

## Association Between Hemoglobin A1c and Reoperation Following Spine Surgery

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# **Learning Objectives**

By the conclusion of this session, participants should be able to:

- 1) Describe the clinical benefit, morbidity, and cost of reoperation following spine surgery.
- 2) Discuss, in small groups, efforts to mitigate the risk of reoperation at the time of index surgery.
- 3) Identify an effective preoperative care path to optimize diabetic status in an effort to prevent reapportion.

#### Introduction

In 2008, nearly 500,000 spine surgeries were performed in the U.S. Spinal fusions are the most expensive hospital-based procedure nationally, incurring more than \$12 billion in annual hospital costs alone. Accordingly, identifying risk factors for reoperation may prevent unnecessary surgical intervention in a growing population of patients with comorbid disease. We hypothesized that serum glycated hemoglobin is a surrogate biomarker for the risk of reoperation.

#### **Methods**

All patients undergoing decompression, fusion, instrumentation, or augmentation of the spine from 2001-2015 at a single tertiary care institution were eligible for inclusion. The primary outcome was the cumulative incidence of reoperation at the index surgical site. Multivariate proportional hazards regression was used to adjust for confounding demographic, comorbid, and operative covariates.

Table 1. Baseline Demographic,
Comorbid, Laboratory, and Operative
Characteristics

Characteristic	Statistic	
No. Patients	13,244	
Age (years)	60 [20 - 90]	
Male	6,977 (53)	
CCI≥2	1,350 (10)	
Prior Spinal Surgery	3,915 (30)	
Race	27	
Caucasian	11,640 (88)	
Black	1,188 (9)	
Other	416 (3)	
Procedural Category*		
Decompression	12,072 (91)	
Discectomy	10,413 (79)	
Instrumentation	5,640 (43)	
Fusion	4,880 (37)	
Vertebral Augmentation	860 (6)	
Surgical Level		
Cervical	1,892 (14)	
Thoracic	531 (4)	
Lumbosacral	10,821 (82)	
Reoperation Performed	2,684 (20)	
Median Time to Reoperation (mo.)	1 [0 - 106]	
Closest HbA1c (%)	6.0 [3.7 - 16.1]	
0.0 - 5.6	3,973 (30)	
5.7 – 6.4	5,165 (39)	
6.5 - 16.1	4,106 (31)	
Closest Serum Glucose (mg/dL)	100 [56 - 1020]	
0 – 100	6,462 (49)	
101 – 130	3,783 (28)	
131 - 1020	2,999 (23)	

Values are presented as number (percent) or median [range].

### Results

13,244 patients underwent surgery during the study period. The majority of interventions were conducted in the lumbosacral spine (82%). Preoperatively, the median HbA1c was 6.0%, with 39% of patients meeting the criterion for pre-diabetes and 31%

6.0%, with 39% of patients meeting the criterion for pre-diabetes and 31% of patients meeting the criterion for diabetes.

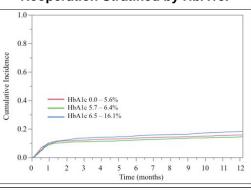
At a median of 1 month following index intervention, 2,684 patients (20%) underwent reoperation. Reoperation was more common among patients with diabetes (23%) than pre-diabetes (19%) or normal glucose tolerance (21%) (p=0.02). Similarly, the 12-month cumulative incidence of reoperation was greater among patients with diabetes (18%) than patients with pre-diabetes (15%) or normal glucose tolerance (16%) (p=0.03). 30- and 90-day emergency room visits and readmissions were not significantly different among cohorts.

After multivariate analysis, HbA1c > 6.4% was identified as an independent risk factor for reoperation (HR 1.13, 95% CI 1.02 – 1.29, p=0.04).

Table 2. Clinical Outcomes				
ic	HbA1c 0.0 - 5.6%	HbAlc 5.7 - 6.4%	HbAlc 6.5 - 16.1%	Statistic
	3,973 (30)	5,165 (39)	4,106 (31)	
'erformed	834 (21)	981 (19)	944 (23)	0.02
umulative Incidence	12%	11%	14%	0.03
umulative Incidence	13%	12%	15%	
Cumulative Incidence	16%	15%	18%	
gency Department Visit	222 (5.6)	299 (5.8)	225 (5.5)	0.93
rency Department Visit	421 (10.6)	572 (11.1)	427 (10.4)	0.74

Values presented as a number (percent)

Figure 1. Cumulative Incidence of Reoperation Stratified by HbA1c.



### Conclusions

In the present investigation, the hazard rate of reoperation was modestly increased among patients meeting the criterion for diabetes. Patients with pre-diabetes were not at elevated risk compared to those with normal glucose tolerance. Preoperative medical management

may mitigate the increased cost and morbidity of reoperation.