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Evaluation of Multiplex PCR Panel for the Microbiologic Diagnosis of Pneumonia in Hospitalized Patients: A Retrospective Analysis from an Academic Medical Center

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A. BACKGROUND

- Based on the 2019 ATS/IDSA pneumonia guidelines, a microbiologic work-up is recommended only for hospitalized patients with severe pneumonia due to limitations of the available diagnostic tests.[1]
- Multiplex PCR assays have the potential to overcome limitations of traditional diagnostic tests.[2]
- We conducted a retrospective cohort study to quantify the changes in the diagnostic yield of microbiologic work-up with the use of the BioFire® FilmArray® pneumonia Panel and the potential for antimicrobial stewardship from its incorporation in clinical practice.

B. METHODS

Study Design:

- We conducted a retrospective cohort study at the NYU Langone Medical Center.
- **Study period:** May 2019- January 2020.
- The patients who had sputum specimens sent to the microbiology laboratory for bacterial culture were reviewed twice daily to select those with radiographic and clinical criteria of pneumonia.
- **Sputum specimens containing ≥10 epithelial cells** per low power field in direct microscopy examination were **discarded** and not considered for further analysis, per standard of care .
- In included patients, the BioFire® FilmArray® Pneumonia panel was run within 24 hours of patient selection.
- A **cutoff of ≥10^5 copies/mL was applied** for semiquantitative bacterial assays.

Outcomes of interest:

- The **main outcome of interest** was the **percentage of patients for whom a microbiological diagnosis was attained** with the use of the BioFire® FilmArray® pneumonia panel.
- The **secondary outcome of interest** was the potential of the addition of the BioFire® FilmArray® pneumonia panel to **change the empiric antimicrobial therapy prescribed at the time of sputum specimen collection**, including either **adjustment** of the prescribed antibiotics or opportunity for antimicrobial **de-escalation**.

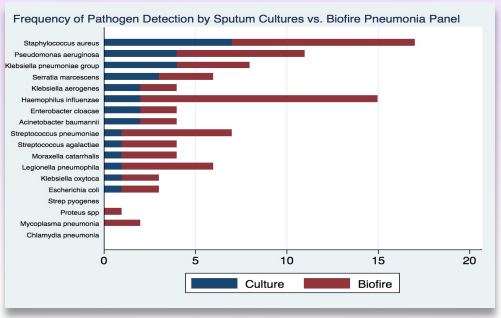
C. RESULTS

- 70 high quality sputum samples from **70 unique patient-hospitalizations** of patients admitted with clinical and radiographic findings suggestive of pneumonia with no other obvious explanation of their presentation were included in the final analysis.
- **15 patients** (21.4%) had sputum specimens submitted **prior to initiation of antibiotics**, while for the remaining 55 the sputum sample was collected while on antibiotics for a median of 20h (IQR 9-44).
- In addition to bacterial cultures, 11 patients (15.7%) had *Legionella pneumophilia* sputum culture.
- **Based on sputum cultures a microbiologic diagnosis was achieved in 29 patients (41%).**
- The panel detected all 31 organisms that grew in the 29 positive sputum cultures.
- **12 resistance genes** were also detected in **11 different patients**; 9 mecA/C, MREJ genes and 3 CTX-M genes.

Patient Characteristics	No. (%) or Median (IQR)
Age (years)	70 (53.5-81.8)
Gender	
Female	27 (38.6%)
Male	43 (61.4%)
Pneumonia Severity Index	
Class I-II	19 (27.2%)
Class III	8 (11.4%)
Class IV-V	43 (61.4%)
At least 5 days antimicrobial course	69 (99%)
Empiric Antimicrobial Therapy	
Ceftriaxone	28 (40.0%)
Vancomycin/Piperacillin-Tazobactam	19 (27.1%)
Vancomycin/Cefepime	6 (8.5%)
Other	17 (24.4%)
Azithromycin	28 (44.0%)
Doxycycline	11 (15.7%)
30-day mortality	10 (14.3%)

[1] **Footnote: No.**= Number, **IQR**= Interquartile Range.

The addition of the BioFire® FilmArray® Pneumonia panel with a cutoff of 10^5 copies/mL increased the number of patients who received a presumptive microbiologic diagnosis from 29 (41%) to 59 (84.3%) (p<0.001).



C. RESULTS

Secondary Outcome:

- 9 bacterial pathogens in 9 unique individuals were not covered by the patient's empiric antimicrobial regimen.
- 70 antimicrobials prescribed for 49 patients could have been stopped either due to lack of activity against the detected pathogen or due to adequate coverage by the second antimicrobial in the prescribed combination.
- 12 antimicrobials prescribed for 12 patients could have been narrowed based on the hospital's antibiogram.
- In total, had the pneumonia panel results been available to clinicians, **a change in the empirically prescribed antimicrobial regimen** for antimicrobial optimization **would have been recommended for 56 out of 70 (80.0%) patients.**

D. CONCLUSIONS

- We observed a **significant increase** in the rate of **microbiologic diagnosis** among adult patients hospitalized with pneumonia where the pneumonia panel was used in addition to current standard of care diagnostic methods, together with **abundant opportunities for optimization of antimicrobial therapy**.
- Further studies should look into clinical outcome data and cost-effectiveness of the incorporation of its use in daily clinical practice.

E. REFERENCES

1. Metlay JP *et al.* (2019) Diagnosis and Treatment of Adults with Community-acquired Pneumonia. An Official Clinical Practice Guideline of the American Thoracic Society and Infectious Diseases Society of America. Am J Respir Crit Care Med. 2019. 200 (7):e45-e67 .
2. Lee SH, et al. Performance of a multiplex PCR pneumonia panel for the identification of respiratory pathogens and the main determinants of resistance from the lower respiratory tract specimens of adult patients in intensive care units. J Microbiol Immunol Infect. 2019. 52 (6):920-928

F. ACKNOWLEDGEMENTS

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