Case-Control study of VRE acquisition in a tertiary care hospital: testing the roles of antibiotic use, proton pump inhibitory use and colonization pressure

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Background

Vancomycin-resistant Enterococcus(VRE) is a leading cause of healthcare associated infections. VRE can asymptomatically colonize the gastrointestinal tract and colonization is a risk factor for subsequent sterile site infection. Active surveillance for colonization using rectal screening and contact precautions of colonized patients has been pursued by multiple institutions. In this setting, risk factors for converting from swab negative to swab positive have not been assessed.

Methods

- Retrospective matched case control study from 6/2013 – 12/2016
- Patients admitted to eight units were routinely screened on admission and weekly thereafter.
- **Cases (N=551):** had a negative swab followed by positive swab > 3 days after admission
  - Exclusion criteria – any positive VRE culture or previous positive VRE Screening swab prior to the start of the study
- **Controls (N=551):** had a negative swab followed by a repeat negative screening swab, and were matched 1:1 with a Case as follows:
  - From to time from admission to second swab(+/-5%)
  - Unit on which the second swab was performed
  - Date of admission(+/-365 days).
- Co-morbidity data, culture data, and antibiotic and proton pump inhibitor (PPI) days on therapy (DOT) and procedures were abstracted from the electronic medical record
- Bivariate analysis on individual procedures and comorbidities was preformed
  - A multivariate risk factor model was generated using conditional logistic regression
  - Those comorbidities and procedures which met a threshold of significance of p<0.2 were included into a multivariate model
  - Days of therapy for individual PPI use were included regardless of p-value
  - One or more days of classes of antibiotic were included regardless of p-value

Results

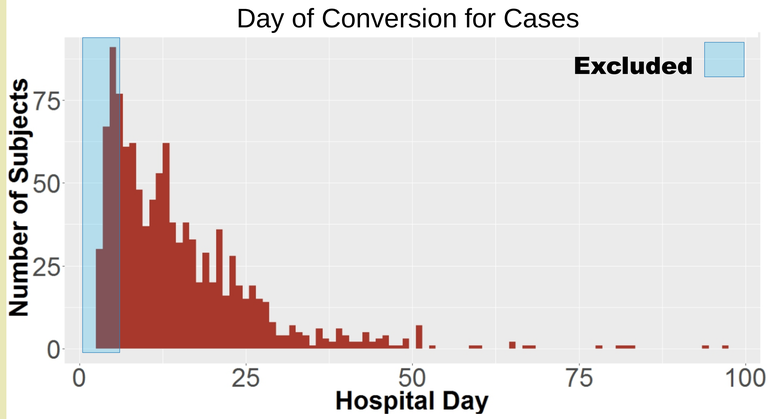

Figure 1 – Distribution of Day of Conversion for Cases

Selected Risk Factors for Bivariate Analysis

	control	case	OR	p-value
Colonization Pressure pt-days exp	45.9	48.2	1.0056	0.077
Outside Hospital Transfer	279	247	0.78	0.045
Time: Admission to Index swab	14.9	15	1.26	0.13
TMP-SMX	26	46	1.95	0.012
Vancomycin	358	421	1.94	1.1e-5
Anaerobic Antibiotic	433	493	2.74	3.2e-7
Any PPI	394	445	1.78	1.7e-4
Any Antibiotic	495	536	4.73	2.9e-6
Omeprazole	4.86	6.8	1.06	4.45e-7
Chronic Lung Disease	112	134	1.24	0.12
Congestive Heart Failure	79	105	1.47	0.027
GI Bleed	71	86	1.28	0.18
GI Tract Disruption	77	62	0.79	0.20
Hypertension	45	32	0.66	0.092
Metastatic Cancer	59	38	0.61	0.026
Neutropenia	181	205	1.36	0.056
Other Neurologic Disorder	64	85	1.4	0.062
Paralysis	12	20	1.64	0.20
Peripheral Vascular Disase	55	36	0.61	0.034
Pulmonary Vascular Disease	53	75	1.45	0.052
Renal Failure (Chronic)	76	93	1.25	0.18
Rheumatologic Disorder	15	24	1.57	0.19
Total Parenteral Nutrition	173	201	1.26	0.073
Non Surgical Procedure GI/GU	202	201	0.99	0.95
Any Surgical Procedure	315	336	1.2	0.15
Acute Central Line	395	348	0.66	0.0022

Table 1-Comorbidities and procedures with significance p<0.2 in Bivariate analysis included in multivariate model

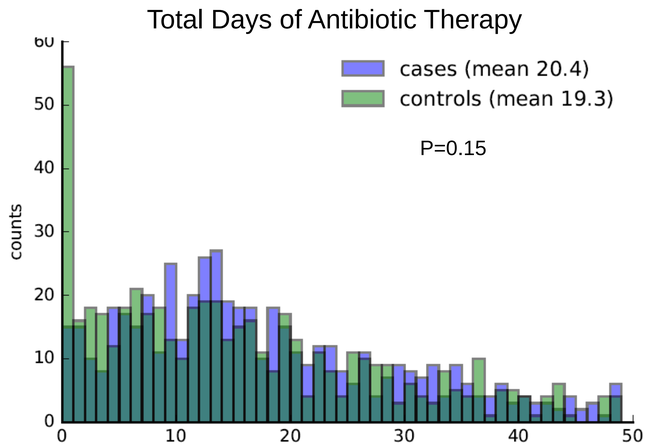

Figure 2 –Mean Days of Therapy for Antibiotic therapy for Cases and Controls show no significant difference

Multivariate Model

Factor	OR	p-value
TPN	1.39	0.033
Hypertension	0.42	0.011
Renal Failure	1.76	0.015
Vancomycin	1.73	0.0031
2nd Gen Cephalosporin	0.46	0.009
Omeprazole	1.06	1.52E-05
Surgery Prior To Conversion	1.39	0.036
Acute CVC Prior To Conversion	0.7	0.024

Table 2 – Selected Comorbidities that achieved significance in multivariate model.

- Comorbidities associated with converting from swab negative to swab positive included chronic renal failure (OR1.76) and hypertension (OR 0.42)
- Interventions shown to be risk factors were use of TPN (OR 1.40) and any surgery (OR 1.38)
- Acute placement of temporary CVC was associated with a decreased risk (OR 0.7)
- Having one or more DOT of vancomycin conferred increased risk (OR 1.73).
- Having one or more DOT of 2nd generation Cephalosporin was shown to be protective (OR 0.46)
- Each Omeprazole DOT conferred an OR of 1.06

Conclusions

- Decreasing PPI use may decrease transmission in the hospital
- Preventing the first dose of vancomycin should be considered to decrease transmission in the hospital
- Colonization pressures from patients identified to be carriers and placed in contact precautions did not confer an increased risk.
- The use of 2nd generation cephalosporin in our hospital is associated with increased risk of VRE acquisition. The mechanism is not immediately clear and unidentified confounders should be sought