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## Comparison between cemented and un-cemented hemiarthroplasty among the patients with fracture neck of femur

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### Abstract

**Background:** Hemiarthroplasty has been accepted as the treatment of choice for displaced femoral neck fractures. In the recent years the use of bone cement in hemiarthroplasty had become a controversial topic as few studies had recommended the use of uncemented hemiarthroplasty because of its minimal complications.

**Aim:** To compare and assess the efficacy of cemented and uncemented bipolar hemiarthroplasty prosthesis among patients with femoral neck fractures.

**Methodology:** A prospective comparative study was conducted at our hospital from the department of Orthopaedics for a period of one year. Patients aged more than 18 years of age of any gender with fracture neck of femur were included as study subjects. A total of 60 patients were included as our study subjects. It was divided into two groups of 30 each, one group received the cemented and the other group underwent an uncemented hemiarthroplasty. Patients were followed up on the 6<sup>th</sup> postoperative week for radiological assessment of the implant position and further advised for complete weight bearing as tolerated. Subsequently patients were followed up at 3<sup>rd</sup> and 12<sup>th</sup> month. At each visit patient was assessed for recovery based on Harris hip score which includes post operative pain, return to activities of daily living, shortening of limb, range of movements, deformity and gait.

**Results:** The duration of surgery was found to be longer in the cemented group with a mean duration of 82.8 mins and among the un-cemented group it was 63.6 mins. The intra-operative blood loss in 60% of the patients among the cemented group had more than 300 ml whereas among the un-cemented group it was only 13.3% had more than 300 ml of blood loss. The mean Harris hip score at the end of 12 months among the cemented group was 81.6 and among the un-cemented group it was 79.07 and both the groups showed a statistical significant improvement in their scores when compared to the score at 3 months whereas no significant difference observed in the scores between the two groups.

**Conclusion:** Both the cemented and uncemented hemiarthroplasty are equally good options in the treatment of fracture neck of femur among elderly patients with minimal complications among the two methods. More data comparing uncemented and cemented hemiarthroplasty in patients with femoral neck fracture are still needed to substantiate our findings.

**Keywords:** Fracture neck of femur, cemented hemiarthroplasty, uncemented hemiarthroplasty, Harris hip score

### Introduction

India being a country with more than 10% of geriatric population and among the various morbidities in them, fracture neck of femur is one of the major public health problem.

The lifetime risk of these fractures is 9% in a female of 50 years age but rises to 12% at 70 years and 18% by 90 years [1]. The limited and unprotected blood supply to the femoral head, the intra capsular location of these fractures and osteoporosis are the major factors that inhibit healing leading to avascular necrosis of femoral head [2]. Surgery being the first choice of treatment for femoral neck fractures, internal fixation which was initially introduced had a high failure rate resulting in complications like nonunion and avascular necrosis [3]. These complications were addressed with the advent of hemiarthroplasty surgery for fracture neck of femur. Although some authors have reported better results with internal fixation, still hemiarthroplasty had been accepted as the treatment of choice for displaced femoral neck

fractures. Total hip arthroplasty is an alternative for active patients with a long life expectancy and arthritic joints [4]. In the recent years the use of bone cement in hemiarthroplasty had become a controversial topic as few studies had recommended the use of uncemented hemiarthroplasty because of its minimal complications.

Cementing has potential physiologically adverse side effects. The major side effects cardiac arrhythmias and cardio-respiratory collapse, which occasionally occur upon in cementing are potentially fatal complications are caused either by embolism from marrow contents forced into the circulation or by a direct toxic effect of the cement [5]. A study done by Clark *et al* had found a transient but significant reduction in cardiac output and stroke volume for those receiving cement [6].

There is some evidence of inferior short-term results, with decreased mobility and more pain when using an uncemented implant, and concerns regarding fixation problems with uncemented stems in osteoporotic bone have been raised. This may be the result of the inferior method of fixation or the design of the prosthesis [7, 8].

