The Utility of a Rapid Multiplex PCR Assay in the Management of Staphylococcus Aureus Bacteremia at a Tertiary Care Center

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Introduction

- Staphylococcus aureus bacteremia (SAB) is a major cause of community and healthcare-associated bacteremia and is associated with a high burden of morbidity and mortality
- Tailoring management based on methicillin sensitivity helps minimize unnecessary administration of broad-spectrum antibiotics and ensures adequate treatment of SAB
- The Verigene® (Luminex Corporation) is a multiplex PCR assay that provides rapid identification of bloodstream pathogens. Time to identification is reported to be 15 hours, compared to traditional blood culture identification methods which may take up to 48 hours

Objective

To determine time to vancomycin de-escalation in cases of MSSA, rates of achieving best practice management, and analysis of outcomes associated with ID consultation and methicillin-sensitivity

Methods

- Single-center healthcare quality improvement project in collaboration with our antibiotic stewardship committee of positive staph aureus blood cultures at MGUH between May 2020 and May 2021.
- Electronic health record review was conducted to abstract patient demographics, clinical characteristics, blood culture data, and SAB specific management (antibiotic selection, echocardiography, and source control).
- Unpaired t-test and fishers exact test to identify associations of statistical significance.

Results

Patient Characteristics

- Between May 2020 and May 2021 we identified 97 cases of SAB: 66% MSSA (n = 64), 34% MRSA (n = 33) .

Table 1. Patient Characteristics

Variable	n or mean (SD)	%
Study population	97	-
Age (mean, SD)	61 (16.2)	-
Gender		
Male	57	58.8%
Female	40	41.2%
Immunocompromised status		
Immunocompromised	46	47.4%
Immunocompetent	51	52.6%
Methicillin sensitivity		
MSSA	64	66%
MRSA	33	34%
Clinical measures		
Length of stay (days)	20.3 (17.6)	-
Duration of SAB (days)	3.09 (2.9)	-
Mortality rate (deaths & hospice/comfort)	24	24.7%
ICU admission (any time during admission)	37	38.1%
Repeat blood cultures within 48 hours	84	86.6%
Echo obtained	83	85.6%
Time to echo (days)	2 (2.9)	-

Verigene® Results and Provider Response

- Using the Verigene® assay, we noted 2.6% discordance with standard microbiological technique (n = 2).
- The mean time to vancomycin discontinuation for MSSA cases was 50 hours from the time the Verigene® report was published to the EMR

Table 2. Verigene® Results & Associated Response

Variable	Mean (SD)	n
Time to Verigene® report from culture collection (hrs)	26.2 (12.2)	92
Time to final report from culture collection (hrs)	82.2 (25.2)	97
Time to ordering new MSSA-targeted agent from Verigene® report (hrs)	65.7 (41.6)	40

Significant Mortality Outcomes

There was a statistically significant difference in patient mortality with respect to methicillin sensitivity status: MSSA 15.6%, MRSA 42.4%, p = 0.0075, as well as mortality with ID consult 19.8% versus no ID consult 50%, p = 0.0223.

Table 3. MSSA/MRSA Outcomes

Variable	MSSA	MRSA	p-value
Mean length of stay (days, SD)	20.3 (17.6)	20.6 (18.0)	0.9477
Mortality rate (deaths & hospice/comfort)	10 (15.6%)	14 (42.4%)	**0.0075***
Mean duration of SAB (days, SD)	2.84 (2.7)	3.58 (3.4)	0.2477
ICU admission (any time during admission)	21 (32.8%)	16 (48.5%)	0.1854

Figure 1: Variables affecting mortality

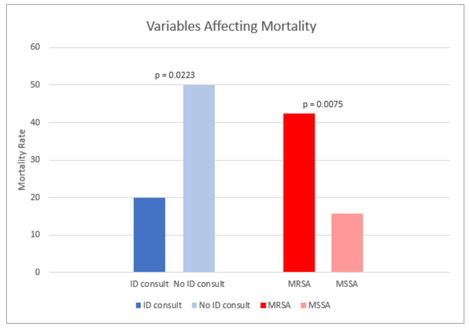

Table 4. ID Consult Associated Outcomes

Variable	ID consult	No ID consult	p-value
Mean length of stay (days, SD)	21.6 (17.8)	13.6 (15.8)	0.0972
Mortality rate (deaths & hospice/comfort)	16 (19.8%)	8 (50.0%)	**0.0223***
Repeat blood cultures within 48 hours	73 (90.1%)	11 (68.8%)	**0.0001***
Echo obtained	78 (96.3%)	5 (31.3%)	**0.0001***
Mean time to echo (days, SD)	2.31 (2.9)	2.60 (3.8)	0.8671

Discussion

- There is a mean delay of 50 hours from the time Verigene® results are published until time to vancomycin discontinuation. Factors may include provider misinformation and patient comorbidities/complexity.
- ID consultation was associated with improved mortality and higher rates of repeat blood cultures and echocardiography
- MSSA status was associated with improved mortality
- Limitations include EHR information availability, retrospective study design, analysis not adjusted for confounding variables, and sample size
- Future healthcare quality improvement includes appropriate education of healthcare providers at our center regarding need for de-escalation in patients with MSSA bacteremia.

Conclusions

In this study, we have identified a potential opportunity for improvement in the time it takes to narrow vancomycin for MSSA cases. Despite the incorporation of a rapid multiplex PCR assay to detect bloodstream infections, the time to de-escalation for MSSA was sub-optimal (2.7 days). ID consultation continues to be an important component of SAB management as it improves patient outcomes and contributes to education of healthcare providers. As a results of these findings, we have incorporated a mandatory ID consult for patients with SAB.

References

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