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Bacteriological Profile and Antibiogram of Blood Culture Isolates From a Tertiary Care Hospital

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Abstract

Bacterial bloodstream infections are a major public health problem, which lead to high morbidity and mortality of patients. Timely diagnosis and appropriate treatment will help reduce morbidity and mortality. A cross sectional study was conducted where 850 blood culture samples were received in the Microbiology laboratory. Bacteriological identification and antimicrobial susceptibility testing were performed for all bacterial isolates adhering to the standard protocol. Culture positivity was seen in 12.35% of the septicemic cases.

Most common bacterial isolates were Coagulase *negative Staphylococcus* 46.66% followed by *Pseudomonas aeruginosa* 11.42%, *Klebsiella species* 11.42%, *Escherichia coli* 9.52%, *Staphylococcus aureus* 8.57%, *Citrobacter species* 6.66%, *Enterococcus species* 2.85% and *Acinetobacter species* 2.85%.

Routine surveillance of baseline resistance, formulation of hospital antibiotic policy and compliance with existing guidelines will go long way in reducing multi drug resistance among pathogens.

Introduction

Blood stream infection (BSI) present a serious challenge to the clinicians as a major cause of death in the paediatric patients.[1-2] Microbial invasion of blood stream can have serious consequences including shock, multiple organ failure, DIC and death. Thus frequently requiring admissions in ICU for appropriate management.[3] Blood stream infections range from self –limiting infections to life threatening sepsis that requires rapid and aggressive antimicrobial treatment.[4] Bloodstream infections are a majore cause of morbidity and mortality worldwide. Approximately 2 lakh cases of bacteremia occur annually with mortality rates ranging from 20-50% worldwide.[5] Whereas rate of blood stream infections in children ranges between 20-25% in developing countries.[6] Blood culture remain the gold standard for laboratory diagnosis of bloodstream infections in infants and chlidrens.[7-8]

Although both Gram positive and Gram negative bacteria are associated with these infections, Gram negative infections are more fatal and cause more serious therapeutic problems as multi drug resistant

strains are more common among them.[9-10] It is therefore necessary to document result obtained from analysis of blood culture for preparing the antibiotic policy for effective management of septicaemia. Timely administration of drugs in patient with septicemia drastically reduces mortality rate.[11]

Thus, regular surveillance of blood stream etiology is important in monitoring the spectrum of bacterial pathogens and their sensitivity pattern in a particular area. Such data is not necessary for the clinicians to be aware of the emerging resistant strains of pathogens that are a threat to the community but also provide platform to initiate effective empirical therapy.[12] Awareness of the baseline microbial resistance specific to a hospital prevents irrational use of antibiotics in that hospital, thus helping us to progress a step forward in the prevention of spread of antibiotic resistance.

The aim of this study is to know the most frequent pathogens from septicemia patients with their antibiotic susceptibility pattern thus providing useful guide to clinicians in initiating empiric therapy.

Materials and Methods

The study was conducted in the Department of Microbiology, School of Medical Sciences and Research, Sharda Hospital, Greater Noida, for a period of 6 months (1 November 2018 to 30 April 2019). Blood samples were collected aseptically from the patient before the administration of any antibiotic. Relevant details of patients were recorded in a predesigned proforma.

10 ml of blood sample from adults and 3-5 ml of blood samples from children were collected and immediately inoculated into Adult and Paediatric BACT/Alert 3D Machine BIOMERIEUX blood culture vials respectively and incubated in BACT/Alert blood culture instrument at 37^0C. All Bact/Alert positive samples were subcultured on Blood agar, Chocolate agar and MacConkey agar plate and were incubated at 37^0C for 18-24 hours on days 2 and 7, respectively, and in between if turbidity appeared visibly.

The growth obtained was identified by colony morphology, gram stain of the isolated colonies and conventional biochemical identification tests as per the standard protocol followed in our laboratory[13].The antibiotic susceptibility pattern of the isolated organism was performed by Kirby-Bauer disc diffusion method on Mueller-Hinton agar plates, and the results were recorded as per the Clinical and Laboratory Standards Institute (CLSI) guidelines using HiMedia (Mumbai) antibiotic discs[14]. Cefoxitin disc diffusion method was used to identify MRSA and *methicillin-resistant coagulase-negative Staphylococci (MRCoNS)* among *Staphylococcus* and *coagulase-negative Staphylococci* isolates, respectively [14].

