Stretch Neuropraxia After L5-S1 Anterior Lumbar Interbody Fusion: Effect of Cage Height and Lordosis

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INTRODUCTION:

Postoperative neurological complications are relatively uncommon after ALIF, reportedly occurring in 0.9% of surgical patients, but remain an important and often understudied complication. Stretch neuropraxia is a known phenomenon, wherein nerves that have previously been compressed by spinal pathology are stretched during surgery, creating transient or even permanent disfunction. Given the variation in preoperative disc heights, lordosis, and nerve function, some patients may be more vulnerable to stretch-related nerve injuries. This study aims to evaluate the association between disc height, lordosis, and postoperative neuropraxia, as well as identify disc height cutoffs that may predispose patients to stretch-related neuropraxia.

METHODS: Adults with degenerative spine pathology who underwent L5-S1 ALIF were identified. Anterior and posterior DHs were measured, and associations with segmental and global lumbar lordosis were evaluated using multivariate regression analyses. Postoperative neuropraxia, whether transient or persistent, was identified up to one-year postoperatively. Receiver operating characteristic (ROC) curve analyses were performed to establish thresholds for DHs that predicted postoperative neuropraxia.

RESULTS: In total, 101 patients were included with mean age of 52.5 years, 55% were females, and mean CCI of 1.7. After ALIF, DHs increased by mean of 8.7mm anteriorly and 3.0mm posteriorly, L5-S1 segmental lordosis increased by mean of 7.0º, and L1-S1 lumbar lordosis increased by mean of 3.6º (**Table 1**). A 1mm improvement in anterior DH was associated with 0.3º increase in L5-S1 segmental lordosis ($p<0.001$) and 0.2º increase in L1-S1 lordosis ($p=0.019$). Among this cohort, 28% developed neuropraxia, of which 75% were transient that resolved by 3 months postoperatively (**Figure 1**). ROC analyses identified cutoffs of 18.9mm and 8.6mm for postoperative anterior and posterior DH, and 9.5mm and 8.6mm for change in preoperative to postoperative anterior and posterior DH, respectively. Patients above these thresholds had nearly 4-fold higher likelihood of developing postoperative neuropraxia ($p<0.01$).

DISCUSSION AND CONCLUSION:

Large increases in anterior or posterior disc heights during ALIF achieved improvements in lumbar lordosis but were associated with increased odds of neuropraxia postoperatively. Patients with a postoperative anterior disc height of 19mm and a posterior disc height of 9mm had 4-fold higher odds of developing neuropraxia. While three-fourth of neuropraxias were transient and resolved spontaneously in the early postoperative period, the high incidence of neuropraxia following ALIF may inform preoperative planning and counselling.

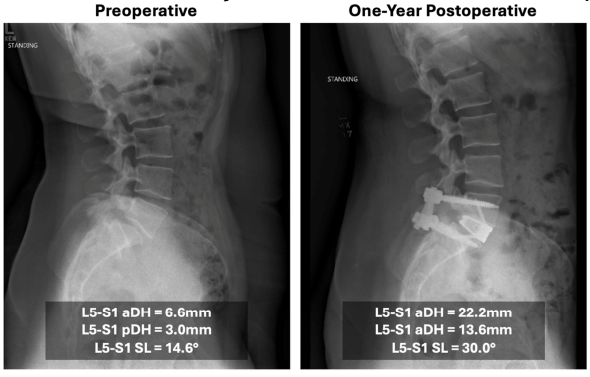

Figure 1. Preoperative (left panel) and one-year postoperative (right panel) standing lateral lumbar radiographs demonstrating a patient who underwent L5-S1 anterior lumbar interbody fusion, with 15.6mm correction in anterior disc height (aDH), 10.6mm correction in posterior disc height (pDH), and 25.4º correction in segmental lumbar lordosis (SL), and developed transient neuropraxia.

Table 1: Preoperative, One-Year Postoperative, and Preoperative to One-Year Postoperative Change in Disc Heights and Lordosis

Parameter	Total (N = 101)	Neuropraxia (N = 28)	No Neuropraxia (N = 73)	P-value	OR	95% CI	P-value
Preoperative							
Anterior DH (mm)	9.11 (5.31)	9.25 (4.85)	9.05 (5.50)	0.878	1.00	0.90 – 1.10	0.929
Posterior DH (mm)	4.96 (2.52)	4.95 (2.75)	4.96 (2.44)	0.878	1.01	0.82 – 1.24	0.932
LL (º)							
L5-S1	19.81 (7.34)	19.81 (7.34)	20.01 (7.14)	0.672	0.99	0.92 – 1.05	0.669
L1-S1	55.56 (13.88)	54.92 (11.69)	55.80 (14.69)	0.787	0.99	0.96 – 1.03	0.693
One-Year Postoperative							
Anterior DH (mm)	17.88 (5.22)	19.62 (5.35)	17.23 (5.05)	**0.050**	1.12	1.01 – 1.25	**0.038**
Posterior DH (mm)	7.96 (3.85)	9.11 (4.25)	7.52 (3.63)	0.078	1.10	0.96 – 1.25	0.163
LL (º)							
L5-S1	26.78 (7.63)	27.69 (8.23)	26.44 (7.43)	0.488	1.04	0.97 – 1.11	0.288
L1-S1	59.17 (12.97)	59.52 (10.51)	59.05 (13.85)	0.879	1.01	0.97 – 1.05	0.782
Preoperative to One-Year Postoperative Change							
Anterior DH (mm)	8.73 (5.62)	10.25 (5.32)	8.18 (5.67)	0.122	1.10	1.00 – 1.22	**0.048**
Posterior DH (mm)	2.95 (4.68)	4.08 (5.40)	2.55 (4.37)	0.169	1.07	0.96 – 1.21	0.236
LL (º)							
L5-S1	6.97 (8.32)	8.41 (7.50)	6.43 (8.60)	0.312	1.04	0.98 – 1.11	0.184
L1-S1	3.61 (9.53)	4.60 (7.95)	3.24 (10.09)	0.547	1.03	0.97 – 1.08	0.353

Abbreviations: OR = Odds Ratio, CI = Confidence Interval, DH = Disc Height, LL = Lumbar Lordosis.