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A Prospective Comparative Study of Unipolar with Bipolar Hemiarthroplasty in Elderly Patients with Fracture Neck of Femur

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ABSTRACT
The hip joint connects the lower limb and pelvic girdle.This joint is designed for a wide range of movements and stability. It is a multi-axial ball and socket joint that allows the entire lower extremity to move in three planes of motion and provides shock absorption function to the trunk and upper body. To compare the functional and radiological outcome of fracture neck of femur in elderly patients treated with unipolar and bipolar hemiarthroplasty. All cases that come to the orthopaedic department and meet the inclusion criteria will be included in the planned study, which is a prospective comparative analysis centered at District Hospital in Tumakuru, Karnataka. The clinical outcome following Unipolar and bipolar hemiarthroplasty based on HHS gives Good clinical outcome of 48.3% (13[46.4%] out of 28 unipolar HA, 15[50%] out of 30 in bipolar) Excellent outcome in 19% (5 in unipolar [17.9%], 6 in bipolar [20%]) , Fair in 17.2% (3 in unipolar [10.7%], 7 in bipolar [23.3%]) and 15.5% of poor outcome (7 in unipolar [25%], 2 in bipolar [6.7%]). In summary, there is a small but statistically insignificant difference in the functional outcomes between the two hemiarthroplasty procedures in favor of Bipolar HA. Rather, early mobilization and appropriate prosthesis installation are more crucial in reducing morbidity and mortality.

INTRODUCTION

The pelvic girdle and lower leg are joined at the hip joint. This joint is made to move in a variety of ways and be stable. It is a multi-axial ball and socket joint that offers the trunk and upper body shock absorption capabilities while enabling full range of motion for the lower extremities in three planes.

Hip fractures are frequently sustained and little trauma to the osteoporotic bone of elderly people increases their risk of morbidity and death.

The frequency of femur fracture necks is gradually rising in the present period of urbanization and longer life expectancies. It contributes for about 20% of the operative workload of an orthopaedic trauma unit. The risk of sustaining a hip fracture in lifetime lies in the range of 40% to 50% in women and 13% to 22% in men[1]. Treating these fractures is a major burden for any healthcare system.

Regaining the patient's pre-fracture functional state is the main aim of the treatment[2]. Many therapy modalities have been used for decades. In order to accomplish early ambulation, surgery was necessary because prolonged immobilization of the elderly caused decubitus issues and related consequences. Because of the avascular necrosis of the femoral head, failure of osteosynthesis and frequent development of non-union, several authors have proposed replacing the femoral head as an alternative to internal fixation[3].

Prosthetic replacement is the initial procedure used to remove the possibility of avascular necrosis and nonunion as consequences of femur intracapsular fracture neck[4].

Different prosthetic replacement designs have been developed.

In 1940s, The unipolar prosthesis of the Moore type was unveiled. Bateman reported on the usage of bipolar or universal prosthesis later in 1974, which served as a halfway ground between total hip replacement and the Moore type[5].

Numerous individuals have opted for a bipolar system due to issues with acetabular protrusio and chronic pain associated with unipolar hemiarthroplasties.

RESULT AND DISCUSSIONS

Comparison of Unipolar hemiarthroplasty with bipolar hemiarthroplasty based on functional outcome which is assessed by using Harris hip scoring system postoperatively on 1st , 3rd 6th 12th and 18th month. Results at the end of 1st and 18th month are tabulated below (Table 1).

Comparison between Unipolar with bipolar hemiarthroplasty at the end of 18 month with P-value of 0.084, indicates no significant difference among the groups (Table 2).

Table 1: Distribution by side of Injury

Side	Frequency	Percent
Left Side	35	54.7
Right Side	29	45.3
Total	64	100

Table 2: Comparison of HSS between Unipolar and Bipolar

HSS	Type	N	Mean	Std. Deviation	t-value	p-value*
1st Month HSS	Unipolar	32	41.44	8.159	0.796	0.429
	Bipolar	32	39.81	8.177		
18th Month HSS	Unipolar	28	78.89	11.83	-1.76	0.084
	Bipolar	30	83.37	7.12		

Table 3: Pairwise Comparison of HSS at 1st month to 18th month

HSS	N	1st Month HSS	18th Month HSS	t-value	p-value*
Unipolar	28	41.11±7.89	78.89±11.83	14.81	<0.001
Bipolar	30	39.87±8.45	83.37±7.12	24.65	<0.001

