Assessing Quality of Reduction After Acetabular Fracture Surgery: Importance of Gap Versus Step Displacement

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Purpose: Our objective was to identify CT-based cut-off values for gap and step displacement associated with conversion to total hip arthroplasty (THA) and to determine the individual association of residual gap versus step displacement and hip survivorship following acetabular fracture surgery.

Methods: Patients who received acetabular fracture fixation (1992-2014) with ≥2-year follow-up (or early THA) and postoperative CT available for review were included, which yielded 227 patients (mean age 51. 2 years [SD 17.8], 46.3% <50 years, mean follow-up 8.7 years [SD 5.6]). Conversion to THA was performed in 55 patients (24.2%). Residual gap and step displacement was measured in axial, sagittal, and coronal planes using a standardized CT-based method. Receiver operating characteristic and Kaplan-Meier survivorship curves and log-rank tests were used to assess statistical differences in hip survivorship curves between gap and step displacement using the respective cut-off values. Multivariate analysis was performed to identify independent variables associated with conversion to THA. A subanalysis was performed in younger patients (<50 years).

Results: The optimal CT cut-off value associated with conversion to THA was 5 mm for gap and 1 mm for step displacement. Hip survivorship at 10 years was 82.0% for patients with <5 mm gap and 56.5% for patients with ≥5 mm gap, and hip survivorship curves were significantly different (P <0.001). Similarly, 10-year hip survivorship was 80.0% for patients with step <1.0 mm and 65.5% for patients with step ≥1.0 mm, and hip survivorship curves were significantly different (P = 0.012). In all patients, age ≥50 years (P = 0.001; odds ratio [OR] 3.7, 1.7-7.8), gap ≥5 mm (P = 0.004; OR 3.1, 1.4-6.7), and posterior wall impaction (P = 0.037; OR 2.1, 1.1-4.4) were independently associated with conversion to THA. In younger patients, only step ≥1 mm was independently (P = 0.046; OR 5.4, 1.1 – 28.8) associated with conversion to THA.

Conclusion: Both residual gap and step displacement are associated with hip survivorship. However, CT cut-off values show that step is tolerated less (1 mm) than gap displacement (5 mm). Only greater gap (≥5 mm) displacement is independently associated with conversion to THA in all patients. Our findings are likely influenced by the large proportion of older patients with significant residual gaps in our study. In younger patients, it appears that only greater step (≥1 mm) displacement is associated with conversion to THA. Residual gap and step displacement after acetabular fracture surgery should be considered as 2 separate entities.

See pages 401 - 442 for financial disclosure information.