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Functional assessment of bipolar hemiarthroplasty versus total hip replacement in trans cervical neck fracture of femur in elderly patients- a prospective observational study

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ABSTRACT

Background: Bipolar hemiarthroplasty and total hip arthroplasty are widely accepted methods of treatment for displaced femoral neck fracture in elderly patients. This study is to compare the functional outcomes of bipolar hemiarthroplasty and total hip arthroplasty in such patients.
Methods: This is a prospective study in which data of all patients with age more than 60 with trans cervical neck of femur fracture undergoing total hip arthroplasty and bipolar hemiarthroplasty in a tertiary care centre in Mumbai is studied. They were followed up and compared with the Modified Harris Hip Score. The results were compared between the two groups for statistical significance.
Results: There was a significant difference seen in pain and gait at 6 and 12 months between two groups with better scores in the total hip arthroplasty group. Better functional activities were seen at 3 and 6 months in the total hip arthroplasty group. A significant difference was seen in the Total Modified Harris Hip Score at 3, 6 and 12 months and was better in the total hip arthroplasty group as compared to the hemiarthroplasty group.
Conclusions: Bipolar hemiarthroplasty is the preferred approach after a displaced femoral neck fracture in the elderly population, but due to potential complications like inguinal pain and low functional outcome, total hip replacement should be considered as the first line of surgical management for the neck of femur fracture in such patients. It has been found to have a good functional outcome, fewer gait disturbances and less post-operative pain.

Key words: Total hip arthroplasty, Bipolar hemiarthroplasty, Total Modified Harris Hip score, Neck of femur fracture, Elderly Indian patients

INTRODUCTION

The incidence of femoral neck fractures is set to double over the next 30 years and it accounts for approximately half of all hip fractures.[1] This is a reflection of a higher number of individuals living beyond 50 years and a parallel rise in those affected with osteoporosis. Surgical treatment options for displaced femoral neck fracture include internal fixation and arthroplasty. In elderly patients with displaced femoral neck fracture, arthroplasty is now preferred as standard treatment over internal fixation.[2-4] Both Bipolar hemiarthroplasty (BHA) and total hip arthroplasty (THA) are widely accepted methods of hip replacement after femur neck fracture. Previous comparative studies on BHA and THA have revealed difference between the two procedures. In this study, we compare the functional outcomes of bipolar hemiarthroplasty versus total hip

replacement in the trans-cervical neck of femur fracture in elderly Indian patients.

METHODS

This is a hospital-based prospective observational study in the orthopaedics department of Topiwala National Medical College, a tertiary-level health care centre in Mumbai, India. Before the study institutional ethical clearance was obtained. Patients of age more than 60 years with a trans-cervical neck of femur fracture and giving consent were included in this study. Patients who underwent hip surgeries previously and those who had ipsilateral lower limb fractures or neuropsychiatric disorders and not giving consent were excluded from the study. This study used prospectively collected data of all patients more than 60 years of age, irrespective of sex with transcervical neck fracture of the femur undergoing Total Hip Replacement or Bipolar Hemiarthroplasty from November 2020 to February 2022. Patients were randomised into two equal groups each having 40 patients. Group 1 was treated with cemented Total Hip Replacement and Group 2 with cemented Bipolar Hemiarthroplasty.

Detailed history and clinical examination were carried out with particular emphasis on the mode of injury and associated medical illness. In all patients, preoperatively skin traction was applied to the affected lower limb to relieve pain, prevent shortening and reduce unnecessary movements of the injured limb. Antero-posterior radiographs of the affected hip joint and lateral radiographs of the affected hip were taken for all the patients. Antero-posterior radiographs were taken by keeping the fractured limb in 15 degrees of internal rotation to bring the neck parallel to the radiograph film. Patients as well as the next-of-kin were explained about the surgery and risk factors and expenses, and written informed consent for the surgery was obtained from all patients.

Surgical technique

All surgeries in our study were elective using aseptic precautions under spinal epidural anaesthesia. After anaesthesia patient was given a lateral decubitus position and continued with a posterior approach to the hip. In all cases, the stem was cemented in place using standard cementing techniques like lavage, cleaning, drying and plugging of the canal. Absolute haemostasis was achieved. Operative time and blood loss were recorded for all cases.