The recent introduction of modular hemiarthroplasty for hip fractures had led to a number of prospective trials comparing cemented and uncemented hemiarthroplasty and had shown a very similar results for both the procedures. However a recent registry based study comparing (mostly modular) cemented and uncemented hemiarthroplasty, more reoperations were detected in patients treated with uncemented hemiarthroplasty [9-11]. These studies, though they had compared many variables of the two techniques using meta-analysis still it needs to be improved in certain aspects. Firstly, predictable bias from quasi-RCTs or non-RCTs exists in all the above mentioned studies. Secondly, complications of cemented and uncemented hemiarthroplasty have not been stratified before comparison and lastly the study which was published in 2012 have not been enrolled in any meta-analysis [12]. In India as of today very few studies were conducted in comparing the cemented and uncemented hemiarthroplasty and so this study was undertaken to assess the efficacy between these two techniques.

### Aim

To compare and assess the efficacy of cemented and uncemented bipolar hemiarthroplasty prosthesis among patients with femoral neck fractures.

### Methodology

A prospective comparative study was conducted at our hospital from the department of Orthopaedics for a period of one year. The study was started after getting the clearance from the institutional ethical committee. Patients aged more than 18 years of age of any gender with fracture neck of femur were included as study subjects. Patients with very severe trauma associated with head injuries, patients with preexisting sepsis and those who were bedridden before injury for any other causes were excluded from the study. A total of 60 patients were reported in the above mentioned study period satisfying our inclusion and exclusion criteria. It was divided into two groups of 30 each, one group received the cemented and the other group underwent an uncemented hemiarthroplasty. Informed consent from all the patients involved in the study. Complete medical evaluation was carried out to rule out any underlying medical illness and the pre anesthetic evaluation was done by the anesthesiologist. Patient is then subjected to surgery under appropriate

anesthesia. Patients underwent a bipolar hemiarthroplasty with either a cemented or an uncemented prosthesis. The arthroplasties were performed through a posterior approach with the patient in a lateral decubitus position using spinal anaesthesia. Using box osteotome, femoral canal was prepared, taking care to lateralize the implant. Femoral canal is broached serially and the most snugly fitting femoral stem was taken as the femoral stem size. Depending upon appropriate size modular bipolar implant was placed. In the cases of cemented hemiarthroplasty, appropriate quantity of cement after preparation was placed into the canal before placing the femoral stem. The polymethyl-metacrylate cement was used as cemented stem among the cemented arthroplasty group. Post-operatively all the vital parameters were monitored adequate blood transfusion was made for the needed patients along with antibiotic and DVT prophylaxis. Pain management was done by injectable NSAID's.

Static quadriceps exercises were started and patients were made to sit up on bed on first post operative day. Gait training exercises was started on the 3rd post-operative day. Patients were discharged after suture removal on the 12<sup>th</sup> post-operative day. Patients were followed up on the 6<sup>th</sup> postoperative week for radiological assessment of the implant position and further advised for complete weight bearing as tolerated. Subsequently patients were followed up at 3<sup>rd</sup> and 12<sup>th</sup> month. At each visit patient was assessed for recovery based on harris hip score which includes post operative pain, return to activities of daily living, shortening of limb, range of movements, deformity and gait. Radiological assessment was done for assessing the signs of loosening, migration, wear and implant failure.

All the data were entered and analysed using SPSS version 21. Mean and standard deviation was derived for all the parametric variables. Chi-square was used to assess the association between the qualitative variables. The mean scores of both the groups were compared and analysed using T test for deriving statistical inference.

### Results

Table 1 shows the age and sex wise distribution of the study subjects among the cemented and un-cemented group. It is seen from the table that the majority of the study subjects are in the age group between 70 and 80 years and the distribution of age and gender was almost similar in both the groups, whereas the females were more than males in both the groups and the difference was found to be statistically significant. The mean age was 72.6 in cemented group and it was 73.8 in un-cemented group. All our patients in both the groups sustained the injury following a trivial trauma. Only two patients in the cemented group and one patient in the un-cemented group had the hemoglobin levels of less than 9gms% and the prevalence of diabetes was 22% in cemented group and 26% in un-cemented group. The average time interval between the incident of injury and surgery was around 6 to 7 days in both the groups and the maximum interval was 14 days (table 2). The duration of surgery was found to be longer in the cemented group with a mean duration of 82.8 mins and among the un-cemented group it was 63.6 mins and among the un-cemented group 36% of the subjects underwent the surgery in less than 60 mins, whereas among the cemented group more than 70% had the duration of more than 80 mins and the difference in duration of surgery between the two groups was found to be statistically significant (table 3).

The intra-operative blood loss in 60% of the patients among the cemented group had more than 300 ml and 6.6% of them had more than 500 ml compared to the un-cemented group where it was only 13.3% had more than 300 ml of blood loss and the remaining patients had a blood loss of between 150 – 300 ml and the difference was found to be statistically significant (table 4). The functional outcome of the patients who had undergone hemiarthroplasty were measured in terms of pain, limp, use of cane and the range of movements at the end of 12 months. It was found that at the end of 12 months 83% of the subjects in cemented group had nil pain compared to only 63% in the un-cemented group and the difference was found to be statistically significant. A mild limp gait was observed in equal numbers at the end of 12 months in both the groups. Majority of the subjects in the un-cemented group had used cane for long walks (73.3%) compared to only 53% in the cemented group and the difference was found to be statistically significant. Among the different range of movements like flexion, abduction and rotation we did not find a statistically significant difference between the cemented and un-cemented group (table 5). The Harris hip score comparison between the cemented and un-cemented group at the end of 3<sup>rd</sup> and 12<sup>th</sup> month was shown in table 6. It is inferred from the table that at the end of 3 months majority of the subjects in both the groups had a fair score in the range of 70 – 79 and similarly at the end of 12 months most of the subjects in both the groups had a good score (80-89) and a statistical significant improvement was seen at the end of 12 months compared to 3 months in both the groups, whereas comparing the scores between cemented and un-cemented group we did not find a statistically significant difference both at the end of 3<sup>rd</sup> month and the 12<sup>th</sup> month.

## Discussion

Bipolar hemiarthroplasty is the most opted surgical treatment modality for displaced fracture neck of femur among the elderly population. The immediate functional recovery and the reduced rate of reoperation when compared to internal fixations had made the surgeons to opt for hemiarthroplasty. However the results of all hemiarthroplasties are not the same which could be probably due to the different variety of prosthesis that is being used, the surgical approach chosen and the post operative rehabilitation which were practiced. Whether a bipolar prosthesis used in an uncemented hemiarthroplasty could yield the same clinical results as in cemented hemiarthroplasty for treatment of treatment of fracture neck of femur is unclear and so this study was undertaken to study the functional outcome between cemented and un-cemented hemiarthroplasty among the patients with fracture neck of femur.

Our series of patients in both the groups is in no exception to the fact that the fractures of the neck of femur are more common in elderly population as the mean age of our study subjects was more than 70 years and the global epidemiology also admit this fact. Khan *et al.* [7] and Santini *et al.* [13] also noted the same scenario among our Indian subjects. Female preponderance in our study is mainly due to the fact that osteoporosis is one of the main risk factor for fracture neck of femur, which is more common in females. As mentioned in numerous studies on proximal femoral fractures, regarding mechanism of injury, trivial fall [like tripping on the road, walking on uneven grounds] has been the main causative factor [14-16]. The same is true in our series also. In our study all patients sustained fracture following simple/trivial fall. However in our observation more than the mechanism of

injury it is the bone quality that has prime impact on fracture pattern. More than 60% of the patients had presented to the hospital as early as within 7 days of injury. Only about 10% of patients had presented in more than 10 days following the injury. We did not have any neglected fractures in our study. This delay in presentation since injury did not have any significant bearing. This fact has also been stressed in various literatures that acceptable time delay in presentation since injury is yet to be established [17, 18].

