Factors Predicting Bacterial Coinfection in Hospitalized COVID-19 Patients

Yi Guo, PharmD, BCIDP[1,5], Kelsie Cowman, MPH[2,5] , Hongkai Bao, PharmD, BCIDP[1], Victor Chen, PharmD, BCPS, BCIDP[3], Mimi Kim, Sc.D.[4], Xianhong Xie, PhD[4], Mei H. Chang, PharmD, BCPS, BCCCP, BCIDP[1], Rachel Bartash, MD[5], Meena Azeem, MD[6], Priya Nori, MD[5]

[1]Department of Pharmacy, Montefiore Medical Center, Bronx, NY, USA, [2]Network Performance Group, Montefiore Health System, Bronx, NY, USA, [3]Department of Pharmacy, UC San Diego Health, San Diego, CA, USA, [4]Division of Biostatistics, Albert Einstein College of Medicine, Bronx, NY, USA [5]Department of Medicine, Division of Infectious Diseases, Montefiore Medical Center, Albert Einstein College of Medicine, Bronx, NY, [6]Department of Medicine, Division of Infectious Diseases, Robert Wood Johnson University Hospital, New Brunswick, NJ, U.S.A

Contact Information
Yi Guo, PharmD, BCIDP
yiguo@montefiore.rg

IDWeek
Poster 276
Abstract 1263608

Background

- Multiple studies indicating a low prevalence of bacterial coinfection in coronavirus disease 2019 (COVID-19) patients.[1,2]
- The majority of hospitalized COVID-19 patients receive one or more antibiotics. [1,2]
- Patients with coinfection usually have multiple risk factors and poor clinical outcomes.[2,3]
- Montefiore Medical Center (MMC), a 1500-bed academic teaching hospital, serves a culturally and econocially diverse community of more than 1.4 million residents during COVID-19 pandemic in Bronx, NY

Objective

- To assess the factors predicting bacterial coinfection in hospitalized COVID-9 patients

Methods

- **Study Design**:
  - Retrospective, case control study
  - Study time frame: March 1, 2020-October 31, 2020 at MMC
  - Identify COVID-19 patients with bacterial co-infections vs. randomly selected COVID-19 patients without co-infections (matched on month of admission)
- **Inclusion criteria:**
  - Adult patients with positive SARS-CoV-2 PCR results with and without a positive microbiology result from cultures (i.e., blood, respiratory, peritoneal, etc.) during the same admission.
- **Exclusion criteria:**
  - Blood cultures positive for common skin contaminants
  - Respiratory cultures positive for yeast, normal oral or respiratory flora, mixed bacterial species, and skin contaminants.
  - Patients with positive urine cultures alone without concurrent bacteremia
- **Primary endpoint:**
  - Coinfection status
- **Secondary endpoint:**
  - Hospital mortality, antibiotic days of therapy (DOT), and *C. difficile* infection
- **Statistical Analysis:**
  - Bivariate analysis: risk factors and coinfection status and coinfection status conducted by means of the T-test and chi-square test
  - Multivariable analysis performed by fitting logistic regression models. Final model included only risk factors that remained significant at p<0.05.

