

Prophylactic Vancomycin Leads to Fewer Device Removals in Sacral Neuromodulation

Introduction

Sacral neuromodulation (SNM) for bladder and bowel dysfunction requires removal for infectious complications in 3-11% of patients. We studied whether preoperative antibiotic choice impacted device removal rates.

Methods

Using the Health Facts® Database, representing more than 750 hospitals, we included female patients who underwent SNM implantation between 2010 and 2018. Exclusion criteria included incomplete records for both stages, an unlikely antibiotic for infection prophylaxis (i.e. Macrobid), or a combination of antibiotics. Univariate and multivariate logistic regression was performed to identify factors associated with device removal. 35 separate comorbidities were evaluated and those with $p < 0.2$ on univariate analysis were included in the multivariate analysis. We decided a priori to include prophylactic antibiotic choice in the final model, but it ultimately also met inclusion criteria with $p = 0.17$.

Results

1,433 patients were included in our final analysis, of which 170 (11.9%) had device removal (Table 1). Subjects were 70.0 ± 14.9 years old, predominantly Caucasian (90.0%), treated in an urban hospital (94.1%), and married (54.2%). 11.8% were obese, and 18.0% smoked. There were no significant differences between the removal and non-removal cohorts apart from more urinary incontinence in the non-removal group (table 1, $p = 0.003$). 52.3% received a 1st gen cephalosporin (CPSN), 7.4% 2nd or 3rd gen CPSNs, 9.1% vancomycin, 13.4% aminoglycoside, 4.6% clindamycin, and 13.3% a fluoroquinolone. Multivariate logistic regression analysis in table 2 revealed fewer removals with vancomycin compared to first generation CPSN (OR=2.5, 95% CI [1.1,5.4]); fluoroquinolone (OR=2.8, [1.2, 6.7]); or second/third generation CPSNs (OR=2.6, [1.0, 6.7]).

LEGENDS:

TABLE 1: Demographics represented as n (%) unless otherwise specified; SD = standard deviation; Differences between study groups determined using Fisher's exact tests (categorical) and t-tests (numerical)

TABLE 2: *Only variables with pre-defined significance of $p < 0.2$ in univariate regression analysis were included in multivariate regression analysis; **Compared to vancomycin; OR = odds ratio.; CI = confidence interval.

Conclusion/Clinical Significance

Vancomycin was a superior prophylactic antibiotic compared to other commonly used antibiotics to prevent SNM device removal. While a prospective trial would help confirm this benefit, low device removal rates overall may make this impractical.

Patient Demographics and Comorbidities				
Variable (represented as n (%) unless otherwise stated)	Removal Cohort (n = 170)	Non-Removal Cohort (n = 1263)	Total (n = 1433)	p-value
Age (mean ± standard deviation)	63.0 ± 15.7	70.0 ± 14.8	63.0 ± 14.9	1.0
Race				0.8
Caucasian	153 (90.0)	1136 (89.9)	1289 (90.0)	
Black/African American	9 (5.3)	49 (3.9)	58 (4.1)	
Native American	3 (1.8)	34 (2.7)	19 (1.3)	
Other or Unknown	3 (1.8)	18 (1.4)	67 (4.7)	
Hospital Region				0.2
Urban	164 (96.5)	1185 (93.8)	1349 (94.1)	
Rural	6 (3.5)	78 (6.2)	84 (5.9)	
Prophylactic Antibiotic				0.21
1st Generation Cephalosporins	93 (12.4)	656 (87.6)	749 (100)	
Aminoglycosides	23 (12.0)	169 (88.0)	192 (100)	
Clindamycin	6 (9.1)	60 (90.9)	66 (100)	
Fluoroquinolones	27 (14.2)	163 (85.8)	190 (100)	
2nd and 3rd Generation Cephalosporins	14 (13.2)	92 (86.8)	106 (100)	
Vancomycin	7 (5.4)	123 (94.6)	130 (100)	
Comorbidities				
Acid-Base Disorder	1 (0.6)	4 (0.3)	5 (0.4)	0.5
Allergies	12 (7.0)	76 (6.0)	88 (6.1)	0.6
Genitourinary Atrophy	0 (0.0)	14 (1.1)	14 (1.0)	0.4
Urinary Retention	5 (2.9)	36 (2.9)	41 (2.9)	0.9
Circulatory	15 (8.8)	130 (10.3)	145 (10.1)	0.6
Coagulopathies	6 (3.5)	52 (4.1)	58 (4.1)	0.7
Cognitive Impairments	1 (0.6)	5 (0.4)	6 (0.4)	0.5
Cystitis	0 (0.0)	19 (1.5)	19 (1.3)	0.2
Diabetes	37 (21.8)	241 (19.1)	278 (19.4)	0.4
Gut Dysmotility/Inflammation	43 (25.3)	278 (22.0)	321 (22.4)	0.3
Dysuria	2 (1.2)	7 (0.6)	9 (0.6)	0.3
Electrolyte Disturbances	5 (2.9)	33 (2.6)	38 (2.7)	0.8
Hydronephrosis	11 (6.5)	68 (5.4)	79 (5.5)	0.6
Hypertension	52 (30.6)	408 (32.3)	460 (32.1)	0.7
Hyperlipidemia	26 (15.3)	249 (19.7)	275 (19.2)	0.2
Immobility	0 (0.0)	2 (0.2)	2 (0.1)	1.0
Immune Disorders	1 (0.6)	21 (1.7)	22 (1.5)	0.5
Liver Disease	6 (3.5)	22 (1.7)	28 (2.0)	0.1

Degenerative Joint Disease	15 (8.8)	116 (9.2)	131 (9.1)	0.9
Neoplasm/Lump	4 (2.4)	49 (3.9)	53 (3.7)	0.4
Obesity	15 (8.8)	154 (12.2)	169 (11.8)	0.3
Steroid Use	0 (0.0)	4 (0.3)	4 (0.3)	1.0
Sexually Transmitted Infections	2 (1.2)	6 (0.5)	8 (0.6)	0.2
Current Smoker	27 (15.9)	231 (18.3)	258 (18.0)	0.5
History of Thromboembolism	13 (7.7)	101 (8.0)	114 (8.0)	0.9
Urinary Frequency	35 (20.6)	335 (26.5)	370 (25.6)	0.1
Urinary Incontinence	4 (2.6)	108 (8.6)	112 (7.8)	0.003
Renal Disease/Inflammation	3 (1.8)	38 (3.0)	41 (2.9)	0.5

Table 2: Multivariable Logistic Regression for Predicting Device Removal

Variable*	Unadjusted OR	95% CI		Adjusted OR	95% CI	
Prophylactic Antibiotic Choice (compared to Vancomycin)						
First Generation Cephalosporin	2.5	1.1	5.5	2.5	1.1	5.4
Second and Third Generation Cephalosporins	2.7	1.0	6.9	2.6	1.0	6.7
Fluoroquinolone	2.9	1.2	6.9	2.8	1.2	6.7
Aminoglycosides	2.4	1.0	5.6	2.4	1.0	5.8
Clindamycin	1.8	0.6	5.5	1.7	0.6	5.4
Rural Hospital (compared to urban)	0.6	0.2	1.3	0.6	0.3	1.5
Liver Disease	2.1	0.8	5.2	2.12	0.9	5.5
Hyperlipidemia	0.7	0.5	1.1	0.8	0.5	1.3
Urinary Frequency	0.7	0.5	1.1	0.8	0.5	1.1
Urinary Incontinence	0.3	0.1	0.7	0.3	0.1	0.8