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A PROSPECTIVE STUDY: ASSESSING THE EFFICACY OF CEMENTED BIPOLAR HEMIARTHROPLASTY IN ELDERLY PATIENTS WITH FEMORAL NECK FRACTURES

Dr. Sharan Sakthivel M[1], Dr. Sathiya S [2], Dr. Dineshram Devakumar[3], Dr. Sathyanarayana L.Y[4*], Dr. Sundararajan T [5], Dr. F Abdul Khader[6], Dr. Mahendhiravarman J [7].

1 Third year Post Graduate, Department of Orthopaedics, Shri Sathya Sai Medical College and Research Institute under Sri Balaji Vidyapeeth, Ammapettai, Chengalpattu District, TamilNadu,603108, India.

2 Assistant Professor, Department of Orthopaedics, Shri Sathya Sai Medical College and Research Institute under Sri Balaji Vidyapeeth, Ammapettai, Chengalpattu District, TamilNadu,603108, India.

3 Assistant Professor, Department of Orthopaedics, Shri Sathya Sai Medical College and Research Institute under Sri Balaji Vidyapeeth, Ammapettai, Chengalpattu District, TamilNadu,603108, India.

4 Professor, Department of Orthopaedics, Shri Sathya Sai Medical College and Research Institute under Sri Balaji Vidyapeeth, Ammapettai, Chengalpattu District, Tamil Nadu,603108, India.

5 Professor, Department of Orthopaedics, Shri Sathya Sai Medical College & Research Institute, Ammapettai, Chengalpattu District, Tamil Nadu, India.

6 Professor, Department of Orthopaedics, Shri Sathya Sai Medical College & Research Institute, Ammapettai, Chengalpattu District, Tamil Nadu, India.

7 Professor, Department of Orthopaedics, Shri Sathya Sai Medical College and Research Institute under Sri Balaji Vidyapeeth, Ammapettai, Chengalpattu District,Tamil Nadu, 603108, India.

Corresponding email id- sathyanarayana2231@gmail.com

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ABSTRACT

Background: Femoral neck fractures are a significant health concern, particularly in elderly populations, with a higher prevalence among females. These fractures often result from minor trauma in older individuals and high-energy trauma in younger patients. The incidence of these fractures has risen due to factors such as increased life expectancy, osteoporosis, and a sedentary lifestyle. Surgical interventions for femoral neck fractures include reduction with internal fixation, unipolar hemiarthroplasty, and total hip arthroplasty. Bipolar hemiarthroplasty, introduced in the 1970s, has shown promise in providing better functional outcomes compared to unipolar prosthesis. **Aim:** This study aimed to evaluate the functional outcomes of cemented bipolar hemiarthroplasty in elderly patients with femoral neck fractures using the Harris Hip Score. **Materials and Methods:** A prospective study involving 45 elderly patients (mean age 71.4 years) with radiologically confirmed femoral neck fractures. Participants underwent cemented bipolar hemiarthroplasty and were assessed pre- and post-operatively using the Harris Hip Score. Statistical analysis was performed using SPSS 25 software, with results presented in descriptive statistics and appropriate tests of significance ($p<0.05$). **Results:** Post-operative assessments revealed significant pain reduction and improvements in functions including limping, use of support and walking distances, Harris Hip Scores improved notably by the third month, with 48.9% achieving excellent, 31.1% good, and 13.3% fair scores. **Conclusion:** Cemented bipolar hemiarthroplasty effectively improves functional outcomes in elderly patients with femoral neck fractures, offering significant pain relief and enhanced mobility. Despite a 20% complication rate, the procedure promotes substantial recovery and is a valuable surgical option for this vulnerable population.

