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DETECTION OF BACTEREMIA IN PEDIATRIC PATIENTS IN A TERTIARY CARE TEACHING HOSPITAL OF RURAL UTTAR PRADESH

Microbiology

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ABSTRACT

Bacteriaemia is associated with high rate of mortality and morbidity in pediatric patients. In this one – year study, 30.70% blood samples showed culture- positivity. Staphylococcus aureus was the most frequently isolated organism, i.e., 31.08%. Automated blood culture system showed slightly better result in terms of culture positivity and time of detection. BACTEC system can be used as a supplementary test along with conventional blood culture method.

KEYWORDS

Bacteriaemia, Blood culture, Conventional, BACTEC

INTRODUCTION:

Blood – stream infection is one of the major causes of mortality and morbidity in hospitalized pediatric patients. Immune defense mechanism is not fully developed in neonates and very young children. Therefore, detection of bacteremia, without further delay is essential, especially in pediatric patients.[1] Timely detection of etiopathological agent and initiation of its treatment saves many untoward effects. According to some researchers, 90% negative of all blood culture report is also important as it rules out bacteremia or fungemia in a patient.[2]

AIMS & OBJECTIVES:

This project was undertaken to identify the causative organisms in indoor pediatric patients with bacteriaemia and septicemia, in a tertiary care rural hospital of central Uttar Pradesh. With geographical variation and different time period, the pattern of isolated organisms changes in a health care setting. In this study, we intended to isolate and identify the etiological agent from indoor pediatric cases of bacteremia. This study also compared the utility of automated blood culture system over the conventional blood culture system if any.

MATERIALS & METHODS:

This prospective, cross – sectional study was done in the microbiology department of the same institute. The study got approval from institutional ethical committee. Study period was one year and study population was 241, under age group of fourteen years. Blood samples of indoor pediatric patients were processed in the microbiology laboratory of the same hospital. Important information of patients, like, age, sex, hospital stay, clinical diagnosis, antibiotic use and day & time of blood collection were noted down.

To improve the detection of bacteriaemia in terms of quality and time, we combined BACTEC system to conventional blood culture after consent of the patient. No additional charge was imposed on patients for automated blood culture system. Blood samples from the patients for both the culture methods were taken at the same time. For conventional blood culture method, blood samples (0.5-5 ml) were collected in blood culture bottle containing 20 ml of brain heart infusion broth and processed in the microbiology laboratory as per standard protocol. [3] All the media, biochemicals and antibiotic disc for this work were obtained from Hi Media Pvt Ltd, India.

For this study, BD BACTEC Ped Plus TM/F culture vials (having soybean – casein digest broth with resin) were used. These vials were obtained from Becton, Dickinson Company. The inoculated vials were placed in the BD BACTEC 9050 fluorescent series instrument for incubation and monitoring following manufacturers instructions (Paisley JW et al., 1994).[4] The instrument was procured from Becton, Dickinson Company. By BACTEC machine, one cannot identify the causative microorganism in blood. Therefore, subculture was done from the positive culture vial on MacConkey's and blood agar media and the isolates were identified as per standard protocols. [3]

RESULTS:

In one year time period, we processed 241 blood samples received for blood culture in the microbiology laboratory. Out of 241 samples, 162 (67.21%) showed no growth and 74 (30.70%) samples showed culture positivity. Out of total 74 culture positive samples, maximum number of isolates was *Staphylococus aureus (S. aureus*) 23(31.08%), followed by *Coagulase negative Staphylococci (CONS)*, 18(24.32%), *Streptococcus faecalis (S.faecalis),* 7(9.45%), *Acinetobacter spp*. 5(6.75%), *Klebsiella pneumoniae (K. pneumoniae)* 5(6.75%), *Escherichia coli (E.coli)*, 3(4.05%) and *Citrobacter freundi* 2(2.70%) in descending order. In 16(21.62%) samples, there was growth of *Candida* spp.

Out of total 74 culture positive samples, 70 (94.59%) showed same growth of organisms in same patient, both in conventional and BACTEC blood culture method & 4 (5.40%) culture positive samples showed growth by BACTEC system only.

Table 1: Distribution of bacterial isolates in culture positive blood samples from indoor pediatric patients. [n (total number of culture positive samples] =74)

Bacterial isolates	Total number	Percentage
S.aureus	23	31.08
CONS	18	24.32
S.faecalis	7	9.45
Acinetobacter spp.	5	6.75
K. Pneumoniae	5	6.75
E.coli	3	4.05
C.freundii	2	2.70

*In 16 (21.62%) samples, we isolated Candida spp.

