Predisposing Characteristics of Adjacent Segment Disease Following Lumbar Fusion

Vincent Alentado BS; Daniel Lubelski; Andrew T Healy MD; Michael P Steinmetz MD; Edward C Benzel MD; Thomas E Mroz MD

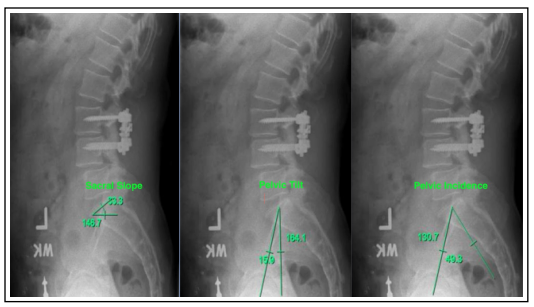
Department of Neurological Surgery, Cleveland Clinic, Cleveland, Ohio, USA

Learning Objectives

1) Describe the importance of determining predisposing characteristics of adjacent segment disease following lumbar fusion
2) Discuss, in small groups, risk factors associated with developing adjacent segment disease
3) Identify the likelihood of a patient developing adjacent segment disease following a lumbar fusion

Introduction

Adjacent segment disease (ASD) is a recognized complication of spinal fusion that leads to increased costs and debilitating symptoms for patients. ASD is hypothesized to occur due to increased biomechanical stress placed on segments near an adjacent spinal fusion. However, a comprehensive understanding of risk factors for the development of this surgical complication does not exist.



Methods

A retrospective review was performed for all patients surgically treated with their first lumbar arthordesis at one institution between January 2008 and December 2011. All patients requiring a corrective surgery at an adjacent level to the original fusion by January 2014 were considered as having developed ASD. Patient medical records were examined for preoperative medical comorbidities and medications, as well as surgical approach and perioperative complications. A blinded reviewer assessed radiographs for each patient to examine sagittal alignment following fusion. Multivariable logistic regression was used to model the risk of developing ASD on the basis of one or more predictors.

Table 1: Variables Marginally Associated with a Higher Risk of ASD

Variable Assessed	ASD Group (n=13)	Non-ASD Group (n=124)	p Value
Age >60	10 (77%)	60 (48%)	0.04*
Antidepressant Use	8 (62%)	37 (30%)	0.03*
Antipsychotic Use	0 (0%)	7 (6%)	0.2
Coronary Artery Disease	5 (38%)	14 (11%)	0.02*
Diabetes	4 (31%)	21 (17%)	0.2
Insulin Use	0 (0%)	8 (6%)	0.2
Smoking History (Pack Years)	17.9±29.6	9.8±12.5	0.1
Disc Herniation	2 (15%)	7 (6%)	0.2
Degenerative Scoliosis	2 (15%)	1 (1%)	0.01*
Stenosis	11 (85%)	83 (67%)	0.2
Interbody + Posterolateral	5 (38%)	25 (20%)	0.2
L4 Fused	12 (92%)	86 (69%)	0.05*
L3-L5 Fusion	1 (8%)	2 (2%)	0.2
L5-S1 Fusion	1 (8%)	37 (30%)	0.05*
L4-S1 Fusion	3 (23%)	3 (2%)	0.008*
Number of Levels Fused	2.3±0.5	2.1±0.4	0.09
Decompression 1 Level Above	0 (0%)	23 (19%)	0.03*
No Adjacent Decompressions	13 (100%)	85 (69%)	0.002*
Decompression 1 Level Below	0 (0%)	13 (10%)	0.09
Blood Loss (mL)	776.8±458.2	576.1±484.6	0.2
Pelvic Incidence	46.0±11.2	53.8±11.8	0.04*
Sacral Slope	27.4±7.9	33.8±10.1	0.04*

ASD: Adjacent Segment Disease

*p Values ≤0.05 were considered statistically significant

Results

-137 patients fit the inclusion criteria
-13 patients (9%) required a follow-up operation for ASD
-The ASD group had a mean follow-up of 21.1 months prior to revision surgery and an overall follow-up of 41.0 months while the average follow-up in the control group was 14.0 months
-The average age of patients in the ASD group was 61 years and in the non-ASD group was 58 years, p=0.5
-The most common indication for surgery was spondylolisthesis (85% of ASD group and 78% of non-ASD group, p=0.5)
-The surgical approach most commonly used was posterior/ transforaminal lumbar interbody fusion (31% in the ASD group vs. 40% in the non-ASD group, p=0.5) followed by posterolateral fusion (31% in the ASD group vs. 35% in the non-ASD group, p=0.7)
-Statistically significant independent predictors of developing ASD included antidepressant use (OR=5.4), diagnosis of degenerative scoliosis (OR=34.2), fusion of L4-S1 (OR=56.5), and low sacral slope (OR=0.9), and having no decompressions adjacent to the fusion (Table 2)

Table 2: Adjusted Odds Ratios of Developing ASD Per 1 Unit Increase in Regressor

Variable Assessed	Odds Ratio	Lower 95% CI	Upper 95% CI	p Value
Antidepressant Use	5.35	1.13	31.99	0.03*
Degenerative Scoliosis	34.22	1.55	1883.03	0.02*
L4-S1 Fusion	56.53	3.34	2114.03	0.006*
No Adjacent Decompression	N/A	N/A	N/A	0.003*
Sacral Slope	0.88	0.78	0.96	0.004*

CI: Confidence Interval

*p Values ≤0.05 were considered statistically significant

Conclusions

This study is the first to use a combination of medical, surgical, and postoperative sagittal balance as risk factors for the development of adjacent segment disease after lumbar fusion. Preoperative antidepressant use, degenerative scoliosis, fusion of L4-S1, a low sacral slope, and having no decompressions adjacent to the fusion were all found to be independent risk factors for the development of ASD. The awareness of these risk factors may allow for better patient selection and surgical technique to decrease the probability of acquiring this complication.

References

1. Ghiselli G, et al. Adjacent segment degeneration in the lumbar spine. J Bone Joint Surg Am. 2004
2. Hilibrand AS, et al. Radiculopathy and myelopathy at segments adjacent to the site of a previous anterior cervical arthrodesis. J Bone Joint Surg Am. 1999
3. Hilibrand AS and Robbins M. Adjacent segment degeneration and adjacent segment disease: the consequences of spinal fusion? Spine J Off J North Am Spine Soc. 2004
4. Mac-Thiong JM, et al. Age- and sex-related variations in sagittal sacropelvic morphology and balance in asymptomatic adults. Eur Spine J. 2011
5. Ould-Slimane M, et al. Influence of transforaminal lumbar interbody fusion procedures on spinal and pelvic parameters of sagittal balance. Eur Spine J. 2012
6. Radcliff KE, et al. Adjacent segment disease in the lumbar spine following different treatment interventions. Spine J Off J North Am Spine Soc. 2013
7. Sears WR, et al. Incidence and prevalence of surgery at segments adjacent to a previous posterior lumbar arthrodesis. Spine J Off J North Am Spine Soc. 2011