



A COMPARATIVE STUDY BETWEEN CEMENTED BIPOLAR AND MODULAR PROSTHESIS IN THE TREATMENT OF DISPLACED FRACTURE NECK OF FEMUR

Orthopaedics

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ABSTRACT

Introduction: There is a debate about the choice of prosthesis in treating unstable intertrochanteric fractures. The present study was done to compare effectiveness of modular prosthesis and bipolar prosthesis. **Methodology:** This comparative prospective study was conducted in the Department of Orthopedics, at a tertiary health care center and medical college in which patients with displaced intracapsular fracture neck of femur or comminuted intertrochanteric fracture who underwent hemiarthroplasty were included. 46 patients included in this study divided into two groups. Examination of Hip was carried out using Harris Hip Score (HHS) technique to examine the attitude, disability, deformity, muscle wasting **Results:** Post-operatively, ability to walk, requirement for support to walk, degree of motion and degree of adduction was similar in the two study groups. Degree of abduction was 10 to 15 degrees in 74% of the patients in the modular group and in only 26% of the patients in the bipolar group (p value < 0.01). Limb length equality was restored in 52% of the modular prosthesis patients and 26% of the bipolar prosthesis patients (p value = 0.06). Implant stability was excellent in 52% and 31% of the modular prosthesis and bipolar prosthesis patients respectively (p value = 0.32). Post-operative complications were found less patients in the modular prosthesis group as compared to bipolar group, though the difference was not statistically significant (61% vs 69%, p value = 0.53). Mean HHS was significantly higher in the modular prosthesis group as compared to the bipolar prosthesis group (83.67 ± 6.08 vs 79.72 ± 5.56 , p value < 0.05). **Conclusions:** Based on the results of the present study, modular prosthesis is found superior as compared to bipolar prosthesis.

KEYWORDS

Neck Of Femur; Modularity; Bipolar ; Hemiarthroplasty

INTRODUCTION

Due to the increase in the worlds ageing population the incidence of femoral neck fractures is expected to triple in the next 50 years (1). Despite the advances that have been made in terms of the surgical and medical management, the one-year mortality rate remains in the region of 30%(2). The frequency is expanding and it has been assessed that the number of femoral neck fractures comes with up to 6.26 million by the year 2050. The point of treatment for the neck of femur fracture is to empower them to walk not long after surgery on a steady, functional, and stable hip. The treatment for non-displaced intra capsular femoral neck fractures in active patients is osteosynthesis with screws. In displaced femoral neck fractures, the treatment among elderly patients stays disputable. Hemi arthroplasty, whether unipolar or bipolar, has been proven clinically more successful and practical than reduction and internal fixation in elderly patients (3,4,5). The management of this fracture has evolved significantly and has been changing from time to time. The management started with closed reduction and immobilization in POP hip spica in abduction and internal rotation (Whitman Abduction plaster) in the early part of 20 century. High incidence of non-union, bed sores and respiratory complications led to exploration of methods of internal fixation. The introduction of Smith Peterson nail brought a new hope of solving the problem, but high failure and complication rates disappointed many surgeons. Further improvement in implant designs brought in newer devices (nail plate assemblies) like Smith Peterson nail plate and McLaughlin nail plate, these also did not withstand the test of time (6). Hemi arthroplasty is the most common treatment for displaced fractures of the femoral neck in the elderly and is associated with better functional outcome and fewer reoperations than internal fixation. A large number of prostheses have been used, and no definite conclusions have been made regarding which type of arthroplasty is preferred (7). Replacement of the head of the femur alone is hemi replacement arthroplasty. It may be either unipolar or bipolar replacement arthroplasty [Figure 1]. Various prostheses are in use for arthroplasty, but the concern with the prosthesis is stem loosening and migration. To overcome these, several strategies are used such as achieving a geometrically stable press fit between bone and implant, stimulating bone growth and use of Polymethyl Methacrylate (PMMA) cement. Among these strategies, use of PMMA cement offers definite advantages as it acts as a grouting agent to replace thinning trabecular bone, offering immediate interference stability between implant and bone, thus greatly simplifying rehabilitation. Bipolar arthroplasty was introduced to prevent or retard acetabular wear. These prostheses have