Keywords: Femoral neck fracture, elderly patients, bipolar hemiarthroplasty, Harris Hip Score, functional outcome, orthopedic surgery

INTRODUCTION

A large percentage of hip fractures are femoral neck fractures, especially in the older population, where females are more likely to sustain one of these fractures. In older people, these fractures are frequently the result of slight trauma. On the other hand, they usually stem from high-energy trauma in younger age groups.[1] Increases in life expectancy, osteoporosis, low eyesight, neuromuscular coordination, and sedentary lifestyles have all contributed to an increase in occurrence.[2.] Surgery for femoral neck fractures might involve complete hip replacement, unipolar hemiarthroplasty, or reduction with internal fixation. Restoring pre-fracture function and reducing related morbidity and death are the main goals of therapy.[3]A single-assembly bipolar prosthesis was first proposed by Bateman in the 1970s.[4] The advantages of bipolar prosthesis over unipolar prosthesis include a greater range of motion in the hip, faster walking speeds, less postoperative pain, erosion of the acetabulum, stem loosening, and a shorter recovery time.[4] PMMA cement has clear benefits since it may be used as a grouting agent to repair trabecular bone that is weakening. This provides instant interference stability between the implant and the bone, which makes rehabilitation much easier. In these situations, internal fixation typically entails extended bed rest or restricted mobility in order to prevent implant failure brought on by osteoporosis. Consequently, there is an increased risk of consequences such as pneumonia, decubitus ulcer, pulmonary embolism, and deep vein thrombosis. Internal fixation is strongly linked to poor functional outcomes and high failure rates in the elderly.[5]Evidence suggests that using cemented hemiarthroplasty leads to better anchoring and lower rates of periprosthetic failure. On the other hand, a cemented prosthesis may increase mortality due to hemodynamic instability and cardiac problems known as "bone cement implantation syndrome" or "cement reaction.".[6,7] It improves stability due to self-centring or self-aligning mechanism. The high cost, lack of accessibility, and similar postoperative outcomes make total hip replacement a rare treatment choice for severe fractures in American medical facilities.[3,8,9] This study used the Harris hip score to evaluate cemented bipolar hemiarthroplasty in older adults with femur neck fractures.

MATERIAL AND METHODS

Prospective study done in all radiologically diagnosed case of neck of femur fractures who opted for cemented bipolar hemiarthroplasty and were willing to be subjected to the study for a period of 18 months.Sample size was calculated based on the previous study with mean and SD of the group treated with cemented bipolar hemiarthroplasty is 86.03 and 6.27. Level of significance - 5%, Power of the study - 80%,Non response error - 10%Sample size derived is 45, calculated using online open Epi software. Xray was the study tool used.Patients with fracture neck of femur,elderly patients of age 60 years and above,patients medically fit for surgery were included and patients below 60 years of age,patient with arthritic changes involving the acetabulum, non ambulatory patients prior to surgery, patients medically unfit for surgery, patients not willing for surgery were excluded. Harris hip score, recovery of ambulatory status, activities of daily living - squatting, climbing stairs, sitting cross legged, correction of limb shortening / lengthening were the study variables used.

METHODOLOGY:45 elderly patients(>60years), clinically and radiologically diagnosed to have fracture of femur neck at the Department of Orthopaedics at Shri Sathya Sai Medical College and Research Institute, Ammapettai, Chengalpet, Tamil Nadu were included in this study based on inclusion and exclusion criteria after taking informed consent.In addition to a clinical examination ,X- ray of Pelvis with bilateral hip in AP view and traction view and Femur AP view and lateral view was also taken to classify the fracture and assess reduction. Cemented bipolar hemiarthroplasty surgery was done after explaining complications and getting proper consent. Most of patients were operated by Hip Direct lateral approach (Hardinge approach).Patient was put on lateral decubitus position. Tip of the greater trochanter is identified by palpating from distal to proximal through the lateral aspect of longitudinal axis of femur and it is the first bony prominence felt .Aseptic precautions were follow. The surgical site was cleansed with 7.5% Povidone-lodine solution for scrubbing and 5% Povidone-lodine solution for painting. Draped in sterile manner . A longitudinal incision was made over the lateral aspect of hip. Incision was made 5cm proximal to the tip of greater trochanter.Incision passed over the center of tip of greater trochanter extending 8cm distal along the longitudinal axis of shaft of femur .Fat and deep fascia were incised in line with the skin incision. Tensor fascia latae retracted and Gluteus medius visualised and fibre as detached. Gluteus medius was split in the direction of the fibres .Anterior flap was developed by dissecting the gluteus medius at musculotendinous junction and retracted and held with Allis tissue forceps.Gluteus minimus was visualised and detached from the anterior part of greater trochanter. Capsule was visualised and longitudinal inverted T- shaped incision made. Fractured femur neck visualised .Hip - flexed, adducted and externally rotated. Soft tissues from the inferior aspect of neck is released and femoral neck osteotomy done 1cm above the lesser trochanter. Femoral head extracted with the help of a Corkscrew. Extracted femur head is measured with the help of head measuring gauge and should be checked with one size above and below. With hip flexed 90 degrees box cutter was progressed from posterlateral direction in the line of femur. Reamer and rasper were progressed in the line of femur where serially rearming lateralisation done. Powdered Polymethyl methacrylate(PMMA) is mixed with liquid monomer .Femoral stem is packed with cement .Average setting time is approximately around 14-16

