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Original Research Article

Comparison between standard and dual mobility implants in total hip arthroplasty for femoral neck fractures in elderly

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ABSTRACT

Background: Dislocation is a major concern after total hip replacement (THR) in displaced fracture neck of femur. Recent studies have shown reduced dislocation rates with dual mobility THR (DMTHR) for femur neck fractures; however, there is a lack of comparative research to show its superiority over conventional THR. Further, its role in the Asian subcontinent, where the patient requires sitting cross-legged or squatting, has not been studied.
Methods: A prospective cohort study of 30 elderly patients with displaced NOF with a minimum follow-up of 2-year. Sixteen patients were operated on with DMTHR and fourteen patients with conventional THR. Both the groups were matched; radiological and functional outcomes in terms of Harris hip score (HHS), visual analog scale (VAS), range of motion, and dislocation rate were compared between the two groups.
Results: Mean HHS of the DMTHR group was 79.99 at three months and 92.73 at the end of the 2 year postoperatively, which was significantly better than the conventional THR group 59.5 at three months and 88.14 at 2-year. The range of motion was significantly better in the DMTHR group than the conventional THR group. There was no significant difference in radiological outcomes and postoperative dislocation rate between the two groups.
Conclusions: Dual mobility implants give better results than conventional implants for primary THA in elderly patients of displaced FNOF regarding better function and greater range of motion. More long-term multicentric studies are still needed.

Keywords: Fracture neck femur, Dual mobility, Total hip replacement, Dislocation rates

INTRODUCTION

Fall is the leading cause of injuries and hospital admissions in the elderly population. Femoral neck fractures contribute a large burden on the health care. Displaced intracapsular fracture of the femoral neck can be treated with internal fixation, unipolar or bipolar arthroplasty or total hip replacement, but each have their own disadvantages and the optimal treatment of these fractures still remains controversial. To this purpose, we evaluated the functional outcome in addition to surgical outcomes in fracture neck of femur in these elderly patients treated with total hip arthroplasty (THA).

THA represents about 1.5 million surgeries performed worldwide each year. Dislocation and polyethylene wear are the two main concerns in total hip arthroplasty.

Dislocation may be described as the slip of the replaced femoral head from the acetabular cup. The causes for dislocation after total hip arthroplasty are malpositioning of stem or acetabular component, hyperlaxity of the joint due to muscular insufficiency or lack of soft tissue tension, contact between bony femur and bony pelvis.

To address this particular problem of dislocation, Pr. Gilles Bousquet and André Rambert shared their knowledge to invent the dual mobility concept patented in 1975. This

innovation has enabled to improve the range of motion and to significantly reduce the number of dislocations even though this postoperative complication depends on several factors other than design-related ones.[1,2] Thus this solution seems to be promising for reducing the risk of instability and thus dislocation.

However, intraprosthetic dislocation, iliopsoas tendon impingement has appeared as new issues and polyethylene wear still remains a concern.[3,4] Therefore, the concept of dual mobility has to be kept improving.

Currently dual mobility hip arthroplasty is one of the treatment options for patients who have a risk of dislocation, neuromuscular diseases, cognitive dysfunction and for patients older than 60 years with prior hip surgery. It also used in revision THA for any cause, primary THA after femoral neck fracture, and primary THA after tumour resection.[4]

The aim of the study is to compare the short term clinical outcomes between the standard and DMC total hip replacement in two groups of patients treated for femoral neck fracture.

Objectives

Objective of the study was to compare the short term functional outcome of total hip arthroplasty in neck of femur fracture using standard and dual mobility implant in elderly using VAS and Harris hip score.

METHODS

The study was conducted in the department of orthopaedics at Bowring and Lady Curzon hospital and Victoria Hospital attached to Bangalore Medical College and Research Institute between August 2016 to July 2020. The ethical clearance has been obtained from the ethical committee before enrolling patients for the study.

A total of 30 patients with displaced fracture neck of femur were included in the study (Figure 1). After excluding patients with age <50 years, polytrauma, neuromuscular disorder, history of previous hip surgery, and the ones with pathological fractures.

After initial optimization, stabilization, and clinical assessment, patients were investigated with plain radiographs in two planes (antero-posterior and lateral) to confirm the diagnosis. Patients were admitted and operated on for THR after written and informed consent.

