Impact of the BioFire® FilmArray® Blood Culture Identification 2 Panel on Antimicrobial Treatment of *Enterobacterales* Blood Stream Infections

Ashley L. Logan, PharmD[1]; James R. Beardsley, PharmD[2,3]; Alex D. Taylor, PharmD[2,3]; John C. Williamson, PharmD[2,3]; Elizabeth L. Palavecino, MD[4]; Vera P. Luther, MD[3]; Christopher A. Ohl, MD[3]; Tyler J. Stone, PharmD[2,3]

[1]University of Kentucky, Department of Pharmacy; [2]Atrium Health Wake Forest Baptist, Department of Pharmacy; [3]Section on Infectious Diseases, Department of Internal Medicine, Wake Forest University School of Medicine; [4]Department of Pathology, Wake Forest University School of Medicine, Winston-Salem, North Carolina

BACKGROUND

- The FilmArray® Blood Culture Identification 2 (BCID2) panel:
  - Rapid diagnostic tool using multiplex polymerase chain reaction (PCR) technology
  - Detects 33 gram-positive and gram-negative bacteria
  - Detects 10 different resistance genes, including CTX-M gene
- Previous studies demonstrated combining PCR technology with antimicrobial stewardship and education decreases time to organism identification and antibiotic change
- Our institution changed from BCID panel (does not include CTX-M gene detection) to BCID2 on August 26, 2020
- Our internal microbiology data demonstrate high rates of ceftriaxone susceptibility for *E. coli* and *Klebsiella* spp isolates observed when CTX-M gene was not detected (94-100%)

OBJECTIVE

- To evaluate the time to first antibiotic change, either escalation or de-escalation, based on either BCID or BCID2 PCR results or culture and susceptibility results

METHODS

- Single-center, retrospective, observational study
- All patients with a positive blood culture obtained from December 2019 – March 2020 for the BCID group and December 2021 – March 2022 for the BCID2 group were screened
- Pharmacy education on BCID2 and de-escalation opportunities provided

Inclusion Criteria	Exclusion Criteria
•Adult patients (≥18 years) •Positive blood cultures for *E. coli* or *Klebsiella* spp •Started on broad spectrum beta-lactam therapy	•Suspected or confirmed polymicrobial infection •Concurrent infection caused by a non-susceptible gram-negative organism •Additional resistance detected by the BCID2 (i.e. IMP, KPC, OXA-48-like, VIM, NDM) •Neutropenia (ANC ≤ 500) •Death < 72 hours after cultures were obtained

Primary Outcome

- Time to antibiotic change in the BCID group compared to the BDIC2 group, defined as time of culture collection to initiation, discontinuation, or alteration of antibiotic therapy

Secondary Outcomes

- Time to first de-escalation or escalation opportunity of antibiotic therapy
  - De-escalation analysis only included patients started on anti-pseudomonal beta-lactam
  - Escalation analysis excluded patients started on a carbapenem prior to PCR or culture results
- Time to actual first de-escalation or escalation
- Number of de-escalations and escalations based on either the PCR or susceptibility results
- Proportion of de-escalation or escalation opportunities that could have occurred from either the PCR or susceptibility results, but did not

RESULTS

Table 1. Patient Characteristics

Characteristic	BCID (n = 65)	BCID2 (n = 49)
Male (n, [%])	25 [38.5]	24 [49.9]
Age, y (mean, [SD])	64.9 [16.6]	65.5 [15.1]
ICU care at time of culture (n, [%])	16 [24.6]	12 [24.5]
Vasopressor Duration, h (median, [IQR])	24.7 [27.6]	23.3 [28.6]
Mechanical Ventilation (# yes, [%])	2 [3.1]	3 [6.1]
Temperature, F (mean, [SD])	101.7 [1.79]	101.4 [1.73]
Length of Admission, d (median, [IQR])	6 [4.0]	5 [6.0]

