

A Prospective Study Comparing the Functional Outcome of Bipolar Hemiarthroplasty (BHA) Versus Total Hip Replacement (THR) in Elderly Patients with Fracture Neck of the Femur

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ABSTRACT

Objective: To compare the Functional Outcome of Bipolar Hemiarthroplasty (BHA) Versus Total Hip Replacement (THR) in Elderly Patients with femoral neck Fractures.

Study Design: Prospective comparative study.

Place and Duration of Study: Department of Orthopedics, Combined Military Hospital, Rawalpindi Pakistan, from Sep 2023 to Sep 2024.

Methodology: Fifty patients with displaced femoral neck fractures were included in the study. The patients were treated with either bipolar hip arthroplasty (BHA) or total hip replacement (THR). Functional assessment was carried out using Harris Hip Score (HHS) at two weeks, three months, six months, nine months and one year postoperatively. The scores were compared for both treatments. Data analysis and management were performed using GraphPad Prism version 6.

Results: During follow-up the mean Harris Hip Scores in BHA group were 57, 61.3, 65.1, 68.8 and 72.2 and in THR group the mean HHS were 72.4, 76.6, 80.6, 83.9 and 87 at fourteen days, three months, six months, nine months and one year respectively. Patients undergoing THR had a higher HHS than patients undergoing BHA.

Post op pain and range of motion (ROM) were significantly improved in patients undergoing THA as compared to patients with BHA.

Conclusion: Patients undergoing THR had a higher Harris Hip Score (HHS) than patients undergoing BHA. Thus, THR is a better option as compared to BHA based on our short-term functional outcome assessment using HHS.

Keywords: Bipolar Hemiarthroplasty, Harris Hip Score, Total Hip Replacement.

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INTRODUCTION

Hip fractures represent a significant health care problem in elderly population, due to their high prevalence and severe consequences. More than 10 million hip fractures in people aged 55+ occur globally.¹ With the ageing global population, the number of hip fractures is projected to nearly double from 2018 to 2050.²

Hip fractures commonly result from falls and are strongly associated with osteoporosis.³ Despite the lack of epidemiological data on osteoporosis in our country, a study on postmenopausal women revealed that 75.3% were prone to the condition and the risk rose with age.⁴ Surgeons, during treatment planning, should consider a number of factors like their individual patient population, patient health, risk of fall, age, cognitive limitations, bone quality, and individual patient goals and expectations.^{5,6}

Majority of the population of Pakistan belong to a

low socioeconomic status. The choice of a prosthesis or the implant is crucial considering the cost of prosthesis and the risk of dislocation. However, controversy exists regarding the optimal prosthesis. This uncertainty about the ideal choice of endo prosthesis for the treatment of fractures in older patients leads to significant variation in the use of each intervention internationally.⁷

Treatment options include internal fixation, hemiarthroplasty, or THR.^{8,9} Currently THA is a preferred option as compared to BHA in the management of elderly patients on account of less complication rates and higher HHS.¹⁰ Based on the cumulative evidence, however, a reevaluation of the role of total hip arthroplasty (THA) is warranted. The present study was performed to compare THR with BHA in the treatment of displaced femoral neck fractures in the elderly patients. It is crucial to understand the epidemiology, risk factors, and outcomes of hip fractures for developing comprehensive approaches to reduce their incidence and improve patient outcomes. The aim of the study

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was to assess outcomes in the two groups of patients undergoing THR and BHA using HHS.

METHODOLOGY

This prospective comparative study was conducted in the Department of Orthopedics, Combined Military Hospital, Rawalpindi Pakistan from September 2023 to September 2024. An approval from the ethical committee was obtained. Patients with femoral neck fracture presenting to the emergency department were admitted. They were subjected to full evaluation including clinical examination, radiological assessment including pelvic radiographs of both hips in a standing anteroposterior (AP) view plus AP and lateral views of the involved hip(s), and laboratory investigations. All patients received standard primary care.