Post-surgical rehabilitation was similar for both groups and consisted of an institutional joint-care programme rehabilitation protocol. Initially, bedside exercises and muscle strengthening exercises have been gradually replaced with full weight-bearing within the first three days after surgery as tolerated. Patients were discharged after 5-7 days as per standard protocol and rehabilitated during the study period. Exercises for active muscle strengthening were advised and the range of motion was tested. Some lifestyle modifications were advised to all the patients like avoiding sitting cross-legged and squatting. For functional assessment, post-operatively patients were followed up at 3, 6 and 12 months in one year period. The hip function was assessed according to the Modified Harris hip score which includes the following dimensions.[5,6] Pain (0 to 44 points), function: gait (0 to 11 points), support (0 to 11 points), distance walked (0 to 11 points) and functional activities: stairs (0 to 4 points), squatting (0 to 4 points), sitting cross-legged (0 to 5 points), public transportation (0 to 1 points).

Data analysis

Data were entered and analysed using computer statistical software (Microsoft Excel, SPSS 20). The results were compared between the two groups for statistical significance by a Student's t-test. Nominal variables were tested with the chi-square test. All tests were two-sided. The results were considered significant if $p<0.05$.

RESULTS

Gender distribution in our study is described in (Table 1). The average blood loss during BHA was 253.8 ml while the THA group had blood loss almost twice with an average of 480.5ml. The average operating time for the BHA group was low as compared to the THA group, 54±15.5 and 85.5±15.2 minutes respectively. Two patients in the THA group had dislocation during their hospital stay and were managed with closed reduction under anaesthesia and supervised physiotherapy and mobilization. In the BHA group, no cases were reported with dislocation during the study period.

Table 1: Distribution of gender (n=40).

Gender	THA, N (%)	BHA, N (%)	Total, N (%)
Female	11 (27.5)	11 (27.5)	22 (27.5)
Male	29 (72.5)	29 (72.5)	58 (72.5)

Table 2: Comparison of pain between THA and BHA.

Time	THA	BHA
3 months		
Mean±SD	22.67±5.94	19.33±5.94
6 months		
Mean±SD	32.93±6.36	26.67±7.24
12 months		
Mean±SD	39.47±5.63	32±7.75

Moderate pain was there in both groups during the initial 3 months which affected gait equally in both groups. The mean±SD of pain at 3 months in THA was 22.67±5.94 and in BHA was 19.33±5.94. There was a significant difference in pain at 6 months and 12 months between THA and BHA ($p<0.05$). Mean±SD of pain at 6 months and 12 months in THA were 32.93±6.36, 39.47±5.63 respectively which was higher as compared to BHA 26.67±7.24 (p value=0.018), 32±7.75 (p value=0.005)

respectively. Comparison of Pain between THA and BHA showed in (Table 2).

Table 3: Comparison of functional activities between THA and BHA.

Time	THA	BHA
3 months		
Mean±SD	2.53±0.83	1.87±0.74
6 months		
Mean±SD	3.53±1.19	2.47±0.92
12 months		
Mean±SD	4.6±1.12	3.8±1.32

Table 4: Comparison of Total Harris Hip score between THA and BHA.

Time	THA	BHA
3 months		
Mean±SD	49±8.23	39.17±7.32
6 months		
Mean±SD	67.07±9.28	56.2±9.8
12 months		
Mean±SD	82.97±9.69	75.37±13.43

Figure 1: Post-operative X ray of patient underwent total hip replacement.

Figure 2: Post-operative X ray of patient underwent bipolar hemiarthroplasty.

Due to moderate pain in both groups, initial gait parameters were similar. No significant difference was seen in gait at 3 months (p value=0.057) between THA and BHA. The mean±SD of gait at 3 months in THA was 13.33±4.43 and in BHA was 10.53±3.2. THA group patients were able to walk without a limp and support in the following months while the number of patients to do the same in the BHA group were less. Mean±SD of gait score at 6 months and 12 months in THA were 19.87±5.38 and 26±6.5 respectively which was higher as compared to BHA; 15.2±5.09 (p value=0.021), 20.93±6.16 (p value=0.037) respectively.

THA group has better functional activities like climbing stairs without rail and using public transport at 3 and 6 months. Mean±SD of functional activities at 3 months and 6 months in THA was 2.53±0.83, 3.53±1.19 respectively which was higher as compared to BHA 1.87±0.74 (p value=0.028), 2.47±0.92 (p value=0.01) respectively. No significant difference was seen in functional activities at 12 months (p value=0.084) between THA and BHA. The mean±SD of functional activities at 12 months in THA was 4.6±1.12 and in BHA was 3.8±1.32. A comparison of functional activities between THA and BHA showed in (Table 3).