Figure 1. Infecting Organism

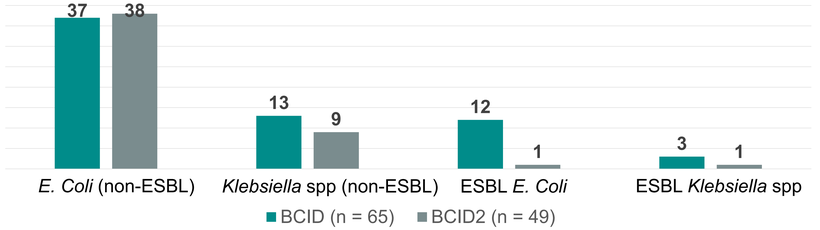
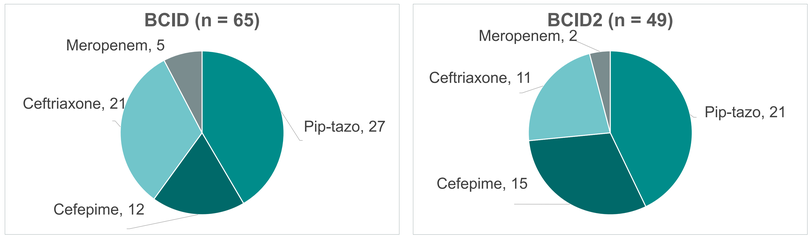


Figure 2. Empiric Beta-lactam Therapy



- Majority of bacteremias (75.4% in the BCID group and 71.4% in the BCID2 group) were concluded to be from a urinary source

Table 2. Time to First Antibiotic Change

	BCID (n = 65)	BCID2 (n = 49)	P-value
Time to first antibiotic change, h (median, [IQR])	62.4 [25.1]	74.4 [44.9]	0.113

RESULTS (CONTINUED)

Table 3. De-escalation Outcomes

	BCID (n = 30)	BCID2 (n = 35)	P-value
Time to first de-escalation opportunity, h	53.8 [16.2]	16.6 [2.3]	< 0.0001
Time to first antibiotic de-escalation, h	56.4 [23.4]	74.4 [42.7]	0.022
Number of total de-escalations based on:			
PCR panel result (n, [%])	0 [0]	8 [22.9]*	0.006
Susceptibility result (n, [%])	30 [100]	30 [85.7]*	0.057

Results expressed as median [IQR] unless otherwise denoted
*Patients in the BCID2 could have more than one de-escalation (i.e. de-escalation based on PCR results, then de-escalation further based on susceptibility results)

- All patients in the BCID group with an opportunity for de-escalation based on susceptibility results had a de-escalation in therapy
- 26.6% (8/30) of patients in the BCID2 group with an opportunity for de-escalation based on PCR results had a de-escalation in therapy
- 88.5% (31/35) of patients in the BCID2 group with an opportunity for de-escalation based on susceptibility results had a de-escalation in therapy

Table 4. Escalation Outcomes

	BCID (n = 13)	BCID2 (n = 6)	P-value
Time to first escalation opportunity, h	57.8 [6.3]	16.1 [0.38]	< 0.0001
Time to first escalation, h	60.0 [11.2]	20.4 [16.9]	0.004
Total escalations based on:			
PCR Panel Result (n, [%])	1 [7.7]	6 [100]	0.0003
Susceptibility Result (n, [%])	12 [92.3]	0 [0]	0.0003

Results expressed as median [IQR] unless otherwise denoted

- All opportunities for escalation based on PCR and susceptibility results were acted upon for both the BCID and BCID2 groups

CONCLUSION

- No difference detected in the time to first antibiotic change between BCID and BCID2 study groups
- Results suggest a significant opportunity for earlier adjustment of therapy when the BCID2 FilmArray® is utilized on blood specimens compared to BCID
- Coupling an active stewardship review component with implementation of the BCID2 panel could impact time to first antibiotic change