Inclusion Criteria: Patients with independent walking prior to the injury and fit for general anesthesia were included using convenience sampling technique.

Exclusion Criteria: All those patients who were non-ambulatory, had a pathological femoral neck fracture, poly trauma, pregnancy or a comorbidity like diabetes, tuberculosis, asthma, allergy, hypertension or any chronic illness were excluded.

Fifty patients were included, divided into two groups A and B of 25 each based on the type of treatment they underwent i.e. treated with BHA and THR respectively.

Preoperative evaluation was performed by an anesthetist one day prior to surgery. Patient who fulfilled the above given criteria were considered for surgery once general anesthesia (GA) fitness was available. Patient and the next of kin (NOK) were explained about the planned surgery, and written consent was obtained.

Lab evaluation included complete blood count (CBC), coagulation profile (PT/INR, APTT), electrolytes panel (sodium, potassium, chloride, bicarbonate), renal function tests (serum creatinine, blood urea nitrogen) and liver function tests (AST, ALT, GGT, Bilirubin). Blood grouping, type and screening were requested for potential transfusion needs and arrangements of blood products if necessary.

Cardiac, pulmonary and nutritional evaluation, and necessary patient education was done prior to surgery and surgical risk stratification was discussed with the patient and their NOK.

Patients were applied skin traction in ward prior to surgery.

The patient was placed on the operating table in a lateral decubitus position, ensuring proper support and alignment of the affected limb, during the procedure. A combination of 2 grams of Sulzone (Cefoperazone sodium and Sulbactam sodium) and 500 mg of Amikin (Amikacin) were given to the patients 30 minutes prior to skin incision. The patients had their surgery performed via the modified Hardinge approach. This approach known as trans gluteal approach has the lowest dislocation rate of 0.55%, compared to 3.23% for the posterior approach and 2.18% for the anterolateral approach.¹¹⁻¹³ It does not use a true inter-nervous plane therefore care must be exercised to prevent any damage to superior gluteal nerve to avoid postoperative Trendelenburg gait. In our unit, BHA and THR are generally performed by a consultant orthopedic surgeon. After giving incision, the soft tissue is retracted to expose the hip joint. The hip is dislocated to access the femoral head.

For total hip arthroplasty the femoral head was excised using an oscillating saw. The acetabulum was reamed gradually till the appropriate fit is achieved. Osteophytes were removed and the acetabulum was prepared as needed. The acetabular cup was placed in the prepared acetabulum. Sequential broaches were used to ream the femoral canal, creating a stable bed for the prosthesis. Trial prosthesis was inserted to check for the fit, stability and appropriate leg length. Necessary adjustments are performed to ensure optimal alignment and range of motion (ROM). Total hip prosthesis was implanted ensuring it fits snugly within the femoral canal and the acetabulum. Now the hip joint was reduced and checked for stability, ROM, absence of impingement and that the leg lengths were equal. Surgical site was irrigated with normal saline to reduce the risk of infection. The deep tissues, fascia and skin were closed in layers using sutures or staples.

The procedure for BHA is similar except that only the damaged femoral head is replaced by a prosthesis.

During postoperative management, antibiotics were continued for 5 days. After two weeks, the sutures were removed and standard physiotherapy protocol was advised to develop quadriceps, to enhance the ROM and encourage early weight bearing ambulation.

Estimation of blood loss was performed in each case intra-operatively. Blood volume was calculated by counting and weighing the blood-soaked swabs and sponges using weighing scales. One gram of blood is approximately equal to 1 ml of blood.

During follow up patients were reviewed at regular intervals of fourteen days, three months, 6 months, 9 months and 1 year and HHS was used to conduct the functional assessment during each follow-up session. This tool was originally developed in 1969 to help evaluate pain, activity, and function after hip replacement. Patients are scored up to a maximum of 100. It is a physician-completed instrument that consists of subscales for severity of pain, support devices, distance walked, limp, put on shoes and socks, stairs, enter public transportation, sitting, absence of deformity and range of motion (ROM). An online free HHS calculator is available for the quick calculation of the HHS score. Scores range from 0 (worse disability) to 100 (less disability). A score of <70 is rated as a poor result, 70–80 is fair, 80–90 good, and 90–100 is considered as excellent. Currently HHS is the best clinician-based tool for the evaluation of any hip arthroplasty.

