ORIGINAL STUDY — HIP

acta orthopaedica belgica, 2024, 90, 575-579

doi.org/10.52628/90.4.12752

Low dislocation rate following revision total hip arthroplasty (THA) with dual mobility cup with minimum 2-year follow-up

Shah JEHAN[1], Aaron BY NG[2], Simon CE JONES[3], Ajit SHETTY[4]

[1]Shah Jehan (FRCS, Tr & Orth) Consultant Orthopaedic Surgeon, York and Scarborough Teaching Hospitals NHS Foundation Trust, Woodlands Dr, Scarborough YO12 6QL, UK; [2]Aaron BY Ng (FRCS Tr &Orth) Consultant Orthopaedic Surgeon, Mid Yorkshire Teaching NHS Trust, Pinderfields General Hospital, Aberford Rd, Wakefield WF1 4DG, UK; [3]Simon CE Jones (FRCS Tr &Orth) Consultant Orthopaedic Surgeon, Mid Yorkshire Teaching NHS Trust, Pinderfields General Hospital, Aberford Rd, Wakefield WF1; [4]DG, UK. 4Ajit Shetty (FRCS Tr &Orth) Consultant Orthopaedic Surgeon, Mid Yorkshire Teaching NHS Trust, Pinderfields General Hospital, Aberford Rd, Wakefield WF1 4DG, UK.

Correspondence at: Shah Jehan, FRCS (Tr &Orth) Consultant Orthopaedic Surgeon, York and Scarborough Teaching Hospitals NHS Foundation Trust, Woodlands Dr, Scarborough YO12 6QL, UK. Email: shahjehan200@gmail.com - Phone: +447898984139

Dislocation is the second most common indication for revision total hip arthroplasty (THA). In revision cases the dislocation rate can be as high as 5-30%. The aim of this study was to assess the outcome, specifically the dislocation rate in revision THA where a dual mobility cup was used. We retrospectively reviewed all the revision THAs where a dual mobility cup (G7) was used. The pre-operative and post-operative oxford hip scores were recorded. Patients' electronic records and radiographs were studied for the indications, approaches used, post-operative complications, re-operation rates, and re-revision surgery. Between 2016 and 2020, we performed 59 revision total hip replacements where a dual mobility cup (G7) was used. There were 23 males and 36 females. The average age was 74 years (range, 64-89). Acetabular components were revised in 47 (80%) cases and both the femoral and the acetabular components were revised in 12 (20%) cases. The average follow-up time was 4 years (range, 2-6 years). Average pre-operative and post-operative oxford hip scores were 17 and 36 respectively. The improvement was significant with P value of <.001. Complications were noted in 5 (8%) patients. One patient had dislocation. This patient required re-revision with constrained liner. One patient had intraoperative fracture of the femur and was treated with plate and cables. We conclude that the dual mobility cup can significantly reduce the risk of dislocation when used in revision THA.

INTRODUCTION

Total hip arthroplasty (THA) is considered one of the most successful surgical interventions in the 20th century. It significantly improves the quality of life for patients and provides life changing experiences. Apart from alleviating pain, it improves mobility and hence the general health of the patient. The number of THAs are increasing every year. It is estimated that in the United States of America the number of primary THAs will increase by 170% by 2030[1]. Similarly the number of revision THAs will increase by 137% by 2030[2,3].

As the number of primary and revision total hip replacement procedures increase, surgeons will encounter more complications of hip arthroplasty. Dislocation is one of the most devastating complications for patients and poses a real challenge for arthroplasty surgeons. The common risk factors of dislocation include revision surgery, soft tissue insufficiency, implant malposition, inadequate bone stock, neuromuscular conditions and patient non-compliance[4,5]. Preoperative identification of the risk factors and planning accordingly may reduce the risk of dislocation but can never eliminate the risk.

Depending upon the indication for revision, dislocation following revision surgery has been cited to be between 5-30%[6,7]. The risk factors for hip instability following revision surgery are mainly inadequate soft tissue and bone stock insufficiency[7]. A variety of implant designs and surgical techniques have been developed to prevent dislocation following revision surgery but the two most commonly used implants to prevent dislocation after revision surgery are dual mobility cups and constrained liners[8-10]. Dual mobility cups increase the jump distance and range of movement, and generally have been shown to be superior to the constrained liners for prevention of dislocation[1,11].

The purpose of this study was to assess the outcome of revision surgery where a dual mobility cup was used. The primary outcome was to assess the dislocation rates following revision surgery with dual mobility cup.

