Abstract

Background
Methicillin-resistant Staphylococcus aureus (MRSA) is a clinically significant pathogen for which empiric therapy is often given. However, vancomycin overuse can be associated with significant harm such as nephrotoxicity and increase in healthcare costs. We hypothesized that MRSA screening results could predict methicillin resistance in S. aureus bacteremia prior to final antibiotic result, and curtail inappropriate vancomycin use.

Methods
We reviewed S. aureus bloodstream infections over a five-year period at two adult tertiary care hospitals at the McGill University Health Center, and determined if MRSA bacteremia could be predicted based on screening swab results. We evaluated MRSA colonization in three ways: known MRSA carrier within 30 days of bacteremia (30-Day Criteria), known MRSA carrier at 30 days or more remotely (All-Time Criteria), and all patients at all times including those unstated for MRSA colonization (Inclusive Criteria).

Results
A negative screening swab within 30 days was done in 235 patients, and yielded negative predictive values of 90% and 95% if the prevalence of MRSA in Staphylococcus aureus bacteremia was less than 39.7% and 23.8% respectively. In such centers, empiric vancomycin could be deferred in most stable patients. Graphs of negative predictive values of screening test and their 95% confidence intervals as a function of MRSA bacteremia prevalence are included below. Results for the inclusive criteria were similar. Conversely, in patients with prior MRSA, the positive predictive value was above 50% even at low prevalence; hence, empiric vancomycin therapy would be appropriate.

Conclusion
Known MRSA screening test results can help in avoiding unnecessary empiric vancomycin treatment and its complications in settings with low-moderate prevalence of MRSA bacteremia.

Introduction

• Methicillin resistant Staphylococcus aureus (MRSA) is a clinically significant pathogen requiring specific therapy.
• MRSA colonization rates vary by region: overall colonization prevalence estimated at 4-7% in the United States [1].
• MRSA specific antibiotics have potential for harm.
• Specifically, Vancomycin is associated with [2]:-increased drug and monitoring costs
• Further, empiric vancomycin use may lead to the inadvertent omission of beta-lactam therapy, superior treatment of MSSA bacteremia [5].
• We hypothesized that for a S. aureus bacteremia, a patient’s MRSA colonization status correlated with the probability of methicillin resistance.

Methods

• We conducted a retrospective review of all consecutive S. aureus bloodstream infections from April 1, 2010 to April 1, 2015 at the McGill University Health Centre.
• We employed universal names MRSA screening on admission to medical wards and critical care units, and targeted screening in other units.
• For the purpose of this analysis, MRSA screening swab status was categorized in three ways (Table 1).
• Sensitivity, specificity, likelihood ratios and negative/positive predictive values were calculated using standard formulas

Microbiology:
S. aureus susceptibilities were determined using the VITEK-2 automated system (Biomerieux, France) and interpreted in accordance with guidelines from the Clinical Laboratory Standards Institute.

Methicillin resistance was confirmed using a 30μg Cefoxitin disk.

Please see [4] for details on microbiologic methodology.

Results

30-Day Criteria (n=235)

Known Positive Criteria (N=235)

Proportion of S. aureus bacteremia resistant to methicillin

Positive MRSA swab within 30 days of blood culture

Positive MRSA swab within 30 days of blood culture

Proportion of S. aureus bacteremia resistant to methicillin

LR- (95% CI)

LR+ (95% CI)

90%

95%

Sensitivity (95% CI)

Specificity (95% CI)

92.8% (87.8-96.2) 87.6% (81.8-92.0) 92.7% (89.2-95.4)

95%

92.5% (88.1-94.9) 85.2% (76.0-91.9) 91.1% (87.9-94.4)

Table 2: Diagnostic Properties of the Three Criteria

Patient Criteria Assignment

Known Positive

Test Property

Sensitivity (95% CI)

Specificity (95% CI)

LR+ (95% CI)

LR- (95% CI)

Positive MRSA swab within 30 days of blood culture

Only negative MRSA swab within 30 days of blood culture

Only negative MRSA swab within 30 days of blood culture

Only negative MRSA swab within 30 days of blood culture

Table 1: Patient Criteria Assignment

Discussion

Limitations:
• Retrospective study
• Absence of specific patient-level data (e.g. comorbidities, physical exam, and other laboratory testing)
• Generalizability: study limited to two hospitals at one academic medical center

Conclusions:
• Given a 5-10% risk of initial MRSA undertreatment, the presence of a negative screening test supports forgoing empiric vancomycin provided MRSA makes up less than 20-40% of local S. aureus bloodstream infections.
• All criteria performed similarly and older screening results can remain helpful depending on the local MRSA proportion.
• Despite the above limitations, MRSA screening tests could help guide the appropriate use of empiric antibiotic therapy in suspected gram-positive bloodstream infections.
• Refer to [4] for more details.