minutes .Make sure that there is no left over bony fragments or cement inside the acetabulum which may result in dislocation. Before the cement hardens ,insert the prosthesis with correct rotation(anteversion) and coronal alignment .Make sure that there is no left over bony fragments or cement inside the acetabulum which may result in dislocation.Traction is given in line of the femur and head is pushed. Intraoperatively all movements are checked. Flexion, adduction, internal rotation, extension, external rotation and Shuck test and kick back test performed to test the stability. Thorough wound wash is given with normal saline solution. Wound closed in layers. Hemostasis achieved .Sterile dressing applied. Patient is shifted with hip in abduction to prevent dislocation .The patient will be transferred to the recovery room for monitoring and pain management will be initiated as per protocol. Weight-bearing status: [Full/Partial/Non-Weight Bearing] as tolerated with the use of assistive devices(Standard folding walker).Physical therapy Static and dynamic quadriceps strengthening exercises were taught and asked to be performed routinely to promote early mobilisation. The patient will be closely monitored for any signs of complications. Follow-up appointment will be scheduled in [2weeks,6weeks and 3 months] for clinical, radiographic and study tools assessment.

RESULTS

Present study included total of 45 patients fulfilling inclusion criteria. With mean age of 71.4±8.2yrs. There was significant reduction in the pain post operative period compared to pre-operative period among the patients.($p<0.05$). The appears to be a significant improvement in the functional activity such as limp, use of support and distance walking among the patient with various interval of post operative period.($p<0.05$).There is significant improvement in the Harris hip score with follow-up post operative period. At 3rd month 48.9% reported excellent, 31.1% with good and 13.3% with fair Harris hip scores.

Table 1: Showing mean age of the patients

	Mean	Standard Deviation
Age	71.4	8.2

Table 2: Comparison of pain during follow-up period

		Pre-OP		Post-OP		Post-OP 2wk		Post-OP 6wk		Post-OP 3m		Chi-square (p-value)
		Count	Per cent	Count	Percent	Count	Per cent	Count	Percent	Count	Per cent	
Pain	None	0	0.0%	0	0.0%	0	0.0%	0	0.0%	25	55.5%	220.3 (0.01)*
	slight	0	0.0%	0	0.0%	0	0.0%	0	0.0%	15	333%	
	Mild	0	0.0%	0	0.0%	0	0.0%	26	57.8%	5	11.2%	
	Moderate	9	20.0%	0	0.0%	33	73.3%	14	31.1%	0	0.0%	
	Marked	36	80.0%	45	100.0%	12	26.7%	5	11.1%	0	0.0%	
	disabling	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	

Table 3: Showing comparison of function such as limp, use of support and distance walk with follow-up

Function		Pre-OP		Post-OP		Post-OP 2wk		Post-OP 6wk		Post-OP 3m		Chi-square (p-value)
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Per cent	
limp	None	0	0.0%	0	0.0%	0	0.0%	32	71.1%	32	71.1%	307.7 (0.01)*
	Slight	0	0.0%	0	0.0%	32	71.1%	10	22.2%	10	22.2%	
	Moderate	0	0.0%	0	0.0%	10	22.2%	3	6.7%	3	6.7%	

