The jumbo acetabular component for acetabular revision

CURTAIN CALLS AND CAVEATS

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The ‘jumbo’ acetabular component is now commonly used in acetabular revision surgery where there is extensive bone loss. It offers high surface contact, permits weight bearing over a large area of the pelvis, the need for bone grafting is reduced and it is usually possible to restore centre of rotation of the hip. Disadvantages of its use include a technique in which bone structure may not be restored, a risk of excessive posterior bone loss during reaming, an obligation to employ screw fixation, limited bone ingrowth with late failure and high hip centre, leading to increased risk of dislocation. Contraindications include unaddressed pelvic dissociation, inability to implant the component with a rim fit, and an inability to achieve screw fixation. Use in acetabulae with < 50% bone stock has also been questioned. Published results have been encouraging in the first decade, with late failures predominantly because of polyethylene wear and aseptic loosening. Dislocation is the most common complication of jumbo acetabular revisions, with an incidence of approximately 10%, and often mandates revision. Based on published results, a hemispherical component with an enhanced porous coating, highly cross-linked polyethylene, and a large femoral head appears to represent the optimum tribology for jumbo acetabular revisions.

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The use of a ‘jumbo’ acetabular component is now a commonplace, reproducible and reliable technique for revision arthroplasty of the acetabulum. This term refers to components of diameters greater than 62 mm in women or 66 mm in men, i.e. 10 mm greater than the mean diameter of those used in primary total hip arthroplasty. Such components offer numerous advantages when compared with other techniques. Surface contact occurs over a large area of the pelvis and hence weight is borne more widely. As the acetabulum, even with a loose or migrated component, remains somewhat spherical the techniques for preparation and implantation are relatively simple. Owing to the large size of the component, the need for bone graft is reduced. The technique is also more likely to restore an anatomical centre of rotation of the joint.

There are also disadvantages to jumbo acetabular components. Their use does not restore acetabular bone stock, unlike other techniques such as impaction grafting. There is little data on the amount of bone which will grow into the porous coating from the damaged acetabular surface and it is unclear whether a relatively small amount of bone ingrowth will provide durable fixation, or lead to late loosening. The centre of rotation of the hip may be elevated by 10 mm or more. Preparation of the acetabulum requires some reaming of the anterior and posterior walls or columns carrying the risk of inadvertent excessive bone loss from the posterior column. Some surgeons may also consider their modular nature an inherent disadvantage. The final caveat is the relatively high risk of dislocation when using ‘conventional’ size heads on the femoral component.

Surgical technique

As the technique requires insertion of a much larger acetabular component than in primary arthroplasty, good exposure through a longer incision is recommended. We prefer the posterolateral approach, with release of the femoral insertion of the gluteus maximus tendon to improve the retraction of the femur or retained femoral component anterosuperior to the acetabulum. Occasionally, in a very stiff or protrusio hip, some form of trochanteric osteotomy may be necessary to provide adequate exposure of the entire rim of the acetabulum. After removal of the existing acetabular component and any residual membrane or bone cement, the acetabulum should be evaluated carefully for pelvic discontinuity. If such discontinuity is present, other techniques beyond the scope of this paper will be required.
The concept of reaming the acetabulum for a jumbo component belies the fact that the surgeon should, in fact, aim to conserve as much bone as possible. This may involve using only a high-speed burr at the periphery of the acetabulum to remove sclerotic bony margins and then using the hemispherical reamer shells as a guide for proper sizing of the jumbo acetabular component. The goal of the technique is to fill the acetabulum from the ilium to the ‘tear drop’ with the component; to do this, some bone from the anterior and posterior acetabulum must be removed to create a new hemispherical acetabulum. A trial component or reamer shell is then inserted, to determine if rim stability can be obtained. Depending on the design of the component (hemispherical vs elliptical), the type of porous coating and the bone quality, a component between 0 mm and 2 mm larger than the final reamer shell is selected. Before insertion of the new component, all fibrous membrane should be curetted, and any defects packed with allograft bone or bone substitute. Fixation with screws is essential for both initial and long-term fixation of the component, but it must be borne in mind that neurovascular structures are more at risk when a jumbo component is used.\(^2,4\) The conventional ‘safe zones’ for acetabular screws are routinely used but, in addition, we recommend fixation to the ischium to prevent late ‘breakout’, or pulling away from the inferior acetabulum. We also fill empty screw holes with allograft before insertion of the modular liner or liner-trial.

