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Clinical Comparison of Lysis-Centrifugation and Radiometric Resin Systems for Blood Culture

PATRICIA BRANNON AND TIMOTHY E. KIEHN*

Diagnostic Microbiology Laboratory and Infectious Disease Service, Department of Medicine, Memorial Sloan-Kettering Cancer Center, New York, New York 10021

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The Isolator 10 lysis-centrifugation blood culture system (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.) and the BACTEC 16B-17D radiometric resin system (Johnston Laboratories, Inc., Towson, Md.) both remove antimicrobial agents from the blood for culture. We compared these two systems for recovery of aerobic bacteria, facultatively anaerobic bacteria, and yeasts. A total of 5,000 blood cultures yielded 467 clinically significant isolates. Both systems recovered 350 (75%) organisms, 56 (12%) were detected by Isolator only, and 61 (13%) were detected by BACTEC resin bottles only. No group of organisms was isolated significantly more often from either system.

Recently, we compared the recovery of bacteria and yeasts in the Isolator lysis-centrifugation blood culture system (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.) and the BACTEC radiometric broth system (Johnston Laboratories, Inc., Towson, Md.) (3). The Isolator system recovered significantly more total organisms, members of the family *Enterobacteriaceae, Staphylococcus* spp., and yeasts. We had earlier reported that the Isolator system recovered more total organisms, *Escherichia coli*, and *Candida* spp. from blood than were recovered with a conventional two-bottle Columbia broth system (9).

Approximately 50% of the patients at Memorial Sloan-Kettering Cancer Center, New York, N. Y., have received one or more antibiotics when blood cultures are taken. The increased yield with the Isolator system may be explained in part by antibiotic removal during the Isolator processing procedure. After blood in the Isolator tube is lysed by saponin, the tube is centrifuged and the supernatant containing most of the antibiotics is discarded. Sediment remaining in the Isolator tube is inoculated onto the centers of agar plates, and then a sterile inoculating loop is passed 15 to 20 times back and forth through the concentrate. Figure 1 shows colonies of *Staphylococcus aureus* growing only at the edge of the inoculum on an agar plate. This is the area where the remaining antibiotic residue in the Isolator sediment should be the least concentrated.

One formulation of the BACTEC broth bottles uses resins as an antimicrobial agent removal device. Several studies have shown that addition of resins to the media increases the yield of organisms from the blood of patients receiving antibiotics (1, 4, 5). We were interested in determining whether the use of BACTEC broth bottles containing resins would increase the isolation of organisms previously recovered more frequently by the Isolator system. We compared the BACTEC resin system using 16B and 17D bottles with the 10-ml Isolator tube for the recovery of aerobic bacteria, facultatively anaerobic bacteria, and yeasts.

From August through November 1985, 5,000 blood cultures from adult patients at Memorial Sloan-Kettering Cancer Center were received in the microbiology laboratory. Equal volumes of each blood sample were collected into an Isolator 10 tube and a 100- by 16-mm VACUTAINER tube containing polyanetholsulfonate (Becton Dickinson Vacutainer Systems, Rutherford, N.J.). The volume of blood ranged from 3 to 8 ml per tube (mean, 6.5 ml). The order of collection of the two tubes was changed each week. After collection, the two tubes were inverted several times for proper mixing and then transported to the microbiology laboratory, where they were processed within 2 h of blood collection. The Isolator tube was processed as directed by the manufacturer. After centrifugation, concentrated sedi-

