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Prospective study of short term functional outcome in elderly patients treated with cemented vs uncemented bipolar hemiarthroplasty for transcervical neck of femur fractures

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Abstract

Objective: Transcervical femur neck fractures are common occurrences in elderly age group leading to significant impact in the health care setup. Bipolar hemiarthroplasty is the commonly performed surgery in this age group. There has been an ongoing debate based on outcome of cemented vs uncemented hemiarthroplasty. The purpose of the study is to evaluate the functional outcome with individual techniques assessed by the Harris Hip Score.

Materials and Methods: It was a single centre prospective study with the total sample size of 50. Randomisation was done into 2 groups, one to be treated with uncemented bipolar hemiarthroplasty and the other one with cemented hemiarthroplasty. The comparison was done based on the demographic data, intraoperative parameters, post-operative complications and functions. The patients were followed up till one year and functional outcome was evaluated using the Harris Hip Score.

Results: The average age of the patients in the study is 75.02 years, with most patients between 70-80 years and females (54%) being more than males (46%). Surgical time and blood loss was greater for the cemented (94.4min and 234.8ml) cohort than the uncemented (60.80 min surgical time and 183.20 ml blood loss) (p value < 0.001). However the functional outcome at the end of one year was the similar in both the study groups. Mean Harris Hip Score at 1 year for cemented group was 94.1 and uncemented group was 94.43 with p value = 0.862 (not significant).

Conclusion: Based on our results the advantages of using an uncemented hemiarthroplasty are less intraoperative bleeding, shorter duration of surgery which was statistically significant. Both cemented and uncemented hemiarthroplasty are accepted modality of treatment in transcervical femur neck fractures in elderly, as there is no statistical difference in the functional outcome at the end of one year.

Keywords: transcervical neck fractures, cemented hemiarthroplasty, uncemented hemiarthroplasty, harris hip score

1. Introduction

Femoral neck fractures are a rising problem in our aging society, frequently troubled with multiple and severe co-morbidities, and are associated with high morbidity and mortality. That with disability and mortality imposes high health care costs on the health system. Epidemiologic studies have recognized several risk factors for femoral neck fracture, including BMI < 18.5, Insufficient sunlight, low activity, smoking, history of osteoporosis related fracture, positive history of hip fracture in his or her mother and treatment with corticosteroid. The usual cause of this fracture is a simple fall in which force is transmitted from greater trochanter to femoral neck [1]. Other mechanism is leg external rotation with increased force on the capsule and iliofemoral ligament. Intracapsular femoral neck fractures account for about 50% of hip fractures. The union rate is low because of low blood supply and intracapsular situation; it is also sometimes associated with femoral head necrosis and delayed segmental necrosis. In recent years, the improvement of health services and increased life expectancy has dramatically increased the incidence of this type of fracture.

Hemiarthroplasty (HA) using modular head partial prostheses is a common surgical procedure used to treat elderly patients with femoral neck fractures. Hip hemiarthroplasty is superior to internal fixation for displaced femoral neck fractures, enabling earlier mobility, less reoperations, and better functional outcome at one year. However, controversy persists as to whether cemented or uncemented HA is preferable for elderly patients. The discussion about cemented or uncemented HA is similar to the discussion about cemented or uncemented prostheses in primary total hip arthroplasty.

There are different types of cement and uncemented bipolar prosthesis. This prosthesis has an articular surface between the head and shell and articular surface between the acetabulum and shell. Two joint prostheses are likely to reduce wear and protrusion to the acetabulum. We can use orthopedic cement for stability of stem into femoral canal to increase the stability of stem and decrease loosening rates; in contrast, this can lead to complications such as increased intraoperative bleeding and embolism.

The purpose of this prospective study is to compare a cemented and uncemented hemiarthroplasty. Considering good number of fracture neck femur encountered in our hospital, I intend to do this clinical study and results will be evaluated in comparison with Harris hip score.

Materials and Methods

Design: Single centre, Prospective study.

Place of study: Tertiary care centre in the city of Mumbai

Sample size: 25 patients with cemented hemiarthroplasty and 25 uncemented hemiarthroplasty

Sampling method: In this study, all the patients presenting with traumatic transcervical neck of fractures in elderly are included. Randomisation was done into 2 groups, one to be treated with uncemented bipolar hemiarthroplasty and the other one with cemented hemiarthroplasty.