	Severe	45	100.0%	45	100.0%	3	6.7%	0	0.0%	0	0.0%	
use of support	single cane for long walks	0	0.0%	0	0.0%	0	0.0%	30	66.7 %	30	66.7%	537.7 (0.01)*
	single cane for most times	0	0.0%	0	0.0%	36	80.0 %	6	13.3 %	6	13.3%	
	one crutch	0	0.0%	0	0.0%	6	13.3 %	6	13.3 %	6	13.3%	
	two canes	0	0.0%	45	100.0%	0	0.0%	3	6.7%	3	6.7%	
	two crutches	0	0.0%	0	0.0%	3	6.7%	0	0.0%	0	0.0%	
	not able to walk at all	45	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	
Distance walking	>1km	0	0.0%	0	0.0%	0	0.0%	8	17.8 %	25	55.6%	393.8(0.01)*
	0.5-1km	0	0.0%	0	0.0%	14	31.1 %	22	48.9 %	14	31.1%	
	100-500m	0	0.0%	0	0.0%	24	53.3 %	9	20.0 %	3	6.7%	
	only inside the house	0	0.0%	38	84.4%	3	6.7%	3	6.7%	3	6.7%	
	confined to chair or bed	45	100.0%	7	15.6%	4	8.9%	3	6.7%	0	0.0%	

Table 4: Showing the Harris Hip score among patients with follow-up

		Pre-OP		Post-OP		Post-OP 2wk		Post-OP 6wk		Post-OP 3m		Chi-square (p-value)
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Harris Hip Score	Excellent	0	0.0%	0	0.0%	0	0.0%	0	0.0%	22	48.9%	333.10(0.01)*
	Good	0	0.0%	0	0.0%	0	0.0%	35	77.8%	14	31.1%	
	Fair	0	0.0%	0	0.0%	29	64.4%	5	11.1%	6	13.3%	
	Poor	45	100.0%	45	100.0%	16	35.6%	5	11.1%	3	6.7%	

DISCUSSION

A femur neck fracture, more prevalent in elderly people, may severely impair quality of life and cause morbidity. Cemented bipolar hemiarthroplasty has emerged as a preferred surgical intervention for this demographic, offering a balance between stability and functional recovery. This discussion aims to critically evaluate the functional outcomes associated with this treatment modality, focusing on pain relief, mobility enhancement, and overall quality of life improvements. By analyzing post-operative data and comparing it with pre-operative baselines, Discussion will focus on cemented bipolar hemiarthroplasty's efficacy, hazards, and therapeutic effects in treating elderly patients' femoral neck fractures. The insights gained will contribute to optimizing surgical strategies and patient management protocols to enhance recovery and functional independence in this vulnerable population.Chhabra S et al. found that patients averaged 64 years old, with 18 women and 12 men. The commonest occurrence of injury is related to self fall.[50] In another study by Rahman M et al., all patients were 50–85 years old with a mean age of 62.09 years for men and 69.42 years for women. Radiographs indicated 48% fractures subcapital and 52% transcervical fractures. Nearly two-thirds were mild trauma. [52]There is significant improvement in the functional activity such as limp, use of support and distance walking among the patient with various interval of post operative period.($p<0.05$) also, there is significant improvement in the functional activity such as stairs, sitting, putting shoe and socks, sitting and use of public transport with the follow-up post operative period. There is

