Utility of Tracheal Aspirates in Guiding Antibiotic Use in Mechanically Ventilated Patients with COVID-19

Denver Health Medical Center, Denver, CO
Katherine C. Shihadeh, PharmD, BCIDP; Axel Vazquez Deida, PharmD; Cory Hussain, MD; Anna Neumeier, MD; Timothy C. Jenkins, MD

Office: 790 Delaware St MC 0056
Denver, CO 80204
katherine.shihadeh@dhha.org
Phone: 303-602-6986

Background

- In critically ill patients with COVID-19 it is difficult to determine the presence of bacterial co-infection; therefore, many patients receive antibiotics until a bacterial infection can be ruled out.
- To minimize aerosolization of SARS-CoV-2, non-invasive sampling, such as endotracheal aspiration (ETA), is preferred over invasive techniques.

Purpose

- The purpose of this study is to determine the diagnostic yield of ETA and effect of ETA on antibiotic management in patients with COVID-19.

Methods

- This retrospective analysis included patients admitted to the intensive care unit (ICU) from March 1 to May 31, 2020 who tested positive for SARS-CoV-2.
- Patients who did not receive mechanical ventilation were excluded.
- Data were extracted from electronic medical records.
- When ETA was performed, records were manually reviewed to determine diagnostic yield and effect on antibiotic management.

- **The primary outcome is the frequency of initiation, change, no change, or discontinuation of antibiotics based on ETA results.**

Definitions:

- Diagnostic yield: ETA result with a plausible respiratory pathogen in a quantity of moderate or many
- Plausible respiratory pathogens exclude normal flora, yeast, coagulase-negative *Staphylococcus sp.* and *Enterococcus sp.*
- Antibiotic initiation: antibiotic was started in a patient who was not receiving an antibiotic prior to ETA
- Antibiotic change:
  - De-escalation: antibiotic was changed to an antibiotic with a narrower spectrum of activity
  - Escalation: antibiotic was changed to an antibiotic with a broader spectrum of activity
- Antibiotic no change: current antibiotic was not changed OR a patient not receiving antibiotics remained off antibiotics
- Antibiotic discontinuation: all antibiotics were discontinued

Results

Table 1. Patient demographics and clinical characteristics

	n=76
Age – yr, average ± SD	58 ± 15
Male – n (%)	57 (75)
Race or ethnic group - n (%)	
Hispanic or Latino	48 (63)
White	12 (16)
Black	11 (14)
Other	5 (7)
Body mass index, median (IQR)	30.6 (26.5, 37.3)
History of smoking – n (%)	34 (45)
No. of coexisting conditions – n (%)	
None	10 (13)
1	9 (12)
2 or more	57 (75)
Coexisting conditions – n (%)	
Hypertension	44 (58)
Obesity	43 (57)
Diabetes	36 (47)
Chronic respiratory disease	25 (33)
Cardiovascular disease	12 (16)
Chronic kidney disease	6 (8)
Immunocompromised	5 (7)
Temperature (max), average ± SD	101.5 ± 1.8
White blood cell count (max), average ± SD	11.6 ± 5.8
Procalcitonin (max), median (IQR), n=64	0.77 (0.3, 1.8)
Length of hospitalization – d, median (IQR)	18 (14, 25)
Receipt of vasopressors – n (%)	45 (59)
ARDS – n (%)	55 (72)
Receipt of antibiotics – n (%)	74 (97)
Days of antibiotics, median (IQR)	11 (7, 21)
In-hospital mortality – n (%)	25 (33)

SD – standard deviation, IQR – interquartile range, ARDS – acute respiratory distress syndrome
Temperature (max), white blood cell count (max), procalcitonin (max) – maximum values within 24 hours of antibiotic initiation or ICU admission if no antibiotics were administered

Table 2. Diagnostic yield

	n=76
Tracheal aspirate diagnostic yield (n=100)	21
Tracheal aspirate led to a change in antibiotic management (n=100)	47
Respiratory culture – n (%)	61 (80)
Tracheal aspirate	55 (72)
1 tracheal aspirate	27 (36)
2 tracheal aspirates	11 (14)
3 or more tracheal aspirates	17 (22)
BAL or mini BAL	28 (37)
Sputum	5 (7)