Data analysis and management were performed using GraphPad Prism version 6. Categorical variables between the groups were compared using Chi-square test. Categorical variables were presented as absolute and relative frequencies and percentages. Continuous data were described using means and standard deviations. Unpaired t-test was used to evaluate differences between the two groups across the time periods of fourteen days, three months, six months, nine months and twelve months after surgery. A p value ≤ 0.05 was considered significant.

RESULTS

Out of 50 patients included, 25 underwent BHA while 25 had THR performed. Table-I shows the demographic details of the patients. Each group comprised of 7(28%) females and 18(72%) males. The BHA group had a mean age of 78.8 ± 9.9 years, while the THR group had a mean age of 59.4 ± 6.9 years.

Table-I: Demographics of patients undergoing Bipolar Arthroplasty vs Total Hip Replacement (n=50)

Demographic(s)		Procedure		p-value
		Bipolar Arthroplasty (n=25)	Total Hip Replacement (n=25)	
Gender	Females	7(28.0%)	7(28.0%)	1.0000
	Males	18(72.0%)	18(72.0%)	
Age in years (Mean $\pm$ SD)		78.8 $\pm$ 9.93	59.4 $\pm$ 6.9	<0.0001

The pre-operative mean hemoglobin levels in BHA group and THR group were 11.29 g/L and 12.9 g/L respectively. Mean blood loss in THR group (520

ml) was considerably higher than the BHA group (279.2 ml) ($p < 0.0001$) shown in Table-II.

During the follow up over a period of one year HHS was measured in both groups as represented in Figure and Table-III. The mean HHS in BHA group were 57, 61.3, 65.1, 68.8, and 72.2, and in THR group were 72.4, 76.6, 80.6, 83.9, and 87 at fourteen days, three months, six months, nine months, and one year, respectively. HHS was significantly higher in patients with THR than patients with BHA (p -value of <0.0001).

Table-II: Operative Record of patients of both groups (n=50)

Variable(s)	Procedure		p-value
	Bipolar Arthroplasty (n=25)	Total Hip Replacement (n=25)	
Hemoglobin (g/L)	11.29 $\pm$ 1.26	12.97 $\pm$ 1.8	0.0004
Blood Loss (ml)	279.2 $\pm$ 33.3	520 $\pm$ 74.1	<0.0001

Table-III: Comparison of Harris Hip Score of patients undergoing Bipolar Hemiarthroplasty vs Total Hip Replacement (n=50)

HHS (over time periods)	Procedure		p-value
	Bipolar arthroplasty (n=25)	Total Hip Replacement (n=25)	
14 days	57.00 $\pm$ 3.85	72.4 $\pm$ 3.67	<0.0001
3 months	61.3 $\pm$ 4.09	76.6 $\pm$ 3.39	<0.0001
6 months	65.1 $\pm$ 4.7	80.6 $\pm$ 3.72	<0.0001
9 months	68.8 $\pm$ 5.01	83.9 $\pm$ 3.42	<0.0001
1 year	72.2 $\pm$ 4.95	87.0 $\pm$ 3.85	<0.0001

HHS: Harris Hip Score, THR: Total Hip Replacement

DISCUSSION

The findings of our study show that patients undergoing THR had a higher Harris Hip Score (HHS) than patients undergoing Bipolar Hip Arthroplasty. There is an ongoing debate on the best course of care for older patients with femoral neck fractures.¹⁴ Across the globe, some surgeons treat older patients similar to the younger individuals by employing Closed Reduction Internal Fixation (CRIF) techniques with cannulated screws or devices such as the sliding hip screw. Conversely, the available reconstruction alternatives consist of hemiarthroplasty (HA) (unipolar or bipolar) and THR.⁹ Previous studies recommend BHA as the treatment of choice for elderly individuals with short life expectancies and modest functional needs. Nevertheless, both unipolar and bipolar hemiarthroplasty are associated with complications requiring subsequent surgical procedure and a conversion to THA.⁶ THR procedure needs more precision and time. Precision demands that the acetabular prosthesis (cup) has to be oriented

precisely with respect to the hip center of rotation (HCR), inclination and anteversion.¹⁵ This approach may yield improved functional outcomes and is more appropriate for relatively younger patients with higher life expectancy, and greater functional requirements.¹⁶

