Role of nasal methicillin-resistant Staphylococcus aureus screening in the management of skin and soft tissue infections

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We set out to determine whether nasal swab isolates can identify methicillin-resistant Staphylococcus aureus (MRSA) colonization and guide therapy in skin and soft tissue infections (SSTI). Among hospitalized patients admitted to a general medicine service with SSTI, specificity and positive predictive value for MRSA in nasal swab isolates were 100%; sensitivity was 55%. Thus, positive nasal swab cultures may help identify MRSA colonization and guide antimicrobial therapy for SSTI when wound cultures cannot be obtained.

Key Words: Methicillin-resistant Staphylococcus aureus; nasal swabs; skin and soft tissue infections.

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Community-associated methicillin-resistant Staphylococcus aureus (MRSA) is increasingly recognized as a pathogen in purulent skin and soft tissue infections (SSTI), with prevalence of up to 75% in high-risk populations1-3 including persons who use intravenous drugs, are homeless, or have been incarcerated. However, it is often difficult to identify causative organisms in SSTI in the absence of a purulent wound or abscess.4 In addition to the challenge of deciding when empiric MRSA coverage is warranted, there is concern about potential emergence of resistance to non-β-lactam agents such as trimethoprim-sulfamethoxazole, tetracyclines, and clindamycin5 used to treat MRSA SSTI in the outpatient setting. Culture data are critical in tailoring antimicrobial therapy, particularly when transitioning to oral therapy at hospital discharge.

MRSA nasal carriage, identified in 0.2% to 2.8% of the United States population, has been recognized as a risk for MRSA SSTI.2 Individuals colonized with MRSA are at increased risk of subsequent infection.2 Previous studies have demonstrated that individuals with Staphylococcus aureus bacteremia6 and surgical site infections7,8 are colonized in their nares with the same isolate 80% to 90% of the time, as determined by pulsed-field gel electrophoresis. Thus, nasal swabs may be a quick and inexpensive method of providing culture data to help guide antimicrobial therapy in SSTI when wound cultures are unavailable.

Data correlating nasal swabs with SSTI cultures in hospitalized medicine patients are limited. We compared nasal swab isolates with SSTI cultures in this population to determine whether nasal swab cultures and sensitivities are predictive of MRSA SSTI to help guide therapy.

METHODS

Patients

We conducted a retrospective review of nasal swab and wound cultures in adults with SSTI admitted to the Medicine Service of a 413-bed urban teaching hospital between August and December 2005. Patients were identified based on discharge diagnosis codes of cellulitis and/or abscess. Patients admitted to the intensive care unit or surgical services were excluded. Standardized SSTI order sets implemented just prior to this study included a nasal swab order to assess for MRSA carriage. Nasal swab MRSA detection was performed by culture. Patient characteristics, including MRSA risks, were abstracted from computerized medical records.
Nasal swabs and wound cultures (obtained from SSTI swabs or incision and drainage) were collected on admission prior to antibiotic administration. Susceptibility testing was performed using disk diffusion. Primary outcome measure was nasal swab performance characteristics for SSTI. Antimicrobial susceptibility concordance between nasal swab and SSTI cultures was also assessed. University of Washington Human Subjects approved this study.

**Statistical analysis**

Patient characteristics were compared using χ² tests for categorical variables and t tests without an assumption of equal variance for continuous variables. Statistical significance was defined as 2-sided P value <.05. Analyses were performed using STATA (Stata Corporation, College Station, TX).

**RESULTS**

Of 179 eligible patients, 52 (29%) had nasal swabs and wound cultures. There were no statistically significant demographic differences between patients who had positive nasal swab cultures and those who did not, including risks for MRSA infection (Table 1). Of 52 study patients, 21 (40%) had wound cultures from superficial swabs (cellulitis without abscess) and 31 (60%) from incision and drainage (cellulitis with abscess). *Staphylococcus* spp grew from nasal swabs in 25 patients: 84% were MRSA, 12% methicillin-susceptible *S aureus*, 4% coagulase-negative. Twenty-seven patients had negative nasal cultures.

Nasal swabs were 55% sensitive for MRSA wound infection and 100% specific; positive predictive value (PPV) was also 100% (Tables 2 and 3). PPV was 100% regardless of whether wound cultures were from swabs or drainage.

