The impact of Microscan versus Vitek-2 for automated susceptibility testing on the utilization of vancomycin alternatives for the treatment of methicillin-resistant *Staphylococcus aureus* bacteremia

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Background

- Methicillin-resistant *Staphylococcus aureus* (MRSA) infections are associated with worse clinical outcomes compared to methicillin-susceptible *Staphylococcus aureus*[1]
- Automated susceptibility testing (AST) provides minimum inhibitory concentrations (MIC) to guide appropriate antibiotic therapy
- MRSA bacteremia with MIC ≥ 1.5 µg/mL is associated with vancomycin (VAN) failure[2]
- One AST system, Microscan (MS), outputs higher MICs for MRSA than Vitek-2 (VTK) and may impact selection of empiric antibiotic therapy[3]

Objectives

- **Primary Objective:** Compare rates of switch to MRSA alternatives in MRSA bacteremia patients based on the MIC values obtained from the Vitek system compared to those obtained from Microscan
- **Secondary Objectives:** Compare mortality (all cause, 30-day), readmission rate (all cause 30-day and 90-day), adverse event rates requiring change of therapy, and length of hospital stay (LOS)

Methods

- Multicenter retrospective cohort study
- Data for MS collected May 1, 2013 - Dec 31, 2016 and VTK Jun 1, 2017 - Feb 29, 2020
- **Inclusion criteria:** ≥18 years of age, ≥1 blood culture positive for MRSA, ≥72 hours of MRSA therapy, and VAN use within 48 hours of positive BC
- **Exclusion criteria**: Death ≤48 hours of admission, pregnancy, MRSA bacteremia or VAN use within 30 days, VAN alternative use prior to transfer, infected cardiac device, resistance to study drugs or failure to start antibiotics within 48 hours of positive culture
- The primary outcome of switch to MRSA alternatives was analyzed using a chi-square test
- MIC values reported by MS and VTK and LOS were analyzed using Wilcoxon rank sum test
- Overall readmission, 30 & 90-day readmission, adverse events, overall and 30-day mortality compared between group using the chi-square or Fisher's exact test as appropriate

Figure 1. Patient Exclusions

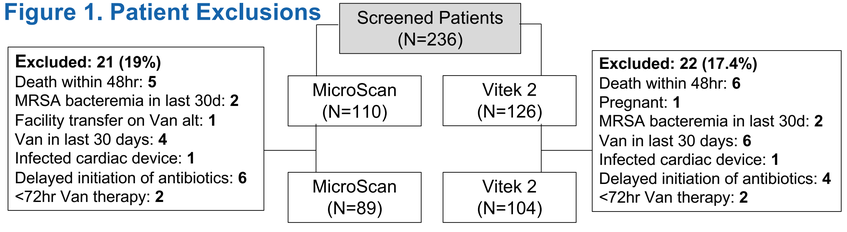
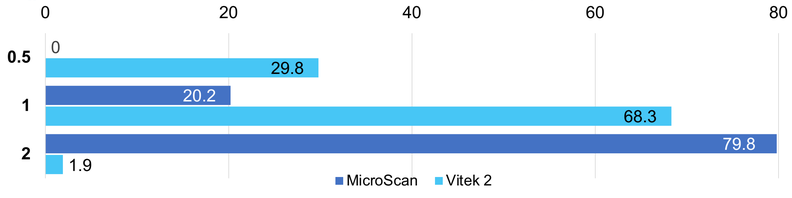


Figure 2. MIC Distribution Between Instruments, (%)



Results

Figure 3. Infection Type between Instrument Groups

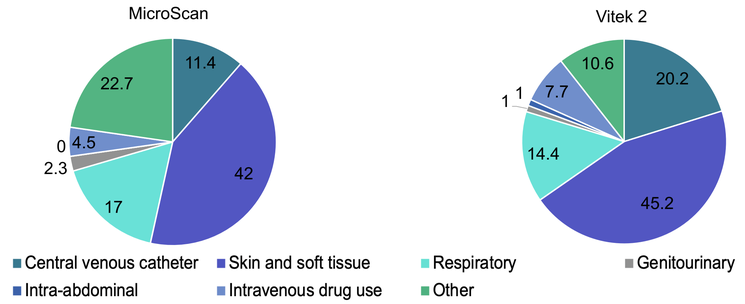
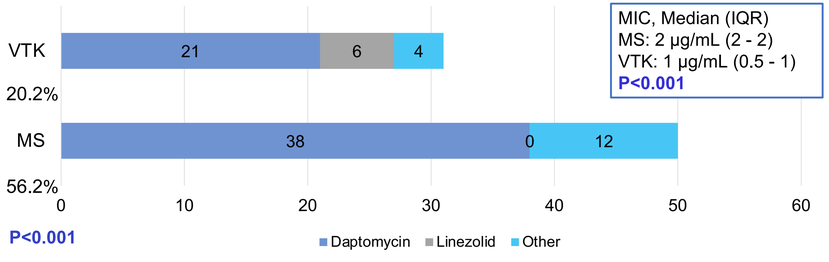