a 22 to 32 mm head that articulate with a ultra-high density polyethylene liner of varying sizes. The liner is covered with polished metal outer head that articulates with the acetabular cartilage. Theoretically, hip motion primarily occurs at prosthetic joint and only secondarily at metal cartilage interface, minimizing articular wear (8). There is evidence for use of cemented hemiarthroplasty resulting in greater anchoring and lesser periprosthetic fracture. However, cemented prosthesis may result in more mortality from haemodynamic instability and cardiopulmonary complications termed as 'cement reaction' or bone cement implantation syndrome . In contrast, uncemented hemiarthroplasty procedures may result in loosening of prosthesis and post-operative fractures and thigh pain (9). In addition, the procedure is less strenuous, and blood loss during procedure is low (10). Bipolar hemi arthroplasty prosthesis decreases the acetabular erosion and can be used in younger patients. It improves stability due to self-centering or self-aligning mechanism. Recently, many surgeons are evaluating effectiveness of cemented and uncemented hemi arthroplasty for fracture neck of femur. There is evidence for better results in terms of mobility, revision rates and thigh pain after cemented hemi arthroplasty in spite of longer duration of surgery and blood loss during the procedure (11). However, a meta-analysis comprising of 7 randomized control trials has shown that, there is no difference between cemented and uncemented hemi arthroplasty in terms of mortality, range of movements, quality of life and reoperation rate (12,13). The aim of this study is to make a comparison between cemented bipolar and cemented modular prosthesis in elderly patients with femoral neck fracture with the objective to assess age distribution, blood loss during surgery, stability of implants, early restoration and quality of life, morbidity and mortality and to evaluate the results of cemented hemi arthroplasty.

MATERIALS AND METHODS

This was a prospective longitudinal study; was conducted in the department of Orthopedics, at a well reputed tertiary medical college and hospital catering patients from middle and east zone of India. 46 patients included in this study were the patients attending outdoor and emergency also some pre-diagnosed cases referred from peripheral hospital after taking written informed consent and ethical clearance certificate. The study duration was 2 years from 2016-2018. Patients with displaced intra capsular fracture neck of femur or comminuted inter trochanteric fractures are the primary subjects for this study along with some cases of failed old inter trochanteric fracture fixation with dynamic hip screw plate. We excluded patients aged below 20 years,

unfit for undergoing operation during pre-anaesthetic check-up, those with head injury or other gross injuries that may preclude undergoing operation, those on irregular treatment of hypertension, coronary heart disease and diabetes mellitus and those with gross neurological deficit (spinal cord injury or spinal cord edema or myelomalacia). The patients were explained the purpose of the study and an informed written consent was obtained from them. The study was approved by the Institutional Ethics Committee. All the patients selected were then be operated and followed up after 2 weeks, 6 weeks for at least 6 months with clinical and radiological assessment at each visit. Examination of Hip was carried out using Harris Hip Score (HHS) technique to examine the attitude, disability, deformity, muscle wasting. Various laboratory investigations were ordered for the patients as deemed necessary by the treating surgeon. Radiological investigations included x-ray and computed tomography (CT) scan. Plain X-ray of pelvis including both hip joint [Antero-posterior (AP) view], plain X-ray of affected hip including thigh (AP and lateral view) were done. CT Scan were done in selected cases. Intraoperative procedures were performed either by posterior or by anterolateral approach to the hip [Figure2]. In all cases a preoperative and postoperative charts (according to HHS technique) were maintained with regular assessment for proper postoperative recovery assessment. The collected data were compiled and analysed in SPSS version 23. Quantitative data were described as means and standard deviation and qualitative data as frequency distribution. To compare quantitative data, student's t test was used and to compare qualitative data chi-square or Fisher's exact test was used. A p value less than 0.05 was considered as statistically significant.

RESULTS

Twenty three patients were included in each of the two study groups by randomization procedure. The mean age of the patients in the modular prosthesis group and bipolar prosthesis group was 59.95 ± 2.94 and 59.78 ± 3.28 respectively, p value = 0.62 (Table 1). Males comprised 83% of the modular prosthesis group and 87% of the bipolar prosthesis group. Extrinsic injuries were mainly responsible for the fractures in both the study groups. Garden type II fractures comprised 52% of the modular prosthesis group and 57% of the bipolar prosthesis group. Most common type of fracture was stress fracture in both the study groups. Mean day of operation was similar in the two study groups (4.69 ± 1.98 vs 4.24 ± 1.45 days, p value = 0.44). The amount of blood loss was also similar in the two study groups. Post-operatively, we observed that moderate pain was experienced by 43% of the patients in the modular group and 48% of the bipolar group (p value = 0.93). Ability to walk, requirement for support to walk, degree of motion and degree of adduction was similar in the two study groups (Table 2). Degree of abduction was 10 to 15 degrees in 74% of the patients in the modular group and in only 26% of the patients in the bipolar group (p value < 0.01). Limb length equality was restored in 52% of the modular prosthesis patients and 26% of the bipolar prosthesis patients (p value = 0.06). Implant stability was excellent in 52% and 31% of the modular prosthesis and bipolar prosthesis patients respectively (p value = 0.32). Post-operative complications were found less patients in the modular prosthesis group as compared to bipolar group, though the difference was not statistically significant (61% vs 69%, p value = 0.53) (Table 3). Mean HHS was significantly higher in the modular prosthesis group as compared to the bipolar prosthesis group (83.67 ± 6.08 vs 79.72 ± 5.56 , p value < 0.05).