Surgical technique

Templating was done in all the patients preoperatively, with the help of X-rays, to determine the implant size, position, and neck cut. All patients were operated in the lateral position, with a posterior approach, and in a similar operative environment by the same index surgeon. Dual mobility cup was positioned according to the anatomy of the native acetabulum in such a way that there is no superior overhang to allow easy reduction.[6] Cemented or uncemented stem was used depending on the bone quality and canal anatomy as per Dorr.

Figure 1: Garden type 4 neck of femur fracture.

Postoperative rehabilitation

All the patients have a similar rehabilitation protocol. They received prophylactic antibiotic of three doses of 1.5 g cefuroxime twelve hours apart. DVT prophylaxis was given in the form of DVT stockings and pharmacological (aspirin or LMWH) methods. All the patients were allowed full weight-bearing mobilization from day one after post-op radiographs and followed the same physiotherapy programme.

Evaluation

All patients were followed up postoperatively at two weeks and six weeks followed by three months, twelve months, and then yearly thereafter with a minimum follow-up of two years. VAS and HSS was calculated at one month, three months, six months and twelve months and 2 years postoperatively (Figure 2). Radiographs were taken at immediate postoperative period and then at three months, six months, twelve months and two years and were evaluated for dislocation, loosening, lysis, and migration.

Figure 2: Follow-up X-ray at 2 year (DMTHR).

Figure 3: At 24 month follow up patient has over 90º flexion, painless walking and full extension.

Statistical analysis

Data recording was done using Microsoft excel. Descriptive statistics for quantitative data were analysed using mean±SD and median and compared with the unpaired t-test. Qualitative data were represented as frequency and percentages; and were compared with the Chi-square test. Data were compared between the two groups – dual mobility implant and conventional THR implant groups.

RESULTS

Study population with a mean age of 64.57±5.98 years, 30 patients with fractured neck of femur were operated on with THR and were available for final follow up at two year (Table 1). 15 patients (50%) were male, and 15 patients (50%) were female of which 16 (53.3%) operated on the left side and 14 (46.7%) operated on right side (Tables 2 and 3).

Table 1: Age distribution in two groups of patients studied.

Age in years	Implant (%)		Total (%)
	Dual mobility	Standard	
<60	1 (6.3)	2 (14.3)	3 (10)
60-70	12 (75)	11 (78.6)	23 (76.7)
>70	3 (18.8)	1 (7.1)	4 (13.3)
Total	16 (100)	14 (100)	30 (100)
Mean±SD	65.06±6.02	64.00±6.11	64.57±5.98

Table 2: Gender distribution in two groups of patients studied.

Gender	Implant (%)		Total (%)
	Dual mobility	Standard	
Female	7 (43.8)	8 (57.1)	15 (50)
Male	9 (56.3)	6 (42.9)	15 (50)
Total	16 (100)	14 (100)	30 (100)

Table 3: Side involved distribution in two groups of patients studied.

Side	Implant (%)		Total (%)
	Dual mobility	Standard	
Left	7 (43.8)	9 (64.3)	16 (53.3)
Right	9 (56.3)	5 (35.7)	14 (46.7)

Based on the type of implant used patients were divided into two groups. 16 patients (53.3%) underwent dual mobility THR, and 14 (46.7%) underwent conventional THR (Table 4). Preoperative demographic data, operative procedure, and postoperative rehabilitation of both the groups were matched.

Table 4: Implant.

Implant	No. of patients	%
Dual mobility	16	53.3
Standard	14	46.7
Total	30	100.0

Out of the 30 patients, 8 (26.7%) underwent cemented fixation while 18 (60%) patients had uncemented fixation and 4 (13.3%) patients got hybrid fixation (Table 5).

Table 5: Fixation- distribution in two groups of patients studied.

Fixation	Implant (%)		Total (%)
	Dual mobility	Standard	
Cemented	4 (25)	4 (28.6)	8 (26.7)
Hybrid	3 (18.8)	1 (7.1)	4 (13.3)
Uncemented	9 (56.3)	9 (64.3)	18 (60)
Total	16 (100)	14 (100)	30 (100)

Clinical outcome mean HHS of the DMTHR group 71.98 at one month and 92.73 at two years postoperatively which was significantly better than the Conventional group 59.5 at one month and 88.14 at the end of the second year postoperatively (Table 6). All the patients have a better functional score at two years as compared to three months postoperatively.

