The impact of film array detection of high-risk and resistant pathogens on the time to optimal antibiotic therapy at a community health system

Jeremy Frens, PharmD, BCPS-AQ ID, BCIDP; Tyler Baumeister, PharmD, BCIDP; Emily Sinclair PharmD, BCPS, BCIDP; Dustin Zeigler, PharmD, BCPS, Cone Health, Greensboro NC

Background

- Rapid diagnostic testing platforms like BioFire® FilmArray® blood culture identification (BCID2) have the potential to decrease time to effective antibiotics when acted on appropriately
- Our antimicrobial stewardship team has a collaborated with clinical pharmacists and infectious diseases physicians to define a process to quickly optimize antibiotic therapy
- After a positive blood culture is identified, microbiology staff calls a member of the stewardship or inpatient pharmacist team who then notifies the attending physician of the results and provides treatment recommendations based on local guidelines

Process For Optimizing Antibiotic Therapy

✓ Blood cultures collected from patient
✓ Bottles incubated in BacT/ALERT® 3D
✓ Microbiology technician alerted when bottle turns positive and gram stain performed

✓ The blood sample with detected growth placed into BioFire® Filmarray ® Torch module for rapid identification
✓ BioFire® performed on first positive bottle unless another bottle's gram stain has different morphology

✓ Microbiology tech calls pharmacist with BioFire ® result
✓ Pharmacist communicates result to provider and adjusts antimicrobial therapy to optimize the antimicrobials
✓ Infections diseases (ID) pharmacists intervene on complicated bacteremia' and ID physicians are consulted for certain organisms

✓ Microbiology plates on agar for bacterial growth
✓ MALDI-TOF performed for identification if needed
✓ Vitek ® 2 performed for final susceptibilities

BioFire® FilmArray® blood culture identification (BCID2) of high-risk and resistant pathogens paired with antimicrobial stewardship team support can optimize the time to optimal antibiotic therapy with bloodstream infections

Methods

- Between August 2021 and March 2022, the times to administration of effective and optimal antibiotics were evaluated in patients with the following BCID2 targets identified: *S. aureus, P. aeruginosa,* CTX-M, KPC, OXA-48 like, IMP, VIM, NDM, and vancomycin resistant enterococcus.
- An effective antibiotic was defined as an antibiotic with *in vitro* activity to the organism, and an optimal antibiotic was defined as the preferred agent based on institutional guidelines.
- Effective and Optimal antibiotics in patients with CTX-M isolates were compared to a historical control of ceftriaxone resistant enterobacterales and analyzed by student's t-test.
- Genotypic testing was compared to phenotypic results.

Reported Rapid ID Results	Cone Health Recommended First-Line Therapy	Acceptable Alternative (if allergic to first-line therapy)
CTX-M (ESBL) producing enterobacterales	Meropenem or Ertapenem	
MSSA	Cefazolin or nafcillin	Vancomycin
MRSA	Vancomycin	Daptomycin
Vancomycin Resistant *Enterococcus faecium* or *faecalis*	Daptomycin	Linezolid
P. aeruginosa	Cefepime +/- tobramycin	Aztreonam +/- tobramycin
Carbapenemase resistant enterobacterales – KPC or OXA-48	Ceftazidime/avibactam	Cefiderocol
Carbapenemase resistant enterobacterales -NDM, IMP, VIM	Cefiderocol	Ceftazidime / avibactam + aztreonam

Abbreviation key

Matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF)	Methicillin sensitive *Staphylococcus aureus* (MSSA)	Markers for carbapenemase production Oxacillinase-48 (OXA-48) Klebsiella pneumoniae carbapenemase (KPC) Active-on-Imipenem (IMP) New Delhi metallo-beta-lactamase (NDM) Verona integron-mediated metallo-beta-lactamase (VIM)
Extended spectrum beta-lactamase (ESBL)	Methicillin resistant *Staphylococcus aureus* (MRSA)	
Cefotaximase – Munich – CTX-M Marker for ESBL production	Vancomycin resistant enterococcus (VRE)	

Results

- The combined mean time from BCID2 administration of effective antibiotics = 1.2 hours (range 0-7.9 hours) and to optimal therapy = 7.6 hours (range 0 – 113.8 hours)
- Time to optimal antibiotics for MSSA was higher as initial empiric therapy was active and there was less urgency to narrow.
- Before BCID2, patients found to be growing ceftriaxone resistant enterobacterales had an average time to optimal antibiotic administration of 17.7 hours, and after BCID2 administration was 2.8 hours (p=0.0041)
- One patient with CTX-M and one with VRE detected was not confirmed by phenotypic testing

Bacteria	Covered by initial empiric antibiotics	Mean time to administration of optimal therapy from BCID2 results (hours)
CTX-M (n=20)	5%	2.8
MSSA (n=31)	100%	17.0
MRSA (n=25)	40%	2.0
VRE (n=4)	25%	2.2
Pseudomonas (n=1)	100%	0
KPC, IMP, VIM, NDM, OXA-48 (n=0)	N/A	N/A

Mean time to administration of optimal antibiotics for patients with ceftriaxone-resistant enterobacterales (hours)	
Before BCID2	17.7
After BCID2	2.8
P-value	0.0041

Conclusions

- BioFire® FilmArray® coupled with antibiotic stewardship team support can help optimize time to effective and optimal antibiotic therapy in bloodstream infection.
- The CTX-M target to BCID2 was a helpful addition to the panel which allowed for decreased time to optimal antibiotic therapy.