

Early Functional Outcome of Hemiarthroplasty in the Elderly with Neck of Femur Fracture: A Single Centre's Experience

Abstract

Introduction: Neck of femur fractures in the elderly population are common and often a devastating condition. The optimal treatment has been a subject of debate. Arthroplasty has been shown to be the most viable treatment option. The high cost of total hip replacement makes hemiarthroplasty a suitable option in our environment. **Materials and Methods:** This study was designed to measure the outcome of hemiarthroplasty after femoral neck fracture using Harris hip score in patients aged 60 and above at the National Orthopaedic Hospital, Dala, Kano, Nigeria. **Results:** Twenty-five consecutive patients 60 years and above with femoral neck fracture who met the inclusion criteria and gave consent were enrolled into the study. The mean Harris hip score at the pre-operative period was 16.92. Fourth week after the surgery, the mean Harris hip score was 69.96. The score rose further to 75.24 and 80.96 at 12 weeks and 6 months post-operatively. The difference between the mean pre-operative and post-operative scores at 4th week, 12th week, and 6th month was statistically significant. During the pre-operative period, all patients had a poor Harris hip score grade. Six months after the surgery, 7 patients (28%) had an excellent Harris hip score grade, 12 patients (48%) had good grades, and 1 patient (4%) had a fair Harris hip score grade. Five patients (20%) had a poor Harris hip score grade at 6 months. **Conclusion:** From the findings of this study, it can be concluded that early functional outcomes of hemiarthroplasty for femoral neck fracture in the elderly are good and satisfactory.

Keywords: *Elderly, functional outcome, hemiarthroplasty*

Introduction

Neck of femur fracture forms a major share in the elderly.^[1] This high incidence is due to osteoporosis and increased incidence of trivial trauma.^[2] Incidence rates of femoral neck fractures in persons 50 years and above from 1960 onwards are higher in the white population than in the black race, Asians, and Hispanics.^[3] In both sexes and in all ethnic groups and geographic areas, incidence rates increase markedly with age.^[3] Femoral neck fracture incidence rises sharply after menopause in women.^[3,4] In America, an estimate of about 14 billion dollars is spent each year to take care of one million affected elderly persons, with only about a quarter regaining their pre-fracture function.^[4] The female-to-male ratio is higher than 1.0 in whites, whereas in Africans the reverse has always been the case.^[3] In Nigeria, Yunusa and Onche^[5] reported an M:F ratio of 2.6: 1. However,

Ogunlade *et al.*^[6] showed an M:F ratio of 1:1.3 for hip fractures.

Femoral neck fractures in the elderly may occur spontaneously or following low velocity trauma.^[7] Elderly persons have been shown to have weak muscles and poor balance, with increased tendency to fall.^[7] Conditions that predispose to femoral neck fractures include diabetes, previous hip fracture, hyperparathyroidism associated with severe renal disease, and maternal history of hip fracture.^[7] It is generally agreed that osteoporosis is associated with femoral neck fractures; hence, bone weakening disorders predispose to femoral neck fractures.^[8] Patients with stroke have been shown to have up to a 4-fold increased risk of hip fracture because of their high incidence of falls and hemiosteoporosis in the paretic side.^[8]

Clinically, there may be a history of trivial trauma which may cause pain and restriction of movement on the affected hip.^[9] There

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may be tenderness over the anterior hip joint line with minimal shortening and minimal external rotation due to the intracapsular nature of the fracture.^[9] The capsule prevents gross displacement of fracture fragments from muscular forces.

X-ray can confirm the diagnosis in most instances, though sometimes other imaging modalities like computed tomography scan, magnetic resonance imaging, and bone scan may be employed to clinch the diagnosis.

