The Journal of Arthroplasty 31 (2016) 846–849

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Salvage of Monoblock Metal-on-Metal Acetabular Components Using a Dual-Mobility Bearing

Darren R. Plummer, MD, MBA [a], Herman G. Botero, DO [b], Keith R. Berend, MD [c], James W. Pritchett, MD, FACS [d], Adolph V. Lombardi, MD, FACS [c], Craig J. Della Valle, MD [e]

[a] Department of Orthopaedic Surgery, The Ohio State University Wexner Medical Center, Columbus, Ohio
[b] Knoxville Orthopaedic Clinic, Knoxville, Tennessee
[c] Joint Implant Surgeons, New Albany, Ohio
[d] Swedish Medical Center, Seattle, Washington
[e] Midwest Orthopaedics at Rush, Chicago, Illinois

A B S T R A C T

Background: Large-diameter, monoblock acetabular components have been used for both hip resurfacing arthroplasty and metal-on-metal (MoM) total hip arthroplasty (THA). If revision is required, one solution is to retain the shell and use a dual-mobility bearing.
Methods: We reviewed the results of 25 revision THAs including 11 hip resurfacing arthroplasty and 14 MoM THAs where a monoblock acetabular component was mated to a dual-mobility bearing.
Results: At a mean of 29 months, there was one failure, an intraprosthetic dislocation of the dual-mobility bearing. There was a significant decrease in serum metal ion levels postoperatively.
Conclusion: Retention of a well-fixed, monoblock MoM acetabular shell and mating it to a dual-mobility bearing in the setting of revision surgery seems to be a reasonable, low-morbidity option at short-term follow-up in appropriately positioned cups.

Article history:
Received 23 July 2015
Accepted 18 August 2015
Keywords: total hip arthroplasty, bearing surfaces, revision total hip arthroplasty, salvage monoblock metal-on-metal, adverse local tissue reaction, metal-on-metal

Large-diameter, monoblock acetabular components have been used for both hip resurfacing arthroplasty (HRA) and metal-on-metal (MoM) total hip arthroplasty (THA). These bearing surfaces were developed to provide an alternative treatment option to traditional THA in younger active patients [1]. Purported advantages of MOM bearings included improved wear characteristics, a larger femoral head to enhance stability and mitigate dislocation risk, and in the case of HRA, preservation of proximal femoral bone stock. These potential advantages resulted in an increased use of these monoblock acetabular components, ultimately accounting for more than one-third of the US market in 2006 [2,3].

Although early reports were encouraging, subsequent studies have shown, in some cases, high early failure rates [4–9]. Adverse local tissue reactions (ALTR) second to bearing surface wear or corrosion have been reported in association with certain designs [10–15]. Although failures of HRA seem to be less common than those of MOM THA, femoral-sided failures can occur secondary to femoral neck fracture or femoral component loosening. Consequently, revision of MoM THA has become increasingly common, and in many cases, the acetabular component may be well fixed.

When revision surgery is required, the surgeon has the option of revising the monoblock shell or, if the acetabular component is well fixed and appropriately positioned, mating it to a dual-mobility bearing. This option should be associated with less morbidity secondary to faster operative time, preservation of host bone stock, and a low risk of dislocation given the stability benefits of a dual-mobility articulation, although little has been written on the outcomes of this option. The purpose of our study is to report on our experience with salvage of a monoblock MOM shell with conversion to a dual-mobility bearing.

Patients and Methods

After obtaining institutional review board approval, we performed a multicenter review of 11 HRAs or 14 monoblock MoM THAs performed between April 2010 and October 2012 where a well-fixed acetabular component was retained and mated to a dual-mobility THA bearing. The minimum follow-up was 2 years for inclusion in the study and no patients were lost to follow-up. The primary reasons for revision

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.arth.2015.08.016.

Reprint requests: Darren R. Plummer, MD, MBA, Department of Orthopaedic Surgery, The Ohio State University Wexner Medical Center, 376 West 10th Ave, 725 Prior Hall, Columbus, OH 43210.

http://dx.doi.org/10.1016/j.arth.2015.08.016
0883-5403/

included an ALTR (15 hips; 60%) and femoral component loosening (7 hips; 28%) with one revision each for instability, femoral neck impingement, and acute hematogenous periprosthetic joint infection. The mean time from index THA to revision was 3.4 years (range, 1-8.2 years).

