PEDIATRIC CENTER EVALUATION OF THE BIOFIRE[®] BLOOD CULTURE IDENTIFICATION 2 (BCID2) PANEL VERSUS THE ORIGINAL BIOFIRE® FILMARRAY® BLOOD CULTURE IDENTIFICATION (BCID) PANEL FOR THE DETECTION OF MICROORGANISMS AND RESISTANCE MARKERS IN POSITIVE BLOOD CULTURES

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BACKGROUND

Studies show a rising annual incidence of severe sepsis, with bloodstream infections continuing to impact children.¹ Rapid identification of causative agents and timely administration of targeted therapy turnaround time.² can positively impact patient outcomes and improve antibiotic stewardship.

The BioFire Blood Culture Identification 2 (BCID2) Panel (BioFire Diagnostics, LLC), an updated versior of the FDA-cleared BioFire FilmArray Blood Culture Identification (BCID) Panel, designed for use on

positive blood cultures (PBCs), assesses 43 analytes, including 17 novel analytes (8 bacterial, 2 fungal, and 7 antimicrobial resistance genes), with a similar

The BioFire FilmArray pouch is a multiplex PCR assay that stores all the necessary reagents for sample preparation, reverse transcription PCR, PCR, and detection in a freeze-dried format. During a test run, the BioFire System extracts and purifies all nucleic acids from the unprocessed sample. Next, it performs

Isolate		BioFi	re BCID2 Pane	el (compo	ared to c	ulture)	BioFi	re BCID	Panel (compo	ired to B	ioFire B	CID2 Panel)
Gram positive organisms	ТР	FN	Sensitivity	FP	TN	Specificity	ТР	FN	Sensitivity	FP	TN	Specificity
E. faecalis	2	0	100%	0	114	100%			Identification	n to genus or	nly	
E. faecium	0	0	N/A	0	116	100%			Identification	n to genus or	nly	
L. monocytogenes	0	0	N/A	0	116	100%	0	0	N/A	0	116	100%
Staphylococcus sp.	57	0	100%	0	59	100%	56	1	98.2%	1	58	98.3%
Staph aureus	17	0	100%	0	99	100%	17	0	100%	1	98	99.0%
Staph epidermidis	30	1	96.8%	0	85	100%			Identificatior	n to genus or	nly	
Staph lugdunensis	0	0	N/A	0	116	100%			Identification	n to genus or	nly	
Streptococcus sp.	23	0	100%	0	93	100%	23	0	100%	1	92	99.1%
Strep agalactiae	0	0	N/A	0	116	100%	0	0	N/A	0	116	100%
Strep pneumoniae	9	0	100%	0	107	100%	9	0	100%	0	107	100%
Strep pyogenes	7	0	100%	0	109	100%	7	0	100%	1	108	100%
Gram negative organisms	ТР	FN	Sensitivity	FP	TN	Specificity	ТР	FN	Sensitivity	FP	TN	Specificity
Enterobacterales	19	0	100%	0	97	100%	18	1	94.7%	0	97	100%
Enterobacter cloacae cplx	0	0	N/A	0	116	100%	0	0	N/A	0	116	100%
E. coli	14	0	100%	0	102	100%	13	1	92.9%	0	102	100%
K. aerogenes	0	0	N/A	0	116	100%			Not o	n panel		
K. oxytoca	1	0	100%	0	115	100%	1	0	100%	0	115	100%
K. pneumoniae group	1	0	100%	0	115	100%	1	0	100%	0	115	100%
Proteus sp.	0	0	N/A	0	116	100%	0	0	N/A	0	116	100%
Salmonella sp.	2	0	100%	0	114	100%			Not o	n panel		
Serratia marcescens	1	0	100%	0	115	100%	1	0	100%	0	115	100%
Acinetobacter	0	0	N/A	0	116	100%	0	0	N/A	0	116	100%
Bacteroides fragilis	0	0	N/A	0	116	100%	Not on panel					
Haemophilus influenzae	4	0	100%	0	112	100%	4	0	100%	1	111	99.1%
Neisseria meningitidis	0	0	N/A	0	116	100%	0	0	N/A	0	116	100%
Pseudomonas aeruginosa	1	0	100%	0	115	100%	1	0	100%	0	115	100%
S. maltophilia	1	0	100%	0	115	100%	Not on panel					
Yeast	ТР	FN	Sensitivity	FP	TN	Specificity	ТР	FN	Sensitivity	FP	TN	Specificity
C. albicans	1	0	100%	0	115	100%	1	0	100%	0	115	100%
C. auris	0	0	N/A	0	116	100%			Not o	n panel		
C. glabrata	0	0	N/A	0	116	100%	0	0	N/A	0	116	100%
C. krusei	0	0	N/A	0	116	100%	0	0	N/A	1	115	99.1%
C. parapsilosis	1	0	100%	0	115	100%	1	0	100%	1	114	99.1%
C. tropicalis	0	0	N/A	0	116	100%	0	0	N/A	0	116	100%
C. neoformans/gattii	0	0	N/A	0	116	100%			Not o	n panel		

Table 1: Comparison of performance of BioFire BCID2 Panel and BioFire BCID Panel.