Non-operative treatment in certain circumstances may be employed for femoral neck fracture in the elderly with impacted undisplaced/minimally displaced fracture or those too ill to undergo or withstand surgery.^[10] However, surgery has been established as the main treatment option.^[10,11] The surgical options include internal fixation (with nails, sliding hip screw, cannulated screws, valgusizing osteotomy, etc.) or prosthetic replacement, which can be either partial or total replacement of the joint.^[11-15] Generally speaking, those with impacted or undisplaced/minimally displaced fractures are managed with internal fixation, whereas displaced fractures are managed with replacement arthroplasty (unipolar/bipolar hemiarthroplasty or total hip arthroplasty).^[12-15] Optimum treatment of a displaced femoral neck fracture in an elderly patient is controversial in terms of the best surgical modality. Some believe that total hip arthroplasty provides the best of outcome in functionality, lower re-operation rate, lower complications as well as better restoration of hip anatomy than hemiarthroplasty. However, comorbidity and life expectancy are an important consideration before any of the replacement surgery.^[14,15] In sub-Saharan Africa, for economic reasons and due to lack of skilled manpower, poor access to orthodox care, etc., hemiarthroplasty (unipolar or bipolar) is the usual replacement procedure carried out.^[15-17] The Harris hip score is an important tool in assessing functionality at the hip. It has eight sections which are pain, distance walked, activities, public transportation, support, limp, climbing stairs, and sitting.^[18] The score ranges from 0 to 100. Scores are grouped as follows: 90–100 as excellent score, 80–89 as good score, 70–79 as fair score, and 0–69 as poor score.^[18]

The Dorr classification of proximal femoral anatomy classifies proximal femur into A, B, and C.^[19] Dorr type A femur has a narrow femoral canal, which increases in canal diameter in Dorr B and C classes.^[19] The Dorr type A femur typically allows cementless prosthesis. Type C typically allows cemented prosthesis, whereas type B Dorr allows both cementless and cemented prosthesis.^[19]

The goal of treating all patients with hip fractures is to return them back to their pre-injury level of activities as much as possible.^[11-14] In Nigeria, various works have been conducted on hip fractures in the elderly.^[1-3,5,6] However, studies addressing the functional outcome of these patients after the surgical procedures, be it internal

fixation or replacement arthroplasty, are still lacking. Hence, the focus of this work is to examine the early functional outcome of hemiarthroplasty in the elderly patients who are 60 years and above with neck of femur fracture in Kano, Nigeria.

Materials and Methods

The study was a prospective hospital-based descriptive survey carried out over a period of 18 months (July 2013 to December 2014) at the National Orthopaedic Hospital, Dala, Kano, Nigeria. Participants were elderly persons aged 60 years and above. Ethical approval was sought and obtained from the National Orthopaedic Hospital Dala Research Ethics Committee with an ID NOHD/RET/ETHIC/60.

Participants were included if they fulfilled the following criteria:

1. Elderly persons above 60 years with neck of femur fracture;
2. Consented to participate in the study;
3. Clinically fit to complete the interview process.

Prospective participants were excluded if they meet any of the following conditions:

1. All non-consenting patients;
2. Persons with multiple injuries;
3. Individuals with pathological fractures.

Sample size and sampling technique

The sample size was obtained using a pilot study that was conducted from January 2011 to June 2012 (1.5 years), and the required sample size for the study was calculated from the result using the following formula^[20]:

$$n = \frac{N}{1 + N(e)^2}$$

where n is the required sample size;

N the required population size;

e the margin of error at 5% (standard value of 0.05) and confidence level of 95%.

From the pilot study carried out from January 2011 to June 2012 (1.5 years), a total of 44 patients had hemiarthroplasty; 24 patients were elderly patients with neck of femur fracture, and none was multiple injured.

$$\text{Sample size } n = \frac{24}{1 + 24(0.05)^2} = 21.75 = 22.6$$

22.6 was rounded up to 23;

10% of calculated value = 2 (to serve as attrition);

Thus, the required sample size is $23 + 2 = 25$ patients.

The sampling technique was by recruitment of consecutive eligible elderly patients with neck of femur fracture who have met the criteria and consented to partake in the study until the required sample size was obtained.