Table 1. Patient Characteristics

Characteristic	MS (n=89)	VTK (n=104)	P-value
Age (years), median (IQR)	57 (44 – 68)	57 (47 – 66)	0.905
BMI (m/kg^2), median (IQR)	27 (22 – 34)	27 (22 – 33)	0.924
VAN trough 15-20 mg/L by day 3, n (%)	27 (31.8)	50 (48.1)	**0.003**
Polymicrobial infection, n (%)	1 (1.1)	10 (9.6)	**0.006**
Duration of bacteremia (days), median (IQR)	3 (1 – 4)	3 (2 – 6)	0.011
Days of IV therapy prior to switch, median (IQR)	3 (2 – 4)	7 (5 – 12)	**<0.001**
ID consultation, n (%)	66 (75.0)	95 (91.3)	**0.002**
Charlson Score, median (IQR)	3 (2 – 6)	4 (1 – 5)	0.987
Pitt Bacteremia score, median (IQR)	2 (0 – 3)	2 (0 – 3)	0.467

Figure 4. Switch to MRSA Alternative by Instrument Group



The MS group was an independent predictor of switch to a vancomycin alternative therapy in multivariable regression (OR 19.23, [95% CI] 6.88-53.73) as well as in the propensity score adjusted regression model (OR 9.71, [95% CI] 4.19-22.57)

Table 2. Secondary Outcomes by Instrument Group

	MS (n=89)	VTK (n=104)	P-Value
Length of stay (days), median (IQR)	16 (10 – 27)	12 (7 – 20)	**0.023**
Composite treatment failure, n (%)	42 (47.2)	42 (40.4)	0.342
30-day all-cause mortality, n (%)	9 (10.1)	8 (7.7)	0.555
30-day all-cause readmission, n (%)	17 (19.1)	23 (22.1)	0.606
90-day all-cause readmission, n (%)	31 (34.8)	31 (29.8)	0.457
ADE requiring change in therapy, n (%)	4 (4.5)	4 (3.8)	0.822
90-day *C. difficile* infection, n (%)	3 (3.4)	1 (1.0)	0.231
Adverse events, n (%)	6 (6.8)	7 (6.7)	0.981

Discussion

- MS was associated with more VAN alternative use for MRSA bacteremia likely due to higher MRSA MICs compared to VTK
- MS was found to be an independent predictor of treatment modification after controlling for several factors that could be associated with switch therapy
- Patients transitioned to alternative treatments on day 3 vs day 7 in MS vs VTK, respectively
- VTK was associated with significantly shorter hospital LOS despite a longer course of VAN therapy prior to switch in therapy
- The switch to VTK presents providers with more desirable, less expensive options without adding language to the microbiology report, thus impacting prescribing practice
- Although VAN failure rates were comparable between MS and VTK groups our study was underpowered to detect differences in clinical outcomes and was not designed to evaluate vancomycin failures; thus, results should be interpreted cautiously
- Limitations included potential documentation errors inherent to retrospective reviews, lack of patient follow-up upon discharge, prescriber bias for antibiotic selection, and lack of MIC verification by reference broth microdilution

Conclusions

- **Since switching from MS to VTK, select Ascension Seton hospitals experienced a decreased median VAN MIC for MRSA bacteremia patients and decreased switches to VAN alternatives**
- **Further analyses are needed to determine the role AST systems play as an independent risk factor for switch in therapy**

References

1. Hassoun A, et al. Incidence, prevalence, and management of MRSA bacteremia across patient populations—a review of recent developments in MRSA management and treatment. *J Crit Care* 2017;21: 211.
2. Murray KP, et al. Early use of daptomycin versus vancomycin for methicillin-resistant Staphylococcus aureus bacteremia with vancomycin minimum inhibitory concentration >1 mg/L: a matched cohort study. *J Infect* 2013; 56.11:1562-9.
3. Wenson, JM, et al. Accuracy of commercial and reference susceptibility testing methods for detecting vancomycin-intermediate Staphylococcus aureus. *J Clin Microbiol* 2009; 47.7: 2013-7.