Inclusion Criteria

1. Any individual above 60 years of age with traumatic transcervical femur neck fracture.

Exclusion criteria

1. Any individual below 59 years of age.
2. Pathological fractures.
3. Intertrochanteric femur fractures.
4. Pre-existing hip arthritis.
5. Type C Dorr canal

After approval of the ethics committee, this observational study was conducted. It involved patients posted for surgery

after satisfying the inclusion and exclusion criteria. Written valid informed consent was taken from the respective patients. At the time of admission detailed physical examination was done. Imaging studies were done i.e. anteroposterior view of pelvis with both hips and lateral films of the affected hip to diagnose the fracture. Demographic data, detailed history of symptoms and other co-morbidities were recorded. Skin traction was applied to all patients in the ward. Routine biochemical and haematological investigations were assessed.

After randomisation, the patients posted for surgery. Hip was approached posteriorly following the Southern Moore approach. Intraoperative assessment was done based on the amount of blood loss, duration of surgery, any incidence of cement reaction, periprosthetic fractures or any conversion of uncemented to cemented hemiarthroplasty.

Intravenous post-operative antibiotics were given for 3 days. Analgesics were given as per the patients' compliance. Limb length discrepancy was noted. VAS (Visual Analogue Scale) score of the patient was noted for all post-operative patients. Patients were made to sit up on the second day, encouraged to perform static and dynamic quadriceps exercise, stand-up with support (walker) on the first or second day (full weight bearing for the cemented group and partial weight bearing for the uncemented group) and were allowed to walk with the help of a walker depending on his/her pain tolerance and were encouraged to walk thereafter. Post-operative radiograph was taken as antero-posterior view of pelvis with both hips. Drain removal was done after 48 hours. Sitting cross-legged and squatting were not allowed. Suture removal was done on the fifteenth postoperative day. Patients were asked to come for follow up after one month, 3 months, sixth month and one year. At follow up, detailed clinical examination was done systematically. Infection was ruled out. Patients were evaluated according to Harris hip scoring system for pain, limp, the use of support, walking distance, ability to climb stairs, ability to put on shoes and socks (in our study for some patients ability to wash feet was enquired) sitting on chair, ability to enter public transportation, deformities, leg length discrepancy and movements. All the details were recorded in the follow up chart. The radiograph of the operated hip was taken at regular intervals, at each follow up. X-Rays were taken to rule out any loosening, subsidence, periprosthetic fractures.

Total Functional outcome was graded at each follow up based on Harris Hip Score.

Poor – Harris Hip Score <70

Fair – Harris Hip Score 70-80

Good – Harris Hip Score 80-90

Excellent – Harris Hip Score >90

Harris Hip assessment tool**I. Pain (44 possible)**

- A) None or ignores it 44
 B) Slight, occasional, no compromise in activities 40
 C) Mild pain, no effect on common activities, rarely moderate pain with unusual activity, may take simple pain medication 30
 D) Moderate pain, tolerable, accepts limitations caused by pain. Some limitation of common activities or work. Occasionally takes pain medication stronger than aspirin 20
 E) Pronounced, serious limitation of activities 10
 F) Totally disabled, crippled, pain in bed, bedridden 0

II. Function (47 possible)**A. Gait (33 possible)**

1. Limp
 a) None 11
 b) Slight 8
 c) Moderate 5
 d) Severe 0
2. Support
 a) None 11
 b) Cane for long walks 7
 c) Cane most of the time 5
 d) One crutch 3
 e) Two canes 2
 f) Two crutches 0
 g) Not able to walk 0
 (specify reason: _____)

2. Shoes and socks

- a) With ease 4
 b) With difficulty 2
 c) Unable 0

3. Sitting

- a) Comfortably in ordinary chair one hour 5
 b) On a high chair for one half hour 3
 c) Unable to sit comfortably in any chair 0

4. Enter public transportation 1

III Absence of deformity points (4) are given if the patient demonstrates:

