Introduction

Broad-spectrum antibiotics are being used in children’s hospitals at higher frequencies and for longer durations, contributing to the emergence of multidrug resistant organisms (MDROs). Understanding current prescribing patterns allow antimicrobial stewardship programs to develop interventions to guide the appropriate use of antimicrobials. Indications for broad-spectrum antibiotic utilization at UF Health Shands Children’s Hospital has not been previously studied.

Aims

- Evaluate utilization of antimicrobials and indications for use in the UF Health Shands Children’s Hospital.
- Identify clinical scenarios where broad-spectrum antimicrobials are used empirically beyond 72 hours.
- Identify clinical scenarios that could be targets for antimicrobial stewardship efforts to reduce broad-spectrum antimicrobial exposure.

Methods

A prospective quality improvement project was performed of patients admitted to the UF Shands Children’s Hospital between mid-June to mid-July 2018 who had new orders of vancomycin, cefepime, piperacillin/tazobactam, meropenem, or linezolid. Each day, a report was generated in the electronic medical record (EMR) to capture patients with new orders of these antibiotics. Patients were then followed throughout the course of their broad-spectrum antimicrobial therapy.

Figure 1: Data Collection

Day 1 Background Data:

- age, height & weight
- antibiotic allergies
- previous antibiotics in the past 7 days
- colonization with MDRO
- hospital unit and unit specific data
- invasive devices

Day 1 Antibiotic Data:

- antibiotic dose, frequency & delivery
- indication for initiation
- antibiotic allergies
- cultures obtained
- category: empirical <72 hr, empirical >72 hr, definitive, prophylactic

Daily Follow-up Data:

- hospital unit and unit specific data
- invasive devices
- antibiotic dose, frequency & delivery
- culture results: organisms and susceptibilities
- indication to either modify therapy or continue empirical therapy
- empirical >72 hr, empirical <72 hr, definitive, prophylactic

Table 1: Days of Therapy

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Empirical &lt;72 hours</th>
<th>Empirical &gt;72 hours</th>
<th>Definitive</th>
<th>Prophylactic</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefepime</td>
<td>47</td>
<td>133</td>
<td>59</td>
<td>91</td>
<td>330</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>53</td>
<td>157</td>
<td>69</td>
<td>31</td>
<td>310</td>
</tr>
<tr>
<td>Piperacillin/tazobactam</td>
<td>23</td>
<td>144</td>
<td>32</td>
<td>30</td>
<td>229</td>
</tr>
<tr>
<td>Linezolid</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>Meropenem</td>
<td>6</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>135</td>
<td>440</td>
<td>165</td>
<td>154</td>
<td>694</td>
</tr>
</tbody>
</table>

Table 2: Antimicrobial Utilization

<table>
<thead>
<tr>
<th>Antimicrobial</th>
<th>Vancomycin</th>
<th>Piperacillin/tazobactam</th>
<th>Cefepime</th>
<th>Meropenem</th>
<th>Linezolid</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of orders</td>
<td>57</td>
<td>46</td>
<td>57</td>
<td>3</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Days of therapy:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empirical &lt;72 hr</td>
<td>310</td>
<td>229</td>
<td>330</td>
<td>6</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Empirical &gt;72 hr</td>
<td>53 (17%)</td>
<td>23 (10%)</td>
<td>47 (14%)</td>
<td>0 (0%)</td>
<td>6 (100%)</td>
<td></td>
</tr>
<tr>
<td>Definitive</td>
<td>157 (51%)</td>
<td>144 (63%)</td>
<td>133 (40%)</td>
<td>0 (0%)</td>
<td>6 (32%)</td>
<td></td>
</tr>
<tr>
<td>Prophylactic</td>
<td>69 (22%)</td>
<td>32 (14%)</td>
<td>59 (18%)</td>
<td>0 (0%)</td>
<td>6 (26%)</td>
<td></td>
</tr>
<tr>
<td>Hospital day initiated</td>
<td>22.44</td>
<td>14.07</td>
<td>30.15</td>
<td>7</td>
<td>31.5</td>
<td></td>
</tr>
<tr>
<td>Female gender</td>
<td>33 (58%)</td>
<td>20 (43%)</td>
<td>30 (53%)</td>
<td>1 (33%)</td>
<td>5 (71%)</td>
<td></td>
</tr>
<tr>
<td>Comorbidity:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior MDRO</td>
<td>2 (4%)</td>
<td>0 (0%)</td>
<td>1 (2%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>Transplant recipient</td>
<td>1 (2%)</td>
<td>0 (0%)</td>
<td>2 (4%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>Previous operation</td>
<td>25 (46%)</td>
<td>11 (24%)</td>
<td>14 (29%)</td>
<td>1 (33%)</td>
<td>7 (17%)</td>
<td></td>
</tr>
<tr>
<td>Intubated</td>
<td>15 (30%)</td>
<td>11 (24%)</td>
<td>13 (27%)</td>
<td>1 (33%)</td>
<td>4 (14%)</td>
<td></td>
</tr>
<tr>
<td>Central lines</td>
<td>24 (47%)</td>
<td>16 (35%)</td>
<td>12 (26%)</td>
<td>1 (33%)</td>
<td>9 (14%)</td>
<td></td>
</tr>
<tr>
<td>PICC line</td>
<td>24 (47%)</td>
<td>16 (35%)</td>
<td>12 (26%)</td>
<td>2 (67%)</td>
<td>6 (14%)</td>
<td></td>
</tr>
<tr>
<td>Urinary catheter</td>
<td>11 (19%)</td>
<td>4 (9%)</td>
<td>9 (9%)</td>
<td>1 (33%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>Enteral feeding tube</td>
<td>25 (51%)</td>
<td>14 (30%)</td>
<td>26 (46%)</td>
<td>1 (33%)</td>
<td>5 (71%)</td>
<td></td>
</tr>
<tr>
<td>ID consulted</td>
<td>21 (21%)</td>
<td>1 (2%)</td>
<td>10 (18%)</td>
<td>0 (0%)</td>
<td>3 (42%)</td>
<td></td>
</tr>
<tr>
<td>Empirical use &gt;72 hr:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suspected sepsis</td>
<td>18</td>
<td>7</td>
<td>15</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>LRTI</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Abdominal infection</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>CNS Infections</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SSTI</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2: Days of Therapy

Table: intravenous antibiotic utilization

Results

Over the course of the 4-week data collection and surveillance period, there were 170 orders of the five selected broad-spectrum antibiotics (in 112 patients). Of the 170 antibiotics given, 57 patients received vancomycin (34%), 57 patients received cefepime (34%), 46 patients received piperacillin/tazobactam (27%), 7 patients received linezolid (4%), and 3 patients received meropenem (2%).

Conclusions and Lessons Learned

- Data is similar to that of other children’s hospitals
- Empirical use made up the majority of antibiotic use (54%) as well as prophylaxis. Definitive therapy had the lowest utilization.
- Goals for ASPs include limiting empirical use past 72 hours with the help of consulting infectious disease physicians and ensuring a culture is collected at the start of therapy.
- Guidelines for prophylactic use of antimicrobials could help to standardize practice and reduce variability in prescribing.

Acknowledgments

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