Was It Just Laminectomy? Drivers of Clinical Improvement After Sagittal Realignment in Adult Spinal Deformity

Atahan Durbas, Han Jo Kim, Andrea Pezzi, Gabrielle Lucia Dykhouse, Tejas Subramanian, Robert Nicholas Uzzo, Luis Felipe Colon, Stephane Owusu-Sarpong, Francis Lovecchio

INTRODUCTION:

Adult spinal deformity (ASD) frequently presents with coexisting lumbar spinal stenosis and global sagittal malalignment, each contributing to patient disability. Whether the improvements in function and pain after ASD surgery result mainly from laminectomy or from realignment remains unclear. This study aimed to determine whether ASD patients with lumbar stenosis experience greater postoperative benefits than those without, and to identify the relative contributions of laminectomy and sagittal realignment to clinical outcomes.

METHODS:

We retrospectively reviewed ASD patients who underwent instrumented fusion of four or more spinal levels, with a minimum of two years of follow-up. Primary outcomes included two-year changes in the Oswestry Disability Index (ODI), Visual Analog Scale scores for back and leg pain (VAS-Back, VAS-Leg), Short Form-12 Physical Component Summary (SF12-PCS), and PROMIS. Patients were grouped based on whether they underwent lumbar laminectomy for stenosis concurrent with sagittal correction (Lam) or sagittal realignment alone (NoLam). Preoperative and postoperative spinopelvic and coronal parameters—including pelvic incidence (PI), pelvic tilt (PT), PI-LL mismatch, L4–S1 lordosis, L1 pelvic angle offset, T4–L1 pelvic angle mismatch, C7 plumb line (C7PL), and maximum Cobb angle—were compared. Data normality was assessed, and appropriate parametric or non-parametric tests were applied.

RESULTS:

A total of 143 patients (mean age 61.2 ± 13.6 years; 59 males, 84 females; mean BMI 27 ± 5.7 kg/m²; mean PI 53.8° ± 12.9) were included in the study, with 73 (51%) undergoing lumbar laminectomy (Table 1). Radiographic parameters and the extent of sagittal correction did not differ significantly between groups, either preoperatively or postoperatively. Before surgery, patients in the Lam group demonstrated worse baseline disability (ODI 44.2 vs. 37.1, p=0.015), higher leg pain scores (VAS-Leg 5.5 vs. 3.5, p<0.001), and lower SF12-PCS scores (23.4 vs. 31.3, p=0.004) compared to the NoLam group. Both groups experienced significant improvement after surgery, but Lam patients showed greater early gains in leg pain relief at 6 months (ΔVAS-Leg 2.9 vs. 1.3, p=0.03) and 1 year (3.4 vs. 1.4, p=0.02). However, by two years, all measured patient-reported outcomes converged, showing no significant differences between groups (Figure 1).

DISCUSSION AND CONCLUSION:

Patients undergoing ASD correction, regardless of preoperative lumbar stenosis or laminectomy, achieve similar long-term improvements in pain and function. These findings suggest that successful clinical recovery in ASD is not due to decompression alone but rather reflects the combined benefits of neural decompression and comprehensive sagittal realignment.

Figure 1: Illustrating the trends in PROMs (ODI, VAS-Back, VAS-Leg, SF12-PCS) from preoperative to 2-year follow-up for both groups (*: p≤0.05, **: p≤0.01, ***: p≤0.001).
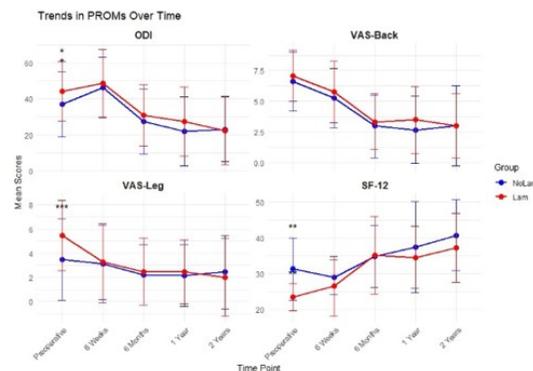
Table 1: Preoperative and Postoperative Radiographic and Clinical Parameters: Summarizing pre-/postop radiographic characteristics and 2-year PROM changes between study groups. Statistical significance was evaluated using either the t-test or the Mann-Whitney U test.

Variable	Group NoLam (Avg-SD)	Group Lam (Avg-SD)	P-value
Pelvic Incidence (Preop)	54.52 (12.26)	53.11 (13.53)	0.515
Pelvic Tilt (Preop)	24.24 (11.21)	23.17 (12.08)	0.585
PI-LL Mismatch (Preop)	17.82 (20.15)	14.57 (18.76)	0.319
Cobb Angle L4-S1 (Preop)	-29.79 (13.82)	-27.26 (15.71)	0.309
C7PL (Preop)	-11.27 (48.89)	-6.87 (41.11)	0.601
Maximum Cobb Angle (Preop)	-8.56 (42.44)	-3.98 (31.87)	0.475
Deviation L1PA (Preop)	5.21 (7.44)	5.75 (7.78)	0.669
Mismatch T4-L1PA (Preop)	8.97 (9.01)	8.49 (6.87)	0.722
Pelvic Incidence (Postop)	53.50 (12.37)	53.19 (10.15)	0.869
Pelvic Tilt (Postop)	19.03 (9.03)	20.60 (8.98)	0.301
PI-LL Mismatch (Postop)	6.32 (11.90)	6.90 (11.64)	0.769
Cobb Angle L4-S1 (Postop)	-30.62 (16.47)	-25.33 (22.08)	0.108
C7PL (Postop)	-5.18 (12.23)	0.82 (21.47)	0.164
Maximum Cobb Angle (Postop)	-8.72 (20.90)	-3.47 (17.59)	0.122
Deviation L1PA (Postop)	2.70 (5.76)	3.64 (6.58)	0.367
Mismatch T4-L1PA (Postop)	3.54 (4.81)	4.50 (3.58)	0.176
Change in ODI at 2 years	-18.28 (15.85)	-21.27 (14.18)	0.564
Change in VAS Back at 2 years	-4.60 (2.91)	-4.50 (3.14)	0.942
Change in VAS Leg at 2 years	-1.56 (3.64)	-3.56 (3.00)	0.222
Change in SF-12 PCS at 2 years	9.37 (11.13)	10.13 (9.75)	0.937
Change in SF-12 MCS at 2 years	9.27 (6.64)	-0.09 (0.08)	0.119
Change in PROMIS at 2 years	5.82 (6.37)	3.02 (7.10)	0.512