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Research Article

EVALUATION OF BLOOD CULTURES AND ANTIBIOTIC SENSITIVITY PATTERN IN A PEDIATRIC INTENSIVE CARE UNIT

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A B S T R A C T

Background: Blood stream infections are the leading cause of sepsis among the pediatric intensive care unit patients leading to morbidity and mortality. The increase use of antimicrobials result in prevalence of of multidrug resistant organisms.
Material and Methods: This retrospective study was conducted on the patients admitted to pediatric intensive care unit over a period of 12 months (February 2018 to January 2019). Data regarding gender, geographical distribution, blood culture results and antibiotic sensitivity patterns was collected.
Results: Out of total samples obtained, 10.2% were culture positive and 89.8% showed no growth. On further analysis of these isolates, gram positive bacteremia rate was found much higher as compared to gram negative infections.
Conclusions: Because of the changing antimicrobial susceptibility patterns, aggressive measures should be taken to prevent bacteremia like routine screening of cultures to know the trend of prevalent microorganisms to initiate appropriate antibiotics.

INTRODUCTION

Patients admitted to ICU's carry higher risk of nosocomial infections compared to those admitted to other general wards of the hospital.[1]Nosocomial infections once occur, delay patient's recovery. Blood stream infections are the leading cause of sepsis among the patients admitted to pediatricintensive care unit, contributing as a major cause of morbidity and mortality.[2]

To rule out sepsis, blood cultures are mandatory because they are an important diagnostic tool for detecting bacteremia. Though, positive culture results are seen only in 50% of the samples, still this a vital step.[3] The chances of getting a false negative result can even increase in the patients who are already on antibiotic therapy.[4]

Most common cause of multidrug resistant organisms is the increased usage of antimicrobials in turn resulting in emergence of multidrug resistant mutants.[5] Knowing the prevalent causative organisms in a given region can help in guiding the initial appropriate antibiotic therapy. Use of various antibiotics in different ICU's can lead to variation in prevalence of causative pathogens and their antimicrobial sensitivity patterns.[5]So, early identification of the responsible organism and its antibiotic sensitivity pattern is beneficial in choosing the correct antimicrobials and improving treatment outcome of the patients.[5,6]

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Although, a pathogen retrieval from the blood culture acts as a negative predictor, still its isolation helps in deciding the appropriate antibiotic treatment, which will further helps in reducing the morbidity and mortality.[7]

Aim of our study, was to evaluate the prevalence of most common microorganism responsible for bacteremia in pediatric intensive care unit in a tertiary care centre and also to know its antibiotic sensitivity pattern so as to guide the primary appropriate usage of antibiotic therapy by the healthcare providers.

MATERIAL AND METHODS

This retrospective study was conducted on the patients admitted to pediatric intensive care unit in a tertiary care hospital over a period of 12 months (February 2018 to January 2019).Referral cases from other hospitals, positive blood culture at the time of admission and those children who died or discharged within 48 hours of PICU admission were excluded from the study. Data regarding gender, geographical distribution, blood culture results and antibiotic sensitivity patterns was collected from the hospital records.

Sample Collection and Processing

2-5 mL of blood sample as per age,was collected from the patients and inoculated immediately into BacT/ALERT culture bottles in sterile conditions. These samples were further processed according to the manufacturer's specifications.Vitek

2 was used to identify organisms and CLSI guidelines were used to interpret antimicrobial susceptibility testing (AST).

RESULTS

During the study period, retrospective data from 342 patients admitted to pediatric intensive care unit in a tertiary care hospital was collected over a time span of 12 months. Demographic data of the enrolled pediatric patients are given in (Table 1).

Out of the total, 62% were males and 38% were female pediatric patients. Among 342pediatric patients, age wise distribution of cases showed, maximum number of septicemic patients in age group less than 5 years (56.9%), 31.1% from 5-10 years and 11.9% falls in age group of above 10 years. Furthermore, majority of the patients were from rural areas (63.6%), as compared to 36.4% from urban distribution. (Table1) Out of total samples obtained from PICU admitted patients, 10.2% were positive for microorganism growth in culture and 89.8% showed negative results after 72 hours of incubation period. (Table 1)

Table 1

Variables	Percentages (%)
Gender	
Male	62
Female	38
Age Group (years)	
<5y	56.9
5-10y	31.1
10-14y	11.9
Geographical Distribution	
Rural	63.6
Urban	36.4
Blood culture results	
Positive	10.2
Negative	89.8

On further analysis of these isolates, it was found that gram positive bacteremia rate was much higher as compared to gram negative bacteriasand fungal isolates. Among the gram positive cocci, staph hominis was the most common bacteria isolated from the blood cultures followed by staph epidermidis and staph aureus.E coli wasmost prevalent amongst the gram negative bacilli followed by Klebsiellaand acinetobacterspecies respectively. In the study time frame, only one case each of candida albicans and candida tropicalis was observed. (Table 2)

Table 2 (Organisms Isolated)

