Does Screening for MRSA Colonization Have a Role in Healthcare-Associated Infection Prevention Programs?

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Antimicrobial Resistance is an Important Public Health Problem

BAD BUGS, NO DRUGS
An Antimicrobial Resistance Symposium...
A Public Health Crisis Evolves

ISDA
Infectious Diseases Society of America
July 2004
“Resistant pathogens lead to higher health care costs because they often require more expensive drugs and extended hospital stays.... The total cost to U.S. society is nearly $5 billion annually.”

MRSA is an Important Part of The Antimicrobial Resistance Problem

Prevalence of Multidrug-Resistance Among HAI Pathogens Reported to NHSN, 2006-2007

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>% of all HAI</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA</td>
<td>8%</td>
</tr>
<tr>
<td>VRE</td>
<td>4%</td>
</tr>
<tr>
<td>Carbapenem-resistant <em>P. aeruginosa</em></td>
<td>2%</td>
</tr>
<tr>
<td>Extended-spectrum cephalosporin-resistant <em>K. pneumoniae</em></td>
<td>1%</td>
</tr>
<tr>
<td>Extended-spectrum cephalosporin-resistant <em>E. coli</em></td>
<td>0.5%</td>
</tr>
<tr>
<td>Carbapenem-resistant <em>A. baumannii, K. pneumoniae, K. oxytoca</em>, and <em>E. coli</em></td>
<td>0.5%</td>
</tr>
</tbody>
</table>
Healthcare-Associated MRSA Infections Are Expensive

Medical plus Societal costs for a Chicago Teaching Hospital:
- $60,984 (2008 dollars) per infection
- Almost $5 million total costs attributable to MRSA per year

Roberts RR et al. Clinical Infectious Diseases 2009;49:1175-84

Outcomes for MRSA Infection are Worse than For MSSA Infection

Summary of Unadjusted Results of Studies Comparing Mortality of MRSA and MSSA Bacteremia

Cosgrove et al. Clinical Infectious Diseases 2003;36:53-59

Limitations in Therapeutic Options For MRSA Exist, and Appear to Be Getting Worse

- Vancomycin susceptibility in MRSA is decreasing over time
  - Infections caused by vancomycin-susceptible MRSA organisms with MICs of ≥ 1 mg/mL appear to respond less effectively to vancomycin than do infections caused by organisms with MICs of <1 mg/mL.
- Reports of linezolid and daptomycin resistance among MRSA poses concern for future durability of these agents

Sakoulas and Moellering. Clinical Infectious Diseases 2008; 46:S360–7
MRSA is an Important Part of The Antimicrobial Resistance Problem

Epidemiology of Healthcare-Associated MRSA

The emergence of Healthcare-Associated MRSA has been due to transmission of relatively few clones, not de novo selection from susceptible S. aureus strains.
Acquisition of MRSA Colonization Has Consequences that Extend Beyond One Hospitalization

- Patients can carry MRSA with them for months or years
  - Infections may develop following hospital discharge, or during subsequent admissions
  - 29% of patients with new MRSA acquisition developed infection in the subsequent 18 months, half of these following hospital discharge
  - When patients are readmitted to the same or another healthcare facility, they serve as a potential reservoir of transmission

Healthcare Facilities Serve as Amplifiers of MRSA Transmission
MRSA Carriage Rates at Admission, Veterans Hospitals 2006-2007 (n=14)

<table>
<thead>
<tr>
<th>Unit Type</th>
<th># Present</th>
<th># Admission</th>
<th>MRSA Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTAC</td>
<td>7</td>
<td>1004</td>
<td>2.79</td>
</tr>
<tr>
<td>ICU</td>
<td>21</td>
<td>2620</td>
<td>1.13</td>
</tr>
<tr>
<td>LCU/Hub</td>
<td>7</td>
<td>132</td>
<td>10.15</td>
</tr>
<tr>
<td>Med/Carb/ICU</td>
<td>3</td>
<td>575</td>
<td>10.74</td>
</tr>
<tr>
<td>Med/Carb/ICU</td>
<td>9</td>
<td>1353</td>
<td>14.76</td>
</tr>
<tr>
<td>Med/R/E/ICU</td>
<td>15</td>
<td>3716</td>
<td>15.26</td>
</tr>
<tr>
<td>Med/ICU</td>
<td>1</td>
<td>407</td>
<td>16.41</td>
</tr>
<tr>
<td>Med/UnI</td>
<td>14</td>
<td>4659</td>
<td>16.84</td>
</tr>
<tr>
<td>Surg/ICU</td>
<td>4</td>
<td>10414</td>
<td>13.55</td>
</tr>
</tbody>
</table>

Healthcare Facilities Serve as Amplifiers of MRSA Transmission

Two Strategies for Preventing Healthcare-Associated MRSA Infection

- Preventing acquisition of MRSA colonization (i.e. preventing transmission)
- Preventing Infection Among Patients Colonized with MRSA (i.e. preventing endogenous infection)
**Michigan Keystone ICU Project**

Overall rate reduction of 67%

Provonost et al. NEJM 2006;355:2725-2732


Burton et al. JAMA. 2009;301(7):727-736
Preventing hospital-onset device and procedure-associated infections, while important, is not a sufficient approach to the problem of healthcare-associated MRSA

- Does not directly address the antimicrobial resistance issue
- Does not address the majority of healthcare-associated MRSA infections that occur
Most Healthcare-Associated MRSA Infections Have Their Onset Outside of the Hospital

Klevens et al JAMA 2007;298:1763-71
Preventing Transmission is Critically Important in Controlling Healthcare-Associated MRSA

How Do We Prevent MRSA Transmission in the Healthcare Setting?