The mean ages of the two groups differed significantly (p -value <0.0001). Patients undergoing THR were relatively younger with mean age of 59.4 years compared to the patients undergoing BHA with mean age of 78.8 years. Our results are consistent with other studies in the region.¹⁷ There are mixed reports on gender disparity in hip fracture incidence. Some studies have shown a female preponderance with fracture neck of the femur.¹⁷ It has been reported that in western countries approximately three out of four hip fractures occur in women.^{18,19} Others have reported a secular trend in hip fracture incidence due to diminished relative risk. Yet, other studies indicate that men are now comparatively more likely than women to have a hip fracture due to shifting gender-specific risk ratios.² However, in our study, both the groups, BHA and THR, showed a male predominance. This could be due to the referral pattern of entitled veteran patients with fracture neck of femur, who are mostly males, to military hospitals for the required treatment.

Anaemia and transfusion are associated with increased morbidity and mortality in surgical patients therefore maintaining a preoperative hemoglobin level above 12.0 g/dl in elderly orthopedic patients is recommended as part of blood management strategy to reduce the need for perioperative blood transfusions.²⁰ The pre-operative mean hemoglobin levels in BHR group and THR group were 11.29 g/L and 12.9 g/L respectively. These levels are close to the recommended hemoglobin level.

As blood loss is a common surgical risk in THR therefore a progressive estimation of the blood loss was performed intra-operatively by counting and weighing the blood-soaked swabs and sponges using weighing scale. One gram of blood is approximately equal to 1 ml of blood. Our study showed that THR was associated with increased mean blood loss of 520 ml as compared to BHA with mean blood loss of 279.2 ml. These findings are in accordance with multiple other studies in the West as well as in South Asia.^{19,21,22}

A number of studies, reviews and meta-analyses have been published comparing modes of arthroplasty in femoral neck fractures.^{6,9,17,23} Traditional outcomes

from surgery are defined within a period following a surgical procedure, frequently 30 days and tend to focus on morbidity and mortality.²⁴

During the follow up of patients over a period of one year HHS was measured to assess the functional outcome in both groups. The mean Harris Hip Scores in BHA group were 57, 61.3, 65.1, 68.8 and 72.2 and in THR group the mean HHS were 72.4, 76.6, 80.6, 83.9 and 87 at fourteen days, three months, six months, nine months and one year respectively. HHS was higher in patients who underwent THR than those who had BHA (p -values of <0.0001) throughout the follow up period of one year. Our findings are in accordance with the earlier studies that report a better HHS after THR as compared to BHA one year postoperatively.²⁵

Arthroplasty for the management of fractures of the neck of femur is noted to be associated with certain immediate complications like infection, deep vein thrombosis (DVT), and delayed mobilization while late complications include implant failure, dislocation, peri-prosthetic fractures, and loosening of the implant.²² In this study, however, the recovery was uneventful and smooth and no such complication was noted during the follow up period of one year.

LIMITATION OF STUDY

Small sample size and short duration of follow-up.

CONCLUSION

Patients undergoing THR had a higher average Harris Hip Score (HHS) than patients undergoing BHA. Thus, based on our short-term functional outcome assessment using Harris Hip Score over a follow up period of one year, THR appears to be a better option as compared to BHA and is recommended in the management of fracture neck of the femur in the elderly patients.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MH & MNC: Data acquisition, data analysis, critical review, approval of the final version to be published.

MAR & AA: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

AR & MM: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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