Table 4: Association between Clinical outcome and surgery type

Clinical Outcome	Surgery Type: Unipolar	Bipolar	Total	Chi-Square	p-value
Poor	7 (25.0%)	2 (6.7%)	9 (15.5%)	4.548	0.208
Fair	3 (10.7%)	7 (23.3%)	13 (17.2%)		
Good	13 (46.4%)	15 (50.0%)	28(48.3%)		
Excellent	5 (17.9%)	6 (20.0%)	11 (19.0%)		
Total	28 (100.0%)	30 (100.0%)	58 (100.0%)		

Table 5: Association between Stem position and surgery type

Stem position	Surgery Type: Unipolar	Bipolar	Total	Chi-Square	p-value
Centre	19 (59.4%)	22 (68.8%)	41 (64.1%)	3.282	0.194
Valgus	7 (21.9%)	2 (6.3%)	9 (14.1%)		
Varus	6 (18.8%)	8 (25.0%)	14 (21.9%)		
Total	32 (100.0%)	32 (100.0%)	64 (100.0%)		

The comparison between 1st month score with 18th month HHS score shows significant improvement in function with p-value is <0.001 (Null hypothesis is rejected) (Table 3).

The clinical outcome following Unipolar and bipolar hemiarthroplasty based on HHS gives Good clinical outcome of 48.3% (13[46.4%] out of 28 unipolar HA, 15 [50%] out of 30 in bipolar) Excellent outcome in 19% (5 in unipolar [17.9%], 6 in bipolar [20%]), Fair in 17.2% (3 in unipolar [10.7%], 7 in bipolar [23.3%]) and 15.5% of poor outcome (7 in unipolar [25%], 2 in bipolar [6.7%]) (Table 4).

The ideal femoral stem position is central. In our study we had 64.1% Neutral Positioning of stem, 21.9% varus and 14.1% of Valgus Positioning of stem (Table 5).

In our study; unipolar HA 12.5% (4 out of 32) had acetabular erosion as a complication but no cases were reported in Bipolar group which is of statistical significance with P value <0.001.

Incidence of Limb length discrepancy of 6.3% in both groups (i.e. 3 cases with subsidence and 1 case with decreased vertical offset) and periprosthetic fracture of 12.5% (4 out of 32) noted in Unipolar and (0.4% (3 out of 32) note in bipolar HA. No cases reported in our study with stem loosening, dislocation at the end of 18 months.

Older adults frequently suffer proximal femur fractures as a result of little trauma or a straightforward fall, with osteoporotic bone increasing the risk of both morbidity and death. Approximately 20% of the surgical cases in an orthopaedic trauma unit have hip fractures. Treating these fractures is a major burden for any healthcare system. Finding an appropriate implant or prosthesis for an early restoration of the patient to their pre-fracture status is essential as the field of surgery continues to advance.

Our study included a total of 64 cases of intracapsular fracture neck of femur, out of which 32 cases were treated with unipolar HA and other 32 were with bipolar HA.

All the patients were above the age of 60 years. 20 patients were in between 60-65 years.18 were between 66 to 70 years, 15 were between 71 to 75 years and 11 patients were above the age of 75 years. Cui *et al*.[6] in 2020 The internal fixation group had a lower operation time, intraoperative blood loss and short-term EQ-5D score than the hemi-hip replacement group, but the reoperation rate was higher. These findings were reported in their RCT and cohort studies that compared internal fixation with screw and hemiarthroplasty in elderly patients with displaced femoral neck fractures. In our study the overall reoperation rate are 7.81% at the end of 18 months.

Marya *et al*.[7] in 2011 in their study, the mean Harris hip score was 85 (range: 69-96) for 29 senior patients with femoral neck fractures and an average follow-up of 36 months. Bipolar HA allows older people with femur neck fractures to return to their pre-morbid lives sooner. In our study, we had 19% (11 out of 58) excellent outcome, 48.3% (28 out of 58) Good outcome 17.2% of fair outcome.

Nottage *et al*.[8] in 1990 52 unipolar prostheses with a mean follow-up length of 35 months were contrasted with 76 bipolar prostheses with a mean follow-up period of 32 months in their retrospective analysis. HHS produced mean scores that were found to be comparable to the current study-85 for the bipolar group and 77 for the unipolar groups. The morbidity was similar in each group. In contrast to our study, which had 6.25% mortality at the 18-month mark, the perioperative death rate was 4.6% and increased to 29% at the time of evaluation.

Functional Outcome: All post-operative patients in the present study were followed up at an interval of 1st, 3rd, 6th, 12th and 18th month for assessing their functional status with Harris hip scoring system. After evaluating ten parameters and summing them up to a maximum of 100 points, the final score was determined.

These include pain, limping, walking distance, length of time spent sitting, utilizing public transportation, claiming stairs, donning socks and shoes, deformity and range of motion.

