Predictors of Radiographic Success of Posterior Spinal Fusions with a Lower Instrumented Vertebra of L3 in Idiopathic Scoliosis

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INTRODUCTION: Determining the optimal LIV in adolescent idiopathic scoliosis (AIS) surgery remains a challenge. Stopping at L3 (vs. L4) preserves motion, but may increase distal decompensation risk, and secondary pain. This study evaluates radiographic predictors of success for L3 LIV selection.

METHODS: A single institution, multi-surgeon database of idiopathic scoliosis (IS) was queried to identify primary PSF with LIV of L3 with a minimum 2 years follow-up. 105 patients were identified for study inclusion. Preoperative measures included: (1) Central sacral vertical line (CSVL), (2) Direction of L3-L4 disc opening, (3) </=1 Nash-Moe grade difference between L3 and L4, and (4) L3 stacking on L4-L5-S1 in non-weight bearing radiographs. Success was defined as coronal balance (C7 plumb line ≤20 mm from CSVL) and L3-L4 disc wedging ≤10°. Data collection and analysis were conducted independently of clinical care.

RESULTS: Among 105 patients (mean age 14.5 years, 87.6% female, mean follow-up 2.5 years), 76.2% achieved radiographic success; no reoperations. The main thoracic deformity preoperatively was 52.8°, which improved postoperatively to 23.5° (55.5% improvement) at most recent follow up. The average lumbar curve of 41.5° preoperatively improved to an average of 16.6° (60% improvement). Individual criteria were met in 41% (n=43) for CVSL, 40% (n=42) for Opening, 93% (n=98) for Rotation, and 55% (n=58) for Stacking. The only radiographic success rate achieving statistical significance was CVSL criteria. Patients that met the CVSL criteria had an 86% success rate vs 69.4% success rate when not meeting criteria (p=0.048). The other criteria (meeting vs. failing) did not achieve statistical significance: Opening 69.1% vs 81.0% (p=0.16), Rotational criteria 75.5% vs. 85.7% (p=0.54), and Stacking criteria 79.3% vs. 72.3% (p=0.40). When the CSVL criteria and one other criteria was met the success rate increased to 93% (p = 0.669).

DISCUSSION AND CONCLUSION: The radiographic success with a LIV of L3 in PSF for IS was greatest in patients that met the CSVL criteria (86%). Additionally, radiographic success increased with patients met CSVL criteria and one additional criteria (93%). In this multi-surgeon experience, the data suggests using the CSVL as a key measure to optimize radiographic outcome when determining LIV of L3 vs. L4.