

## Cemented Versus Un-Cemented Hemiarthroplasty Management of Fracture Neck of Femur: A Comparative Study

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### Abstract

**Aim:** The study has been carried out to study the advantages, complications, morbidity and mortality rates, the recovery to physical independence encountered in each of the procedure and to draw a conclusion based on study results as to which of the above type of implant and type of fixation would be better in the management of fracture neck of the femur for elderly.

**Methods:** The prospective comparative study was conducted in the Department of Orthopaedics, institute of medical sciences BHU, Varanasi, Uttar Pradesh, India for nine months included 50 cases of intracapsular fracture neck of femur in the elderly aged more than 60 years where 25 patients were treated by hemiarthroplasty using uncemented fenestrated prosthesis whereas 25 patients were treated with hemiarthroplasty using cemented non-fenestrated prosthesis.

**Results:** 50 patients with fracture neck femur were operated on for hemiarthroplasty, cemented or uncemented, during the study period. The mean age was  $66.30 \pm 5.78$  years with the cemented cohort and  $64.36 \pm 6.20$  years in the uncemented cohort. Of these, 22 (44%) were men and 28(56%) were female. The most common mechanism of injury was a trivial fall (88%) as opposed to a road traffic accident (12%).

**Conclusion:** Bipolar hemiarthroplasty whether cemented or uncemented is an excellent treatment for fracture neck femur. No significant difference between both methods in terms of functional outcome. Cemented hemiarthroplasty results in more blood loss and takes more operative time but is associated with less post-operative pain and complication and better functional outcome.

**Keywords:** Cemented, Displaced Femoral Neck Fractures, Hemiarthroplasty, Uncemented

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### Introduction

The fracture neck of the femur is associated with one of the most serious health problems affecting the geriatric population. It is associated with a high risk

of morbidity, low quality of life, and premature mortality. It has always presented great challenges for orthopedic surgeons. The incidence of hip fractures is

159/100,000 population in India and out of these 50% are fracture neck of the femur. [1] Non-operative treatment of fracture neck of femur includes bed rest with or without traction. This results in the increased incidence of non-union, secondary displacement, and avascular necrosis. [2]

Surgical treatment is the open or close reduction and internal fixation using cannulated screws or sliding hip screw. Sometimes this is associated with non-union, AVN, Implant failure. Reconstruction options include hemiarthroplasty (HA) - unipolar or bipolar and total hip arthroplasty. [2,3] In cemented hemiarthroplasty, polymethylmethacrylate bone cement is used during surgery to create a solid bone-implant interface. Cemented bipolar prosthesis is associated with less post-operative thigh pain, as the prosthesis is firmly fixed within the femur. [3] Bone Cement Implantation Syndrome (BCIS) is side effect of using cement. The syndrome is potentially life threatening and is characterized by hypoxia and/or hypotension in combination with an unexpected loss of consciousness. However, advantages are early ambulation.

Uncemented hemiarthroplasties are placed press-fit in the femur. In the weeks after the surgery, the bond between the femur and the stem is dependent on osseous integration. However, bone quality is generally poor in the elderly, which may lead to periprosthetic fractures during press-fit placement or inadequate bony ingrowth post-operatively, [4] loosening of the implant, pain, and gait abnormality.

A femoral neck fracture is more common in females and the mean age of onset is 81 years that with disability and mortality impose high health care costs on the health system. The risk of femoral neck fracture is about 40-50% in females and 13-22% in males. [5] 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 a corticosteroid. The usual cause of this fracture is a simple fall in which force is transmitted from the greater trochanter to the femoral neck. [6] Other mechanism is leg external rotation with increased force on the capsule and iliofemoral ligament. [7]

An arthroplasty using a cemented implant may be associated with increased mortality compared with an arthroplasty using an uncemented implant. Cementation of prosthesis achieves a good initial fix in an osteoporotic bone, however, arthroplasty using a cemented implant may be associated with increased mortality compared with an arthroplasty using an uncemented implant, as it has the risk of bone marrow and fat embolization with resulting intra-operative hypotension and increased incidence of deep vein thrombosis. The mechanisms involved are not fully understood but involve cardiorespiratory disturbances caused by venous and pulmonary embolization of bone marrow contents and methyl methacrylate particles. [8] An uncemented implant may be associated with design-specific complications such as stress shielding, thigh pain, and a higher risk of periprosthetic fracture. This may be the result of the inferior method of fixation or the design of the prosthesis. Although hemiarthroplasties are an important treatment for femoral neck fractures, the literature does not provide a clear approach for selecting the implant fixation method. [9]

Whether a specific type of hemiarthroplasty using an uncemented implant could yield the same clinical results as a hemiarthroplasty using a cemented implant for treatment of displaced femoral neck fracture is unclear.