There was a significant difference in Total Modified Harris Hip Score at 3 months, 6 months and 12 months between THA and BHA (p value <0.05). Mean±SD of total modified Harris hip score at 3 months, 6 months and 12 months in THA was 49±8.23, 67.07±9.28, 82.97±9.69 while BHA was 39.17±7.32 (p value=0.039), 56.2±9.8 (p value=0.012), 75.37±13.43 (p value=0.012) respectively, more score indicates a better outcome. A comparison of the Total Modified Harris Hip Score between THA and BHA showed in (Table 4).

DISCUSSION

Among elderly people, femoral neck fractures are common injuries.[7] Management of fracture of the femoral neck remains a major and difficult undertaking for an orthopaedic surgeon. The pendulum is swinging between reduction and internal fixation with various supplementary methods as osteosynthesis to arthroplasty. It is now the general feeling that reduction and internal fixation should be reserved for the younger patients in whom revision surgery may be done at a later date if needed. Primary prosthetic replacement should be considered in older patients in whom osteosynthesis will not give the desired outcome and who are active and need early mobilization. Previous studies have showed that there is an increased blood loss and operative time in THA group, but it shows excellent function with shortened hospitalization stays and early ambulation.[8,9] So this study was done to evaluate the functional outcome of BHA and THA in fracture neck of femur in the elderly Indian population. We found out that the THA group has better Modified Harris hip scores at 3, 6 and 12 months intervals. Elderly females are more prone to fracturing the neck of femur.[10-12] Male predominance is

also reported in a few series.[13] In our study male preponderance was 72.5% in both groups. Mean blood loss in total hip replacement was found to vary from 780 ml to 2620 ml, with a weighted overall mean of 1490 ml.[14] The introduction of hypotensive anaesthesia reduced mean intraoperative blood loss by 210-730 ml.[15] In our study duration of surgery and blood loss were significantly higher in the THA group than in the BHA group which can be attributed to additional acetabular component preparation in the THA group. This was followed by earlier studies.[16,17]

There was moderate pain in both groups during the initial 3 months which affected gait equally in both groups. Patients in the BHA group continued to have mild to moderate pain which was not affecting activities of daily living when compared to the THA group. In our study out of 6 patients who had slight pain, one patient had a superficial infection and the rest of the patients had no post-operative complications. Blomfeldt et al reported two cases of superficial infection in both groups and one case of deep infection which required wound debridement.[18] No case of deep infection was noted in our study.

Sign of infection was evident in the first postoperative week and was treated with appropriate antibiotics and dressings. A study done by Fan L et al shows that the mean Visual analogue score (VAS) for the severity of pain in total hip replacement patients was 1.6+0.6 and in the bipolar hemiarthroplasty group, it was 1.8+0.5, showing more severity of pain in bipolar hemiarthroplasty patients than total hip replacement patients.[19] Pain following hemiarthroplasty is a major concern. Approximately 20% of the unipolar prostheses implanted in mobile independent elderly patients needed revision surgery because of pain. Up to 50% of these revisions are required within 3 years. Hinchey and Day et al in their series of 294 patients found pain following hemiarthroplasty in 22 patients in the early postoperative period.[20] They could not find any definitive cause in them.

Poor muscle control is the probable cause. In our study, two patients in the THA group had dislocation during their hospital stay and were managed with closed reduction under anaesthesia and supervised physiotherapy and mobilization. In the BHA group, no cases were reported with dislocation during the study period. Avery et al. and Macaulay et al. reported 3 (7.5%), and 1 (5.88%) hip dislocations, respectively, in the THA group and none in the BHA group. Poignard et al in their retrospective analysis reported 13% dislocation with THR compared to 5% in the BHA.[21-23]

Due to moderate pain in both groups, initial gait parameters were similar. No significant difference was seen in gait at 3 months. In our study, most of the patients in the BHA group had a limp, used a cane for most of the time and walking distance was also less. THA group were able to walk long distance without difficulty or significant limp. Gait parameter scores like limp, support and distance walked were higher in the THA group. This shows that there is an early postoperative recovery of normal gait in the THA group than BHA group. In a study done by Naidu et al, seven patients have varying degrees of limping.[24]

All of them had slight limps. Alteration in the abductor mechanism due to the excision of a little more neck is the most probable cause for this. THA group has better functional activities like climbing stairs without rail and using public transport at 3 and 6 months in our study. This shows that post-operative mobility was early in the THA group than BHA. Functional activities were comparable in both groups at 12 months.

