The Role of the MRSA Nasal PCR in Empiric Antibiotic Selection

By Charles Derek Leiner, MD, Bahnsen Miller, MD, Patrick Fadden, MD, and Jonathan Van Name

Case

A 67-year-old man with chronic obstructive pulmonary disease (COPD) was admitted to inpatient general medicine from his nursing home for pneumonia. He reported a 10-day history of an upper respiratory viral infection with symptoms improving until two days ago. Initial evaluation revealed a temperature of 100.5°F, heart rate of 95 beats per minute, blood pressure of 147/89 mm Hg, respiratory rate of 25 per minute, and O2 saturation of 92% on room air. His white blood cell count was 14,000. Both a COVID-19 and methicillin-resistant Staphylococcus aureus (MRSA) nasal polymerase chain reaction (PCR) assay were negative. Chest X-ray revealed a right lower lobe opacity. Ceftriaxone and azithromycin were started for quick detection of resistant pathogens must be balanced with stewardship of empiric antibiotic use.

Overview of the data

MRSA nasal PCR in pneumonia

Recent studies have demonstrated high sensitivity and high negative predictive value (NPV) of the MRSA nasal PCR in respiratory illness.1 In a 2018 meta-analysis of 5,163 patients diagnosed with either community-acquired pneumonia (CAP) or ventilator-associated pneumonia (VAP), the MRSA nasal PCR had a high NPV (CAP: 98.2%; VAP: 96.8%) and a low positive predictive value (PPV) (CAP: 56.8%; VAP: 35.7%) for MRSA pneumonia. A 2020 retrospective study conducted at the Veterans Affairs health system using more than 90,000 respiratory cultures also found a high NPV (96%) but low PPV (35%) for MRSA infection.2

Given the robust data showing an excellent NPV, a negative MRSA nasal PCR can be used to either withhold empiric anti-MRSA agents or de-escalate if those agents have already been started.3 Studies have shown the use of the rapid MRSA nasal screen in CAP leads to earlier de-escalation of MRSA therapy by approximately two days and reduction of vancomycin serum level monitoring and dose adjustments nearly three-fold without a statistically significant difference in in-hospital mortality.4 Earlier de-escalation may reduce hospital costs for patients while reducing adverse drug reactions and side effects of MRSA-active agents.5

A MRSA nasal PCR should only be used to guide treatment if obtained within 72 hours of presentation for pneumonia. However, a retrospective study demonstrated a persistent high NPV (94.9%) of the rapid MRSA nasal PCR up to 14 days from the time of test to confirmation of disease.6 It is extremely important to emphasize that a negative MRSA nasal PCR should not guide treatment in patients with recent MRSA decolonization, structural lung diseases such as cystic fibrosis and/or bronchiectasis, or septic shock.7

Data is limited on the use of MRSA nasal PCR to guide the treatment of non-pneumonia infections.

Key Points

- A negative MRSA nasal PCR result can be used to de-escalate or avoid empiric anti-MRSA antibiotics for pneumonia.
- A positive MRSA nasal PCR does not diagnose or rule in MRSA pneumonia due to poor positive predictive value.
- A negative MRSA nasal PCR should not guide treatment in patients with recent MRSA decolonization, structural lung diseases such as cystic fibrosis and/or bronchiectasis, or septic shock.
- Data is limited on the use of MRSA nasal PCR to guide the treatment of non-pneumonia infections.

A 65-year-old man is admitted for community-acquired pneumonia (CAP). On hospital day two, respiratory symptoms are improving while being treated with ceftriaxone and azithromycin. As you are planning his discharge home, his MRSA nasal PCR collected on admission returns positive. Sputum cultures are still pending. What are your antibiotic recommendations?

a. Continue current CAP therapy; transition to oral, and discharge as planned
b. Do not discharge and start vancomycin
c. Discharge with oral linezolid to cover MRSA pneumonia
d. Repeat chest X-ray

Correct option: A. Sputum cultures can be followed to help direct therapy when the MRSA nasal PCR is positive. However, due to the test’s low positive predictive value, the positive result should not change empiric treatment, especially when the patient is demonstrating clinical improvement. Due to the high negative predictive value for MRSA pneumonia, a negative MRSA nasal PCR assay can prompt the de-escalation of anti-MRSA antibiotics.

MRSA nasal PCR in non-pneumonia infections

The utility of MRSA nasal PCR to guide treatment in non-respiratory infections is unclear. Current studies are often limited by retrospective data, an unclear history of MRSA colonization, and a need for a culture of the suspected source of infection. Notably, local MRSA prevalence also influences the predictive values of the MRSA nasal PCR. In one recent meta-analysis, the MRSA nasal PCR had an NPV of greater than 90% in environments where MRSA prevalence was less than 15%. One large, multicenter, retrospective Veterans Affairs study listed the NPV for several infection locations including bloodstream (96.5%), intra-abdominal (98.6%), respiratory (96.1%), wound (93.1%), and urinary (99.2%). PPV for the entire cohort was 24.6%. MRSA prevalence in the whole cohort was 8%. A smaller, single-center, retrospective study reported the NPV of MRSA nasal PCR as 97.5% in skin and soft tissue infections. MRSA was isolated in only 9% of the total study population while the institutional prevalence of MRSA was approximately 1 to 2.5%. In contrast, a single-center study of skin and soft tissue infections in the emergency department with a MRSA prevalence of 44.8% revealed a higher PPV (95.7%) and a lower NPV (72.8%).

These studies highlight the importance of MRSA prevalence when interpreting NPV, especially in clinical situations where data on treatment decisions are limited or mixed.

Due to the lack of strong evidence, a MRSA nasal PCR should not be used to determine treatment in patients with severe infections such as bacteremia. Due to low prevalence, MRSA nasal PCR does not have a role in the treat-
someday need. Hospitalists’ awareness that virtually all of us will one day face the “publish or perish” cliché, but almost no one is prepared to deal with the reality.

We’re all familiar with the “publish or perish” cliché, but almost no one is prepared to deal with the reality.

Bottom line
Upon admission to the hospital, a negative MRSA nasal PCR result can be used to de-escalate or avoid anti-MRSA antibiotics for treating bacterial pneumonia.

References

Additional Reading
1. Metlay et al. Am J Respir Crit Care Med. 2019