Chlorhexidine Baths and Central Line Blood Stream Infections
Prof. L. Silvia Munoz-Price, University of Miami Miller School of Medicine
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Chlorhexidine baths and central line associated bloodstream infections (CLABSIs)

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Disclosures
- Speaker for Sage Inc.

Outline
- Broad overview of chlorhexidine
- Bio-burden of patient’s surfaces (fecal patina)
- Sources of CLABSIs
- Chlorhexidine baths for prevention of CLABSIs
  - Studies using impregnated cloths
  - Studies using liquid chlorhexidine
- Conclusions

Chlorhexidine gluconate
- Long acting topical antiseptic
- In use since 1954
- Water soluble
- Remains active for hours after application

Chlorhexidine gluconate
- Binds to negatively charged bacterial cell wall, causing osmotic changes and finally destroying the organism
- Activity against:
  - Gram positive bacteria
  - Gram negative bacteria
  - Yeast
- No sporicidal activity

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Main uses of chlorhexidine baths

- To decrease CLABSIs
- To decrease acquisition of multidrug resistant organisms
- To decrease surgical site infections

Fecal patina

- Stool organisms do not remain in the stool but rather contaminate patient’s skin and the environment
- This is known as fecal patina or fecal veneer

Why would chlorhexidine decrease CLABSIs?

- Skin organisms
  - Staphylococcus aureus
  - Enterococcus faecalis
- Microbial density
- Skin barrier
- Microbial load

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LET'S REVIEW THE LITERATURE

We will divide the studies based on the preparation used:
- Chlorhexidine impregnated cloths
- Chlorhexidine solution

STUDIES USING CHLORHEXIDINE IMPREGNATED CLOTHS

ORIGINAL INVESTIGATION
Effectiveness of Chlorhexidine Bathing to Reduce Catheter-Associated Bloodstream Infections in Medical Intensive Care Unit Patients
Susan C. Bleasdale, MD; William P. Trick, MD; Jose M. Gonzalez, MD; Brian D. Lykes, MD; Mary K. Hayler, MD; Robert A. Winters, MD

Table 2: Comparison of Incidence of Infection by Method of Bathing Patients and Infection Category

<table>
<thead>
<tr>
<th>Infection Category</th>
<th>Soap and Water</th>
<th>2% CHG</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bloodstream infection</td>
<td>0.000</td>
<td>0.000</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Surgical site</td>
<td>0.000</td>
<td>0.000</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Infection site not specified</td>
<td>0.000</td>
<td>0.000</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bacteremia</td>
<td>0.000</td>
<td>0.000</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Superficial wound infection</td>
<td>0.000</td>
<td>0.000</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

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Table 1: Comparison of nosocomial infection rates in the Medical intensive care unit during 2 study periods

<table>
<thead>
<tr>
<th>Type of infection or culture</th>
<th>Soap-and-water period</th>
<th>Chlorhexidine gluconate period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nosocomial blood stream</td>
<td>94</td>
<td>3.59</td>
</tr>
<tr>
<td>VAP</td>
<td>5</td>
<td>3.40</td>
</tr>
<tr>
<td>UTI</td>
<td>20</td>
<td>1.25</td>
</tr>
<tr>
<td>Staphylococcus epidermidis</td>
<td>7</td>
<td>1.16</td>
</tr>
<tr>
<td>MRSA</td>
<td>10</td>
<td>1.63</td>
</tr>
<tr>
<td>VRE</td>
<td>6</td>
<td>0.33</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>2.57</td>
</tr>
</tbody>
</table>

Note: Data are expressed as cases per 1,000 patient-days, unless otherwise indicated. There were 2719 patient-days, 1329 (52%) days, and 1390 (48%) days during the soap-and-water period. There were 2310 patient-days, 1249 (54%) days, and 1061 (46%) days during the chlorhexidine gluconate period. Chi-square analysis showed a significant decrease in the rate of infection with chlorhexidine gluconate. P-values were calculated using a chi-square test for trend. *Cases per 1,000 patient-days

