Study of Bloodstream Infections in Paediatric Patients by using Automated Systems

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ABSTRACT

Introduction: Bloodstream infections in paediatric patients is one of the important cause of morbidity and mortality. Blood culture technique is the gold standard for the diagnosis of such infections. Early diagnosis and appropriate treatment is essential to reduce mortality rate. Multidrug resistant bacterial strains are very difficult to treat. Present study was undertaken to identify the bacteria associated with bloodstream infections and detect their antibiotic sensitivity pattern.

Material and Methods: Blood cultures from 94 paediatric patients were screened for bloodstream infections by automated systems BacT/Alert and the positive blood culture bottles were subcultured and were run on Vitek II for antibiotic sensitivity with their MIC and ESBL, MRSA was noted.

Results: out of 94 bloodstream infection suspected cases, 24 (24.5%) were culture positive, 41% isolates were gram negative bacilli, 37% isolates were CONS, 12.5% isolates were coagulase positive *staphylococci*. 30% strains were ESBL producers, 33% were MRS (CONS), 22% were MRSA.

Conclusion: Proper diagnosis of bloodstream infections in paediatric patients is life saving. Using automated systems like BacT/Alert and Vitek II reduces the time for diagnosis and appropriate treatment of bloodstream infections

Keywords: Automation, Blood Culture, Bloodstream Infections, BacT/Alert, Vitek II

INTRODUCTION

Bloodstream infection is one of the common causes of morbidity and mortality in paediatric patients. Various organisms are associated with bloodstream infections such as *E.coli*, *Coagulase negative Staphylococci, Haemophilus influenza, Listeria monocytogen, Pseudomonas spp, Acinetobacter spp* etc.

In neonates the risk factors for septicaemia may be due to premature rupture of membrane, prolong labour, premature birth, low birth weight, congenital anomalies, urinary tract infection of the mother.[1] The signs of blood stream infections include bradycardia, high grad fever, vomiting, diarrhoea and jaundice. Serious complications such as shock, multiorgan failure, disseminated intravascular coagulation and death.[1]

Early diagnosis is essential and the gold standard for detection of bloodstream infections is isolation of bacterial agents by blood culture.[2] Automated systems like BacTech, Vitek etc are useful for correct and faster detection of bacteria causing bloodstream infections and also help for management of such infections. Antibiotic sensitivity testing with MIC of the antibiotics plays a significant role in treatment of multidrug resistant bacterial strains.

Present study was undertaken to identify the bacteria associated with bloodstream infections in paediatric patients and to study the antibiotic resistance in those pathogens.

MATERIAL AND METHODS

The study was conducted between April 2015 to March 2016 in Microbiology Clinical Laboratory, Department of Microbiology Dr. D.Y. Patil Hospital and Research Centre, Kolhapur, Maharashtra. The samples were collected from paediatric ward, PICU and NICU patients of suspected blood stream infections.

Ethical clearance: Not needed because we received blood culture samples directly from NICU and Paediatric wards.

Sample size: All blood culture samples received between April 2015 to March 2016 were taken up for the study.

We included blood cultures from paediatric age gr (neonates to 15 years), other blood cultures were excluded from study.

Blood samples were collected under strict aseptic precautions and 3-4 ml blood was inoculated in 30 ml BacTech blood culture bottles. These bottles were incubated in BacT/Alert automated system. The bottles which showed growth were removed and subculturs were done on Blood agar and MacConkey's agar (primary isolation)[3], smear from the colony was prepared and stained with Gram stain to identify gram positive or gram negative bacteria. Then colonies were run on VITEK II automated system for identification of organism and Antibiotic Sensitivity with their Minimum Inhibitory Concentration (MIC) as per CLSI[4] and detection of Extended Spectrum Beta Lactamases (ESBL) in GNB, Methicillin Resistant Staphylococcci (MRS), Methicillin Resistant *Staphylococcus aureus* (MRSA) in GPC. After seven days of incubation with no growth in BacTec bottle, negative report was given.

STATISTICAL ANALYSIS

Microsoft office 2007 was used for the statistical analysis. Descriptive statistics like mean and percentages were used for data analysis.