The Harris hip score was used to assess the functional outcome.^[18] Eight sections were rated including pain, distance walked, activities, public transportation, support, limp, stairs, and sitting. Absence of deformity and range of motion were assessed based on the physical examination of the patient. The score ranges from 0 to 100. Scores were grouped as follows: 90–100 as excellent score, 80–89 as good score, 70–79 as fair score, and 0–69 as poor score.^[18]

Study protocol

Patients were identified and recruited at the Surgical Outpatient Department and Accident and Emergency units of the National Orthopaedic Hospital, Dala, Kano. All patients and their caregivers were approached to participate in the study and the reason for the research given to them. Informed consent was obtained from the patients who agreed to participate or from their caregivers. Initial clinical assessment was done using a self-administered questionnaire which contained information on biodata, preinjury ambulation status, and comorbid conditions. Clinical examinations and radiographs were done, and the fracture was classified based on Garden's classification and recorded. Full blood count, urea and electrolyte, electrocardiograph (ECG), and plain chest radiograph were requested as part of preparation for surgery and results noted. The pre-operative Harris hip score was assessed and recorded. All patients with comorbidity (hypertension, diabetes, cardiac, renal diseases, and others) were optimized by physicians in conjunction with anaesthetist prior to surgery.

Cemented or cementless implants were used on the basis of the state of the calcar and degree of osteopenia using Dorr index. All Dorr A and B femurs had cementless prosthesis, whereas all Dorr C had cemented prosthesis. The prosthesis used for surgery was a 135° hip prosthesis manufactured and marketed by Orthotech India (orthotechindia.com) for both the bipolar cemented and cementless implants and unipolar implants (Appendices 8 and 9). The cement powder used was that produced by Synimed-Synergie Ingenierie Medicale (SARL, EUROFIX G40), France.

Two patients had pre-operative skeletal traction for 2 weeks prior to surgery due to proximal migration of the femur. Patients who were on admission for 3 days or more were placed on low-molecular-weight heparin and discontinued 24 h before surgery. Informed consent was obtained for surgery. On the night before the surgery, the blood pressure, pulse rate, and respiratory rate were recorded. The American Society for Anesthesiology (ASA) score of each patient was

also recorded as assigned by the anaesthetist. All surgeries were performed by either a Consultant Orthopaedic Surgeon or a Senior Registrar under supervision. Parenteral antibiotics (ceftriaxone and gentamicin) were given at induction of anaesthesia. General anaesthesia or spinal anaesthesia was used in all the patients. The anterolateral approach was used for exposure of the hip in all patients, and hemiarthroplasty was performed with implant base on the criteria mentioned earlier (either cementless or cemented based on the Dorr index of each respected patient). Wounds were closed in layers over a Redivac drain in all patients. An abduction pillow was used to keep the legs slightly abducted after surgery as a standard protocol. Immediate post-operative complications were noted.

Antibiotics were continued post-operatively for 5 days parenterally, and oral antibiotics commenced thereafter for another 2 weeks which is the protocol in our hospital.

Parenteral analgesics (pentazocine and paracetamol) were given for the first 48 h after surgery and oral analgesics continued thereafter. Drains were removed 48 h after surgery, and post-operative radiograph was also taken. All patients had deep venous thrombosis (DVT) prophylaxis by using clexane after the drain was removed, which was later converted to dabigatram after 5–7 days until discharge.

Patients were commenced on quadriceps exercises as early as they can tolerate, and ambulation commenced thereafter. Patients were counselled and placed on rehabilitation after discharge on an outpatient basis. All patients were properly educated on the need to avoid position that can cause dislocation/other complications after discharge (avoid sitting on low seats or lavatory, avoid crossing over their legs, etc.).

The Harris hip score was assessed at 4 weeks, 12 weeks, and 6 months after surgery. Two patients had their Harris hip score assessed by a senior registrar in a sister teaching hospital after due phone communication. Adequate follow-up was ensured using a dedicated GSM line to contact patients and their caregivers.

