Comparative Analysis of Reoperation and Recovery in Adult Spinal Deformity Patients with Proximal Junctional Kyphosis or Failure Initially Fused to the Upper versus Lower Thoracic Spine

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INTRODUCTION: Proximal junctional kyphosis (PJK) development after adult spinal deformity (ASD) corrective surgery is a major concern for surgeons and patients. Few studies have distinguished failure, reoperation, and recovery of patients with proximal junctional kyphosis (PJK) or failure (PJF) when fused to the upper (UT) versus lower (LT) thoracic spine.

METHODS: ASD patients ≥18yrs with pre-(BL) and 5-year(5Y) fused to sacrum/pelvis were included. Rates of radiographic PJK, revision surgery for PJK, and Lafage et al. radiographic PJF were assessed and compared between patients whose UIV ended in the upper thoracic spine (UT; T1-T7) and lower thoracic spine (LT; T8-L1). BL and peri/post-operative factors were assessed using ANOVA and ANCOVA while controlling for BL age, 6W C7-S1 SVA, and PJF prophylaxis measures. Backstep logistic regressions assessed predictors of achieving Smith et al. Best Clinical Outcomes (BCO) controlling for age, 6W SVA, and PJF prophylaxis used.

RESULTS: 232 ASD patients with up to 5Y data were included (64.2±10.2 years, 78% female, 28.1±5.5 kg/m2). Of these patients, 36.3% had a UIV in the UT spine, compared to 63.7% of patients with a UIV in the LT spine. Post-operatively, prevalence of PJK for UT vs LT patients at 6W was 35.9 vs 42.3% (p=.357), at 1Y was 34.6 vs 50.4% (p=.024), at 2Y was 29.5 vs 49.6% (p=.003), and by last follow up was 48.7 vs 62.8% (p=.048). Rates of radiographic PJF were comparable between groups (p>.05). 4.0% of UT patients underwent subsequent reoperation, compared to 13.0% of LT patients (p=.025). If reoperation was indicated, LT patients more proximal levels fused compared to their UT counterparts (p<.001). For patients who required reoperation for PJK, UT patients reported higher rates of improving by MCID in ODI by 2Y (p=.007) and by last follow-up (p<.001). Adjusted logistic regression revealed that for UT patients, minimization of construct extension were independent predictors of achieving BCO by last follow-up (model p<.001); no such relationship was identified in LT patients. Furthermore, predictive analysis found that in UT patients, non-match in 6W age-adjusted criteria and requiring fusion extention were significant predictors of neurological complications requiring reoperation (model p<.001).

DISCUSSION AND CONCLUSION: While the risk for reoperation for proximal junction kyphosis or failure may be lessened by primary fusion to the upper thoracic spine, such procedures may be limited by patient age, frailty, or physiology. Predictive analysis reveals that increasing levels of proximal extension in patients with proximal junctional kyphosis initially fused to the upper thoracic spine may result in decreased probability of achieving optimal post-operative outcomes. Conversely, patients initially fused to the lower thoracic spine demonstrate increased incidence of PJK and lower rates of gross disability improvement, but are at lessened risk of neurologic complications if reoperation is required.