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Modular Dual Mobility Total Hip Replacement – Does it Reduce the Rate of Early Dislocations in Elderly Neck of Femur Fractures?

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Abstract

Introduction: *Total hip replacement (THR) following intracapsular neck of femur (NOF) fractures in the fit and mobile elderly is currently the preferred surgical option. Modular dual mobility (MDM) cup is a surgical option to reduce dislocation risk in THR. The aim of this study was to compare early dislocation rate (within 2 years) between THR using conventional and MDM cups in NOF fractures.*

Materials and method: *This is a retrospective study conducted with prospectively collected data from January 2019 to March 2021 with a minimum of 2-year follow-up (mean, 36 months). All patients above 60 years of age who had THR for NOF fractures were included. Data collected were patient demographics, presence of degenerative spinal pathology, mortality rate, oxford hip score, post-operative complications and need for further unplanned surgeries.*

Results: *A total of 112 patients underwent THR for NOF fractures. There were 37 (33%) patients in the MDM group and 75 (67%) patients in the conventional THR group. There were no early dislocations in the MDM group and there were two (2.7%) dislocations in the conventional THR group following surgery ($p = 0.554$).*

Conclusion: *From our study, THR using MDM reduces the rate of post-operative early dislocations in traumatic NOF fractures although not statistically significant. It should be considered in this cohort especially those at high risk to try and prevent early dislocations.*

Keywords: *Modular Dual Mobility (MDM), Total Hip Replacement (THR), Neck of Femur (NOF) Fracture, Dislocations.*

Introduction

Total Hip Replacement (THR) is increasingly recognized as the treatment of choice for displaced intracapsular neck of femur (NOF) fractures in the fit and mobile elderly patients. However, dislocation is one of the most common complications. The incidence of dislocation is reported to be around 3.2% in primary THR for osteoarthritis of which 50-70% occur within 3 months postoperatively (1). Prosthesis dislocation is the most common reason for revision (31.3%) for NOF fractures in the Australian registry.

Dislocations may be due to surgical or patient factors. Patient factors include female gender, age above 80 years, cognitive disorders, neuromuscular disorders and abductor weakness (2). Surgical factors include the approach employed, whether capsular repair was performed, soft tissue tension, component malposition, femoral head size, impingement and surgeon experience (2). Prosthetic dislocation accounts for 31.7% of all revisions after THR for NOF fractures (3).

Modular Dual Mobility (MDM) cups have gained popularity especially for NOF fractures (3). These are indicated for patients who are at high risk of dislocation, in patients with a stiff spine and in revision cases (4,5). The lower dislocation rate is due to a larger outer head diameter and thus a greater jump distance (6). However, MDM extra-articular or intra prosthetic dislocations have been infrequently documented in primary and revision THR, albeit with lower dislocation rates (7). In line with Charnley low-friction arthroplasty (LFA) principles, MDM heads are demonstrated to produce less wear particles as a result of the smaller head diameters producing lower acetabular shell torque forces (8). MDM THR was introduced in Malaysia in 2015. There are no local publications in Malaysia comparing the rate of dislocation between MDM and conventional THRs for NOF fractures in the elderly.

Methods

This is a retrospective study with prospectively collected data conducted at our tertiary Arthroplasty referral unit between January 2019 and March 2021. A total of 112 patients underwent THR for NOF fracture during this period, and all patients were included in the study. This study compares the dislocation rate between patients who underwent MDM and conventional THR with the same inclusion and exclusion criteria. The decision on the type of surgery was determined by the treating surgeon. Patients with degenerative spinal disease and neuromuscular impairment who were perceived to have a higher risk of dislocation had a MDM THR.

Inclusion criteria were patients above the age of 60 who sustained a NOF fracture and underwent a THR using the modified lateral approach. Exclusion criteria were patients who were less than 60 years of age. All surgeries were performed either by a consultant arthroplasty surgeon or a subspecialty arthroplasty fellow under the supervision of a consultant arthroplasty surgeon. Patients were followed-up for a minimum of 2 years post-operatively, with visits to the Orthopaedic clinic at 3 weeks, 6 weeks, 3 months, 6 months, 12 months post-operatively and yearly thereafter.

Patients' demographic information was collected from the clinical notes, and their clinical outcomes recorded in a standardized data collection sheet. Patients were assessed using the Oxford Hip Score (OHS). OHS is a joint-specific, patient-reported outcome measure designed to assess disability in patients undergoing THR. The questionnaire consists of 12 questions, and was self-administered to the patients in the clinic. All patients provided a written consent during the data collection. Ethical approval for this study was obtained from the Medical Research Ethics Committee (NMRR 22-02594-0ZO). Additional data collected included mortality rate, ASA, presence of degenerative spinal pathology, complication rate and number of unplanned surgeries.

The descriptive results were reported and independent t-test was used to compare continuous outcome variables while Chi-square test and Fisher`s exact test was used to compare categorical variables. All data were analyzed using SPSS Ver 23.

Results

A total of 112 patients met the inclusion and exclusion criteria. The mean follow-up was 36 months (range, 24 months – 51 months). Seventy-five patients underwent

a hybrid (uncemented acetabulum and a cemented femoral stem) THR with conventional articulation and 37 patients had THR performed with MDM. All MDM THR were an uncemented acetabular cup and a cemented femoral stem.

There were two (2.7%) dislocations in the conventional THR group and no dislocations in the MDM THR group.

One patient dislocated his THR eleven days post operatively by rolling over the bed and flexing his hip at home. Another patient dislocated her THR seven weeks after surgery upon standing from a sitting position. Both patients who sustained THR dislocations underwent closed reduction, bed rest with skin traction for 2 weeks followed by full weight bearing mobilization following removal of traction. They had no further dislocations.

One patient in the conventional THR group underwent revision THR for a periprosthetic Vancouver B2 fracture after a motor vehicle accident. This patient was also one of the two patients who had an early THR dislocation. Another patient in the conventional THR group had a DAIR (Debridement, Antibiotics and Implant Retention) procedure for a deep periprosthetic joint infection six weeks post-THR. Cultures grew Staphylococcus Aureus and she was treated with antibiotics for six months. She is now infection free for three years. Three patients had post operative pulmonary embolism and were treated with oral Warfarin for six months.

Both groups were matched for age (Table 1), gender (Table 2) and ethnicity (Table 3). There was no statistical difference in the dislocation rate (table 4) and Oxford Hip Scores (Table 5) in both groups. The mortality rate at the time of final follow-up (April 2023) in the conventional group was 20% and in the MDM group was 16% (Table 6).

Data are as follows: -

Group	**Number**	**Mean**	**Std. Deviation**	**P value**
MDM	37	73.89	10.61	0.835
Conventional	75	73.52	7.87	

No significant difference in mean age between groups. P value = 0.835 (independent t-test)

Table 1: Age Differences between groups.

Sex	**Group**		**Total**
	MDM	**Conventional**	
Male	9	17	26
Female	28	58	86
Total	37	75	112

No significant difference in gender between groups. P value = 0.845 (Chi-Square test)

Table 2: Gender differences between groups.

Ethnicity	Group		Total
	MDM	Conventional	
Malay	31	58	89
Chinese	5	16	21
Indian	1	1	2
Total	37	75	112

No significant difference in ethnicity between groups. P value = 0.549 (Chi-Square test)

Table 3: Ethnicity of MDM and Conventional THR patients.

Dislocation	Group		Total
	MDM	Conventional	
Yes	0	2	2
No	37	73	110
Total	37	75	112

No significant difference in dislocation. P value = 0.554 (Fisher's Exact test)

Table 4: Dislocation rates between groups

Group	Number	Not Available	Mean	SD	P value
MDM	18	17	45.11	6.30	0.884
Conventional	43	32	44.81	7.68	

No significant difference in mean OHS. P value = 0.884 (Independent t-test)

Table 5- Oxford Hip Score (OHS) between groups.

	Group	
	MDM	Conventional
Dead	6	15
Alive	31	60
Total	37	75

No significant difference in mortality between groups. P value = 0.798 (Fischer's Exact Test)

Table 6- Mortality between groups

Discussion

Total hip replacement using modular dual mobility cups has been our preferred choice for patients with intracapsular femoral neck fractures who have spinal pelvic stiffness and for revision total hip replacement. Between January 2019 to March 2021, we performed a total of 57 MDM THR in our hospital, 37 for NOF fractures and 20 for revision cases. We have had 3 dislocations in revision THRs performed with MDM in this cohort of patients. In this study, there were no dislocations in the NOF fractures who underwent THR using a MDM articulation and there were two dislocations in the conventional THR group (0 vs 2.7%). This was not statistically significant (p=0.554) as the sample size was small and due to the low incidence of dislocation in our centre. The higher percentage of dislocation for conventional THR could be due to either patient or surgical factors. Performing MDM THR may have prevented such dislocations. MDM usage in NOF fractures has been shown to reduce the rate of dislocation compared to conventional THR (9).