It has been reported that host component-bone contact less than 50% may be a contraindication to the use of a jumbo component alone.\(^5\) With the availability of enhanced porous surfaces such as tantalum trabecular metal, however, this may no longer be the case (Fig. 1).\(^2,8\) In a study of 53 hips in which such a component was implanted, when there was less than 50% component-bone contact, the rate of failure was only 7.5% at a mean follow-up time of 72 months (60 to 102).\(^8\) Other studies have also reported successful complex acetabular revision procedures using components with an enhanced porous surface.\(^9,10\)

**Results in the literature**

Ten studies report the results of jumbo acetabular components in revision hip arthroplasty (Table I). Dearborn and Harris\(^11\) described the use of jumbo porous-coated acetabular components for large, contained and uncontained bony defects in 24 patients. Dislocation occurred in five hips (21%), with recurrent dislocation in four. Of 18 patients alive after five years, three had implants removed for late infection. There was no loosening in the remaining 15 living patients at a mean follow-up of seven years. Hendricks and Harris\(^12\) reported the long-term results of this same series, and at a mean follow-up of 13.9 years, 12 of the original 24 patients had well-fixed components. Whaley et al\(^1\) reported the results of 89 jumbo acetabular revisions with a titanium fibre-mesh component, of whom 79 patients had segmental or combined segmental and cavitory bone defects. Four hips required revision or removal of the jumbo component: two for loosening, one for infection, and one for recurrent dislocation. Two other hips showed radiographic loosening (migration), but were not revised. With either revision for aseptic loosening or radiologically reported loosening as an end point, survival was 95% at eight years. Dislocation occurred in 11 hips (12%), of which four were revised. Patel et al\(^13\) reported the results of 43 jumbo revisions, in which bulk allograft was used in eight. In total 36 hips had clinical and radiological follow-up at a mean of ten years. Five acetabular components were re-revised: two for loosening, one for recurrent dislocation, one for wear, and one for unexplained groin pain. The rate of dislocation was 4.6%. Gustke\(^14\) reported 166 jumbo acetabular revisions, the majority in hips with combined...
segmental and cavitary defects. The paper reported that 19% of components were intentionally placed with a high hip centre. At a mean follow-up of 6.1 years, five hips were revised, but only one with aseptic loosening. The outcomes of an expanded group of 199 revision procedures based on this original cohort, with a minimum follow-up of two years and a mean follow-up of ten years has also been reported.15 Two additional patients had undergone resection arthroplasty for infection and recurrent dislocation and the rate of dislocation was only 4.2%. Wedemeyer et al16 reported 17 cases with a mean follow-up of 6.9 years; one was revised for aseptic loosening and one removed for infection. One patient (5.8%) sustained an early dislocation. Fan et al’s17 cohort of 47 cases were followed up for a mean of 5.4 years, although the authors’ definition of a jumbo acetabular component was more conservative at 60 mm for women and 64 mm for men. There were three revisions, which were for infection, early loosening after trauma and recurrent dislocation, respectively. The most common complication was dislocation (10.6%).17

The senior author (PFL) described the results of 129 cases.2 Three infections occurred at less than two years post-operatively and the components were removed. Complete clinical and radiological data was available for 108 hips at a mean of 8.1 years post-operatively and survival data were available up to 15 years. There was one additional late infection. Aseptic loosening of the component was seen in four patients (3.1%), three of whom underwent further revision surgery. With failure defined by either acetabular revision for loosening or confirmed radiological loosening, ten-year survival was 97.3% (95% confidence interval (CI) 89.6 to 99.3) and 15-year survival was 82.8% (95% CI 59 to 97.6). Dislocation occurred in 12 patients (9.3%) and three patients underwent additional surgery. von Roth et al18 recently updated the Mayo Clinic cohort at a mean follow-up of 20 years. In keeping with our results, there was increased failure in the second decade, with three additional acetabular components revised for aseptic loosening. A total of seven jumbo components were, therefore, revised at a mean of 11 years post-operatively. There were no late infections or dislocations. Component survival was 85% at 20 years.

**Complications.** Dislocation is the most frequent complication after revision hip arthroplasty with a jumbo acetabular component. Its incidence has been reported in several series to be in the region of 10% to 15%. The aetiology of dislocation with the jumbo acetabular component is multifactorial, but two key drivers are the extensile exposure and the mismatch of the sizes of acetabular component and femoral head.19 In most of the studies of jumbo acetabular components, the sizes of the femoral heads ranged from 22 mm to 32 mm, with 28 mm being the most common. In our experience, those hips with a femoral head diameter in excess of 32 mm had a significantly lower risk of dislocation.4 This observation has been reflected by a randomised controlled trial (RCT) comparing 36 mm with 28 mm femoral heads in both primary and revision hip arthroplasty.20

