Examining the Role of Pre-Operative Retrolisthesis in Single-Level Lumbar Fusion

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INTRODUCTION

- Lumbar spinal fusion is one of the most common spine surgeries performed in the United States.
- By fusing two or more vertebrae together surgeons are able to provide patients with relief by:
  - Decompressing the neural elements
  - Preventing inappropriate motion in the spine
- Most common diagnoses that require a a lumbar spinal fusion are degenerative lumbar stenosis and degenerative spondylolisthesis.
- Revision surgeries after a lumbar spinal fusion can be due to numerous reasons such as(ref):
  - Pseudoarthrosis
  - Adjacent Segment Disease
  - Infection
- Retrolisthesis is defined as the posterior displacement of a vertebral body with respect to the subjacent vertebrae.
- Currently, there is a paucity of literature on the role that pre-operative retrolisthesis plays in the requirement for revision surgery after a lumbar spinal fusion.

PURPOSE

The purpose of this study is to explore whether or not patients with preoperative retrolisthesis in their lumbar spine are more likely to require additional surgery after a primary single-level lumbar fusion.

METHODS

- Study Design: Retrospective cohort study
- Setting: Conducted at an academic tertiary referral center in an urban setting
- Data Collection: Data was collected manually from the electronic medical record
- Patient Identification: Single level lumbar fusion cases were identified via CPT codes between January 2018 and December 2022
- Inclusion/Exclusion Criteria: Only adults age 18-89 undergoing L4-5 lumbar fusion were included with appropriate preoperative imaging were included.
- Groups: Patients were divided into two cohorts: 1) Reoperation and 2) No reoperation.
- Outcomes of Interest: Reoperation rates, reasons for reoperation, incidence of preoperative retrolisthesis in both cohorts and the incidence of risk factors in patients undergoing reoperation.
- Analysis: Patient demographics, operative variables, and radiographic parameters were compared with Welch's modified two sample t-tests, chi-squared tests, or Fisher's exact tests.

RESULTS

- A total of 125 patients were included. There were 20 patients in the reoperation cohort and 105 in the no reoperation cohort.
- There were no significant differences between the two cohorts in any of the demographic variables collected including age (P = .2684), sex (P = .5952), BMI (P = .1878), patients with ASA > 2 (P = .6903), pre-operative back pain (P = .5624), pre-operative leg pain (P = .6332), bilateral leg symptoms (P = .8754), previous spine surgery (P = .5833), CCI > 2 (P =.545), or substance use.
- Patients requiring reoperation were found to have significantly increased follow-up times (P = .0002).
- There were no differences between the two groups in length of surgery (P = .5036), EBL (P = .7055), complications (P = 1), or length of stay (P = .8296).
- There were also no significant differences found between the groups in any of the radiographic parameters measured including pelvic incidence (P = .8517), sacral slope (P = .4993), L1-S1 lordosis (P = .9308), or L4-S1 lordosis (P = .9751).
- It was also found that there was no difference in the prevalence of lumbar retrolisthesis between the patients requiring reoperation and those that did not (P = .7638).

Table 1.
Patient Demographics

Patient Demographics			
Variable	Revision Surgery N (% or SD)	No Revision Surgery N (% or SD)	p-Value
Total	20 (16%)	105 (84%)	
Age	61.6 (+/-10.3)	64.4 (+/-9.6)	0.2684
Sex			
Male	6 (30%)	38 (36.2%)	0.5952
Female	14 (70%)	67 (63.8%)	0.5952
Race			
White	15 (75%)	74 (70.5%)	
Black	5 (25%)	26 (24.8%)	
Hispanic	0	3 (2.9%)	
Native American	0	1 (0.95%)	
Asian	0	1 (0.95%)	

Demographics Continued			
Variable	Revision Surgery N (% or SD)	No Revision Surgery N (% or SD)	p-Value
BMI	32.1 (+/-5.6)	30.2 (+/-6.4)	0.1878
CCI >2	11 (55%)	50 (47.6%)	0.545
Current Smoker	0	13 (12.4%)	0.1261
Former Smoker	8 (40%)	41 (39.1%)	0.9363
EtOH Use	1 (5%)	5 (4.8%)	1
IVDU	0	1 (0.95%)	1
DM	5 (25%)	18 (17.1%)	0.4059
Chronic Steroid Use	1 (5%)	15 (14.3%)	0.4649
Kidney Disease	1 (5%)	7 (6.7%)	1
Osteoporosis	3 (15%)	8 (7.6%)	0.3809
Cancer	3 (15%)	20 (19.1%)	1
Hypertension	15 (75%)	74 (70.5%)	0.6822

