



Prospective randomized study on outcomes in elderly patients with displaced neck of femur fractures managed with unipolar and bipolar hemiarthroplasty

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Abstract

Background: In elderly patients diagnosed with displaced femoral neck fractures Hemireplacement arthroplasty (HRA) of the hip is considered to be the treatment of choice. Although still controversy exist whether using bipolar prosthesis has any added functional advantage over unipolar prosthesis. Several research papers have been published over the past few decades, with few articles stating no added advantage with bipolar prosthesis and few stating Bipolar prosthesis has good functional outcomes. The primary aim of this study was to analyze if there is any functional benefit using bipolar prosthesis, functional assessment was done using Harris Hip Score (HHS).

Methods: a prospective comparative study was conducted from Jan 2022-2023 in HIMS Hassan, elderly patients diagnosed with displaced femoral neck fractures in outpatient and casualty, Department of Orthopaedics. 60 such patients were selected as per inclusion and exclusion criteria. Consent was taken and patients were assessed for functional outcomes in post operative follow-ups 3 months and 1 year using HHS (Harris Hip Score). Post operative standard rehabilitation and mobilization protocols were followed.

Results: the average HHS were similar in unipolar and bipolar prosthesis in both the follow ups and hence no significant statistical difference between both the groups. 10% of unipolar patients showed radiological features of acetabular erosion at 12 month follow up. Although unipolar candidates had 71.4 and bipolar candidates had 78.3 HHS scores at 12 months, no significant statistical difference ($p=0.09$) was observed between the two groups.

Conclusion: although there is no significant statistical and functional difference between use of unipolar and bipolar prosthesis in treating displaced femoral neck fractures in elderly patients, radiological signs of acetabular erosion were found at the end of one year follow up in case of unipolar candidates henceforth use of bipolar prosthesis is recommended for hemi replacement arthroplasty.

Keywords: Prospective study, displaced femoral neck fracture, fractures hemi replacement arthroplasty (HRA), harris hip score (HHS)

Introduction

Neck of femur fractures are one of the most common orthopaedic injuries among elderly aged more than 60. The annual incidence of hip fractures in India exceeds 6,00,000 [1]. This is expected to double by year 2050 [2], as there is rise in geriatric population due to advanced healthcare facilities and increased life expectancy.

Elderly people sustaining hip fractures have a mortality rate ranging 15 to 40% at 1 year, with half of them losing their functional ability [3-8]. Displaced femoral neck fracture is common incidence in elderly individuals and treating them using bipolar and unipolar prosthesis has been a controversy for years [9-12].

The ideal treatment for displaced femoral neck fractures in elderly patients has been controversial over the past several decades and multiple publications and research articles were put forth with few suggesting no significant advantage using bipolar prosthesis over unipolar prosthesis and few research papers suggesting functional advantage of bipolar prosthesis [10, 13-14]. Theories have suggested that use of bipolar has the advantage of having moving inner bearing in addition to articulating at the prosthesis-acetabulum interface, this will decrease the rates of acetabular erosion and reduces pain [15, 16]. But some studies showed that this inner bearing loses its mobility with time and becomes stiff, which will eventually makes bipolar no more advantageous than unipolar prosthesis [14, 17, 18]. Question of concern is, bipolar

prosthesis is costlier than unipolar prosthesis, whether this additional cost practically adds up to the better functional outcomes and quality of life of the patient.

The aim of this study was to compare the efficacy in terms of functional outcome scores of unipolar and bipolar hemiarthroplasty in elderly patients diagnosed with displaced femoral neck fractures. Earlier studies were retrospective and hence selection bias was there in these groups [19, 20]. More recent studies have improved comparative statistics in terms of prospective simple randomization studies [21-23]. In this study we carried out simple randomized prospective comparative study in elderly patients treated with hemiarthroplasty using unipolar and bipolar prosthesis at one year follow up.

Materials and methods

study was conducted for a period one year from January 2022 to January 2023, patients aged more than 60 years or older who presented to our institution with acute displaced femoral neck fractures (Garden 3 and 4 types) were included in this simple randomized prospective study. Ethical clearance was taken from the institution board and proper informed consent was taken from each patient after explaining the necessary information required for the procedure. Exclusion criteria being patients who were not fit for surgery due to medical comorbidities, patients who did not give consent for surgery, non-ambulatory patients,

patients with psychiatric illnesses like dementia and pathological femoral neck fractures.

