Mid-term Radiological Results Of Rotational Acetabular Osteotomy In 93 Hips With More Than 5 Years’ Follow-up

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Introduction: Hip osteoarthritis (OA) in Japanese patients occurs, in most cases, secondary to congenital hip dislocation or acetabular dysplasia. Total hip arthroplasty (THA) in young, active patients with hip dysplasia is associated with implant longevity problems. Therefore, the optimal selection of periacetabular reorientation osteotomy in patients with early OA due to acetabular dysplasia should successfully delay THA, until essential. Rotational acetabular osteotomy (RAO) is a pelvic osteotomy method used to prevent or treat secondary OA of the hip. Although most patients undergoing RAO show satisfactory results, some do not. One of the most important factors for a successful outcome is joint congruity. Good or excellent congruity, young age, and prearthritis or early-stage arthritis have been reported as factors for successful RAO. This study investigated the mid-term radiological results of RAO in acetabular dysplasia patients and also determined the risk factors for poor outcomes.

Methods: Between 1991 and 2008, we performed RAO on 93 ambulatory patients who had acetabular dysplasia or OA secondary to acetabular dysplasia. In all, 9 men and 84 women were included (mean age at operation, 36.5 years; range, 11-56 years). The joint status, including prearthritis and early- or advanced-stage arthritis, was assessed on anteroposterior radiography. The average follow-up period was 139 months (60-270 months). The center-edge (CE) angle, Sharp angle, acetabular femoral head index (AHI), acetabular cartilage (AC) angle, obturator foramen-head distance (OFHD), joint space width (JSW), radiographic stage, joint congruity, and presence of cysts were measured before and immediately after the operations and at the latest follow-up.

Statistical analysis
The end-point for joint survival was defined as conversion to THA or radiographic progression of OA. Kaplan-Meier survival analysis was used to calculate RAO survival probabilities. The survival probabilities for conversion to THA and radiographic progression of OA were estimated using the Kaplan-Meier method. We used a Cox multivariate regression model to detect any association between outcomes and the radiographic parameters. Potential risk factors, including CE angle, Sharp angle, AHI, AC angle, OFHD, age at time of surgery, JSW, radiographic stage, joint congruity, and presence of cysts, which might impact conversion to THA or radiographic OA progression were studied using multivariate analysis and the Cox proportional hazard model. A p-value < 0.05 was considered statistically significant. These analyses were performed using SPSS ver.16 (IBM, Armonk, NY, USA).

Results: Conversion to THA was necessary in 9 of the 93 hips, and radiographic progression of OA was observed in 43 of the 93 hips. The 10-year unadjusted Kaplan-Meier survival was 91.0% for conversion to THA after RAO (Figure 1) and 79.9% for radiographic OA progression after RAO (Figure 2).
We compared the surviving 84 hips with the 9 requiring conversion to THA. The mean age at the time of surgery was 35.3 years for the surviving group and 47.9 years for the group converting to THA. In the Cox univariate regression analysis, there was a significant difference in the risk for conversion to THA that was associated with the patient’s age at the time of surgery (hazard ratio [HR], 1.209; p = 0.006).
The CE angle, sharp angle, AHI, AC angle, OFHD, JSW, radiographic stage, joint congruity, and presence of cysts did not show significant differences between the groups. In the Cox multivariate regression analysis, only age at the time of surgery was a significant independent risk factors for conversion to THA (HR, 1.233; p = 0.007).

We also compared the surviving 50 hips with the 43 demonstrating radiographic OA progression. In the Cox univariate regression analysis, CE angle (HR, 0.975; p = 0.044), AHI (HR, 0.969; p = 0.031), and age at time of surgery (HR, 1.078; p = 0.000) were significant independent risk factors for the radiographic progression of OA. Sharp angle, AC angle, OFHD, JSW, radiographic stage, joint congruity, and the presence of cysts did not show any significant differences between the groups. In the Cox multivariate regression analysis, CE angle (HR, 0.944; p = 0.000) and age at time of surgery (HR, 1.088; p = 0.000) were significant independent risk factors for the radiographic progression of OA (Figure 3).

Figure 3.

**Discussion:** Several reports have described the long-term outcomes of RAO. Several authors have reported that the significant risk factors for progression of OA were age, transtrochanteric approach, absence of acetabular bone grafts, thin acetabular fragments, nonspherical femoral heads, postoperative femoral head coverage, and incongruence. Yasunaga et al. reported that the significant factors associated with progression of radiographic OA after RAO, in 43 patients included a preoperative joint space of <2.2 mm and a postoperative joint space of <2.5 mm. The presence of a large acetabular bone cyst after periacetabular osteotomy creates the risk of collapse, resulting in a clinically and radiographically poor result. Acetabular coverage using peri-acetabular osteotomy conferred favorable results and prevented osteoarthritic progression in patients with early-stage disease secondary to acetabular dysplasia. Restoration of the acetabular fragment by using acetabular osteotomy in patients with advanced OA prevented further degeneration and allowed repair of the damaged cartilage, thus
showing biomechanical improvement. These outcomes, in turn, could significantly delay the time to THA conversion. In this study, we found that the significant factors associated with radiographic OA progression after RAO were CE angle and age at the time of surgery.

**Significance:** The risk factors associated with RAO were determined after analysis of our mid-term radiological results. The most significant risk factors for OA progression after RAO were age at the time of surgery and CE angle.

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