The mean range of motion for the DMTHR group at 2nd year postoperative was 108.65 degree of flexion, 10 degree of extension, 28.27 degree of adduction, 40.77 degree of abduction, 16.92 degree of internal rotation, and 40.85 degree of external rotation; being significantly better than conventional THR group which was 93.53 of flexion, 5 of extension, 23.82 of adduction, 33.33 of abduction, 12.35 of internal rotation, and 37.65 of external rotation.

VAS of the DMTHR group 5.44 at one month and 1.31 at two years postoperatively which was relatively similar than the Conventional group was 4.57 at one month and 0.86 at the end of second year postoperatively (Table 7).

Table 6: Harries HIP score- an assessment in two groups of patients during study period.

Harries hip score	Implant		Total	P value
	Dual mobility	Standard		
1 month	71.98±8.78	59.5±12.93	65.04±12.75	0.009**
3 months	79.99±6.50	66.87±15.13	72.64±13.63	0.013*
6 months	85.96±4.81	76.41±11.27	80.61±10.09	0.015*
1 year	91.45±3.76	82.95±9.21	86.69±8.39	0.009*
2 years	92.73±3.55	88.14±6.00	90.16±5.49.	0.035*

Table 7: VAS- an assessment in two groups of patients during study period.

VAS	Implant		Total	P value
	Dual mobility	Standard		
Baseline	8.81±0.83	8.29±0.99	8.57±0.94	0.126
1 month	5.44±2.16	4.57±2.03	5.03±2.11	0.269
3 months	4.36±2.44	3.18±1.94	3.84±2.27	0.205
6 months	3.36±1.98	2.18±1.54	2.84±1.86	0.120
1 year	2.64±1.78	1.55±1.75	2.16±1.82	0.137
2 years	1.31±1.40	0.86±1.35	1.10±1.37	0.374

All the patients had a better VAS score at the end of two years.

Radiological outcome

Mean cup inclination on the anteroposterior view was 43.3 in the DMTHR group which was not significantly different from 41.9 of the conventional THR group. Radiologically no signs of loosening, radiolucent lines or heterotrophic ossification in any patient at the end of follow up.

Table 8: Complications distribution in two groups of patients-studied.

Complications	Implant (%)		Total (n=30)
	Dual mobility (n=16)	Standard (n=14)	
No	14 (87.5)	11 (78.6)	25 (83.3)
Yes	2 (12.5)	3 (21.4)	5 (16.7)
Death	0 (0)	1 (7.1)	1 (3.3)
Dislocation	0 (0)	1 (7.1)	1 (3.3)
Heterotrophic ossification	1 (6.3)	0 (0)	1 (3.3)
Prosthetic fracture	1 (6.3)	1 (7.1)	2 (6.7)

Complications

In this present study 5 patients encountered complications. All patients were allowed to walk with full-weight-bearing and climb stairs by three months postoperatively. None of the patients had any complications intra operatively. One patient (conventional) had postoperative dislocation. On the first follow-up, one patient from both the group developed superficial surgical site infection which resolved completely with debridement and antibiotics. One patient from either group was diagnosed with periprosthetic fracture and treated with revision arthroplasty. One patient from the DMTHR group had heterotopic ossification and was managed with excision. All the patients went back to routine daily activities by 1-year postoperatively (Table 8).

DISCUSSION

In the present study, the dual mobility group showed significantly better functional outcome of HHS at both the follow-ups than the conventional implant group (p=0.035) (Figure 3). The score was significantly better in activity sections like sitting cross-legged and squatting and in the motion section. Also, both the groups showed better function at the second follow-up compared with the first of the respective group, indicating there were no delayed complications.

The present study has separately compared the postoperative range of motion of the hip joint in these two groups and has shown DMTHR to be significantly better than conventional THR. This is due to the movement by the smaller inner head of dual mobility cup. At the time of extreme of movement on the inner diameter, the femoral neck abuts the outer femoral head causing this to articulate with the acetabular component. This, therefore, decreases the incidence of impingement and increases the range of movement.[7] This also supports our finding of better scores in squatting and sitting cross-legged activities that need extremes of the range of movements.

