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Use of Jumbo Cups for Revision of Acetabulae With Large Bony Defects

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ABSTRACT

Several methods of treatment are available for acetabular revision associated with bone loss. Jumbo cups (minimum diameter of 62 mm in women, 66 mm in men, or 10 mm larger than the normal contralateral acetabulum) are often useful for large defects. The purpose of this study is to report a large jumbo cup series with an average 10-year follow-up. A total of 196 jumbo cups in 186 patients with a minimum of 2-year follow-up were available for review. Harris hip score improved from 44 preoperatively to 72 postoperatively. Survivorship was 98% at 4 years and 96% at 16 years. Five revisions and two resection arthroplasties were performed for failure. In conclusion, porous jumbo cup acetabular revision with supplemental screw fixation provides good to excellent intermediate- and long-term outcomes.

Good long-term results have been shown with use of porous cups for revision of the acetabulum in a total hip revision [1–4]. Biological fixation can be expected even when there is not 100% host bone apposition [5]. The ideal treatment for an acetabular revision with a small cavitary defect is a porous cup. If there is a large acetabular defect with greater than 1 cm of bone loss, standard size cups alone placed in the anatomic acetabulum have difficulty achieving initial stability due to lack of host bone contact. This is frequently present with peripheral or combined peripheral and cavitary defects. Treatment options for acetabular revisions with peripheral or combined peripheral and cavitary defects are standard size porous cups with bulk supporting allograft [6,7], porous cups placed proximally [8–10], oblong [11–13], or custom cups [14,15], cages [16–19], tantalum metal cups and augments [20–24] or jumbo cups [4,25–29].

The advantage in using a jumbo porous cup is that it has a larger surface area allowing for greater contact with host bone in order to allow biological attachment, which is required for long-term fixation. Several studies have reported success with the use of jumbo cups [4,25–29]. The purpose of this study is to report a large series of jumbo cups with a minimum of 2-year follow-up.

Methods

From 1986 to 2007, the senior author performed 949 revision total hip replacements of which 690 acetabular shells were revised. Two hundred sixteen jumbo cups were used which represents 31% of all acetabular revision cases. The Mayo Clinic suggested definition of a "jumbo cup," is an acetabular component with a minimum diameter of 62 mm in women and 66 mm in men or is greater than 10 mm larger than the normal contralateral acetabulum [26]. Certainly a very large patient could require a large-diameter acetabular component in this range, but it is uncommon. In general, the concept is in the use of a much larger component which would not have been used if significant bone loss were not present. Their use is facilitated by expansion reaming of the acetabulum.

All patients who had a revision total hip with a jumbo cup, a minimum follow-up of 2 years, or failure for any reason were included in the analysis. In the group of 216 jumbo cups, 8 patients died prior to 2 years of follow-up. Nine patients were excluded because they were lost to follow-up leaving 199 jumbo cup cases available for review. The cohort comprised 189 patients, 118 women and 71 men, with an average age of 66 years. There were 108 right hips and 91 left hips in the study. Most acetabular implants used were either APR, InterOp, or Converge hemispherical shells (Zimmer Orthopedics, Warsaw, Indiana) (formerly Intermedics, Sulzer Orthopedics and Centerpulse Orthopedics) (Fig. 1A and B). These implants have a thin 4-mm titanium shell with holes in a cluster pattern for screws.

All patients were reviewed utilizing the Harris hip score [30]. The preoperative and postoperative scores were statistically compared with a *t*-test. A *p*-value less than 0.05 was considered significant. Radiographs were reviewed utilizing the criteria of DeLee and Charnley [31]. Loosening was defined as migration greater than 2-mm, screw breakage, or greater than 1-mm radiolucent line in all three zones [32]. The Kaplan–Meier method was used for survivorship analysis [33].

Operative Technique

The goal in the treatment of a revision total hip which has a large acetabular defect is to ream the available acetabulum to maximize

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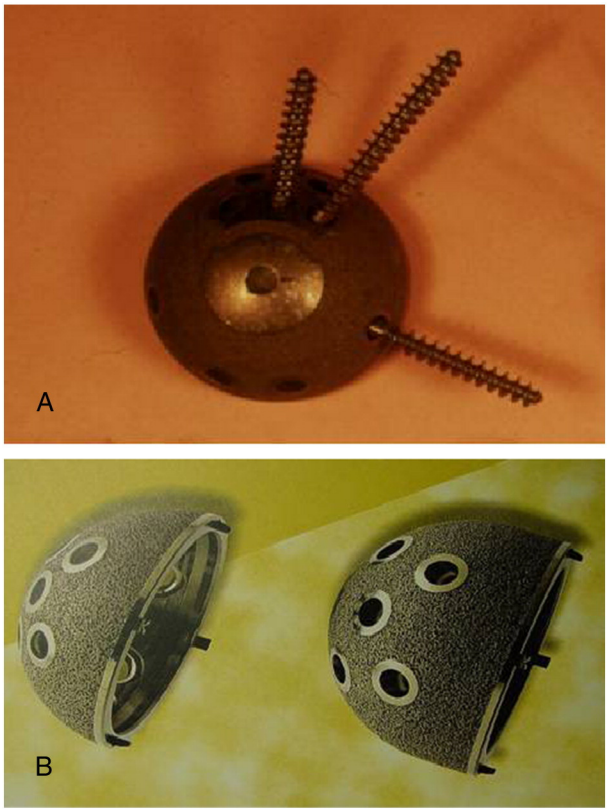