Results

A total of 850 blood culture samples were received from different wards and intensive care units (ICUs) of the hospital. Positive bacterial growth was observed in 105 isolates showing a blood culture positivity of 12.35% [Figure 1]. *Coagulase negative staphylococcus* 49 (46.66%) was the predominant isolate followed by *Klebsiella species* and *Pseudomonas aeruginosa* 12 (11.42%), *Escherichia coli* 10(9.52%), *Staphylococcus aureus* 09 (8.57%), *Citrobacter species* 07(6.66%), *Acinetobacter species* 03(2.85%) and *Enterococcus species* 03 (2.85%) [Figure 2]. Of the 105 positive samples, maximum samples were found to be from ICU 40 followed by Paediatric ward 32 [Figure 3]. Sex wise distribution showed 59 samples from males and 46 samples from females of the total 105 positive samples. Age wise distribution showed 29 samples from males of less than 14 years of age, 19 samples from females

of less than 14 years of age, 30 samples from males of more than 14 years of age and 27 samples from females of more than 14 years of age. The antibiotic susceptibility patterns of *Gram positive cocci, Enterococcus faecalis, Pseudomonas aeruginosa, Acinetobacter species, Enterobacteriaceae* have been shown in the tables [Table 4,5,6,7,8] respectively.

Figure 1: Blood Culture Positivity

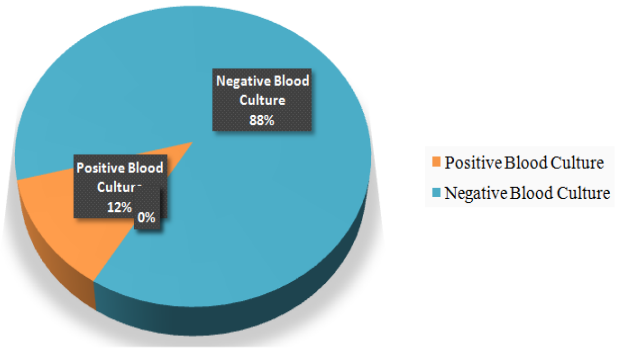

Figure 2: Bacteriological Profile of Isolated Organisms (n=105)

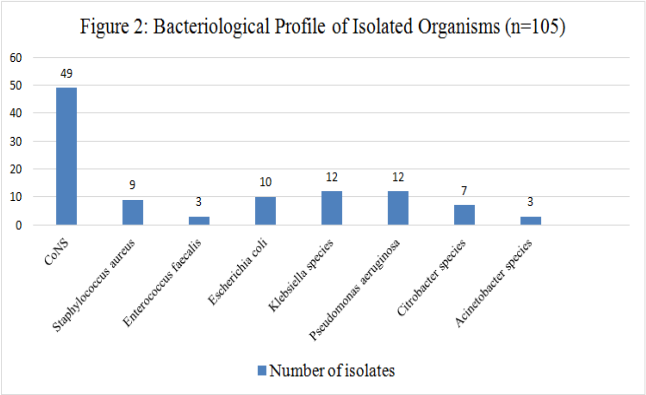

Figure 3: Ward Wise Distribution of Positive Samples (n=105)

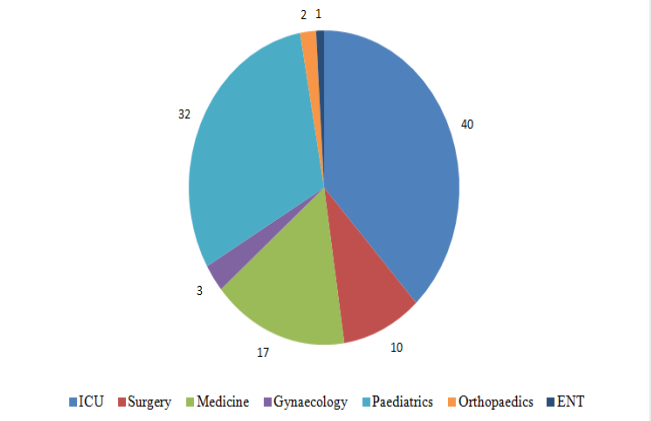

Table 1: Antibiotic susceptibility patterns of Gram Positive Cocci

Antibiotic	Sensitivity%	Resistance%
Penicillin	21 (36.20%)	37 (67.795%)
Erythromycin	15 (25.86%)	43 (74.13%)
Clindamycin	36 (62.06%)	22 (37.93%)
Vancomycin	54 (93.10%)	04 (6.89%)
Cefoxitin	26 (44.82%)	32 (55.17%)
Linezolid	52 (89.65%)	06 (10.34%)
Ciprofloxacin	26 (44.84%)	32 (10.34%)
Gentamicin	43 (74.13%)	15 (25.86%)