The duration of the surgical procedure for cemented hemiarthroplasty was significantly higher than the uncemented hemiarthroplasty and the studies done by Santini S *et al.* [13] and Wender Figved *et al.* [9] had also noticed this increase in the duration of surgery in cases of cemented hemiarthroplasties but however this increased duration of surgical time did not alter or affect the total functional recovery of the patient. In our study we noted a significant increase in intra-op blood loss in case of cemented hemiarthroplasties as compared to uncemented ones. Wender Figved *et al* reported duration of 70.2 min with a blood loss of 300 ml in uncemented group and 82.6 min with a blood loss of 390 ml in the cemented group [9]. Jaimo Ahn, Li-Xing Man *et al.*, in their study recorded two operative parameters of blood loss and surgical times were lower for the uncemented cohorts [19]. Another study done by Ankush V Mohabey *et al* reported that among uncemented group the mean duration of surgery was 78.25 min with a mean amount of blood loss of 176 ml, where as in the cemented group the mean duration of surgery was 111.5 min and mean amount of blood loss being 310.50 ml and the difference was found to be statistically significant [20].

In our study we found a statistical significant difference in the pain scoring ( $p < .05$ ) between the cemented and uncemented groups with cemented group patients showing lesser pain score, which matches with the other similar studies like M. J. Parker *et al* concluded that degree of residual pain was less in those treated with a cemented prosthesis ( $p < 0.0001$ ) three months after surgery [21]. R.J. Khan *et al.*, by prospective assessment revealed a highly statistically significant greater deterioration in pain ( $P = 0.003$ ), walking ability ( $P = 0.002$ ), use of walking aids ( $P = 0.004$ ) and activities of daily living ( $P = 0.009$ ) in the uncemented group [7]. Few studies done by Jaimo Ahn, Li-Xing Man *et al.* [19] noted that persistence of pain did not reach statistical significance between groups and Wender Figved *et al.* [9] reported there were no differences in pain scores and use of analgesics and a study done by Hansen *et al* did not find any statistically significant difference in pain score between the groups [22]. The results in our study did not show any statistical difference in the evaluation of limp which matches with other similar studies like Jaimo Ahn, Li-Xing Man, *et al*; Wender Figved, *et al*; Hansen, *et al.* [19, 9, 22] In the present study we found that the use of walking aids was more common among the un-cemented group than that of the cemented group and the difference was found to be statistically significant and the results are in par with the study done by R J Khan *et al.* [7]

The mean Harris hip score among the un-cemented group and cemented group at the end of 12 months in the present study was 79 and 81 respectively and no statistical significant difference was seen between these scores and it is almost similar to the results quoted by Ankush V Mohabey *et al* where the score was 85 and 81 among the un-cemented and cemented group [20]. A study done by Deangelis JP *et al.* [10] found that in the treatment of nonpathologic displaced femoral neck fractures, the use of cemented and uncemented

femoral components is associated with similar functional outcome at 6 months and similarly study done by M. J. Parker *et al.* [21] 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. We did not notice any major complications like cardio pulmonary embolism, in

cases of cemented hemiarthroplasty, as described in most of the literatures and also complications related to un-cemented hemiarthroplasty like persistent thigh pain, subsidence of prosthesis & stress shielding has not been reported in the present study which is probably because of the standard press fit bipolar femoral stems and these finding correlates with the randomized controlled trial done by Wender Figved *et al.* [9]

**Table 1:** Age and gender wise distribution of the study subjects

Age group	Cemented group (n=30)		P value	Un-cemented group (n=30)		P value
	Male	Female		Male	Female	
50 – 60	0	1 (4.3%)	0.003	0	2 (7.6%)	0.0028
61 – 70	3 (42.8%)	5 (21.7%)		1 (25%)	5 (19.2%)	
71 – 80	2 (28.5%)	8 (34.7%)		2 (50%)	9 (34.6%)	
>80	2 (28.5%)	9 (39.1%)		1 (25%)	10 (38.4%)	
Total	7 (100%)	23 (100%)		4 (100%)	26 (100%)	

