**Staphylococcus aureus** colonized patients receiving mechanical ventilation progress to pneumonia despite antibiotic treatment

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**Introduction**

Background: Colonization of the airways by *Staphylococcus aureus* is a risk factor for the development of ventilator-associated pneumonia (VAP). The objective of this prospective, natural history study was to follow the progression of nasal and tracheal *S. aureus* colonization to VAP and to analyze the impact of antibiotics.

**Methods**

Methods: Endotracheal aspirates (ETAs), nasal swabs, and clinical data were collected from 238 patients admitted to 3 intensive care units (ICUs) at the Lahey Clinic/Tufts University (Burlington, MA) between June 2014 and June 2015 who were mechanically ventilated for >2 days. *S. aureus* colonization was analyzed by semi-quantitative microbiological analysis of ETAs. Heavy colonization was defined as moderate/many (>3+4) bacterial growth. VAP diagnosis was assigned retrospectively, according to criteria based on Johanson, 1977. *S. aureus* active antibiotics were analyzed by chart review.

**Discussion**

- **Patients taking care of in intensive care units, especially those receiving mechanical ventilation are typically treated empirically with several antibiotics either as a defensive strategy to prevent potentially life-threatening infections or as a response to symptoms indicating infection.**
- **In this study, >90% of ventilated patients were given antibiotics. Despite treatment with appropriate types and dosage of antibiotics at least for 2 days, no significant effect on *S. aureus* colonization burden was observed in endotracheal aspirate samples by semi-quantitative analysis.** Moreover, antibiotics did not seem to halt progression to *S. aureus* pneumonia that developed in approximately 1/3 of heavily colonized subjects.
- **This lack of effect is most likely explained by reaching sub-therapeutic concentrations of antibiotics (e.g. due to lower tissue penetration into the lower respiratory tract lining fluid, biofilm).**

**Use of antibiotics with antistaphylococcal activity**

- **Treated**
- **Not treated**

**Antibiotics use and progression to *S. aureus* VAP: examples**

- **VAP diagnosis (based on Johanson et al, 1972):**
  - New or progressive chest radiographic infiltrate
  - Presence of at least 2 of the following features:
    - Fever (>38°C) or hypothermia (<35°C)
    - Leukocytosis or leukopenia
    - Purulent respiratory secretions
  - *S. aureus* VAP diagnosis: moderate or many (>3+4) bacterial growth of *S. aureus* in SQ-ETA

**Demographics and healthcare utilization**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>&gt;2 days of MV, all patients (n=238)</th>
<th>Heavily colonized in the trachea with <em>S. aureus</em> (n=37)</th>
<th>Heavily colonized with <em>S. aureus</em> without VAP (n=26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male (68, 45.1%)</td>
<td>Male (34, 44.5%)</td>
<td>Male (18, 35.3%)</td>
</tr>
<tr>
<td></td>
<td>Female (160, 54.9%)</td>
<td>Female (136, 55.5%)</td>
<td>Female (108, 61.5%)</td>
</tr>
<tr>
<td>Age (mean)</td>
<td>63.9</td>
<td>64.5</td>
<td>66.2</td>
</tr>
<tr>
<td>BMI (mean)</td>
<td>30.3</td>
<td>30.9</td>
<td>31.4</td>
</tr>
<tr>
<td>Days on MV (mean)</td>
<td>9.1</td>
<td>10.7</td>
<td>13.8</td>
</tr>
<tr>
<td>Hospitalization days</td>
<td>19.6</td>
<td>19.2</td>
<td>24.3</td>
</tr>
<tr>
<td>ICU type</td>
<td>MICU: 130 (45.1%)</td>
<td>MICU: 32 (25.5%)</td>
<td>MICU: 8 (30.8%)</td>
</tr>
<tr>
<td></td>
<td>SICU: 100 (34.6%)</td>
<td>SICU: 35 (45.5%)</td>
<td>SICU: 8 (28.6%)</td>
</tr>
</tbody>
</table>

**Nasal and tracheal colonization: contingency analysis**

- **S. aureus active antibiotics use in the 3 days prior to heavy tracheal *S. aureus* colonization appearance**

- | Antibiotics used |
- | MICU: 17 (62.4%) |
- | SICU: 12 (42.0%) |

- **S. aureus-active antibiotics in the study**

- **If MSSA or mixed MSSA/MRSA were isolated from the ETA, only vancomycin and linezolid were considered as *S. aureus* active**

References: