SOUTHERN ILLINOIS UNIVERSITY EDWARDSVILLE

Impact of a Rapid Multiplex Polymerase Chain Reaction Blood Culture Identification Panel and a Pharmacist-driven Protocol on Antibiotic Management

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SCHOOL OF PHARMACY

BACKGROUND

- Traditional testing of blood cultures is time consuming and can take days for results which increases the duration of broad antibiotic therapy and leads to overuse of antibiotics.
- According to the Infectious Disease Society of America guidelines for implementing an antibiotic stewardship program, it is suggested that use of rapid diagnostic testing in addition to conventional blood cultures and rapid notification of results has been associated with significant improvements.[1]
- BioFire Blood Culture Identification 2 (BCID2) Panel is a multiplex polymerase chain reaction (PCR) test that simultaneously can detect 43 common targets and pathogens associated with blood stream infections with a 99% sensitivity and 99.8% specificity.[2]

OBJECTIVES

- To evaluate the advantages of using the BCID2 Panel for rapid identification of blood pathogens compared to traditional blood culture testing.
- Assess the impact of having a pharmacist-driven protocol where the pharmacist is contacted with initial results of rapid blood culture testing and can make appropriate antibiotic recommendations based on the results.

METHODS

Study Design
- Single-center, retrospective chart review at HSHS St. Elizabeth's Hospital in O'Fallon, IL
- Approved by Southern Illinois University institutional review board
- Data was collected from hospital electronic medical records and protected health information was not documented in the data collection sheet

Inclusion
- 18-89 years old
- Hospitalized with positive blood cultures between October to December of 2023 and March to May of 2024

Exclusion
- Emergency department (ED) visit only
- Presented to ED, then later called back for admission due to positive blood culture results
- No BioFire Panel completed with the post group (March to May 2024)

Primary Outcome
- Time to antibiotic de-escalation comparing pre and post BioFire BCID2 Panel implementation – analysis limited to cases when de-escalation is possible

Secondary Outcomes
- Time from initial positive blood culture to de-escalation, antibiotic durations, frequency of pharmacist interventions, hospital LOS, 30-day all cause mortality

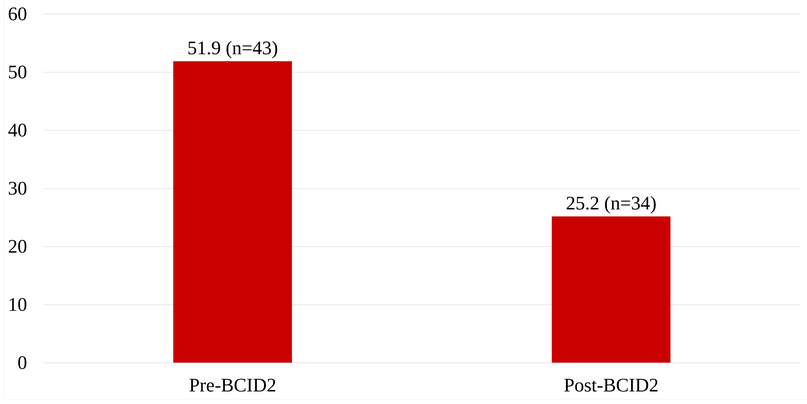
Data Analysis
- Descriptive statistics, independent t-test, and chi-squared test

RESULTS

Patient Characteristics (n=286)