Results

Table 1. Bivariate Table of Predictors of Interest by Co-infection

	Coinfection		P-value
	No (n = 150)	Yes (n = 150)	
Gender, n (%)			0.48
Male	85 (56.7)	91 (60.7)	
Female	65 (43.3)	59 (39.3)	
Age, mean (SD)	60.49 (16.53)	61.97 (14.10)	0.41
Race/Ethnicity, n (%)			0.003
Hispanic/Latino	53 (35.3)	62 (41.3)	
Non Hispanic Black	31 (20.7)	43 (28.7)	
Non Hispanic White	9 (6.0)	9 (6.0)	
Non Hispanic Asian	4 (2.7)	11 (7.3)	
Non Hispanic Other	4 (2.7)	5 (3.3)	
Unknown/missing	49 (32.7)	20 (13.3)	
Body mass index, mean (SD)	30.14 (7.40)	30.48 (7.67)	0.70
Immunosuppressive conditions, n (%)			
Active malignancy	7 (4.7)	6 (4.0)	0.78
Bone marrow transplant	1 (0.7)	1 (0.7)	1.00
Chronic diabetes	60 (40.0)	77 (51.3)	0.049
Chronic receipt of immunosuppressive medication	11 (7.3)	9 (6.0)	0.64
Hepatitis C	3 (2.0)	3 (2.0)	1.00
Human immunodeficiency virus	1 (0.7)	3 (2.0)	0.62
Rheumatologic disease	5 (3.3)	3 (2.0)	0.72
Systemic lupus erythematosus	1 (0.7)	0 (0)	1.00
Solid organ transplant	7 (4.7)	5 (3.3)	0.56
Other	9 (6.0)	10 (6.7)	0.81
Any comorbid condition	73 (48.7)	94 (62.7)	0.01
Charlson index, median (IQR)	3 (1-5)	3 (2-5)	0.32
COVID-19 treatment received, n (%)			
Biologic	9 (6.0)	21 (14.0)	0.02
Steroid	50 (33.3)	105 (70.0)	<0.0001
Biologic duration of treatment (n = 30), median (IQR)	1 (1-2)	1 (1-4)	0.27
Steroid duration of treatment (n = 155), median (IQR)	6 (4-10)	8 (3-11)	0.73
Central line, n (%)	23 (15.3)	101 (67.3)	<0.0001
Procalcitonin at admission, median (IQR)	0.2 (0.1-1.2)	0.6 (0.2-2.4)	<0.0001
C-reactive protein at admission, median (IQR)	11.3 (4.5-18.5)	16.2 (8.1-25.4)	<0.0001
White blood cell at admission, median (IQR)	7.5 (5.4-11.3)	9.1 (6.4-13.4)	0.004
Receipt of antibiotic(s) within 30 days prior to the FIRST positive or negative bacterial culture, n (%)	56 (37.3)	122 (81.3)	<0.0001
X-ray finding for pneumonia, n (%)			0.04
Yes	128 (85.3)	141 (94.0)	
Not available	4 (2.7)	1 (0.7)	
Location prior to admission, n (%)			0.55
Home	112 (74.7)	122 (81.3)	
Nursing home/group home/rehab	26 (17.3)	18 (12.0)	
Recent admission	2 (1.3)	2 (1.3)	
Transfer from outside hospital	9 (6.0)	8 (5.3)	
Others/Unknown/missing	1 (0.7)	0 (0)	
Intensive care unit admission (prior to coinfection), n (%)	24 (16.0)	95 (63.3)	<0.0001
Length of stay (days), median (IQR)	9 (5-15)	21 (14-36)	<0.0001
Time from admission to coinfection (days), median (IQR)	NA	9 (5-14)	NA

Table 2. Logistic Regression Model Result on Co-infection

Variable	Odds Ratio	95% CI	P-value
Central line	5.43	(2.67-11.06)	<.0001
Receipt of antibiotics within 30 days	5.30	(2.80-10.04)	<.0001
Intensive care unit admission (prior to coinfection)	3.61	(1.72-7.57)	0.001
Any comorbid condition	2.70	(1.39-5.26)	0.003
Covid-19 treatment - steroid	2.66	(1.43-4.94)	0.002

Results (cont.)

Table 3. Patient Outcomes

	Coinfection		P-value
	No (n = 150)	Yes (n = 150)	
Outcomes			
Mortality	17 (11)	84 (56)	<0.0001
C. difficile during admission	0 (0)	6 (4)	0.03
Organism			
Positive Culture Source	-		
Blood	-	68	
Respiratory	-	113	
Peritoneal fluid	-	1	
Other	-	4	
Multidrug resistant organisms	-	61 (41%)	
Antibiotics			
Days of therapy, average	4.0	10.5	<0.0001
Received empiric antibiotics	111 (74)	149 (99)	<0.0001
Top 5 empiric antibiotics			
Azithromycin	20 (13)	7 (5)	
Ceftriaxone	78 (52)	17 (11)	
Cefepime	6(4)	35 (23)	
Piperacilin/tazobactam	34 (23)	74 (49)	
Vancomycin	33 (22)	96 (64)	
Empiric antibiotic(s) covered cultured organism(s)	0	108 (42)	
Empiric antibiotics changed to cover cultured organism(s)	0	110 (73)	
Received appropriate antibiotics less than 1 hour after culture results	NA	92 (61)	
Top 5 targeted antibiotics			
Cefazolin		21	
Ceftriaxone		19	
Cefepime		22	
Meropenem		16	
Vancomycin		16	

Discussion

- Central line, prior antibiotic exposure within 30 days, prior ICU admission, steroid use, and having any co-morbid condition were significantly associated with the development of coinfection
- Mortality was higher in patients with coinfection
- Average antibiotic DOT and C. difficile rate were significantly higher in coinfected patients

Conclusions

- Understanding risk factors most predictive of bacterial coinfection can guide empiric antimicrobial therapy and targeted stewardship interventions
- Developing co-infection scores may be useful for future inpatient surges.

References

1. Vaughn V, et al. Clin Infect Dis. 2021 May 18;72(10):2533-e541
2. Nori, P, et al. Infect Control Hosp Epidemiol. 2021 Jan;42(1):84-88
3. Kubin C, et al. Open forum Infect Dis. 2021 May 5;8(6): ofab201.doi: 10.1093/ofid/ofab201.