*Changes recommended in central line insertion practice

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**Phases**
- Phase 1: Baseline
- Phase 2: Scrub-the-hub (chlorhexidine gluconate for 15 sec)
- Phase 3: 2% chlorhexidine daily body baths AND scrub-the-hub
- Phase 4: Daily ICU nursing rounds AND 2% CHG AND scrub-the-hub

**Table 4. Comparison of Infection Incidence by Method of Bathing**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Without Chlorhexidine</th>
<th>With Chlorhexidine</th>
<th>Difference (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>15 (9.4)</td>
<td>4 (2.1)</td>
<td>11 (6.1 to 17.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Phase 2</td>
<td>12 (7.1)</td>
<td>6 (3.4)</td>
<td>6 (1.3 to 10.9)</td>
<td>0.05</td>
</tr>
<tr>
<td>Phase 3</td>
<td>3 (1.6)</td>
<td>2 (1.0)</td>
<td>1 (0.1 to 2.0)</td>
<td>0.20</td>
</tr>
<tr>
<td>Phase 4</td>
<td>6 (3.5)</td>
<td>5 (2.5)</td>
<td>1 (0.2 to 2.0)</td>
<td>0.76</td>
</tr>
</tbody>
</table>

**Table 5. Causative Microorganisms in Catheter-Related Bloodstream Infections**

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>No. of Cases</th>
<th>Without Chlorhexidine</th>
<th>With Chlorhexidine *</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Gram-positive bacteria</td>
<td>6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Gram-negative bacteria</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Coccal-positive bacteria</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Coccal-negative bacteria</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Enterococcus species</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>18</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

*Administrated in a washcloth as 2% chlorhexidine gluconate.

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Topical antimicrobials in combination with admission screening and barrier precautions to control endemic methicillin-resistant Staphylococcus aureus in an Intensive Care Unit

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Table 3. Time series analysis of the results of introduction of daily chlorhexidine bathing on the incidence of MRSA and VRE colonization and bacteremia.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Incidence Rate at End of Intervention</th>
<th>Incidence Rate at End of Intervention of Chlorhexidine Bathing</th>
<th>Change in Incidence Rate of Introduction of Chlorhexidine Bathing (% Change)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA</td>
<td>5.59</td>
<td>3.15</td>
<td>-43.5 (25%)</td>
</tr>
<tr>
<td>VRE</td>
<td>&lt;1.0</td>
<td>&lt;1.0</td>
<td>0</td>
</tr>
<tr>
<td>VRE Bacteremia</td>
<td>2.26</td>
<td>0.75</td>
<td>-65 (60%)</td>
</tr>
</tbody>
</table>

The effect of daily bathing with chlorhexidine on the acquisition of methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant Enterococcus, and healthcare-associated bloodstream infections: Results of a quasi-experimental multicenter trial. Michael W. Climo, MD, Krista A. Selwa, MD, Glenn Dzuckowski, MD, MPH, Virginia J. Frazer, MD; David K. Warren, MD; Thad M. Petrie, MD, MSC; Kathleen Spodick; John A. Jeremijenko, MD; James A. Babcock, PhD; Edward S. Wang, MD.

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Climo MW et al Crit Care Med 2009; 37:1858-1865


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### Implementations of Chlorhexidine Baths
- Remove all non-compatible products from the units (soaps, lotions, skin barriers, etc)
- In-service staff giving the baths
- Personally observe baths in a regular basis
- Quantify the usage of the product by the units

### Challenges During Implementation of Chlorhexidine
- Chlorhexidine doesn’t foam
- Personnel perceives this lack of foaming as lack of cleaning
- Mixing with other products (soap and water) might happen at the bedside, especially with liquid preparations

### Conclusions
- Chlorhexidine baths constitute a powerful tool to decrease CLABSIs
- Preparation of the inpatient units should be done before instituting chlorhexidine baths
- Frequent observations should occur after implementation in order to ensure compliance