Solving The MRSA Paradox:
A Self–Controlled Case Series Study Of The Temporal Relationship Between MRSA Colonization And Subsequent Bacteremia

Isam Mawas, MD¹, Jairo Olivas, MD², and Susan Kellie, MD, MPH¹

Definitions

- New MRSA colonization date: acquisition of MRSA colonization-defined as the date of the last negative PCR prior to bacteremia.
- Study period: chart review covered the 455 days (15 months) prior to MRSA bacteremia.
- Observation period: time from first PCR (positive or negative) or first culture positive for MRSA recorded within the 450 days prior to bacteremia.

Results

534 cases were identified for chart review of which 225 had documented MRSA bacteremia. In this group, there were 5,172 days under observation in the 6 weeks prior to bacteremia, and 21,072 days under observation in the 43-455 days prior to bacteremia. 78 patients had apparent acquisition of MRSA during the study period with a negative PCR prior to MRSA bacteremia. 26 patients had a last negative PCR (surrogate for MRSA acquisition) in the 42 days prior to bacteremia vs. 52 patients in the earlier study period.

The incidence rate ratio for MRSA acquisition in the 42 days prior to MRSA bacteremia compared to that in the 43-455 days prior to MRSA bacteremia was 2.04 (95% CI 1.3-3.25, p=0.025), using a Poisson regression model.

In patients who reverted to negative PCR after being positive, using the later date as last negative did not alter the analysis.

Schematic of timing of last negative PCRs prior to MRSA bacteremia (blue dots–days of last negative PCR, red dot–median value)

Conclusions

The risk of invasive MRSA infection appears to be greater in recently colonized patients, which would explain the rapid and decrease in invasive MRSA infections which have been observed in healthcare settings where measures are taken to reduce new colonizations through active surveillance testing and contact precautions (9).

The association of MRSA bacteremia with more recent acquisition of MRSA highlights the need for ongoing aggressive infection control in settings housing patients at high risk. The rapidity of isolation of MRSA-positive patients may play a critical role, explaining the disparate results between the VA and STAR-ICU studies, where the VA protocol used rapid testing with PCR to identify patients colonized with MRSA, whereas the STAR-ICU study used culture methods (5.10). The most recent update of the SHEA compendium for prevention of MRSA continues to advocate AST in high-risk, high-transmission settings (11) and our findings support protecting the MRSA-negative patient from colonization to reduce the risk of invasive infection, even in the setting of high endemic rates of colonization.

References


Background:

Active surveillance testing (AST) has been implemented in hospitals across the United States in an effort to decrease the burden of invasive methicillin-resistant Staphylococcus aureus infections (1).

Healthcare-associated invasive MRSA infection rates have declined 32% from 2007-2013 (2), but the role of AST remains controversial (3,4). Data from the Veterans Affairs MRSA Initiative demonstrate the MRSA paradox: after the initiation of AST and contact precautions, the prevalence of MRSA colonization increased from 12-16%, but the rate of invasive infections declined by 79% in ICUs and 58% in non-ICU settings (5).

A VA-wide analysis suggested that the decrease in nosocomial invasive MRSA was limited to those patients who were nasal screen-negative on admission (6).

We hypothesized that AST reduces the incidence of MRSA bacteremia in hospitals because the risk of infection is highest in the first 6 weeks after colonization and AST allows for prevention of transmission to new patients in hospitals within this risk period.

Materials and methods:

We used a self-controlled case series analysis to compare the incidence rate of new colonization with MRSA in the 42 day interval prior to MRSA bacteremia to the incidence rate in the 43-455 day interval prior to MRSA bacteremia.

Self-controlled case series:

This method may be used to study the association between transient exposure and acute outcome using only data on cases, and is an alternative to more established cohort or case-controlled studies (7,8).

The key advantage of this method is that controls are required as the cases act as their own controls. It implicitly controls for all confounding factors that do not vary with time within the observation period such as location, age, gender, socio-economic status, and underlying co-morbidities.