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Operative Technique Factors That Predict Adjacent Segment Disease after Fusion For Lumbar Degenerative Disease: A Retrospective Analysis of 779 Patients

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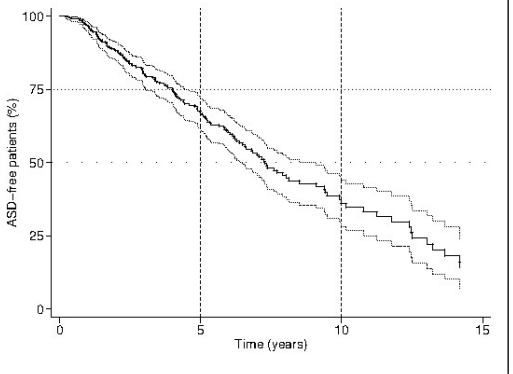
Introduction

This study aims to evaluate demographic and operative factors which influence and predict occurrence of adjacent segment disease (ASD) after fusion for lumbar degenerative pathologies.

Methods

A retrospective review was performed on patients who had undergone lumbar fusion for degenerative pathologies (stenosis, spondylolisthesis, or disc degeneration) within the L1 to S1 segments between 2007 and 2016. Patients without any follow-up data were excluded from the study. Effects of demographic (age, gender, smoking status, osteoporosis, diebetes) and technical factors (surgical approach, type of procedure, number of fused levels, performing decompression in any segments without fusion, type of bone graft) on ASD rates were analyzed.

ASD-free survival curve



Percentage of patients presenting for follow-up, graphed against time of follow-up in years. The dashed lines represent 95% confidence intervals.

Demographic Characteristics

Variable	Total (%), n=779
Age, mean years ± SD	55.3 ± 13.8
Sex	
Male	354 (45.4)
Female	425 (54.6)
Diagnosis [a]	
Spondylolisthesis	336 (48.8)
Multilevel lumbar degeneration	353 (51.2)
Surgical Approach [b]	
Anterior	21 (3.0)
Posterior	370 (52.2)
Circumferential	318 (44.9)
Fusion Type	
Pedicular screws	302 (38.8)
Interbody fusion	27 (3.5)
Combined	450 (57.8)
Interbody fusion approach [c]	
Anterior	370 (77.9)
Posterior	104 (21.9)
Anterior and posterior	1 (0.2)
Decompression Type	
Laminotomy [f]	88 (12.3)
Laminectomy [g]	638 (88.1)
Foraminotomy [h]	101 (14.1)
Corpectomy [i]	265 (37.0)
Discectomy [j]	482 (67.5)
Segmental decompression without fusion	299 (38.4)
Number of fused segments, mean ± SD	1.74 ± 0.88
Number of unfused segments, mean ± SD	0.52 ± 0.78
Bone morphogenic protein [d]	312 (44.8)
Bone graft type [e]	
Autograft	245 (37.4)
Allograft	7 (1.1)
Autograft and allograft	403 (61.5)
Smoking status [k]	
Current smoker	83 (11.4)
Former smoker	83 (11.4)
Lifetime nonsmoker	559 (77.1)
Osteoporosis [l]	19 (2.6)
Diabetes [m]	94 (12.9)
Follow-up, mean years ± SD	2.71 ± 3.76
Time to ASD, mean years ± SD	4.86 ± 4.93
Revision surgery	222 (28.5)
Adjacent segment disease	170 (21.8)

Categorical values are presented as frequencies and percentages; continuous variables are presented as means and SD. (ASD, adjacent segment disease; SD, standard deviation). Missing data: a=90, b=70, c=2, d=83, e=124, f=61, g=55, h=63, i=62, j=65, k=54, l=51, m=50.

Results

779 patients met our inclusion criteria, 170 (21.8%) of whom were re-operated for ASD. Mean follow-up was 2.7 years, and mean time to ASD was 4.9 years. Univariate analysis showed that unfused decompression adjacent to the fused segments was significantly associated with higher ASD rates (P=0.003), as was laminotomy (P=0.05), discectomy (P=0.031), number of decompressed segments (P=0.007), and combination of allograft and autograft (P=0.014). There was no statistically significant association between fusion technique (pedicular screw only vs. interbody fusion only vs. both), surgical approach (anterior vs. posterior vs. combined), smoking, osteoporosis or diabetes and ASD. Multivariate analysis identified that presence of unfused decompression adjacent to the fused segments (OR=3.34, P=0.001), the number of segments decompressed (OR=1.47, P=0.004), and the type of bone graft used (OR=0.75, P=0.023), were independently associated with ASD rates.

Multivariate logistic regression analysis of prognostic factors for development of ASD.

Variables	Odds Ratio (CI 95%)	*p*-Value
Unfused Surgery on Adjacent Segments	3.34 (1.65 - 6.77)	**0.001**
Number of unfused segments	0.63 (0.40 - 1.00)	**0.050**
Number of segments involved	1.47 (1.12 - 1.78)	**0.004**
Laminotomy	1.47 (0.83 - 2.61)	0.186
Diskectomy	0.92 (0.55 - 1.54)	0.761
Bone Graft Type	0.75 (0.59 - 0.96)	**0.023**

Statistically significant p-values are highlighted in bold. (ASD, adjacent segment disease; CI, confidence interval)

Conclusions

No difference in ASD rates was identified between pedicular screw fixation with and without interbody fusion. Additionally, spinal decompression adjacent to the fused segments may possibly weaken the structural integrity of the remaining segments and lead to higher rates of ASD.

Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the factors predicting adjacent segment disease after lumbar fusion for degenerative spinal disease; 2) Discuss, in small groups which operative techniques may influence ASD rates; 3) Identify an effective management plan for degenerative spinal disease to potentially decrease ASD rates.

References

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3. Strube P, Hoff E, Hartwig T, Perka CF, Gross C, Putzier M. Stand-alone anterior versus anteroposterior lumbar interbody single-level fusion after a mean follow-up of 41 months. Journal of spinal disorders & techniques. 2012;25(7):362-369.