Pseudobacteremia due to Contaminated Alcohol Swabs

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Fifteen isolates of Bacillus species were recovered during a 19-day period after the introduction of an automated radiometric blood culture system. The outbreak was traced to alcohol-resistant spores present in the cotton used to disinfect blood culture bottles. The role of Bacillus species as a pathogen and a laboratory contaminant is discussed.

Pseudo-outbreaks of bacteremia have been ascribed to the contamination of blood culture bottles during collection, transport, or processing (9). Most reports describe inoculation of extraneous microorganisms as being from disinfectants or blood culture additives. A recent episode of pseudobacteremia was found to be caused by the use of contaminated cotton during the preparation of blood culture bottle tops.

The Microbiology Laboratories of Ichilov Hospital process 50 to 70 new blood culture bottles daily. In December 1982, an automated radiometric blood culture system (BACTEC 460; Johnston Laboratories, Inc.) was introduced. Between 5 and 24 days thereafter, 15 blood cultures (BACTEC 6B) yielded aerobic, gram-positive, spore-forming bacilli with identical microscopic and colonial appearance. Only two isolates of Bacillus species had been recovered during the preceding 12 months.

All isolates were first detected on either the third or fourth day after venipuncture, and no more than one bottle was positive for any given patient. From one to five additional blood culture specimens were received from each of the 15 patients, and all specimens remained sterile after 7 days of incubation at 37°C. No more than one blood culture bottle was found to contain the organism in question on any given day.

Positive blood cultures originated from five areas of the hospital. They were obtained by at least eight separate physicians with equipment designated for each specific hospital ward and with iodine-alcohol skin preparation in all cases.

Attempts to recover Bacillus species from the following were unrevealing: hospital ward disinfectants; unused needles and syringes; the surfaces, needles, and tubing of the radiometric blood culture device; and the rubber diaphragm covering 25 unused blood culture bottles. Results of routine processing of the unused blood culture bottles by the radiometric system remained negative after 7 days.

Instructions for operation of the radiometric blood culture device specify that the rubber stopper of each blood culture bottle should be cleansed with alcohol before inoculation of the blood specimen (iodine and acetone are said to alter the rubber). It was found that cotton pads, maintained in 70 to 90% ethanol by the nursing staff, were used for this purpose. The cotton in question is supplied in soft plastic packages and is not specified to be sterile.

 Cultures obtained from the center of five unused packages of cotton, each from a separate area of the hospital, produced an organism identical to that found in blood cultures. Agitation of cotton in sterile saline for 10 s produced 125 CFU/mg of dry cotton in the supernatant fluid. No other microorganism was identified in the cotton.

Subsequent investigation revealed that non-sterile cotton was also used in the microbiology laboratory during days 5 through 10 of the pseudobacteremic outbreak. The number of blood culture bottles exposed to contamination in this manner could not be determined.

After substitution of sterile cotton for the preparation of blood culture bottles, no further isolate of Bacillus species was recovered during a 60-day period.

In 1897, Epstein demonstrated that antibacterial effects of ethyl alcohol, and subsequent studies have found that 50 to 70% solutions are most effective (7, 10). Spore forming microorganisms are resistant to ethanol, but they may be destroyed after exposure for 24 to 48 h to ethanolic 1% solutions of H2SO4 or NaOH (10). As of this writing, a cotton sample immersed in 70% ethanol in my laboratory has continued to produce Bacillus species after 28 days.

It has been estimated that 6% of nosocomial epidemics reported in the United States between 1956 and 1975 were instances of pseudobacteremia due to contamination of blood culture bottles during collection or analysis (9). In some instances, contaminated solutions of benzalkonium chloride or povidone iodine were used for
disinfection of skin or bottle tops or both (1, 4). The rubber seals of the bottles themselves have also been implicated (8).

Most reports of pseudobacteremia involve contamination by aerobic, gram-negative bacilli. Review of the English-language literature published since 1949 has revealed only two outbreaks ascribed to spore forming bacilli. In one outbreak, Bacillus species were present before use in the media and rubber stoppers of commercially prepared blood culture bottles (6). A second reported outbreak, similar to the present one, described the isolation of Clostridium sordellii from a solution of thimerosal tincture used to disinfect the tops of blood culture bottles (5).

The present episode was the result of an interesting coincidence: the introduction of a system requiring alcohol swabs and the contamination of these swabs by one of the few known organisms resistant to alcohol. Contamination of radiometric blood culture bottles is not, however, unique. In a recent study, 11 of 533 bottles found positive by this system were identified as containing Bacillus species which were determined to be clinically insignificant (2). Neither the latter study, nor any of the other studies reviewed, specifies the nature of materials used to swab patient skin and blood culture bottles. If Bacillus species were isolated, particularly from several blood culture bottles, it would seem prudent to examine the sterility of swabs used for such purposes.

Although Bacillus species other than Bacillus anthracis are rarely pathogenic, severe and even fatal infections have been described, particularly among immunocompromised patients (3). Therefore, I was somewhat alarmed by the presence of heavily contaminated cotton in patient care areas during the present investigation. Increasing use of automated radiometric blood culture systems requiring alcohol disinfection of bottle diaphragms could potentially result in further instances of contamination by spore-forming bacteria. Use of sterile cotton or prepared sterile alcohol pads is, therefore, recommended for institutions that use such systems.

LITERATURE CITED


