Original Research Article

Bacteriological profile and antibiotic resistance pattern in systemic infection in children.

Khushboo Kumari[1*], Ramkrishna Mahato[2], Chhitiz Anand[3], Sushant Kumar[4*]

[1]Tutor ,Department of Microbiology,Sheikh Bhikhari Medical College, Hazaribag, Jharkhand,India
[2]Associate Professor & HOD,Department of Microbiology,Sheikh BhikhariMedical College, Hazaribag, Jharkhand,India

[3]Assistant Professor,Department of Pediatrics,Sheikh Bhikhari Medical College, Hazaribag, Jharkhand,India
[4]Senior Resident ,Department of Pediatrics,Vardhman Institute of Medical Sciences, Pawapuri, Bihar,India

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Abstract

Background: Blood stream infections (BSIs) are an important cause of morbidity and mortality worldwide. The condition can be life threating in critically ill patients specially in pediatric intensive care unit of the hospital. Emergence of resistance among the bacterial pathogens causing these infections is another issue of the public health concern. **Aim:**This study was carriedout to knowthespectrum of bacterial pathogens causing BSIs and also to know the trends of resistance among these agents **Materials & Methods:** It was a hospital based retrospective cross-sectional study. The data was collected by reviewing the records of 565 patients admitted to pediatric critical care units of the hospital from March 2020 to November 2020. **Results:** Out of total 565 blood samples of the patients suspected of bacteremia, admitted to critical care units of the hospital 140 were culture positive. Out of these isolates 74(53%) were Gram positive bacteria (GPB) and 55(39.3%) were Gram negative bacteria (GNB) and 11(7.9%) were non-albicans Candida. The predominant bacterial isolate were Coagulase negative staphylococcus (CoNS) 49(34.5%)followed by *Acinetobacter*22(15.4%)and *Staphylococcus aureus*20(14%). The antimicrobial resistance profile of both Gram positive and Gram negative isolates showed a high prevalence of resistance among them. **Conclusion:** The present study will provide the pediatricians an update on high prevalence of multi-drug resistant isolates in the critical care units of the hospital.

Keywords: Blood stream infections, Critical care units, Multi-drug resistance

Introduction

Blood stream infections (BSIs) are an important cause of morbidity and mortality worldwide. The condition can be life threatening in critically ill patients in intensive care units (Pediatric ICUs) of the hospitals. The case fatality rate associated with BSIs in NICU patients is between 35% - 50%[1]. Risk factors contributing to these infections are many but leading causes are intravascular catheters (IVCs), debilitating condition of the patients due to some underlying disease/infection or invasive diagnostic or therapeutic procedures [2-4].Emergence of resistance among the bacterial pathogens causing these infections is another issue of the public health concern.Studies have shown that there is a wide range of bacteria, both Gram negative and Gram positive which are associated with this infections[5-8].The diagnosis of these infections can easily be made with blood culture and since blood is a sterile fluid, the positive predictive value of a blood culture is high. Early identification of the causative pathogen and start of appropriate treatment can significantly reduce the morbidity, hospital stay and mortality among patients with BSIs.Therefore, this study was carried out in our hospital to evaluate the spectrum of bacterial pathogens causing BSIs in the patients admitted to the critical care units and also to know the trends of resistance among these agents.

**Correspondence*

Dr.Sushant Kumar
Senior Resident ,Department of Pediatrics,Vardhman Institute of Medical Sciences, Pawapuri, Bihar,India

E-mail: suushant@gmail.com

Materials and method

Study design and data collection:This prospective study was conducted at Sheikh Bhikhari Medical College, Hazaribag, Jharkhand.The data was collected from the records of 565 patients admitted to pediatric ICU of the hospital from March 2020 to November 2020. The samples of these patients were routinely processed for blood culture in the department of Microbiology. Data collection included age & sex of the patients, the results of the blood culture and antimicrobial sensitivity testing (AST).Blood samples were collected from the patients taking all aseptic & antiseptic measures. For all samples phlebotomy was performed after

disinfection of vein puncture site with 70% alcohol followed by 2% tincture iodine. Blood was collected using 2 ml for paediatric age group which was then inoculated in brain heart infusion (BHI) broth 50 ml and 10 ml respectively. Blood culture bottles were incubated at 37ºC aerobically for 24hrs followed by subcultures on a blood agar plate and MacConkey's agar. Blood culture broth which did not show any signs of bacterial growth (hemolysis or turbidity) were reported negative after 7 daysof incubation,after doing af inal subculture.Isolates were identified by Vitek 2 Compact (Biomerieux) using gram negative, gram positive and yeast identification cards and AST cards for sensitivity. Antibiotic sensitivity results were interpreted as per CLSI guidelines.For statistical analysis SPSS version 11.0 software and MS excel 2007 were used.We also used Chi-square test to know the association between thevariable.

