Inoculation of peritoneal dialysate fluid into blood culture bottles improves culture rates

B. L. RAYNER, D. S. WILLIAMS, S. OLIVER

Abstract **The aim of the study was to determine if direct inoculation of peritoneal fluid into Bactec blood culture bottles would improve the positive bacteriological yield compared with conventional techniques in continuous ambulatory peritoneal dialysis (CAPD) patients with peritonitis. All patients presenting with suspected peritonitis had peritoneal fluid injected directly into aerobic and anaerobic Bactec blood culture bottles as well as into sterile culture tubes. Thirty-seven paired samples were analysed. Twenty conventional cultures (54%) were positive compared with 33 (89%) done according to the Bactec system ($P < 0,002$). In only 1 case did the former technique prove superior. Direct inoculation of peritoneal fluid into Bactec blood culture bottles is therefore superior to conventional methods and has obvious therapeutic implications.**

S Afr Med J 1993; **83:** 42-43.

Peritonitis remains the single most important complication of continuous ambulatory peritoneal dialysis (CAPD) causing morbidity and mortality. Although prevention remains the ultimate goal, successful treatment of established peritonitis depends on the early administration of empirical antibiotics followed by definitive microbiological diagnosis and appropriate adjustment of therapy. A significant percentage of routine cultures are negative and antimicrobial treatment is largely empirical. In 1982 Luce *et al.*[1] showed that the incidence of culture-negative peritonitis could be reduced from 22% to 4% by inoculating blood culture bottles with infected dialysis fluid, but more recent reports have yielded conflicting results.[2-4] Runyon *et al.*[5] reported that the diagnosis of peritonitis in patients with cirrhosis and ascites could also be significantly improved by direct inoculation of ascitic fluid into blood culture bottles.

With this in mind it was decided to undertake a prospective study to determine whether direct inoculation of peritoneal fluid into Bactec blood culture bottles could improve positive microbiological culture rates in patients with suspected peritonitis.

Methods

All patients presenting to the CAPD unit over a 2-month period with suspected peritonitis, i.e. cloudy bags with or without abdominal pain, were included. Five millilitres of peritoneal dialysis fluid from each patient were inoculated into a sterile culture tube and an aerobic and anaerobic Bactec blood culture bottle. These were dispatched to the laboratory in the routine manner. The dialysis fluid in sterile culture tubes was spun down and the deposit used to smear for Gram staining and inoculate a cooked meat/trypticase soy broth as well as a 2% blood agar plate which had been incubated under CO_2. These media were kept for 48 hours before a final report was issued. The Bactec bottles were incubated on arrival and tested in the manner prescribed for blood cultures. A final report was only issued after 7 days. All results were recorded and compared, and analysed statistically using the χ^2-test.

Renal Unit, Groote Schuur Hospital and Departments of Microbiology and Medicine, University of Cape Town
B. L. RAYNER, M.B. CH.B., F.C.P. (S.A.), M.MED.
D. S. WILLIAMS, S.E.N.
S. OLIVER, M.B. CH.B., M.MED. PATH. (MICROBIOL.)

Accepted 11 Oct 1991.

Results

During this period 37 paired samples were analysed. There were 33 (89%) positive cultures using the Bactec system and 20 (54%) the conventional sterile tubes. This was a highly significant result ($P < 0,002$).

Further analysis of the results (Table I) showed that the most common Gram-positive organisms were *Staphylococcus aureus* and *S. epidermidis*. The main difference between the two methods was the lower positive culture of *S. aureus* using the tubes and their failure to culture *Streptococcus mitior* and diphtheroids. The Bactec system also yielded 2 *Pseudomonas* isolates that were not grown by the tube system. The tubes were superior on only one occasion. This occurred in a patient with a small colonic perforation, where 3 organisms were cultured by the tubes and only 1 by the Bactec system.

Discussion

This study demonstrated that microbiological culture rates are significantly improved ($P < 0,002$) using the Bactec blood culture media. This has important implications for the treatment of peritonitis. Isolation, identification and the antibiotic sensitivity of the infecting organism allow for more rational and effective treatment. In this study, for example, the greater recognition of *S. aureus* by the Bactec system and the failure of the tubes to culture *P. aeruginosa* have important therapeutic implications.

There are several possible explanations for the difference between the two techniques. In conventional sterile tubes bacteria may die *en route* given delays and continued endogenous antimicrobial activity of the ascitic fluid. With the Bactec system the dilution of the ascitic fluid immediately reduces this activity, and the medium

TABLE I.
Culture results

Organism	Bactec	Conventional
Gram-positive	26	16
S. aureus	16	12
S. epidermidis	4	3
S. mitior	2	0
Diphtheroids	2	0
Miscellaneous	2	1
Gram-negative	7	3
Klebsiella	2	2
Pseudomonas	2	0
Miscellaneous	3	1
Polymicrobial	0	1
Total	33	20

itself protects and nourishes the bacteria. Conventional cultures are usually kept for 48 hours but if there is a low inoculum of bacteria, keeping the cultures for 5 days can significantly improve positivity by allowing bacteria to multiply to reach detectability.[6] These observations also help explain the conflicting data previously reported in the literature. In the studies by Doyle *et al.*[2], Males *et al.*[3] and Ryan and Fessia[4] the whole bag was dispatched to the laboratory to be processed. The inevitable variability in the time taken for the specimens to reach the laboratory probably accounts for the conflicting results. Directly inoculating the peritoneal dialysis effluent into the blood culture bottles may overcome this problem.

In summary, direct inoculation of peritoneal fluid improves the positive culture rate in patients with suspected peritonitis and this has important therapeutic implications.

REFERENCES

1. Luce E, Nakagawa D, Lovell J, *et al.* Improvement in the bacteriological diagnosis of peritonitis with the use of blood culture media. *Trans Am Soc Artif Intern Organs* 1982; **28:** 259-261.
2. Doyle PW, Crichton EP, Mathias RG, Werb R. Clinical and microbiological evaluation of four culture methods for the diagnosis of peritonitis in patients on continuous ambulatory peritoneal dialysis. *J Clin Microbiol* 1989; **27:** 1206-1209.
3. Males BM, Walshe JJ, Garringer L, Koscinski D, Amsterdam D. Addi-Chek filtration, Bactec, and 10-ml culture methods for recovery of micro-organisms from dialysis effluent during episodes of peritonitis. *J Clin Microbiol* 1986; **23:** 350-353.
4. Ryan S, Fessia S. Improved method for recovery of peritonitis-causing micro-organisms from peritoneal dialysate. *J Clin Microbiol* 1987; **25:** 383-384.
5. Runyon BA, Umland ET, Merlin T. Inoculation of blood culture bottles with ascitic fluid. Improved detection of spontaneous bacterial peritonitis. *Arch Intern Med* 1987; **147:** 73-75.
6. Runyon BA. The importance of duration of observation of ascitic fluid culture in the detection of spontaneous bacterial peritonitis. *Gastroenterology* 1986; **90:** 510.