METHODS

All revision THAs between 2016 and 2020 were reviewed retrospectively, and cases selected where a dual mobility cup was used. All revisions cases with the G7 dual-mobility cup (Zimmer Biomet, Warsaw, IN, USA), from 2016 to 2020 were performed in one institute by more than one surgeon. In all cases the acetabular components were revised. In some cases, both acetabular and femoral components were revised. We excluded the cases where the minimum follow-up time was less than 2 years and if the dual mobility cup was not used.

Patients' electronic records and radiographs were retrieved retrospectively. Data were collected for demographic characteristics, indications for revision surgery, time interval between primary and revision surgery. Pre-operative and post-operative oxford hip scores were recorded. The primary outcome measure was post-operative dislocation following revision THA. The secondary outcome measures were patient-reported outcome measures (PROMS) and re-revision for any reasons. We also collected data for readmission within 30 days and 90 days for any reasons, any hip related surgical procedures other than revision and any other complications. Microsoft Excel spreadsheet (Microsoft, Redmond, Washington, USA) was used to analyse the data for ranges and means. The preoperative and post-operative oxford hip scores were compared using two-tailed student's t -test.

RESULTS

We had 59 patients who had revision total hip replacement where a dual mobility cup was used. In 47 cases only the acetabular components were revised whilst in 12 cases both the femoral and acetabular components were revised. There were 36 females and 23 males. The age range was 64-89 years with mean age of 74 years. The mean follow-up time was 4 years (range, 2-6 years). The mean time between primary and revision surgery was 13 years (range, 2-18 years). The indications for revision surgery are shown in figure 1. The most common indication was recurrent dislocation (32), followed by aseptic loosening (10), infection (9), acetabular wear (3), adverse soft tissue reaction (pseudotumor) (3), and periprosthetic fractures (2). In 48 cases a posterior approach was used, and in 11 cases anterolateral approach was used. The oxford hip scores are shown in Table I. The mean pre-operative oxford hip score was 17 and the mean oxford hip score at one year follow-up was 36. There was significant improvement in the oxford hip score with a p-value of <.001.

Complications were recorded in 5 patients (8%). Complications are shown in Table II. One patient had dislocation at three months after revision surgery. This patient had recurrent dislocation following total hip arthroplasty (Figure 2-a). The revision was done with a dual mobility cup using a skirted head (Figure 2-b). Patient had subsequent dislocation possibly due

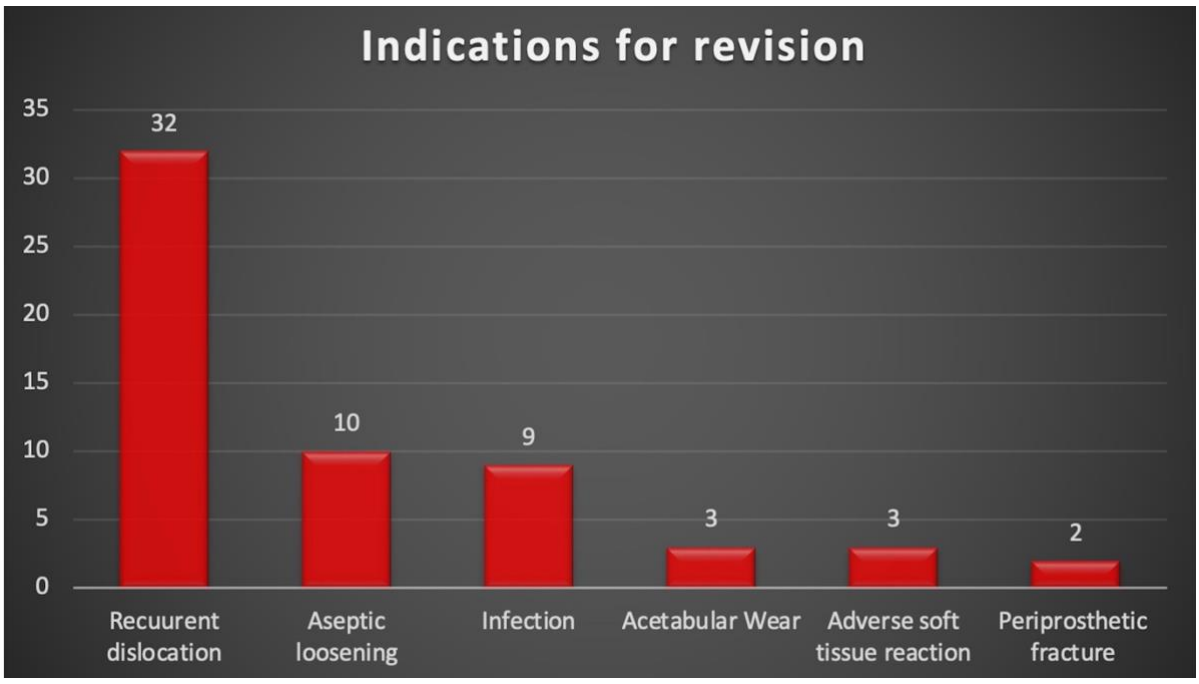

Fig. 1 — Indications for revision total hip replacement.

