

Original article

## Comparison of classical methods versus BACTEC blood culture system for culture of normally sterile body fluids

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**Abstract:** *Background* — Presence of microorganisms in sterile body sites leads to life-threatening infections. For early and accurate diagnosis of those infections, cultures of the sterile fluids have to be done. These cultures can not always detect the causative agents due to insufficient number or fastidious growing of the probable microorganisms in the material.

*Objectives* — In this study, it was aimed to compare sterile body fluid cultures which had been processed with both conventional culture methods and BACTEC automatized blood culture system retrospectively.

*Material and Methods* — A total of 138 body fluid cultures were compared retrospectively from the laboratory records.

*Results* — Amongst the specimens, 122 cultures were negative. Nine of the rest 16 specimens were positive with both culture methods and seven cultures were positive with BACTEC only. None of the specimens which were negative in BACTEC system revealed positive with the conventional method. BACTEC detected significantly higher number of positivity ( $P < 0.001$ ). No significant difference was found between the methods due to contamination ( $P = 0.183$ ).

*Conclusion* — In conclusion, our study shows that inoculation of the sterile body fluid specimens into blood culture bottles and incubation of them in BACTEC system as well as culturing with conventional methods increase the detection rate of probable causative agents.

**Keywords:** sterile body fluids, BACTEC, blood culture bottle, cerebro spinal fluids

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### Introduction

Presence of microorganisms in normally sterile body sites causes life-threatening infections [1, 2]. For early and accurate diagnosis of those infections, sterile body fluids such as cerebro spinal fluids (CSF), peritoneal fluids, pleural fluids and snovial fluids are supposed to be cultured [1, 2]. Sterile body fluid cultures are not always capable of detecting the causative agent of infection due to the fastidious or probable insufficient number of microorganisms in the specimen [1, 2]. It is reported that inoculation of sterile body fluids into the blood culture bottles simultaneous with conventional culture methods and processing them in the automatized blood culture systems are useful in detecting the probable causative microorganisms [1, 2].

In this study, we aimed to compare the culture results of sterile body fluids processed simultaneously by both of conventional method and BACTEC blood culture system within the last one and a half year in microbiology laboratory retrospectively.

### Material and Methods

#### *Specimens*

A total of 138 normally sterile body fluid specimens obtained from patients of various clinics of Abant İzzet Baysal University Health Research and Practice Hospital between March 2011 and June 2012 which were processed with both conventional methods and BACTEC automatized blood culture system (BD, USA) were compared retrospectively.

#### *Culture methods*

The specimens were inoculated onto blood agar, EMB and chocolate agar mediums and incubated in 37°C and simultaneously 1-3 ml of the specimens were inoculated into the blood culture bottles and incubated in BACTEC automatized blood culture system. The results of the culture methods, the species of the growing microorganisms, the presence of bacterial morphologies or leukocytes observed in the microscopic examination were retrospectively evaluated from the laboratory records. In the study, coagulase-negative staphylococci and diptheroids were considered “probable skin contaminants” in cases of absence of leukocytes in microscopy.

**Table 1. Distribution of specimens according to culture methods**

Specimen	Classic (+) BACTEC (-)	Classic (-) BACTEC (-)	Classic (+) BACTEC (-)	Classic (-) BACTEC (-)	Total
Cerebro spinal fluid	0	6	7	70	83
Pleural fluid	0	1	1	26	28
Snovial fluid	0	0	0	19	19
Peritoneal fluid	0	0	1	7	8
Total	0	7	9	122	138

**Table 2. Comparison of culture results according to the methods**

	BACTEC system		Total	P
	Positive	Negative		
Classical method	9	0	9	<0.001
	7	122	129	
Total	16	122	138	

**Table 3. Distribution of microorganisms revealed by culture methods**

Microorganism	Growth in classical method	Growth in BACTEC system
CNS*	5	10
Staphylococcus aureus	2	2
Diphtheroids	1	2
Enterococcus spp.	1	1
Pseudomonas aeruginosa	0	1
Total	9	16

CNS, coagulase-negative staphylococci.

### Statistical analysis

Statistical analysis was performed using SPSS (Version 15.0) software. Descriptive statistics are expressed as numbers and percentages. Differences between groups and correlations between the variables according to categorical variables are analysed with Chi Square Test and Fisher's Exact Tests. Differences between dependent groups are analysed with McNemar Chi Square Test. The results are evaluated within 95% confidence interval and a P value of <0.005 is accepted as significant.