The total scores were then grouped as:

- Excellent : 90-100
- Good : 80-89
- Fair : 70-79
- Poor : ≤69

Somashekar *et al*.[9] in 2013 conducted In a research, 41 elderly individuals with femoral neck fractures were randomized at random to have unipolar or bipolar hemiarthroplasty as treatment. With a 1-year follow-up, their functional outcome was evaluated utilizing radiological and HHS measures. Results were mean Harris hip score in bipolar and unipolar groups was 86.18±12.18 and 79.79±15.55, respectively (p = 0.183); range of motion was 210.63±28.39 and 181.58±37 (p = 0.015) with bipolar and unipolar groups, respectively. The bipolar group experienced better functional outcomes. Unipolar prostheses have been associated with complications such as acetabular erosion, posterior dislocation, uncomfortable hip and periprosthetic fracture. They came to the conclusion that using a bipolar endoprosthesis to treat displaced femoral neck fractures in older people was linked to a lower incidence of comorbidities and a better mean Harris hip score. Hence, bipolar would be a better option in elderly patients with fracture neck of femur. In our study also bipolar HA had mean HHS of 83.37 and unipolar of 78.89 with P-value of 0.084.

Alazzawi *et al*.[10] in their study 164 patients reviewed with a minimum of 1 year from date of surgery, 4 patients had undergone a conversion of their bipolar prosthesis to THA. For fracture, dislocation and infection, 3 conversions were carried out. For groin discomfort, just 1 (0.6%) conversion was carried out. They came to the conclusion that bipolar HA converts to THA less frequently than unipolar HA. In our study, we had 10.71% conversion rate in unipolar HA to THAs due to acetabular erosion. In the bipolar group, there was no conversion during our follow-up period.

Klestil *et al*.[11] in 2018 conducted a prospective cohort studies on elderly with fracture neck of femur. Patients operated within 48 hours had a 20% lower risk of dying within 12 months (risk ratio (RR) 0.80, 95% confidence interval (CI) 0.66-0.97). No statistical significant different mortality risk was observed when comparing patients operated on within or after 24 hours (RR 0.82, 95% CI 0.67-1.01). Data suggests fewer complications (8% vs. 17%) in patients who had early surgery and increasing risk for pressure sores/ ulcers in delay surgery. Less perioperative problems and a

decreased risk of death were linked to early hip surgery performed within 48 hours. During the course of our follow-up, we operated on all instances in our study within 1 week of the injury and we discovered that the death rate was 6.25%.

Acetabular Erosion: Hedbeck *et al*.[12] in 2011 there were no discernible changes in complications between the groups in their 12-month follow-up study of 120 patients with femur neck fractures. The HHS results during the two follow-ups were identical. At the 12-month follow-up, 20% of patients in the unipolar HA group and 5% in the bipolar HA group had acetabular erosion. (p = 0.03) stated that after 1 year, unipolar HA and bipolar HA seemed to generate similar clinical outcomes; however, as unipolar HA had a much higher incidence of acetabular erosion, bipolar HA would be the better course of treatment. Our results were similar to this and we had acetabular erosion of 14.28%

Femoral Stem Position: Gema *et al*.[13] in 2021 in their retrospective study of 179 patients who underwent cementless bipolar HA. Post-operative pain, functional result utilizing HHS and post-operative femoral stem subsidence were the main goals. To find risk factors connected to the main outcome, statistical analysis was done. Their results found mean femoral stem subsidence to be 2.16±3.4 mm and mean HHS on follow-up was 85.28±10.3. American Society Anaesthesiologist score 3 (p = 0.011, OR = 2.77) and varus alignment (p = 0.039, OR = 6.963) were related to worse stem subsidence. Otherwise, neutral alignment (p = 0.045 and OR = 0.405) gave protection against femoral stem subsidence. The female gender (p = 0.014, OR 2.53) was associated with postoperative pain onset. Neutral alignment had significant relationship with functional outcomes (p = 0.01; OR 0.33). They came to the conclusion that a higher risk of femoral stem sinking was associated with higher ASA scores and varus stem alignment. On the other hand, the femoral stem subsidence and result were protected by neutral stem alignment. This data support our study Neutral alignment / central stem placement had mean excellent to fair outcome of 61.78%. And, we did not have any cases with stem loosening or Dislocation as a complication during our study.

CONCLUSION

We conclude that appropriate prosthesis implantation and early mobilization are more critical to reduce morbidity and mortality and that there is a minor but statistically non-significant difference in the functional outcomes between the two hemiarthroplasty in favor of Bipolar HA.

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