The purpose of this prospective study is to compare a hemiarthroplasty using a well-documented cemented implant with a hemiarthroplasty using a well-documented uncemented implant.

The study has been carried out to study the advantages, complications, morbidity and mortality rates, the recovery to physical independence encountered in each of the procedure and to draw a conclusion based on study results as to which of the above type of implant and type of fixation would be better in the management of fracture neck of the femur for elderly.

### Materials and Methods

The prospective comparative study was conducted in the Department of Orthopaedics, institute of medical sciences BHU, Varanasi, Uttar Pradesh, India for nine months included 50 cases of intracapsular fracture neck of femur in the elderly aged more than 60 years where 25 patients were treated by hemiarthroplasty using uncemented fenestrated prosthesis whereas 25 patients were treated with hemiarthroplasty using cemented non-fenestrated prosthesis.

### Methodology

Patients of age more than 60 years with the closed displaced neck of femur fracture were included in this study. Patients with basicervical neck femur fracture, valgus impacted fracture, pathological fracture,

associated with other fractures such as ipsilateral shaft femur fracture and acetabulum fracture, active infection around the hip, and surgically unfit patients were excluded from the study.

The Ethical clearance was obtained from the ethical committee and written informed consent was obtained from patients participating in the study. Follow-up was performed at 1 month, 3 months, 6 months, and 1 year after the surgery. The intensity of the pain (based on visual analog scale), hip function (according to Harris hip score), radiological signs of patient's x-ray (the presence or absence of acetabular erosion, loosening of the prosthesis, heterotopic ossification), and postoperative complications were recorded. All data including age, sex, type of treatment, intraoperative bleeding volume, the mortality rate (during surgery until discharge), and treatment costs were collected by a questionnaire and checklist and analyzed by SPSS-19. Frequency, ratio, a mean, and standard deviation of variables were calculated, to compare quantitative variables for which chi-square was used. Binary variables were analyzed by Fisher's exact test, and continuous outcomes were analyzed with the use of the Student's t-test (two-tailed).  $P < 0.05$  was considered significant for all analyses.

### Results

**Table 1: Demographic variables of two groups of study patients**

| Variables                 | Uncemented (N=25) | Cemented (N=25)  | P-value |
|---------------------------|-------------------|------------------|---------|
| Age(year) (Mean $\pm$ SD) | 64.36 $\pm$ 6.20  | 66.30 $\pm$ 5.78 | 0.070   |
| Male (%)                  | 12(48)            | 10(40)           | 0.720   |
| Female (%)                | 13(52)            | 15(60)           |         |
| Right side (%)            | 11 (44)           | 9 (36)           | 0.450   |
| Left side (%)             | 14 (56)           | 15 (60)          |         |
| Garden Type 3             | 10 (40)           | 8 (32)           | 0.550   |
| Garden Type 4             | 15 (60)           | 17 (68)          |         |
| Injury due to fall        | 20 (80)           | 22 (88)          | 0.620   |
| Injury due to RTA         | 5 (20)            | 3 (12)           |         |

50 patients with fracture neck femur were operated on for hemiarthroplasty,

cemented or uncemented, during the study period. The mean age was 66.30  $\pm$

5.78years with the cemented cohort and  $64.36 \pm 6.20$ years in the uncemented cohort. Of these, 22 (44%) were men and 28(56%) were female. The most common

mechanism of injury was a trivial fall (88%) as opposed to a road traffic accident (12%).

**Table 2: Comparison between total functional outcomes at 12 months**

| Criteria  | Uncemented |            | Cemented  |            |
|-----------|------------|------------|-----------|------------|
|           | Frequency  | Percentage | Frequency | Percentage |
| Excellent | 6          | 24         | 5         | 20         |
| Good      | 8          | 32         | 10        | 40         |
| Fair      | 5          | 20         | 5         | 20         |
| Poor      | 6          | 24         | 5         | 20         |
| Total     | 25         | 100        | 25        | 100        |

Total Functional outcome at 12 months by Harris Hip Score follow up was found to be statistically insignificant. In the uncemented cohort, 6 patients (24%) had excellent results; 8 patients (32%) had good results and 5 patients (20%) had fair

results and 6 patients (24%) had poor results; whereas in the cemented cohort, 5 patients (20%) had excellent results; 10 patients (40%) had good results; 5 patients (20%) had fair results and 5 patients (20%) had poor functional result.

