Surgical Site Infection due to MRSA: Facts, Fiction, and Frustrations

Deverick J. Anderson, MD, MPH
Asst. Professor of Medicine, DUMC
Co-Director, Duke Infection Control Outreach Network (DICON)
Outline

- SSIs - The Basics
- **MRSA** - The Facts
  - Epidemiology
  - Risk Factors
  - Outcomes
- Prevention of SSIs
- **MRSA** - Fiction and Frustrations
- Take Home Points
SSI Classification

- Skin
- Subcutaneous Tissue
- Deep Soft Tissue (fascia & muscle)
- Organ/Space

- Superficial Incisional SSI
- Deep Incisional SSI
- Organ/Space SSI
Risk Factors

- Microbial Characteristics
- Surgical Characteristics
- Patient Characteristics

Risk of SSI
Risk Factors

- **Patient Related**
  - Age
  - Diabetes
  - Obesity
  - Smoking
  - Immunosuppression

- **Organism**
  - Colonization
  - Virulence
  - Drug-Resistance

- **Peri-operative**
  - Hair removal
  - Pre-op infections
  - Surgical scrub
  - Skin prep
  - Antimicrobial prophylaxis
    - Agent
    - Timing
  - Surgical skill
  - Operative time
  - OR traffic
Outcomes

- Prolonged duration of hospitalization
  - 7-10 additional days

- Increased costs
  - Depends on type of procedure/SSI
  - Range: $3,000-$29,000
  - Up to $10 billion each year for US healthcare

- Kills patients
  - 2-11-fold higher risk of death than uninfected surgical patients
  - 77% of deaths among surgical patients with SSI

SSI due to MRSA - FACTS
SSI due to MRSA is Common...

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>No. (%) of pathogenic isolates</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>CoNS</td>
<td>965 (13.7)</td>
<td>2</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>2,108 (30.0)</td>
<td>1</td>
</tr>
<tr>
<td><em>Enterococcus</em> species</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><em>E. faecalis</em></td>
<td>194 (2.8)</td>
<td></td>
</tr>
<tr>
<td><em>E. faecium</em></td>
<td>345 (4.9)</td>
<td></td>
</tr>
<tr>
<td>NOS</td>
<td>249 (3.5)</td>
<td></td>
</tr>
<tr>
<td><em>Candida</em> species</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td><em>C. albicans</em></td>
<td>115 (1.6)</td>
<td></td>
</tr>
<tr>
<td>Other <em>Candida</em> spp. or NOS</td>
<td>30 (0.4)</td>
<td></td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td>671 (9.6)</td>
<td>4</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>390 (5.6)</td>
<td>5</td>
</tr>
<tr>
<td><em>Klebsiella pneumoniae</em></td>
<td>213 (3.0)</td>
<td>7</td>
</tr>
<tr>
<td><em>Enterobacter</em> species</td>
<td>293 (4.2)</td>
<td>6</td>
</tr>
<tr>
<td><em>Acinetobacter baumannii</em></td>
<td>42 (0.6)</td>
<td>9</td>
</tr>
<tr>
<td><em>Klebsiella oxytoca</em></td>
<td>47 (0.7)</td>
<td>9</td>
</tr>
<tr>
<td>Other</td>
<td>1,363 (19.4)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7,025 (100)</td>
<td></td>
</tr>
</tbody>
</table>

49.2% were MRSA

...In ALL Locations

Anderson et al. ICHE 2007; 28:1047-53
Specific Risk Factors - MRSA SSI

• **Case-control study (n=77 patients)**
  - Post-operative risk factors included discharge to LTCF and post-operative antibiotics > 1 d
• **Cohort study (n=35)**
  - Multiple operations, cancer, wound drains
• **Study of MRSA mediastinitis (n=64)**
  - Diabetes, age > 70

## Specific Risk Factors - MRSA SSI

### Table 3. Independent Predictors of Surgical Site Infection Due to Methicillin-Resistant *Staphylococcus aureus*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adjusted OR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need for assistance with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥3 ADLs</td>
<td>3.97 (2.18–7.25)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Medicaid insurance</td>
<td>3.31 (1.14–9.58)</td>
<td>.03</td>
</tr>
<tr>
<td>Wound classification of &gt;2</td>
<td>2.91 (1.07–7.87)</td>
<td>.04</td>
</tr>
<tr>
<td>Duration of surgery &gt;75th percentile&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.98 (1.11–3.55)</td>
<td>.02</td>
</tr>
<tr>
<td>Obesity</td>
<td>1.86 (1.14–3.02)</td>
<td>.01</td>
</tr>
</tbody>
</table>

