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Comparison of a Radiometric and a Broth-Slide System for Aerobic Blood Culture

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In a comparison of the radiometric BACTEC 460 (Johnston Laboratories) and the BCB broth slide system (Roche Diagnostics Division), the latter yielded a slightly greater number of clinically significant microorganisms, as well as contaminants, from aerobic blood cultures. These differences may reflect the larger volume of blood required for and the greater amount of manipulation associated with the BCB.

In recent years there has been a trend to use automated methods for processing blood cultures. These methods require the use of expensive equipment, with the result that their acceptance is limited by economic factors. The advantages of such methods are the more rapid detection of positive cultures and a reduction in technologist time requirements.

A blood culture with slide format (BCB-SF) combined with the blood culture bottle slide (BCB-S) comprises the BCB system (Roche Diagnostics, Div. Hoffmann-La Roche, Inc., Montreal, Canada, also known as Septi-Chek. It has been evaluated recently (1) and does not require the purchase of any machine. This labor-saving subculturing system is only available for aerobes and so must be combined with another traditional method for the isolation of anaerobes. This study was undertaken to compare the BCB-SF with the BACTEC 460 (Johnston Laboratories Inc., Cockeysville, Md.) with regard to their speed and accuracy in detecting bacteremia.

The study was performed at the 1,500-bed Vancouver General Hospital. Patients were selected only for their ability to provide 20 ml of blood for culture, thus excluding infants and young children. All cultures were processed in the hospital laboratories and isolates identified by standard methods based on the *Manual of Clinical Microbiology* (4). The BCB-SF system consisted of a bottle containing 70 ml of tryptic soy broth with 0.05% sodium polyanethol sulfonate in an atmosphere of 10% CO_2-90% air under negative pressure. Ten milliliters of blood was introduced through the rubber stopper by a syringe and needle. The BCB-S consisted of a slide covered with chocolate, MacConkey, and malt agars in a clear plastic cylinder that was screwed onto the neck of the blood culture bottle after the rubber stopper was removed. Twice a day the broth and agars were checked for turbidity, and routine subculture was performed by simply inverting the unit.

With the BACTEC 460 we used the enriched tryptic soy broth medium (6B) for aerobic cultures and the prereduced enriched tryptic soy broth medium for anaerobes (7C). Each bottle contained 30 ml of medium and was under a reduced pressure to accept 3 to 5 ml of blood.

The study was performed by withdrawing 20 ml of blood from the patient after the skin was prepared with 70% alcohol and by placing 3.5 ml of blood into each of the BACTEC bottles and 10 ml into the BCB-SF bottles. In the laboratory, the aerobic culture was processed through the BACTEC 460 twice a day for the first 2 days and daily for days 3, 4, and 6. The anaerobic bottle was sampled daily on days 2, 3, 4, and 6. On day 6 both bottles were subcultured to chocolate agar incubated aerobically with 6% CO_2 and to Schaedler agar incubated under anaerobic conditions. The BCB-SF bottle had the BCB-S unit attached and inverted to inoculate the agars and then placed upright in the incubator, thus allowing the broth to drain back into the bottle. The units were checked visually morning and night and inverted to reinoculate the agar slopes.

The charts of patients with positive cultures were reviewed to determine the significance of the isolates.

Of 903 cultures, 107 (12%) showed growth in at least one bottle. This isolation rate compares favorably with reported values ranging from 7.6 (5) to 17.6% (2). The clinically significant isolation rate was 8.6%, similar to that in recent reports (2, 5, 6). The 78 clinically significant cultures included 9 which were isolated only by the BACTEC 460 system and 20 which were

TABLE 1. Results of 903 aerobic blood cultures by the BACTEC and BCB systems

Organism	Cultures (significant/not significant)		
	Total	Isolated only by:	
		BACTEC 460	BCB
S. aureus	13/0	1/0	0/0
S. epidermidis	16/21	4/3	7/14
Streptococci	12/1	0/0	3/1
Gram-positive bacilli	1/7	0/0	0/5
Gram-negative bacilli	25/0	3/0	7/0
Yeasts	3/0	0/0	1/0
Mixed organisms	7/0	0/0	1/0
Different organisms[a]	1/0	1/0	1/0

[a] BACTEC 460 grew *Proteus mirabilis*, and BCB grew *Escherichia coli*.

isolated only by the BCB system ($P = 0.024$). The greater yield of clinically significant cultures by the BCB method probably resulted from the larger volume of blood utilized. The combined volume of blood used in both the anaerobic and aerobic BACTEC cultures is only half that utilized by the BCB method. The results did not suggest any failure by either system to sustain the growth of any specific organism.

Table 1 summarizes the discrepancies in the results of the two methods. The streptococci included four β-hemolytic streptococci, four *Streptococcus pneumoniae*, two viridans streptococci, two microaerophilic streptococci, and one *Streptococcus faecalis*. A variety of gram-negative bacilli were isolated, with *Escherichia coli* being most common. The one patient with different gram-negative bacilli isolated by the two systems had a catheter-associated urinary tract infection, and both bacteria were isolated from blood cultures.

In 33 of the 49 clinically significant cultures which were positive by both systems, information was available to compare the time required to detect a positive culture. The BACTEC 460 was positive 24 h earlier in two instances and 12 hours earlier in one. This advantage is partially offset in the BCB system by the availability of colonies on an agar slope; this can aid in organism identification and antimicrobial sensitivity testing.

The 29 contaminants included 3 which were isolated only by the BACTEC 460 and 20 which were isolated only by the BCB. The difference in the incidence of contaminants between the two methods was statistically significant ($P = 0.001$). The large number of clinically insignificant *Staphylococcus epidermidis* isolates encountered in the BCB cultures may have been related to the removal of the top of the bottle and its replacement with the slide unit. Only one strict anaerobe was isolated from the BACTEC 460 anaerobic cultures; this was 0.1% of all blood cultures or 1.3% of those with clinically significant growth.

This rate was lower than that in the literature (5 to 15% [3]) and may have been a reflection of the study size or the patient population, from whom an increased volume of blood was required.

The BCB system was found to be a reliable means for aerobic blood cultures. Its design permits the use of larger volumes of blood than many other systems, and thus conforms to the methods recommended in the literature. The attached slide unit makes subculturing simple and time-effective but may also be responsible for increased laboratory contamination.

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