Does Transposition Osteotomy of the Acetabulum Improve the Natural History of Hip Dysplasia?

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INTRODUCTION:

Developmental dysplasia of the hip (DDH) is a major cause of premature hip osteoarthritis (OA). Transposition osteotomy of the acetabulum (TOA) is a type of periacetabular osteotomy (PAO), characterized by a spherical osteotomy and a lateral trochanteric approach, developed for the treatment of symptomatic DDH to delay or prevent subsequent hip OA via three-dimensional acetabular correction. Previous studies have confirmed the efficacy of TOA in relieving pain, improving function and quality of life, and promoting long-term joint preservation.

However, its long-term impact on the natural history of DDH and borderline DDH (BDDH) remains to be determined. The purpose of this study was to determine the efficacy of TOA in improving the natural history of DDH and BDDH by comparing postoperative cumulative joint survival to that observed in untreated contralateral hips.

METHODS: A retrospective cohort study was conducted on 683 hips treated with TOA for DDH or BDDH with Tönnis grade 0 or 1 between 1998 and 2021, and 353 contralateral hips that did not undergo TOA (native hips). The median follow-up period was 10 years (range, 2-30 years). Hips were classified based on the lateral center-edge angle (LCEA) as normal (25º ≤ LCEA < 40º), BDDH (20º ≤ LCEA < 25º), and DDH (LCEA < 20º). Cumulative joint survival was calculated using Kaplan-Meier product-limited method, with Tönnis grade 3 or total hip arthroplasty as the endpoint. Subgroup survival curves were compared using the log-rank test with Bonferroni correction. Multivariate Cox proportional hazards models were used to identify risk factors for OA progression.

RESULTS:

In 353 native hips, the 20-year joint survival rate was significantly lower in DDH at 65% compared with Normal (100%) and BDDH (95%) hips ($p < 0.05$), with no difference between Normal and BDDH hips ($p = 0.806$). Multivariate analysis identified BMI ($p = 0.002$) and LCEA ($p < 0.001$) as independent risk factors for OA progression in native hips.

In the DDH subgroup (779 hips), the 20-year survival rate after TOA was 88%, significantly higher than that of native DDH hips (65%) ($p < 0.001$). In this subgroup, native hip (vs. TOA) ($p < 0.001$), age ($p = 0.002$), and BMI ($p = 0.004$) were independent risk factors for OA progression. In the BDDH subgroup (190 hips), the 20-year survival rate after TOA (100%) was comparable to that of native hips (95%) ($p = 0.422$), with BMI being the only significant risk factor for OA progression.

DISCUSSION AND CONCLUSION:

Natural progression of untreated DDH leads to significantly lower joint survival rates compared to Normal and BDDH hips, while Normal and BDDH hips showed comparable joint survival. TOA showed significantly higher long-term joint survival than native hips in DDH patients, demonstrating its efficacy in modifying the natural history of DDH. Conversely, TOA demonstrated comparable postoperative joint survival compared to the natural history in BDDH patients, suggesting the need for careful consideration of surgical indications for BDDH.

To our knowledge, the current study is the first report on the natural history of BDDH. Although we acknowledge the limitations of this study including the small number of cases and possible selection bias, we contend that our results provide insight into the efficacy of TOA for treating BDDH patients and offer an evidence base for future studies on this topic. Recent studies have consistently reported favorable outcomes after PAO for BDDH. However, it should be noted that there is no evidence of superiority of PAO over conservative management in the treatment of BDDH. Further research is essential to refine the patient selection for TOA and to optimize its therapeutic benefits in BDDH.

FIGURE LEGENDS

Figure 1: A STROBE flowchart of this study.

Figure 2: Kaplan-Meier survival curves with 95% CI (shaded area) for native hips classified according to LCEA (Normal, BDDH, and DDH).

Figure 3: Kaplan-Meier survival curves with 95% CI (shaded area) for post-TOA and native hips in the DDH subgroups.

Figure 4: Kaplan-Meier survival curves with 95% CI (shaded area) of post-TOA and native hips in the BDDH subgroups.

Fig. 1

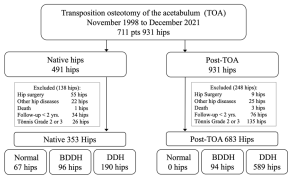

Fig. 2

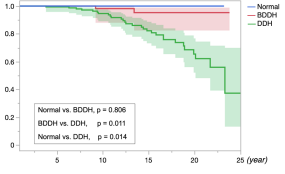

Fig. 3

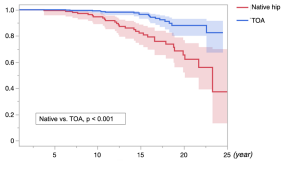

Fig. 4