150 MRSA SSI, 231 uninfected, 128 MSSA SSI

### Table 4. Independent Predictors of Surgical Site Infection (SSI) Due to Methicillin-Resistant *Staphylococcus aureus*, Compared with SSI Due to Methicillin-Susceptible *S. aureus*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adjusted OR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need for assistance with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥3 ADLs</td>
<td>3.88 (1.91–7.87)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Duration of surgery &gt;75th percentile$^a$</td>
<td>2.33 (1.17–4.62)</td>
<td>.02</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>2.22 (1.17–4.22)</td>
<td>.01</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>0.52 (0.27–0.99)</td>
<td>.05</td>
</tr>
</tbody>
</table>

150 MRSA SSI, 231 uninfected, 128 MSSA SSI

Outcomes due to MRSA SSI

• 3 studies compared MRSA v. MSSA SSI
  - #1 - 15 MRSA v. 26 MSSA mediastinitis
    • Mortality increased 4.6-fold
  - #2 - 73 MRSA v. 145 MSSA mediastinitis
    • Increased LOS and ventilation
    • NOT independent risk factor for mortality
  - #3 - 127 MRSA v. 173 MSSA - all procedures
    • 3-fold higher mortality
    • 3 additional days of hospitalization
    • Additional $14,000 in charges

Outcomes due to MRSA SSI

150 patients with MRSA SSI vs. 231 uninfected controls

<table>
<thead>
<tr>
<th>Independent Predictor</th>
<th>Odds Ratio [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Readmission within 90 days of surgical procedure</strong>a</td>
<td></td>
</tr>
<tr>
<td>SSI due to MRSA</td>
<td>35.0 [17.3–70.7]</td>
</tr>
<tr>
<td>Need assistance with ≥3 ADLs</td>
<td>4.28 [1.52–12.0]</td>
</tr>
<tr>
<td><strong>Death within 90 days of surgical procedure</strong>b</td>
<td></td>
</tr>
<tr>
<td>SSI due to MRSA</td>
<td>7.27 [2.83–18.7]</td>
</tr>
<tr>
<td>Need assistance with ≥3 ADLs</td>
<td>6.73 [2.80–16.2]</td>
</tr>
<tr>
<td>Age ≥65</td>
<td>4.45 [1.41–14.0]</td>
</tr>
<tr>
<td>Orthopedic procedure</td>
<td>0.27 [0.10–0.71]</td>
</tr>
</tbody>
</table>

Anderson et al. PLOS One; 4: e8305.
Outcomes due to **MRSA SSI**

<table>
<thead>
<tr>
<th></th>
<th>Length of Stay Least Squares Mean (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unadjusted</td>
</tr>
<tr>
<td>Cases</td>
<td>23.6 (21.7–25.5)</td>
</tr>
<tr>
<td>Controls</td>
<td>5.2 (3.7–6.7)</td>
</tr>
<tr>
<td>Attributable difference</td>
<td>18.4 (16.0–20.8)</td>
</tr>
</tbody>
</table>

150 patients with MRSA SSI vs. 231 uninfected controls

Anderson et al. PLOS One; 4: e8305.
## Outcomes due to MRSA SSI

150 patients with MRSA SSI vs. 231 uninfected controls

|               | Unadjusted | Adjusted  
|---------------|------------|-----------
| **Charges Least Squares Mean (IQR)** |            |           |
| Unadjusted    | Adjusted   |           |
| 105,214 (91,458–118,971) | 112,144 (85,850–138,438) |
| 47,099 (35,485–58,714)     | 50,463 (34,551–66,375)  |
| 58,115 (40,111–76,119)     | 61,681 (23,352–100,011) |

Anderson et al. PLOS One; 4: e8305.
Outcomes due to MRSA SSI
Outcomes due to MRSA SSI

