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Characterization of antibiotic use and culture data in COVID-19 pandemic patients

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OBJECTIVE

The objective of this study was to identify the prevalence of bacterial, viral, or fungal coinfections and to describe the empiric antimicrobial regimens in patients with confirmed COVID-19.

BACKGROUND

- COVID-19 is an infection caused by a novel coronavirus (SARS-CoV-2) causing a respiratory infection that can be spread easily from person-to-person.
- Bacterial and viral coinfections have been studied and are well-known in relation to other viral infections, such as influenza.[1]
- Current literature has shown little association between bacterial, viral or fungal co-infections with COVID-19.[2,3,4]
- Recently, a survey completed around the world found that only 29.1% of providers elected to not prescribe initial antibiotics for patients presenting with COVID-19.
  - Most providers initiated therapy to cover for *Staphylococcus aureus*, a pathogen that is known to cause bacterial superinfection in patients with influenza.[5]
- The Infectious Disease Society of America suggests that the benefits of starting antimicrobial therapy early in patients with COVID-19 may not outweigh the risks of increased bacterial resistance.[6]

METHODS

- Retrospective chart review conducted on inpatients with confirmed COVID-19 from March 1, 2020 to August 5, 2020
- **Inclusion Criteria:** Positive COVID-19 polymerase chain reaction (PCR) test and received antibiotics while admitted to the facility
- **Exclusion Criteria:** Initiation of antibiotics for reasons other than relating to the concern for possible coinfection with COVID-19
- **Primary Outcome:** Prevalence of patients with bacterial, viral or fungal respiratory coinfections
  - Cultures within the first 48 hours of admission were included in the analysis
- **Secondary Outcomes:**
  i. Co-infectious organisms identified
  ii. Mechanical ventilation requirement
  iii. Inpatient mortality
  iv. Empiric antibiotic regimens used
  v. Duration of inpatient antibiotic therapy

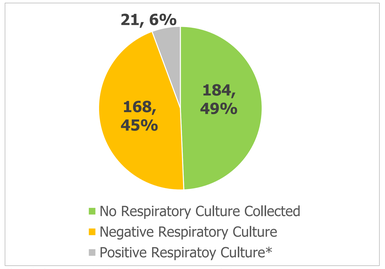
RESULTS

Baseline Characteristics

Characteristic	n = 373
Age (n, %)	
0 – 17 years	7 (1.9%)
18 – 64 years	167 (44.8%)
≥ 65 years	199 (53.4%)
Male (n, %)	190 (50.9%)
Female (n, %)	183 (49.1%)

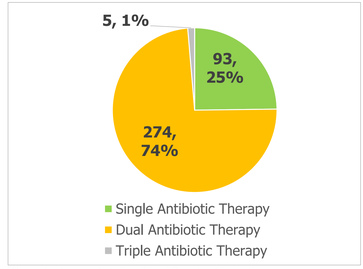
RESULTS

Percentage of Respiratory Coinfections



*coinfections include: 15 bacterial, 5 viral, and 1 fungal

Number of Antibiotics Initiated



One patient was initiated on four different antibiotic therapies.

Pathogens Identified in Patients with a Positive Respiratory Culture

Pathogen		Pathogen	
Bacterial† (n)		**Viral** (n)	
Staphylococcus aureus (MSSA)	5	Coronavirus (NL63)	2
Staphylococcus aureus (MRSA)	3	Coronavirus (OC43)	1
Klebsiella pneumoniae	3	Influenza B	2
Haemophilus influenzae	2	Rhinovirus/ Enterovirus	1
Escherichia coli	2		
ESBL *Escherichia coli*	2		
Pseudomonas aeruginosa	2	**Fungal** (n)	
		Aspergillus niger	1

†Bacterial pathogens identified in only one patient: *Providencia startii, Acinetobacter baumannii, Streptococcus pneumoniae, Serratia marcescens, Enterobacter cloacae, Mycobacterium fortuitum*

