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Predictive characteristics of methicillin-resistant *Staphylococcus aureus* (MRSA) nares swabs for MRSA-positive cultures among hospitalized veterans

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Background

Providers often face the consideration of whether to treat a patient with suspected *Staphylococcus aureus* (SA) infection for MRSA before the availability of susceptibility results. Although failing to provide adequate antibiotic coverage for MRSA in a patient with MRSA infection can lead to significant harm, antibiotics for empiric coverage for MRSA are not first-line for methicillin-susceptible SA (MSSA), can be more expensive than non-MRSA-active antibiotics, and may put patients at greater risk for toxicity. Additionally, the recent increase in resistance to primary MRSA antibiotics is concerning (1,2).

Although MRSA nares screening is generally performed for infection control purposes, previous studies have shown that nasal colonization with MRSA is associated with an increased risk of clinical MRSA infection, suggesting that this test could be used to guide clinical management (3). However, there are variable reports regarding the strength of association between MRSA nares screen results and MRSA-positive culture results (4-8).

Objectives of the Project

- Determine the predictive characteristics of MRSA nares swab results for MRSA-positive cultures among patients with a SA-positive clinical culture
- Assess how these predictive characteristics change according to type of culture
- Compare the two types of nares testing commonly performed: polymerase chain reaction (PCR) and agar culture

Methods

Retrospective electronic medical record (EMR) review

INCLUSION CRITERIA

- Inpatient hospital stay at the Minneapolis VAHCS within years 2013-2016
- SA-positive culture obtained during hospital stay

EXCLUSION CRITERIA

- > 90 yrs of age
- No MRSA swab prior to SA culture
- Both MRSA and MSSA present in single culture
- Cultures labeled "stool," "rectal," "vaginal," "genital," 'throat," "nares", and "nasal," as these are thought to be unlikely sources of true infection

All patients with SA clinical cultures from 2013-2016 were identified in the Vitek microbiology database

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Patient's most recent culture identified; more distant cultures excluded (only one culture per patient). Total N=559.

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Culture located in EMR; MRSA status and type of culture confirmed

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Results of most recent MRSA nares prior to culture located in EMR

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Congruency between SA clinical culture and MRSA swab evaluated

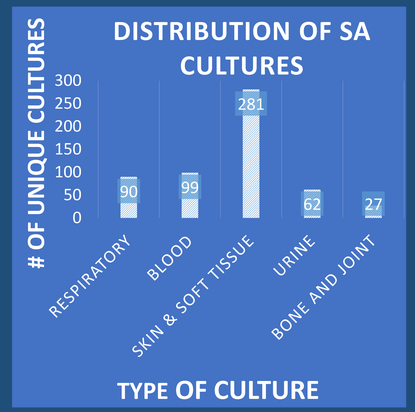

Figure 1: Culture Distribution

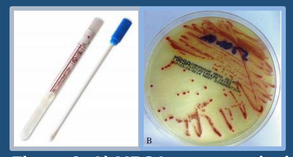

Figure 2: A) MRSA nares swab alongside B) MRSA CHROMagar (9)

Results

Table 1: Predictive characteristics of MRSA nares swab results for MRSA-positive cultures by type of culture

Culture Type	OR (95% CI)	Sens % (95% CI)	Spec % (95% CI)	PPV %	NPV %
All cultures	40.9 (24.4-74.7)	63.2 (56.3-69.7)	96.0 (93.3-97.8)	90.5	81.0
Respiratory	64.1 (13.3-309.5)	73.3 (57.0-85.8)	95.9 (86.0-99.5)	93.8	81.0
Blood	50.9 (10.6-244.2)	61.8 (43.6-77.8)	96.9 (89.3-99.6)	91.3	82.9
Skin & soft tissue	45.6 (18.5-112.7)	61.5 (51.5-70.9)	96.6 (92.8-98.7)	91.4	81.0
Urine	13.5 (3.7-49.5)	64.3 (44.0-81.4)	88.2 (72.6-96.7)	81.8	75.0
Bone & joint	N/A	20.0 (0.5-71.6)	100.0 (N/A)	100.0	84.6

- Respiratory cultures were most strongly associated
- Urine had the lowest odds ratio (OR) and lowest predictive values
- Bone and joint had 100% specificity, but the lowest sensitivity (20%) and was the smallest group (N = 27)

Table 2: Predictive characteristic of PCR versus agar

Type of test	# of swabs (% of total)	Sens % (95% CI)	Spec % (95% CI)
PCR	396 (70.8)	67.3 (59.4-74.6)	95.0 (91.4-97.4)
AGAR	163 (29.2)	51.8 (38.0-65.3)	98.1 (93.4-99.8)

- PCR more sensitive; only slightly less specific

Discussion

- MRSA nares swab results significantly predicted the MRSA status of a clinical SA isolate among patients with a SA-positive clinical culture.
- The predictive value of MRSA nares swabs was:
  - strongest for respiratory cultures, consistent with prior literature (7).
  - weakest for urine cultures.
- For MRSA nares testing, PCR was more sensitive than agar culture, and only slightly less specific.
- Overall, MRSA nares swabs had lower sensitivity and NPV for MRSA-positive culture than expected.
- MRSA swab results may assist providers when selecting antibiotic regimens prior to the return of susceptibilities, particularly when illness severity and likelihood of SA infection are also considered.

Limitations

- Limited to veterans, mostly males > 65 yrs of age
- Predictive characteristics of MRSA swab described among SA-positive cultures only (rather than among all cultures)
- Only the most recent prior MRSA was considered – many patients had multiple historical MRSA swabs, inclusion of which might improve predictive power

Take-Home Points

- Positive MRSA swab greatly increases odds that SA isolate is MRSA
- Respiratory cultures have the strongest congruency with MRSA swabs, consistent with prior studies
- MRSA nares swab had lower sensitivity (63.1%) and NPV (81.0%) than expected

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