Rapid Diagnosis of \textit{Brucella} Bacteremia by Using the BACTEC 9240 System

ROBERT M. BANNATYNE, MYRNA C. JACKSON, AND ZIAD MEMISH*

Departments of Pathology and Infection Control, King Fahad National Guard Hospital, Riyadh, Saudi Arabia

Received 7 March 1997/Returned for modification 27 May 1997/Accepted 25 June 1997

Almost 93% of 97 separate patient isolates of \textit{Brucella} bloodstream infections were recovered within 5 days of incubation by using the BACTEC 9240 continuous-monitoring blood culturing system.

\textit{Brucella} species are slow-growing, fastidious bacteria that in areas in which \textit{Brucella} is endemic, can cause serious bloodstream infections. Blood culture by the classical Castaneda method can take up to 35 days of incubation before growth is detected (1). The advent of the new, third-generation continuous-monitoring blood culture systems (8) offered the possibility of an accelerated diagnostic modality. To test this potential, we evaluated the BACTEC 9240 instrument for its speed of detecting \textit{Brucella} bacteremia in a population with a high incidence of the disease.

\textbf{Patient population.} The King Fahad National Guard Hospital serves a large population of Saudi National Guard servicemen and their extended families. Many of these individuals retain traditional lifestyles and living patterns in which communities may live in close association with livestock such as sheep, goats, and camels. The consumption of fresh, unpasteurized milk from the animals, in which the incidence of brucellosis is high, is a cultural norm.

\textbf{Blood culture.} Between 5 and 10 ml of blood from patients was inoculated into each of a Standard aerobic/F or Plus aerobic/F bottle and a Standard anaerobic/F or Plus anaerobic/F BACTEC bottle. The number of sets of blood cultures was uncontrolled, but generally there was one from the outpatient clinic site and there were up to three from hospitalized inpatients. Bottles were incubated for up to 21 days in the incubator-rocker compartment of the BACTEC 9240 instrument and examined for the presence of growth on a 10-min cycle by the measurement of carbon dioxide-induced fluorescence (indicator of organism metabolism) emitted from a sensor in the bottom of the bottle. Bottles giving a positive growth index were Gram stained and subcultured to chocolate blood agar at 37°C in CO₂. Isolates characteristic of \textit{Brucella} species were identified by conventional biochemical tests. Ninety-seven separate patient isolates of \textit{Brucella} species (85 \textit{B. melitensis} and 12 \textit{B. abortus} isolates) were recovered in a 2-year period. The times to detection are depicted in Fig. 1. The majority of isolates (92.7%) were detected within 5 days of incubation. No significant differences in the detection times of the two species were noted. This is the largest reported study of the detection of \textit{Brucella} bacteremia by an automated, continuous-monitoring blood culture system. Our study confirms the findings of others with similar systems (4, 7, 9) and smaller numbers of patients. Using the Bact/Alert instrument, Solomon and Jackson (7) obtained a single patient isolate from three blood cultures after 2 to 8 days of incubation, and Gedikoglu et al. (4) recovered 15 patient isolates with the BACTEC 9120 system after 4 days of incubation. More recently, Yagupsky, et al. (9), with a population similar to ours and using the same instrument as we did, isolated \textit{B. melitensis} from 11 patients after 5 days of incubation.

The superior performance of the 9240 continuous-monitoring version of the BACTEC instrument compared with that of the intermittent-monitoring 660 system as noted in an earlier study (10) and in the present study (data not shown) is likely due to several factors. Improvement in the blood/broth ratio (5) due to the larger volume of broth (40 ml for the 9240 system versus 30 ml for the 660 system) may have contributed, since it has been shown that this can affect both time to detection and recovery rates for blood cultures (2, 6). The lower concentration of sodium polyanethol sulfonate (0.025% for the 9240 system versus 0.035% for the 660 system) may also have been partly responsible, because the presence of sodium polyanethol sulfonate has been noted to reduce the growth index of

* Corresponding author. Mailing address: Department of Infection Control, King Fahad National Guard Hospital, P.O. Box 22490, Riyadh 11426, Saudi Arabia. Phone: (966-1) 252-0088, ext. 3718. Fax: (966-1) 252-0088, ext. 3733.
B. melitensis below the detection threshold in a simulated blood culture (3). Certainly the earlier detection of bacteremia with the 9240 system is not simply the result of continuous monitoring of bottles, since critical changes in CO₂ concentration in the 9240 system occur before the growth index threshold for the 660 system is exceeded (5) as a result of better analysis of growth by computer algorithms. Finally, the subtle differences in basal medium formulation between the BACTEC 9240 and 660 systems may play a part in the better isolation rates and shorter detection times.

The present report demonstrates the utility of the BACTEC 9240 system for the rapid detection of Brucella bacteremia in any area in which infection with this fastidious organism is widespread.

REFERENCES