Table I. — Pre-operative and post-operative oxford hip scores.

	Minimum	Maximum	Mean
Pre-op	4	44	17
Post-op	15	48	36

Table II. — Complications and their management.

Commplications	Number of patients	Management
Dislocation	1	Re-revision
Leg length discrepancy	2	Shoe raise
Infection	1	Suppressive antibiotics
Intraoperative fracture of distal femur	1	Fixation with locking plate

to impingement (Figure 2-c) This was treated with a constrained acetabular liner (figure 2-d). Two patients had a leg length discrepancy, and both were treated with shoe raise. One patient had deep infection, and due to poor general health, this patient was treated with long term suppressive antibiotics. One patient had intraoperative fracture of the femur which was managed with a locking plate and cables.

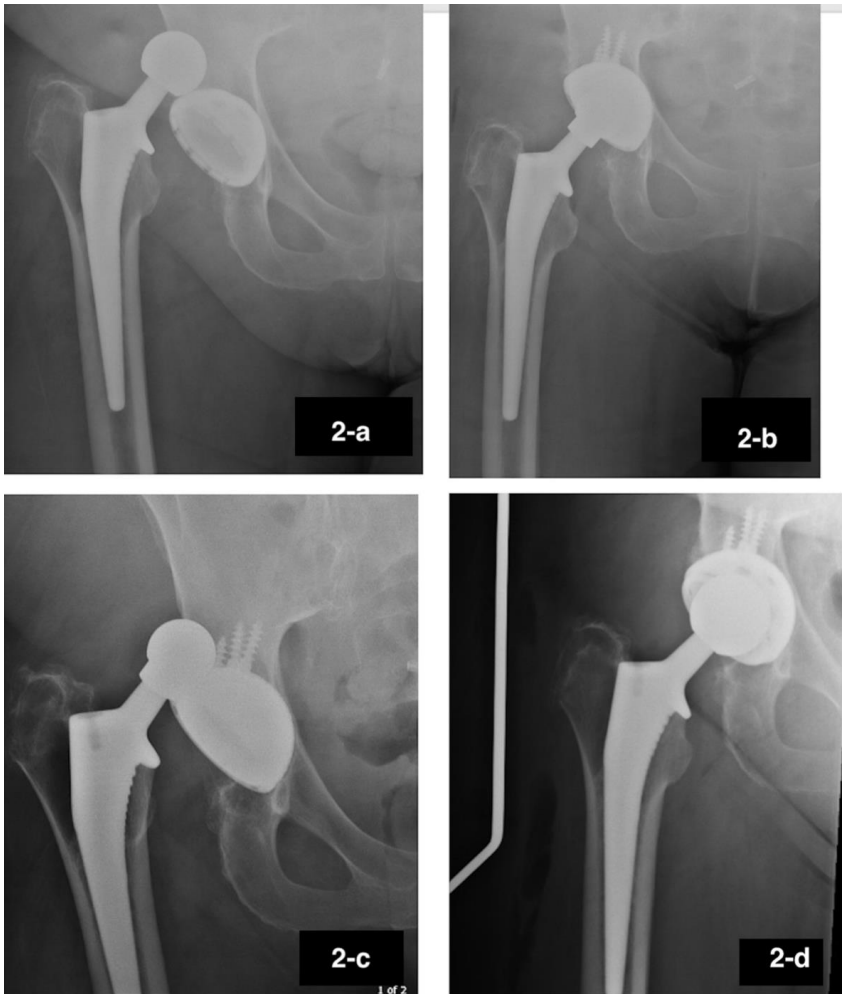

Fig. 2 — 2-a Pre-op X-ray of patient with recurrent dislocation of right hip. 2-b X-ray of the same patient following revision surgery with dual mobility cup. Skirted head was used. 2-c X-ray showing dislocation following revision with the dual mobility cup. 2-d X-ray showing re-revision with constrained liner.

