

# Predictors of Post-Discharge Prophylactic Antibiotics Following Spinal Fusion

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## REVISED ABSTRACT

**Background:** Discontinuation of prophylactic antibiotics < 24 hours after surgery is recommended in multiple guidelines, but prophylactic antibiotics are still prescribed at discharge for some procedures. The objective of this study was to determine the prevalence and predictors of post-discharge prophylactic antibiotic use after spinal fusion.

**Methods:** We established a retrospective cohort of patients aged ≥18 years undergoing spinal fusion between 7/2010 and 6/2015 at 3 teaching hospitals. We excluded patients with infections during the spinal fusion admission. Prophylactic antibiotics were identified at discharge.

**Results:** 9689 spinal fusion admissions were identified. The median age of patients was 57 years; 4425 (45.7%) were male; 1069 (11.0%) were trauma patients; and 352 (3.6%) had underlying malignancy. Antibiotic(s) were prescribed at discharge in 310 (3.2%) admissions. The most commonly prescribed antibiotics were trimethoprim/sulfamethoxazole (22.0%), cephalexin (18.3%), and ciprofloxacin (18.0%).

**Conclusions:** Post-discharge prophylactic antibiotics were uncommon after spinal fusion. Factors associated with use included hospital, trauma, prolonged surgery time, intra-operative antibiotics, plus patient factors including obesity, malignancy, fluid and electrolyte disorders, and high American Society of Anesthesiologists (ASA) class.

## INTRODUCTION

- CDC guidelines for the prevention of surgical site infection (SSI) recommend the use of pre-operative antibiotic prophylaxis for procedures in which there are data supporting its benefit, that involve implantation of a medical device, or in surgeries where an SSI is potentially catastrophic.
- CDC, SIS, IDSA, and multiple specialty surgery guidelines advise discontinuation of prophylactic antibiotics within 24 hours for most procedures. However, in practice, prophylactic antibiotics are still prescribed at discharge for some procedures.
- The objective of this study was to determine the prevalence and predictors of post-discharge prophylactic antibiotic use after spinal fusion procedures.

## METHODS

### Inclusion Criteria

- Spinal fusion admission (ICD-9-CM procedure codes 81.00-81.08, 81.30-81.39)
- Admission at 1 of 3 Epicenter teaching hospitals between 7/2010 and 6/2015
- Age ≥ 18 years

### Exclusion Criteria

- Spinal fusion not verified per provider CPT-4 coding or operating room log
- Admissions that would likely have antibiotics prescribed at discharge for therapeutic indications (e.g., gunshot wound, motor vehicle accident, SSI, pneumonia, urinary tract infection, sepsis)
- Patient discharged on intravenous (IV) antibiotics
- Admissions lacking any ICD-9-CM diagnosis codes
- Patient died during the admission
- Length of stay >90 days

### Definition of Post-Discharge Prophylactic Antibiotics

Prophylactic antibiotics were defined as oral antibiotics prescribed at discharge in the absence of an infectious diagnosis during the surgical admission. If the patient was admitted on oral antibiotic therapy and the same antibiotic was prescribed at discharge it was not considered prophylactic.

### Predictors of Post-Discharge Prophylactic Antibiotics

Comorbidities were defined by ICD-9-CM diagnosis codes and operative factors by ICD-9-CM procedure codes during the surgical admission. Demographics and other surgical details were abstracted from the electronic health record.

### Statistical Analysis

Univariate risk factors were evaluated using  $\chi^2$ , logistic regression, or the Mann-Whitney U test. Variables with  $p < 0.2$  in univariate analysis were included in the multivariable logistic regression model with backward selection, with cutoff of  $p < 0.1$  for inclusion. Multicollinearity was assessed with tolerance values to ensure independence of explanatory variables. All data management and analyses were performed using SAS v9.4 (SAS Institute Inc., Cary, NC). This study was approved by the Human Research Protection Offices of the three institutions.