Demographics Continued			
Variable	Revision Surgery N (% or SD)	No Revision Surgery N (% or SD)	p-Value
ASA >2	14 (70%)	78 (74.3%)	0.6903
Pre-Operative Back Pain	20 (100%)	99 (94.3%)	0.5833
Pre-Operative Leg Pain	18 (90%)	95 (90.5%)	1
Weakness	4 (20%)	39 (37.1%)	0.1995
Bilateral Leg Symptoms	14 (70%)	62 (59.1%)	0.3578
Previous Spine Surgery	3 (15%)	24 (23.3%)	0.56

Table 2. Operative Variables

Operative Variables			
Variable	Revision Surgery N (% or SD)	No Revision Surgery N (% or SD)	p-Value
Follow-Up Time (Months)	38.6 (+/-20.7)	17.2 (+/-16.3)	**0.0002**
Length of Surgery (Minutes)	153.8 (+/-37.9)	160.3 (+/-46.7)	0.5036
EBL (mL)	315 (+/-188)	296 (+/-287)	0.7055
Complications	6 (30%)	35 (33.3%)	1
Length of Stay (Days)	4.4 (+/-2.4)	4.2 (+/-2.9)	0.8296

Table 3.
Listhesis Characteristics

Listhesis Characteristics	
Location	N (%)
L1-2	
Anterolisthesis	0
Retrolisthesis	47 (37.6%)
Meyerding Grade > 1	0
L2-3	
Anterolisthesis	0
Retrolisthesis	67 (53.6%)
Meyerding Grade > 1	0
L3-4	
Anterolisthesis	4 (3.2%)
Retrolisthesis	56 (44.8%)
Meyerding Grade > 1	0
L4-5	
Anterolisthesis	122 (97.6%)
Retrolisthesis	0
Meyerding Grade > 1	7 (5.6%)
L5-S1	
Anterolisthesis	6 (4.8%)
Retrolisthesis	26 (20.8%)
Meyerding Grade > 1	1 (0.8%)

Table 4. Radiographic Parameters

Radiographic Parameters			
Variable	Revision Surgery N (% or SD)	No Revision Surgery N (% or SD)	p-Value
Pelvic Incidence	61.8 (+/-12.1)	62.3 (+/-11.5)	0.8517
Sacral Slope	40.0 (+/-8.3)	38.6 (+/-9.7)	0.4993
L1-S1 Lordosis	55.16 (+/-8.6)	55.36 (+/-12.7)	0.9308
L4-S1 Lordosis	31.7 (+/-7.9)	31.7 (+/-9.7)	0.9751

Table 5. Retrolisthesis Parameters

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Variable	Revision Surgery N (% or SD)	No Revision Surgery N (% or SD)	p-Value
Lumbar Retrolisthesis	17 (85%)	82 (78.1%)	0.7638
L1-L2 Retrolisthesis	8 (40%)	39 (37.1%)	0.809
L2-L3 Retrolisthesis	13 (65%)	54 (51.4%)	0.3313
L3-L4 Retrolisthesis	9 (45%)	47 (44.8%)	0.9843
L5-S1 Retrolisthesis	5 (25%)	21 (20%)	0.6136

CONCLUSIONS

- Reoperation after single level L4-5 lumbar fusion is not uncommon, occurring in 16% of the patients included in this study.
- While this is the case, we found no significant differences between the two groups in any of the parameters analyzed with the exception of mean follow-up time.
- This suggests that other variables such as operative indications, surgical technique, and surgeon experience may play a larger role in reoperation rates in single level lumbar fusion than the variables included in this study.
- While there were no significant differences demonstrated, it is worth noting that the data indicates a trend toward reoperation in patients with pre-operative lumbar retrolisthesis at any level.

DISCLOSURES

DC and EK are consultants for Alphatec. SCL is a board member for the American Board of Orthopaedic Surgery, the American Orthopaedic Association, the Cervical Spine Research Society, and the Society for Minimally Invasive Spine Surgery; is a consultant for DePuy Synthes and K2M/Stryker; is a board member for Nuvasive; receives payment for lectures and travel accommodations from DePuy Synthes and K2M/Stryker; receives payment for patents and royalties from DePuy Synthes; has stock in Innovative Surgical Designs and the American Society for Investigative Pathology; receives research support from AO Spine North America Spine Fellowship support, Baxter International, and AOA Omega Grant; is a board member of Maryland Development Corporation; receives royalties from Thieme, Quality Medical Publishers; is on the editorial board of Journal of Spinal Disorders and Techniques, The Spine Journal, and Contemporary Spine Surgery. [illegible]

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