Effects of an Antimicrobial Stewardship-guided MRSA Nasal Screening Review on Vancomycin Utilization for Respiratory Infections: A Quasi-Experimental Study

Ross Pineda, PharmD; Meganne Kanatani, PharmD; Jaime Deville, MD
Ronald Reagan UCLA Medical Center, Los Angeles, CA

Contact Information:
Ross Pineda, PharmD
Ronald Reagan UCLA Medical Center
Department of Pharmaceutical Services
E-mail: rppineda@mednet.ucla.edu

ABSTRACT

Background: Methicillin-resistant *Staphylococcus aureus* (MRSA) remains a significant pathogen in patients with respiratory infections. Guidelines recommend empiric MRSA coverage in patients at increased risk, resulting in substantial vancomycin use. Recent literature highlights the use of MRSA nasal assays as a rapid screening tool for MRSA pneumonia, demonstrating high negative predictive values and allowing for shorter empiric coverage. We aimed to evaluate the impact of MRSA nasal screening review by the antimicrobial stewardship program (ASP) on vancomycin utilization for respiratory infections.

Methods: This was a retrospective, quasi-experimental, pre-post intervention study. The intervention saw the addition of an MRSA screening review tool into the ASP electronic record, highlighting patients on vancomycin (actively or recently administered) with a pulmonary indication and a negative MRSA screening. Vancomycin days of therapy (DOT) were collected for all orders within the two weeks following a negative screening. Additional outcomes include vancomycin total dose and DOT per 1,000 patient days. Outcomes were compared via independent samples t-tests.

Results: Just over 1,100 MRSA screenings resulted over the 2 month study period, the majority of which were excluded for either not having vancomycin ordered, or for having vancomycin ordered for a non-pulmonary indication. This left 37 and 35 evaluable screenings in the pre- and post-intervention groups, respectively. Regarding vancomycin DOT, we did not identify a significant difference between pre- and post-intervention groups with respective means of 2.45 (SD=1.52) and 2.14 (SD=1.12) (p=0.35). We identified a total 8.78 vancomycin DOT per 1,000 patient days in the pre-intervention group versus 6.69 post-intervention.

Conclusion: ASP-guided review of MRSA screenings was associated with both a nonsignificant decrease in mean vancomycin DOT and a lower total DOT per 1,000 patient days for a pulmonary indication following a negative screening. Given the recent implementation of our intervention, our analysis covered a small sample size, highlighting the need for continued data collection. MRSA screenings are not always fully or immediately utilized in our institution, demonstrating room for the de-escalation of MRSA-targeted antibiotics.

BACKGROUND

- Infections caused by MRSA are associated with increased hospital length of stay, mortality, and treatment costs
  - Pneumonia accounts for the second most commonly associated MRSA infection and is associated with higher crude mortality
- IDSA Clinical practice guidelines for community-acquired pneumonia (CAP) (2019) and hospital-acquired/ ventilator-associated pneumonia (2016) recommend MRSA coverage for patients at increased risk, resulting in substantial vancomycin use
- MRSA nares surveillance cultures demonstrate high negative predictive value (96.5%) to rule out MRSA pneumonia, allowing for rapid de-escalation of MRSA-active antibiotics
  - CAP guidelines recommend utilizing data from nasal cultures and/or PCR to de-escalate or confirm the need for MRSA-targeted antibiotics

STUDY OBJECTIVE

- **Hypothesis**: Implementation of an MRSA nasal screening review tool into ASP electronic record will decrease utilization of vancomycin for respiratory infections in patients with a negative screening

METHODS

- **Study Design:** Retrospective, single-center, quasi-experimental pre-post intervention study
- **Intervention:** ASP-guided MRSA Screening Review
  - Target Population: Negative MRSA screening in past 30 days and active vancomycin order in past 14 days
  - Action: Patient highlighted in the ASP electronic record
- **Study Groups**: Pre-intervention MRSA nasal screenings (March 2019) vs. post-intervention screenings (May 2019)
- **Primary Outcome**: Vancomycin days of therapy
  - Inclusion Criteria: Administered within 14 days after negative MRSA screening for a pulmonary indication
- **Secondary Outcomes**: Total vancomycin dose; cumulative days of vancomycin therapy per 1,000 patient days
- **Analysis**: Descriptive statistics; Independent samples T-test

