Failure of an Automated Blood Culture System To Detect Nonfermentative Gram-Negative Bacteria

Dr. Klaerner and colleagues (1) reported interesting data about the automated BacT/Alert blood culture system. A total of 605 out of 8,107 blood culture bottles yielded relevant microorganisms. The system failed to detect 15 nonfermentative species out of 605 bottles. The authors speculated that this was due to growth of microorganisms during preincubation at 36°C, and they suggested keeping the bottles at room temperature until loading. Preincubation at room temperature may reduce the failure to detect nonfermentative species; however, detection of other clinically relevant microorganisms may be delayed.

Automated blood culture systems (BACTEC 9240 and BacT/Alert) detect growth of microorganisms by continuous monitoring of CO₂ without manipulations of the bottles, which delayed detection of other clinically relevant microorganisms. The system failed to detect 15 nonfermentative species out of 605 bottles. The authors speculated that this was due to growth of microorganisms during preincubation at 36°C, and they suggested keeping the bottles at room temperature until loading. Preincubation at room temperature may reduce the failure to detect nonfermentative species; however, detection of other clinically relevant microorganisms may be delayed.

Rapid detection and identification of bacteremia by a clinical laboratory add to prompt and adequate antibiotic therapy. Hence, the reported failure in detection of bacteremia is of great concern. Fast transportation of the bottles to the laboratory and immediate loading are not always feasible, and the growth of microorganisms in the bottles may already have reached steady state. The algorithm for detection of growth estimates both the initial CO₂ level (reflection units) and changes in this level but proved to be not sensitive enough. Adaptation of the software may be indicated; however, this should not cause an increase in the number of false-positive readings (2).

The results of Dr. Klaerner et al. (1) indicate the need for continuous quality improvement to ensure optimal use of the benefits of the automated blood culture systems, including short transportation time, adequate filling of the bottles, and evaluation of the detection algorithm of the blood culture system. The authors suggest subculturing of all bottles with a transportation time longer than 4 h prior to loading. This causes a substantial increase in the workload. In order to cope with the advanced growth in blood culture bottles, in our laboratory the technicians screen the color at the bottom of the bottles prior to loading. From “suspect” bottles with yellow color indicators a sample is drawn for Gram staining and subculture. In our experience the BacT/Alert system (software version BacT/Link E.00) detects growth of microorganisms in such bottles soon after loading, though we did not record this routinely. Subculturing on indication seems reliable and is less laborious than subculturing all bottles with a transportation time longer than 4 h; moreover, often the transportation time is unknown.

Measurement of the absolute number of reflection units by the system is more accurate than evaluation of the color by the human eye; however, a plot of reflection units can be generated only after six measurements (60 min). If there is a correlation between the number of bacteria in the bottles at arrival in the laboratory and the degree of yellowness (or the absolute number of reflection units), this can be used to detect preincubational growth and it would be worthwhile to investigate whether the software of the blood culture system can select bottles which should be subcultured.

REFERENCES

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Author’s Reply
We agree that blood culture bottles have to be filled adequately in order to allow optimal conditions for the detection of microorganisms that invade the bloodstream. Our remark that smaller inocula reduce the number of false-negative blood cultures detected by the BacT/Alert system was in conjunction with the experimental results where smaller numbers of microorganisms but not smaller volumes were added to the blood culture bottles; this procedure allowed the detection of nonfermentative species even though the bottles were preincubated. This experimental result should not be interpreted as a recommendation to fill blood culture bottles with smaller volumes of blood.

We are not convinced that a change in the software of the BacT/Alert system in order to minimize the problem with preincubated blood cultures in detecting nonfermentative species will solve the problem. An increased sensitivity of the software will probably also result in more cases of false-positive readings. This issue, of course, can be solved only by the manufacturer. The results of our study reemphasize the need of rapid transportation to the laboratory. In our eyes, the speed of transportation is increased by the presence of automatic transportation systems and, more importantly, by the awareness of physicians and nurses. We have to bear witness to the fact that blood culture bottles were forgotten and left in the incubators in the ward for several days, a situation which cannot be tolerated. To detect growth of nonfermentative species in preincubated bottles, we decided to subculture all blood culture bottles on their arrival in the laboratory. The workload, of course, is increased; on the other hand, the bottles have to be
vented manually, and at this point of the working process a subculture is performed quickly. We checked visually whether a change in the color indicator of the blood culture bottles from the clinic occurred upon their arrival in the laboratory, and “suspect” bottles, as discussed by Drs. Messen and de Vries-Hospers, were subcultured immediately. However, this procedure did not prevent our failure to detect nonfermentative species, because the color indicators of these bottles did not change. In addition, our experimentally seeded blood culture bottles did not show changes in the color indicator after the period of preincubation. Therefore, in our experience changes in the color indicator do not predict reliably whether subcultures need to be performed or not.

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