Comparative Study of Functional Outcome of Cemented and Uncemented Bipolar Hemiarthroplasty in Neck of Femur Fractures

Dr. Sharat Pandian[1], Dr. K. Soundararajan[2], Dr. Siva Vignesh S[3], Dr. Gokul S[4]

[1] Third year Post Graduate, Department of Orthopedics, Vinayaka Missions Kirupanada Variyar Medical College, Salem.
[2] Professor, Department of Orthopedics, Vinayaka Missions Kirupanada Variyar Medical College, Salem
[3] Senior Resident, Department of Orthopedics, Vinayaka Missions Kirupanada Variyar Medical College, Salem.
[4] Second year PG Resident, Department of Orthopedics, Vinayaka Missions Kirupanada Variyar Medical College, Salem.

Corresponding Author: *Dr. Sharat Pandian**

ORCID ID: https://orcid.org/0009-0002-0325-1270

ABSTRACT: Background: Femoral neck fractures are common in the elderly population and majority of which need surgical intervention. Cemented and uncemented bipolar hemiarthroplasty are common treatment options for these fractures. The outcome from both procedures have generated debates around the extent to which their differences may reflect altered functioning of the affected limb.
Aim and Objectives: To compare the functional results of cemented and uncementedbipolar hemiarthroplastyin femoral neck fractures patients.
Methods: We prospectively followed up and also analysed records of patients from our hospital Vinayaka missions Hospital, Salem, a tertiary-care centre. This study involved patients who had undergone either cemented or uncemented bipolar hemiarthroplasty. Pain relief, range of motion (ROM), gait pattern, and limb function status were evaluated post operatively with functional scoring systems that had been validated.
Results: The cemented bipolar and uncemented bipolar hemiarthroplasty were both associated with good function of the hip peri-operatively, after 6 months and after 1 year follow up. For this reason, surgeons must be judicious in selecting the optimal method based on individual patient factors.

Keywords: *femoral neck fractures, bipolar hemiarthroplasty, cemented and uncemented technique*.

INTRODUCTION

Bipolar hemiarthroplasty for femoral neck fractures in orthopaedics continues to be a promising debated and researched topic concerning whether the prosthesis should have cemented or uncemented techniques of fixation.Neck fractures of the femur in particular, clinical wise are rather difficult problems to handle specifically for elderly individuals [1] and they may require surgical intervention to provide mobility as well as pain relief. Bipolar hemiarthroplasty is now commonly accepted, utilizing the advantages of sparing acetabular bone to reduce potential morbidity, and may improve range of motion over that in comparison to total hip arthroplasty. Eleven percent of formerly ambulatory patients will not be able to walk independently following a fracture, and a significant minority of fracture patients cannot resume their pre-fracture activity level [3]. Within the first year following surgery, one-third of the patients pass away[4]. The sole distinction that makes the difference between cemented and uncemented hemiarthroplasty is related to the way in which fixating of femoral component is carried out. In cemented fixation the use of polymethylmethacrylate (PMMA) bone cement acts to fixate a prosthesis into the femoral canal, allowing for immediate stability. In contrast, fixation without cement depends on achieving osseointegration for biological fixation and perhaps has potential long-term advantages in terms of bone preservation and a reduced risk of complications related to the cement.

A definitive consensus as to the best method of fixation, in spite of years and decades-long clinical experience, along with advances in surgical techniques has not yet materialized. The debate of whether to use a cemented or uncemented bipolar head in hemiarthroplasty has seen conflicting results published to date with regards functional outcomes, complications and revision rates. This disparity in knowledge should be addressed by robust prospective investigation comparing surgical outcomes to favourable post-operative functional outcomes and patient satisfaction. This study was undertaken to address these gaps by analysing a prospective database comparing the functional outcomes such as pain relief, range of motion (ROM), quality of life and complications in patients following cemented vs. uncemented bipolar hemiarthroplasty for treatment of neck of femur fractures. This study will employ standardized outcome measures and advanced statistical analysis to produce high-quality evidence that can ultimately be translated into clinical guidelines, which aim at optimizing patient care in the treatment of femoral neck fractures. The data gathered from this prospective study provide the necessary information for comprehensive analysis and interpretation, which when correlated with patient satisfaction scores as well as postoperative adverse outcomes, the insights regarding selection of fixation method that would contribute to bettering patient outcome following bipolar hemiarthroplasty.