**Table 2:** Distribution of the study subjects based on the time between injury and surgery

Time between injury and surgery (in days)	Cemented group (n=30)	Un-cemented group (n=30)	P value
1 – 3	8 (26.6%)	9 (30%)	0.739
4 – 7	12 (40%)	10 (33.3%)	
8 – 10	6 (20%)	8 (26.6%)	
11 – 14	4 (13.3%)	3 (10%)	
Mean ± SD	6.8 ± 3.8	7.1 ± 3.2	

**Table 3:** Distribution of the study subjects based on the duration of surgery

Duration of surgery	Cemented group (n=30)	Un-cemented group (n=30)	P value
Upto 60 mins	0	11 (36.6%)	<.0001
61 – 70 mins	0	19 (63.3%)	
71 – 80 mins	8 (26.6%)	0	
>80 mins	22 (73.3%)	0	
Mean ± SD	82.8±6.4	63.6±4.8	

**Table 4:** Distribution of the study subjects based on the intra-operative blood loss

Intra-operative blood loss	Cemented group	Un-cemented group	P value
100 – 300 ml	10 (33.3%)	26 (86.6%)	0.0003
300 – 500 ml	18 (60%)	4 (13.3%)	
>500 ml	2 (6.6%)	0	

**Table 5:** Functional outcome at the end of 12 months after hemiarthroplasty among the two groups

Functional outcome	Cemented group (n=30)	Un-cemented group (n=30)	P value	
Pain	Absent	25 (83.3%)	0.016	
	Mild	5 (16.6%)		11 (36.6%)
Limp	None	3 (10%)	0.529	
	Mild	26 (86.6%)		28 (93.3%)
	Moderate	1 (3.3%)		0
Use of cane	None	8 (26.6%)	0.0318	
	For long walks	16 (53.3%)		22 (73.3%)
	Most of the time	6 (20%)		8 (26.6%)
Range of movement	Flexion <60°	2 (6.6%)	0.0816	
	Flexion >60°	28 (93.3%)		26 (86.6%)
	Abduction <20°	0	0.619	
	Abduction >20°	30 (100%)		28 (93.3%)
	Rotation <15°	2 (6.6%)		2 (6.6%)
Rotation >15°	28 (93.3%)	28 (93.3%)	1.000	

**Table 6:** Comparison of Harris hip score between cemented and un-cemented hemiarthroplasty groups.

Harris hip score	Follow-up at 3 months		P value	Follow-up at 12 months		P value
	Cemented group	Un-cemented group		Cemented group	Un-cemented group	
90 – 100 (excellent)	0	0	0.684	1	0	0.581
80 – 89 (good)	1	0		18	16	
70 – 79 (fair)	29	28		11	14	
<70 (poor)	0	2		0	0	
Mean score	71.4 ± 4.2	70.2 ± 3.8		81.6 ± 4.8	79.07 ± 5.1	

P<.001 for comparing the scores of both the cemented and un-cemented group between the 3<sup>rd</sup> and 12<sup>th</sup> month of follow-up.

## Conclusion

Hemiarthroplasty, as an effective treatment, can help resume the walking ability as soon as possible, thereby reduce the risk of respiratory infection and urinary tract infection. However, there has been controversy regarding the use of cement for a long time. Our study had proven that the duration of surgery and intraoperative blood loss were less in the uncemented group as compared to cemented hemiarthroplasty group. Among the function outcome only pain reduction and use of cane was favourable towards cemented group whereas the range of movements and limp was almost similar in both the groups and more so the Harris hip score also did not show a statistical significant difference between the two groups. So both the cemented and uncemented hemiarthroplasty are equally good options in the treatment of fracture neck of femur among elderly patients with minimal complications among the two methods. More data comparing uncemented and cemented hemiarthroplasty in patients with femoral neck fracture are still needed to substantiate our findings.

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