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Efficacy of Cemented Bipolar Hemiarthroplasty in Fracture Neck of Femur Patients

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ABSTRACT

This study explores the outcomes of cemented bipolar hemiarthroplasty in patients with fracture neck of femur, focusing on early recovery and return to daily activities, particularly in the elderly. A hospital-based, prospective, observational analysis was conducted at GSL Medical College and General Hospital, Rajanagaram on 30 patients with intracapsular femoral neck fracture. Patients aged 60 and above were included, with exclusions for those under 60, avascular necrosis with acetabular changes, pathological fractures and those medically unfit for surgery. The study spanned from September 2016 to September 2018. Surgical procedures involved a posterior approach and postoperative care followed ACCP guidelines for deep vein thrombosis prevention. Functional outcomes were assessed using the modified Harris hip scoring system. Most patients presented with Garden type IV fractures and arrived at the hospital within three days of injury. The study observed a higher incidence in females, mostly due to trivial trauma. Co-morbidities significantly affected recovery, with heart disease and diabetes being most common. The average Harris Hip Score at six months was 87.2, with 80% of patients achieving Excellent or Good results. No late complications were noted and hospital stays averaged 21 days. Cemented bipolar hemiarthroplasty is effective in treating fracture neck of femur, particularly in elderly patients with severe osteoporosis. While age and gender had minimal impact, co-morbidities significantly influenced recovery. The procedure aids in early rehabilitation and return to daily activities, with a high percentage of patients achieving satisfactory outcomes.

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Key Words

Fracture neck of femur, cemented bipolar hemiarthroplasty, harris hip score, osteoporosis

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INTRODUCTION

Femoral neck fractures represent a significant portion of hip fractures, accounting for half of such incidents. These fractures have become more prevalent as life expectancies have increased, with projections suggesting a doubling in the next two decades and a tripling by 2050[1]. Elderly individuals often suffer these fractures due to low-energy falls, while in younger people; they are usually the result of high-energy impacts. Women over 60 years of age experience a higher incidence compared to men in the same age bracket. Typically, the fracture occurs when a fall causes force to transmit to the femoral neck through the greater trochanter. The fracture commonly happens at the femoral neck's weakest point, just beneath the joint surface, leading to potential damage to the fragile blood supply to the femoral head[2].

Sometimes, these fractures result from the leg's external rotation, which increases tension in the anterior capsule and iliofemoral ligaments. This action can cause the neck to rotate, fracturing it while the head remains stationary, often leading to posterior neck comminution[3]. The primary objective in treating femoral neck fractures is to restore the patient's function to pre-fracture levels without additional complications. Studies have demonstrated that, for elderly patients with displaced fractures, arthroplasty tends to yield better outcomes than internal fixation[4]. Hemiarthroplasty, particularly common for treating displaced femoral neck fractures in the elderly, offers improved functional outcomes and fewer repeat surgeries than internal fixation. There are two types of hemiarthroplasty: unipolar and bipolar[5]. The unipolar version has been in use for decades, with the vitallium unipolar femoral head system introduced by Moore in the 1950s being a notable example. Although the initial results of unipolar hemiarthroplasty are favorable, long-term survivors may experience declining function due to complications such as infection, dislocation, perioperative mortality, increased pain, loosening, and acetabular erosion.

In contrast, the bipolar prosthesis, developed by Bateman and Giliberty in 1974, aims to reduce internal friction. It features a polyethylene insert that articulates with a metal femoral head, which in turn interfaces with the acetabulum. This design intends to distribute forces evenly across both articulation sites. The bipolar prosthesis is favored for its ability to decrease residual thigh pain and acetabular erosion, owing to the movement occurring within the prosthesis itself rather than between the prosthesis head and the acetabulum[6]. Cemented prostheses are typically used because they provide immediate stability and enable full weight-bearing soon after surgery. On the other hand, un-cemented implants have been associated with short-term issues such as reduced mobility, increased pain, and fixation problems, particularly in osteoporotic bones. They may also lead to specific complications like stress shielding, thigh pain, and a higher risk of periprosthetic fractures[7].

The consensus leans towards cemented bipolar hemiarthroplasty for treating intra-capsular femoral neck fractures due to its association with lower postoperative pain scores. Additionally, the use of cement adds significant stability, especially beneficial in patients with osteoporosis. Therefore, this study was undertaken to evaluate the functional outcomes of treating femoral neck fractures with cemented bipolar hemiarthroplasty[8]. The aim of this study is to comprehensively evaluate the functional outcomes of cemented bipolar hemiarthroplasty in patients with femoral neck fractures. Objectives include assessing the time taken for patients to mobilize postoperatively, examining complications associated with the procedure, and evaluating the quality of life following hemireplacement arthroplasty with a cemented bipolar endoprosthesis.