Meta-analysis including 3720 patients by Meek et al has shown postoperative dislocation after primary THR.[8] It is a dreaded complication with a multifactorial etiology and an incidence of 1% in one month, 1.9% in one year, and a constant increase of 1% every 5 years thereafter. The dislocation rate of THR done for the acute fracture neck of

the femur in the early postoperative period is 3.9%, which is 2–4 times more than that of the elective THR.[9]

Concerning the surgical approach, the posterior approach is associated with a dislocation rate of 3–8%.[10] Meticulous capsular closure and preservation of pyriformis muscle may reduce the incidence to 1% or less but it remains higher than that with the anterior and lateral approach, which is 0.5–0.6%.[11] The head diameter also influences the postoperative dislocation rate in inverse relation. Increasing the head size from 28 mm to 32 mm and 36 mm reduces the dislocation rates from 1.1% to 0.7% and further to 0.5%, respectively.

Neri et al in an original designer retrospective study on Primary DMTHR for 212 cases, showed excellent implant stability and survivorship with no dislocation at a mean follow-up of more than twenty-five years.[18] Zagorov et al in 2018 compared postoperative dislocation rate with dual mobility cup with that of conventional THR and bipolar hemiarthroplasty for displaced femoral neck fractures and concluded that DMTHR had 0% dislocation rate as compared to 11.1% in conventional THR and 3.1% in bipolar hemiarthroplasty.[13]

Similar comparative studies in the literature have shown the superiority of DMTHR over conventional THR in terms of postoperative stability and requirement of revision arthroplasty and are enlisted in Table 3.[14-16,20] There were no difference between postoperative dislocation rate, postoperative stability, implant loosening, and rate of revision surgery between the two groups.

Newer generations of DM articulations have sought to address the issues of excessive polyethylene wear (due to dual articulation), aseptic loosening, and intra-prosthetic dissociation by incorporating ultra-high molecular weight polyethylene (UHMWPE), improved capture mechanisms with larger retention collar, optimal neck design with mirror polished surface, modular coupling options, non-hemispherical shells, and porous coatings. This reduces wear particle generation, improves versatility, reduces soft tissue impingement and improves construct stability.[21-23]

Dual mobility implants have increasingly gained recognition in the literature as an effective option to increase postoperative function, survivorship and reducing instability.[24] However, there are very few long-term studies substantiating its use and advantage over its predecessor making it under-utilized.

Matched groups for comparison and separate assessment of the postoperative range of motion are the strengths of this study. In contrast, the limitations being the small sample size and short duration of follow-up.

CONCLUSION

This study shows that dual mobility implants have better results in treating elderly patients with fracture neck of femur than conventional single bearing implants for primary THA in terms of better function and greater range of motion. Long-term multicentric studies are still needed on its usage and durability.

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REFERENCES

1. Caton JH, Prudhon JL, Ferreira A, Aslanian T, Verdier R. A comparative and retrospective study of three hundred and twenty primary Charnley type hip replacements with a minimum followup often years to assess whether a dual-mobility cup has a decreased dislocation risk. Int Orthop. 2014;38:1125-9.
2. Lachiewicz PF, Watters TS. The use of dual-mobility components in total hip arthroplasty. J Am Acad Orthop Surg. 2012;20:481-6.
3. Philippot R, Farizon F, Camilleri JP, Boyer B, Derhi G, Bonnan J, et al. Survival of cementless dual mobility socket with a mean 17 years follow-up. Rev Chir Orthop Reparatrice Appar Mot. 2008;94(8):e23.
4. Vielpeau C, Lebel B, Ardouin L, Burdin G, Lautridou C. The dual mobility socket concept: experience with 668 cases. Int Orthop. 2011;35:225-30.
5. Martino I. Dual mobility cups in total hip arthroplasty. World J Orthop. 2014;5(3):180.
6. Agarwala S, Shetty V, Taywade S, Vijayvargiya M, Bhingraj M. Dual-mobility THR: resolving instability and providing near normal range of movement. J Clin Orthop Trauma. 2020;13:40-5.
7. Darrith B, Courtney PM, Della Valle CJ. Outcomes of dual mobility components in total hip arthroplasty: A systematic review of the literature. Br Editorial Soc Bone Joint Surg Bone Jt J. 2018;100B:11-9.
8. Meek RMD, Allan DB, McPhillips G, Kerr L, Howie CR. Epidemiology of dislocation after total hip arthroplasty. Clin Orthop Relat Res. 2006;447:9-18.
9. Hailer NP, Weiss RJ, Stark A, Kärrholm J. The risk of revision due to dislocation after total hip arthroplasty depends on surgical approach, femoral head size, sex, and primary diagnosis. Acta Orthop. 2012;83(5):442-8.
10. Prigent F. Incidence of capsular closure and piriformis pre-servation on the prevention of dislocation after total hip arthroplasty through the minimal posterior approach: Comparative series of 196 patients. Eur J Orthop Surg Traumatol. 2008;18(5):333-7.
11. Zijlstra WP, De Hartog B, Van Steenbergen LN, Scheurs BW, Nelissen RGHH. Effect of femoral head size and surgical approach on risk of revision for dislocation after total hip arthroplasty: Analysis of 166,231 procedures in the Dutch Arthroplasty Register (LROI). Acta Orthop. 2017;88(4):395-401.
12. Neri T, Philippot R, Farizon F, Boyer B. Results of primary total hip replacement with first generation