All data collected were recorded for each patient and input into Microsoft Excel. Demographic variables were represented using tables and charts. Absolute numbers and simple percentages were used to describe categorical variables. The statistical analyses of the results were done using Microsoft Excel and SPSS version 17.0, and the significance level will be set at $P \leq 0.05$. Quantitative variables were described using measures of central tendency (mean, median) and measures of dispersion (standard deviation) as appropriate. Tests of association for quantitative variables were done using Student's *t*-test and for qualitative variables using the χ^2 test.

Results

A total of 25 patients 60 years and above with neck of femur fracture who had hemiarthroplasty and met the inclusion criteria were studied.

Table 1 shows the demographic profile of the patients. The mean age of the patients was 71.68 with an age range of 60–92 years. Fourteen patients (56%) were within the age range of 60–70 years. Four patients (16%) were within 71–80 years, 5 patients (20%) were within 81–90 years, and 2 patients (8%) were within 90–100 years.

A total of 22 patients had bipolar hemiarthroplasty, whereas 3 of them had a unipolar prosthesis.

Out of the total of 25 patients, 18 of them had a cementless prosthesis, whereas the remaining 7 patients had a cemented prosthesis.

There were 8 females (32%) while 17 patients (68%) were males and a male-to-female ratio was 2.13:1. Twenty-one patients (84%) were married, whereas four patients (16%) were widows. Thirteen patients (52%) were Hausa. Eight patients (32%) were Fulani. Other tribes were Yoruba, Margi, Esako, and Muhavuul, each contributing 1 patient (4%).

Muslims constituted 22 (88%) patients. Others 3 (12%) were Christians.

Occupational distribution as depicted in Figure 1 showed that eight patients (32%) were dependents; another eight patients (32%) were traders. Five patients (20%) were retired civil servants. Others included were farmer, technician,

traditional ruler, and civil servant, each contributing 1 patient (4%).

Table 2 shows the total score, mean Harris hip score, and standard deviation (SD). The total score at the pre-operative period was 406 with a mean score of 16.92 and an SD of 14.33. At 4th week post-operatively, the total Harris hip score was 1749 with a mean score of 69.96 and an SD of 10.51. At 12th week post-operatively, the total Harris hip score was 1881 with a mean score of 75.24 and an SD of 8.66, whereas at the 6th month, the total score was 2024 with a mean score of 80.96 and an SD of 14.26.

Table 3 shows a paired sample *t*-test done between pre-operative Harris hip score and that at 4 weeks, 12 weeks, and 6 months. There was a statistically significant difference between the pre-operative Harris hip score and the Harris hip score at 4 weeks, 12 weeks, and 6 months ($P < 0.05$).

Table 4 shows the distribution of Harris hip score grades pre-operatively and those at 4 weeks, 12 weeks, and 6 months post-operatively. All patients during the pre-operative period had a poor Harris hip score grade. At the 4th week, 4 patients (16%) had a good Harris hip score grade, 10 patients (44%) had fair grades, and 11 patients (44%) had poor grades. At the 12th week, 11 patients (44%) had good Harris hip score grades, 9 patients (36%) had fair grades, and 5 patients (20%) had poor grades. At the 6th month, 7 patients (28%) had excellent Harris hip score grades, 12 patients (48%) had good grades, and 1 patient (4%) had a fair Harris hip score grade. Five patients (20%) had a poor Harris hip score grade at 6 months.

Overall, at the final follow-up, 19 patients (76%) had good and excellent Harris hip score grades.

Figure 2 is a box and whiskers plot showing the distribution of Harris hip score grades during the pre-operative period and at 4 weeks, 12 weeks, and 6 months post-operatively. During the pre-operative period, the plot shows a low Harris hip score for all study participants. At the 4th week, there is an improvement in the Harris hip score which continues to increase through the 12th week and 6 months after hemiarthroplasty.

