A Long-Term Survivorship Comparison Between Cemented and Uncemented Cups With Shelf Grafts in Revision Total Hip Arthroplasty After Dysplasia

Amir Sternheim, MD, Mansour Abolghasemian, MD, Oleg A. Safir, MD, MEd, FRCSC, David Backstein, MD, MEd, FRCSC, Allan E. Gross, MD, FRCSC, O.Ont, and Paul R. Kuzyk, MD, MASc, FRCSC

Abstract: Long-term outcomes of cemented and uncemented cups were compared in patients with hip dysplasia who had undergone revision hip arthroplasty. Patients had uncontained superolateral acetabular defects reconstructed with a structural allograft. This retrospective study compared 18 cemented acetabular cups to 27 uncemented acetabular cups. Average follow-up was 216 months (range, 96-312). Nineteen acetabular cups (42%) failed due to loosening and were revised. The 10- and 20-year cup survival was 88% and 76% in the uncemented group and 67% and 36% in the cemented group. Log rank analysis showed this difference to be significant (P = .0077). Uncemented acetabular cups performed significantly better than cemented cups.
Keywords: revision hip arthroplasty, hip dysplasia of adulthood, structural shelf allograft, cemented acetabular cups, uncemented acetabular cups.

Total hip arthroplasty (THA) in the presence of acetabular deficiency often necessitates reconstruction of bone defects to place the cup center in its anatomical location, provide circumferential support, and restore bone stock. Uncontained acetabular bone defects of the superolateral rim with less than 50% bone loss may be reconstructed with a structural bone graft, a metal augment, a roof ring, impaction grafting, an oblong cup, or a cementless cup with a high hip center [1,2]. Long-term results are available for the use of structural bone graft to reconstruct these uncontained defects for both primary and revision THA [3-5]. Metal augments have been introduced in recent years for reconstructing uncontained defects, but they still lack long-term follow-up studies [6,7].

The 2011 Australian Orthopaedic Association National Joint Replacement Registry suggests that uncemented acetabular cups have significantly better survivorship at 10 years when compared with cemented cups for primary THA in all age groups [8]. However, cemented cups are still common practice in many countries. Longer term registry data are lacking as well as data regarding cup survivorship in revision surgery. Impaction bone grafting and a cemented acetabular cup are the alternative treatment option for acetabular bone defects. Long-term results of impaction bone grafting show an 84% survivorship at 8 years in 1 study [9] and 88% at 10 years, 73% at 20 years, and 52% at 25 years in a second long-term study [10].

Developmental dysplasia of the hip (DDH) may present in adults as a spectrum from mild hip incongruence to low or high dislocation [11]. The dysplastic acetabulum is often shallow and may be deficient in its superolateral rim. Patients with hip dysplasia may develop end-stage hip arthritis during early adulthood. The relatively young age at which these patients undergo primary THA, their high activity level, and the anatomical deficiencies around the hip expose them to higher rates of mechanical failure and the need for revision THA.

We have treated active young adult patients with hip dysplasia and a superolateral defect with structural bone graft. Those presenting for revision surgery of the acetabular cup due to loosening underwent reconstruction of the deficient acetabular rim with allograft

From the Division of Orthopaedic Surgery, Mount Sinai Hospital, Toronto, Ontario, Canada.
Submitted December 21, 2011; accepted June 7, 2012.
The Conflict of Interest statement associated with this article can be found at http://dx.doi.org/10.1016/j.arth.2012.06.004.
Reprint requests: Amir Sternheim, MD, 600 University Ave Suite 476A, Toronto, Ontario, Canada, M5G 1X5.

0883-5403/2802-0017$36.00/0
http://dx.doi.org/10.1016/j.arth.2012.06.004

femoral head bone. An acetabular cup, either cemented or uncemented, was then implanted into the reconstructed acetabulum. The goal of this study was to define the long-term implant survivorship and to assess the difference in survivorship between cemented and uncemented cups, in revision hip arthroplasty. Our hypothesis was that long-term survivorship would significantly favor uncemented cups.

Materials and Methods

We retrospectively reviewed prospectively collected data on 45 hips in 38 patients who underwent revision of their acetabular components using a structural shelf allograft between 1984 and 2000. All patients had a diagnosis of hip dysplasia and had undergone primary hip arthroplasty as young adults. These patients were referred to our tertiary institution with mechanical loosening and failure of one or both of their implants. A single surgeon (AEG) treated all patients.

Patients were included in the study if they had: (1) a diagnosis of DDH, (2) revision of their acetabular implant due to mechanical loosening, (3) an uncontained superolateral defect that was reconstructed with a minor column femoral head allograft during the index revision, and (4) an acetabular cup that was either cemented or uncemented. Historically, we cemented the acetabular cups, as the technology became more readily available we gradually converted to uncemented cups. Thus, the cemented group, generally, predates the uncemented group. This was partially related to the small diameter of some of the cups, which was initially not readily available in uncemented cups.

Patients were excluded from the study if they had less than 5 years of follow-up. All patients were classified intraoperatively as having type 3 acetabular defects as defined by the Gross Classification [12]. Type 3 defects are uncontained acetabular defects with loss of more than 30% but less than 50% of the acetabular rim.

During the study period, there were 124 revisions of the acetabular side in patients with DDH. Twenty-five included a major column structural allograft. Fifty-three were revised with a minor column structural allograft (shelf graft) due to a superolateral defect. Eight patients lacked the minimum 5 years follow-up. This left 45 revision hip surgeries that were included in the study. An additional 46 patients underwent acetabular side revision without structural allograft.

Our surgical technique for acetabular reconstruction has been previously published [13]. The transgluteal approach or the modified trochanteric slide osteotomy was used to provide adequate exposure for the hip revision. The loose cup, cement, and soft tissue debris were removed from the acetabulum. The acetabulum was then reamed, and a trial cup was used to assess the size of the uncontained defect. Defect size was determined by dividing the acetabulum into 4 quadrants and assessing bone loss in each quadrant. Femoral head allograft was provided by our institutional bone bank, which is accredited by the American association of tissue banks. The allograft bone was preirradiated with 25 to 45 kGy of gamma radiation and stored at −60°C to −80°C. This bone allograft was thawed intraoperatively, shaped to fill the rim defect, and fixed with two 4.5 or 6.5 mm partially threaded cancellous screws with washers. At this point, an acetabular cup was either cemented into place (Fig. 1, cemented cup) or press-fit into the acetabulum with the addition of screws placed through the uncemented cup (Fig. 2). The 18 acetabular cemented cups used were 15 Protek AG (Bern, Switzerland), 1 Johnson & Johnson (Warsaw, Ind), and 2 Charnley Biomet (Warsaw, Ind). The 27 uncemented cups used were 9 Harris-Galante Zimmer (Warsaw, Ind), 15 PCA Osteonics (Mahwah, NJ),1 Morcher Protek AG (Bern, Switzerland), and 2 AML DePuy (Warsaw, Ind). The primary outcome was failure of the acetabular cup, which was measured as the time from surgery to re-revision surgery of the acetabular cup due to loosening. Secondary outcomes were time

Fig. 1. A cemented acetabular cup 23 years after surgery. There are no signs of loosening on the acetabular side or graft resorption. The false acetabulum is evident. A trochanteric claw holds the greater trochanter in place, although there is evidence of nonunion and proximal migration of the greater trochanter.