MATERIAL AND METHODS

The study was a hospital-based, prospective, observational analysis conducted at the Department of Orthopaedics in GSL Medical College and General Hospital, Rajanagaram. It included a sample size of 30 patients who had sustained an intracapsular femoral neck fracture and consented to participate. The study period spanned from September 2016 to September 2018.

Inclusion criteria: Patients aged 60 and above with an intra-capsular fracture neck of femur, un-united fractures, or those with a vascular necrosis.

Exclusion criteria: Ruled out patients under 60, those with a vascular necrosis and acetabular changes, pathological fractures, and those medically unfit for surgery. Random selection was used to choose 30 cases of intracapsular femoral neck fractures. Detailed clinical and radiological examinations were performed to record essential information, and the patient's fitness for anesthesia and surgery was evaluated.

The pre-operative management involved pain alleviation and stabilization of the fractured limb. The surgical procedure involved the use of a cemented bipolar prosthesis, with patients positioned laterally and a posterior or posterolateral approach was utilized for the surgery.

Post-operative management adhered to ACCP guidelines for deep vein thrombosis prevention and included monitoring, pain management, and early mobilization with the aid of a walker. Follow-ups were scheduled at 6 weeks, 3 months and 6 months to

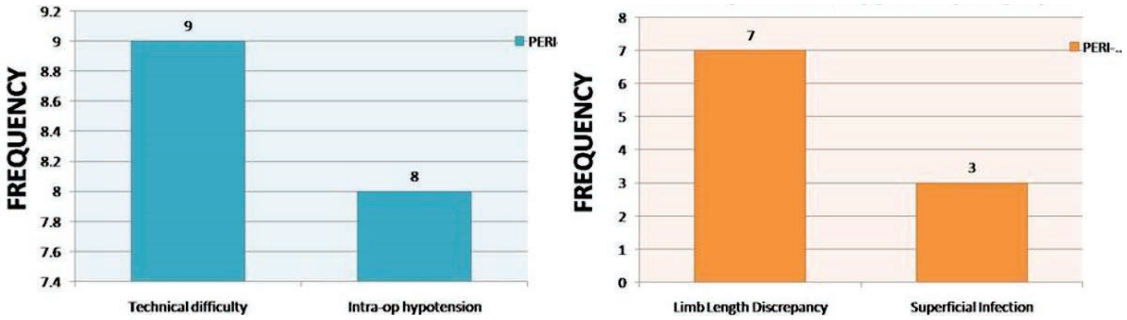

Fig. 1: Distribution of Immediate Surgical Complications And Post-Surgery Issues.

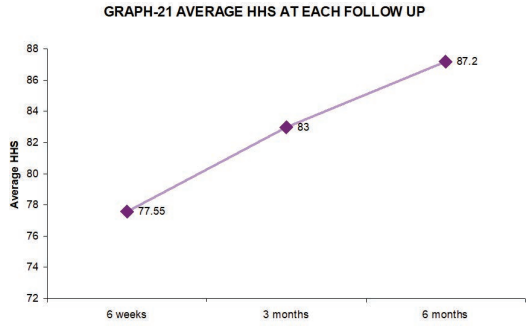

Fig. 2: Average HHS at each follow up

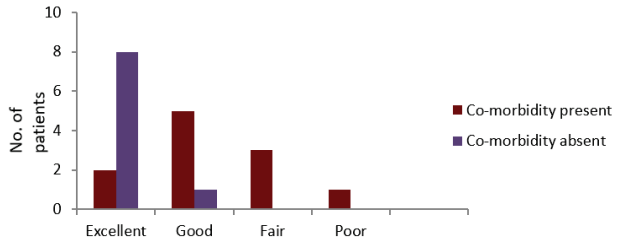

Fig. 3: Correlation of Systemic Co-Morbidities With Outcome

assess the functional outcome using the modified Harris hip scoring system. Radiographs of the hip were taken at each interval for radiological analysis. Patients were educated on postoperative care, including the prohibition of sitting cross-legged and squatting. Harris hip scores were used to grade the total functional outcome.

Statistical analysis: Results thus obtained were subjected to statistical analysis $p<0.05$ was considered significant. The data was analyzed by computer software IBM Statistical Package for Social Sciences (SPSS) version 20.0. The qualitative variables were assessed as mean±standard deviation. The quantitative variables were expressed as frequencies and percentages.