Characteristics		Pre-BCID2 (n=151)	Post-BCID2 (n=135)
Age in years, median		66 (19-89)	68 (19-89)
Suspected infection source, N (%)	Urinary	40 (26.5)	40 (29.6)
	Respiratory	24 (15.9)	28 (20.7)
	Skin and soft tissue	30 (19.9)	26 (19.3)
	Gastrointestinal	19 (12.6)	13 (9.6)
	Other	38 (25.2)	28 (20.7)
Pathogen, N (%)	**Gram + organisms**	**107 (70.9)**	**86 (63.7)**
	Staphylococcus spp. (not *aureus*)	44 (29.1)	40 (29.6)
	Staphylococcus aureus	20 (13.3)	19 (14.1)
	Streptococcus spp.	22 (14.6)	8 (5.9)
	Enterococcus spp.	4 (2.7)	3 (2.2)
	Micrococcus spp.	3 (2.0)	3 (2.2)
	Multiple gram + organisms present	7 (4.6)	6 (4.4)
	Other	7 (4.6)	7 (5.2)
	Methicillin resistance	9 (8.4)	26 (30.2)
	Gram – organisms	**44 (29.1)**	**47 (34.8)**
	Escherichia coli	22 (14.6)	23 (17.0)
	Klebsiella pneumonia	5 (3.3)	4 (3.0)
	Pseudomonas aeruginosa	1 (0.7)	4 (3.0)
	Other	16 (10.6)	16 (11.9)
	ESBL	5 (11.4)	7 (14.9)
	Yeasts	**0 (0)**	**2 (1.5)**

Primary Outcome: Average Time to Antibiotic De-escalation (hours), p-value <0.001



Primary Outcome			
	Pre-BCID2 (n=151)	**Post-BCID2 (n=135)**	**p-value**
Time to de-escalation, average (hours)	51.9 (n=43)	25.2 (n=34)	<0.001
Secondary Outcomes			
Time from initial + blood culture result to de-escalation, average (hours)	43.7 (n=43)	11.2 (n=34)	<0.001
Duration of broad-spectrum antibiotics, average (hours)	143.2	147.2	0.879
Duration of IV antibiotics, average (hours)	168.7	186.8	0.419
Duration of total antibiotics, average (hours)	174.5	193.4	0.429
Length of hospital stay, average (days)	7.9	9.5	0.069
Frequency of possibility to de-escalate antibiotics, N (%)	44 (29.1)	36 (26.7)	0.216
Frequency of necessity to escalate antibiotics, N (%)	12 (7.9)	22 (16.3)	0.0294
Amount of times pharmacy interventions made total, N (%)	15 (9.9)	50 (37.0)	<0.001
Amount of pharmacy attempt interventions total, N (%)	17 (11.3)	54 (40.0)	<0.001
Amount of times pharmacy de-escalation interventions, N (%)	13 (8.6)	28 (20.7)	0.004
Amount of times pharmacy escalation interventions, N (%)	2 (1.3)	22 (16.3)	<0.001
30-day all-cause mortality, N (%)	18 (11.9)	14 (10.4)	0.711

DISCUSSION

Limitations
- Longer durations of broad antibiotic therapy were continued in some cases due to patients having multiple suspected infections which could explain the increased durations for antibiotic therapy in both groups
- In each group, there were some patients who expired before the final culture results were released and antibiotics could be adjusted
- Although BCID2 Panel tests for most common pathogens, there are still some pathogens that the panel cannot detect
- Single-center, retrospective design

Conclusion
- Implementation of the BCID2 Panel plus a pharmacist-driven protocol to adjust antibiotic regimens significantly improved the time to de-escalation of antibiotics by cutting the time in half
- In addition, this protocol allowed pharmacists to recommend appropriate interventions for escalation of antibiotic therapy when necessary for a patient
- The use of this process can help improve antimicrobial stewardship, resource utilization, and patient outcomes

REFERENCES

1. Barlam TF, Cosgrove SE, Abbo LM, et al. Implementing an Antibiotic Stewardship Program: Guidelines by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America. *Clin Infect Dis*. 2016;62(10):e51-e77. doi:10.1093/cid/ciw118
2. BIOFIRE® Blood Culture Identification 2 panel. bioMérieux Website. Accessed August 22, 2024. https://www.biomerieux.com/us/en/our-offer/clinical-products/biofire-blood-culture-identification-2-panel.html.