The study group consisted of 13 men (52%) and 12 women (48%) with a mean age of 61.7 years (range, 46-91 years) and average body mass index of 29.2 kg/m^2 (range, 19.7-40.4 kg/m^2). The average cup abduction angle was 49° for the entire cohort (range, 39°-67°), and the average cup anteversion was 19° (range, 10°-39°). Revisions were performed by 1 of 3 fellowship-trained surgeons via a posterior approach (52%), anterior approach (32%), or direct lateral (16%) based on the primary THA approach. The mean index acetabular component diameter was 50 mm (range, 42-60 mm). The outer diameter of the dual-mobility polyethylene bearing was matched to the inner diameter of the retained shell as per manufacturer specifications, and this was confirmed based on a review of implant stickers, operative notes, and/or markings on the implants themselves (Figures. 1-3). All 12 HRA acetabular components were the Birmingham Hip Resurfacing system (Smith & Nephew, Memphis, TN). The MoM monoblock THA included 11 Biomet Magnum (Biomet, Inc, Warsaw, IN) and 2 Wright Conserve (Wright Medical Technology, Inc, Arlington, TN). The inner femoral head materials used at the time of revision included 14 metal, 9 ceramic (36%), and 2 ceramicized metal (8%). In addition, no femoral stems with modular necks were included in the study.

Patients were evaluated preoperatively and postoperatively in the outpatient office at standard intervals (3 weeks, 6 weeks, 3 months, 1 year, and annually thereafter) for a physical examination and plain radiographs. Using an analytical methodology previously established [16], serum cobalt and chromium levels were obtained preoperatively and postoperatively at a specialized trace metal analysis laboratory for 13 of the 25 patients. Review of clinical evaluations and outcomes was performed by observers who were not directly involved with the index surgical procedures. Clinical outcome was assessed using the Harris Hip Score [17]. Preoperatively and posteoperative clinical outcomes were analyzed using a Student *t* test, with a *P* value less than .05 considered significant.

Results

At a mean of 29 months (range, 24-45 months), there was 1 failure, in a 59-year-old woman with a body mass index of 44.4 kg/m^2. Her acetabular component had a 67°cup abduction angle, and at 19.2 months after her revision arthroplasty, she sustained an intraprosthetic dislocation (IPD) of the dual-mobility bearing treated with acetabular component revision. No other complications or revisions were identified.

Preoperative and postoperative serum cobalt and chromium were obtained on 12 of the 25 patients. The mean serum cobalt level decreased from 14.8 ppb preoperative to 1.36 ppb postoperatively ($P = .02$). The mean serum chromium level decreased from 11.9 ppb preoperative to 1.59 ppb ($P = .04$) postoperatively. Average blood loss during revision arthroplasty was 250 mL (range, 150-450 mL). All patients had radiographs performed at a minimum of 2 years, and no progression of osteolysis or obvious wear/deformity of the outer polyethylene liner was identified. The mean Harris Hip Score increased from 57 to 87 points ($P < .005$), with 22 patients reporting clinical outcomes considered good (>80 points) or excellent (>90 points; Figure 4).

Discussion

Failure of a MOM THA or an HRA is a common cause of revision surgery. In many cases, the acetabular component is monoblock and well fixed. The results of this report suggest that retention of the cup and conversion to a dual-mobility bearing is a reasonable option that offers a technically simple solution that avoids the risk, complexity, and time associated with removal of a well-fixed shell.

Fig. 1. Anteroposterior left hip showing narrowing of the femoral neck and a large retroacetabular osteolytic lesion. The acetabular component is well fixed and acceptably positioned.

Recent studies examining the results of revision of a failed large-head MOM THA have identified a relatively high rate of complications overall, with dislocation and failed ingrowth among the most commonly cited reasons for repeat revision. Retention of the shell obviates the concern regarding ingrowth of a new shell if the acetabular bone bed has been damaged from metallic debris, which has been noted to occur in some cases. If the technique described in this report is to be used, it is critical to ensure that the cup is well fixed. Furthermore, it is important to recognize that although some of the monoblock MOM cups retained in this series have been associated with excellent bony ingrowth (such as the Birmingham Hip Resurfacing [18–23]), in other monoblock MOM cup designs, osseointegration was problematic, and hence, familiarity with the track record of the device to be retained is important.

Dislocation is among the most common complications after revision THA, and as previously described, this has been noted as a particular problem after revision of the failed MOM hip, particularly if a large head was originally used [24–26]. In a study following 32 hips after

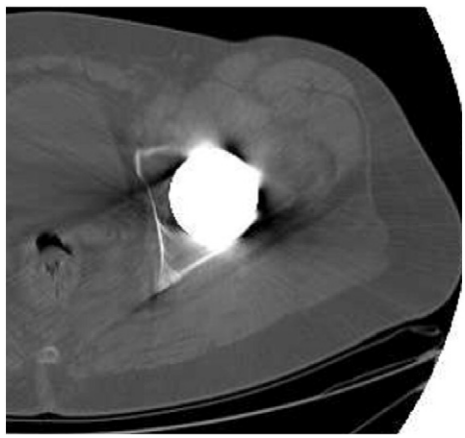

Fig. 2. Axial computed tomographic scan image showing acetabular osteolysis and confirming acceptable component anteversion.