DISCUSSION

In the present study, we did not observe significant differences in the patient characteristics and clinical outcomes among the modular prosthesis and bipolar prosthesis group, except for degree of abduction and mean HHS, which were significantly better for patients in the modular prosthesis group. We did not observe any difference between the two groups with respect to the development of complications. Using modular bipolar prosthesis, Sharanprasad et al that the mean age of the patients was 67.9 years and the youngest patient in their study was 60 years (14). Majority of their patients belonged to Garden type III. In their study, mean HHS at 6 months was 80.86, which increased to 81.96 at 12 months, where in this study mean HHS was significantly higher in the modular prosthesis group as compared to the bipolar prosthesis group (83.67 ± 6.08 vs 79.72 ± 5.56 , p value < 0.05). Furthermore, the authors reported that superficial infection in the form of a wound dehiscence was seen in 15.2% patients, who were a diabetic or hypertensive with diabetic. One patient had deep vein thrombosis post-operatively, confirmed by colour Doppler. Post-operatively one patient had loosening of implant which resulted in anterior thigh pain.

There were no late postoperative complications like dislocation, erosion, subsidence, protrusion acetabuli or periprosthetic fracture. Compared to this, in our study post-operative complications were found less patients in the modular prosthesis group as compared to bipolar group, though the difference was not statistically significant (61% vs 69%, p value = 0.53). In the study by Wathne and colleagues, 112 patients were given cemented bipolar prosthesis and 64 were given cemented modular unipolar prosthesis (15). Post-operatively there were no significant differences between the two groups with respect to mean operative blood loss, length of hospital stay and the number of post-operative complications. The level of independence in performing daily activities were measured using basic activities of daily living (BADL) and instrumental activities of daily living (IADL). The percentage change of independence of performing different activities in the modular group or the bipolar group were statistically similar. In another study, Wang et al used a tapered modular femoral prosthesis for 62 patients undergoing femoral revision surgery (16). The authors noted that pre-operatively mean HHS was 40.5, which increased to 81.4 at last follow up. In addition, 78% patients had no or a slight limp and 22% had a moderate limp post-operatively. Stage I incision healing was observed in 57 patients, with only one patient experiencing delayed wound healing. Leg length discrepancies were corrected to within 5 mm in 37 (64 %) patients, with the median leg length discrepancy in all 58 patients being 4.7 mm (range 0–26 mm). But in our group of observation limb length equality was restored in 52% of the modular prosthesis patients and 26% of the bipolar prosthesis patients (p value = 0.06). Meganath et al evaluated the functional and clinical outcomes of cemented modular bipolar hemiarthroplasty as a primary treatment for unstable intertrochanteric fracture in the elderly patient (17). The average age at operation was 64.6 years (range, 60 to 85 years). Patients with modular bipolar hemiarthroplasty had less postoperative complications; pressure sores 1 (5%), pulmonary complications (0%), cardiac complications (0%), superficial wound infection 2 (10%) urinary tract infection 3 (15%). In the radio-clinical results of one patient were considered unsatisfactory: one patients had restriction in the range of movement of the affected hip. The Harris Hip Score at 3 months postoperatively was significantly higher in patients with bipolar hemiarthroplasty (76, range 66 to 86). The Harris Hip Score at 12 months postoperatively was significantly higher in patients who underwent modular bipolar hemiarthroplasty (82, range 72 to 90). At 24 months, Harris Hip Score was significantly higher in patients who underwent bipolar arthroplasty (85, range 76 to 90). In a prospective cases series study in 2017, for functional evaluation of cemented hemi arthroplasty as a treatment option for unstable intertrochanteric fractures in the elderly, 27 cases were included and functional outcomes were assessed based on Harris hip score. The mean Harris Hip score was 87.20 point at final follow up at 12 months. A majority of the patients had a pain free mobile hip with a nearfull range of flexion, abduction and adequate amount of rotations and adduction. This study concluded that primary hemi arthroplasty does provide a stable, pain-free, and mobile joint with acceptable complication rate (18). There are a few limitations of the present study. First it was single centre study. So the results might not be comparable with another surgical centre which employs a different technique or component. Second, we used a modest sample for analysis. Third, Garden type 3 and 4 patients were not included in the study. Despite these limitations, very few studies from India have compared the clinical and functional outcomes of patients undergoing hemiarthroplasty with modular and bipolar prosthesis.