Figure 1. Patient flow

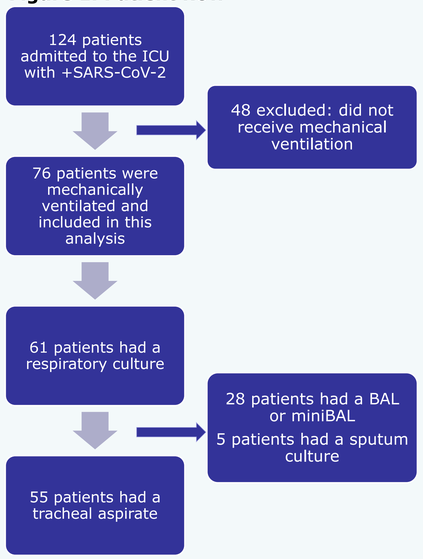


Figure 2. Effect of ETA on antibiotic management, n=100 ETAs

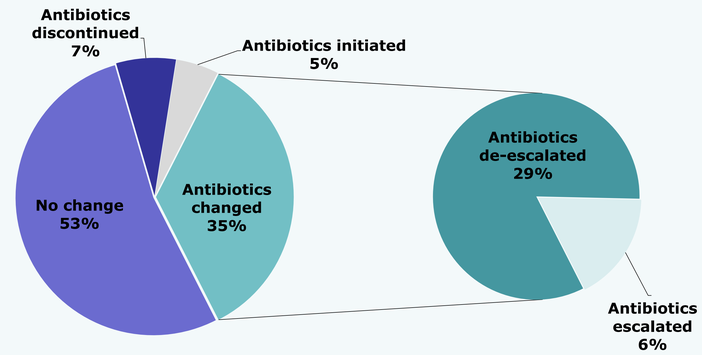
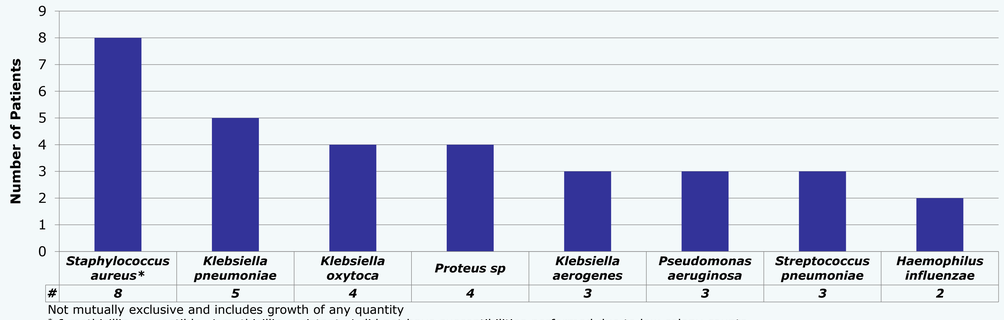


Figure 3. Number of patients with at least one ETA yielding the following pathogens



Not mutually exclusive and includes growth of any quantity
* 6 methicillin-susceptible, 1 methicillin-resistant, 1 did not have susceptibilities performed due to low colony counts
31 patients grew normal flora
6 patients grew other pathogens including 1 *Enterococcus sp*, 1 *Enterobacter cloacae*, 1 *E. coli*, 1 *Stenotrophomonas maltophila*, 2 not otherwise specified lactose fermenting gram-negative bacilli

Conclusions

- The diagnostic yield of ETA in mechanically ventilated patients with COVID-19 was low. Furthermore, ETA results led to a change in antibiotics less than half of the time.
- The use of ETA to diagnose bacterial co-infection and guide antibiotic therapy in patients with COVID-19 should be weighed against the risk of using a more invasive sampling technique vs the benefit of potential for increased diagnostic yield. Another conclusion may be to forgo ETA if the result is unlikely to change management.