids for 2 months and (14.3%) patients used the walking aids for 3 months. While the group of BHA used the walking aids during the 5 months. The difference between values of the two groups showed statistically significant ( $p = 0.008$ ). We found the variables of operative time and blood transfusion tended positively to the BHA group.

The operative time for all patients of the group THA was 2 hours for each surgery procedure while the operative time for each surgery procedure for the group BHA was only one hour. There was statistically highly significant between the values of the two groups ( $p = 0.000$ ).

In the current study, blood transfusion was given for 3 patients of the group BHA and for 4 patients of the group THA; ( $p > 0.05$ ).

Previous study had reported that THA used to treat femoral neck fractures in elderly patients increases operative time and bleeding compared with BHA, but does not increase mortality; additionally, patients initially exhibit excellent function with shortened hospitalization stays and early ambulation. Furthermore, there was no significant difference in long-term clinical

results following THA compared with BHA [25].

BHA holds advantages over total hip arthroplasty in terms of reduced operative time, lower blood loss [26].

In the present study we found deep vein thrombosis, superficial infection and deep infection found among patients of group BHA (9.6%), (9.6%), and (4.8%) respectively, and not found among patients of the group THA.

Contrary to what is in our study, Ashour et al [27] found that infection was found postoperative THA. They reported that their study defined that 11.1% of follow up patients had post-operative superficial infection and 5.6% of the studied group had early deep infection. Cordero-Ampuero et al [28] reported that wound infections were the most common complication with both BHA and THR and there was one case of deep wound infection in the patients managed by BHA.

In the current study, dislocation was found only in (4.8%) patient of the group THA. Published studies have shown that the postoperative dislocation rate is higher in the group THA than in the group BHA [29,30]. Takahisa et al [23] reported that their results showed that the risk of hip dislocation during the postoperative in-hospital period was significantly higher in the THA group than in the BHA group.

Avery et al [31] found in their published study that the rate of dislocation in THA group was high. Yoo et al [32] reported in their study, that the risk of dislocation after THA in pre-injury independent walker patients was higher than in those treated with BHA. It is possible that preinjury activity may be associated with a difference in dislocation rates between these two types of prostheses. The dislocation rate of those treated with THA was observed to increase in active people.

In the current study, the leg length discrepancy was found in 3 (14.3%) patients of the group THA.

Ranawat et al [33] mentioned that one of the intraoperative challenges in THA is

correcting limb length inequality without compromising hip stability. They added that discrepancy of leg length (LLD) is common after arthroplasty of the hip, with lengthening being the more noticeable to patients than shortening. The incidence of LLD after primary THA has been reported to range from 1 % to 27 % [34] and in the literature the LLD is reported to vary from 3 to 70 mm [35].

Most often the limb is lengthened rather than shortened after THA [36] and  $\geq 1$  cm LLD is noted in up to 50 % of cases; of which only 15%–20 % of patients require shoe correction for leg-length equalization [37].

Several studies have also demonstrated superior functional outcomes with THA over BHA [26,38,39].

## CONCLUSION

Femoral neck fractures pose a significant burden to the healthcare system in developed and developing countries, with the annual incidence expected to increase in the coming years. A femoral neck fracture is the most common hip fracture. Hemiarthroplasty is the preferred treatment option for displaced FNF, as it is faster and leads to satisfactory function and performance in the elderly. Further studies with large number of study samples are needed.

### Declaration by Authors

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**Conflict of Interest:** The authors declare no conflict of interest.

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