RESULTS

This table 1 presents demographic and clinical data for patients with a specified condition or injury. Patients are categorized by age, sex, side affected and mode of injury. Age groups include 60-69, 70-79 and 80-89, with corresponding patient counts and percentages. The gender distribution consists of males (43.3%) and females (56.7%). Patients affected on the right and left sides each represent 50%. The mode of injury breakdown includes tripping/slipping (73.3%), road traffic accidents (16.7%), and falls from a height (10%).

This table 2 provides key data on patients with a specific medical condition. It divides patients into four categories based on the time taken to seek medical attention: < 24 hrs, 24 hrs -72 hrs, 72 hrs -1 wk and >1 week. Additionally, it classifies patients by radiological type, including Garden types I, II, III, IV and Non-union. For example, 53.3% of patients presented in < 24 hrs, while Garden type IV was the most prevalent radiological type, accounting for 60% of cases. This concise table aids in understanding patient presentation times and radiological patterns.

This table 3 illustrates the systemic co-morbidities among patients, including heart disease, diabetes and hypertension, either individually or in combination. It presents the number of patients and their respective percentages within the total population, offering a quick insight into the prevalence of these co-morbidities. For example, 20% of patients have heart disease, while 10% have diabetes, and various combinations of these co-morbidities are also represented.

Fig. 1 highlights the most common peri-operative issues encountered in a surgical setting. Technical difficulties, particularly with the insertion of the

Table 1: Demographic and clinical characteristics of patients

Age in yrs	No. of patients	Percentage
60-69	13	43.3
70-79	12	40
80-89	5	16.7
Sex		
Males	13	43.3
Females	17	56.7
Side affected		
Right	15	50
Left	15	50
Mode of injury		
Tripping/slipping	22	73.3
RTA	5	16.7
Fall from a height	3	10

Table 2: Time to Presentation and Radiological Types in Patients

Time to presentation	No. of patients	Percentage
< 24 hrs	16	53.3
24 hrs -72 hrs	9	30
72 hrs -1 wk	3	10
>1 week	2	6.7
Radiological type		
Garden type I	0	0
Garden type II	0	0
Garden type III	10	33.3
Garden type IV	18	60
Non-union	2	6.7

Table 3: Systemic Co-morbidities in Patients

Systemic co-morbidity	No. of Patients	Percentage
Heart Disease	6	20
Diabetes	3	10
Hypertension	2	6.7
Heart disease+Diabetes mellitus	3	10
Heart disease+Hypertension	2	6.7
Hypertension+Diabetes mellitus	2	6.7

Table 4: Final harris hip score and clinical result

Grade	Harris Hip Score	No. of patients	Percentage
Excellent	90-100	15	50
Good	80-89	9	30
Fair	70-79	5	16.7
Poor	<70	1	3.3

Table 5: Correlation of age with outcome

	Result				
Age	Excellent	Good	Fair	Poor	Chi square p-value
60-69	10	3	0	0	15.4: 0.017
70-79	6	3	1	2	
80-89	1	1	3	0	

Table 6: Correlation of type of fracture with outcome

	Result				
Fracture type	Excellent	Good	Fair	Poor	Chi square: p-value
Grade III	9	1	0	0	39.8 0.000
Grade IV	8	4	8	0	
Non union	0	0	0	2	

prosthesis and cementation, were the most frequent complications, followed by intra-operative hypotension during cement insertion, which was promptly managed by the attending anaesthetist. Post-operatively, limb length discrepancies were noted, with a few patients experiencing either a lengthening or shortening, likely due to errors in calcar preparation. Additionally, superficial wound infections were observed in two diabetic patients, effectively treated with antibiotics, debridement and meticulous diabetes management, leading to full resolution without further complications.

The progression of the harris hip score: The average Harris Hip Score at 6 weeks after surgery was 77.55 with the highest score being 91 and the lowest being 63. The average Harris Hip Score at the second follow-up of 3 months was 83 with the maximum score being 100 and the minimum 66. At the third and final follow-up at 6 months the average Harris Hip Score was 87.2 with the highest being 100 and the lowest being 55.

Final harris hip score and clinical result: In our study, the final Harris Hip Score as evaluated at six month follow-up averaged 87.2 with the maximum score being 100 and the minimum score being 55. Overall, 15 patients (50%) achieved Excellent result, 9 patients (30%) achieved Good result, 5 patients (16.7%) achieved fair result and 1 patient (3.3%) achieved poor result. 80% of the patients achieved an excellent or good result. Table 4 categorizes post-hip surgery outcomes based on the Harris Hip Score. Most patients achieved 'Excellent' (50%) or 'Good' (30%) results, indicating high levels of function and minimal pain. A smaller portion rated 'Fair' (16.7%), with moderate limitations and a minority (3.3%) had 'Poor' outcomes, suggesting significant functional impairment or pain.

