Identifying Predictors of Early Reoperation in Lumbar Spine Surgery: Insights from a National Propensity-Matched Cohort Study

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INTRODUCTION:

Lumbar spinal fusion is frequently performed to address degenerative spinal pathology, but a subset of patients require early reoperation due to complications such as pseudoarthrosis, adjacent segment disease, and hardware failure. Identifying risk factors for repeat surgery within the first postoperative year may inform preoperative optimization and surgical planning.

METHODS:

A retrospective cohort study was conducted using a large, multicenter electronic health record database spanning 2003 to 2023. Adult patients who underwent lumbar fusion were identified and categorized based on whether they required a second lumbar fusion procedure within one year of the index surgery. A 1 to 1 propensity score match was performed based on age at initial surgery, yielding 4835 patients in each group. Demographic, behavioral, clinical, laboratory, and procedural variables were analyzed to identify risk factors for early reoperation.

RESULTS:

Compared to patients who did not require reoperation, those who underwent repeat lumbar fusion within one year were more likely to be male and White, and had a higher prevalence of hypertension, obesity, osteoporosis, anemia, and malnutrition (all $p < 0.05$). Psychiatric comorbidities, particularly depressive disorders, and opioid use disorder were significantly more common in the reoperation group. Surgically, anterior and multilevel fusion constructs were more frequently employed in patients who required reoperation, whereas posterior approaches were more common in the non-revision group. Body mass index and hemoglobin A1c levels were not significantly different between groups.

DISCUSSION AND CONCLUSION:

Patients undergoing early reoperation after lumbar fusion demonstrate distinct demographic, medical, psychiatric, and procedural risk profiles. Attention to modifiable factors such as nutritional status, mental health, and construct selection may improve initial surgical success and reduce the likelihood of early revision. These findings support the development of risk stratification tools to guide preoperative optimization and surgical decision-making.

Demographic	Re-Lumbar Fusion (N=4835)	No Re-Lumbar Fusion (N=4835)	P-Value
Age at Index	59.0 +- 13.5	59.0 +- 13.5	1
M: Male	2174 (45.0%)	2013 (41.6%)	0.001
F: Female	2495 (51.6%)	2581 (53.4%)	0.08
2106-3: White	3796 (78.5%)	3714 (76.8%)	0.045
UN: Unknown Ethnicity	654 (13.5%)	689 (14.3%)	0.303
2054-5: Black or African American	404 (8.4%)	408 (8.4%)	0.883
2131-1: Other Race	120 (2.5%)	108 (2.2%)	0.421
2028-9: Asian	77 (1.6%)	79 (1.6%)	0.872
1002-5: American Indian or Alaska Native	15 (0.3%)	12 (0.2%)	0.563
2076-8: Native Hawaiian or Other Pacific Islander	14 (0.3%)	16 (0.3%)	0.715
2186-5: Not Hispanic or Latino	3887 (80.4%)	3889 (80.4%)	0.959
2135-2: Hispanic or Latino	294 (6.1%)	257 (5.3%)	0.105

Table 1. Demographic Characteristics of Patients Undergoing Repeat Lumbar Fusion Versus No Repeat Lumbar Fusion

CPT Code & Procedure Description	Incidence in Re-Lumbar Fusion Cohort (N=4,835)	Incidence in No Re-Lumbar Fusion Cohort (N=4,835)	P-Value
22558: Ant. lumbar interbody fusion	39.34%	13.59%	<0.001
22612: Post. lumbar arthrodesis	43.64%	57.00%	<0.001
22633: Combined lumbar arthrodesis	18.68%	28.75%	<0.001
22533: Lateral lumbar extracavitary fusion	0.56%	0.48%	0.571
22585: Add. anterior lumbar interspace	22.79%	5.52%	<0.001
22614: Add. posterior lumbar interspace	33.86%	37.99%	<0.001
22632: Add. posterior lumbar interbody fusion	1.82%	2.65%	0.006
22634: Add. combined lumbar fusion with decompression	6.20%	7.67%	0.004
22534: Add. thoracic/lumbar extracavitary fusion	0.46%	0.33%	0.329

Table 3. Procedural Variation Between Patients With and Without Repeat Lumbar Fusion

Lab Test (Code and Description)	Re-Lumbar Fusion Cohort (Mean ± SD)	No Re-Lumbar Fusion Cohort (N=4835) (Mean ± SD)	Re-Lumbar Fusion Cohort (N=4835)	No Re-Lumbar Fusion Cohort (N=4835)	P-Value
9083: BMI (kg/m²)	30.6 ± 6.3	30.5 ± 6.5	4,065 (84.1%)	4,045 (83.7%)	0.509
BMI 20–30 kg/m²			52.90%	52.70%	0.839
BMI 30–35 kg/m²			40.00%	37.50%	0.012
BMI 35–40 kg/m²			23.80%	22.40%	0.087
9037: Hemoglobin A1c	6.1 ± 1.4	6.2 ± 1.4	1,670 (34.5%)	1,619 (33.5%)	0.624
9063: C-Reactive Protein	26.3 ± 51.7	22.1 ± 49.5	945 (19.5%)	812 (16.8%)	0.085

Table 4. Laboratory Biomarkers and BMI Stratification in Re-Lumbar Fusion vs. No Reoperation Cohorts