Emergence of *Staphylococcus caprae* in a Neonatal Intensive Care Unit (NICU)

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**Background**

- *Staphylococcus caprae* (S. caprae) is a coagulase-negative *Staphylococcus* species (CoNS) usually associated with animals and an uncommon cause of healthcare-acquired infections in humans
- An outbreak was suspected in the fall of 2015 when 5 S. caprae infections (blood-3, wound with underlying osteomyelitis=1; paracentesis fluid=1) were identified in patients admitted to the same NICU; review of records revealed no prior isolates
- Four isolates available for testing were identical by repetitive element sequence based-PCR (rep-PCR), and exhibited high-level resistance to mupirocin (MU)
- The identification of the first S. caprae isolate was coincident with the introduction of MALDI-TOF for organism identification

**Objective**

- To describe the emergence of S. caprae in a NICU that has used universal monthly MU prophylaxis since 12/9/13

**Setting**

- 101-bed Level IV NICU with comprehensive strategy for preventing MRSA transmission
  - All infants screened for MRSA on admission
  - Weekly surveillance cultures for MRSA using chromogenic plates
  - Cohorting of positive patients
  - Contact precautions
  - Topical MU treatment of positive patients
  - Chlorhexidine bathing twice weekly
  - Hand hygiene (HH) program
- Every 4 weeks, all infants received MU applied to anterior nares and perirectal area twice daily for 5 days beginning 12/9/13

**Methods**

- Available archived isolates of invasive CoNS from NICU infants (1/1/14 to 9/1/15) were re-evaluated by MALDI-TOF
- S. caprae isolates were prospectively identified (9/1/15 to 5/4/16) in children’s hospital and four affiliated community hospitals
- MU-minimum inhibitory concentration (MIC) determined by E-test for all prospectively and retrospectively identified S. caprae isolates (susceptible ≤4 μg/mL, high-level resistance ≥512 μg/mL)
- Isolate relatedness assessed by rep-PCR; clonality defined as >97% similar
- The University of Louisville Institutional Board Review approved this study

**Results**

**Table 1: Characteristics of Infants with Positive S. caprae Cultures**

<table>
<thead>
<tr>
<th>Key</th>
<th>Gender</th>
<th>Race</th>
<th>Place of birth</th>
<th>Birth weight (grams)</th>
<th>Gestational Age (weeks)</th>
<th>Source</th>
<th>Identification of isolate</th>
<th>Resistance to antimicrobials</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>White</td>
<td>NICU A</td>
<td>1025</td>
<td>35</td>
<td>Blood</td>
<td>MU</td>
<td>Resistant to all antimicrobials</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>White</td>
<td>NICU A</td>
<td>976</td>
<td>34</td>
<td>Blood</td>
<td>MU</td>
<td>Resistant to all antimicrobials</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>White</td>
<td>NICU A</td>
<td>1000</td>
<td>36</td>
<td>Blood</td>
<td>MU</td>
<td>Resistant to all antimicrobials</td>
</tr>
<tr>
<td>4</td>
<td>M</td>
<td>White</td>
<td>NICU A</td>
<td>1055</td>
<td>37</td>
<td>Blood</td>
<td>MU</td>
<td>Resistant to all antimicrobials</td>
</tr>
</tbody>
</table>

**Table 2: Antibiotic Susceptibilities for S. caprae Isolates**

<table>
<thead>
<tr>
<th>Key</th>
<th>ID</th>
<th>Source</th>
<th>Ery</th>
<th>Rif</th>
<th>Van</th>
<th>Gent</th>
<th>Tob</th>
<th>Dapt</th>
<th>MOX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Blood</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Blood</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Blood</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Blood</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Figure 1: Dendrogram of All S. caprae Isolates**

**Figure 2: Timeline**

- 7 additional isolates of S. caprae were identified through 5/4/16 (Figure 2)
  - 4 from NICU patients (blood=3, urine=1)
  - 3 from non-NICU patients (blood=1, ankle=1, ear=1)
- Twenty-one archived CoNS isolates from 19 patients were evaluated by MALDI-TOF
- 6 initially biochemically identified as S. epidermidis were re-identified as S. caprae (earliest isolate 12/23/14)
- Demographic and clinical characteristics presented in Table 1
- Spectrum of clinical illness similar to that caused by other CoNS in this population
- Patients were not clustered geographically and review of pseudo-outbreak group did not identify a healthcare worker who was epidemiologically linked
- For the review period: S. caprae was identified in 17% of blood cultures that grew any CoNS (NICU A); S. caprae was identified in 3% of blood cultures that grew any CoNS (NICU B)
- 3/3 non-NICU isolates were susceptible to MU and all systemic antibiotic tested (Table 2)
- 10/10 available NICU isolates had high level MU resistance (Table 2)
- One MU-resistant isolate also was resistant to linezolid, rifampin, and daptomycin
- Rep-PCR grouped the MU-resistant NICU isolates into two primary clusters (Figure 1)

**Limitations**

- Not all S. caprae isolates were available for testing (n=1)
- Not all archived isolates of CoNS were available for re-identification (n=1)
- CoNS other than S. caprae were not tested for MU resistance
- No archived isolates available from before the initiation of MU prophylaxis in 12/9/13

**Conclusions**

- S. caprae is a common pathogen in this NICU, but rare in other pediatric/adult patients
- A pseudo-outbreak was associated with MALDI-TOF implementation
- Isolates from the NICU are polyclonal
- It is possible that MU prophylaxis is driving MU resistance of S. caprae

**Acknowledgments**

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