<table>
<thead>
<tr>
<th>Independent Predictor</th>
<th>Odds Ratio [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Readmission within 90 days of surgical procedure (^a)</td>
<td>0.43 [0.21–0.89]</td>
</tr>
<tr>
<td>Methicillin-resistance</td>
<td>0.43 [0.21–0.89]</td>
</tr>
<tr>
<td>Underwent coronary artery bypass grafting</td>
<td>4.35 [1.31–14.5]</td>
</tr>
<tr>
<td>Procedure performed at tertiary care facility</td>
<td>2.19 [1.03–4.63]</td>
</tr>
<tr>
<td>Admission to ICU prior to infection</td>
<td>0.20 [0.05–0.72]</td>
</tr>
<tr>
<td>Death within 90 days of surgical procedure (^b)</td>
<td>1.72 [0.70–4.20]</td>
</tr>
<tr>
<td>Methicillin-resistance</td>
<td>1.72 [0.70–4.20]</td>
</tr>
<tr>
<td>Need assistance with (\geq) 3 ADLs</td>
<td>3.79 [1.33–10.8]</td>
</tr>
<tr>
<td>Antimicrobial prophylaxis administered appropriately</td>
<td>0.35 [0.14–0.88]</td>
</tr>
</tbody>
</table>

150 patients with MRSA SSI vs. 128 MSSA

Anderson et al. PLOS One; 4: e8305.
# Outcomes due to MRSA SSI

150 patients with MRSA SSI vs. 128 MSSA

<table>
<thead>
<tr>
<th></th>
<th>Length of Stay Least Squares Mean (IQR)</th>
<th>Adjusted (^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unadjusted</td>
<td>Adjusted</td>
</tr>
<tr>
<td>SSI due to MRSA</td>
<td>24.3 (21.7–26.8)</td>
<td>23.7 (21.3–26.0)</td>
</tr>
<tr>
<td>SSI due to MSSA</td>
<td>17.4 (14.6–20.2)</td>
<td>18.1 (15.5–20.7)</td>
</tr>
<tr>
<td>Attributable difference</td>
<td>6.86 (3.07–10.4)</td>
<td>5.5 (1.97–9.11)</td>
</tr>
</tbody>
</table>

Anderson et al. PLOS One; 4: e8305.
Outcomes due to MRSA SSI

| Charges Least Squares Mean (IQR) | Unadjusted          | Adjusted  
|----------------------------------|---------------------|----------
| 105,214 (89,558–120,871)         | 99,466 (86,352–112,580) |
| 68,835 (52,164–85,506)           | 75,353 (61,351–89,355) |
| 36,379 (13,509–59,250)           | 24,113 (4,521–43,704)  |

150 patients with MRSA SSI vs. 128 MSSA

Anderson et al. PLOS One; 4: e8305.
Prevention of MRSA SSI - The Basics

*Spoiler Alert*: There are NO specific recommendations for prevention of MRSA SSI in published guidelines!!
Strategies to Prevent Surgical Site Infections in Acute Care Hospitals

Deverick J. Anderson, MD, MPH; Keith S. Kaye, MD; David Classen, MD, MS; Kathleen M. Arias, MS, CIC; Kelly Podgorny, RN, MS, CPHQ; Helen Burstin, MD; David P. Calfee, MD, MS; Susan E. Coffin, MD, MPH; Erik R. Dubberke, MD; Victoria Fraser, MD; Dale N. Gerding, MD; Frances A. Griffin, RRT, MPA; Peter Gross, MD; Michael Klompas, MD; Evelyn Lo, MD; Jonas Marschall, MD; Leonard A. Mermel, DO, ScM; Lindsay Nicolle, MD; David A. Pegues, MD; Trish M. Perl, MD; Sanjay Saint, MD; Cassandra D. Salgado, MD, MS; Robert A. Weinstein, MD; Robert Wise, MD; Deborah S. Yokoe, MD, MPH
The Basics

- Perform surveillance for SSIs (A-II)
  - Feedback
  - Enhance with automated data collection
- Peri-operative antimicrobial prophylaxis (A-I)
  - Agent
  - Timing
  - Discontinue within 24 hours
- Do not shave hair (A-II)
The Basics

- Control blood glucose during immediate post-operative period (A-I)
  - Cardiac procedures
- Feedback data on process measures (A-III)
- Implement policies to reduce risk of SSI that are aligned with evidence-based standards (A-II)
### Examples: Evidence-Based Standards