Patients fulfilling the inclusion criteria are recruited in this simple randomized prospective study. On admission patient data was collected with regard to age gender ambulatory status before fracture. Patients were classified based on use of assistive devices for walking before fracture. The comorbidities of each patient were noted. Physician fitness was taken before surgery adequate blood was arranged preoperatively. And routine intraoperative protocol was followed such as administering antibiotics. Simple randomization was conducted and 30 patients were assigned to undergo unipolar and 30 patients were assigned to undergo bipolar prosthetic replacement.

Data was collected with respect to intraoperative complications and early postoperative complications, operative duration, hypoxic episode, pneumonia, wound hematoma, fever, altered mental status and urinary retention. Serious complications like pulmonary embolism, arrhythmias, bed sores grade 3 and 4, cerebrovascular accident and uncontrolled diabetes. Late complications like

delayed surgical site infection, dislocation and periprosthetic fractures were also noted. Same team of surgeons work involved in this study and same surgical approach was used for each patient.

Postoperatively patients were followed at three months and 12 months to assess functional outcome scores using Harris Hip Score (HHS). Plane radiographs of hip joint was taken to assess prosthetic loosening, osteolysis, acetabular erosion, dislocation, periprosthetic fractures and subsidence. The Harris hip score [21] assesses hip function in four categories: pain (0–44), function (0–47), absence of deformity (0–4) and range of motion (0–5). The maximum score possible is 100.

Table 1: Garden classification of femoral neck fractures.

Type	Description
1	Undisplaced. Incomplete. valgus impacted
2	Undisplaced. complete fractures
3	complete fractures, incompletely displaced
4	complete fractures completely displaced

