Utilization Review of the Use of BACTEC PLUS High-Volume Blood Culture Bottles

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The BACTEC PLUS 26 (NR26) (Becton Dickinson, Towson, Md.) high-volume blood culture bottle replaced the less expensive smaller-volume NR6A bottle in our hospital. An audit carried out several months after their introduction revealed that only 17.5% of the NR26 bottles received the required blood volume. Several audits and educational programs were required in order to achieve a compliance rate of >60%.

Several studies have shown that an increased volume of blood inoculated into blood culture bottles will increase the yield of positive cultures in bacteremic patients (1-3, 6-9). The BACTEC PLUS 26 (NR26) bottle, a resin-containing aerobic bottle, was introduced by Becton Dickinson (Towson, Md.) to function optimally with an inoculum of 8 to 10 ml of blood compared with the BACTEC NR6A low-volume (3- to 5-ml inoculum), non-resin-containing, aerobic blood culture bottles (4, 5). We replaced the NR6A bottles that we had been previously using with NR26 bottles. The NR7A low-volume (3- to 5-ml inoculum), non-resin-containing, anaerobic bottle was retained as part of the blood culture set. Staff responsible for the collection of blood cultures were notified of this change by a memorandum outlining the new blood volume requirements.

After several months of using the NR26 bottles, it became apparent that the observed volume frequently was less than optimal. This observation led to a series of audits and educational programs designed to improve compliance with the inoculum requirements, which we set at 8 to 12 ml for the NR26 and 3 to 6 ml for the NR7A bottles.

In the first four audits, the volume of blood inoculated into the bottles was determined by subtracting the mean weight of the uninoculated bottles (corrected for the removal of bottle caps and the addition of specimen labels) from the weight of the inoculated bottles. In order to minimize any variation that may have occurred because of weight differences between different lots of bottles, each uninoculated bottle was weighed before distribution in subsequent audits. The difference in weight between inoculated and uninoculated bottles was then converted into a volume by a blood density conversion factor of 0.985 ml per gram of blood. The conversion factor was determined from the mean weight of 10 ml of pooled human blood. The level of hemoglobin had no significant effect on the conversion factor (data not shown).

Nine audits were performed over a 19-month period (Table 1). As a result of the poor compliance found in audit 1a, a second memorandum was issued to all health care personnel involved in blood culture collection. This memo-

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TABLE 1. Audits of the volume of blood inoculated into NR26 and NR7A blood culture bottles

<table>
<thead>
<tr>
<th>Audit no.</th>
<th>Date</th>
<th>Comment</th>
<th>No. of sets</th>
<th>Vol. of blood inoculated in bottlesa</th>
<th>Distribution in NR26 and NR7A (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Oct. 1990</td>
<td>Initial audit after NR26 introduction</td>
<td>280</td>
<td>5.5 17.5 5.1 66.4 1.5 16.5 40.3</td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>Jan. 1991</td>
<td>Post color-photo memorandum</td>
<td>233</td>
<td>7.9 45.9 6.3 60.9 23.6 2.2 12.5</td>
<td></td>
</tr>
<tr>
<td>1c</td>
<td>Mar. 1991</td>
<td>3 mo post color-photo memorandum</td>
<td>330</td>
<td>8.2 52.1 7.6 28.7 10.3 0.6 25.8</td>
<td></td>
</tr>
<tr>
<td>2a</td>
<td>July 1991</td>
<td>New intern rotation</td>
<td>265</td>
<td>8.5 63.0 6.0 57.4 35.2 4.2 9.1</td>
<td></td>
</tr>
<tr>
<td>2b</td>
<td>Sept. 1991</td>
<td>3 mo post new intern rotation</td>
<td>238</td>
<td>7.0 37.4 5.4 45.0 23.1 5.5 10.1</td>
<td></td>
</tr>
<tr>
<td>3a</td>
<td>Nov. 1991</td>
<td>Post labelling</td>
<td>361</td>
<td>7.6 53.5 4.4 83.9 46.5 7.2 2.5</td>
<td></td>
</tr>
<tr>
<td>3b</td>
<td>Jan. 1992</td>
<td>3 mo post labelling</td>
<td>515</td>
<td>7.7 61.9 4.0 81.9 55.7 11.3 0.6</td>
<td></td>
</tr>
<tr>
<td>3c</td>
<td>Apr. 1992</td>
<td>Blood cultures drawn by interns, residents,</td>
<td>592</td>
<td>8.3 71.1 4.3 83.8 64.2 6.6 1.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>and unspecified staff</td>
<td></td>
<td>9.3 91.6 4.5 93.7 86 0.0 0.5</td>
<td></td>
</tr>
</tbody>
</table>

a Optimal volume of blood: NR26A, 8 to 12 ml; NR7A, 3 to 6 ml.

b IV, intravenous.

Our use of blood culture bottles requiring different volumes may have contributed to the lack of compliance and may explain the overinoculation of the NR7A bottle. Also, technical problems in obtaining blood may limit the compliance rate.

Although it is difficult to define an acceptable compliance rate, a rate of >60% may be reasonable, since we were able to obtain this simply by modifying the blood culture bottle labels and in-service programs. Failure to achieve this rate with such a new system should prompt a reevaluation of its cost effectiveness.

REFERENCES