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Can Dual Mobility Cups prevent Dislocation in All Situations After Revision Total Hip Arthroplasty?

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ABSTRACT

The outcome of a single design of dual mobility cup was prospectively evaluated in a continuous series of 994 revision THAs with respect to dislocation and intra-prosthetic dislocation (IPD). At a 7.3-year mean follow-up, the dislocation rate was 1.5% and the IPD rate was 0.2%. The 2 IPD occurred in acetabular-only revisions and were related to a poor head-to-neck ratio with early impingement and wear at the polyethylene mobile component chamfer. Dual mobility cups demonstrated a low dislocation rate in revision THA but did not compensate for potential perioperative technical errors. In addition, IPD did not appear to be a concern with respect to the benefit in term of instability prevention though caution is advised in acetabular-only revision associated with a poor head-to-neck ratio. Level of Evidence: Therapeutic study—Level IV

Instability represents the leading cause of failure in revision total hip arthroplasty (rTHA) accounting for up to 35% of these failures [1,2]. The cause of dislocation after revision is related to multiple factors such as patient characteristics, revision etiology, component orientation, location of the hip center of rotation, limb length and status of the hip abductor mechanism [1–4]. In an attempt to stabilize the hip, several options for the acetabular reconstruction have been proposed including constrained acetabular components, large femoral heads and dual mobility cups. The rational of constrained components is to prevent instability by constraining the femoral head into a polyethylene (PE) liner and restricting hip range of motion. However, such a mechanism may result in high stress applied to the bone–implant interface leading to loosening and impingement at the PE liner rim leading to locking ring damages and subsequent dislocation [5–7]. Therefore, with a 10-year failure rate up to 42.1%, many authors advocated limiting their use to salvage situation of recurrent instability [5–7]. With the improvement in highly cross-linked PE (XLPE), large femoral heads have emerged with the rational of increasing the head-to-neck ratio to prevent instability [8]. In a short-term follow-up randomized trial, Garbuz et al [8] demonstrated that large femoral head of 36- or 40-mm reduced significantly the dislocation rate to 1.1% versus 8.7% with 32-mm head. Used in Europe for more than 25 years, dual mobility cups have demonstrated effectiveness to prevent instability with dislocation rates ranging from 0% to 8.7% in rTHA [2,9–14]. However, these encouraging results were mostly based on retrospective series including a limited number of patients with various designs and generations of implants [9–14]. In addition, concerns were raised due to the risk of intra-prosthetic dislocation (IPD) although the rate of IPD was low in literature reported from 0.28% to 1% [15–17].

Therefore, the current series prospectively evaluated the outcome of a single dual mobility cup in rTHA with respect to dislocation and IPD rates at mid- to long-term follow-up. The purpose of this study was (1) to demonstrate the effectiveness of a dual mobility cup to prevent instability in a large, prospective and continuous series of rTHA and (2) to analyze the cases of dislocation or IPD to determine the mechanisms of failure. We hypothesized that dual mobility cups could prevent dislocation after rTHA and that IPD is not a concern with respect to the benefit in term of instability prevention.

Patients and Methods

From January 2000 to December 2011, a continuous series of 1178 patients (1219 hips) who have undergone a rTHA associated with acetabular reconstruction using a dual mobility cup was prospectively included in our institutional Total Joint Registry (TJR). Exclusion criteria were revision performed in the case of bone tumors, with a different acetabular component and femoral-only revision. Owing to the French regulation, patient's informed consent was not required to be included in this study. At the time of evaluation, 139 patients (159 rTHA, mean follow-up = 3.1 years [0.2–11 years]) died of causes unrelated to revision. In addition, 59 patients (66 rTHAs, mean follow-up = 2.4 years [1–8 years]) were lost to follow-up due to failure to return for the post-operative evaluation and no response to phone calls or letters. In

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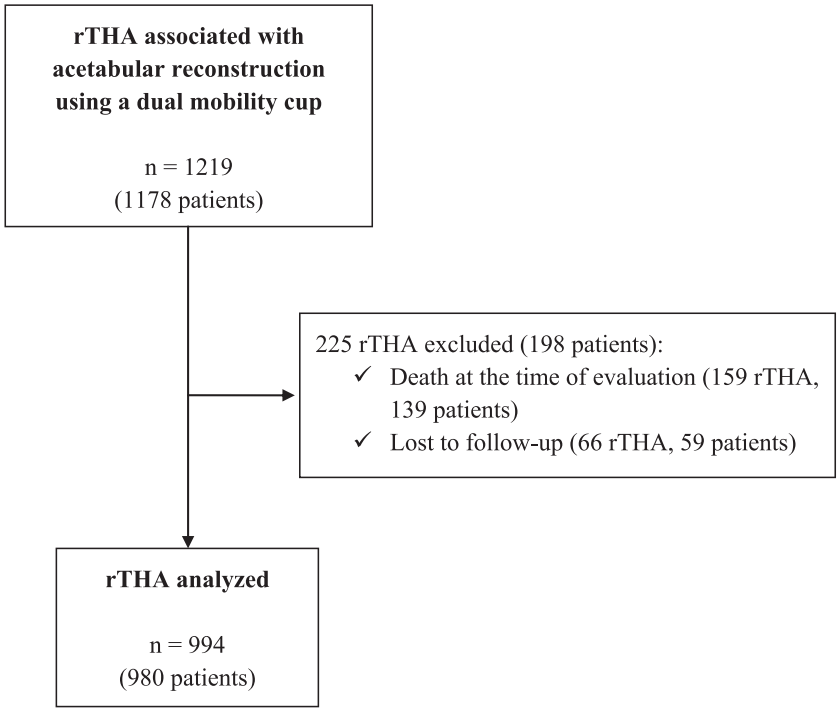