Results

A total of 565 blood samples of the patients suspected of bacteremia,admitted to critical care units of the hospital were processed routinely for blood culture in the department of Microbiology. Out of these patients 379 were (67%) were males. Male to female ratio was approximately 2:1. Medium age of the patients was 4.3 years with a range from 1 year to 8.5 years. In our study total no of positive blood culture was 140. Out of these isolates 74(53%) were Gram positive bacteria (GPB) and 55(39.3%)were Gram negative bacteria (GNB) and 11(7.9%) were non- albicans Candida (Fig. 1).

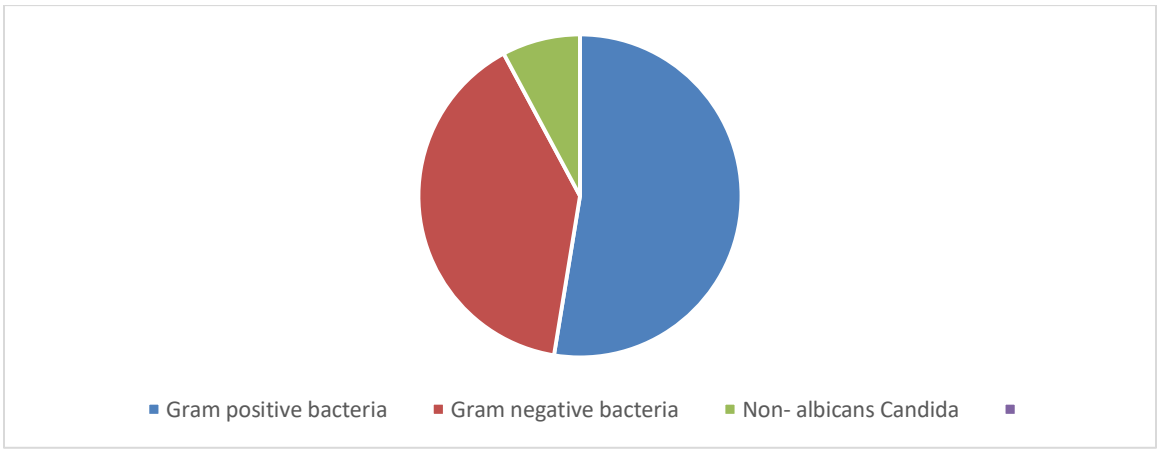

Fig 1:Percentage distribution of bacteria isolates

The predominant bacterial isolate were Coagulase negative *staphylococcus* (CoNS) 49 (34.5%) followed by *Acinetobacter* 22(15.4%) and *Staphylococcus aureus* 20 (14%) (Fig. 2, Table 1). In addition there were 11 isolates of Candida species, all non albicans with *Candida utilis* (9) being the predominant species followed by *Candida tropicalis* (2). All blood stream infections were due to a single organism only.

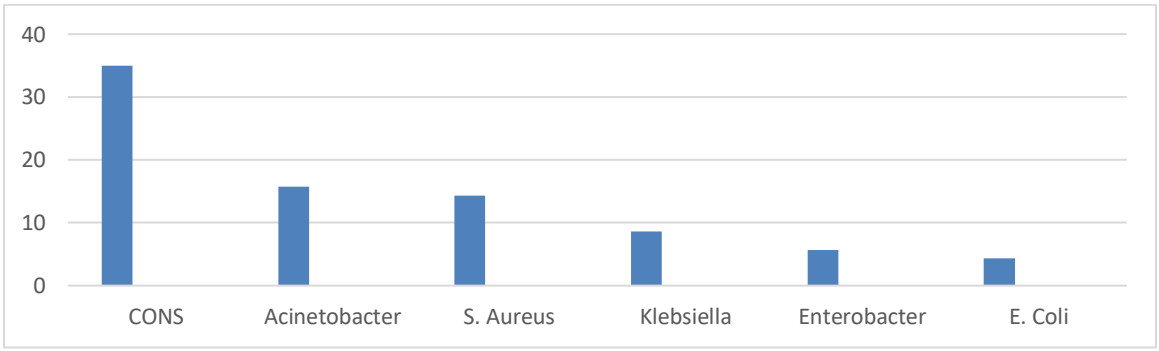

Fig 2:Graph showing frequency of bacterial isolates recovered from patients

Table 1: Showing age wise frequency of bacterial isolates recovered from patients with BSI