## RESULTS

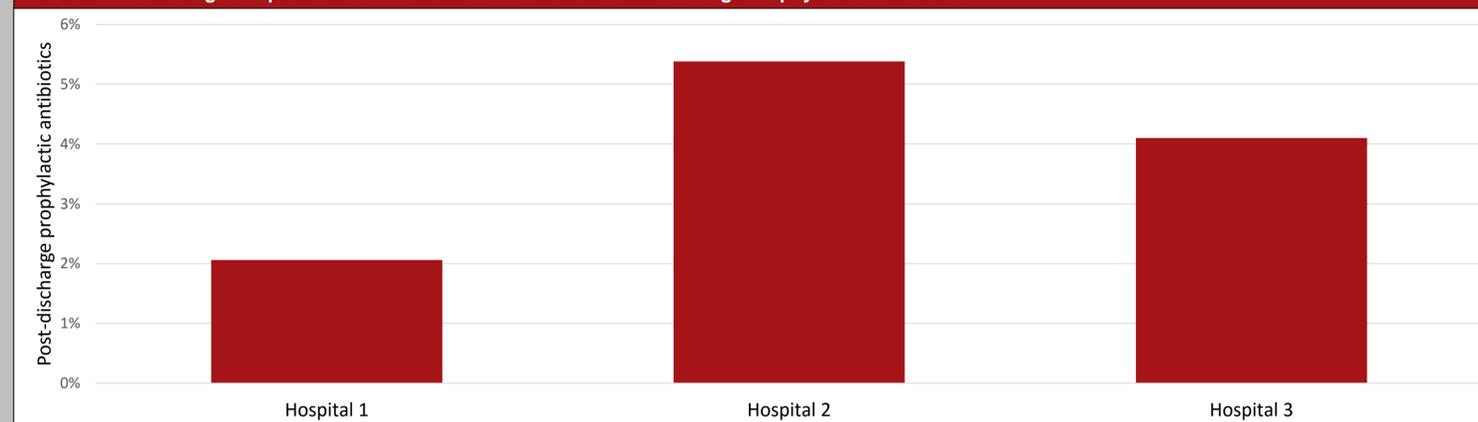
**TABLE 1. Select Univariate Predictors of Post-Discharge Prophylactic Antibiotics after 9,689 Spinal Fusion Procedures**

Variable	Category	Post-Discharge Prophylactic Antibiotics		p
		Yes, n = 310 n (%)	No, n = 9,379 n (%)	
<b>Demographics</b>				
Hospital	1	109 (35.2)	5,178 (55.2)	Ref.
	2	86 (27.7)	1,513 (16.1)	<0.001
	3	115 (37.1)	2,688 (28.7)	<0.001
Female		181 (58.4)	5,083 (54.2)	0.145
Age (median, IQR)		61 (51-69)	57 (48-66)	<0.001
Race	White	253 (81.6)	7,949 (84.8)	Ref.
	Missing	4 (1.3)	136 (1.5)	0.877
	Other	9 (2.9)	216 (2.3)	0.436
	Black	44 (14.2)	1,078 (11.5)	0.135
Payer	Dual Medicare/ Medicaid	4 (1.3)	225 (2.4)	Ref.
	Medicaid	26 (8.4)	432 (4.6)	0.025
	Medicare	141 (45.5)	3,375 (36.0)	0.095
	Private	130 (41.9)	4,866 (51.9)	0.427
	Self pay/none	9 (2.9)	227 (2.4)	0.187
	VA	0 (0)	254 (2.7)	0.972
<b>Operative factors</b>				
Anterior approach		113 (36.5)	4,787 (51.0)	<0.001
Posterior approach		231 (74.5)	5,424 (57.8)	<0.001
Cervical region		112 (36.1)	5,033 (53.7)	<0.001
Lumbar region		155 (50.0)	3,567 (38.0)	<0.001
Thoracic region		80 (25.8)	1,438 (15.3)	<0.001
Spinal levels	1-2 levels	177 (57.1)	6,468 (69.0)	Ref.
	3-7 levels	105 (33.9)	2,338 (24.9)	<0.001
	≥ 8 levels	28 (9.0)	573 (6.1)	0.005
Multiple fusions		11 (3.6)	196 (2.1)	0.081
Surgery duration ≥ 90 minutes		297 (95.8)	8,278 (88.3)	<0.001
Intraoperative antibiotics	Cefazolin- or clindamycin-only	149 (48.1)	5,226 (55.7)	Ref.
	Vancomycin-any	141 (45.5)	3,660 (39.0)	0.012
	Other or >1 abx	14 (4.5)	346 (3.7)	0.219
	None documented	6 (1.9)	147 (1.6)	0.398
Trauma patient		63 (20.3)	1,006 (10.7)	<0.001
Hematoma/seroma		6 (1.9)	43 (0.5)	<0.001
ASA class ≥ 3		197 (63.6)	4,535 (48.4)	<0.001
<b>Comorbidities</b>				
Hypertension		126 (40.7)	3,351 (35.7)	0.076
Smoker	Yes	40 (12.9)	1,623 (17.3)	0.055
	No	259 (83.6)	7,549 (80.5)	Ref.
	Not available	11 (3.6)	207 (2.2)	0.166
Anemia		66 (21.3)	1,360 (14.5)	0.001
Electrolyte disorders		50 (16.1)	799 (8.5)	<0.001
Hypothyroidism		31 (10.0)	736 (7.9)	0.167
Morbid obesity		31 (10.0)	563 (6.0)	0.004
Deficiency anemias		26 (8.4)	450 (4.8)	0.004
Malignancy		30 (9.7)	322 (3.4)	<0.001
Valvular disease		13 (4.2)	243 (2.6)	0.084
Renal failure		11 (3.6)	205 (2.2)	0.11
Coagulopathy		14 (4.5)	181 (1.9)	0.001
CHF		10 (3.2)	165 (1.8)	0.056
Paralysis		14 (4.5)	149 (1.6)	<0.001
Alcohol abuse		8 (2.6)	144 (1.5)	0.145