Table 2: Comparison of conventional and BACTEC blood culture system, in terms of culture positivity, culture negativity, time of detection of culture positivity, growth with empirical antibiotic therapy and without empirical antibiotic therapy. (n=total number of samples)

Various Criteria (n=total numbers)	Conventional blood culture method	BACTEC blood culture method
Culture positive (n=241)	70(29.04%)	74(30.70%)
Culture negative (n=241)	171(70.95%)	167(69.29%)
Time of detection of growth (average) (n=74)	24 hours	18 hours
Growth without empirical antibiotic therapy (n=74)	65(87.83%)	65(87.83%)
Growth with empirical antibiotic therapy (n=74)	5(6.75%)	9(12.16%)

By conventional method, 70 (29.04%) out of total 241 samples were culture positive and average time of detection of growth was 24 hours. 65 (87.83%) culture positive cases were without empirical antibiotic therapy, where as, only 5(6.75%) cases were with empirical antibiotic therapy.

By BACTEC blood culture system, 74(30.70%) out of 241 blood samples were culture positive and average growth - detection time was 18 hours. Growth without empirical antibiotic therapy was 65(87.83%) and without empirical therapy, 9(12.16%).

DISCUSSION:

Conventional Blood culture method for suspected cases of bacteriaemia and septicaemias allows the identification and sensitivity of causative microorganisms. Therefore, it is still considered as a "gold standard" for diagnosis of sepsis. But for "culture negative" or "difficult to grow" organisms and for rapid identification, automated blood culture system and molecular techniques are useful. [5]

We collected 0.5-5 ml blood samples from the pediatric patients for processing. Usually 1-2 ml blood was collected from neonates. According to some researchers, bacteriaemia could not be detected when <1 ml blood was collected.[6,7] Some found that BACTEC vial with higher volume of blood showed higher positivity[1,8] whereas, others observed that recovery rate of microbes decreased with >10 ml of blood sample. This might be due to the improper dilution of blood samples. The recommended dilution of blood samples is 1:10 to dilute effects of the inhibitory substances present in blood. [8]

In our study, 74 (30.70%) samples showed culture positivity. According to Oren Z et al, 2006; 90% of all blood culture reports were negative.[9,10] In a hospital set up, even a negative blood culture was also important as it ruled out bacteriaemia or fungemia in a patient. [2,5,11]

We isolated *S.aureus* in maximum number, 23 (31.08%) from blood samples followed by *CONS, S.faecalis, Acinetobacter spp, K.pneumoniae, E.coli and C.freundii*. Some researchers also reported rising incidence of blood-stream infection in a health-care setting, with *S.aureus and CONS.* [12]

We included automated blood culture system along with conventional method of blood culture in our study. Others also used both the systems to improve the detection of bacteremia in terms of quality and time. [2,13,14]

Timely detection of aetiopathogenic agents and initiation of its treatment saves many untoward outcomes in recovery. [2]

We observed that BACTEC system had higher recovery rate of causative organisms 74(30.70%) than conventional method 70(29.04%). Time of recovery was 18 hours on an average and culture positivity with empirical antibiotic therapy was 9(12.16%). Whereas, in conventional method, Time of recovery was 24 hours and culture positivity with empirical antibiotic therapy was 5(6.75%). Because of automation, BACTEC was less labour intensive. In BACTEC system, pediatric vials are specially designed to accommodate smaller volume of blood and often-additional growth factors are incorporated to it. Besides, addition of resins in blood culture bottle absorbs inhibitory substances, including antibiotics from blood samples. Reports from other workers were also in accordance with this study.[14,15]

We isolated 16 *Candida* spp, but did not include fungal or viral causes in blood infection in this study. Mark I.N et al, 2017 also reported that one of the major cause of limited isolation rate of aetiopathogenic organism, are their fungal or viral origin.[16]

CONCLUSION:

Blood culture is the main investigation to detect bacteriaemia and even negative culture is also useful to decide further treatment of the patient. With good sample collection and processing practice in laboratory, the validity of conventional blood culture method is quite high. It is cost effective and useful in small laboratories but more time consuming and labour intensive. On the other hand, in BACTEC system, there are higher recovery rate of etiological organisms. Because of automation, it is less time consuming and less labour intensive. Disadvantages of automations are, high implementation cost, maintenance of instruments and availability of constant power supply. BACTEC system can be combined as a complementary system to conventional blood culture method to improve quality and time of detection.

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