DISCUSSION

In this study we assessed the outcome of revision THAs with the use of a dual mobility cup. We were specifically interested to see the effect on post-operative instability. In addition, we collected data for PROMS following revision THA. In majority (54%) of the cases the indication for revision surgery was recurrent dislocation. In the remaining cases, the risk of dislocation was equally high following complex revision surgery such as two-stage exchange for prosthetic joint infection (PJI) or adverse soft tissue reactions from metal-on-metal THAs. The latter cases had either pre-existing soft tissue damage or it was anticipated that there would be extensive soft tissue debridement during surgery resulting in abductor insufficiency.

Historically, dual mobility cups have been used for both primary and revision total hip arthroplasty in high risk patients[12]. The construct provides better range of movement and an effective large head and neck ratio[11]. The smaller head moves first inside the mobile polyethylene bearing. Once the neck starts impinging on the polyethylene liner (larger head), the latter starts moving in the metal liner increasing the jump distance and improving the arc range of motion[12].

There have been several studies in the literature supporting the evidence of dual mobility cups in reducing dislocation rate. A recent retrospective study by Wakeling et al showed a dislocation rate of 15.4% in complex revision total hip replacement where a dual mobility cup was used[13]. They concluded that dual mobility cups can be successfully used in complex revision hip arthroplasty with an acceptable subsequent re-revision rate for post-operative dislocation.

Simian et al[14] reported the results of dual mobility cups with minimum 5 year follow up. In their study they used dual mobility cups in revision hip arthroplasty for instability and infection and reported low rate of re-revision for dislocation (1.4%).

Hailer et al[15] reported the results of 228 cases from the Swedish Hip Arthroplasty Register utilising dual mobility cups for revision in hip instability. At two years follow-up they reported 2% revision rate due to dislocation.

The main theoretical concern is potentially increased polyethylene wear rate. There are two articulating surfaces; the first where the metal or ceramic head articulates with the concave surface of the polyethylene and a second one where the convex surface of polyethylene articulates with polished metal liner[16]. The wear has been noted more on the inner concave surface indicating that there is more motion on the inner articulation[17]. However, the total wear volume has been reported similar to that seen with conventional metal-polyethylene bearings with 22.2 mm metal heads[18]. However the factors which can lead to excessive polyethylene wear in dual mobility cups include high body mass index, type of stem and size of acetabular cup[19]. Excessive wear in turn can lead to late dislocation and intraprosthetic dislocation in dual mobility cups. The latter is a unique complication seen in dual mobility cups and necessitates open reduction and possible modular exchange and even revision if there is significant damage of the prosthetic components. This complication has become rare with new bearing designs and with the use of highly cross-linked polyethylene (HXLPE)[19].

Our study showed one dislocation in revision THA using a dual mobility construct at a mean four year follow-up. This patient had anterolateral approach for primary surgery. During revision surgery significant abductor insufficiency was noted. A long skirted head was used to achieve soft tissue tension. We would like to emphasize that the use of dual mobility cup is not a substitute for inadequate surgical technique or improper orientation of the implant. In our case, the use of a skirted head in dual mobility cup construct resulted in prosthetic impingement. In addition, the inadequate hip offset, and abductor insufficiency can result in recurrence of dislocation. Therefore, we strongly advocate the use of a constrained liner in the cases with significant abductor insufficiency. In addition to that the use of skirted head should be avoided to compensate for soft tissue inadequacy as this will result in prosthetic impingement and dislocation.

The limitations of our study include the relatively short follow-up data and the absence of a control group. The relatively small sample and the retrospective nature of the study may have inherent bias in our results. The revision THA using dual mobility construct were performed by multiple arthroplasty surgeons with different surgical techniques, which could lead to heterogenous data. However, the design of this particular dual mobility cup remains unchanged in all revision cases.

CONCLUSION

The use of dual mobility cups can provide durable fixation and favourable outcomes in revision THA. It also significantly reduces the risk of dislocation

in patients with recurrent dislocation and can be considered in patients with high risk of dislocation following revision THA. Intraprosthetic dislocation is rare with modern bearing designs. Long term follow-up studies are paramount to support the continuous use of this construct in revision THA.

