The Revision Hip: A Potpourri of Options

The Role of Cages and Rings: When All Else Fails

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The goals of acetabular revision surgery are to restore anatomy and provide stable fixation for the new acetabular component. The most important parameter affecting the surgeon’s ability to accomplish this goal is the existing bone stock. Protective rings facilitate restoration of bone stock by providing a scaffold at the correct anatomic level, which protects the graft while remodeling occurs and also provides a bed into which the cup is cemented.

There are two types of rings: the roof reinforcement ring and the antiprotrusio cage. The roof ring protects the dome of the acetabulum and extends from the ilium superiorly to the inferomedial aspect of the acetabulum. This device can be used with structural or morselized bone graft but is more commonly used with the latter. With the availability of better designs and larger uncemented acetabular components, it appears that the use of the roof ring has decreased.

The cage extends from the ilium superiorly to the ischium inferiorly spanning and protecting the entire acetabulum. This device can be used with morselized or structural graft and is used for the reconstruction of much larger bone defects. Cages place the cup at the correct anatomic level and allow and protect morsellized or structural bone grafting. Cups are cemented into rings allowing adjustment of version independent of the ring and the local delivery of antibiotics. The cement penetrates the holes in the ring but only makes contact with the surface of impacted morsellized bone graft or the surface of structural graft, and as far as host bone is concerned, rings provide a cementless reconstruction. Rings can be used in irradiated bone and also allow use of a constrained cup (Figures 1 and 2).

Cages can fracture or loosen early if not supported by graft or host bone. The present generation of rings are not made of materials that provide permanent biological fixation by bone ongrowth or ingrowth.

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asymptomatic loosening was reported in 4 hips.\(^1\) For uncontained defects involving >50% of the acetabulum in 8 patients where a major column structural allograft was used with a cage at an average follow-up of 7.5 years, 1 failure occurred due to infection.\(^2\) We later reported on 13 patients with an average follow-up of 10.5 years with a clinical and radiographic success in 10 (77%) hips.\(^3\)

### Complications and Avoidance

Recently, we reviewed our complications associated with the cage use. Sixty-one cases with an average follow-up of 4.6 years were reviewed. These were complex acetabular revisions with 48 of 61 cases requiring a structural allograft and the remaining 12 morsellized allograft bone, all of which healed uneventfully without radiographic evidence of resorption or fracture. Of 61 patients, 20 had complications related to the use of the ring but not all complications led to failure of the reconstruction.

Six sciatic nerve injuries occurred, all of which made significant partial or full recovery. All six cases were associated with placing the inferior flange on top of the ischium rather than slotting it inside the ischium. Placing the flange on top of the ischium puts it close to the sciatic nerve whereas slotting it inside the ischium keeps it away from the nerve. In addition, when the flange is placed on top of the ischium, the cup is too lateralized. We now routinely slot the flange into the ischium.

Three rings had fractured flanges, one of which has been revised. This can be avoided by ensuring the ring is solidly supported by host bone or bone graft. Seven (11%) hips dislocated. This can be avoided by orientating the cup independently of the ring position. Also in the multiply operated hip with poor abductor function, a constrained cup can be cemented into the ring. Another preventative measure is the use of a brace for 3 months following surgery. Three cups loosened requiring revision. We use a cup with cement spacers with an outer diameter at least 2 mm less (excluding the spacers) than the inner diameter of the ring. Also in the multiply operated hip with poor abductor function, a constrained cup can be cemented into the ring. Another preventative measure is the use of a brace for 3 months following surgery. Three cups loosened requiring revision. We use a cup with cement spacers with an outer diameter at least 2 mm less (excluding the spacers) than the inner diameter of the ring.

A pelvic discontinuity was associated with uncontained bone loss in 10 cases. A posterior column plate was not used. Of the 10 cases, 3 rings loosened and 2 rings had fractured flanges. If a pelvic discontinuity can be demonstrated radiographically and intraoperatively, the cage should be supplemented by a posterior column plate.

The most common complication related to the present generation of rings is loss of fixation. In our series four rings required revision and three had fractured flanges. This problem relates to the fact that the present generation of rings does not achieve biological fixation and only serve as a buttress plate while the bone graft heals. If and when the ring fails, the bone graft may have incorporated enough to restore bone stock for an uncemented cup. Any motion between the ring and host or grafted bone will eventually cause the ring to loosen or fracture. The rings should be made of a material that achieves biological fixation and provides a friendly environment for bone healing (eg, trabecular metal).

### References

