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Total Hip Arthroplasty (THA) versus Bipolar Hemi-arthroplasty (BHA) for displaced fracture neck of femur in elderly patients- A prospective study

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ABSTRACT

Background

Femoral neck fracture is the most common injury in elderly population. Prevention of complications by early surgery and mobilization in these patients is of prime importance. Bipolar hemi-arthroplasty (BHA) and Total Hip Arthroplasty (THA) are the treatment options available for elderly patients with displaced femoral neck fractures. In our study, we analysed the outcomes following Bipolar Hemi-arthroplasty (BHA) in comparison to Total Hip Arthroplasty (THA).

Methods

We enrolled 64 elderly patients of displaced fracture neck femur in our study who presented from August 2021 to July 2022. All patients were operated through Modified Hardinge approach. 32 patients underwent BHA and 32 patients underwent THA. Functional outcome, dislocation rate, mortality rate, duration of surgery, blood loss and complications were documented and analyzed.

Results

Functional outcome (Harris Hip Score) was significantly better in THA group (88.3) than BHA group (76.2) (p-value : 0.001). There were no dislocations in both the groups. Duration of surgery and blood loss were low in cases of BHA, but were having no significant correlation to the complication rates.

Conclusion

THA is preferable in elderly patients with displaced fracture neck of femur as it gives better functional results and no increased risk of dislocation as compared to BHA. THA is having longer surgery time and blood loss but were not associated with higher complications.

Key Words: Fracture neck of femur, Total hip arthroplasty, Bipolar hemi arthroplasty, Harris hip score.

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INTRODUCTION

Femoral neck fractures are one of the commonest injury in the elderly population. It is a major epidemic problem which causes significant morbidity and mortality in elderly population [1].Over 90% of these fractures are associated with osteoporosis and the fracture occurs due a trivial fall[2].

Fracture neck femur in elderly population is mostly treated surgically and has a great success rate. Surgical treatment in the form of arthroplasty is an established modality of treatment as it allows early mobilization and full weight bearing reducing the complications associated with prolonged recumbence. Bipolar hemi-arthroplasty (BHA) and Total hip arthroplasty (THA) are widely accepted arthroplasty options for treatment of displaced fracture neck of femur. Bipolar hemi-arthroplasty (BHA) is the widely accepted treatment of choice and is still preferred by many surgeons worldwide. But with the advent of modern prosthesis and improved patient care the functional demands of patients has increased considerably. Total hip arthroplasty (THA) in fracture neck femur has emerged as a treatment option. Bipolar hemi-arthroplasty (BHA) is associated with short surgical time, lower blood loss, acceptable functional outcome and lower initial cost but is plagued by groin pain due acetabular erosion and need for revision surgeries[3]. Total hip arthroplasty (THA) done in fracture neck femur offers better functional outcome and less re-operation rate, but has higher rates of dislocations. [4-9]

The aim of this study is to compare functional outcome, dislocation rates, complications and mortality rate between Bipolar hemi-arthroplasty (BHA) and Total hip arthroplasty (THA) in displaced fracture neck femur in the elderly patients.

METHODS

This is a single center study done at Saraswathi Institute of Medical Sciences, Hapur, U.P. during the period of August 2021 to July 2022 with minimum 6 months of follow up. All patients(64) 60 year or older with displaced neck of femur fractures following a trivial fall were selected for this study after written informed consent. All patients were actively ambulant prior to the fracture. Patients were randomized into two groups Bipolar hemi-arthroplasty (BHA) or Total hip arthroplasty (THA). Open fractures, associated ipsilateral femur fractures and patients with head injury were excluded from this study. Patient's demographic profile was noted. Thorough history, clinical examination and relevant investigations including blood parameters and X-rays were done to diagnose and also document the current status of co-morbidities.

Linear regression analyses of all the parameters were done. The Bipolar hemi-arthroplasty (BHA) group and Total hip arthroplasty (THA) group were matched for age, sex, co-morbid illness, time gap from injury to surgery, preoperative hemoglobin.

Pre-operative radiological assessment was done using x-ray pelvis with both hips antero-posterior view (PBH-AP) with limb in 15 degrees internal rotation (to assess calcar status), lateral view of the affected hip, full length femur antero-posterior (AP) and lateral views of the affected limb. In all patients pre-operative templating was done to assess cup size, stem size, level of neck resection and radiological limb length discrepancy.