<table>
<thead>
<tr>
<th>Study</th>
<th>Hips</th>
<th>Definition</th>
<th>Paprosky type (n)</th>
<th>Mean follow-up (yrs) (range)</th>
<th>Acetabular failures and revisions</th>
<th>Dislocations (n, %)</th>
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<tbody>
<tr>
<td>Dearborn and Harris11</td>
<td>24</td>
<td>≥ 66 mm</td>
<td>Not stated</td>
<td>7 (5 to 10.3)</td>
<td>3 infection 0 loosening</td>
<td>5 (21)</td>
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<tr>
<td>Whaley et al1</td>
<td>89</td>
<td>≥ 62 female, ≥ 66 male</td>
<td>1 (6) 2 (54) 3 (29)</td>
<td>7.2 (5 to 11.3)</td>
<td>4 loosening 1 dislocation 1 infection</td>
<td>11 (12)</td>
</tr>
<tr>
<td>Patel et al13</td>
<td>43</td>
<td>≥ 62 female, ≥ 66 male</td>
<td>2 (37) 3 (6)</td>
<td>10 (6 to 14)</td>
<td>2 loosening 1 dislocation 1 wear 1 groin pain</td>
<td>2 (4.6)</td>
</tr>
<tr>
<td>Gustke14</td>
<td>166</td>
<td>≥ 62 female, ≥ 66 male</td>
<td>2 (119) 3 (38)</td>
<td>6.1</td>
<td>5 revisions</td>
<td>4 (2.4)</td>
</tr>
<tr>
<td>Hendricks and Harris12</td>
<td>12</td>
<td>≥ 66 mm</td>
<td>Not stated</td>
<td>13.9</td>
<td>0 loosening</td>
<td>5 (21)</td>
</tr>
<tr>
<td>Fan et al17</td>
<td>47</td>
<td>≥ 60 female, ≥ 64 male</td>
<td>1 (6) 2 (30)</td>
<td>5.4 (4 to 7)</td>
<td>1 infection 1 loosening 1 dislocation</td>
<td>5 (10.6)</td>
</tr>
<tr>
<td>Wedemeyer et al16</td>
<td>17</td>
<td>≥ 64 mm</td>
<td>1 (12) 3A (5)</td>
<td>6.9 (2.7 to 12.5)</td>
<td>1 infection 1 loosening</td>
<td>1 (5.8)</td>
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<tr>
<td>Lachiewicz and Soileau2</td>
<td>108</td>
<td>≥ 62 female, ≥ 66 male</td>
<td>1 (1) 2 (50) 3 (57)</td>
<td>8.1 (2 to 22)</td>
<td>4 infection 4 loosening</td>
<td>12 (9.3)</td>
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<tr>
<td>Gustke et al15</td>
<td>199</td>
<td>≥ 62 female, ≥ 66 male</td>
<td>1 (7) 2 (68) 3 (25)</td>
<td>10 (2 to 19)</td>
<td>5 revisions 1 infection 1 dislocation</td>
<td>9 (4.2)</td>
</tr>
<tr>
<td>von Roth et al18</td>
<td>89</td>
<td>≥ 62 female, ≥ 66 male</td>
<td>1 (6) 2 (54) 3 (29)</td>
<td>20 (14 to 27)</td>
<td>7 loosening 1 dislocation 1 infection</td>
<td>11 (12)</td>
</tr>
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</table>
The revision group, however, included hips with all sizes of acetabular components and in this sample the difference between 5% dislocation with 36 mm heads and 12% with 28 mm did not reach statistical significance. In another RCT comparing femoral head size in revision arthroplasty only, the rate of dislocation was lower for the group with 36 mm and 40 mm femoral heads (1%, one of 92 hips) than the group with 32 mm femoral heads (9%, eight of 92 hips) and in this case the difference was significant. Neither study stated what proportion of acetabular components fulfilled jumbo criteria, and so the rate of dislocation of 36 mm and 40 mm femoral heads (1%, one of 92 hips) than the group with 32 mm femoral heads (9%, eight of 92 hips) and in this case the difference was significant. On occasion, our surgeons use a prophylactic hip orthosis for six weeks after revisions with a jumbo acetabular component as, in the senior author’s experience, dislocation after such a revision often becomes recurrent, and requires revision to either a dual mobility or constrained liner.

Revision using a jumbo acetabular component is a relatively straightforward procedure for revision THA with moderate to extensive acetabular bone loss. In several studies, there is a high rate of success with the component, with 90% or greater ten-year survival. Longer-term studies reporting results into the second decade, however, have shown late loosening of ‘first-generation’ porous surfaces and wear with periprosthetic osteolysis of standard (not highly cross-linked) polyethylene liners. Thus, the current recommendations for acetabular revision with a jumbo acetabular component include the use of components with enhanced porous coatings, highly cross-linked polyethylene liners, and 36 mm or 40 mm femoral heads.

**Author contributions:**

P F. Lachiewicz: research, data analysis, manuscript preparation.

T. S. Watters: research, data analysis, manuscript preparation.

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**References**