AIM AND OBJECTIVES:

To compare functional benefits between cemented and uncemented bipolar hemiarthroplasty prostheses treated for elderly patients with displaced femur neck fractures.

MATERIALS AND METHODS:

The study population consists of all patients with fracture neck of femur admitted in Vinayaka Missions Kirupananda Variyar Medical College and Hospital during the period from October 2022 to March 2024. Patients with displaced femoral neck fracture underwent different treatments in the following informal two groups:1. Patients treated with uncemented bipolar hemiarthroplasty 2. Patients treated with cemented bipolar hemiarthroplasty. Patients of age group above 60 years, fracture neck of femur, avascular necrosis of head of femur without osteoarthritic changes and non-union fracture neck of femur were included in the study. Patients aged less than 60 years, patients who presented with polytrauma, patients with past history of symptomatic hip disease such as osteoarthritis, patients lost for follow ups, patients who were unable to walk before the fracture and pathological fractures were excluded from the study. The patients were treated with bipolar hemiarthroplasty cemented or uncemented. The surgery is performed under spinal anaesthesia through a posterior approach, with the patient in lateral position. After surgery, ICU monitoring, routine vitals check as per protocol of the department; blood transfusions as and when required; enough antibiotic & DVT prophylaxis in every case along with physiotherapy that is proper were carried out.

In the outpatient clinic, follow-up visits are done 2 weeks, 3 months, 6 months and a year post procedure. Early ambulation and weight-bearing as tolerated. Patient is followed up on every visit for wound healing, functional recovery and radiological signs of loosening, migration /wear/ implant failure. Standard roentgenogram of the involved hip, including antero-posterior and lateral views, are taken at each follow-up.

RESULTS:

Table 1. AGE DISTRIBUTION:

AGE GROUP	FREQUENCY	PERCENTAGE
60 to 69	37	61.7
70 to 79	19	31.7
>79	4	6.7
Total	60	100

Our 60 patients were older than 60 years old. 69 years old was the average age. The majority of our patients were between the ages of 60 and 80. This implies that femur fractures are frequent in the older population.

Table 2. GENDER DISTRIBUTION OF THE STUDY POPULATION

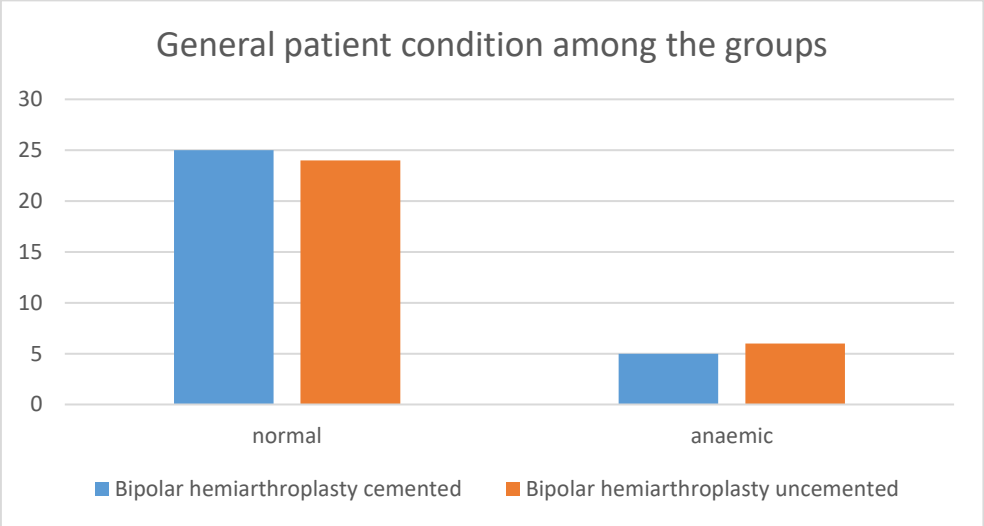
GENDER	FREQUENCY	PERCENT
Male	11	18.3
Female	49	81.7
Total	60	100

81.7% patients of our series were females.

Table 3: GENDER VS TYPE OF BIPOLAR FIXATION

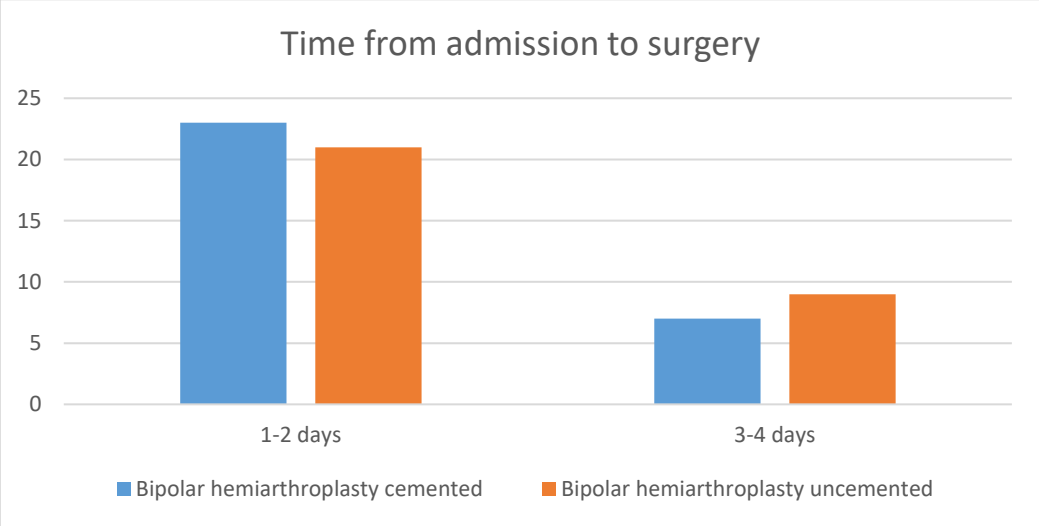
SEX	BIPOLAR HEMIARTHROPLASTY				TOTAL	
	CEMENTED		UNCEMENTED			
	N	%	N	%	N	%
Male	6	20	5	16.7	11	18.3
Female	24	80	25	83.3	49	81.7
Total	30	100	30	100	60	100

Graph 1: General patient condition among the study population



18.3% of patients had anaemia as depicted by Haemoglobin percentage between 7 to 9gm%.P-value is 0.739 which is statistically insignificant in between the groups.

Graph 2: Time from admission to surgery



P-value is 0.559 which is statistically insignificant in between the groups.

Table 4: INTRA OPERATIVE BLOOD LOSS:

Intra Operative Blood Loss (In Hb%)	Bipolar Hemiarthroplasty				Total		Chi Square	P Value
	Cemented		Uncemented					
	N	%	N	%	N	%		
Less than 2%	13	43.3	11	36.7	24	40	0.278	0.598
More than 2%	17	56.7	19	63.3	36	60		
Total	30	100	30	100	60	100		

Table 5: FUNCTIONAL OUTCOME: Pain: at 12 months follow up

Pain	Hemiarthroplasty	
	Cemented	Uncemented
Absent	3 (10%)	5 (16.7%)
Slight	18 (60%)	15 (50%)
Mild	9(30%)	10 (33.3%)
Moderate	-	-
Severe	-	-
Bedridden	--	-
Total	30 (100%)	30 (100%)

Table 6: RANGE OF MOVEMENTS: at 12 months follow up

MOVEMENTS		HEMIARTHROPLASTY	
		CEMENTED	UNCEMENTED
FLEXION	<60°	1 (3.33%)	3 (10%)
	>60°	29 (96.67%)	27 (90%)
ABDUCTION	<20°	1 (3.33%)	0
	>20°	29 (96.7%)	30 (100%0
ROTATION	<15°	2 (6.67%)	3 (10%)
	>15°	28 (93.33%)	27 (90%)

Table 7: HARRIS HIP SCORE: For assessing functional recovery.