RESULTS

In the present study out of 94 paediatric blood culture samples screened for bloodstream infections, there were 24 (24.5%) blood culture were positive.

Out of the se 24 positive blood cultures 10 isolates were Gram Negative Bacilli (GNB), 9 were Coagulae Negative *Staphylococci* (CONS), 3 were Coagulase positive *Staphylococci*, 2 were budding yeast as shown in table 1. The frequency of isolation of

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organisms	No and percentage
GNB	10 (41%)
CONS	9 (37%)
Coag +ve Staph	3 (12.5%)
Budding yeast	2 (8.3%)

Table-1: Isolation of organisms from blood culture

GNB	No and percentage
Salmonella typhi	5 (50%)
Escherichia coli	3 (30%)
Acinetobacter baumanni	1 (10%)
Serratia marcescence	1 (10%)

Table-2: Distribution of GNB

CONS spp	No and percentage
Staphylococcus hemolyticus	5 (55%)
Staphylococcus hominis	3 (33%)
Staphylococcus gallinarium	1 (11%)

Table-3: Distribution of CONS

GNB and GPC is shown in Table 2 and 3

Antibiogram of GNB were 100% sensitive to Imepenem, Meropenem, Tobramycin, Tegecyclin and 90% sensitivity to Amikacin, Ampicillin-Sulbactum, Piperacillin-Tzobactum, Gentamicin etc. *Acinetobacter baumanii and Serratia marcescence* showed sensitivity to all antibiotics. In GNB 2 strains of *E.coli* and 1 strain of *S.typhi* were ESBL producers (30%). Antibiogram of GPC: (*CONS and S.aureus*): 100% sensitivity to Linezolid and Teicoplanin, 90% sensitivity to Amikacin, Gentamicin, piperacillin-Tazobactum. In GPC one strain was MRSA(22%), two strains were MRS (33%)

DISCUSSION

Blood stream infections are common cause of neonatal death in developing countries. Proper isolation of causative agents and their antibiotic susceptibility is essential.

In present study total no of 94 paediatric blood samples were studied during one year of span and septicaemia was detected in 25.5% of patients, Bhat et al reported (47%)[1], Chandra Madhur et al reported (37%)[5], Bhattachacharya et al reported (32%)[6] in their study. *Salmonella typhi* strains were isolated from PICU patients age group between 2-15 years. Other organisms were isolated from neonates. In present study 41% isolates were GNB and 37% were CONS, 12% were *Staphylococcus aureus*. Higher incidence of neonatal sepsis was reported Baby et al reported (78%) in GPC and 20 % in GNB their study[7], Lee CY et al reported 30% in GPC and 56% in GNB in their study[8], Shukla et al reported 69% GNB and 30.23% CONS in their study[9]

In the present study 2 (8.3%) were candida spp, 3 (1.3%) isolates were reported by Baby et al[7] in their study, Shukla et al reported 2% in their studies.[9]

In our study 30% strains of GNB isolates were ESBL producers. Bhat et al reported 35% ESBL producers in their study[1], Lee C Y et al reported 20% ESBL producers in their study.[8] In our study staphylococcal isolates 33% were MRS (CONS) and 22% were MRSA. Baby et al reported 14% MRSA in their study[7] Bhat et al reported 23.07% MRSA.[1] In our study we used automated systems as they are more sensitive than conventional methods.

In the present study antibiotic pattern of GNB showed 100% sensitivity to Imepenem and Meropenem similar findings were reported by Chandra Madhur et al[5]

Interpretation of positive results of blood culture mainly depends on clinical presentation, time of collection of blood for culture, time taken for the growth in blood culture bottle, the organism grown in culture. Some organisms like candida spp are nearly always significant.[10]

CONCLUSION

Proper diagnosis of blood stream infections in paediatric patients is life saving. The antibiotic resistance is increasing day by day which leads to treatment failure and mortality in patients. Using automated systems like BacT/Alert and VITEK II reduces the time for diagnosis and appropriate treatment is life saving in blood stream infections.

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