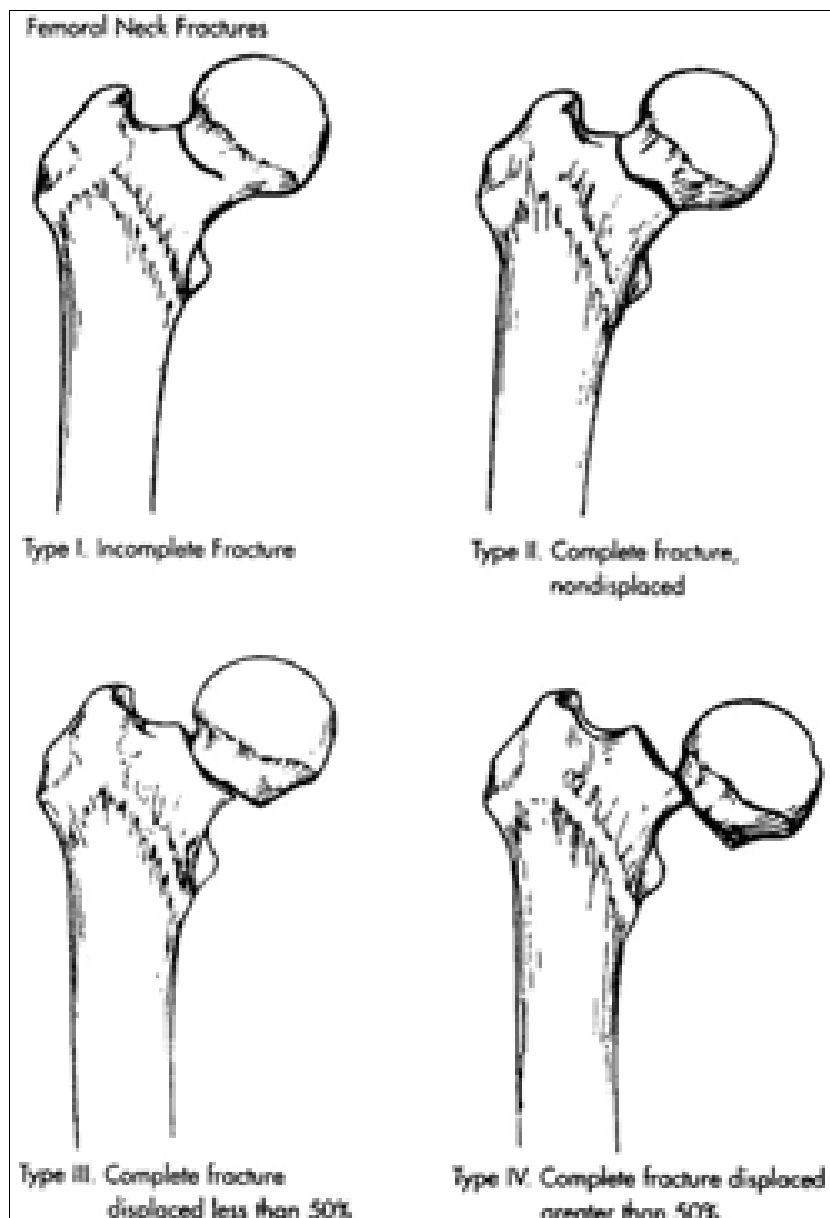


Fig 1

Table 2: Patient data

Age (years)	Unipolar	Bipolar
Range	60-95	60-95
Average	78.6	72.6
Median	75.6	75.6
Gender	females	Males
	45	15
	75%	25%
	Unipolar	Bipolar
Blood loss	160mL	145mL
Dislocation	0	1
joint infection	1	2
Acetabular erosion	6	0

Table 3: Harris hip score

Section 1	
Pain <input type="radio"/> None, or ignores it <input type="radio"/> Slight, occasional, no compromise in activity <input type="radio"/> Mild pain, no effect on average activities, rarely moderate pain with unusual activity, may take aspirin <input type="radio"/> Moderate pain, tolerable but makes concessions to pain. Some limitations of ordinary activity or work. May require occasional pain medication stronger than aspirin <input type="radio"/> Marked pain, serious limitation of activities <input type="radio"/> Totally disabled, crippled, pain in bed, bedridden	Support <input type="radio"/> None <input type="radio"/> Cane/Walking stick for long walks <input type="radio"/> Cane/Walking stick most of the time <input type="radio"/> One crutch <input type="radio"/> Two Canes/Walking sticks <input type="radio"/> Two crutches or not able to walk
Distance walked <input type="radio"/> Unlimited <input type="radio"/> Six blocks (30 minutes) <input type="radio"/> Two or three blocks (10 - 15 minutes) <input type="radio"/> Indoors only <input type="radio"/> Bed and chair only	Limp <input type="radio"/> None <input type="radio"/> Slight <input type="radio"/> Moderate <input type="radio"/> Severe or unable to walk
Activities - shoes, socks <input type="radio"/> With ease <input type="radio"/> With difficulty <input type="radio"/> Unable to fit or tie	Stairs <input type="radio"/> Normally without using a railing <input type="radio"/> Normally using a railing <input type="radio"/> In any manner <input type="radio"/> Unable to do stairs
Public transportation <input type="radio"/> Able to use transportation (bus) <input type="radio"/> Unable to use public transportation (bus)	Sitting <input type="radio"/> Comfortably, ordinary chair for one hour <input type="radio"/> On a high chair for 30 minutes <input type="radio"/> Unable to sit comfortably on any chair
To score this section all four must be 'yes', then get 4 points. Nb. Not 1 point for each four or nothing.	

Section 2	
Does your patient have ALL of the following: -	
<input type="radio"/> yes <input type="radio"/> no	Less than 30degrees of fixed flexion Less than 10 degrees of fixed int rotation in extension Less than 10 degrees of fixed adduction Limb length discrepancy less than 3.2 cm (1.5 inches)

Section 3 - Motion	
Total degrees of Flexion <input type="radio"/> None <input type="radio"/> 0 > 8 <input type="radio"/> 8 > 16 <input type="radio"/> 16 > 24 <input type="radio"/> 24 > 32 <input type="radio"/> 32 > 40 <input type="radio"/> 40 > 45 <input type="radio"/> 45 > 55 <input type="radio"/> 55 > 65 <input type="radio"/> 65 > 70 <input type="radio"/> 70 > 75 <input type="radio"/> 75 > 80 <input type="radio"/> 80 > 90 <input type="radio"/> 90 > 100 <input type="radio"/> 100 > 110	Total degrees of Abduction <input type="radio"/> None <input type="radio"/> 0 > 5 <input type="radio"/> 5 > 10 <input type="radio"/> 10 > 15 <input type="radio"/> 15 > 20 Total degrees of Ext Rotation <input type="radio"/> None <input type="radio"/> 0 > 5 <input type="radio"/> 5 > 10 <input type="radio"/> 10 > 15 Total degrees of Adduction <input type="radio"/> None <input type="radio"/> 0 > 5 <input type="radio"/> 5 > 10 <input type="radio"/> 10 > 15

Excellent (90-100 points), good (80–89 points), fair (70–79 points), or poor (<70 points).

