Bipolar revision arthroplasty for failed threaded acetabular components: radiographic evaluation of cup migration

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Abstract We studied the radiographic results of bipolar revision hip arthroplasty in 25 patients (25 hips). These patients had suffered from osteoarthrosis of the hip due to acetabular dysplasia and had undergone total hip replacement using smooth threaded acetabular components. In the revision surgery, these components were replaced by bipolar cups; autografts were implanted in 23 patients and hydroxyapatite grains were added in 7. At the time of follow-up, the severity of migration was radiographically graded from I to IV: grade I, 5 mm or less; grade II, 6 to 10 mm; grade III, 11 to 15 mm; and grade IV, 16 mm or more. Five to 11 years (average, 7.0 years) after surgery, 9 patients were classified as grade I, 6 as grade II, 4 as grade III, and 6 as grade IV. Among the 6 individuals with grade IV migration, hydroxyapatite grains had been used in 5. There was a significant negative correlation between the distance of migration and the increase in size of the threaded acetabular components used in the primary total hip replacement and the bipolar cups in the revision surgery. Because of the tendency to migrate, we concluded that this procedure has a limited role in revision surgery.

Key words Revision arthroplasty · Acetabulum · Bipolar endoprosthesis · Bone graft · Hydroxyapatite

Materials and methods

Between 1989 and 1995, we performed 30 consecutive acetabular reconstructions in 30 patients using a bipolar cup. These individuals suffered from secondary osteoarthrosis of the hip due to acetabular dysplasia. They had undergone THR using smooth-surface threaded acetabular components as a primary intervention to the acetabulum between 1985 and 1989. A TTAP-ST cup (Biomet, Warsaw, IN, USA) was used in 24 patients, a TTAP cup (Biomet) in 3, an Omnifit cup (Howmedica, Rutherford, NJ, USA) in 2, and a Lord cup (France) in 1. Before revision surgery, all the patients suffered moderate to severe hip pain, and the radiographs revealed apparent superomedial migration of the acetabular components.
Operative technique

The patient was placed in the lateral decubitus position. A posterior approach was used in 17 patients and a transtrochanteric approach in 13. The acetabulum showed cavitary defects, with or without medial wall deficiency, and the cavity was larger than the entrance, the so-called monkey trap defect (Fig. 1a). Thus, the acetabular defects were similar to Paprosky Type 2C defects. To extract the acetabular components without accidental fracture, we trimmed the inferoposterior rim of the acetabulum in some patients. After removal of the soft tissue and debris, autografts were implanted in 28 patients. These autografts were obtained from the ilium in 26 and from both the ilium and the fibula in 1. In the remaining individual, we used the contralateral femoral head, which was obtained in the course of simultaneous primary THR. Hydroxyapatite grains, Boneceram P (Sumitomo Pharmaceuticals, Osaka, Japan), were mingled with the autografts in 8. Then, powered reamers were used in reverse to make the cavity conform to a bipolar cup. The size of the bipolar cup was usually larger than that of the preceding threaded acetabular component. Determination of the size of the bipolar cup was made on the basis of a feeling of suction between the prepared acetabulum and the cup at first, and later, on the basis of support of the cup on the periphery of the acetabulum (Fig. 1b).1

The bipolar cups were made of cobalt-chromium (CoCr) alloy in 29 patients and titanium (Ti) alloy in 1. We also exchanged the modular femoral heads in 19 patients and the femoral stem in 1. Consequently, after revision surgery, the femoral heads were made of CoCr alloy, in 16 patients and of Ti alloy, with or without nitrogen ion implantation, in 14. Closure was carried out in routine fashion.

Postoperatively, femoral nerve palsy of the operated limb and a dislocation of the bipolar cup occurred in one patient of each group. The former recovered in 2 months without treatment and the latter was reduced manually. Otherwise, the postoperative course was uneventful in all patients. They were mobilized 1 to 3 weeks after surgery and instructed to increase weight-bearing in 3 months.

An effort was made to contact all 30 patients. Anteroposterior radiographs of the hip joints were obtained from those who agreed to come to our hospital. These radiographs were used to measure the distance of migration of the bipolar cup. If re-revision surgery had been performed during the follow-up period, we employed the radiographs made just prior to that surgery. Migration of the bipolar cup was defined as a change in the position of the center of the outer cup measured with reference to the tip of the ipsilateral teardrop; the diameter of the outer cup was used to adjust each measurement. The severity of migration was graded from I to IV: grade I, 5 mm or less; grade II, 6 to 10 mm; grade III, 11 to 15 mm; and grade IV, 16 mm or more.

We analyzed the correlation between the distance of migration and variables that included Charnley’s category, the admixture of hydroxyapatite grains, age and body weight at the time of revision surgery, and the increase in size of the two successive acetabular components, i.e., the difference in diameter between the threaded component used in the primary THR and the bipolar component in the revision surgery. Mann-Whitney’s U test or Spearman’s rank correlation test was used for statistical evaluation. A P value less than 0.05 was regarded as significant.

Results

Five patients were lost to follow-up. They had been followed for 6 months to 3 years and showed grade I migration at the time of the last follow-up. The remaining 25 were followed for 5 to 11 years (average, 7.0 years) after the revision surgery. All of them were female and were entered into this study (Table 1).

In these 25 patients, the severity of migration was classified as grade I in 9, grade II in 6, grade III in 4, and grade IV in 6. Among the 6 individuals with grade IV migration, hydroxyapatite grains were used in 5. Figure 2 shows an illustrative case.

There was a significant negative correlation between the distance of migration and the increase in size of the two successive acetabular components (P < 0.01) (Fig. 3). This negative correlation was also found among the 18 patients without hydroxyapatite grains (P < 0.05). There was no correlation between the distance of migration and other variables.

In this series, 4 patients had had re-revision surgery of the acetabular components during the follow-up period. Cementless porous-coated acetabular components were