REFERENCES

1. Van Eecke E, Vanbiervliet J, Dauwe J, Mulier M. Comparison of Constrained Acetabular Components and Dual Mobility Cups in Revision Total Hip Arthroplasty: A Literature Review. Hip Pelvis. 2020;32(2):59.
2. Iorio R, Robb WJ, Healy WL, Berry DJ, Hozack WJ, Kyle RF, et al. Orthopaedic surgeon workforce and volume assessment for total hip and knee replacement in the United States: preparing for an epidemic. J Bone Joint Surg Am. 2008 Jul;90(7):1598–605.
3. Wera GD, Ting NT, Moric M, Paprosky WG, Sporer SM, Della Valle CJ. Classification and management of the unstable total hip arthroplasty. J Arthroplasty. 2012 May;27(5):710–5.
4. Biedermann R, Tonin A, Krismer M, Rachbauer F, Eibl G, Stöckl B. Reducing the risk of dislocation after total hip arthroplasty: THE EFFECT OF ORIENTATION OF THE ACETABULAR COMPONENT. The Journal of Bone and Joint Surgery British volume. 2005 Jun;87-B(6):762–9.
5. Pai FY, Ma HH, Chou TFA, Huang TW, Huang KC, Tsai SW, et al. Risk factors and modes of failure in the modern dual mobility implant. A systematic review and meta-analysis. BMC Musculoskelet Disord. 2021 Dec;22(1):541.
6. Alberton GM, High WA, Morrey BF. Dislocation after revision total hip arthroplasty : an analysis of risk factors and treatment options. J Bone Joint Surg Am. 2002 Oct;84(10):1788-92.
7. Philippot R, Adam P, Reckhaus M, Delangle F, Verdot FX, Curvale G, et al. Prevention of dislocation in total hip revision surgery using a dual mobility design. Orthopaedics & Traumatology: Surgery & Research. 2009 Oct;95(6):407–13.
8. Mohammed R, Hayward K, Mulay S, Bindi F, Wallace M. Outcomes of dual-mobility acetabular cup for instability in primary and revision total hip arthroplasty. J Orthopaed Traumatol. 2015 Mar;16(1):9–13.
9. Batailler C, Fary C, Verdier R, Aslanian T, Caton J, Lustig S. The evolution of outcomes and indications for the dual-mobility cup: a systematic review. Int Orthop. 2017 Mar;41(3):645–59.
10. Su EP, Pellicci PM. The role of constrained liners in total hip arthroplasty. Clin Orthop Relat Res. 2004 Mar;(420):122–9.
11. Yang S, Xie F, Cui W, Zhang Y, Jin Z. A review of the clinical and engineering performance of dual-mobility cups for total hip arthroplasty. Am J Transl Res. 2021 Aug 15;13(8):9383-9394
12. Plummer DR, Haughom BD, Della Valle CJ. Dual mobility in total hip arthroplasty. Orthop Clin North Am. 2014 Jan;45(1):1–8.
13. Wakeling CP, Sandiford NA, Ghani R, Bridle SJ, Mitchell PA, Hutt JR. Dual-mobility bearings in complex revision hip arthroplasty. Hip Int. 2022 Jul;32(4):460-465
14. Simian E, Chatellard R, Druon J, Berhouet J, Rosset P. Dual mobility cup in revision total hip arthroplasty: Dislocation rate and survival after 5 years. Orthopaedics & Traumatology: Surgery & Research. 2015 Sep;101(5):577–81.
15. Hailer NP, Weiss RJ, Stark A, Kärrholm J. Dual-mobility cups for revision due to instability are associated with a low rate of re-revisions due to dislocation: 228 patients from the Swedish Hip Arthroplasty Register. Acta Orthopaedica. 2012 Dec;83(6):566–71.
16. De Martino I, D'Apolito R, Soranoglou VG, Poultsides LA, Sculco PK, Sculco TP. Dislocation following total hip arthroplasty using dual mobility acetabular components: a systematic review. The Bone & Joint Journal. 2017 Jan;99-B(1_Supple_A):18–24.
17. D'Apuzzo MR, Koch CN, Esposito CI, Elpers ME, Wright TM, Westrich GH. Assessment of Damage on a Dual Mobility Acetabular System. J Arthroplasty. 2016 Aug;31(8):1828-35.
18. Adam P, Farizon F, Fessy MH. Dual mobility retentive acetabular liners and wear: surface analysis of 40 retrieved polyethylene implants. Orthop Traumatol Surg Res. 2014 Feb;100(1):85-91.
19. Neri T, Boyer B, Geringer J, Di Iorio A, Caton JH, Philippot R, et al. Intraprosthetic dislocation of dual mobility total hip arthroplasty: still occurring? International Orthopaedics (SICOT). 2019 May;43(5):1097–105.