HEMIARTHROPLASTY		HARRIS HIP SCORE		
	BASELINE	3 MONTHS	6 MONTHS	12 MONTHS
CEMENTED	79.2	80.7	81.6	82.4

UNCEMENTED	79.6	80.8	80.9	82.6

DISCUSSION

Bipolar hemi arthroplasty is commonly selected as the surgical procedure of choice for older patients with displaced femoral neck fractures. This is why it is well liked by surgeons as opposed to internal fixations, which usually mean a faster recovery, and are less likely for the patient needing to go back for more surgery. The difference in outcome from hemiarthroplasty might be due to different type of prostheses, methods of surgery or post-operative rehabilitation protocols. The earlier prostheses were also cemented to enhance stability and freedom of motion, which helped with recovery. However, the method was not without risk. There remain potential problems like embolism or such related issues in heart/lung etc. Uncemented implants may result in stress shielding, soreness in the thighs, implant loosening, and an increased risk of fractures near the prosthesis. There could be a higher chance for fracture around an implant if there is subsidence at its stem-related complications /morbidity. But unfortunately, we do not know the effect of using an uncemented bipolar over cemented one. In our study, we compared the results of cemented with uncemented bipolar hemiarthroplasty to assess this aspect in a better way. The results of our research also support the accepted view that femoral neck fractures are more common in old people. However, literature does not contribute enough to describe the epidemiological profile of these fractures in Indian population. Santini et al (6). And Khan et al (7) reported analogous patterns considering age and gender. Incidence of this fractures was higher for females. Osteoporosis is a substantial risk factor in these patients that is probably related to higher proportion of incidence in women. These serious cases of nutritional anaemia that we observed are examples of the negative impact poor nutrition on our patients, which can be partly explained by low per capita income, little dietary knowledge, increased age and large families. All of these patients needed preoperative nutritional repletion that afforded them major orthopaedic surgery. Understanding the mechanism of proximal femoral fractures has focused a huge amount of research, which suggests that these injuries often result from seemingly minor incidents. There are many studies showing that the most frequent causal incident is trivial trauma such as a stumble-over, slipping on uneven ground or a minor fall during walking. Our study similarly reports this, with every patient falling from a low height causing their fracture. When considering proximal femoral fractures: type of fall is also important to the extent that it affects how a fracture might be displaced or complex itself. This study indicates that bone quality if a key determinant of fracture patterns, severity and our observations. Bone quality includes bone density, bone structure and general health of the bones. Osteoporosis, in which bones lose density and are easily broken by the elderly. This is a situation through which the bones grow to be extra brittle and so are more likely in order that they break with minor trauma. The deterioration of bone strength increases the likelihood of fractures occurring from everyday activities or minor falls. The underlying bone health has a direct bearing on the pattern of a femoral fracture. Even low-energy falls—those that happen from a standing height or less—can cause serious fractures in patients with poor bone quality. For example, a simple trip or slip might result in complicated fractures, such as those involving several fragments or displacements, in those who have osteoporosis. In comparison, the same slight fall may cause less severe or more stable fractures in people with robust bone health.

Other things that influence risk of fracture:

1) Age-related changes: with age, humans naturally become weaker and their bones more brittle so it is due to this factor that many of our elders suffer from hip fractures. The weakening of the bones that occurs in this age-related process leads to a higher risk for fractures, even during simple accidents.
2) Nutritional Deficiencies: Not getting enough of the nutrients your bones need, including calcium and vitamin D, can weaken them and make you more likely to break a bone. Deficiencies in these nutrients can hinder bone remodelling and therefore be detrimental to the fragility of bones.
3) Preexisting Medical Conditions: Rheumatoid arthritis; essential thrombocythemia, a disorder that causes the bone marrow to produce too many platelets; Chronic Kidney Disease or End Stage Renal Disease (ESRD): fragility fracture of the lumbar spine due increased bone turnover and decreased bone mineral density for age. These conditions can also be managed with medications - many of which pose an additional risk to bone health and increase the likelihood of fractures.

Falling Risk Factor: factors that increase the risk of falling, such as a lack of balance or muscle weakness for example (that increases even more indirectly to be able to withstand a fracture). Thus, targeting these significant risk factors with physical therapy and precaution for in danger older adults may reduce fractures rates. Although the mechanism of injury, including how a fall occurred is important, it appears that bone mineral density plays more of an important role in determining the severity and type of proximal femoral fractures. Measures to deal with bone health, osteoporosis therapies, and mitigating fall risk should be an extensive approach for fracture prevention. By addressing both falls and bone quality, we can reduce the number of severe fractures that occur and ultimately improve patient outcomes.