- A) Less than 30° fixed flexion contracture
 B) Less than 10° fixed adduction
 C) Less than 10° fixed internal rotation in extension
 D) Limb length discrepancy less than 3.2 centimeters

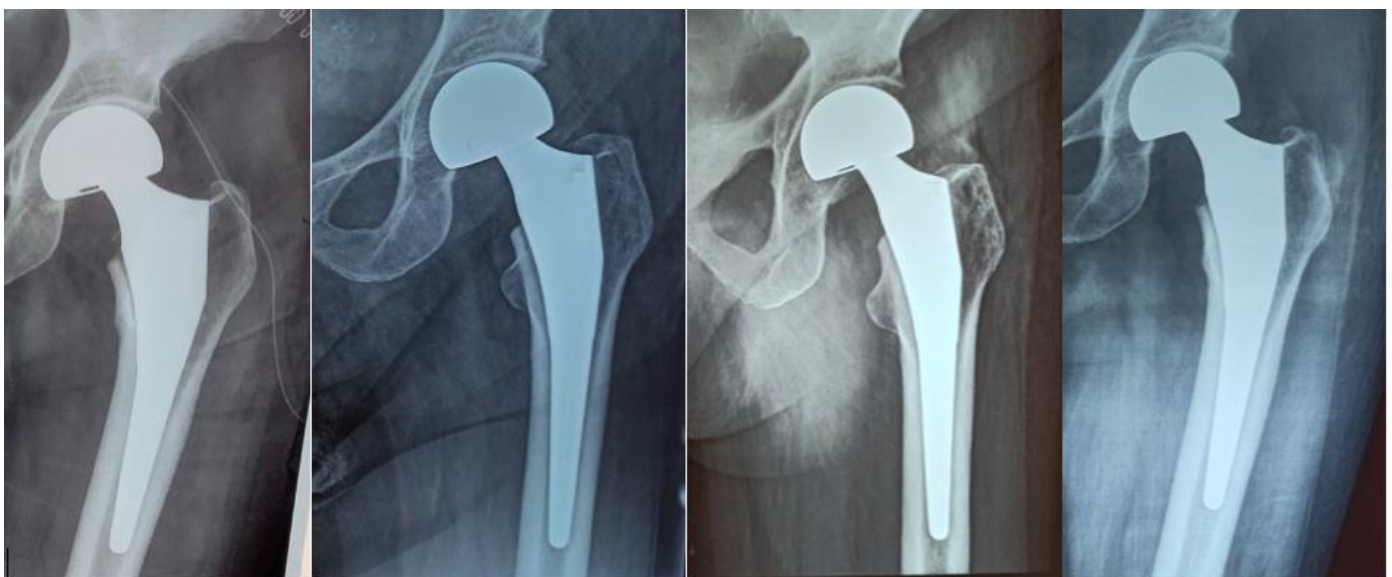
IV. Range of motion (index values are determined by multiplying the degrees of motion possible in each arc by the appropriate index)

A. Flexion

- 0—45 degrees X 1.0
 45—90° X 0.6
 90—110° X 0.3

B. Abduction

- 0—15° X 0.8
 15—20° X 0.3
 over 20° X 0

Fig 1: Harris Hip Assessment Tool**Fig 2:** Post-operative and follow up (1, 3, 12 months) radiographs of a case treated with uncemented hemiarthroplasty