Fig. 1. Study flow diagram of the rTHA and patients.

these 198 patients (225 rTHAs), no dislocation was reported at the latest follow-up available. However, one of deceased patient underwent IPD 13 months after an acetabular-only revision for instability as previously reported by Guyen et al [10]. This 84-year-old patient with Parkinson's disease was re-operated for a Girdlestone procedure and died at 3 months [10]. Therefore, a continuous series of 980 patients (994 rTHAs, 568 women, 412 men, mean age at the time of the revision = 70 years [39–92 years]) was included and analyzed in this study (Fig. 1). The mean follow-up of the 994 rTHAs was 7.3 years (2–13 years). Among the 994 rTHAs, 576 (58%) were acetabular-only revisions and 418 (42%) acetabular and femoral revisions. Etiologies for revision were aseptic loosening in 739 cases (74%), periprosthetic infection in 173 cases (17%), instability in 68 cases (7%), and periprosthetic fracture in 14 cases (2%). In addition, the rTHA included was the first revision in 795 cases (80%), the second in 159 cases (16%), the third in 30 cases (3%) and the forth or more in 10 cases (1%).

All revisions were performed through a posterolateral approach by or under the supervision of two senior surgeons. The acetabular reconstruction was systematically performed using a single M30NW dual mobility cup (Saturne®, Amplitude, Valence, France) with a 22.2-mm cobalt–chrome femoral head impacted in force and captured into an ultra-high molecular weight PE mobile component using a snap-fit technique (Fig. 2A and B) [18]. After acetabular component removal and granulomatous tissue debridement, occurrence of acetabular bone deficiency was addressed and graded according to the 4-grade classification of the AAOS [19]. In 695 rTHAs (70%), no acetabular bone defect or AAOS grade I and II defects were reported and a cementless hydroxyapatite-coated dual mobility cup was used. In 218 rTHAs (21.9%) with AAOS grade III and IV defects, an acetabular reconstruction using a dual mobility cup cemented into a 316 L stainless steel Kerboull cross-plate (Amplitude, Valence, France) associated with structural bone graft was performed according to the technique described by Wegrzyn et al [20]. In 74 rTHAs (7.4%) with AAOS grade IV defect, the acetabular reconstruction was performed using a dual mobility cup cemented into a titanium Burch-Schneider cage (Zimmer, Warsaw, IN) in 69 cases and into a porous tantalum revision shell (TMARS®, Zimmer, Warsaw, IN) in 5 cases. In 7 rTHAs (0.7%), the acetabular revision consisted in the cementation of a dual mobility cup into a well-fixed metal-back according to the technique described by Wegrzyn et al [21]. Polymethylmethacrylate bone cement with 0.5 g of gentamicin (Palacos®R + G, Heraeus Medical GmbH, Wehrheim, Germany) was used. After 3.5 min of manual mixing at controlled-operating room

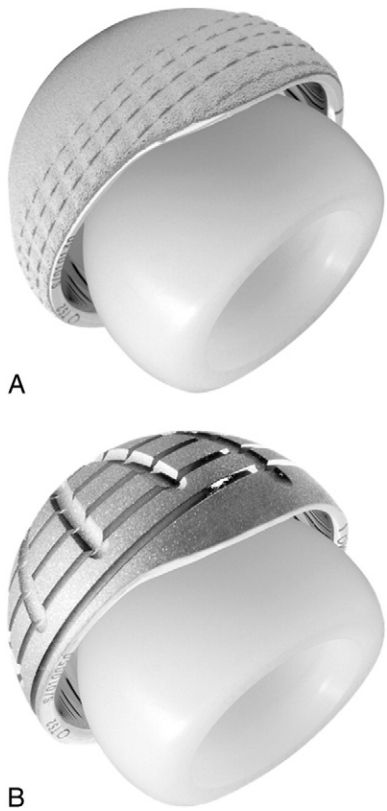

Fig. 2. The Saturne® dual mobility cup. (A) Cementless hydroxyapatite-coated implant. (B) Cemented implant with microblasted-finished hemispheral grooves for cement interdigitation.