significant improvement in the Harris hip score with follow-up post operative period. At 3rd month 48.9% reported excellent, 31.1% with good and 13.3% with fair harris hip scores. In present study 20% of the cases reported with complications, among which 6.7% with deep infection and 13.3% were with superficial infection. A related study by Ponraj RK et al. reported that the average Harris hip score was 84.2, and patients in the 51-60 age range had statistically significant better Harris hip scores (F-ratio: 25.919, p-value: 0.001).We conclude that, even in cases when several co-morbidities are present, the bipolar prosthesis seems to be a safe alternative for treating femoral neck fractures in older patients, resulting in satisfactory recovery. [44]Figved W et al. found that uncemented patients had 89 mL less intraoperative blood loss and 12.4 minutes less surgical time. The groups' Barthel Index and EQ-5D scores were similar. Both groups had comparable complications and deaths. The results of both kinds of arthroplasty were satisfactory after displaced femoral neck fractures.[7] According to Khorami M et al., the cemented group's mean pain score was considerably lower than the Other group's (P = 0.001). Furthermore, the HHS indicated that the cemented group had better hip functional results (P=0.001). In the uncemented group, there was a greater frequency of both intraoperative and postoperative problems (P<0.05).[47]In another study by Chhabra S et al., the mean Harris score at 6th month followup was 88.5, with 14 patients achieved excellent results, 12 had good outcomes, One patient had good results, while one patient had bad results. No patients had stem subsidence, acetabular erosion, protrusion, or heterotopic ossification during follow-up. Every patient had good functional results. Despite various co-morbidities, the bipolar prosthesis is a better option for treating these fractures in old patients, resulting in a good recovery.[50]Consistent with the current research by Yurdakul E et al., no statistically significant variations in HHS, complications, or mortality rates were seen between the groups over the follow-up period.The cemented group, on the other hand, showed better walking abilities and less pain ratings in the early follow-up period. Surgery times and perioperative deaths were both somewhat shorter in the cementless group, but these differences were not statistically significant. Patients over the age of 65 who had hip hemiarthroplasty with cement did not have an increase in mortality or an increase in morbidity. While hemodynamic changes during cement application are noteworthy, it is important to highlight that patients receiving cemented endoprostheses displayed increased activity levels and reduced pain."[46]An independent study by Rahman M et al. In all situations, 28% got good outcomes, 8% fair and 64% excellent . No poor outcomes came out of it. 52 Another study by Kumar S et al., Two-thirds (66.66%) were able to walk unaided, while 43.33% could walk a distance of 6 blocks. Of the patients, half needed help, and thirty percent could climb stairs on their own. 83.33% of the sample showed a good range of motion. The Harris Hip Score average was 85.76, and no notable radiological anomalies were seen. For femur neck fractures, cemented bipolar hemiarthroplasty is the best option because it provides good range of motion, early mobilisation, efficient pain management, and a high degree of activity with few complications.[54]Patients over the age of 60 who suffer from femoral neck fractures may benefit from cemented bipolar hemiarthroplasty, as shown in this prospective research, which leads to much better functional results. Of the 45 rural patients, 55.6% were female and the mean age was 71.4 years. The research indicated that falls caused most fractures (93.3%), with a virtually equal right (55.6%) and left (44.4%) side distribution. Most patients were female. The fractures were classified as transcervical (51.1%), basicervical (26.7%), and subcapital (22.2%). Post-operatively, patients experienced marked pain reduction and substantial enhancements in various functional activities, which was evident in their Harris Hip Scores, with 48.9% achieving excellent, 31.1% good, and 13.3% fair scores by the third month. Although 20% of patients had complications, including deep (6.7%) and superficial infections (13.3%), results showed that the surgery was successful in reducing mobility impairment and enhancing quality of life for older individuals who had femoral neck fractures. These results emphasize cemented bipolar hemiarthroplasty as a valuable surgical option for this population, promoting significant functional recovery and offering a favorable prognosis.

CONCLUSION

This prospective study demonstrates the effectiveness of cemented bipolar hemiarthroplasty in treating fracture neck of femur in elderly patients, resulting in significantly improved functional outcomes. The study included 45 patients with a mean age of 71.4 years, predominantly female (55.6%), and largely from rural areas (73.3%). The majority of fractures resulted from falls (93.3%), with a nearly even distribution between the right (55.6%) and left (44.4%) sides. The fractures were classified as transcervical (51.1%), basicervical (26.7%), and subcapital (22.2%).Post-operative assessments revealed a notable reduction in pain and significant enhancements in functional activities such as limping, use of support and walking distances. These improvements were reflected in the Harris Hip Scores, with 48.9% achieving excellent scores, 31.1% good, and 13.3% fair by the third month after surgery.The overall outcomes were highly positive. This underscores the procedure's efficacy in restoring mobility and improving the quality of life for elderly patients with femoral neck fractures. These findings highlight cemented bipolar hemiarthroplasty as a valuable surgical option, promoting substantial functional recovery and offering a promising prognosis for this vulnerable patient population.

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