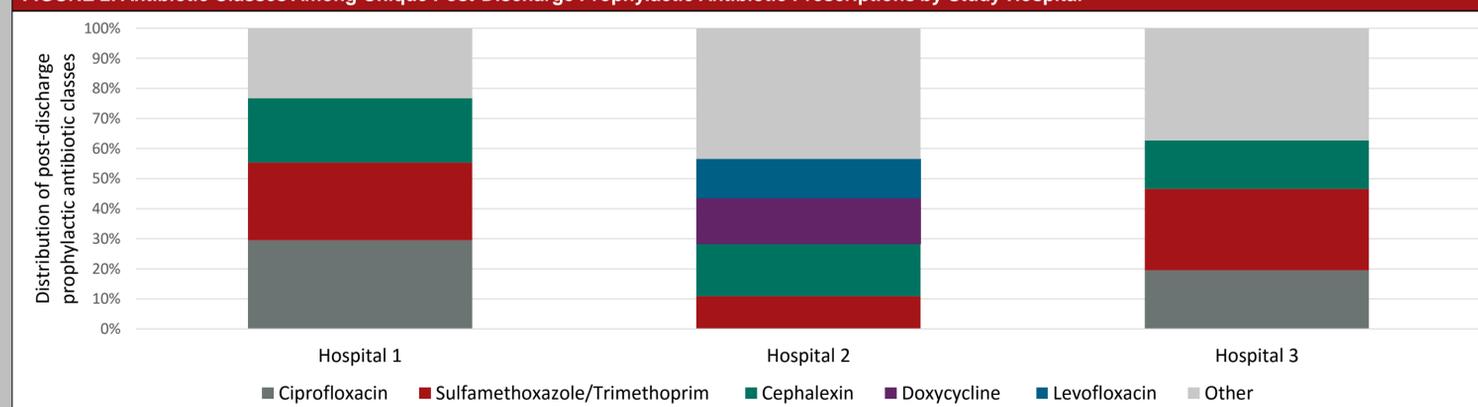
## RESULTS

• Among the 10,589 spinal fusion admissions entered into the database, 900 were excluded for the following reasons: infection coded during index admission (n = 624), spinal fusion was not performed (n = 255), or discharged on IV antibiotics (n = 21). 9,689 spinal fusion admissions were included in the study (Table 1).

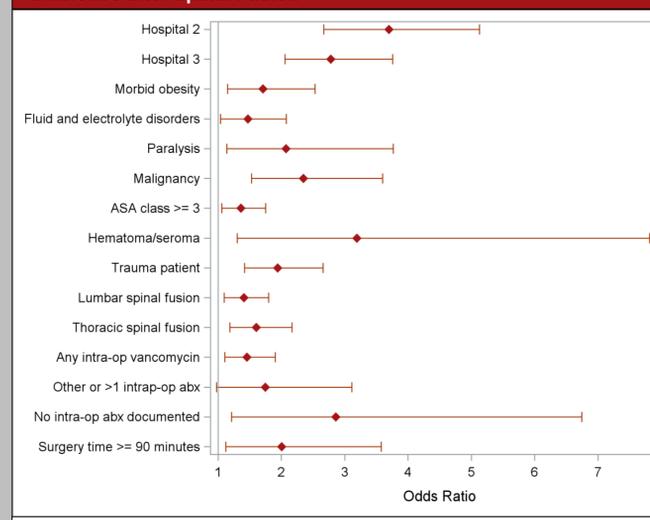
**FIGURE 1. Percentage of Spinal Fusion Procedures Prescribed Post-Discharge Prophylactic Antibiotics**



**FIGURE 2. Antibiotic Classes Among Unique Post-Discharge Prophylactic Antibiotic Prescriptions by Study Hospital**



**FIGURE 3. Multivariable Predictors of Post-Discharge Prophylactic Antibiotics after Spinal Fusion**



Note: Reference group for hospital is hospital 1. Reference group for intra-operative antibiotics is cefazolin/clindamycin-only

## CONCLUSIONS

- Post-discharge prophylactic antibiotic use was uncommon after spinal fusion ranging from 2.1% to 4.1% across hospitals.
- Heterogeneity existed between hospitals for antibiotic classes prescribed.
- Factors associated with post-discharge prophylactic antibiotic use included hospital, trauma, prolonged surgery time, intra-operative antibiotics, obesity, malignancy, fluid and electrolyte disorders, and high ASA class.
- Future studies to better understand surgeon-based factors for prescribing post-discharge antibiotics and its impact on SSI and other complications are needed.

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## CONTACT INFORMATION

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