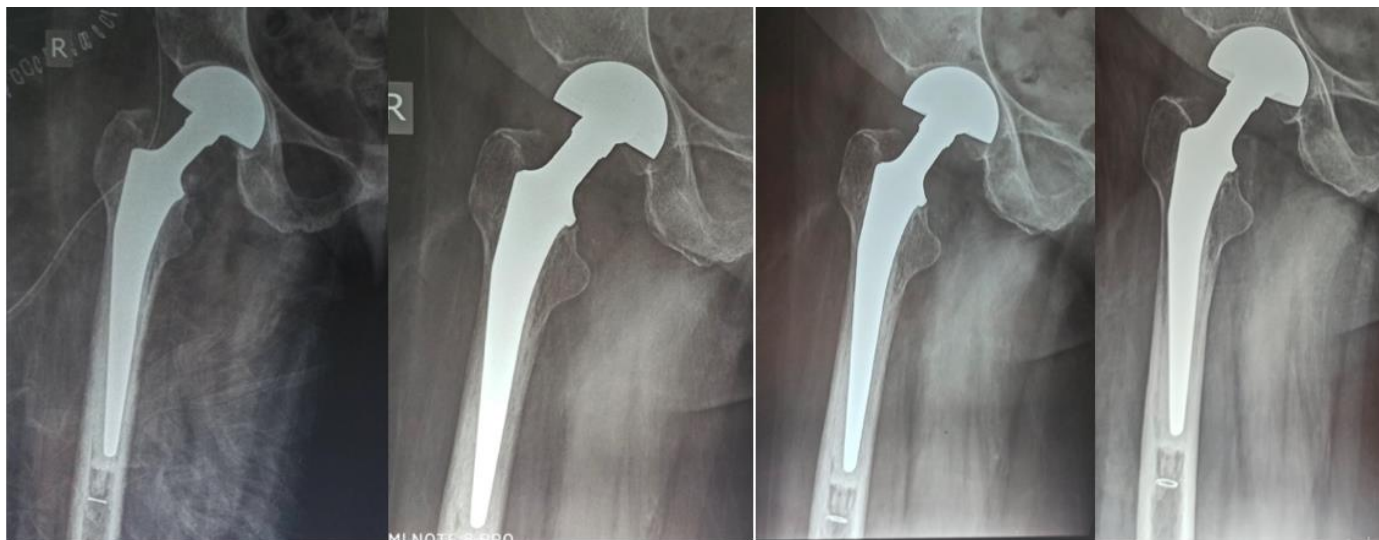


Fig 3: Post-operative and follow up (1, 3, 12 months) radiographs of a case treated with cemented hemiarthroplasty



Fig 4: Picture showing functional outcome at one year follow up

Results

The average age of the patients in the study is 75.02 years, with most patients between 70 -80 years. Maximum age was

87years and minimum age of 64 years. The Mean age in cemented group was 75.56 years (SD-4.86). The Mean age in uncemented group was 74.48 years (SD-7.73). Total number of females in the study were 27 (54%) and number of male were 23 (46%). Out of 50 patients, 27 patients had trauma to right side and 23 had trauma to the left side. Majority of the patients had trauma due to fall at home due to slip in the bathroom or while walking (84%). 16 percent of patients had history of road traffic accident. On an average patients were operated after 5.8 days after trauma in both the groups.

In the cemented group the mean duration of surgery was 94.40 minutes with a mean amount of blood loss of 235.80 millilitres, whereas in the uncemented group the mean duration of surgery was 60.80 minutes and mean amount of blood loss being 183.20 millilitres . Surgical time and blood loss was greater for the cemented cohort than the uncemented. The difference between the groups was significant (P= 0.0001). All the cases were stable intraoperatively. There were no cases of intraoperative dislocation or peri prosthetic fracture. there were no conversion of uncemented bipolar hemiarthroplasty to cemented ones.

Table 1: Comparison of Operative Time and Blood Loss between Cemented and Uncemented Groups (N=50)

Parameter	Group		P Value
	Cemented (n=25) n (%)	Uncemented (n=25) n (%)	
Operative Time (min)	94.40 (12.18)	60.80 (11.42)	<0.001*
Blood Loss (ml)	235.80 (37.46)	183.20 (29.11)	<0.001*
Unpaired t Test, P Value *Significant			

In the cemented group, 24 percent of patients had VAS (Visual Analogue Scale) score of 4 , 64 per cent had VAS 5, and 12 percent had VAS 6 . In the uncemented group, 44 percent had VAS 4, 44 percent had VAS 5, and 12 percent of patient had VAS 6.

Superficial infection was seen in 3 cases (12%) of cemented bipolar hemiarthroplasty and 2 cases (8%) of uncemented hemiarthroplasty which was treated with surgical debridement and intravenous antibiotics, followed by oral antibiotics. There was one case of deep infection in cemented group who expired during the course of treatment. There were total 4 cases (16%) of mortality in cemented group and 2 cases (8%) in uncemented group. There were no cases of bone cement implantation syndrome. There were no cases of postoperative

periprosthetic fractures, dislocations, deep vein thrombosis, loosening or subsidence.