RESULTS

- 1,110 MRSA nasal screenings resulted and were reviewed
  - Pre-intervention: 590 screenings across 537 patients
  - Post-intervention 520 screenings across 476 patients
  - Majority of screenings were excluded (see Figure 1) for not having vancomycin ordered or for having vancomycin ordered for a non-pulmonary indication following a negative screening. Final study cohorts were as follows:
    - Pre-intervention: **37 evaluable screenings**
    - Post-intervention: **35 evaluable screenings**
- **Vancomycin Days of Therapy** (following a negative screening)
  - Pre-intervention: 2.45 (SD=1.52) days
  - Post-intervention: 2.14 (SD=1.12) days
  - P value = 0.35
- **Total Dose of Vancomycin** (following a negative screening)
  - Pre-intervention: 3,810 (SD=4,620) mg
  - Post-intervention: 3,195 (SD=2,793) mg
  - P value = 0.51
- **Days of Vancomycin Therapy per 1,000 Patient Days**
  - Pre-intervention: 8.78 DOT per 1,000 patient-days
  - Post-intervention: 6.69 DOT per 1,000 patient-days

RESULTS (FIGURES)

Figure 1. MRSA Nasal Screening Characteristics

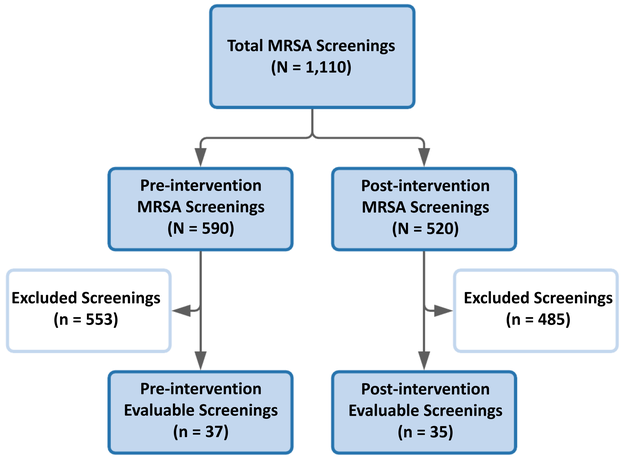

Table 1. Patient Characteristics

	Pre-intervention	Post-intervention
Unique Patients	33	35
Age (years), median (IQR)	66 (60.0-76.0)	61 (49.5-69.2)
Gender, n (%)		
Female	12 (36.4)	12 (34.3)
Male	21 (63.6)	23 (65.7)
Number of MRSA Screenings, n (%)		
Single	31 (93.9)	30 (85.7)
Multiple	2 (6.1)	5 (14.3)

Table 2. Vancomycin* Utilization Following ASP-guided MRSA Screening Tool

	Pre-intervention	Post-intervention	P Value
Vancomycin Days of Therapy, Mean (SD)	**2.45** (1.52)	**2.14** (1.12)	0.35
Vancomycin Dose (mg), Mean (SD)	**3,810** (4,620)	**3,195** (2,793)	0.51

**Vancomycin indicated for a pulmonary indication and administered after a negative MRSA screening*

DISCUSSION

- **Limitations**
  - Recent implementation of MRSA nasal screening tool resulting in smaller sample size and limited utilization
  - Difficulty assessing correlation between ordered MRSA nasal screening and subsequent vancomycin doses
- **Conclusions**
  - ASP-guided review of MRSA nasal screening associated with a nonsignificant decrease in average vancomycin days of therapy in respiratory infections following a negative screening, as well as lower cumulative days of therapy normalized to 1,000 patient days
    - ASP-designed tools can be effective given the appropriate bandwidth and workforce to use them
  - Across the institution, MRSA nasal screenings were not consistently ordered or fully utilized
    - Continued opportunities exist to further de-escalate MRSA-targeted antibiotics
- **Resulting Institutional Changes**
  - Addition of MRSA nasal screening review tool to ASP electronic record
  - Addition of MRSA nares surveillance culture orderable to admission order sets alongside vancomycin
  - Revision of vancomycin per pharmacy protocol to include ordering MRSA nares surveillance cultures

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