All patients were operated within 24 hours to 48 hours from time of arrival at the hospital after pre-operative optimization of patient's general condition. All patients were operated under combined spinal and epidural anesthesia (CSEA). Patients were operated in lateral positions on the operating table. Modified Hardinge approach was used in all cases. In Bipolar hemi-arthroplasty (BHA) group only femoral preparation is done which is common in both the groups. The final prosthesis was implanted using 40g bone cement .

Post operatively all patients were allowed immediate weight bearing and active assisted exercises. Post-operative analgesia, DVT prophylaxis and antibiotic prophylaxis were the same in all patients. Pneumatic compression boot and tablet aspirin 150 mg once daily for 4 weeks were given for DVT prophylaxis. Wound inspection was done on the day of discharge.

Follow-up was done at 2 weeks for suture removal, 6 weeks for documentation of gait, complaints and daily activities. Harris hip score was done at 6 weeks, 3 months, and 6 months post-operative period. Complications, if any, was

meticulously noted and addressed.The collected data was tabulated and analyzed in accordance with objectives of the study. Statistical analysis was done by using IBM SPSS Version 20 for windows. Chi square test and independent t test was used for analysis of categorical variables and continuous variables respectively. A p-value <0.05 was considered as statistically significant.

RESULTS

A total of 64 cases of displaced fracture neck of femur in elderly population were included who met the inclusion criterion. 32 (50%) cases underwent Bipolar hemi-arthroplasty (BHA) and 32(50%) cases underwent Total hip arthroplasty (THA).In Bipolar hemi-arthroplasty (BHA) group all cases underwent cemented fixation using polished tapered stems. In Total hip arthroplasty (THA), all patients underwent hybrid fixation with un-cemented cup in acetabulum and cemented stem polished tapered stem for femur.

Age, sex, co-morbidities, pre-op and post-op hemoglobin values were matched for in both the groups (Table 1).

Table 1 : Patient Demography

	BHA Group	THA Group	*P* value
Number of patients(n)	32	32	0.08
Mean age in years(range)	73(62.5-93)	69.9(62-84)	0.11
Gender			0.771
Male	18	21	
Female	14	11	

Thus statistically significant better functional outcome was achieved in Total hip arthroplasty (THA) group than in Bipolar hemi-arthroplasty (BHA) group at all three instances.

Table 2: Outcomes

	BHA Group	THA Group	*P* value
Average surgery duration(min)	45	68	0.04
Average blood loss(ml)	225	460	0.009
HHS Post op	57.5(SD-/+7.57)	66.38(SD-/+11.58)	0.002
HHS at 3 months	67.2(SD-/+6.36)	78.78(SD-/+10.21)	0.002
HHS at 6 months	76.23(SD-/+10.74)	88.31(SD-/+10.02)	0.001

There were no dislocations in both the groups.[10]The mean surgical time was significantly longer (p-value : 0.009) in the Total hip arthroplasty (THA) group(68min) than the Bipolar hemi-arthroplasty(BHA) group (45min).The mean intra-operative blood loss was greater (p-value : 0.009) in the THA group (460ml) than in the Bipolar hemi-arthroplasty(BHA) group (225ml).There was 2(6.25%) mortality at the end of 6 months in Total hip arthroplasty (THA) group and 3(9.37%) in the Bipolar hemi-arthroplasty (BHA) , which could nor achieve statistical significance (p value : 0.59). (Table 3)

Table 3: Complications

	BHA Group	THA Group	*P* value
Groin Pain	3(9.375%)	0	
Mortality at 1 year(%)	3(9.375%)	2(6.25%)	0.59

1 patient in the Bipolar hemi-arthroplasty (BHA) group developed deep infection which was treated with debridement and antibiotics therapy. There was no infection in the Total hip arthroplasty (THA) group.None of the patients in either group needed re-operation. Aseptic loosening was also not reported in either of the two groups.3 patients (9.37%) reported groin pain in the Bipolar hemi-arthroplasty (BHA) group while no groin pain was reported in the Total hip arthroplasty (THA) group.

