Trends in HAI Etiologic Organisms at a Pediatric Medical Center – 2004-2015

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Background
- Healthcare-associated infection (HAI) prevention efforts are usually directed towards likely sources and causative pathogens.
- Over the last decade, our institution has implemented numerous different strategies and practices to prevent HAIs.
- The effect of interventions on causative organisms of HAI prevention efforts is unknown.

Objective
- To explore the effect of HAI prevention activities on the organisms identified in HAIs occurring at our institution from 2004 to 2015.

Methods

STUDY DESIGN
- Retrospective analysis of HAI culture data

CASE IDENTIFICATION
- HAIs were defined according to national standard definitions at the time of occurrence.
- Pathogens were identified using our local Infection Control database.

INCLUSION CRITERIA
- Any of the following HAIs detected between January 1, 2004, and December 31, 2014 at our institution that had an associated pathogen identified:
  - Central line-associated catheter infection (CLABSI)
  - Catheter-associated urinary tract infection (CAUTI)
  - Surgical site infection (SSI)
  - Ventilator-associated pneumonia (VAP)

EXCLUSION CRITERIA
- Any HAI that was not CLABSI, CAUTI, SSI, or VAP.
- Any of the selected HAIs with no associated pathogen identified.

ANALYSIS
- Annual rates for all HAIs combined were calculated by organism identified.
- Organism predominance was calculated by year as well as in three 4-year periods to compare proportions of HAI by organism.
- Poisson regression analysis was used to assess trends among the ten most frequently identified organisms.

Results

OVERALL HAI INCIDENCE (FIGURE 1)
- Over the 12 year period, combined incidence of the 4 HAIs decreased from a peak of 2.86 in 2005 to 0.90 per 1000 patient days in 2015.

PATHOGEN TRENDS (TABLE 1)
- Over the 12 year period, the proportion of HAIs with *S. aureus* identified increased significantly (15.8% to 24.8%, p<0.01).
- Concomitantly, the proportion of coagulase-negative staphylococci (CoNS) identified decreased significantly (20.9% to 12.3%, p<0.01).
- No other organism demonstrated a significant change in proportion.

TABLE 1 – PATHOGEN TREND BY PROPORTION OF ALL HAIS

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><em>S. aureus</em></td>
<td>15.8</td>
<td>21.4</td>
<td>24.8</td>
<td>24.8</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>CoNS</td>
<td>20.9</td>
<td>8.8</td>
<td>12.3</td>
<td>12.3</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Enterococcus spp.</td>
<td>10.5</td>
<td>10.8</td>
<td>12.0</td>
<td>12.0</td>
<td>0.64</td>
</tr>
<tr>
<td><em>P. aeruginosa</em></td>
<td>10.7</td>
<td>11.3</td>
<td>10.8</td>
<td>10.8</td>
<td>0.93</td>
</tr>
<tr>
<td>Klebsiella spp.</td>
<td>8.6</td>
<td>10.2</td>
<td>9.7</td>
<td>9.7</td>
<td>0.53</td>
</tr>
<tr>
<td>Enterobacter spp.</td>
<td>6.9</td>
<td>8.5</td>
<td>6.6</td>
<td>6.6</td>
<td>0.37</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>6.0</td>
<td>7.7</td>
<td>8.1</td>
<td>8.1</td>
<td>0.23</td>
</tr>
<tr>
<td>Candida spp.</td>
<td>7.5</td>
<td>7.2</td>
<td>5.5</td>
<td>5.5</td>
<td>0.29</td>
</tr>
<tr>
<td>Strep viridans</td>
<td>5.6</td>
<td>3.6</td>
<td>3.5</td>
<td>3.5</td>
<td>0.07</td>
</tr>
<tr>
<td><em>S. marcescens</em></td>
<td>2.1</td>
<td>3.8</td>
<td>3.0</td>
<td>3.0</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Limitations

- Single center analysis, limited generalizability.
- Decrease in absolute number of HAIs may decrease analysis power.
- Different HAIs have different pathogen profiles.
- Future study will examine pathogen incidence and trends by each HAI.

Conclusions

- Annual HAI incidence.
  - Decreased during the 12-year study period.
  - Concomitant change in proportion of identified organisms was not observed.
- Stratification into 3 4-year periods.
  - Overall staphylococcal predominance was unchanged.
  - *S. aureus* replaced CoNS by ~10%.
- Measures to prevent HAIs in our institution have decreased the annual HAI incidence, but have had little impact on the relative proportion of etiologic organisms.