ORGANISM	Percentages (%)
Staphylococcus aureus	14.28
Staphylococcus epidermidis	11.42
Staphylococcus hominis	22.84
Candida albicans	2.85
Staphylococcus haemolyticus	11.42
Candida tropicalis	2.85
Burkholderia	2.85
pseudomonas	2.85
Klebsiellapneumonae	5.7
Escherichia coli	11.42
Salmonella typhi	2.85
Staph warneeri	2.85
acinetobacter	5.7
total	100

In our study, staphylococcus hominis was most sensitive to vancomycin, nitrofurantoin, gentamicin and tigecycline. E. coli showed more sensitivity towards piperacillin-tazobactum, nitrofurantoin, ertapenem, meropenem and clavulanic acid whereas the fungal isolates were sensitive for almost all the antifungals viz. fluconazole, voriconazole, amphotericin B and caspofungin. (Table 3)

DISCUSSION

Hospital acquiredinfections(HAI) and antibiotic resistance are the major limiting steps in the management of patients admitted in the ICU's, as they increase the length of hospitalization. HAI also poses burden on the family members both in terms of expense andoutcome of the patients.[8]

The risk of getting nosocomial infections is influenced by several factors like length of hospital stay, greater number of interventions, invasive procedures under septic conditions and inappropriate and excessive usage of antimicrobials.[9]Patients admitted to intensive care units are at greater risk of acquiring hospital acquired infections as compared to patients admitted to other areas, because of the fact that, these patients are generally expose to much number of reservoirs and microorganism sources.[10]Other factors like malnourished patients , referral from other centres and multi systemic involvement at the time of presentation also contributes to signicant amount of bacteremia.[11]

Causative microorganisms responsible for blood stream infections were detected in only 10.2% cases in our study. Whereas, higher percentage of hospital acquired infections in pediatric ICU's were observed by Tauhid *et al.*[12]Our study showed that, gram positive cocci infections (e.g. staphylococcushominis and staphylococcusepidermidis) were most common compared to gram negative bacilli and fungal growths. Studies by Mukherjee *et al.*(61%) and Japoni *et al.*(67.7%) also observed that coagulase negative staphylococcus was the the commonest blood stream isolate[13,14]These infections are preventatable when appropriate measures are taken. Hence, there should be fixed protocols or guidelines for control measures and initiating appropriate antimicrobial therapy will help in preventing cross infectionof multidrug-resistant organisms from patient-to-patientand also from ICU staff.

CoNS isolates are often present on the surface, therefore, known as skincolonizers and commonly appears in blood culture as contaminants when sample collection was not done under aseptic techniques.[15]So preparations like skin disinfection before withdrawing the samples, can limit the sample contamination rates. [16]Escherichia coli, Klebsiella pneumonia, Acinetobacter and Pseudomonas areuginosa were the common gram negative inoculated pathogens. In other study from developing countries, Klebsiellaspp., were found to be the leading causes of neonatal NI.[17]

In our study, staphylococcus hominis was most sensitive to vancomycin, nitrofurantoin, gentamicin and tigecycline. E. coli showed more sensitivity towards piperacillin-tazobactum, nitrofurantoin, ertapenem, meropenem and clavulanic acid whereas the fungal isolates were sensitive for almost all the antifungals viz. fluconazole, voriconazole, amphotericin B and caspofungin. Although, there is no direct relationship between the number of antibiotics used and the pattern of development of resistance, still data from various studies document that the inappropriate and excessive usage of antimicrobial therapy has led to the formation of multidrug resistant microorganisms.[18,19]

Table 3 (Blood Culture and Sensitivity Of Organisms)

Drugs	Staph aureus (%)	Staph epidermidis (%)	Acinetobacter (%)	Klebsiellapneumonae (%)	E.Coli (%)	Staph haemolyticus (%)	Staph Hominis(%)
Ampicillin					25		
Ciprofloxacin					25	20	37.5
Gentamicin	100	50				20	87.5
Tetracycline	50						
Piperacillin-tazobactam			50		100		
Cotrimoxazole	25	75	50			20	25
erythromycin	50					80	50
trimethoprim		50				20	50
Linezolid	100	25				40	37.5
Meropenem			50				
Colistin			100	100			12.5
Tigecycline	75	100	100	100	50	80	100
Ticarcillin	25						
Polymyxin B			100	100	25		
Daptomycin	100	100				60	75
Teicoplanin	100	100				40	75
Vancomycin	100	100				60	100
Nitrofurantoin	100	75		50	100	80	100
Rifampicin	100	100					75
Levofloxacin						40	37.5
Clindamycin	75	25	100	50		20	50
ertapenem					100		
imipenam					50		
meropenam					75		
amikacin	25			50	50		
Clavulinic acid					75		

In conclusion, gram positive isolates followed by gram negative bacilli were responsible for large number of cases of nosocomial infections in a pediatric intensive care unit. Because of the changing antimicrobial sensitivity and susceptibility patterns, more aggressive measures to prevent and control the bacteremia should be taken into consideration like routine screening of cultures to know the trend of prevalent microorganisms and appropriate measures should be instituted accordingly. Further, de-escalation of the high-end antibiotics therapy after confirming the sensitivitypattern helps in reducing the antimicrobial pressure.

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