The Mean Harris Hip Score at first month for cemented group (73.68) was slightly better (although insignificant as p value < 0.05) than uncemented group (71.28), due to the early full weight mobilization for the cemented group. The Mean Harris Hip Score of cemented group was 83.09 (good) and uncemented group was 86.88 (good) (Unpaired t Test, P Value = 0.365, Not Significant). The Mean Harris Hip Score of cemented group was 91.75 (excellent) and uncemented group was 93.17 (excellent) (Unpaired t Test, P Value = 0.521, Not Significant)

However at the end of one year the mean Harris Hip Score of cemented (94.1) and uncemented group (94.43) was similar (P

Value = 0.862, Not Significant). 15 patients (71.43%) in the cemented group had excellent outcome and 6 patients (28.57%) had good outcome. 16 patients (69.57) in the uncemented group had excellent outcome and 7 (30.43%) patients had good outcome.

Table 2: Comparison of Mean Harris Hip Score between Cemented and Uncemented Groups at different time intervals (N=50)

Interval	Mean Harris hip score (cemented)	Mean Harris hip score (uncemented)
1 month	73.68 (Fair)	71.28 (Fair)
3 rd month	83.09 (Good)	86.88 (Good)
6 th month	91.75 (Excellent)	93.17 (Excellent)
12 th month	94.10 (Excellent)	94.43 (Excellent)

Table 3: Comparison of Harris Hip Score at 12 months Post-op between Cemented and Uncemented Groups (N=50)

Harris Hip Score	Group	
	Cemented (n=25) n (%)	Uncemented (n=25) n (%)
80-90 (Good)	6 (28.57)	7 (30.43)
90-100 (Excellent)	15 (71.43)	16 (69.57)
Mean (SD)	94.10 (6.63)	94.43 (5.92)
Unpaired t Test, P Value = 0.862, Not Significant		

Discussion

With the trend of global aging, femoral neck fractures have become an increasingly serious problem for elderly patients. Hemiarthroplasty, as an effective treatment, can help resume the walking ability as soon as possible, thereby reducing the risk of respiratory infection and urinary tract infection. In elderly patients with a displaced femoral neck fracture hemiarthroplasty is therefore the widely accepted treatment of choice. Comparisons between cemented hemiarthroplasty and uncemented hemiarthroplasty have mostly favoured cemented fixation because of superior outcome in pain relief, better postoperative hip function recovery, less prosthesis loosening and periprosthetic fractures [2]. On the other hand, many hip fracture patients have significant cardiovascular and cerebral co-morbidities with little functional reserve. In these frail patients, operative time and blood loss can influence outcome. Therefore, some surgeons prefer to apply the uncemented hemiarthroplasty technique because they believe it can reduce operation time, and intraoperative blood loss. In addition, there is considerable evidence that cementing has potential physiologically adverse side effects.

In our study, the average age incidence of the patients was 75.02 years, with most patients (68%) between 70 -80 years. It was comparable to various studies, mean age in the study of Wender Fivved [3] *et al* was 70 years, mean age incidence in Li-Xing *et al.* [4] study was 78 years.

Total number of females in the study were 27 (54%) and number of male were 23 (46%). There is a slightly higher incidence of female in the study. Female preponderance has been reported in several series Moore [5] 1957: 62.5%, Campbell (1960): 80.9%, Anderson & Neilson [6] (1972): 85%.

Majority of the patients (84%) had trauma due to fall at home due to slip in the bathroom or while walking. This is in accordance with majority of the series reported – Ingahalikar [7] (1987), Seth [8] (1987), Scott and Gray (1980), Evarts [9] (1973).

In the cemented group the mean duration of surgery was 94.40 minutes (SD-12.18) with a mean amount of blood loss of 235.80 millilitres (SD-37.46), whereas in the uncemented

group the mean duration of surgery was 60.80 minutes (SD-11.42) and mean amount of blood loss being 183.20 millilitres (SD-29.11). Surgical time and blood loss was greater for the cemented cohort than the uncemented. The difference between the groups was significant (P<0.0001). Wender Figved MD *et al.* [3] reported duration of 70.2 min with a blood loss of 300ml in uncemented group and 82.6 min with a blood loss of 390ml in the cemented group. Jaimo Ahn MD, PhD, Li-Xing Man MD *et al.* [4] in their study recorded two operative parameters of blood loss and surgical time was lower for the uncemented cohorts. The weighted average blood loss was 476 mL for the cemented and 338 mL for the uncemented groups. Surgical time was greater for the cemented cohort than the uncemented (95 minutes versus 80 minutes, respectively).