THA group showed a higher Total Modified Harris Hip Score at 3 months, 6 months and 12 months between THA and BHA as compared to the BHA group. In a study done by Naidu et al, 7 (31.82%) patients had excellent results with total modified Harris Hip Score of more than 90, 12 (54.55%) patients had good results with an 80 to 90 score, 2 (9.09%) had fair results with score 70 to 80 and 1 (4.55%) had poor results with score < 70. In a study done by Fan L et al. mean Total Modified Harris Hip Score in patients operated on for total hip replacement was 76.8+17.1 and for bilateral hemiarthroplasty was 74.6+15.3. Blomfeldt et al. in their study reported a mean Total Modified Harris Hip Score of 77.5 in bipolar prosthesis and 82.5 in the THA group. Vanden et al, Cadossi et al, Giannini et al, Hedbeck et al and Macaulay et al also found comparable results between BHA and THR in terms of Modified Harris Hip score.[25,26]

Limitations

Current study had 40 patients in each group which could have been higher for better comparison. Time period in our study is 12 months which cannot accommodate long term complications like loosening, osteolysis, periprosthetic fracture.

CONCLUSION

In elder patients with trans cervical neck of femur fracture bipolar hemiarthroplasty is the preferred approach because of the short operation time, low dislocation rate, less complex surgery, less blood loss, lower initial costs and functional improvements achieved. However, potential complications, including inguinal pain accompanied by low functional outcomes have not satisfied the demand for a higher quality of life due to prolonged lifespan. Total hip replacement should be considered as the first line of surgical management for the neck of femur fracture in elderly patients with an expected prolonged life span, those without any medical or surgical comorbidities and good functional activity during the pre-fracture state. It has been found to have a good functional outcome, fewer gait disturbances, less post-operative pain and better hip ROM in patients when compared to bipolar hemiarthroplasty but bipolar hemiarthroplasty should be considered as

traditionally for those elderly patients who did not fall into this group.

