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Retrospective Review of the utility of MRSA NAAT screening to predict MRSA Infections

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Background

- Appropriate and timely antibiotic de-escalation is a cornerstone of antimicrobial stewardship. Cultures and sensitivities may not be known for up to 96 hours, exposing patients to broad-spectrum antibiotics.¹
- The MRSA NAAT is a screening tool that is used to detect nasal colonization of MRSA and has been shown to have a strong negative predictive value (NPV) for MRSA pneumonia in multiple studies.²⁻⁵
- In a retrospective study of patients with suspected MRSA pneumonia, utilization of MRSA NAAT was associated with approximately 2 days less of empiric antibiotic therapy.⁶
- There are fewer retrospective studies on the utility and NPV for other infection types, such as skin and soft tissue infections and intra-abdominal infections.
- A small prospective cohort study looking at MRSA NAATs for patients in the emergency department with skin and soft tissue infections found that the MRSA NAAT was a better predictor of MRSA infection than risk factors for MRSA. In this study, the NPV was found to be 72.8%.⁷
- Conversely, a large retrospective cohort study of 200,000 patients found that MRSA NAAT had a NPV greater than 90% for most types of infections, skin and soft tissue infections.⁵
- Discordance is likely due to the differences in prevalence of MRSA in different regions. NPV is driven by prevalence, and MRSA NAAT screening is considered to have a stronger NPV in areas with a low incidence of MRSA.³
- There are less data to understand predictive value of MRSA NAAT screening in the Oregon region given the lack of studies in this area. The purpose of this study is to identify the prevalence of MRSA in the Oregon region as well as the NPV of MRSA NAAT screening, eliciting its utility in predicting MRSA infection and optimizing antimicrobial therapy.

Objectives

Primary Outcome

- Evaluate the sensitivity, specificity, positive predictive value (PPV), and NPV of MRSA NAAT to predict MRSA infections within a regional health system in Oregon

Secondary Outcome

- Evaluate the sensitivity, specificity, PPV, and NPV of MRSA NAAT to predict MRSA infections for specific culture sources within a regional health system in Oregon

Methods

Study Design

- Retrospective study

Inclusion Criteria

- Age 18 years or older
- Admitted to a regional health system in Oregon between 6/30/2021 and 10/24/2022
- MRSA NAAT collected
- Corresponding culture collected within 7 days of MRSA NAAT collection

Exclusion Criteria

- Rejected or inconclusive MRSA NAAT
- Rejected or inconclusive culture

Data Collection

- Retrospective report using WebIntelligence

Data Analysis

- Sensitivity, specificity, positive predictive value (PPV) and NPV were calculated using a script written in R
- Exact binomial method was used to calculate 95% confidence intervals

Preliminary Results

Prevalence

Test	Number	Number Positive for MRSA	Prevalence
MRSA NAAT w/ corresponding clinical culture	4296	491	11.4%
Clinical culture	4296	209	4.9%

Sensitivity, Specificity, PPV, and NPV

Culture Source	Number	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)	Accuracy (95% CI)
All sources	4296	67.5% (60.7-73.8)	91.4% (90.5-92.3)	28.7% (24.8-32.9)	98.2% (97.7-98.6)	90.3% (89.3-91.1)
Blood	1702	68.3% (51.9-81.9)	89.5% (87.9-90.9)	13.8% (9.4-19.3)	99.1% (98.5-99.5)	89% (87.4-90.4)
Pulmonary	809	84.6% (71.9-93.1)	95.2% (93.5-96.6)	55% (43.5-66.2)	98.9% (97.8-99.5)	94.6% (92.8-96)
Urine	789	85.7% (42.1-99.6)	90.3% (88-92.3)	7.3% (2.7-15.2)	99.9% (99.2-100)	90.2% (88-92.2)
Wound	710	59.6% (48.6-69.8)	92.8% (90.4-94.7)	54.1% (43.7-64.2)	94.1% (91.9-95.8)	88.6% (86-90.8)
Unknown	153	53.3% (26.6-78.7)	90.6% (84.4-94.9)	38.1% (18.1-61.6)	94.7% (89.4-97.8)	86.9% (80.5-91.8)
Intra-abdominal	73	0% (0-70.8)	98.6% (92.3-100)	0% (0-97.5)	95.8% (88.3-99.1)	94.5% (86.6-98.5)
Central nervous system (CNS)	47	NA	93.6% (82.5-98.7)	0% (0-70.8)	100% (92-100)	93.6% (82.5-98.7)
Miscellaneous	13	100% (15.8-100)	90.9% (58.7-99.8)	66.7% (9.4-99.2)	100 (69.2-100)	92.3% (64-99.8)

Discussion

Results

Prevalence

- Difference in prevalence between MRSA NAAT and culture
 - Patients may be asymptomatic carriers
 - Lower prevalence helps strengthen NPV

Predictive Value for All Sources

- NPV of 98.2% is similar to other retrospective studies
- As expected, specificity and NPV are high
- Consistent with other studies

Predictive Value for Different Culture Sources

- The majority of culture sources were blood, followed by pulmonary, urinary, and wound
- NPV was 94-99%
- For wound cultures, NPV may be stronger in this region due to lower prevalence
- Strong predictor that infection is not MRSA

- For abdominal cultures, NPV was still high at 95%
- Small sample size for cultures of abdominal source limits strength of NPV

- For CNS, there were no positive MRSA cultures
- Unable to calculate sensitivity
- Limits strength of NPV

- For unknown cultures, NPV was 94.7%, but the exact source of these cultures is not yet known

Limitations

- WebIntelligence
- Only able to pull data for previous 15 months
- Limits sample size
- Unable to identify type of wound culture based on report
- Certain culture types have small sample sizes
- Limits ability to interpret NPV

Next Steps

- Confirm culture type in unknown and miscellaneous samples
- Repeat calculations to finalize NPV for different culture types
- Share results with infectious disease clinicians to determine impact on practice

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