Table 2: Antibiotic Susceptibility patterns of Enterococccus feacalis

Antibiotic	Sensitivity%	Resistance%
Penicillin	0 (0%)	03 (100%)
Vancomycin	02 (66.66%)	01 (33.33%)
HL-Gentamicin	02 (66.66%)	01 (33.33%)
HL-Streptomycin	02 (66.66%)	01 (33.33%)
Linezolid	03 (100%)	0 (0%)
Levofloxacin	01 (33.33%)	02 (66.66%)
Tetracyclin	02 (66.66%)	01 (33.33%)

Table 3: Antibiotic Susceptibility patterns of Pseudomonas aeruginosa

Antibiotic	Sensitivity %	Resistance %
Aztreonam	09 (75%)	03 (25%)
Ceftazidime	08 (66.66%)	04 (33.33%)
Imipenem	11 (91.66%)	01 (8.33%)
Levofloxacin	10 (83.33%)	02 (16.66%)
Piperacillin\Tazobactam	09 (75%)	03 (25%)
Tobramycin	11 (91.66%)	01 (8.33%)

Table 4: Antibiotic Susceptibility patterns of Acinetobacter species

Antibiotic	Sensitivity%	Resistance%
Ampicillin	0 (0%)	03 (100%)
Gentamicin	0 (0%)	03 (100%)
Levofloxacin	1 (33.33%)	02 (66.66%)
Imipenem	1 (33.33%)	02 (66.66%)
Cefepime	0 (0%)	03 (100%)
Cefuroxime	0 (0%)	03 (100%)
Cotrimoxazole	0 (0%)	03 (100%)
Colistin	03 (100%)	0 (0%)
Poymyxin B	03 (100%)	0 (0%)

Table 5: Antibiotic Susceptibility patterns of Enterobacteriaceae

Antibiotic	Sensitivity %	Resistance %
Ampicillin	13 (44.82%)	16 (55.77%)
Gentamicin	21 (72.41%)	08 (27.58%)
Cefepime	16 (55.77%)	13 (44.82%)
Levofloxacin	23 (79.31%)	06 (20.68%)
Cefotaxim	13 (44.82%)	16 (55.77%)
Imipenem	19 (65.57%)	10 (34.48%)
Cotrimoxazole	19 (65.57%)	10 (34.48%)
Colistin	29 (100%)	0 (0%)
Polymyxin-B	29 (100%)	0 (0%)

Discussion

Sepsis remains one of the leading causes of mortality in paediatric population. Studies of the bacteriological profile and antibiotic susceptibility pattern of the blood culture isolates guide the clinicians for effective management of BSI. The present study shows the bacteriological profile and antimicrobial susceptibility pattern of the blood culture isolates, thus helping in the effective management of septicemic cases. Blood culture positivity of 12.35% was observed in our study. Similar blood culture positivity was found in other studies as well.[15,16] Although there is wide variation of blood culture positivity rates in different studies varying from 10 to 46%. *Gram-negative bacteria* were found to predominate over *Gram-positive bacteria* in most of the studies. However in our study *Coagulase negative staphylococci* were found to predominate. Over the past 2 decades, *CoNS*, which is the usual skin commensal is being increasingly recognised as an important bloodstream pathogen. Improper blood collection methods and the presence of long-standing i.v. catheters are recognized as possible modes of spread of blood stream infection by *CoNS*. Similar studies reported *CoNS* as the most common isolate causing BSI's in ICU patients. [17,18] The etiological profile and antibiotic spectrum of bacterial pathogens vary geographically due to variations in social and environmental conditions. [15] AST results show Vancomycin and Linezolid to be the most effective antibiotic for *Gram positive isolates* and *Enterococcus faecalis* respectively. Imipenem was found to be the most effective antibiotic for *Non-fermenters* whereas Colistin and Polymyxin-B were found to be equally effective for *Enterobacteriaceae* group of bacterias.

Conclusion

Bacteremia is an independent risk factor of mobidity and mortality in cases of septicemia, with the emergence of multi resistant bacteria in many regions worldwide, leaving limited options for treatment. Thus timely detection and knowledge of most likely pathogens causing BSI along with their antibiotic susceptibility pattern will help the clinician in choosing appropriate antimicrobial for treatment which will reduce the major burden of BSIs in critically ill patients and will also minimize the further emergence of resistance. Therefore, there should be an intensive surveillance, antibiotic policy formulations and

prevention efforts for effective management and prevention of drug resistance.

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