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CORR Insights®: Custom Acetabular Cages Offer Stable Fixation and Improved Hip Scores for Revision THA With Severe Bone Defects

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Where Are We Now?

The ideal reconstructive method for the severely deficient acetabulum in revision THA remains unsolved. Severe acetabular deficiencies may be evaluated by the Paprosky et al. [7] grading system from which both the anticipated bony defects and the reconstruction needs may be identified. Fortunately, the incidence of severe acetabular deficiency is low, with a report from the Mayo Clinic finding that Paprosky IIIB defects occurred in only 0.9% of hips (31/3505) undergoing revision acetabular surgery at that tertiary care center between 1969–1995 [1].

Most acetabular reconstructions are performed with a large hemispherical shell with a survivorship range of 94% to 100% at mid- to long-term followup [2]. For acetabuli with greater bony loss, porous metal augments may be added, allowing the creation of a bony and metal concavity supportive of a hemispherical shell. As the defect worsens, more-elaborate options come into the picture, perhaps including custom acetabular cages (or triflange cups), reconstruction cages, cup-cage constructs, or cup-cup constructs. Surgeons must recognize the high surgical complexity when contemplating using one of these approaches, as complications can be severe, and unrecognized or untreated pelvic discontinuities can result in a high risk of failure.

During more than a 10-year period, the authors of the current study reported the surgical treatment of 26 patients (all with Type IIIB defects, four with a pelvic discontinuity) who underwent acetabular reconstruction using a grit-blasted titanium custom cage. At a mean followup of 67 months (range, 24 months to 120 months) in 24 patients only one cage was felt to be possibly loose, and the authors reported the appearance of particulate allograft incorporation in 23 of 24 patients. One important caveat of this study is that this was the first revision surgery for all but one patient.

We can compare the results in this series to other reports about severe acetabular defects, which used other approaches, namely reconstruction cages, or custom triflange cups. In a single-surgeon series, reconstruction cages failed in 24% of reconstructions at mean 4.6-year followup, with the highest failure rates occurring in 10 hips with American Academy of Orthopaedic Surgeons (AAOS) Type

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IV (pelvic discontinuity) defects [5]. In these 10 reconstructions, even with the use of structural allograft, three cages loosened, two flange fractured, and a pelvic dissociation remained in two reconstructions. Similar results were shown by Perka et al. [8] who reported that three of 12 revisions for Grade IIIB defects failed at a mean of 5.5 years.

Where Do We Need To Go?

These failures, in my opinion, are not secondary to the concept of spanning a deficient acetabulum with a large metal frame, but due to the loss of either ischial fixation, or malleable flange fracture, both possibly related to the use of materials of inadequate strength. Material issues and fixation can be addressed by the use of a custom triflange. Christie et al. [3] reported on 78 acetabular reconstructions performed with a custom triflange component of which 32 involved an AAOS Type IV defect. At mid-term followup 94% (30/32) of the reconstructions showed healing of the pelvic discontinuity. Similar results have been reported [6] with those authors suggesting posterior column plating of the discontinuity. Therefore, both the current report, and prior data, would suggest three key elements for success: Material rigidity, fixation stability, and creation of a custom implant that attempts to reproduce the joint center. Whether filling the acetabular defect with metal or as in the current report, allografting of the defects, will lead to improved longevity, remains unanswered.

These unique reconstruction situations point to three research needs: (1) To confirm that we are comparing apples to apples in terms of the defects being studied, (2) to identify the implant most likely to result in a durable long-term reconstruction for Type IIIA and IIIB defects, and (3) to try to lower the cost when a custom implant is needed.

How Do We Get There?

Regarding the first unmet need, while the Paprosky classification system has concrete radiographically identifiable guidelines which allow discrimination between a Type IIA/B and IIIA/B defect, decisions are subjective. The preoperatively identified Paprosky clasification has been shown to corelate to the intraoperativley identified acetabular defect volume [9]. A prospective study that included the preoperative Paprosky defect classification, the intraoperative bony defects identified, and the implant(s) used, might allow further refinement of the classification system.

Although the data on the use of one or more augments and a porous metal acetabular component appear extremely promising [4], in order to satisfy the second unmet need, we need long-term data (a minimum of 10 years) before concluding that the majority of type IIIA defects can and should be managed in this fashion.

Finally, what to do for the most-severe defects remains unsolved and it remains up to the discretion of the surgeon whether to use a reconstruction cage, the custom implant as described by Li et al., or a custom triflange cup. The apparent reconstructive answer at this time is that the implant needs to be structurally rigid, and obtain bony fixation. One may consider these custom implants to be analogous to "orphan drugs," in that these devices are relatively rarely used and so there is little incentive for implant vendors to keep the prices down. The general cost from the time of CT scanning to custom implant creation is more than USD 5000. Therefore, it seems rational to try to create an off-the-shelf reconstruction cage that incorporates the benefits shown with the use of custom implants, without the need for component fabrication for individual patients.

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