Risk Factors for a Central Line Associated Bloodstream Infection Amongst Hospitalized Patients with COVID

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Background

- Central line-associated bloodstream infections (CLABSI) are serious healthcare-associated infections (HAIs)
- During the COVID pandemic, we observed an increased incidence of CLABSIs in our healthcare system

Primary Objective

- Identify risk factors for the development of a CLABSI in inpatients diagnosed with COVID

Methods

- Single-center, matched case-control study between 3/2020 - 12/2020
- Included patients diagnosed with COVID who were at risk for developing a CLABSI
- Patients at risk for developing a CLABSI had a central line present for >2 consecutive calendar days while admitted to an inpatient unit
- Cases: diagnosed with a CLABSI
- Controls: not diagnosed with a CLABSI
- Cases and controls: 1:4 matched based on age at admission (+/- 5 years) and COVID diagnosis date (+/- 45 days)
- Statistical analyses were performed using SAS version 9.4
- Univariate and multivariate analyses used generalized estimating equations to account for clustering by case-control matches

References

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Results

Table 1: Patient characteristics at time of COVID Diagnosis

	COVID patients at risk for developing a CLABSI (N=174)	Diagnosed with CLABSI (N=35)	Not diagnosed with CLABSI (N=139)	p-value
Sex, n (%)				0.70
Female	74 (42.5%)	14 (40.0%)	60 (43.2%)	
Male	100 (57.5%)	21 (60.0%)	79 (56.8%)	
5-category race, n (%)				0.10
White	93 (53.4%)	13 (37.1%)	80 (57.6%)	
Black	30 (17.2%)	9 (25.7%)	21 (15.1%)	
Asian	29 (16.7%)	7 (20.0%)	22 (15.8%)	
American Indian, Pacific Islander	3 (1.7%)	1 (2.9%)	2 (1.4%)	
Other/Declined/Unknown	19 (10.9%)	5 (14.3%)	14 (10.1%)	
2-category race, n (%)				0.04
White	93 (53.4%)	13 (37.1%)	80 (57.6%)	
All other races	81 (46.6%)	22 (62.9%)	59 (42.4%)	
Ethnicity, n (%)				0.94
Hispanic or Latino	9 (5.2%)	2 (5.7%)	7 (5.0%)	
Not Hispanic or Latino	157 (90.2%)	31 (88.6%)	126 (90.6%)	
Other/Declined/Unknown	8 (4.6%)	2 (5.7%)	6 (4.3%)	
Age at admission, median (IQR)	61 (55-70)	59 (55-70)	61 (55-70)	0.47
Diabetes, n (%)	98 (56.3%)	26 (74.3%)	72 (51.8%)	0.05
Malignancy, n (%)	18 (10.3%)	4 (11.4%)	14 (10.1%)	0.67
BMT, n (%)	4 (2.3%)	1 (2.9%)	3 (2.2%)	0.84
SOT, n (%)	18 (10.3%)	4 (11.4%)	14 (10.1%)	0.85
CKD, n (%)	86 (49.4%)	16 (45.7%)	70 (50.4%)	0.72
ESRD, n (%)	30 (17.2%)	7 (20.0%)	23 (16.5%)	0.69
HIV, n (%)	11 (6.3%)	2 (5.7%)	9 (6.5%)	0.82
CAD, n (%)	59 (33.9%)	13 (37.1%)	46 (33.1%)	0.66
HTN, n (%)	146 (83.9%)	31 (88.6%)	115 (82.7%)	0.26
CHF, n (%)	71 (40.8%)	16 (45.7%)	55 (39.6%)	0.58
Liver cirrhosis, n (%)	37 (21.3%)	8 (22.9%)	29 (20.9%)	0.81
Obesity, n (%)	87 (50.0%)	19 (54.3%)	68 (48.9%)	0.69
COPD, n (%)	36 (20.7%)	6 (17.1%)	30 (21.6%)	0.58

