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Cemented or uncemented bipolar hemiarthroplasty for femoral neck fractures in aged patients

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Abstract
Background: In aged patients, a femoral neck fracture is the most common hip fracture injury and most commonly treated with bipolar hemiarthroplasty. The available data on the outcomes of cemented bipolar hemiarthroplasty or uncemented bipolar hemiarthroplasty in terms of functional parameters is scant. Hence we had evaluated the functional outcomes in a femoral neck fracture patients treated with either cemented bipolar hemiarthroplasty or uncemented bipolar hemiarthroplasty.
Material and Methods: About 120 aged patients who had a femoral neck fracture, constituted the total sample size. Out of which 60 aged patients were treated with cemented bipolar hemiarthroplasty and rest 60 patients were treated with uncemented bipolar hemiarthroplasty. The patients were followed up at 3rd, 6th and 12th postoperative months.
Results: The mean age was 69.83 years in cemented bipolar hemiarthroplasty group and 69.6 years in uncemented bipolar hemiarthroplasty. The Harris Hip Score was 90.2 in cemented bipolar hemiarthroplasty group and 87.9 in uncemented bipolar hemiarthroplasty group. Our study show more blood loss in the cemented bipolar hemiarthroplasty group while more implant-related complications in an uncemented bipolar hemiarthroplasty group. The follow up rate was 100% in our study.
Conclusion: This study was able to show that cemented bipolar hemiarthroplasty had a good functional outcome.

Keywords: Fracture neck femur, cemented bipolar hemiarthroplasty, and uncemented bipolar hemiarthroplasty

Introduction
In aged patients, a femoral neck fracture is the most common hip fracture injury which can lead to an increase in the incidence of morbidity and mortality in the postoperative period [1]. Bipolar hemiarthroplasty is an excellent and effective treatment and helps in early ambulation and functional recovery of patients [2]. However, there has been persistent controversy over whether cemented bipolar hemiarthroplasty or uncemented bipolar hemiarthroplasty is preferable for the aged patient population [3]. Cemented bipolar hemiarthroplasty may bring low prosthetic loosening periprosthetic and fractures whereas it may lead to embolism and decreased cardiac output with the insertion of bone cement. However, there is a higher rate of postoperative prosthesis loosening for uncemented bipolar hemiarthroplasty while it may require shorter operation time and less intraoperative blood loss [4-6].

Several studies have been published in recent years comparing cemented bipolar hemiarthroplasty and uncemented bipolar hemiarthroplasty. Khan *et al*. prospective and retrospective review study show that cemented bipolar hemiarthroplasty has advantages in terms of less postoperative pain, lower postoperative complication rate, and better mobility over uncemented bipolar hemiarthroplasty. Complications such as longer operative time and more intraoperative blood loss are present after cemented bipolar hemiarthroplasty [7]. A meta-analysis study by Luo *et al*. which includes 8 RCTs demonstrated that there was no significant difference between cemented hemiarthroplasty and uncemented hemiarthroplasty regarding the mortality, revision surgery rate, and postoperative complications, while cemented hemiarthroplasty can reduce the risk of residual pain (RR=0.69, 95% CI 0.53–0.90; p=0.007) and achieve better functional recovery [8].

A meta-analysis by Azegami *et al*. pooled 8 RCTs and quasi-RCTs (the methodological quality of 2 trials ≤4 scores and the maximum quality score is 12 points) and reported that cemented hemiarthroplasty achieved better functional outcome and less residual pain [9].

The main goal of treatment of femoral neck fracture is the restoration of the patient to maximum possible function with disability-free life. These studies are not without limitations. The data on clinical outcomes after bipolar hemiarthroplasty is scant. Hence this study was undertaken to study the functional outcome of the aged patients with femoral neck fracture treated with cemented bipolar hemiarthroplasty or uncemented bipolar hemiarthroplasty.

Material and methods

Study Design: A prospective study.

A prospective study was undertaken in a Tertiary Hospital in January 2018 to August 2019, 60 newly diagnosed cases of femoral neck fracture treated with cemented bipolar hemiarthroplasty and 60 cases with uncemented bipolar hemiarthroplasty in aged patients and both sexes.

Inclusion Criteria

- Age of more than 65 years.
- Unilateral and fresh femoral neck fracture.
- Patients who will give consent for the study.

Exclusion Criteria

- Age less than 65 years.
- Active infection anywhere in the body.
- Revision surgery.
- Patient having a neurological and psychological disorder
- Patients having an intertrochanteric and subtrochanteric fractures.