Table 1: Sociodemographic characteristics of study respondents

Variable	n=25	%
Age group		
60–70	14	56
71–80	4	16
81–90	5	20
91–100	2	8
Gender		
Male	17	68
Female	8	32
Marital status		
Married	21	84
Widow	4	16

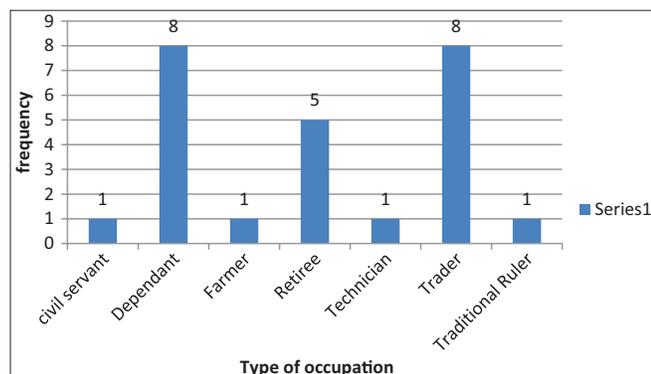


Figure 1: Occupational distribution of patients

Discussion

Hemiarthroplasty is a viable option for the treatment of femoral neck fracture in the elderly. This study demonstrates a good early outcome in the elderly following hemiarthroplasty for neck of femur fractures.

Table 2: Total score, mean Harris hip score, and SD

	Total score (N = 25)	Mean	SD
Pre-operative	406	16.24	14.33
4th week	1749	69.96	10.51
12th week	1881	75.24	8.66
6th month	2024	80.96	14.26

Table 3: Paired t-test between pre-op Harris hip score and Harris hip score at 4th week, 12th week, and 6th month, respectively

Variables	Mean	Mean difference	SD	P-value
Pair 1: Pre-op Harris hip score 4th week Harris hip score	16.24 69.96	53.72	14.33 10.51	<0.0001
Pair 2: Pre-op Harris hip score 12th week Harris hip score	16.24 75.24	59	14.33 8.66	<0.0001
Pair 3: Pre-op Harris hip score 6th month Harris hip score	16.24 80.96	64.72	14.33 14.26	<0.0001

Table 4: Harris hip score grading pre-operatively and 4th week, 12th week, and 6th month post-operatively

Harris hip score grade	Pre-operative Frequency (%)	4th week Frequency (%)	12th week Frequency (%)	6th month Frequency (%)
0–69 (Poor)	25 (100)	11 (44)	5 (20)	5 (20)
70–79 (Fair)	0	10 (40)	9 (36)	1 (4)
80–89 (Good)	0	4 (16)	11 (44)	12 (48)
90–100 (Excellent)	0	0	0	7 (28)
Total	25 (100)	25 (100)	25 (100)	25 (100)

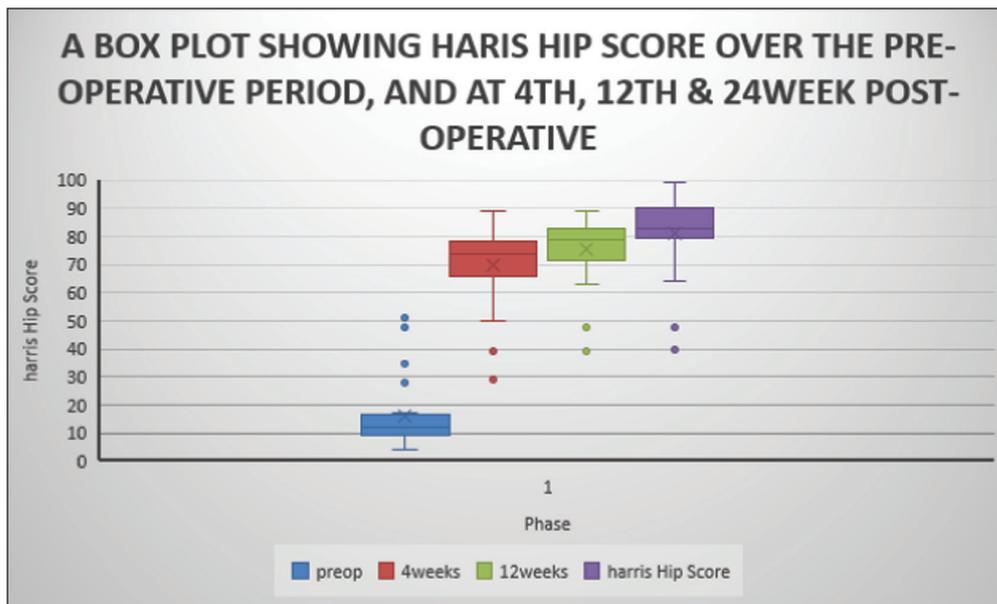


Figure 2: A box plot showing Harris hip score over the pre-operative period and at the 4th, 12th, and 24th weeks post-operatively