Duration since injury:
Most patients in our study sought care within 3 days after their injury, which is relatively quick following the event. We did not encounter any instances where the presentation of a fracture was so profoundly delayed, more than three days .The main reason for delay in presentation was the cautious approach of patients to seek treatment rather than any negligence on their part. The presence of a moderate delay in seeking treatment does not appear to have had a notable impact on the management or outcome of the fractures. This finding supports the notion, reinforced by various medical texts, that a certain degree of delay in presenting to a healthcare facility is acceptable, particularly when the exact nature and severity of the injury may not be immediately apparent. The delay is due to initial symptom management and may not significantly alter the overall outcome.

Our study demonstrated a there is no significant variability in the intraoperative blood loss through cemented and uncemented hemi arthroplasties. Additionally, Khan et al(7). and Wender et al. have done studies and their results shows higher blood loss accompanied with cemented procedures. This greater blood loss as explained them, is probably due to prolonged time required for adequate cementation of the femoral canal in cemented hemiarthroplasties. Operations taking longer may bleed more as the cementing process requires a lot of time to manipulate and press the tissues around. Such results must be interpreted with caution, however, given the potential for differences in surgical techniques and incision lengths affecting our findings. Variability in surgical techniques make it difficult to determine how much bleeding one technique would cause compared to another. According to our study, we haven'tobserved significant variability of intraoperative blood loss between two groups. However, the postoperative blood transfusion requirements for both cemented and uncemented groups does not vary significantly. Both groups experienced a similar rate of post-operative infection complications. One patient in each group developed wound infection and required subsequent debridement. However, the patients in all these scenarios had long standing diabetes. These patients also had an improved functional status at 12 months' follow-up after meticulous antibiotic management, followed by regular debridement and dressing. During the long term follow-up, both groups pain relief are similar. The principal functional outcome measure was Harris hip score at 1-year follow-up that incorporated items regarding pain, hip flexion range of motion (in both the supine and sitting positions), ambulation status, and limp; this performed well in distinguishingly between the two groups with little statistically significant difference.

CONCLUSION

With the prolonged operation time required by cemented hemi arthroplasty, in this series of elderly patients with femoral neck fractures both techniques comparably lead to better long-term functional outcomes and complication rate appeared similar between those performed on a cemented or uncemented basis. As both techniques produce similar results in terms of complications and function, cemented or uncemented hemi arthroplasty surgery should be decided on a case-by-case basis by the operating surgeon with respect to patient needs and surgical considerations.

CONFLICT OF INTEREST: NIL

REFERENCES

1. Foss NB. Kehlet H. Mortality analysis in hip fracture patients implications or design of future outcome trials. Br J Anaesth 2005, 94:24-9
2. Kärnholm J. Garallick G, Herberts P. The Swedish Hip Arthroplasty, Register (SHAR). In Annual Report Mölndal, Sweden, 2006.

3. Nurmi 1, Lüthje P. Narinen A, Tanninen S: [Treatment outcome and overall costs of femoral neck fractures). Duodecim. 2003,119(2):123
4. 4.Lönnroos E, Kautiainen H, Sund R, Karppi P, Hartikainen S, Kiviranta 1, et al: Unlization of inpatient care before and after hip fracture: a population-based study. Osteoporosis Int. 2009;20(6):879-886.
5. Robert WB, James DH Rockwood, Green's fracture in adults-5th Edition.
6. Santini S (2005) Hip fractures in elderly patients treated with bipolar hemi arthroplasty: comparison between cemented and cementless implants Journal of Orthopedics and Traumatology June 2005, Volume 6, Issue 2, pp 80-87
7. Khan RJK et al (2002) Hemiarthroplasty versus internal fixation for displaced intracapsular hip fractures in the elderly J Bone Joint Surg [Br] 2002; 84-B;1150-5.
8. Lu-Yao GL, Keller RB, Littenberg B, Wennberg JE. Outcomes after displaced fractures of the femoral neck: A meta-analysis of one hundred and six published reports. J Bone Joint Surg Am 1994; 76:15-25.
9. Parker MJ, Handoll HH: Arthroplasties (with and without bone cement for proximal femoral fractures in adults. Cochrane Database Syst Rev 2006, 3.