

## Bedside Inoculation of Blood Culture Bottles with Ascitic Fluid Is Superior to Delayed Inoculation in the Detection of Spontaneous Bacterial Peritonitis

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**Ascitic fluids from patients suspected of having spontaneous bacterial peritonitis were inoculated into blood culture bottles (i) at the bedside and (ii) in the laboratory after a delay. In 29 episodes in which the bedside bottles were culture positive, only 22 (75.9%) of the laboratory-inoculated sets demonstrated growth; this difference was statistically significant ( $P < 0.02$ ).**

Six studies have demonstrated that bedside inoculation of blood culture bottles with ascitic fluid is superior to laboratory inoculation of broth and agar plates in the detection of bacterial growth in spontaneous bacterial peritonitis (1, 2, 4, 5; B. Dalmau, A. Nogueras, P. Mas, and S. Segura, *Letter, Arch. Intern. Med.* **147**:1849-1850, 1987; S. Sainz, G. Soriano, C. Guarner, P. Coll, and F. Vilardell, *Letter, Hepatology* **9**:662-663, 1989). Bedside inoculation of blood culture bottles has not been compared with delayed inoculation of blood culture bottles in the laboratory. In some hospitals (e.g., those that use radioactive media), laboratories do not release blood culture bottles to the physicians on patient wards; laboratory technicians bring the bottles with them when they draw blood for culture. It is unknown whether the transportation of infected ascitic fluid to the laboratory and the delay in inoculation of culture media with the fluid result in death of bacteria and therefore a false-negative culture. The goal of this study was to compare the sensitivity of bedside inoculation of blood culture bottles with that of delayed laboratory inoculation of blood culture bottles with ascitic fluid in the detection of bacterial growth.

Patients hospitalized with ascites at the University of Southern California Liver Unit at Rancho Los Amigos Medical Center between April 1988 and August 1989 underwent routine admission paracentesis and repeat paracentesis if signs or symptoms of peritonitis (i.e., fever, abdominal pain, or encephalopathy) developed. Patients strongly suspected of having infected ascites were the subjects of this study. Immediately after 60 ml of fluid was withdrawn in a single syringe, the needle on the syringe was aseptically changed to a sterile needle, and at the bedside 10 ml of ascitic fluid was inoculated into one 100-ml Difco tryptic soy broth bottle (Difco Laboratories, Detroit, Mich.) and one 100-ml Difco Thiol broth bottle (both with sodium polyanetholesulfonate and  $\text{CO}_2$ ). Fluid was also placed in the appropriate tubes for testing of cell counts and analysis of protein concentration, etc. The syringe was sealed and transported to the laboratory, where it was placed at room temperature

for 4 h and vortexed, and 10 ml was inoculated into each of two bottles of the same medium. The bottles were incubated at 35°C immediately after inoculation. The cultures were processed and organisms were identified in the routine fashion (3, 4).

The study was approved by the Institutional Review Board of Rancho Los Amigos Medical Center. Informed consent was obtained from patients or their guardians (if patients were encephalopathic or otherwise unable to give informed consent). The  $\chi^2$  test (with Yates' correction) was used for statistical analysis. A  $P$  value of  $<0.05$  was considered significant.

The ascitic fluids were cultured from 53 paracenteses performed on patients in whom ascitic fluid infection was strongly suspected. In 29 sets of culture bottles (four bottles per set), at least one bottle grew a pathogenic organism in the setting of an elevated ( $\geq 0.25 \times 10^9$ /liter) ascitic fluid neutrophil count. Each of these 29 culture sets grew a single organism. Of these 29 organisms there were 13 *Escherichia coli* isolates, 6 *Klebsiella pneumoniae* isolates, 3 viridans group streptococci, 2 *Streptococcus pneumoniae* isolates, 2 enterococci, 2 nonenterococcal group D streptococci, and 1 *Citrobacter amalonaticus* isolate. There were seven sets (24.1% of 29) in which the bedside pair of bottles grew bacteria but the delayed pair did not. This difference in sensitivity of culture was statistically significant ( $\chi^2 = 5.85$ ,  $P < 0.02$ ). There was no set in which the delayed pair of bottles grew bacteria and the bedside bottles did not. The bacteria involved in the seven sets in which the delayed cultures were sterile included two *E. coli* isolates, two *K. pneumoniae* isolates, one *S. pneumoniae* isolate, one enterococcus, and one *C. amalonaticus* isolate.

This study demonstrates that bedside inoculation of blood culture bottles is superior to delayed laboratory inoculation of blood culture bottles in the detection of bacterial growth in spontaneous bacterial peritonitis. In 7 (24.1%) of 29 episodes of ascitic fluid infection, the delayed cultures were sterile whereas the bedside cultures grew pathogenic bacteria.

The median colony count in spontaneously infected ascites has been shown in another study to be only 1 organism per ml (4). With only a few organisms in the entire aliquot of fluid cultured, small variations in the processing of cultures might be expected to have an impact on the results. Blood culture bottles were originally designed to detect bacterial

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growth in the setting of low concentrations of bacteria. The nutrients and the phagocyte inhibitors in the media of these bottles nourish and protect the bacteria from further phagocyte-mediated death, such that if a single viable organism is inoculated into a bottle, it should theoretically grow to detectability. Presumably, in this study the attrition of the bacteria in the delayed cultures was due to continued phagocytosis by neutrophils in the transport syringe or due to the fragility of the organisms, e.g., pneumococci.

A 4-h delay in inoculation of the bottles in the laboratory was chosen arbitrarily in this study. Some laboratories process specimens much more rapidly than this. In other hospitals, longer delays take place. Further studies will determine whether shorter delays are less problematic in resulting in falsely negative cultures. However, until such studies are available, it must be assumed that any delay in culture risks loss of viable organisms and a falsely negative culture.

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