**Table 3: Distribution of complications in both the groups**

| Complications           | Uncemented |            | Cemented  |            |
|-------------------------|------------|------------|-----------|------------|
|                         | Frequency  | Percentage | Frequency | Percentage |
| Death                   | 0          | 0          | 0         | 0          |
| Periprosthetic fracture | 3          | 12         | 0         | 0          |
| Deep Infection          | 0          | 0          | 0         | 0          |
| Superficial Infection   | 2          | 8          | 1         | 4          |
| Dislocation             | 0          | 0          | 1         | 4          |
| Bedsore                 | 3          | 12         | 2         | 8          |
| BCIS                    | 0          | 0          | 1         | 4          |
| Sciatic Neuropraxia     | 0          | 0          | 1         | 4          |

The intraoperative and postoperative total complication rate was 24% in cemented cohort and 32% in the uncemented cohort which was not statistically significant [Table 4] ( $P < 0.05$ ).

### Discussion

Hemiarthroplasty is the most commonly used treatment for displaced femoral neck fractures in the elderly. Although the number of randomized trials is increasing, there are still problems with diversity of implants that are studied, short follow-up time, and interpretation of functional results versus reoperation and, maybe most important, rates of subsequent fractures. [10,12,13]

Many types of arthroplasties are used to treat displaced fractures of the femoral neck in the elderly. [11] There is some evidence of inferior short-term results with decreased mobility and pain when using an uncemented implant, but the diversity of implants used in clinical trials represents a problem. [10]

Neck of femur fractures is common injuries among elderly people and often due to trivial fall. The most common treatment for a displaced femoral neck fracture in the elderly is hemiarthroplasty. The most common fixation method of the femoral stem has been cementing with PMMA bone cement. However, this method has some disadvantages. The

duration of surgery is longer than in uncemented techniques. Blood loss is higher and there is a risk of sudden death due to BCIS. There exists a debate about the superiority of the cemented and uncemented prosthesis. In this context, we undertook the present study to evaluate the immediate results of a comparative study of an uncemented hemiarthroplasty with cemented hemiarthroplasty in the geriatric population. The results were analyzed and observations were made. This study was comparable with similar studies.

Figved et al, [14] found after comparing a cemented hemiarthroplasty with an uncemented, hydroxyapatite-coated implant that mean Harris hip score showed equivalence between the groups throughout the follow-up period of 1 year. In the uncemented group, the mean duration of surgery was shorter and the mean intraoperative blood loss was found to be less.

Lo et al, [15] found less thigh pain (13% versus 46.2%) and higher Harris hip scores (86 versus 79) in the cemented group in comparison with the uncemented group. In the cemented group, radiology revealed fewer radiolucent zones and prosthesis subsidence. Heterotopic ossification was more common in the cemented group.

A meta-analysis study by Li et al, [16] found that the operative time of cemented hemiarthroplasty was more than that of uncemented and was statistically significant. Blood loss during surgery was higher in cemented hemiarthroplasty but was statistically insignificant. Better functional outcome in terms of HHS was found to be higher for cemented hemiarthroplasty and was statistically significant.

A meta-analysis study by Ning et al, [17] compared cemented with uncemented hemiarthroplasty. Operative time of cemented hemiarthroplasty was more but was statistically insignificant. They did not find any statistical difference between the

two groups in terms of blood loss, residual thigh pain, complication, and mortality rates.

In our study, improvement in terms of functional outcome (HHS) and pain score (VAS) was observed from 1 month to 12 months in both cemented and uncemented hemiarthroplasty but was not found to be statistically significant. Cemented Hemiarthroplasty takes more operative time and more blood loss when compared to uncemented. This was found to be statistically significant. Other studies showed similar results were done by Figved et al, [14] Xing Man et al, [18] and Lo et al. [15,19]

### Conclusion

Bipolar hemiarthroplasty whether cemented or uncemented is an excellent treatment for fracture neck femur. No significant difference between both methods in terms of functional outcome. Cemented hemiarthroplasty results in more blood loss and takes more operative time but is associated with less post-operative pain and complication and better functional outcome. For treatment of displaced femoral neck fractures, we recommend performing hemiarthroplasties using femoral stems that have performed well in THAs. Cemented and uncemented prostheses used in this trial can be recommended because they were equally good regarding functional outcome and health-related quality of life, contrary to the generalized and limited published evidence.

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