Table 2: In-Hospital patient characteristics during admission for COVID

	COVID patients at risk for developing a CLABSI (N=174)	Diagnosed with CLABSI (N=35)	Not diagnosed with CLABSI (N=139)	p-value
Number of days at risk for CLABSI, median (IQR)	18 (11-27)	17 (12-24)	18 (9-29)	0.41
Length of stay (Days, median (IQR)	20 (12-35)	37 (24-46)	18 (9-29)	0.001
Discharge disposition (%)				0.01
Acute Hospital	26 (14.9%)	6 (17.1%)	20 (14.4%)	
Expired	33 (19.0%)	11 (31.4%)	22 (15.8%)	
Home	50 (28.7%)	2 (5.7%)	48 (34.5%)	
Hospice	3 (1.7%)	0 (0%)	3 (2.2%)	
Other	4 (2.3%)	0 (0%)	4 (2.9%)	
Rehab or other long term facility	58 (33.3%)	16 (45.7%)	42 (30.2%)	
Prescribed anti-COVID therapeutics				
Remdesivir, n (%)	83 (47.7%)	15 (42.9%)	68 (48.9%)	0.46
Steroids, n (%)	122 (70.1%)	29 (82.9%)	93 (66.9%)	0.05
Tocilizumab, n (%)	27 (15.5%)	9 (25.7%)	18 (12.9%)	0.09
Clinical Trial, n (%)	90 (51.7%)	17 (48.6%)	73 (52.5%)	0.61
Azithromycin, n (%)	54 (31.0%)	11 (31.4%)	43 (30.9%)	0.90
Ivermectin, n (%)	7 (4.0%)	1 (2.9%)	6 (4.3%)	0.58
ImmuneGlobulin, n (%)	1 (0.6%)	1 (2.9%)	0 (0%)	0.20
Pressor use, n (%)	113 (64.9%)	27 (77.1%)	86 (61.9%)	0.10
TPN, n (%)	10 (5.7%)	4 (11.4%)	6 (4.3%)	0.22
CCRT, n (%)	20 (11.5%)	6 (17.1%)	14 (10.1%)	0.34
Intermittent hemodialysis, n (%)	20 (11.5%)	6 (17.1%)	14 (10.1%)	0.34
Chemotherapy, n (%)	4 (2.3%)	0 (0%)	4 (2.9%)	0.58
Hemoglobin A1C, median (IQR)	7 (6-8)	7 (6-8)	6 (6-8)	0.78
Neutrophil, median (IQR)	7 (5-10)	9 (6-14)	7 (5-9)	0.05
CRP, median (IQR)	72 (24-91)	29 (16-80)	79 (41-92)	0.07
Max procalcitonin, median (IQR)	0.7 (0.1-3.6)	1.1 (0.2-4.6)	0.6 (0.1-3.2)	0.97
Max ferritin, median (IQR)	599 (306-1699)	1016 (599-5132)	490 (234-1291)	0.19
First admission for COVID, n (%)	104 (59.8%)	22 (62.9%)	82 (59.0%)	0.67
Admission unit, n (%)				0.25
Emergency Medicine	25 (14.4%)	3 (8.6%)	22 (15.8%)	
Intensive Care Units	40 (23.0%)	13 (37.1%)	27 (19.4%)	
Medical and Surgical Units	86 (49.4%)	14 (40.0%)	72 (51.8%)	
Missing	21 (12.1%)	4 (11.4%)	17 (12.2%)	
Other	2 (1.1%)	1 (2.9%)	1 (0.7%)	
Antibiotics received				
Cephalosporins, n (%)	55 (31.6%)	10 (28.6%)	45 (32.4%)	0.61
Carbapenems, n (%)	20 (11.5%)	5 (14.3%)	15 (10.8%)	0.62
Vancomycin, n (%)	126 (72.4%)	34 (97.1%)	92 (66.2%)	0.004
Piperacillin/tazobactam, n (%)	101 (58.0%)	24 (68.6%)	77 (55.4%)	0.15
Fluoroquinolones, n (%)	16 (9.2%)	3 (8.6%)	13 (9.4%)	0.95

Table 3: Multivariate logistic regression analysis for the outcome of CLABSI (cases) versus non-CLABSI (controls)

	Odds Ratio	Lower 95% CI	Upper 95% CI	p-value
White Race	0.98	0.94	1.02	0.37
Length of Stay	1.002	1.000	1.003	0.02
Discharge Disposition				
Acute Hospital	0.98	0.89	1.08	0.75
Expired	1.04	0.92	1.18	0.55
Home	0.96	0.89	1.03	0.25
Rehab or other long term facility	1.00			

- 174 patients diagnosed with COVID were at risk for CLABSI. 35 (20.1%) developed a CLABSI (cases), 139 (79.9%) patients did not (controls)
- Median number of days of risk for CLABSI was 17 and 18 days for cases and controls, respectively (p=0.41)
- Cases were more commonly admitted to the ICU, but this trend was non-significant

Univariate analysis:

- The development of a CLABSI was associated in univariate analysis with non-white race (p=0.043) and diabetes (p=0.05)
- Among cases, there was a trend towards receipt of tocilizumab (p=0.09). Cases more frequently received vancomycin (p=0.004) and corticosteroids (p=0.05)
- Median number of days for length of stay (LOS) was 37 days for cases and 18 days for controls (p=0.001)

Multivariate analysis:

- In a multivariate analysis only the length of stay was significantly associated with development of a CLABSI (p=0.02), but the clinical relevance of this association is unclear given the odds ratio of 1.002 [95% CI 1.000-1.003]

Conclusions

- Risk factors associated in univariate analysis for the development of a CLABSI among COVID patients include non-white race, diabetes, and receipt of vancomycin and steroids.
- COVID patients who develop CLABSI were more likely to have a prolonged length of stay and were less likely to be discharged home.
- Our multivariate analysis did identify LOS as a risk factor for CLABSI among patients with COVID but the clinical significance will need to be investigated further

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