Aged patients with femoral neck fracture were admitted to the tertiary care hospital and included in this study after obtaining informed, written and video consent. Clearance from an institutional ethics committee was obtained before starting the study. All patients evaluated preoperatively in detail, treated surgically with cemented bipolar hemiarthroplasty or uncemented bipolar hemiarthroplasty by fixed surgeon team, with standard operative and the postoperative protocol followed for every patient. The patient was evaluated by using modified Harris hip score at 3months, 6 months, 12 months including postoperative hip function, residual pain, complications rates, and mortality [10]. Complications were analyzed according to implant-related (intraoperative and postoperative periprosthetic fractures, prosthesis loosening, and dislocation), cardiovascular or cerebrovascular complications (cardiac arrest, myocardial infarction, pulmonary embolism), local complications (superficial or deep wound infection, wound hematoma) and general complications (pneumonia, urinary tract infection, bedsore). The secondary outcomes consist of revision surgery rate, operation time and intraoperative blood loss.

Statistical Analysis

The data thus obtained was entered in a pre-designed proforma and entered into the excel sheet. The data was analyzed using Statistical Package for Social Sciences (SPSS vs 20). Independent Sample t-test for Quantitative variables, Paired t-test for paired observations and Chi-Square test for categorical observations were used as a test of significance. Value of less than 0.05 was considered a significance level and all the values below it were considered as statistically significant.

Results

A total of 120 aged patients constituted the sample size. 60 patients were operated with cemented bipolar hemiarthroplasty and 60 patients with uncemented bipolar hemiarthroplasty. The patients were followed for 12 months postoperatively and assessed by using the Modified Harris Hip Score. The follow-up rate was 100% in our study. There was no mortality in our study.

Table 1: Distribution of age in the study group

Age group	Cemented Hemiarthroplasty N (%)	Uncemented Hemiarthroplasty N (%)
65 – 70 years	43 (71.7)	44 (73.3)
71 – 75 years	13 (21.7)	12 (20.0)
76 – 80 years	4 (6.7)	4 (6.7)
Total	60 (100)	60 (100)

χ^2 Value= 0.051, df=2, P value=0.975, NS

71.7% of patients were in the age group of 65 – 70 years in the cemented bipolar hemiarthroplasty group. 20 % of patients were in the age group of 71 – 75 years in the uncemented bipolar hemiarthroplasty group. The difference was statistically insignificant.

Table 2: Socio-demographic characteristics of the study group

Parameter		Cemented Bipolar Hemiarthroplasty	Uncemented Bipolar Hemiarthroplasty	χ^2 Value	df	P value
Age (years)	Mean ± SD	69.8 ± 3.21	69.6 ± 3.26			
	Median	69	69			
	Range	65 – 79	65 - 78			
Sex	Female	33 (55.0)	35 (58.3)	0.136	1	0.713, NS
	Male	27 (45.0)	25 (41.7)			
Side	Right	31 (51.7)	30 (50.0)	0.033	1	0.855, NS
	Left	29 (48.3)	30 (50.0)			
Co morbidities	Diabetes	13 (21.7%)	13 (21.7%)	5.665	5	0.34, NS
	Hypertension	22 (36.7%)	17 (28.3%)			
	DM+ HT	03 (5%)	09 (15.0%)			
	HT+ prostate	01 (1.7%)	00			
	HT + hypothyroid	01 (1.7%)	00			
	No condition	20 (33.3%)	21 (35.0%)			
Mode of injury	Domestic fall	52 (86.7)	51 (85.0)	0.069	1	0.793, NS
	RTA	8 (13.3)	9 (15.0)			

The mean (± SD) age of the study group was 69.8 (± 3.21) years in cemented bipolar hemiarthroplasty group and 69.6 (± 3.26) years in uncemented bipolar hemiarthroplasty group. In cemented bipolar hemiarthroplasty group 55% were female patients and 41.7% were male patients in uncemented bipolar hemiarthroplasty group. Nearly half of the patients were operated on the right side in both groups. 13 patients were diabetics in both groups, 36.7% of patients were hypertensive in cemented bipolar hemiarthroplasty group and 15% of patients were diabetic and hypertensive in uncemented bipolar hemiarthroplasty group. 85% of patients in the cemented bipolar hemiarthroplasty group and 86.7% in the uncemented bipolar hemiarthroplasty group were having domestic fall.

Table 3: Operative time of the study group

Operative time	Cemented Hemiarthroplasty	Uncemented Hemiarthroplasty	T value	P value, Sig
Mean ± SD	83.5 (± 4.81)	69.6 (± 4.1)	16.974	0.000, Sig

Average operative time was 1Hr 24 mins (± 5 mins) in cemented bipolar hemiarthroplasty group while 1Hr 10 mins (± 4 mins) in an uncemented bipolar hemiarthroplasty group which was statistically significant.