All the cases were stable intraoperatively . There were no cases of intraoperative dislocation or peri prosthetic fracture. There were no conversion of uncemented bipolar hemiarthroplasty to cemented ones. R.J.K. Khan *et al.* [10] reported three iatrogenic periprosthetic fractures, all occurring in the uncemented group. Foster *et al.* [11] in 2005 from Northern Ireland (15). In their retrospective analysis of 244 patients of which 70 patients had uncemented prosthesis, 7% (5/70) of patients with uncemented prosthesis suffered a periprosthetic fracture. Wender Figved MD *et al.* [3] reported Intraoperative periprosthetic fracture one case (0.9%) in cemented group & 2(1.9%) in uncemented groups. There was no cases reported in our study studies have reported higher rates of intraoperative periprosthetic fracture in uncemented hemiarthroplasty.

There were 16% (4 cases) of cemented and 8% (2 cases) of uncemented cases were infection . The cemented group had slightly higher number of infection, although the P value is not less than 0.001, so it is not significant. Wender Figved MD *et al.* [3] in his study reported only one case of superficial infection (0.9%) in the cemented group.

There were no cases of dislocation in our study. Manoj Kumar Rajak *et al.* reported 3% prosthesis dislocation following bipolar hemiarthroplasty [12]. Unwin *et al.* reported a 6.5% dislocation rate among all their patients, with those having posterior approaches being three times more likely to dislocate [13].

There were total 4 cases (16%) of mortality in cemented group and 2 cases (8%) in uncemented group. No cases of intraoperative cardiac arrest or perioperative myocardial infarction leading to death which was seen in our study. D'Angelo *et al.* reported 25% one year follow up mortality rate following hemiarthroplasty [14]. Eiskjar reported 20% mortality rate at six months and 28% mortality rate at one-year.

Though the cemented group had better functional outcome (although insignificant) in terms of Harris Hip Score at the first month, over the period at the end of one year the functional outcome of the two groups are similar.

One year Harris Hip Score results were equivalent and there were no differences in ability to walk, use of analgesics, or place of living in both the groups in the study reported by Wender Figved MD *et al.* [3]. Deangelis JP *et al.* [15] concluded in the treatment of non-pathologic displaced femoral neck fractures, the use of cemented and uncemented femoral components is associated with similar functional outcome at 1 year. At 30-day, 60-day, and 1-year follow-ups, no clinically or statistically significant differences were found in mortality, disposition, need for assistance with ambulation.

M. I. Parker, MD *et al.* [16] in their study noted no statistically significant difference between the cemented and the uncemented groups with regard to mortality, implant-related complications, re-operations or post-operative medical complications.

According to Veldman *et al.* [17] systematic review and meta-analysis to compare the outcomes of cemented and cement less hemiarthroplasty of the hip, in elderly patients with a fracture of the femoral neck, there was no statistically significant difference for any other outcome between the two methods of fixation. In hemiarthroplasty of the hip using current generation stems, cemented stems result in fewer implant-related complications and similar mortality compared with cement less stems.

Conclusion

Hip fractures in the elderly represent a major public health concern. Fracture neck of femur is a geriatric disease more so common in elderly females. Based on our results the advantages of using an uncemented hemiarthroplasty are also less intraoperative bleeding, shorter duration of surgery which was statistically significant. Complications like infection were distributed in both cemented and uncemented hemiarthroplasty groups and were statistically insignificant. The functional outcome at the end of one year is similar in both the groups.

Based on results of this prospective study it could be concluded, that both cemented and uncemented hemiarthroplasty are accepted modality of treatment in transcervical femur neck fractures in elderly age group, as there is no statistical difference in the functional outcome (Harris Hip Score) at the end of one year.

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