Evaluation of Broth Enrichment for the Detection of Vancomycin Resistant Enterococci on Two Chromogenic Media


1Queen’s University School of Medicine, Department of Pathology and Molecular Medicine, Kingston, ON, Canada, 2Kingston General Hospital, Kingston, ON, Canada

Abstract

Background: Rapid and accurate screening for vancomycin resistant enterococci (VRE) is essential in a hospital setting. We recently evaluated the performance of Brilliance VRE Agar (BVA) and Colorex VRE Agar (CVA) to identify VRE isolates in broth-enriched (BE) rectal swabs and found high sensitivity but also high numbers of false positives (FP). We sought to determine whether eliminating BE step would improve specificity of BVA and CVA without significantly affecting the sensitivity of detection of VRE.

Methods: Evaluation of BVA and CVA were performed at different time periods, following the same protocol. For BE method, rectal swabs were inoculated into BH enrichment broth and incubated overnight at 35-37°C, followed by streaking 10 µL onto BVA or CVA. For the direct method, swabs were inoculated onto BVA or CVA, and streaked for isolation. BH plates were read at 24 h and CVA plates were read at 24 h and 48 h. In the BE study, 2160 and 935 samples were evaluated on BVA and CVA, respectively. Comparison of direct versus BE was performed on 101 and 208 samples for BVA and CVA, respectively. Suspicious VRE colonies were confirmed by Gram stain, biochemical identification, and antibiotic susceptibility testing. Enterococcus faecium or E. faecalis with a minimum inhibitory concentration (MIC) of 8 µg/mL for vancomycin were considered VRE positive.

Results: In the BE study for BVA, 649 (32%) samples required further work-up; 199 (9%) were VRE and 450 (22%) were FP. For BE on CVA, further work-up was performed on 125 (14%) with 69 (7%) confirmed as VRE and 66 (8%) FP. The specificity for BVA and CVA were 77% and 92%, respectively. In the direct inoculation study for BVA, sensitivity decreased from 100% to 93% and specificity increased from 80% to 91%. For CVA, sensitivity was the same (85%) but specificity increased from 80% to 92%. The FP rate decreased by 47% (8/17) for BVA and 56% (15/28) for CVA when BE was eliminated. Direct inoculation of CVA detected 91% VRE at 24 h and 121% FP at 48 h.

Conclusion: Although BVA and CVA both showed exceptional sensitivity using BE method, the number of FP were significant. When direct inoculation was used, FP rate decreased significantly by 54% (15/28) after elimination of BE. There was no change in sensitivity for Colorex VRE agar after 24 h incubation and for Colores VRE agar after 24 h and 48 h incubation.

Methods

Data:

- **BVA and CVA**: 101 (20V) and 208 (CVA) rectal swabs were collected from patients admitted to Kingston General Hospital for VRE colonization.
- **Incubation time**: 35-37°C: 24 h for BVA and 24 h and 48 h for CVA as per manufacturer’s protocol.
- **Swabs or stools**: Inoculated into BH enrichment broth and incubated overnight at 35-37°C in ambient air, followed by streaking 15 µL of broth onto BVA and CVA with replicating streaking for isolation.
- **MIC**: 8 µg/mL for vancomycin were considered VRE positive.

Goals of this study:

- To determine the specificity and sensitivity of two chromogenic agars when BE step is incorporated.
- To determine whether a BE step is required, prior to inoculation of a chromogenic media when a chromogenic agar with a lower MIC of vancomycin is utilized.
- To evaluate two new chromogenic agars and select the superior one that meet our requirements for accurate identification with minimal levels of extraneous workload caused by false positive results.

Conclusions

- Evaluation of BVA and CVA will likely meet our requirements for accurate identification with minimal levels of extraneous workload caused by false positive results.

## Table 1. TP and FP VRE results broth vs. direct

<table>
<thead>
<tr>
<th></th>
<th>BVA (N = 101)</th>
<th>CVA (N = 208)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Incubation time</strong></td>
<td>Direct</td>
<td>BE</td>
</tr>
<tr>
<td><strong>TP</strong></td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td><strong>FP</strong></td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td><strong>TN</strong></td>
<td>19</td>
<td>19</td>
</tr>
</tbody>
</table>

Figure 1. Broth Enrichment with Brilliance VRE and Colorex VRE agar

Figure 2. Broth Enrichment TP and FP percentage rates for BVA and CVA

Figure 3. Direct vs. BE results for BVA agar

Figure 4. Direct vs. BE results for CVA agar

Figure 3. Direct vs. BE results for BVA agar

Table 1. TP and FP VRE results broth vs. direct

- **TP**: True Positive
- **FP**: False Positive
- **TN**: True Negative
- **BE**: Broth Enrichment
- **BVA**: Brilliance VRE Agar
- **CVA**: Colorex VRE Agar

References:


Affiliations: