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Opportunities for antimicrobial stewardship: Rapid blood culture identification of gram-positive organisms and contaminated blood cultures, time to optimal therapy, and vancomycin use

Corresponding author: Kelsey Olion
kelsey.olion@va.gov

Kelsey Olion[1], PharmD; Laura Hamann[1], PharmD, BCPS; Rebecca Jennemann[1], MT (ASCP);
Julie A. Shapiro-Schere[1,2], D.O.; Yvonne J. Burnett[1,3], PharmD, BCIDP

[1]Missouri Baptist Medical Center, St. Louis, MO [2]Northwest Infectious Disease, St. Louis, MO
[3]University of Health Sciences and Pharmacy; St. Louis, MO

Introduction

- In the U.S., antibiotic resistance causes over 35,000 deaths annually.
- Rapid blood culture identification (BCID) can reduce unnecessary antibiotic use by decreasing time to organism identification and, theoretically, time to optimal antimicrobial therapy or discontinuation.
- Blood cultures contaminated with skin flora often result in unnecessary antimicrobial treatment, contributing to increased risk of antimicrobial resistance and antimicrobial-associated adverse events.

- **Study Objective:** Assess the impact of BioFire FilmArray® blood culture identification implementation on time to optimal therapy in gram-positive bloodstream infections compared to traditional organism identification (ID).
- Additional outcomes analyzed include: time to organism identification, incidence of contaminated gram-positive blood cultures, antibiotic duration, incidence of nephrotoxicity, and length of stay.

Methods

Study population:
Retrospective review of 242 adult patients admitted with a positive monomicrobial blood culture with gram-positive bacteria between February 2018 – June 2018 (Pre-BCID) and February 2019 – June 2019 (Post-BCID). Data was collected related to baseline characteristics, antibiotic administration, and adverse effects.

Statistical Analysis:
- Descriptive analysis of patient demographics, baseline characteristics, and infection data was conducted.
- Continuous data was analyzed using the Whitney Mann-U test
- Nominal Data was analyzed with Chi squared and Fisher's Exact tests

Definitions:
Time to optimal targeted therapy = number of hours from sample collection to when the patient is receiving the most appropriate antibiotic therapy based on organism, susceptibility, stewardship, and patient-specific factors.
Nephrotoxicity = an increase in SCr by > 0.5 mg/dL or > 50% increase from baseline for two consecutive measurements from initiation of antibiotics to 72 hours after completion/discontinuation of therapy. Patients on dialysis are excluded from this definition.

Results

Table 1: Patient Demographics

Characteristic	Pre-BCID (n = 143)	Post-BCID (n = 89)
Male, n (%)	73 (51)	53 (60)
Median age, yr	70	70
Median Charlson Comorbidity Index	6	6
Median CrCl, mL/min	41	46
Median length of stay, days	7.1	8.1
Intensive care unit admission, n (%)	42 (29)	27 (30)
Sepsis, n (%)	68 (48)	53 (60)
Infectious Diseases consult, n (%)	78 (54)	52 (58)
Contaminant, n (%)	79 (55)	45 (51)

Table 2: Infection Diagnoses

Diagnosis, n (%)	Pre-BCID (n = 143)	Post-BCID (n = 89)
Contaminant	76 (53)	45 (51)
Skin and soft tissue infection	**16 (11)**	**5 (6)**
Central line-associated infection	5 (4)	4 (5)
Osteomyelitis	**3 (2)**	**5 (6)**
Pneumonia/pulmonary infection	9 (6)	6 (7)
Urinary tract infection	4 (3)	2 (2)
Endocarditis	**12 (8)**	**4 (5)**
Other	6 (4)	6 (7)
Unknown	12 (8)	12 (14)

Table 4: Primary & Secondary Outcomes – Overall population

Outcome	Pre-BCID (n = 143)	Post-BCID (n = 89)	p value
Time to optimal therapy, hr	**53.3**	**28**	**<0.001**
Time to organism ID, hr	**60.2**	**23.5**	**<0.001**
Median antibiotic duration, days	5.72	6.06	0.492
Empiric vancomycin, n (%)	108 (76)	63 (71)	0.425
Median vancomycin duration, hr	35.1	25.2	0.231
Nephrotoxicity, n (%)	**17 (12)**	**23 (26)**	**0.008**
Optimal therapy selected, n (%)	**119 (83)**	**83 (93)**	**0.028**

Figure 1: Patient Population & Key Points

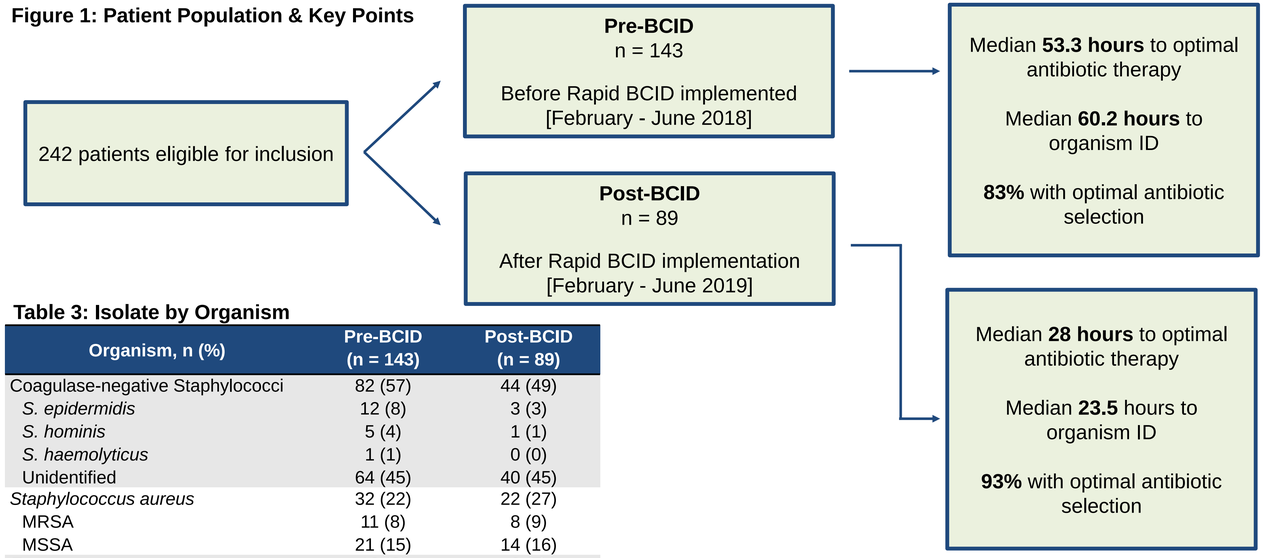

Table 3: Isolate by Organism

Organism, n (%)	Pre-BCID (n = 143)	Post-BCID (n = 89)
Coagulase-negative Staphylococci	82 (57)	44 (49)
S. epidermidis	12 (8)	3 (3)
S. hominis	5 (4)	1 (1)
S. haemolyticus	1 (1)	0 (0)
Unidentified	64 (45)	40 (45)
Staphylococcus aureus	32 (22)	22 (27)
MRSA	11 (8)	8 (9)
MSSA	21 (15)	14 (16)
Enterococcus	12 (8)	6 (7)
E. faecalis	10 (7)	5 (6)
E. faecium	2 (1)	1 (1)
Streptococcus spp.	13 (9)	10 (11)

Table 5: Primary & Secondary Outcomes - Contaminants

Outcome	Pre-BCID (n = 79)	Post-BCID (n = 45)	p value
Time to optimal therapy, hr	**54**	**27.3**	**<0.001**
Time to organism ID, hr	**54.6**	**26.9**	**<0.001**
Median antibiotic duration, days	3.85	4.35	0.591
Empiric vancomycin, n (%)	54 (67)	27 (33)	0.433
Median vancomycin duration, hr	27.5	16.6	0.253
Nephrotoxicity, n (%)	**6 (8)**	**15 (33)**	**0.006**
Optimal therapy selected, n (%)	71 (90)	44 (98)	0.154

Conclusions

- Rapid BCID significantly improved time to optimal therapy
- Rapid BCID also was associated with:
  - Reduced time to organism identification
  - Improved rates of optimal therapy
  - Downward trend in vancomycin use
- Similar results were seen in contaminated blood cultures
- Further coordination with the antimicrobial stewardship program may improve appropriate antimicrobial therapy selection and duration for patients with positive blood cultures

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