CONCLUSION

Based on the results of the present study, modular prosthesis is found superior as compared to bipolar prosthesis. The present study provides evidence and further insights into the selection of prostheses to achieve better therapeutic outcomes in patients with intertrochanteric fractures of the femur. Future randomized studies are required to support the results of the present study.

Table 1. Comparing Baseline Information Of The Patients Included In The Study

	Groups		
	Modular prosthesis (n=23)	Bipolar prosthesis (n=23)	p value
Mean age (years)	59.95 ± 2.94	59.78 ± 3.28	0.62
Males	19 (83%)	20 (87%)	0.68
Mode of injury			
Extrinsic	12 (52%)	13 (57%)	0.76
Intrinsic	11 (48%)	10 (43%)	

Fracture classification			
Garden I	11 (48%)	10 (43%)	0.76
Garden II	12 (52%)	13 (57%)	
Fracture type			
Impaction	8 (35%)	6 (26%)	0.92
Intertrochanter	2 (9%)	2 (9%)	
Partial	3 (13%)	3 (13%)	
Stress	10 (43%)	12 (52%)	
Mean day of surgery	4.69 ± 1.98	4.24 ± 1.45	0.44
Blood loss			
None	10 (43%)	8 (34%)	0.32
Mild	13 (57%)	13 (57%)	
Moderate	0 (0%)	2 (9%)	

Table 2. Comparing Post-operative Characteristics Of The Patients Included In The Study

	Groups		
	Modular prosthesis (n=23)	Bipolar prosthesis (n=23)	p value
Pain			
None	7 (31%)	6 (26%)	0.93
Mild	6 (26%)	6 (26%)	
Moderate	10 (43%)	11 (48%)	
Ability to walk			
Indoor only	8 (35%)	9 (39%)	0.61
10 mins	5 (22%)	7 (31%)	
15 mins	2 (9%)	1 (4%)	
30 mins	6 (26%)	6 (26%)	
40 mins	2 (8%)	0 (0%)	
Support requirement			
None	15 (65%)	10 (43%)	0.13
Crutches	8 (35%)	13 (57%)	
Degree of motion			
8 to 16	6 (26%)	7 (31%)	0.41
16 to 24	10 (43%)	6 (26%)	
40 to 45	1 (4%)	4 (17%)	
45 to 55	6 (26%)	6 (26%)	
Degree of abduction			
5 to 10	6 (26%)	17 (74%)	< 0.01
10 to 15	17 (74%)	6 (26%)	
Degree of adduction			
None	3 (13%)	3 (13%)	0.81
5 to 10	9 (39%)	11 (48%)	
10 to 15	11 (48%)	9 (39%)	
Limb length equality restored	12 (52%)	6 (26%)	0.06
Implant stability			
Excellent	12 (52%)	7 (31%)	0.32
Fair	2 (9%)	3 (13%)	
Good	9 (39%)	13 (56%)	

Table 3. Comparing Post-operative Complications And Harris Hip Score At 6 Months

	Groups		
	Modular prosthesis (n=23)	Bipolar prosthesis (n=23)	p value
Complications			
No	9 (39%)	7 (31%)	0.53
Yes	14 (61%)	16 (69%)	
Mean HHS	83.67 ± 6.08	79.72 ± 5.56	< 0.05

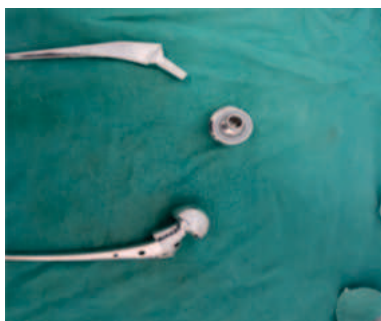


Figure 1 : Modular And Bipolar Hip Prosthesis



Figure 2: Intraoperative Picture Of Bipolar Hemiarthroplasty Procedure

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