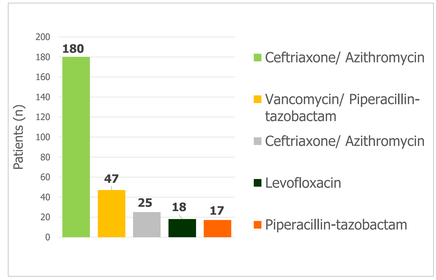
Secondary Outcomes Related to Presence of Coinfection

	Non-respiratory Coinfections (n = 81)	Respiratory Coinfections (n = 21)	Without Detected Coinfection (n = 271)
Duration of Hospitalization (median days, IQR)	7.4 (4.8 – 13.7)	12.3 (4.6 – 19.2)	6.2 (3.2 – 10.9)
Type of Coinfection* (n, %)			
Bloodstream	35 (43.2%)	4 (19.0%)	*n/a*
Urinary Tract	46 (56.8%)	7 (33.3%)	*n/a*
Other†	10 (12.3%)	0 (0.0%)	*n/a*
Laboratory Values± (median, IQR)			
WBC	7.3 (4.1 – 10.7)	8.2 (4.1 – 12.5)	6.8 (5.2 – 9.0)
CRP	14.1 (6.9 – 20.1)	8.5 (3.2 – 21.1)	8.5 (4.9 – 15.2)
Procalcitonin	0.28 (0.15 – 0.63)	0.19 (0.13 – 0.91)	0.15 (0.09 – 0.29)
Temperature	99.2 (98.2 – 101.4)	99.4 (98.6 – 100.2)	99.5 (98.6 – 101.0)
Ventilator Use¥ (n, %)	28 (27.5%)	12 (57.14%)	38 (14.0%)
Inpatient Mortality (n, %)	20/102 (19.6%)	6/21 (28.6%)	30/271 (11.1%)

*Including patients with more than one detected coinfection.
†Other infections including wounds (abdominal, amputation, etc.), liver abscess, intra-abdominal infection, *C. difficile*
±Laboratory values collected on admission
¥Patients requiring mechanical ventilation at any point during their admission

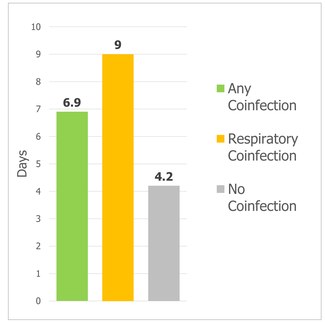
RESULTS

Most Common Antibiotic Regimens Initiated



Other antibiotics initiated either monotherapy or in combination: doxycycline, meropenem, ertapenem, ampicillin/ampicillin-sulbactam, cefepime, aztreonam, clindamycin, linezolid, gentamicin, metronidazole, amoxicillin-clavulanate and cephalexin.

Duration of Antibiotic Use



DISCUSSION & CONCLUSIONS

- Out of the 373 patients included in the study, 189 patients (51%) were tested for a respiratory coinfection, with 21 of those patients (11.1%) testing positive for a detected respiratory pathogen.
- The low number of identified respiratory coinfections and baseline characteristics (i.e. WBC) indicates that empiric antibiotics for a respiratory coinfection are likely not needed upon admission. However, clinical correlation with chest x-ray and possible sputum production is warranted.
  - In patients with a suspected respiratory coinfection, the culture data suggests that ceftriaxone monotherapy would be an appropriate empiric regimen.
  - Of note, it is unknown if the bacterial pathogens identified in the respiratory cultures were responsible for a secondary infection, were contaminants, or if they were colonizers of the respiratory tract.
- It appears that patients with respiratory coinfections on admission were more likely to need mechanical ventilation and had a higher rate of mortality during their hospital admission than those without a respiratory coinfection, indicating the dangers of bacterial superinfections with COVID-19. However, this data does not reflect additional coinfections that may have been acquired during their hospitalization.
- Lastly, the findings suggested that we currently have de-escalation strategies in place to prevent unnecessary use of antibiotics, as patients without a coinfection had shorter durations of antibiotic use. It is recommended that pharmacists and physicians continue to diligently eliminate unnecessary antibiotic therapy earlier on in the course to avoid unnecessary exposure.

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Disclosure
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