The average age of the patients in this study was found to be 71.9 years. Previous studies in southern Nigeria also found similar average age among participants.^[1,21] This may be because both populations are Nigerians with similar demographics and life expectancy. In the UK, a study found a mean age of 80.8 years on comparing internal fixation and hemiarthroplasty in the elderly.^[22]

Male patients predominate in this study. This is similar to the findings of Daniel et al.^[21] This may be due to the fact that both study populations are from the same region with similar demographics. However, Eyichukwu and Iyidobi^[1] found an equal male and female ratio in their study. This is likely because they studied both the elderly and those in the middle age groups.

The mean Harris hip score rose from 16.24 pre-operatively to 69.96 at the 4th week and to 75.24 at the 12th week post-operatively, respectively. At the final follow-up (6 months), the mean Harris hip score was 80.96. The increase from the pre-operative period to the post-operative period was found to be statistically significant ($P < 0.05$). At the pre-operative phase, all patients had a poor Harris hip score grade. At the final follow-up, 19 patients (76%) had excellent and good Harris hip score grades. One patient (4%) had a fair grade, and 5 patients (20%) had a poor Harris hip score grade.

Various authors have demonstrated similar results with hemiarthroplasty for femoral neck fracture in the elderly. Figved et al. showed that using bipolar prostheses at 12 months, the mean Harris hip score was 78.9 ($n = 77$) and

79.8 ($n = 90$) for the cemented and the cementless groups, respectively.^[23] Their mean age was 83.4 years and 83.0 for the cemented and cementless groups, respectively.^[24] Similarly, Ozturkmen *et al.*^[25] showed that in elderly patients with femoral neck fracture who had hemiarthroplasty with a cementless bipolar stem, the mean Harris hip score was 84 ($n = 48$) at the final follow-up (4.2 years). However, the duration of follow-up and the number of patients in this study are far less when compared with their study.

Siraj *et al.*,^[26] while evaluating the outcome of hemiarthroplasty after femoral neck fracture in the elderly, showed that the average Harris hip score ($n = 62$) at 12 months was 71.4. The value obtained is lower than the figure obtained in this study. This may be because the number of patients in this study ($n = 25$) is lower than that in their study. Similarly, no mention was made as to the number of unipolar or bipolar endoprostheses used. In this study, all but three patients had bipolar endoprostheses.

Nicolaides *et al.*,^[27] in their study on arthroplasty and internal fixation of femoral neck fractures in the elderly Greeks, found a Harris hip score of about 80 at the 6 months follow-up period for those who had hemiarthroplasty. This is also similar to what we found in this study.

Mouzopoulos *et al.*^[28] in their study on the 4-year functional result after a displaced subcapital hip fracture treated with three different surgical options found Harris hip scores of 77.9 and 79.5 at 1 and 4 years of follow-up, respectively, for the patients who had hemiarthroplasty. Their follow-up period is much longer than that in our study (4 years); however, the Harris hip score is comparable to what we obtained in this study.

Conclusion

From the findings of this study, it can be concluded that early functional outcomes of hemiarthroplasty for femoral neck fracture in the elderly are good and satisfactory.

Recommendation

1. Clinicians should not hesitate to carry out hemiarthroplasty among the elderly with neck of femur fracture as soon as they are present in the hospital.
2. A high-quality multicentre randomized controlled trial should be conducted to establish the present evidence of this study.

Limitations

- This study has a small number of patients and shorter duration of follow-up limits when compared with most studies elsewhere.

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Conflicts of interest

There are no conflicts of interest.

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