Comparative Analysis of Factors Associated with Achieving Clinical Improvement in Adult Spinal Deformity Patients after Reoperation for Junctional Failure, Instrumentation Failure, or Pseudoarthrosis

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INTRODUCTION:

Postoperative failure after adult spinal deformity (ASD) surgery may refer to a variety of complications, including instrumentation failure, junctional failure, or pseudoarthrosis. However, there is a paucity of current literature describing the rates, outcomes, and predictors of optimal outcomes after reoperation different types of failure.

METHODS:

Operative ASD patients ≥18yrs with pre-(BL) and two-year (2Y) postop radiographic/HRQL data were assessed. Patients were categorized as having suffered mechanical failure (Failed) or not (Not Failed) at any point after index surgery. Patients were then subdivided into 3 failure groups: instrumentation failure (rod fracture, screw failure), pseudoarthrosis, or junctional failure [PJF (PJK requiring reoperation or Lafage et al. radiographic PJF)]. Differences in demographics, radiographic parameters, and complication rates were assessed via means comparison analyses. Conditional backstep binary regression analysis was used to identify associated predictive factors of achieving MCID in ODI within each failure subtype controlling for reoperation.

RESULTS:

A total of 266 ASD patients met inclusion criteria (60.0±15.1yrs, 79%F, BMI:26.7±5.5kg/m^2). Surgically, patients had a mean anterior levels fused of 1.78±1.4, and mean posterior levels fused of 10.4±4.6. 20.7% of patients underwent 3-column osteotomy. In terms of failure rate by 2Y, 10.9% of patients suffered instrumentation failure, 3.8% suffered pseudoarthrosis, and 7.1% suffered PJF. At baseline, cohorts were comparable in age, gender, BMI, ASA grade, and frailty (all p>.05). Operatively, patients who developed pseudoarthrosis were significantly less likely to undergo interbody fusion versus instrumentation or junctional failure patients (30.0% vs. 76.0% vs. 68.0%, p=.029). Postoperatively, all Failed cohorts demonstrated comparable patient-reported measures per ODI and SRS-22 (p>.05). When controlling for BL age C7-S1 SVA, and reoperation, pseudoarthrosis patients reported significantly higher mean ODI at 1Y. Yet, Failed patients reported significantly higher ODI at 1Y vs. Not Failed patients per controlled analysis (p<.05). In total, 59.0% of Failed patients required reoperation, with no significant differences between groups (p>.05). When reoperation is indicated in instrumentation failure patients, decreased age, BL PT, and BL PI-LL only increased BL PT (p=.002) was predictive of instrumentation failure, and increasing age and sacral slope were predictive of achieving MCID-ODI. Decreased age, and lack of 3CO were predictive of MCID-ODI in pseudoarthrosis failure patients. In junctional failure patients, and age-adjusted match at 6W was predictive of meeting MCID-ODI (all models p<.01).

DISCUSSION AND CONCLUSION:

Junctional failure, instrumentational failure, and pseudoarthrosis may adversely affect outcomes after adult spinal deformity surgery and increase the need for reoperation. In this study, failure rates remained below 10% in each subtype, yet each cohort had distinct predictive profiles of achieving minimum clinically important difference (MCID) by ODI when reoperation was required.