Results

out of 60 patients, as per randomization patients were divided into two equal groups to undergo unipolar and bipolar hemi replacement arthroplasty. The overall mean age was 75.6 (60-95) years with 76% patients being female. The proportion of males was slightly higher in 30 percent bipolar group compared to 18 percent unipolar group.

There was no difference in duration of surgery, intraoperative blood loss or need for blood transfusion between these two randomized groups. Unipolar hemiarthroplasty group had one patient with deep infection at the surgical site and one patient with prosthetic dislocation, in case of bipolar hemiarthroplasty group which had two cases of prosthetic dislocation and one case of surgical site infection. However these complications were found to be statistically insignificant when compared with both groups ($p=0.3$). There was no statistically significant difference between these two groups with respect to complications like decubitus ulcers, pneumonia and cardiac complications. Out of 60 patients we did not encounter any intraoperative or postoperative periprosthetic fractures. 6 patients who underwent unipolar hemiarthroplasty had radiological signs of acetabular erosion at the end of one year however these patients had good functional outcome scores.

The average HHS were similar in unipolar and bipolar prosthesis in both the follow ups and hence no significant statistical difference between both the groups. 10% of unipolar patients showed radiological features of acetabular erosion at 12 month follow up. Although unipolar candidates had 71.4 and bipolar candidates had 78.3 HHS scores at 12 months, no significant statistical difference ($p=0.09$) was observed between the two groups.

Discussion

In our study we found that there was no significant statistical difference with respect to functional outcome scores at the end of one year between these two groups. Several studies have supported this hypothesis that there is no functional difference unipolar and bipolar hemiarthroplasty. In 1988, Cornell *et al* [22], reported no differences in functional outcome in a small study including 48 patients with a six-month follow-up which is similar compared with our results. In 1996, Calder *et al* [21], published the results of a study including 250 patients, all aged 80 years or more, with a 1.5–2-year follow-up. A higher proportion of patients returning to their preinjury condition was found in the unipolar HA group, but no other differences were found. In 2001, Davison *et al* [23], presented the results from the same study for the 187 patients aged 65–79 years with a minimum two-year follow-up. No differences between randomization groups were reported, but the interpretation is limited by the fact that 18% of the patients were lost to follow-up. Finally, in 2003, Raia *et al* [24], reported the results of a study including 115 patients randomised to a more modern cemented unipolar HA or bipolar HA with identical stems.

In this study we found that there is increased incidence of acetabular erosion at the end of one year in patients treated with unipolar hemiarthroplasty compared to patients treated with bipolar hemiarthroplasty. However there is no significant statistical difference between functional outcome scores in these two randomized groups, the functional scores in unipolar candidates was on the lower margin of fair HHS

grade 71.4 Compared to bipolar candidates having higher margin of fair HHS grade 78.3. It is difficult to compare these scores with previous studies because of use of different scoring methods and different study types which were retrospective and non randomized.

There was no significant statistical difference between unipolar and bipolar hemiarthroplasty with respect to intraoperative and early post operative complications. There are studies on earlier designs of the bipolar prosthesis showing that the bipolar HA functions as a unipolar HA a few months (3–12) after surgery [25, 26], but the results of our study, displaying a significantly higher rate of acetabular erosion in the unipolar HA group, indicate that there is a real advantage in favor of the bipolar design, which is most probably due to the function of the dual-bearing system. The other hip complications, namely, deep infection and prosthetic dislocation, were evenly distributed between the groups. The overall dislocation rate was 2.5%, which is what can be expected after an HA performed using the anterolateral approach [27], and there were no inter prosthetic dissociations in the bipolar HA group.

The advantages in this study compared to other studies watch simple randomized study design, well defined population, use of validated functional outcome scores, high follow-up rate and radiological assessment of acetabular erosion. The shortcomings of this study was, this study was not blinded which may add to risk of bias, Objective measurement of hip function prior to fracture was not available.

Hence based on these results and comparison between other studies, it is concluded that bipolar prosthesis is recommended over unipolar prosthesis hemiarthroplasty for treatment of displaced femoral neck fractures in elderly individuals.

Authors' note

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