A history of back pain, spine movement limitation and lumbosacral x-rays are components used to asses spinal pelvic stiffness in our patients. Lumbosacral x-rays can detect previous lumbosacral surgery, advanced degenerative spine disease with loss of lumbar lordosis or scoliosis. Spinal pelvic stiffness is assessed by lumbosacral x-rays done in standing and sitting positions which determine dynamic changes in functional acetabular positions (10). It is difficult to perform sitting and standing x-rays in patients who have sustained a NOF fracture. We aimed for acetabular cup placement in accordance to the Lewinnek safe zone, with an inclination of 40° ± 10° and anteversion of 15° ± 10° for all patients. Although some of our patients were diagnosed to have early-stage dementia, they had been physically fit to mobilise independently prior to the trauma. In such patients we opted to perform

THR rather than bipolar hemiarthroplasty to afford them better functional outcome. Patients mobilizing independently with residual weakness such as grade 4 power in the lower limb were also included in our study in both groups.

All 112 NOF fractures that underwent conventional THR and MDM had hybrid fixation (an uncemented acetabulum and a cemented femoral stem). The Australian registry shows no difference in revision rate between cemented or uncemented MDM (3). Fifty-one (68%) patients in the conventional THR group were either diagnosed to have degenerative spine disease, dementia or stroke with residual weakness. Both patients who sustained a dislocation in this group had degenerative spinal pathology. We were unable to use MDM in these patients due to financial constraints. The cost of MDM is higher than conventional THR. The processing period for approval of national medical funds could take more than a week. The key in management of hip fracture in the elderly is urgent surgical intervention for faster full weight bearing ambulation in order to prevent deconditioning of patients (11).

Early dislocations in this study was defined as those that occurred within 2 years of surgery. Most dislocations occur during this period (1). The dislocations in the non-MDM group occurred at day eleven and at seven weeks post-operatively respectively. Both these patients sustained posterior dislocations and underwent closed manual reduction (CMR) in the operation theatre under image intensifier guidance. Both were placed on fixed traction for 2 weeks. There was no evidence of fracture or infection in these patients. Both patients had underlying advanced degenerative spine disease with loss of lumbar lordosis. They were allowed full weight bearing following completion of the 2 weeks of traction and did not develop further dislocations or complications.

Falls prevention strategies are required to be enforced post-operatively for all elderly patients following hip fractures. Caution also needs to be taken when performing immediate postoperative check x-ray. At this stage patients are under epidural; muscle tone is reduced and dislocations may occur during patient transfer or while positioning during the check x-ray procedure. In our unit, all patients get an immediate post operative radiograph of the hip prior to ward transfer from theatre.

A total of 21 patients died between January 2019 to March 2023 (Table 6). Ten patients passed away within a year of their surgery (8.9%) and 11 (9.8%) more than a year post-operatively. Causes of mortality were sepsis (7 patients), cardiovascular complications (5 patients), terminal lung cancer (1 patient) and unknown etiology (8 patients). Factors that contributed to these deaths were multifactorial and delay in surgery from the onset of injury remains a concern (12).

The mean post-operative Oxford Hip Score (OHS) for both MDM and conventional THR were 45.11 and 44.81 respectively (Table 5). There is no significance difference (p=0.884) between both these groups. These scores are considered good compared to the article reported by Field et al (13). This article did not state indication for primary total hip replacements nor post-operative care, but is a reference to how our patients fared post-operatively in terms of hip scoring.

There are certain limitations in performing THR with MDM in Malaysia:

1) The smallest acetabular cup size available to accommodate a MDM is 44 mm. In our study, the most commonly used acetabular cup size was 48mm. Acetabulum cup sizes of 50 mm and above accommodate a size 28mm head, with smaller cups restricted to usage of 22.2 mm heads. At the time of the surgeries, only uncemented MDMs were available in Malaysia.

2) Cost is another limitation as MDM usage incurs a higher price than conventional THR.

3) Application through the national medical fund often leads to delay in performing THR which may lead to unwanted complications for patients whom are subjected to prolonged bed immobilization.