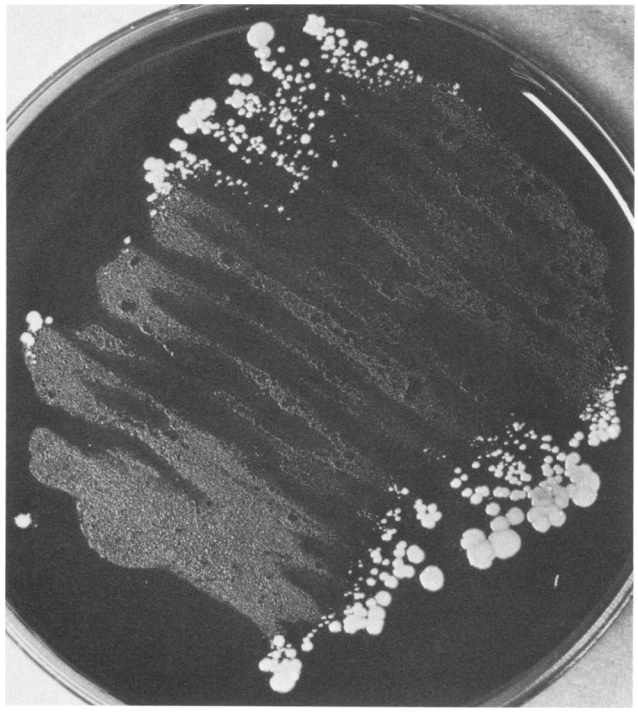

FIG. 1. Growth of *S. aureus* at 24 h on a Columbia blood agar plate inoculated with sediment from the Isolator blood culture system. Colonies of *S. aureus* were found only at the edge of the inoculum, whereas inhibition of growth was noted at the center of the plate. The patient, a 24-year-old male with leukemia, was receiving gentamicin, ticarcillin, clindamycin, and vancomycin when the blood culture was taken.

* Corresponding author.

TABLE 1. Number of significant isolates from the Isolator 10 and BACTEC resin systems

Organism group (no. of isolates)	No. of isolates from:		
	Isolator and BACTEC resin	Isolator only	BACTEC resin only
Enterobacteriaceae (188)	138	25	25
Staphylococcus spp. (100)	85	4	11
Pseudomonas spp. (78)	57	10	11
Streptococcus spp. (53)	40	7	6
Yeasts (29)	15	10	4
Other bacteria (19)	15	0	4

ment from the Isolator tube was inoculated in equal portions onto two Columbia sheep blood agar plates and two chocolate agar plates inside a SteriLGARD hood (The Baker Company, Inc., Sanford, Maine). All agar plates were incubated aerobically at 35°C in 5% CO_2 in air for 5 days. All Isolator plates were examined daily in a SteriLGARD hood. Blood from the VACUTAINER tube was divided equally into aerobic 16B and anaerobic 17D BACTEC resin bottles. All broth cultures were incubated at 35°C for 7 days. The 16B broth bottles were agitated for the first 2 days, and they were visually and radiometrically examined three times on days 1 and 2 and once a day on days 3 to 5 and on day 7. The 17D broth bottles were examined visually and radiometrically once each day on days 1 to 5 and on day 7. Samples from all negative broth bottles were inoculated onto chocolate agar as a blind subculture procedure after the day 5 radiometric reading. The chocolate agar plate was incubated at 35°C in 5% CO_2 in air for 48 h.

The asymptotic chi-square test of McNemar (10), as applied to comparative blood culture methods by Ilstrup (7), was used for statistical analysis. Chi-square values of ≥ 3.84, which defined P values of ≤ 0.05, were considered significant.

From 5,000 cultures, 467 clinically significant isolates were recovered. Table 1 lists significant groups of organisms isolated and the blood culture system from which the organisms were isolated. No group of organisms was isolated significantly more often from either the Isolator or the BACTEC system. Only seven organisms, including two yeasts, recovered from the BACTEC system were detected by 5-day blind subculture.

Previous studies from our laboratory and other groups have found that the Isolator 7.5- and 10-ml systems, when compared with broth systems including BACTEC non-resin media, improved the recovery of staphylococci, members of the family *Enterobacteriaceae*, and yeasts (2, 3, 6, 8, 9). In this study, the BACTEC resin broth system recovered aerobic and facultatively anaerobic bacteria and yeasts as efficiently as did the Isolator lysis-centrifugation system. This efficient recovery of organisms by the BACTEC resin system occurred even though incubation environments favored recovery of some organisms by the Isolator system. The results also indicated that the use of resins did not adversely affect the recovery of organisms seen in this study.

Many patients have already received broad-spectrum antibiotics when blood cultures are drawn. The presence of antibiotics can inhibit the recovery of microorganisms by blood culture. This study suggests that, in a hospital where many patients have received antibiotics when blood cultures are taken, either the Isolator system or BACTEC media with resins would efficiently detect the organisms seen in this study.

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