Fig. 1. (A) APR acetabular component. (B) InterOp acetabular component. They have a thin-walled titanium shell with cancellous structured titanium and clustered pattern of holes for screws. The InterOp component is available in a standard hemisphere and a protrusio depth. The unused screw holes can be sealed.

host bone to shell contact without causing significant further bone compromise. The acetabulum is reamed at the level of the normal acetabulum with successively larger diameter reamers until the anteroposterior aspect of the acetabulum is filled. Frequently there is still a defect superiorly. If the defect is less than 2 cm, one option is to allow the reamer to migrate superiorly up to the remaining superior bone and accept a higher hip center. Alternatively, larger reamers are used while maintaining posterior bone stock at the expense of the anterior acetabular bone until the superior bone is contacted. Reaming some of the anterior acetabular bone is inconsequential since it is frequently deficient anyway and if present provides minimal support. Reaming for a larger acetabular component diameter allows for a less proximally positioned hip center than if a smaller acetabular component was used with a high hip center. If the defect is larger than 2 cm, larger reaming is still performed in order to minimize the remaining defect size and provide sufficient bone contact for primary stability. It is important to retain at least some of the anterosuperior acetabulum for cup stability. The goal is to achieve three-point contact of the cup and host bone in order to establish a stable construct. Osseous support superiorly from the anterosuperior and posterosuperior ilium, and posteroinferior from the ischium are necessary for 3-point contact. Usually, minimal medial reaming is required. Particulate graft obtained from reaming is placed along the anterior column defect (Fig. 2A–C). After reaming, trial implantation is performed and component stability is assessed. If one is unable to achieve stable 3-point fixation with the trial component, alternative methods for acetabular revision such as a peripheral bulk allograft, trabecular metal augment, or cup/cage composite should be considered. Except for some Paprosky 3B defects, they are usually not necessary.

Fifty percent implant bone contact is not needed, just a stable cup. By the nature of their large surface area, a jumbo cup will provide a large amount of available porous surface for bone ingrowth even if less than 50% of the cup is in contact with host bone. Any remaining superior defect of around a centimeter or more in size can then be filled with a bulk bone allograft. However, the bulk allograft should not be the primary means of obtaining cup stability. Use of a trabecular metal augment is an excellent alternative to a bulk bone allograft, but was not available during the time frame of surgeries reported in this study. Smaller cavitary defects are filled with particulate autograft and/or allograft. An acetabular reamer with the same diameter as the final reamer is run in reverse to impact the particulate bone graft into the remaining cavitary defects.

A shell 1- to 2-mm diameter larger than the final reamer diameter is used to obtain an initial stable press-fit. The shell should be inherently stable, with screws placed through the cup into the ilium and ischium to supplement the stability (Fig. 3A and B). The acetabular components reported in this study all have five available holes for screws superiorly in a cluster pattern and two holes in the pubic and ischial areas. As many screws that can be inserted and obtain good bone purchase are inserted. Usually a minimum of two screws are used.

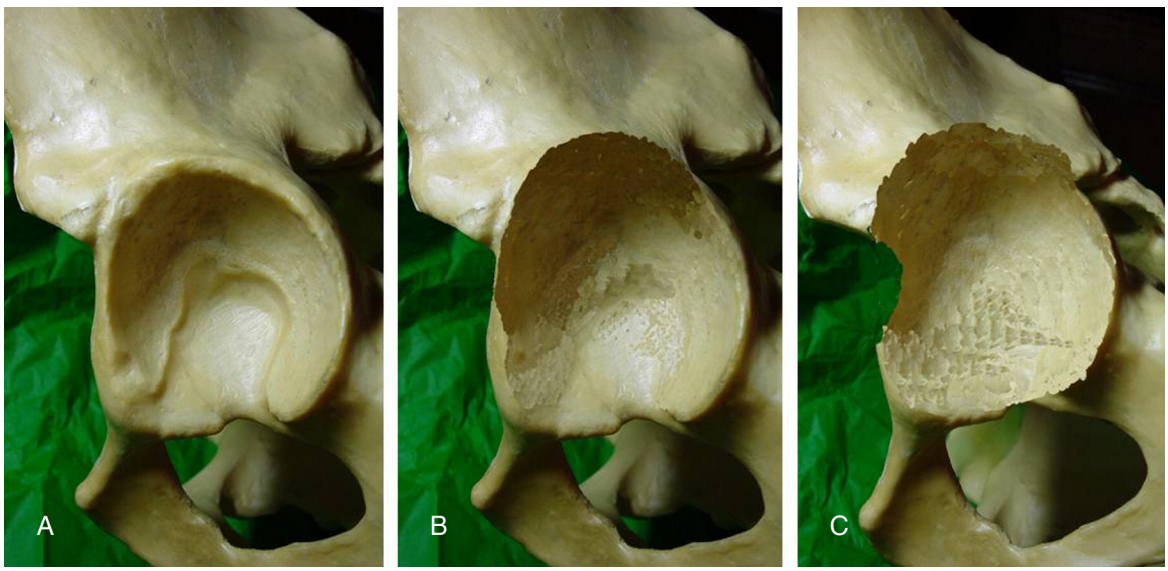

Fig. 2. (A) Normal acetabulum. (B) Typical acetabulum with superolateral defect. (C) Spherically reamed acetabulum for jumbo cup. The posterior wall is maintained.