The table 5 shows a statistically significant relationship (Chi-square = 15.4, p-value = 0.017) between patient age groups and post-treatment results, with 'Excellent' outcomes being most common in the 60-69 age range and a trend towards fewer 'Excellent' and more 'Fair' results in older age groups. Table 6 shows a strong correlation (Chi-square = 39.8, p-value = 0.000) between fracture type and surgical outcomes. Grade III fractures mostly led to 'Excellent' results, Grade IV fractures had mixed outcomes and 'Non-union' fractures resulted exclusively in 'Poor' outcomes, highlighting the impact of fracture severity on recovery.

The fig. 2 shows a significant correlation (p-value = 0.017) between systemic co-morbidities and surgical outcomes. Patients with co-morbidities had mixed results, with fewer 'Excellent' outcomes, while those without co-morbidities predominantly experienced 'Excellent' results, suggesting co-morbidities negatively impact surgical recovery.

DISCUSSIONS

The present study was conducted among 30 fracture neck of femur patients, who were treated by hemiarthroplasty using cemented bipolar prosthesis to know the functional outcome. The aim of replacement surgery in fracture neck femur is early return to daily activities. This is particularly applicable to the elderly age group where complications due to long periods of immoblization have to be prevented.

Patients, aged above 55 yrs, were followed for a year. The mean age was 70.76 yrs, with a range from 60-82 yrs. Interestingly, age showed minimal influence on the final outcome. A higher incidence of these fractures was noted in females, likely due to osteoporosis[9]. Most injuries (73.3%) resulted from trivial trauma like tripping. The study initially used the Austin-Moore endoprosthesis but shifted to hemiarthroplasty due to fewer complications like anterior thigh pain and acetabular protrusion. Most patients arrived at the hospital within three days post-injury. All had displaced fractures, predominantly Garden type IV. Co-morbidities, particularly heart disease and diabetes, were common and significantly affected post-operative rehabilitation and outcomes. Even in a comparison study by Krishnan *et al*[10], between the outcomes following Cemented and Uncemented bipolar prosthesis, 29 patients were of Garden type IV, while 5 patients sustained a Garden type III fracture type.

Surgery typically occurred 2-4 days post-trauma, using spinal or epidural anesthesia. The posterior approach was preferred for surgery. Prostheses of varying sizes were used; with the majority being 45 mm. Technical difficulties were encountered in osteotomy angle calculation and cement insertion[11]. Blood loss was generally less than 500ml and no cases of Deep vein thrombosis were reported due to effective prophylaxis. Post-operatively, limb length discrepancies and superficial infections were observed, particularly in diabetic patients, but managed effectively. Hospital stays averaged 21 days. Average hospital stay of 21 days with bipolar hemiarthroplasty has been reported by Lestrange[12]. Drinker and Murray have reported an average hospital stay of 23 days with the same procedure[13]. No late complications like loosening or dislocation were noted, and most patients were pain-free after the procedure. The Harris Hip Score average was 88.6 at six months follow-up, with 80% achieving Excellent or Good results. The study aligns with other research, confirming the effectiveness of cemented bipolar hemiarthroplasty in treating fracture neck femur, particularly in older adults with severe osteoporosis. Co-morbidities were found to significantly impact outcomes, with better results in patients without them. Similar to present study results, Raghvendra et al (14) found that final Harris hip score as evaluated at 6 months follow-up averaged 87.2 with the maximum score being 100 and the minimum score being 55. Of 20 patients, 10 patients (50%) achieved excellent result, 6 patients (30%) achieved good result, 3 patients (15%) achieved fair result and one patient (5%) achieved poor result. Overall, 80% of the patients achieved either an excellent or a good result. To conclude, the study on 30 fracture neck of femur patients treated with cemented bipolar hemiarthroplasty showed that this method effectively aids in early recovery and daily activity resumption, particularly in the elderly. The outcomes were generally positive, with age and gender having minimal impact. Co-morbidities like heart disease and diabetes were significant factors affecting recovery. Overall, 80% of patients achieved Excellent or Good outcomes based on the Harris Hip Score, supporting the procedure's efficacy in treating these fractures, especially in older adults with osteoporosis.

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