DISCUSSION

Treatment of displaced fracture neck of femur in elderly patients is still controversial.[10] The guidelines are not clear even for elderly age group. The ideal management of a patient presenting with fracture femoral neck remains a challenge even today. Both bipolar hemi-arthroplasty (BHA) and total hip arthroplasty (THA) are widely used treatment modalities. Bipolar hemi-arthroplasty is less invasive, associated with less surgical time, less blood loss, is economical with good functional outcome.[3]Total hip arthroplasty (THA) in displaced fracture neck of femur in elderly patients has better functional outcome, less revision rates but has high dislocation rate along with higher blood loss and more duration of surgery.[4-9]

The mean age for Bipolar hemi-arthroplasty (BHA) group was 73 years and Total hip arthroplasty (THA) group was 69.9 years which is comparable with **Lim Jw et al** study in which average age was 70 years[11] .The difference in age is statistically not significant (p-value : 0.11).

The average duration of surgery was 45 min in Bipolar hemi-arthroplasty (BHA) as compared to 72 min in Total hip arthroplasty (THA) group (Graph 2). Average blood loss in Bipolar hemi-arthroplasty (BHA) group was less (225 ml) compared to Total hip arthroplasty (THA) group (460 ml).In **Sonaje JC et al** , total blood loss while performing Bipolar hemi-arthroplasty (BHA) was 238.15 ± 20.43 ml compared to 336.85 ± 23.56 ml in Total hip arthroplasty (THA) ($p < 0.0001$). Total duration of surgery was found to be 51.80 ± 8.70 min in Bipolar hemi-arthroplasty (BHA) group which was significantly more in Total hip arthroplasty (THA) group i.e. 71.10 ± 16.75 min ($p < 0.0001$)[12]. Though, duration of surgery and blood loss were low in cases of Bipolar hemi-arthroplasty (BHA), but both had no significant correlation to the complication rates.

In Bipolar hemi-arthroplasty (BHA) one patient got superficial infection one month after the surgery which was treated with debridement and IV antibiotics according to culture and sensitivity. There was no infection in the Total hip arthroplasty (THA) group.

Fracture neck femur in elderly patients is associated with significant mortality .No difference in mortality at 6 months is reported in various studies between Bipolar hemi-arthroplasty (BHA) and Total hip arthroplasty (THA) [14-16].In our study also we found no statistically significant 6 month rate between the two group.

Total hip arthroplasty (THA) is associated with more dislocations than Bipolar hemi-arthroplasty (BHA) in displaced FNF patients[17]. Total hip arthroplasty (THA) is associated with significantly reduced dislocation rates[18]. In our study there was no dislocation in either of the two groups.

In literature Bipolar hemi-arthroplasty (BHA) is having higher revision rates than Total hip arthroplasty (THA), which could be attributed to acetabular erosion[19], starting from 4th postoperative period. In our studies there was no revision needed in either of the two groups. This could be due to the shorter follow up.

Most of the studies report better functional outcome after Total hip arthroplasty (THA). In prospective study conducted by **Blomfeldt et al.**

Harris Hip Score (HHS) was significantly better in Total hip arthroplasty (THA) (87) than in Bipolar hemi-arthroplasty (BHA) (80)[20].In meta-analysis by **Burgers et al.**, the HHS was significantly higher after Total hip arthroplasty [21]. In our studies also, HHS was higher in Total hip arthroplasty (THA) group than Bipolar hemi-arthroplasty (BHA) group (88.3 v/s 76.2) at six month follow up.

Even though Bipolar hemi-arthroplasty (BHA) is less time consuming with less blood loss and financially sound to most patients coming from developing countries, the patients carry the risk of developing groin pain. This is because, bipolar acts like a unipolar prosthesis, and high metal on bone friction leads to chondrolysis on acetabular side and if bones are osteoporotic it often leads to metal head migration[22]. According to literature average time to failure for Bipolar hemi-arthroplasty (BHA) is 38 months and average rate of wear is 0.7mm per year[23-25]. This indicates, patients treated with Bipolar hemi-arthroplasty (BHA) do better in the short term but long term outcomes are poor. So Bipolar hemi-arthroplasty (BHA) should currently be considered only for patients with low life expectancy and in patients with low demand.

In our Total hip arthroplasty (THA) group, there was no dislocation, no infection and all patients had good pain relief and early recovery. Limitations of our study include small sample size, short follow-up period, and lack of randomization. Some outcome measures could not achieve statistical significance due to smaller values. Radiological measurements like offset, acetabular protrusion, stem positioning was also not taken in account.

CONCLUSION

Total hip arthroplasty (THA) is preferable in elderly patents with displaced fracture neck of femur as it gives better functional results and no increased risk of dislocation and mortality at one year as compared to Bipolar hemi-arthroplasty (BHA).

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