Optimizing Vancomycin Prescribing Through a Pharmacist Driven Monitoring Intervention at a Children’s Hospital

Jared Olson, PharmD1, Chris Stockmann, PhD, MSc2, Adam L. Hersh, MD, PhD3, Collin Anderson, PharmD PhD1, Jeffery Zobell, PharmD3 and Emily Thorell, MD, MSCI2

BACKGROUND

- Therapeutic drug monitoring of vancomycin is essential to optimize therapeutic efficacy and to monitor risk of nephrotoxicity
- Area under the curve (AUC24) is the pharmacodynamic target for vancomycin
- Trough concentrations between 15 and 20 mcg/ml are often used as surrogate for serious MRSA infections, but does not accurately predict AUC24 in pediatric patients
- The majority of patients receiving vancomycin have treatment discontinued prior to 72 hours of therapy, therefore obtaining drug levels for all patients is unnecessary
- We designed a pharmacy driven vancomycin dosing intervention to accomplish the following objectives:
  1) Optimize AUC24 ≥ 400 attainment
  2) Minimize unnecessary vancomycin levels
  3) Reduce the number of levels ordered among children treated for < 72 hours

METHODS

- This was a retrospective study that evaluated vancomycin use at a 290 bed, freestanding children’s hospital
- During the pre-intervention period 6/2012 – 5/2014 physicians were responsible for vancomycin dosing
- Troughs were routinely obtained prior to the 4th dose with a targeted trough of 15-20 for most indications
- During the intervention period (6/2014-5/2016), pharmacists ordered and modified vancomycin dosing regimens to target an AUC24 ≥ 400
- Level obtainment could be deferred for up to 72 hours in patients with estimated GFR greater than 49 ml/min/1.73 m2
- Renal function was also routinely monitored by the pharmacist

Primary Outcomes

- The percentage of patients receiving <72 hours of therapy with ≥1 vancomycin concentration
- Average number of vancomycin levels/course
- Attainment of AUC24 ≥400 after the first dose regimen (estimated using a midpoint and a trough)

Balance Measure

- The percentage of patients that experienced acute kidney injury (defined as doubling serum creatinine up to 72 hours after receiving vancomycin)

RESULTS

All Courses of Vancomycin

<table>
<thead>
<tr>
<th></th>
<th>Pre-intervention N = 1996</th>
<th>Post-Intervention N = 1716</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received &lt; 72 hours of vancomycin</td>
<td>1334 (67%)</td>
<td>1243 (72%)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Average vancomycin levels per course</td>
<td>2.0</td>
<td>1.1</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Average dose adjustments</td>
<td>1.8</td>
<td>1.4</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Patients experiencing nephrotoxicity</td>
<td>45 (2.3%)</td>
<td>56 (3.3%)</td>
<td>0.07</td>
</tr>
<tr>
<td>≥ 1 serum creatinine measured</td>
<td>1590 (80%)</td>
<td>1472 (86%)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

CONCLUSIONS

- A pharmacist driven intervention that redesigned vancomycin dosing and monitoring:
  - was successful in achieving the target AUC24 for the majority of patients
  - reduced unnecessary vancomycin monitoring primarily by avoiding unnecessary levels in patients with early discontinuation
  - and did not increase risk for nephrotoxicity

LIMITATIONS

- Insufficient data to calculate AUC24 during pre-intervention period for comparison
- This is a pre/post study design with no control group

NEXT STEPS

- Evaluate impact of intervention on costs and dosing errors
- Evaluate provider satisfaction

In memory of Chris Stockmann PhD 1988-2016