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Recommendation</th>
<th>Grade*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic, patient related (preoperative)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unmodifiable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>No formal recommendation: relationship to increased risk of SSI may be secondary to comorbidities or immune senescence [28-30]</td>
<td></td>
</tr>
<tr>
<td>Modifiable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glucose control, diabetes</td>
<td>Control serum blood glucose levels [5]; reduce glycosylated hemoglobin A1c levels to &lt;7% before surgery, if possible [31]</td>
<td>A-II</td>
</tr>
<tr>
<td>Obesity</td>
<td>Increase dosing of prophylactic antimicrobial agent for morbidly obese patients [32]</td>
<td>A-II</td>
</tr>
<tr>
<td>Smoking cessation</td>
<td>Encourage smoking cessation within 30 days before procedure [5]</td>
<td>A-II</td>
</tr>
<tr>
<td>Immunosuppressive medications</td>
<td>No formal recommendation; in general, avoid immunosuppressive medications in perioperative period, if possible</td>
<td>C-II</td>
</tr>
</tbody>
</table>
### Extrinsic, procedure related (perioperative)

#### Preparation of patient

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Description</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hair removal</td>
<td>Do not remove unless hair will interfere with the operation [5]; if hair removal is necessary, remove by clipping and do not use razors</td>
<td>A-I</td>
</tr>
<tr>
<td>Preoperative infections</td>
<td>Identify and treat infections (e.g., urinary tract infection) remote to the surgical site before elective surgery [5]</td>
<td>A-II</td>
</tr>
</tbody>
</table>

#### Operative characteristics

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Description</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical scrub (surgical team members’ hands and forearms)</td>
<td>Use appropriate antiseptic agent to perform 2-5-minute preoperative surgical scrub [5] or use an alcohol-based surgical hand antisepsis product</td>
<td>A-II</td>
</tr>
<tr>
<td>Skin preparation</td>
<td>Wash and clean skin around incision site; use an appropriate antiseptic agent [5]</td>
<td>A-II</td>
</tr>
<tr>
<td>Antimicrobial prophylaxis</td>
<td>Administer only when indicated [5]</td>
<td>A-I</td>
</tr>
<tr>
<td><strong>Timing</strong></td>
<td>Administer within 1 hour before incision to maximize tissue concentration [5, 33]</td>
<td>A-I</td>
</tr>
<tr>
<td><strong>Choice</strong></td>
<td>Select appropriate agents on the basis of surgical procedure, most common pathogens causing SSI for a specific procedure, and published recommendations [5, 33]</td>
<td>A-I</td>
</tr>
<tr>
<td><strong>Duration of therapy</strong></td>
<td>Stop prophylaxis within 24 hours after the procedure for all procedures except cardiac surgery; for cardiac surgery, antimicrobial prophylaxis should be stopped within 48 hours [5, 33]</td>
<td>A-I</td>
</tr>
<tr>
<td>Surgeon skill/technique</td>
<td>Handle tissue carefully and eradicate dead space [5]</td>
<td>A-III</td>
</tr>
<tr>
<td>Asepsis</td>
<td>Adhere to standard principles of operating room asepsis [5]</td>
<td>A-III</td>
</tr>
<tr>
<td>Operative time</td>
<td>No formal recommendation in most recent guidelines; minimize as much as possible [34]</td>
<td>A-III</td>
</tr>
<tr>
<td>Operating room characteristics</td>
<td>Details</td>
<td>Level</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Ventilation</td>
<td>Follow American Institute of Architects’ recommendations [5]</td>
<td>C-I</td>
</tr>
<tr>
<td>Traffic</td>
<td>Minimize operating room traffic [5]</td>
<td>B-II</td>
</tr>
<tr>
<td>Environmental surfaces</td>
<td>Use a US Environmental Protection Agency–approved hospital disinfectant to clean surfaces and equipment [5]</td>
<td>B-III</td>
</tr>
<tr>
<td>Sterilization of surgical equipment</td>
<td>Sterilize all surgical equipment according to published guidelines; minimize the use of flash sterilization [5]</td>
<td>B-I</td>
</tr>
</tbody>
</table>
SSI due to MRSA

Fiction and Frustrations
Strategies for Prevention of MRSA SSI

- **Decolonization**
  - Issues include
    - Method of surveillance
    - Which patients?

- **Change prophylaxis**
  - Issues include
    - Problems with alternative agents
    - Which patients?
Colonization with MRSA - Who Cares?

- Operative patients who are colonized with *S. aureus*/MRSA are 2-9 times more likely to develop SSI

- Infecting organism usually the same as organism colonizing patient in pre-operative period

Wenzel, J Hosp Infect, 1995
Shukla, A, JBJS Br, 2009
## Methods for MRSA Screening

- **Time required to detect MRSA in nasal swabs** varies considerably based on methods used. PCR vs. standard culture: faster, but more expensive.

