Impact of the Verigene Rapid Diagnostic Blood Test as an Antibiotic Stewardship Tool Amongst Hospitalized Patients in a Community Healthcare System

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**BACKGROUND**

- Rapid diagnostic testing of blood specimens is suggested by the IDSA/SHEA/PIDS to optimize antibiotic therapy and improve clinical outcomes.
- The Verigene (Nanosphere) Gram negative (BC-GN) and Gram positive (BC-GP) blood culture nucleic acid tests allow for the identification of select blood pathogens, common contaminants, and resistance genes within 2 to 2.5 h.
- The impact of combined BC-GN and BC-GP rapid testing on antibiotic use within a large community healthcare system has yet to be assessed.

**OBJECTIVES**

1. Primary Objective: To compare the time to appropriate antibiotic therapy following implementation of a Pharmacy-driven Verigene-guided antibiotic stewardship protocol to that of a pre-implementation control group
2. Secondary Objectives: To determine potential differences between Verigene-guided antibiotic stewardship protocol and the historical control for the following:
   - Time to discontinuation of antibiotics for blood contaminants
   - Length of stay
   - Total admission costs
   - Pharmacy charges
   - Clostridium difficile infection
   - Mortality
   - 30-day readmission

**STUDY LIMITATIONS**

- A delay in posting of Verigene results at some hospitals due to need to transport to the central lab may have prolonged time to appropriate therapy.
- The primary outcome was not evaluable in patients with concurrent non-bloodstream infections or whom were already on appropriate antibiotics at time of Verigene or culture result.
- The Verigene cohort study period was only 6 weeks after implementation of the test, and some physicians did not fully trust test results yet.
- Data on four Gram negative pathogens are missing from results due to malfunctioning alert during study period.
- Negative Ctx-M results in Gram negative organisms do not rule out an ESBL producer, which limited the ability to streamline based on Verigene results.

**METHODS**

- Study Design: IRB-approved, pre-post interventional study
- Setting: 10 community hospitals in Tampa Bay, FL
- Study Duration: Control Group: May 2015 - Verigene Group: August 2015

**EXCLUSION CRITERIA**

- Hospitalized adult, pediatric, and neonatal patients
- First blood Gram stain during study time frame per patient

**METHODS (CONTD.) AND RESULTS**

<table>
<thead>
<tr>
<th>ORGANISM (FINAL CULTURE)</th>
<th>Verigene (n=241)</th>
<th>Control (n=213)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GRAM POSITIVE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coagulase-negative Staphylococcus</td>
<td>99 (41.1%)</td>
<td>70 (32.9%)</td>
<td>0.08</td>
</tr>
<tr>
<td>Streptococcus spp.</td>
<td>35 (14.5%)</td>
<td>29 (13.6%)</td>
<td>0.79</td>
</tr>
<tr>
<td>Staphylococcus aureus (MRSA)</td>
<td>24 (10.0%)</td>
<td>22 (10.3%)</td>
<td>1.00</td>
</tr>
<tr>
<td>Enterococcus spp.</td>
<td>19 (7.9%)</td>
<td>21 (9.9%)</td>
<td>0.51</td>
</tr>
<tr>
<td>Other Gram positive</td>
<td>6 (2.5%)</td>
<td>5 (2.3%)</td>
<td>0.76</td>
</tr>
<tr>
<td><strong>GRAM NEGATIVE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. coli (No resistance genes)</td>
<td>28 (11.6%)</td>
<td>36 (16.9%)</td>
<td>0.14</td>
</tr>
<tr>
<td>Klebsiella spp</td>
<td>8 (3.3%)</td>
<td>8 (3.8%)</td>
<td>0.8</td>
</tr>
<tr>
<td>A. baumannii</td>
<td>6 (2.5%)</td>
<td>2 (0.9%)</td>
<td>0.29</td>
</tr>
<tr>
<td>Achromobacter spp</td>
<td>2 (0.8%)</td>
<td>3 (1.4%)</td>
<td>0.67</td>
</tr>
<tr>
<td>Other Gram negative</td>
<td>14 (5.8%)</td>
<td>6 (2.8%)</td>
<td>0.17</td>
</tr>
</tbody>
</table>

**EXCLUSION CRITERIA**

- Discharge or expiration prior to clinician assessment of results
- Verigene results that were misreported in Cerner
- Polymicrobial initial Gram stains
- Non-Listeria Gram positive rods upon final culture
- Gram variable blood isolates
- Cultures results with Pseudomonas aeruginosa, Citrobacter spp., Enterobacter spp., or Proteus spp.:
- The Pharmacy Verigene Theradoc alert was not functioning appropriately during study time frame.

**INTERVENTION**

- Verigene testing was performed for all blood isolates with unique morphology upon Gram stain within 72 hours.
- Pharmacists were alerted to Verigene results via the Theradoc electronic data capture system.
- Physicians were called with antibiotic stewardship interventions based on Verigene results.

**SECONDARY OUTCOMES**

- Time on antibiotics for contaminant (h): 14.3 (N=72) vs. 39.7 (N=51) <0.0001
- Contaminant, antibiotics never initiated: 52.8% vs. 31.4% 0.03
- Length of stay (d), mean: 9.7 vs. 10.7 0.9
- Total admission costs, mean: $14,534 vs. $17,745 0.04
- Pharmacy charges, mean: $3,804 vs. $4,197 0.34
- Clostridium difficile infection: 2.5% vs. 6.1% 0.06
- 30-day mortality: 2.5% vs. 4.2% 0.70
- Readmission within 30 days: 7.6% vs. 19.7% 0.02

**REFERENCES**