Table 4: Grade of anesthesia of the study group

Grade of anesthesia	Cemented Hemiarthroplasty N (%)	Uncemented Hemiarthroplasty N (%)
II	2 (3.3)	2 (3.3)
III	34 (56.7)	34 (56.7)
IV	24 (40.0)	24 (40.0)
Total	60 (100)	60 (100)

χ^2 Value= 0.0, df=2, P value=1.0, NS

56.7% of patients were having grade III while 40% of patients were having grade IV in both groups.

Table 5: Type of anesthesia of the study group

Type of anesthesia	Cemented Hemiarthroplasty N (%)	Uncemented Hemiarthroplasty N (%)
General anesthesia	3 (5.0)	4 (6.7)
Spinal	20 (33.3)	15 (25.0)
Spinal + Epidural	37 (61.7)	41 (68.3)
Total	60 (100)	60 (100)

χ^2 Value= 1.062, df=2, P value=0.588, NS

33.3% of patients were operated under spinal anesthesia in cemented group while 68.3% of patients were operated under combined anesthesia.

Table 6: Intraoperative blood loss in the study group

Intraoperative blood loss	Cemented Hemiarthroplasty	Uncemented Hemiarthroplasty	T value	P value, Sig
Mean ± SD	384.2 (± 29.8)	340.8 (± 57.1)	5.21	0.000, Sig

The intraoperative blood loss was more in cemented group than uncemented group which was statistically significant.

Table 7: Blood transfusion of the study group

Blood transfusion	Cemented Hemiarthroplasty N (%)	Uncemented Hemiarthroplasty N (%)
1	18 (30.0)	12 (25.0)
2	4 (6.7)	5 (8.3)
No	38 (63.3)	43 (71.7)
Total	60 (100)	60 (100)

Total of 22 patients were required intraoperative or postoperative blood transfusion in cemented group.

Table 8: A complication in the study group

Complication		Cemented bipolar hemiarthroplasty	Uncemented bipolar hemiarthroplasty	χ^2 Value	Df	P value
Superficial infection	No	58 (96.7)	59 (98.3)	0.342	1	0.559, NS
	Yes	2 (3.3)	1 (1.7)			
Cardiovascular	No	59 (98.3)	59 (98.3)	0.0	1	1.000, NS
	Yes	1 (1.7)	1 (1.7)			
Cerebrovascular	No	59 (98.3)	59 (98.3)	0.0	1	1.000, NS
	Yes	1 (1.7)	1 (1.7)			
Loosening of implants	No	60 (100.0)	58 (96.7)	2.034	1	0.154, NS
	Yes	0	2 (3.3)			
Periprosthetic fracture	No	60 (100.0)	58 (96.7)	2.034	1	0.154, NS
	Yes	0	2 (3.3)			

Implants related complications rate in cemented bipolar hemiarthroplasty group was lower than in uncemented bipolar hemiarthroplasty group. However, there was no significant difference between the two groups in cardiovascular and cerebrovascular complications, local complications and general complications.

The rate of infection was 3.3% (2/60) in the cemented bipolar hemiarthroplasty group while 1.7% (1/60) in the uncemented bipolar hemiarthroplasty group. The patient in both groups had a superficial infection which was managed by incision drainage and IV antibiotics following which they recovered.

2 patients from the uncemented bipolar hemiarthroplasty group had loosening of the implant. 2 patients from the uncemented bipolar hemiarthroplasty group sustained periprosthetic fracture which was managed by open reduction with tension band wiring.

One patient from the cemented bipolar hemiarthroplasty group developed a sudden fall in blood pressure intraoperatively while cementing insertion and was admitted to the ICU postoperatively. The patient was managed conservatively with life-saving measures and recovered. The patient was shifted to ward and post-op mobilization protocols initiated after 5 days.

Table 9: Harris Hip score of the study group

Harris Hip scores (Mean ± SD)	Cemented Hemiarthroplasty	Uncemented Hemiarthroplasty	T value	P value, Sig
3 months	78.9 (± 5.9)	77.8 (± 7.4)	0.862	0.39, NS
6 months	83.9 (± 5.9)	83.8 (± 7.4)	0.027	0.978, NS
12 months	90.2 (± 6.2)	87.6 (± 7.0)	2.164	0.033, Sig

A difference in the Harris Hip score at 3 months and 6 months was not statistically significant. Average Harris hip score was 90.2 for the cemented bipolar hemiarthroplasty group and 87.6 for an uncemented bipolar hemiarthroplasty group which was a statistically significant difference.