Bousquet dual mobility socket with more than twenty five years follow up. About a series of two hundred and twelve hips. Int Orthop. 2017;41:557-61.
13. Zagorov M, Mihov K, Dobrilov S, Tabakov A, Gospodinov A, Nenova G. Dual mobility cups reduce dislocation rate in total hip arthroplasty for displaced femoral neck fractures. J IMAB. 2018;24(2):2077-81.
14. Tarasevičius S, Robertsson O, Dobozinskas P, Wingstrand H. A comparison of outcomes and dislocation rates using dual articulation cups and THA for intracapsular femoral neck fractures. HIP Int. 2013;23:22-6.
15. Rowan FE, Salvatore AJ, Lange JK, Westrich GH. Dual-mobility vs fixed-bearing total hip arthroplasty in patients under 55 years of age: as single-institution, matched cohort analysis. J Arthroplasty. 2017;32:3076-81.
16. Canton G, Moghnie A, Ratti C, Murena L. Dual mobility total hip arthroplasty in the treatment of emoral neck fracture: a systematic review of the literature. Recent Adv Arthroplast. 2018;2(1):32-8.
17. Jobory A, Kärrholm J, Overgaard S, Pedersen AB, Hallan G, Gjertsen J-E, et al. Reduced revision risk for dual-mobility cup in total hip replacement due to hip fracture: a matched-pair analysis of 9,040 cases from the Nordic Arthroplasty Register Association (NARA). J Bone Joint Surg Am. 2019;101(14):1278-85.
18. Mufarrih SH, Qureshi NQ, Masri B, Noordin S. Outcomes of total hip arthroplasty using dualmobility cups for femoral neck fractures: a systematic review and meta-analysis. Hip Int. 2020;31(1):12-23.
19. You D, Sepehri A, Kooner S, Krzyzaniak H, Johal H, Duffy P, et al. Outcomes of total hip arthroplasty using dual mobility components in patients with a femoral neck fracture. Bone Joint J. 2020;102-B(7):811-21.
20. Darrith B, Courtney PM, Della Valle CJ. Outcomes of dual mobility components in total hip arthroplasty: A systematic review of the literature. Br Edit Soc Bone Joint Surg Bone Jt J. 2018;100B:11-9.
21. Neri T, Philippot R, Klasan A, Putnis S, Leie M, Boyer B. Dual mobility acetabular cups for total hip arthroplasty: advantages and drawbacks. Expert Rev Med Devices. 2018;15:835-45.
22. Neri T, Boyer B, Geringer J, Di Iorio A, Caton JH, PhiIippot R. Intraprosthetic dislocation of dual mobility total hip arthroplasty: still occurring? Int Orthop. 2018;43:10971105.
23. Neri T, Boyer B, Batailler C, Klasan A, Lustig S, Philippot R. Dual mobility cups for total hip arthroplasty: tips and tricks. SICOT J. 2020;6:17.
24. Mouzopoulos G, Stamatakos M, Arabatzi H, Vasiliadis G. The four-year functional result after a displaced subcapital hip fracture treated with three different surgical options. Int Orthop. 2008;32(3):367-73.

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