- General approach
  - Optimizing antimicrobial use
  - Standard precautions for all patients
- Targeted approach
  - Additional infection control measures to prevent transmission from colonized individuals (e.g. Contact Precautions)
Antibiotic Management alone does not appear to effectively control MRSA transmission.

Use of Standard Precautions alone is not as effective at preventing transmission in comparison to strategies that use additional infection control precautions (e.g., Contact Precautions).

Comparing Rates of MRSA Transmission: Standard Precautions vs. Contact Precautions

<table>
<thead>
<tr>
<th>Source</th>
<th>Isolated</th>
<th>Unisolated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmissions</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Patient-days</td>
<td>558</td>
<td>71.5</td>
</tr>
<tr>
<td>Rates</td>
<td>0.009</td>
<td>0.140</td>
</tr>
</tbody>
</table>

RR=15.6, 95% CI=5.3-45.6, p<0.0001

Between 1992-2001, screening cultures taken twice weekly on all patients in SICU
- 3 MRSA-colonized patients admitted and isolated at admission
- Single transmission documented
- 3 MRSA-colonized patients admitted, but not isolated at time of admission
- 37 transmissions documented

76-85% of MRSA carriers admitted to acute care hospitals will remain unrecognized if clinical cultures alone are used to identify them

What is the Evidence that Use of Active Surveillance is Effective?
CDC 1

**Post-intervention:**

- ICU MRSA bacteremia rate declined 80%, p<.001
- Non-ICU bacteremia rate declined 67%, p=.002
- No decline in MSSA bacteremia


**Universal Surveillance for Methicillin-Resistant Staphylococcus aureus in 3 Affiliated Hospitals**


**Hospital-based Measures May Prevent Post-Discharge Infections**

MRSA Incidence: Pittsburgh VA Hospital, October 1999 to November 2008

Proportion of Clinical S. aureus Isolates Resistant to Methicillin, Pittsburgh VA Hospital, 1999-2008

Admission Prevalence of MRSA Carriage Based on Clinical Cultures, Pittsburgh VA Hospital, 1999-2008
Results of a Multicenter MRSA Prevention Collaborative

- Intervention
  - 3 hospitals in geographically distinct areas of US (Montana, Pennsylvania, Kentucky)
  - Active Surveillance in ICUs, Contact Precautions for MRSA carriers, Hand hygiene promotion, Systems/Behavioral Change Strategies
  - ICU intervention focus, housewide evaluation
- 18 months post-intervention
  - Reduction in MRSA incidence in all three hospitals (26%, 31%, 62%, pooled result p<.001)
  - Increase % S. aureus susceptible to methicillin (7%, 15%, 28%, pooled result p<.02)

Ellington et al. Abstract Presentation, SHEA 2009

Preventing Surgical-site infections in nasal carriers of *Staphylococcus aureus* Using Active Surveillance: Randomized Double-Blind, Placebo Controlled Trial


Conclusions of Two Systematic Reviews on Use of Active Surveillance and Isolation for Controlling MRSA

- “There is evidence that concerted efforts that include isolation can reduce MRSA even in endemic settings. Current isolation measures recommended in national guidelines should continue to be applied until further research establishes otherwise.”
  - Cooper et al. BMJ 2004;329:533
- “Evidence from multiple observational studies suggest that use of ASCs reduces the incidence of MRSA infection…….”
Summary

- We are currently experiencing a crisis in antimicrobial resistance in healthcare, and MRSA is a major part of the problem
- Our response needs to be multi-faceted, and must include both measures to prevent transmission and prevent infections among MRSA-colonized individuals

Summary (continued)

- Effective prevention of transmission has benefits that persist beyond a single hospitalization, and is currently the most logical strategy for preventing the "downstream" adverse effects of healthcare-acquired MRSA acquisition
  - Usual facility-based surveillance strategies do not capture these downstream events, and therefore grossly underestimate the burden of consequences resulting from healthcare-acquired MRSA acquisition

Summary (continued)

- The weight of the current evidence suggests that strategies that use active surveillance are more effective at preventing epidemic and endemic MRSA transmission than strategies that do not
  - Given the current burden of the MRSA problem and evidence suggesting uncontrolled transmission in healthcare settings, active surveillance-based strategies should be widely employed
- The optimal strategy for implementation of active surveillance has yet to be fully determined (e.g. universal screening versus screening in targeted settings and patient populations)