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REFERENCES

1. Wang F, Zhang H, Zhang Z, Ma C, Feng X. Comparison of bipolar hemiarthroplasty and total hip arthroplasty for displaced femoral neck fractures in the healthy elderly: a meta-analysis. BMC Musculoskelet Disord. 2015;28:229.
2. Støen RØ, Lofthus CM, Nordsletten L, Madsen JE, Frihagen F. Randomized trial of hemiarthroplasty versus internal fixation for femoral neck fractures: no differences at 6 years. Clin Orthop Relat Res. 2014;1: 360-7.
3. Keating JF, Grant A, Masson M, Scott NW, Forbes JF. Displaced intracapsular hip fractures in fit, older people: a randomised comparison of reduction and fixation, bipolar hemiarthroplasty and total hip arthroplasty. Health Technol Assess. 2005;41:1-65.
4. Khalil CG, Mukka A. Total hip replacement versus open reduction and internal fixation of displaced femoral neck fractures. J Bone Joint Surg. 2012;94: 1921-8.
5. Kumar P, Sen R, Aggarwal S, Agarwal S, Rajnish RK. Reliability of modified Harris Hip score as a tool for outcome evaluation of total hip replacements in Indian population. J Clin Orthop Trauma. 2019;10:128-30.
6. Vishwanathan K, Akbari K, Patel AJ. Is the modified Harris hip score valid and responsive instrument for outcome assessment in the Indian population with pertrochanteric fractures?. J Orthop. 2018;3:40-6.
7. Parker MJ. Fractures of the neck of the femur. Trauma. 2008;10(1):43-53.
8. Solomon L, Warwick D, Nayagam S. Injuries of the Hip and Femur. In: Solomon L, Warwick D, Nayagam S, eds. Apley's System of Orthopaedics and Fractures. 9th ed. Usa: CRC Press; 2008:740-845.
9. Hedbeck CJ, Enocson A, Lapidus G, Blomfeldt R, Törnkvist H, Ponzer S, et al. Comparison of bipolar hemiarthroplasty with total hip arthroplasty for displaced femoral neck fractures: a concise four-year follow-up of a randomized trial. J Bone Joint Surg Am. 2011;93(5):445-50.
10. Hopley C, Stengel D, Ekkernkamp A, Wich M. Primary total hip arthroplasty versus hemiarthroplasty for displaced intracapsular hip fractures in older patients: systematic review. BMJ. 2010;340:c2332.
11. Schmidt AH, Leighton R, Parvizi J, Sems A, Berry DJ. Optimal arthroplasty for femoral neck fractures: is total hip arthroplasty the answer? J Orthop Trauma. 2009; 23(6):428-33.
12. Kyle RF. Subcapital fractures: in the bucket or on top of the neck? Orthopedics. 2010;33(9):644.
13. D'Arcy J, Devas M. Treatment of fractures of the femoral neck by replacement with the Thompson prosthesis. J Bone Joint Surg Br. 1976;58(3):279-86.
14. Flordal PA, Neander G. Blood loss in total hip replacement. A retrospective study. Arch Orthop Trauma Surg. 1991;111(1):34-8.
15. Davis FM, McDermott E, Hickton C. Influence of spinal and general anaesthesia on haemostasis during total hip arthroplasty. Br J Anaesth. 1987;59(5):561-71.
16. Tol MC, van den Bekerom MP, Sierevelt IN, Hilverdink EF, Raaymakers EL, Goslings JC. Hemiarthroplasty or total hip arthroplasty for the treatment of a displaced intracapsular fracture in active elderly patients: 12-year follow-up of randomised trial. Bone Joint J. 2017;99-B(2):250-4.
17. Sonaje JC, Meena PK, Bansiwal RC, Bobade SS. Comparison of functional outcome of bipolar hip arthroplasty and total hip replacement in displaced femoral neck fractures in elderly in a developing country: a 2-year prospective study. Eur J Orthop Surg Traumatol. 2018;28(3):493-8.
18. Blomfeldt R, Törnkvist H, Eriksson K, Söderqvist A, Ponzer S, Tidermark J. A randomised controlled trial comparing bipolar hemiarthroplasty with total hip replacement for displaced intracapsular fractures of the femoral neck in elderly patients. J Bone Joint Surg Br. 2007;89(2):160-5.
19. Fan L, Dang X, Wang K. Comparison between bipolar hemiarthroplasty and total hip arthroplasty for unstable intertrochanteric fractures in elderly osteoporotic patients. PLoS One. 2012;7(6):e39531.
20. Hinchey A, John J, Phillip L. Primary prosthetic replacement in fresh femoral-neck fractures. J Bone Joint Surg. 1964;46(2):223-334.
21. Avery PP, Baker RP, Walton MJ, Rooker JC, Squires B, Gargan MF, et al. Total hip replacement and hemiarthroplasty in mobile, independent patients with a displaced intracapsular fracture of the femoral neck: a seven- to ten-year follow-up report of a prospective randomised controlled trial. J Bone Joint Surg Br. 2011;93(8):1045-8.
22. Macaulay W, Nellans KW, Garvin KL, Iorio R, Healy WL, Rosenwasser MP. Other members of the DFACTO Consortium. Prospective randomized clinical trial comparing hemiarthroplasty to total hip arthroplasty in the treatment of displaced femoral neck fractures: winner of the Dorr Award. J Arthroplasty. 2008;23(6):2-8.
23. Alexandre P, Mohamed BP, Lachaniette OF, Philippe CHH. High dislocation cumulative risk in THA versus hemiarthroplasty for fractures. Clin Orthopaed Related Res. 2010;487:3148-53.
24. Naidu KA, Sunil T, Koduru SK. A clinical study of management of intracapsular fracture neck of the femur in elderly with bipolar hemiarthroplasty. Int J Orthop Sci. 2020;6(2):319-25.
25. Cadossi M, Chiarello E, Savarino L, Tedesco G, Baldini N, Faldini C, et al. A comparison of hemiarthroplasty with a novel polycarbonate-urethane

acetabular component for displaced intracapsular fractures of the femoral neck: a randomised controlled trial in elderly patients. Bone Joint J. 2013;95(5):609-15.
26. Giannini S, Chiarello E, Tedesco G, Cadossi M, Luciani D, Mazzotti A, et al. Atypical femoral fractures. Clin Cases Miner Bone Metab. 2013;10(1):30-3.

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