### Results

Amongst the 138 specimens processed, 83 were CSFs, 28 were pleural fluids, 19 were snovial fluids and 8 were peritoneal fluids. None of the snovial fluid cultures revealed positive (Table 1). No growth was detected in 122 specimens. Nine of the rest 16 specimens revealed positive in both culture methods. In seven specimens, conventional method showed no growth but BACTEC system revealed positive. None of the specimens which resulted negative in BACTEC system revealed positive in the classical method. BACTEC blood culture system revealed significantly more positive cultures in comparison to the conventional method (P<0.001) (Table 2). The distribution of the microorganisms according to the culture methods is shown in Table 3.

No leukocytes were observed in the microscopic examination of the specimens which revealed coagulase-negative staphylococci (CNS) or diptheroids. When those culture results are evaluated as "probable skin contamination", six of nine specimens which had positive results in the conventional method and 12 of 16 specimens which revealed positive results with BACTEC system were considered contaminants. But according to this evaluation, no significant difference was found between the methods in respect to revealing contaminant microorganisms (P=0.183) (Table 4).

### Discussion

Presence of microorganisms in normally sterile body sites is a marker of severe infection in general [3, 4]. In those sites fastidious microorganisms are common causative agents [4, 5]. The conventional culture methods can not frequently detect the causative agents because of either the insufficient amount of CSF and snovial fluids or presence of little amount of microorganisms in respect to the total specimen volume in peritoneal fluids [1, 3, 5]. In those infections, the false-negativity of the cultures may lead to life-threatening results for the patients [2, 6].

In our study, BACTEC system detected more positivity than the conventional method (P<0.001). The sensitivity of blood culture systems is reported to be higher in previous studies [1, 3, 4, 6-11]. This is because the blood culture systems can support the increasing the amount of low number of microorganisms present in the specimen [11]. Blood culture bottles are designed to obtain the optimal conditions for particularly low bacteria including specimens with either the feeding materials and medium or the naturalizing the probable present antimicrobials in the specimen which may be taken by the patient [1, 11].

Akcam et al. [5] reported that fastidious causative agents are isolated only by BACTEC blood culture system. That may be because the classical methods can miss the fastidious agents or are effected easily with the probable present antimicrobials which can inhibit the microbial growth [5, 11].

Our study shows that culturing of normally sterile body fluids with both the conventional method and BACTEC blood culture system simultaneously is an effective way to detect the probable present microorganism in the specimen. It is stated that this finding may be explained with

- i) more amount of the material is incubated into the blood culture bottle in comparison to the classical method,
- ii) blood culture bottles which are enriched special mediums can support the growing of microorganism in low amounts,
- iii) the increasing chance of isolation of fastidious microorganisms with longer incubation period with blood culture systems and
- iv) the presence of naturalizing elements in blood culture bottles can prevent the inhibitory effect of antimicrobials probably used by the patient [1, 2, 5].

For snovial fluids, Sesli Cetin et al. [8] detected in eight of 55 and Akcam et al. [5] detected in 10 of 66 specimens with blood culture systems, besides Kuzucu et al. [4] reported no detection in five snovial fluids. In our study, none of the snovial fluid specimens revealed positive. So we can not comment about the usefulness of blood culture systems for snovial specimens, we consider that a large number of snovial fluid specimens is needed to be processed to make the comparison.

**Table 4. Comparison between methods according to considering the microorganism as significant/contaminant**

		BACTEC			Total	P**
		Significant microorganisms	Probable contaminants*	No growth		
Classical method	Significant microorganisms	3	0	0	3	0.183
	Probable contaminants	0	6	0	6	
	No growth	1	6	122	129	
	Total	4	12	122	138	

\*CNS and diptheroids are classified as probable contaminants. \*\*P value is calculated with converting of data to 2x2 table.

Simor et al. [6] and von Essen et. al. [12] reported that blood culture systems significantly increased the isolation rate of contaminants. But in our study, no significant difference was found between the methods according to growing of probable skin contaminants. Our study showed that inoculation of the sterile body fluids into blood culture bottles didn't lead to false-evaluation of the culture results. Besides, we think that false-positivity or false-negativity of the culture results of normally sterile body fluids are need to be evaluated together and compared with each other to decide which is more useful or harmful for the patient's life.

### Conclusion

As a conclusion, data of our study show that incubation of normally sterile body fluids in blood culture system simultaneously with conventional method can increase the isolation rate significantly and it is useful to evaluate the culture result with the presence of leukocytes in microscopic examination.

### Conflict of interest

We declare that we have no conflict of interest.

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