<table>
<thead>
<tr>
<th>Method</th>
<th>Time (hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood agar + Suscep testing</td>
<td>48-96</td>
</tr>
<tr>
<td>Mannitol salt/oxa plate</td>
<td>24-48</td>
</tr>
<tr>
<td>Chromogenic media</td>
<td>28-24</td>
</tr>
<tr>
<td>PCR</td>
<td>≤ 2</td>
</tr>
</tbody>
</table>

- **PCR vs. standard culture:** faster, but more expensive.
Screening Does Nothing (without additional processes)

- Who performs tests?
- Who follows-up on results?
- What is done with results?
- Are test results available in time to act upon?
- What are consequences of process failure?
  - ? Delay surgery
  - ? Change prophylaxis
  - ? Litigation
Different Approaches

- Can empirically decolonize, treat
  - Decolonization for all preoperative patients

- Can “search and destroy” (for *S. aureus* or MRSA)
  - Screen for S. aureus/MRSA and decolonize/treat patients who are screen or culture-positive
Decolonization

- **Mupirocin** temporarily decolonizes many patients of *S. aureus*
  - Colonization often returns, depending on level/number of additional co-morbidities
- "Standard" method: mupirocin applied to nares for 3-5 days prior to surgery
- ? Chlorhexidine gluconate (CHG) on skin
  - Soap
  - Wipes
Can Routine Decolonization Prevent SSI?

- 4 RCTS compared mupirocin to placebo
- All showed essentially the same thing:
  - Rate of *S. aureus* nasal carriage decreased, but not real impact on SSI
- Largest included 4,000 surgical patients
  - No effect on incidence of *S. aureus* SSI (~2.3% in each group)
  - For patients with pre-operative colonization with *S. aureus*, decrease in risk for *S. aureus* SSI (3.7% vs. 5.9%, NS)

Can Decolonization of Patients with *S. aureus* Prevent SSI?

- **Systematic review of 4 RCTs**
- Analyzed patients with *S. aureus* colonization only

---

<table>
<thead>
<tr>
<th>Study</th>
<th>Mupirocin n/N</th>
<th>Control n/N</th>
<th>RR (random) 95% CI</th>
<th>Weight %</th>
<th>RR (random) 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garcia</td>
<td>1/31</td>
<td>3/34</td>
<td>5.26</td>
<td>4.83</td>
<td>0.37 [0.04, 3.33]</td>
</tr>
<tr>
<td>Kalmeijer</td>
<td>2/95</td>
<td>5/86</td>
<td>9.87</td>
<td>1.42</td>
<td>0.36 [0.07, 1.82]</td>
</tr>
<tr>
<td>Perl</td>
<td>16/432</td>
<td>26/439</td>
<td>69.46</td>
<td>2.82</td>
<td>0.63 [0.34, 1.15]</td>
</tr>
<tr>
<td>Konvalinka</td>
<td>5/130</td>
<td>4/127</td>
<td>15.41</td>
<td>1.14</td>
<td>1.22 [0.34, 4.44]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>688</strong></td>
<td><strong>686</strong></td>
<td>100.00</td>
<td></td>
<td>0.64 [0.38, 1.06]</td>
</tr>
</tbody>
</table>

Total events: 24 (treatment), 38 (control)
Test for heterogeneity: $\chi^2 = 1.69$, df = 3 ($P = 0.64$), $I^2 = 0$
Test for overall effect: $Z = 1.73$ ($P = 0.08$)

---

Can Routine Decolonization Prevent SSI?

- Systematic review and meta-analysis
  - 3 RCTs
  - 4 “before-after” studies
- Correlation depended on type of surgery and type of study
  - No effect in RCTs
  - In observational studies, appeared to be some benefit when used in non-general surgical procedures
    - 5,946 patients in 3 studies: RR=0.40 (0.29-0.56)

Kallen et al. ICHE 2005;26:91&92
Can Decolonization of Patients with *S. aureus* Prevent SSI?

- Some more recent studies have demonstrated that screening for MRSA led to lower rates of MRSA SSI
  - Most before-after, single-center experiences
- **Cardiac surgery (n=1,462)**
  - Decolonization and change prophylaxis
  - MRSA SSI rate fell from 3.30% to 2.22% (RR=0.7, 95% CI 0.06-0.95)
- **SCIP procedures (n=5,094)**
  - Institution of broad screening program for MRSA
  - Screen positive operative patients treated with mupirocin + CHG X 5 days
  - Changes in pre-operative prophylaxis left up to the surgeon

Can Decolonization of Patients with S. aureus Prevent SSI?


Figure 1. Rate of MRSA surgical-site infections before (blue bar) and after (red bar) universal screening. *p = 0.04 before versus after.
Can Decolonization of Patients with *S. aureus* Prevent SSI?

- Prospective, interventional cohort study of 20,000 surgical patients with crossover design comparing standard IC plus rapid screening for MRSA with standard IC methods alone.

- Bottom line: Rates of MRSA infection did not change.

Can Decolonization of Patients with *S. aureus* Prevent SSI?

Decolonization: Other Considerations

- Can’t be done in emergency settings
- Patients can be colonized in multiple, diverse anatomic sites (e.g., peri-rectal, IV sites, axilla)
- Mupirocin resistance is a concern
  - With prolonged use, usually see emergence of mupirocin-resistant strains
- MRSA may be acquired AFTER surgery

MRSA Screening Cultures

- Best method (where to culture?) is unclear
- Presence of skin lesions or chronic wounds is an important risk factor for MRSA colonization at the time of hospital admission
- Community-associated MRSA infections often present as skin and soft tissue infections
  - Rarely isolated from nares cultures

Percent of Patients Positive for MRSA by Body Site

Change Prophylaxis?

- No current guidelines recommend routine use of vancomycin (or other anti-MRSA agent) for peri-operative prophylaxis
- Specific scenarios where appropriate
  - Proven outbreak of SSI due to MRSA
  - Institutions with “high endemic rates” of SSI due to MRSA
  - Targeted high-risk patients who are at increased risk for SSI due to MRSA
- Disadvantages
  - Vancomycin takes >1 hour to infuse
  - Beta-lactams more active against susceptible gram-positive organisms
  - Vancomycin has no activity against gram-negative organisms
  - Wide spread use may lead to increased vancomycin resistance

Bratzler CID 2004.
Dodds CID 2004;38:1555-60.
Prophylaxis with Vancomycin

• Most studies done in cardiac surgery
• Meta-analysis of 7 studies comparing vancomycin to cephalosporin
  - No difference in overall rate of SSI
  - Issue: studies were published before MRSA became such a big problem

Prophylaxis with Vancomycin

Prophylaxis with Vancomycin

- More recent studies continue to provide conflicting results

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Coagulate-negative <em>Staphylococcus</em></td>
<td>4.8 ± 2.4</td>
<td>3.8 ± 3.0</td>
</tr>
<tr>
<td>MRSA</td>
<td>0.79 ± 0.93</td>
<td>0.52 ± 0.87</td>
</tr>
<tr>
<td>Other gram-positive organisms</td>
<td>1.8 ± 1.4</td>
<td>1.9 ± 2.0</td>
</tr>
<tr>
<td>Gram-negative organisms</td>
<td>3.2 ± 2.3</td>
<td>3.2 ± 2.6</td>
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</tbody>
</table>

- None have showed increase in gram-negative infections
  - Our own data shows that there may be a trend

Garey et al. AAC 2008;52:446
Vancomycin + Beta-lactam?

- At Duke, program to decrease rates of mediastinitis due to MRSA
  - Aggressive glucose control
  - Increased compliance with pre-operative antiseptic CHG shower
  - Addition of vancomycin and rifampin to cefuroxime for antibiotic prophylaxis in “high risk patients”

- Before-after design
- Sustained decrease

Engemann et al. IDSA 2005
Rate of SSI and MRSA SSI following CARD or CABG

Engemann et al. IDSA 2005
Take Home Points

- **MRSA** is the leading cause of SSI
  - Leads to adverse outcomes
  - Patients with decreased function appear to be at highest risk
- No well-proven interventions to specifically prevent MRSA exist
  - “UNRESOLVED ISSUES”
- Make sure evidence-based measures are in place for SSI prevention before you target MRSA specifically
Take Home Points

- Targeted efforts to screen, decolonize and/or broaden antibiotic prophylaxis are options
  - But ALL remain controversial
  - NO data to support general application of these methods
  - Have process in place to manage results from screening tests BEFORE you start screening

- Make decisions based on local epidemiology:
  - Know your rates and bugs
  - Is MRSA a problem pathogen for SSI?
    - If not, specific interventions might not be worth it