Impact of Repeating Blood Cultures on Detecting Unpredicted Causative Microorganisms

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ABSTRACT

Blood cultures (BCs) are important for diagnosis and management of patients with infection. However, the impact of repeating BCs has not yet been elucidated. The objective of this study was to investigate the difference between initial and repeated BCs results over the past decade.

METHODS

We retrospectively analyzed all consecutive BCs performed at the Mie University Hospital, Japan from January 2006 to December 2015. All patients with repeating BCs were recruited to this study. Any episode occurred 31 or more days after previous BC was considered as a separate condition. The timings of repeating BCs after initial episode (Day 0) were categorized as follows: Day 1-2, Day 3-5, and Day 6 or later. The following microorganisms were considered as probable contaminants: CNS, Bacillus species, Corynebacterium spp., Propionibacterium spp., and Micrococcus species. The frequencies of BCs’ positivity and distribution of detected microorganisms in the initial and repeated BCs were analyzed. Results: Among a total of 12,593 cases with initial BCs, repeating BCs were performed in 4,136 cases. The positivity rates among each group were 7.7%, 6.0%, and 4.7%, respectively. The frequently detected microorganisms at initial BCs were as follows: CNS (21.5%), E. coli (13.0%), MSSA (9.4%), and E. faecalis (5.4%). However, at Day 3-5, increasing frequencies of MSSA, MRSA, and E. faecalis detection and decreasing of E. coli, Streptococcus sp., Klebsiella sp. were observed. At Day 6 or later, Candida sp. (6.0%) and E. faecium (5.7%) came up to the top 5 organisms following CNS (26.0%), MSSA (11.9%) and E. coli (7.9%).

RESULTS

This study was conducted at the Mie University Hospital, a 685-bed educational hospital, in Japan. We performed a retrospective evaluation of the results of all BCs from both inpatient and outpatient department in hospital between January 2006 and December 2015. A blood culture inoculation was conducted using an automated blood culture monitoring system, and was continued for 7 days if there was no growth.

BACT/ALERT® 3D system (January 2006 to December 2012)
BACTECTM FX system (January 2013 to December 2015)

A second episode occurring 31 or more days after previous BC was considered as a separate case. The timing of follow-up BCs after initial episode (Day 0) were categorized as follows: Day 1-2, Day 3-5, and Day 6 or later. Commensal organisms such as Coagulase-negative staphylococci, Bacillus sp., Corynebacterium sp., Propionibacterium sp., and Micrococcus sp. were considered as potential contaminants.

Isolation of one of these organisms was considered as contamination (pseudo-positive BC) regardless of clinical situation in this study, whereas isolation of pathogenic organisms, except potential contaminants listed above, was considered as bacteremia (true-positive BC). Isolation of both pathogenic organisms and potential contaminants was considered as mixed bacteremia.

In total, 23,297 BCs in 12,593 cases (11,584 inpatients and 1,009 outpatient) and 10,704 follow-up BC in 4,136 patients were performed during this study period.

Table 1: The results of repeated BCs among initial cases.

<table>
<thead>
<tr>
<th>Day 1-2</th>
<th>Day 3-5</th>
<th>Day 6 or later</th>
</tr>
</thead>
<tbody>
<tr>
<td>True-positive</td>
<td>549</td>
<td>New pathogen 61</td>
</tr>
<tr>
<td>Pseudo-positive</td>
<td>246</td>
<td>True-positive 25</td>
</tr>
<tr>
<td>Negative</td>
<td>3315</td>
<td>Pseudo-positive 191</td>
</tr>
</tbody>
</table>

The results of repeated BCs among initial cases were same pathogen (21.5%) and new pathogen (11.1%). The positive rates of repeating BCs’ among initial pseudo-positive and negative cases were 10.2% and 9.8%, respectively.

CONCLUSIONS

A certain number of repeating BCs cases showed different microorganisms from initial one. There were several changes in the distribution of detected microorganisms from initial BCs to repeating BCs cases with chronologically increased frequencies of drug resistant organisms. These results suggest repeating BCs are needed in cases of unfavorable clinical course.

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