There was 100% concordance of susceptibilities for patients with MRSA in nares and wounds for vancomycin, trimethoprim-sulfamethoxazole, tetracycline, and clindamycin including exact concordance for inducible clindamycin resistance. Fluoroquinolone susceptibility was identical in 18 of 21 (86%) isolates, with differences being due to “intermediate” susceptibility as determined by disk diffusion.

**DISCUSSION**

MRSA is increasingly recognized as an SSTI pathogen but may be difficult to identify when wound cultures cannot be obtained, making it challenging to tailor therapy in hospitalized patients at discharge. In this study, only 52 patients had both nasal and wound cultures performed. However, if the nasal swab grew MRSA, the wound was also likely to grow MRSA, with a 100% PPV even in patients with only superficial infection. Unfortunately, nasal swabs had a low sensitivity, so they cannot be used to “rule out” MRSA infections when negative, particularly in patients with high epidemiologic MRSA risks. In addition, patients may be colonized with MRSA at other body sites despite a negative nares culture.
Concordance between susceptibilities from nasal swabs and wound culture MRSA isolates was excellent for all antimicrobials tested. In patients with SSTI, positive MRSA nasal culture may allow for tailoring of oral antimicrobials at hospital discharge when wound cultures cannot be collected.

This study is limited by its retrospective, observational nature and small sample size. Despite the use of a preprinted nasal swab order for all patients with SSTI, they were only performed in 29% of eligible patients. Possible explanations include variability in order set utilization because the study was conducted soon after implementation. Patients may have declined nasal swabs. Nasal swab results may have been falsely negative because of sampling error, operator variability, or may represent the intermittent nature of nasal MRSA colonization. Another study limitation is the use of disk diffusion as opposed to pulsed-field gel electrophoresis to determine nasal swab test characteristics in SSTI, although previous studies have found the same isolate 80% of the time when comparing nasal S aureus colonization with site of infection.

This study was conducted in patients admitted to a general medicine service; use of nasal swabs in SSTI among surgical patients or outpatients requires further study. Patients were admitted to an urban county hospital that serves a population known to be at high risk for MRSA, including patients who are homeless, low income, or have a history of incarceration, thereby limiting generalizability.

It is also unclear whether nasal swab cultures have the same validity for SSTI cultures from superficial swabs and incision and drainage; however, there were not great differences between nasal swab performance characteristics between patients with purulent wounds and superficial infection.

**CONCLUSION**

In hospitalized patients with SSTI, positive nasal swabs can identify MRSA colonization, leading to appropriate infection control measures for SSTI and antimicrobial tailoring at discharge when wound cultures are unavailable. Although nasal swab sensitivity for MRSA SSTI is moderate, specificity and PPV are excellent even in patients with superficial infection suggesting that, whereas a positive nasal swab culture is extremely helpful, a negative result does not exclude the possibility of MRSA infection. In addition, this small study suggests that antimicrobial susceptibility data from a positive nasal swab culture can help guide therapy in the hospital and at discharge when wound cultures cannot be obtained or are inconclusive. A larger prospective study is warranted to validate these findings because nasal swabs may be an effective and inexpensive means of improving inpatient care of SSTI.

**References**


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**Table 2. Performance characteristics of nasal swabs for methicillin-resistant Staphylococcus aureus**

<table>
<thead>
<tr>
<th>Wound (+) MRSA</th>
<th>Wound (-) MRSA</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>NS (+) MRSA</td>
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<td>0</td>
</tr>
<tr>
<td>NS (-) MRSA</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>14</td>
</tr>
</tbody>
</table>

MRSA, methicillin-resistant Staphylococcus aureus; NS, nasal swab.

**Table 3. Performance characteristics of nasal swabs for methicillin-resistant Staphylococcus aureus**

<table>
<thead>
<tr>
<th>All patients (n = 52), %</th>
<th>Patients with superficial infection (n = 21), %</th>
<th>Patients with incision and drainage (n = 31), %</th>
</tr>
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<tbody>
<tr>
<td>Sensitivity</td>
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<td>47</td>
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<tr>
<td>Specificity</td>
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<td>100</td>
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<tr>
<td>Negative predictive value</td>
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