Table 10: Clinical result according to Harris Hip score of the study group at 12 month follow up

Scale	Clinical Result	Cemented Bipolar Hemiarthroplasty N (%)	Uncemented Bipolar Hemiarthroplasty N (%)
90 – 100	Excellent	41 (68.3)	32 (53.3)
80 – 90	Good	11 (18.3)	17 (28.3)
70 – 80	Fair	07 (11.7)	10 (16.7)
<70	Poor	01 (1.7)	01 (1.7)

Table 11: Comparison with similar studies in literature

Study	Type of Study	Patients (No. in CH/UCH)	Mean Age (Year, CH/UCH)	Gender (Men/Women)	Mean Follow up (months)	Harris HIP Score (CH/UCH)	Excellent result (No. patients, CH/UCH)
Prashanth *et al*. [14]	Prospective	24/28	-	22/30	12	86.5/85.3	8/6
Siddiqui *et al*. [15]	Prospective	52	65.4	12/23	12	86.84	13 (37.1%)
Khorami *et al*. [16]	Prospective	22/29	79/71.1	19/32	6	-	7/5
Rai *et al*. [17]	Prospective	42/42	79.5/79.5	35/49	24	81.50/75.87	-
Annappa *et al*. [18]	RCT	100	66.5	-	12	89.25/83.5	-
Our study	Prospective	60/60	69.8/69.6	52/68	12	90.2/87.6	41/32

68.3% of patients showed excellent functional results in cemented bipolar hemiarthroplasty group while 28.3% of patients showed good functional results in an uncemented bipolar hemiarthroplasty group. 1.7% of the patients showed poor results in both groups.

1A **1B**

Fig 1: 1A, 1B Preoperative x-rays of uncemented bipolar hemiarthroplasty.

2A **2B**

Fig 2: 2A, 2B Postoperative x-rays of uncemented bipolar hemiarthroplasty.

3A **3B**

Fig 3: 3A, 3B Preoperative x-rays of cemented bipolar hemiarthroplasty.

4A **4B**

Fig 4: 4A, 4B Postoperative x-rays of cemented bipolar hemiarthroplasty

Discussion

A femoral neck fracture has become a serious problem for aged patients. Hemiarthroplasty is an effective treatment and can help resume the walking ability as soon as possible, thereby reducing the risk of respiratory infection and urinary tract infection. However, there has been controversy regarding the use of cement for a long time. Some surgeons prefer to apply the uncemented hemiarthroplasty technique since it can reduce operation time, intraoperative blood loss and perioperative cardiovascular complications, while others believe that cemented hemiarthroplasty technique can achieve better postoperative hip function recovery and less prosthesis loosening. Therefore this study was undertaken to compare the efficacy and safety of cemented bipolar hemiarthroplasty and uncemented bipolar hemiarthroplasty techniques for femoral neck fractures.

In this study, 60 aged patients in each group were selected and constituted the sample size. The postoperative hip function at 12 months was better in the cemented bipolar hemiarthroplasty group than that in an uncemented bipolar hemiarthroplasty group. That indicated with the time passing after the operation, cemented bipolar hemiarthroplasty technique can bring better joint function recovery. This showed that the result was consistent with previous studies.

A study by Khan's *et al*. using validated scoring systems for pain and functional ability assessment demonstrated that there was a significant deterioration in pain (p=0.003), walking ability (p=0.002), and daily activities (p=0.009) in the UCH group during the follow- up of 32–36 months [7].

In a retrospective study by Lo *et al* involving 447 patients with 451 displaced fractures of the femoral neck treated by Bateman bipolar hemiarthroplasty, concluded that the cemented prostheses brought better functional results in the early stage [11].

A study by Santini *et al*. and Livesley *et al*. suggested that there was no clinically or statistically significant difference in the postoperative hip function recovery. In spite of an obvious tendency for CH in postoperative function recovery, it was difficult to pool and compare other parameters due to the inconsistency of outcome parameters applied. Further researches with large samples and standardized hip function scoring systems are warranted to confirm these findings and elucidate the potential advantages of CH in postoperative hip function recovery [12, 13].

Interestingly, a recent large scale retrospective study comparing CH with UCH involving 60,848 patients showed that cementless implants were related to significantly higher rates of myocardial infarction (2.86% versus 2.46%, OR=1.17, 95%CI, 1.07–1.28) and lower respiratory tract infection (9.21% versus 7.26%, OR=1.15, 95% (1.09–1.22),

p<0.001) within 30 days compared with cemented implants [14]. In table11 we compared our results with similar studies previously done in the literature.

Though this study has several advantages still some limitations have been identified such fewer parameters were analyzed, shorter duration of follow up. But long term results of this procedure are awaited. Certainly, high-quality evidence with well- designed multicentre RCTs with large samples are still required in the future to verify our results.

Conclusion

Our study cemented or uncemented bipolar hemiarthroplasty was able to show that cemented bipolar hemiarthroplasty had a better functional outcome and better mobility in postoperative hip function recovery, less residual pain, less implant-related complications than uncemented bipolar hemiarthroplasty. There was no significant difference in other complication groups. There was no mortality in our study.

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Conflicts of Interrest: Nil

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