The limitations of our study are that it is a retrospective study and the sample size is relatively small. There were more conventional THRs performed. Patients were not randomized to both groups as higher risk patients had MDM THR and those with perceived lower risk of dislocation had conventional THR. This is one of the reasons why both groups are not equal in numbers for comparison. Another reason is the high cost of MDM THR. At final follow up, 15 patients (20%) died in the conventional THR group and 6 patients (16%) in the MDM group (p=0.798).

It is our dilemma whether to perform MDM THR for all our NOF fractures as they are at a higher risk of dislocation. Both the UK National Joint Registry and Australian registry have reported higher numbers of revision for MDM for all cases compared to other acetabular prosthesis in the first post-operative year (3,14). Although our numbers are relatively small, this study can act as a benchmark for future upcoming studies in this area. The rate of dislocation was higher in the conventional THR group compared to the MDM group (2.7% vs 0) although this was not statistically significant due to a relatively small patient number.

Conclusion

MDM THR is a viable option in treating NOF fractures to prevent early dislocations post operatively. It should be considered in this cohort especially those at high risk to try and prevent early dislocations. Larger sample size with prospective randomized controlled trial is required to further consolidate this.

References

1. Morrey BF. Difficult complications after hip joint replacement: Dislocation. In: Clinical Orthopaedics and Related Research [Internet]. Springer New York LLC; 1997 [cited 2021 Jun 22]. p. 179–87. Available from: https://pubmed.ncbi.nlm.nih.gov/9372770/

2. Werner BC, Brown TE. Instability after total hip arthroplasty. World Journal of Orthopedics. 2012;3(8):122–30.

3. Australian Joint Registry 2019.pdf.

4.Chalmers BP, Syku M, Sculco TP, Jerabek SA, Mayman DJ, Westrich GH. DualMobility Constructs in Primary Total Hip Arthroplasty in High-Risk Patients With Spinal Fusions: Our Institutional Experience. Arthroplasty Today. 2020 Dec 1;6(4):749–54.

5.Modular dual mobility cups with multihole metal back in total hip arthroplasty revision: a systematic review - PubMed [Internet]. [cited 2021 Sep 6]. Available from: https://pubmed.ncbi.nlm.nih.gov/31169005/

6. Philippot R, Camilleri JP, Boyer B, Adam P, Farizon F. The use of a dual-articulation acetabular cup system to prevent dislocation after primary total hip arthroplasty: Analysis of 384 cases at a mean follow-up of 15 years. International Orthopaedics [Internet]. 2009 Aug [cited 2021 Jun 22];33(4):927–32. Available from: https://pubmed.ncbi.nlm.nih.gov/18521598/

7. Darrith B, Courtney PM, della Valle CJ. Outcomes of dual mobility components in total hip arthroplasty: A systematic review of the literature. Vol. 100B, Bone and Joint Journal. British Editorial Society of Bone and Joint Surgery; 2018. p. 11–9.

8. Wroblewski BM, Siney PD, Fleming PA. The principle of low frictional torque in the Charnley total hip replacement. Journal of Bone and Joint Surgery - Series B [Internet]. 2009 Jul [cited 2021 Jun 22];91(7):855–8. Available from: https://pubmed.ncbi.nlm.nih.gov/19567846/

9. 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: A systematic review and meta-analysis [Internet]. Vols. 102-B, Bone and Joint Journal. British Editorial Society of Bone and Joint Surgery; 2020 [cited 2021 Jun 22]. p. 811–

10. Attenello JD, Harpstrite JK. Implications of Spinopelvic Mobility on Total Hip Arthroplasty: Review of Current Literature [Internet]. Vol. 78, Hawai'i journal of health & social welfare. NLM (Medline); 2019 [cited 2021 Jun 22]. p. 31–40. Available from: https://pubmed.ncbi.nlm.nih.gov/31773109/

11.Borges FK, Bhandari M, Guerra-Farfan E, Patel A, Sigamani A, Umer M, et al. Accelerated surgery versus standard care in hip fracture (HIP ATTACK): an international, randomised, controlled trial. The Lancet. 2020 Feb 29;395(10225):698– 708.

12. Nanchappan NS, Chopra S, Samuel A, Therumurtei L, Ganapathy SS. Mortality rate and ten years survival of elderly patients treated with total hip arthroplasty for femoral neck fractures. Malaysian Orthopaedic Journal. 2021 Jul 1;15(2):136–42.

13. Field RE, Cronin MD, Singh PJ. The Oxford hip scores for primary and revision hip replacement. THE JOURNAL OF BONE AND JOINT SURGERY. 2005;

14. NJR 17th Annual Report 2020.pdf.