

Achievement and Maintenance of Optimal Alignment following Adult Spinal Deformity Corrective Surgery: A 5-Year Outcome Analysis

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INTRODUCTION:

Assessment of factors associated with maintenance of optimal alignment until five-year post adult spinal deformity (ASD) surgery can provide insight to components that lead to durable outcomes.

METHODS:

Operative ASD patients with preoperative baseline and at least 5-year data were included. Durable alignment (D) was defined as improving in at least one SRS-Schwab modifier without worsening in any SRS-Schwab modifier. A robust outcome was defined as having durable alignment at 2Y that maintained it at 5Y. Means comparison tests assessed differences in demographic and clinical data between the robust and non-robust groups. Predictors of robust outcomes were identified using multivariate regression analysis, with conditional inference tree (CIT) for continuous variables.

RESULTS:

A total of 297 ASD patients met inclusion criteria (59.3±14.9yrs, 79%F, BMI 27.1±5.5kg/m², CCI: 1.6±1.7, ASD-mFI: 6.5±4.9) and underwent surgery (levels fused 11.0±4.5, EBL 1547mL, op time 418min). Some 49% had a staged approach, with 1.1% undergoing anterior, 63.2% posterior-only, and 35.7% combined. BL SRS-Schwab modifiers assessment found 36.4% ++PI-LL, 31.8% ++SVA, 25.1% ++PT. At 5Y postop: 12.1% ++PI-LL, 10.6% ++SVA, 17.6% ++PT. By Lafage et al. age-adjusted alignment goals, 20.7% were matched at 5Y.

In total, 77.4% met D at 6W, 54.2% met radiographic durability at 2Y, while 89.4% of those went on to meet radiographic durability at 5Y (48.5% of total cohort). Durable outcome cohort at 5Y was younger, had lower BMI and frailty (all p<0.05). Those that did not achieve D2 had higher rates of reoperations due to implant failure (10% vs. 4%, p=0.024) and sagittal imbalance (4% vs. 0%, p=0.014).

Rates of junctional failure were 70% in those that did not achieve D5 when met at D2, compared to 33.3% in those that met both (p=0.013), with reoperation rates of 17.2% due to loss of alignment. Major complication due to pseudarthrosis were also higher in those that failed to achieve 5Y durability after meeting 2Y, (6% vs. 1%, p=0.069).

Multivariate regression controlling for gender, baseline age, BMI, CCI, osteoporosis, frailty, invasiveness, BL PT, SVA, and PI-LL, and prophylaxis identified the following independent predictors of durability of alignment at 5Y in those that achieved 2Y: BL to 6W decreased correction in PT, and increased correction in PI-LL (p<0.05). Increased age, BMI, and invasiveness were the most significant non-radiographic predictors for not achieving 5Y durability (Age OR: 1.025 [1.002-1.049], p=0.032, BMI OR: 1.098 [1.017-1.185], p=0.016, Invasiveness OR: 1.028 [1.015-1.041], p<0.001).

DISCUSSION AND CONCLUSION:

Durability of achieving optimal alignment following corrective ASD surgery was sustained in half of the patients at 5 years. While the majority of patients at 2 years sustained their radiographic outcomes at 5 years, major contributors to loss of alignment included junctional failure and adjacent region compensation, with only a minority of patients losing correction through the existing construct. Reoperation rate for loss of alignment was 17.2%. Loss of alignment requiring reoperation had a detrimental effect on 5-year clinical outcomes.