BioFire BCID2 Panel was completely negative for 11 specimens; two were negative by culture and the remaining nine grew organisms on culture that are not part of the panel. Of these same 11 specimens, two were false positive on BioFire BCID Panel.





nested multiplex PCR in two stages. The first stage includes a single, large volume, multiplexed reaction. The second stage includes individual, single-plex reactions to detect the products from the first stage.

Using endpoint melting curve data, the BioFire System software automatically analyzes the results for each target on the panel. When the run is complete, the software reports whether each pathogen is detected in the sample. This information is printed in an automated response at the end of the test run.³

METHODS

De-identified residual PBCs for which clinician-ordered testing per standard of care (SoC) had been performed were enrolled and tested. This study was conducted with an investigational-use-only (IUO) version of the BCID2 panel that is identical to the commercial (i.e., FDA-cleared, CE-marked) in vitro diagnostic (IVD) version. One positive bottle per patient was enrolled. Results of the BioFire BCID2 Panel and the BioFire BCID Panel were compared.

Sample	Bottle Type	BioFire BCID2 Panel Result	BioFire BCID Panel Result	Culture Results
8	anaerobic	No organisms detected	Streptococcus/Streptococcus pyogenes	No organisms detected
13	aerobic	Staphylococcus spp./Staphylococcus epidermidis; Streptococcus spp.	Staphylococcus/Staphylococcus aureus; Streptococcus	Staphylococcus species; Staphylococcus epidermidis
25	aerobic	Streptococcus spp./Streptococcus pneumoniae	Staphylococcus; Streptococcus/ Streptococcus pneumoniae	Streptococcus species; Streptococcus pneumoniae
43	aerobic	Staphylococcus spp.; Streptococcus spp.	Streptococcus	Streptococcus mitis; Staphylococcus hominis
45	anaerobic	Staphylococcus spp./Staphylococcus epidermidis	Staphylococcus; Haemophilus influenzae	Staphylococcus epidermidis
65	aerobic	No organisms detected	Candida krusei; Candida parapsilosis	No organisms detected
108	anaerobic	Enterobacterales/Escherichia coli	No organisms detected	Enteric gram negative bacteria; Escherichia coli

Table 2. Discrepant results between BioFire BCID2 Panel and BioFire BCID Panel.



Figure 1. BioFire[®] FilmArray[®] Pouch.

RESULTS

116 PBCs (48 aerobic and 68 anaerobic) were evaluated using the BioFire BCID2 Panel and results were compared to the BioFire BCID Panel. Of the 116 cases, 100 were positive on both the BioFire BCID2 Panel and the BioFire BCID Panel and were fully concordant with culture. Nine cases were negative on both tests. While the two panels showed 94% agreement (109/116), seven cases were discrepant. Using culture (SoC) as the tiebreaker, five cases were false positive and two cases were false negative on the BioFire BCID Panel. In all seven cases, results from culture and the BioFire BCID2 Panel were in agreement. As expected, no organisms were detected on the BioFire BCID2 Panel in PBCs from 7.8% (9/116) of PBC bottles where culture identified only organisms that are not part of the panel menu. With the BioFire BCID2 Panel's expanded platform, 31 cases detected to the genus level on the BioFire BCID Panel were identified to the species level on the BioFire BCID2 Panel. Two other cases that were identified to the family level (Enterobacteriaceae family) on the BioFire[®] BCID Panel were identified to the genus level (*Salmonella* spp.) on the BioFire[®] BCID2 Panel.



Figure 2. BioFire[®] FilmArray[®] Processing Protocol.

CONCLUSION

Overall, the BioFire BCID2 Panel performed well against the BioFire BCID Panel for identification of bloodstream pathogens and provided additional discrimination of some pathogens to the genus or species level.

Comments

- BioFire BCID Panel false positive for Streptococcus/Streptococcus pyogenes
- BioFire BCID Panel false positive for Staphylococcus aureus
- BioFire BCID Panel false positive for Staphylococcus
- BioFire BCID Panel false negative for Staphylococcus species
- BioFire BCID Panel false positive for
- Haemophilus influenzae
- BioFire BCID Panel false positive for Candida krusei; Candida parapsilosis
- BioFire BCID Panel false negative for Enterobacteriaceae/Escherichia coli

REFERENCES

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- 2. Pardo, J., et al. Clinical and economic impact of antimicrobial stewardship intervention with the FilmArray blood culture identification panel. Diagn. Microbiol. Infec Dis. 2016:84 (2): 159-164.
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Figure 3. Standalone instrument. The standalone instrument processes one pouch at a time with throughput of around 22 panels per day.



Figure 4. BioFire[®] Torch Instrument: The BioFire Torch can be modified to support processing of up to 440 panels per day.

PATHOLOGY