	Number and Percentage of organisms isolated									
Age of patient	**Gram positive cocci (53%)**			**Gram negative bacilli (39.3%)**						**Candida**
	CoNS (49) 35%	***S.aureus(20) 14.3%***	***Enterococcus(5) 3.6%***	***Acinetobacter(22)15.7%***	***Klebsiella(12) 8.6%***	***Enterobacter (8) 5.6%***	***E. coli (6) 4.3%***	***Pseudomonas (5) 3.6%***	***Burkholderiacepacia(2) 1.4%***	***Non albican 11(7.9%)***
1yrs	29	11	5	13	8	8	2	1	2	9
1-2yrs	6	2	0	2	1	0	0	0	0	2
2-5yrs	7	4	0	3	1	0	1	1	0	0
>5 yrs	7	3	0	4	2	0	3	3	0	0

Antibiotic susceptibility patterns: Among Gram positive bacterial isolates, 100% isolates of CONS and Enterococcus and 85% isolates of Staphylococcus aureus were resistant to penicillin and oxacillin. However most of the GPB were sensitive to teichoplanin, daptomycin and linezolid and 100% were sensitive to vancomycin. Among Gram negative bacterial isolates, Acinetobacter and Klebsiella were dominant species in descending order. Third generation cephalosporins showed a very weak activity against them. carbapenem resistance was detected in 64% isolates of Acinetobacter spp. and in 92% of Klebsiella pneumonia. 100% stains of both species were multidrug resistant (MDR). However most of their strains were sensitive to both tegicycline and colistin.

Discussion

Patients admitted to the critical care units of the hospitals are always at a higher risk of developing nosocomial BSIs which results in high morbidity and mortality among these patients. This study was done to know the spectrum of pathogens causing BSIs in the pediatric patients admitted to the critical care units of ourhospital and also to know the trends of resistance among them.Theresultsofthe study showed the microbial profile of the blood stream infections as well as the resistance pattern of the isolates as follows. Out of total 565 patient's blood samples, 140 were culture positive; the rate of isolation was 24.8% which was comparable to other studies from India and abroad. Similar results were also shown by a study done in Gonder, Ethiopia, 24.2% by Ali and Kebede et al in 2008[9]. Studies from India by Arora et al 2007[10] (20.02%) and Sharma et al 2002 [11] (33.9%) also showed comparable results. Slight variation may be due to many factors like geographical locations, patient type, timing and number of blood cultures or difference in blood culture system[9-11]. There is a wide rangeof organisms which can cause BSIs and same has been studied by many researchers.In our study 53% of the infections were caused by Gram positive bacteria and 39.3% were due to Gram negative bacteria.There are several studies from different parts of the world which show a higher prevalence of Gram-positive over Gram- negative organisms; a study by Wasihun et al. 2015[12] showed 72.2% of infections were caused byGPB and 27.8% by GNB, Dagnew et al 2013[13] at Gonder Ethiopia (69% and 31% respectively) and Obiand Mazarura in Zimbabwe 1996 (71.9% and 28.1%)[12-14]. Among GPB, CoNS was the most frequently isolated pathogen and this has also been reported by other studies conducted in the country[15-17] Reason for high incidence of CoNS probably was that most of the samples were received from the neonatal intensive care unit (NICU). Although CoNS can be a skin contaminant but it is now a well-described pathogen associated with prematurity and central venous lines. On the contrary, in most of the studies from India and other developing counties, Gram-negative bacteria have been reported as the commonest cause of bacteremia in hospitalized patients; studies in India by Singh et al 2014[15] with 51.82% GNB and 46.56% GPB and Alamet al in 2011[16] and a Nigerian study by Nwadiohaet al. 2010[18] (69.3 GNB and 30.7% GPB) [15,16,18]. Candida was reported in 7.9% of positive blood culture and all were non albicans Candida species. Predominant species was Candida utilis and all the 9 isolates were reported in neonates. There are only few cases in literature that has reported Candida utilis candidaemia in neonates[19].In our study we also notice a significant number of cases with septicemia were in neonates. A higher rate of occurrence in neonatal septicemia has been reported by previous studies also [13,20].The antimicrobial resistance profile of both GP and GN isolates showed a high prevalence of resistance among them. CoNS and Enterococcus spp isolates showed higher level of resistance to beta-lactam antibiotics than Staphylococcus aureus. However all the three were sensitive to vancomycin which is similar to other studies[12,21].Most of the Gram-negative bacteria were MDR with a very high resistance to beta-lactam antibiotics. Among Gram negative bacterial isolates, Acinetobacter and Klebsiella were dominant species. Third generation cephalosporins showed a very weak activity against them. Carbapenem resistance was detected in 64% isolates of Acinetobacter spp. and in 92% of Klebsiella

pneumonia.This might be due to inappropriate empirical use of meropenem as the firstline treatment. As many as 8% isolates of klebsiella spp and 12% of Enterobacter sppwere even resistant to colistin.

Conclusion

The present study showed prevalence of multi-drug resistant isolates in pediatric critical care patients and this limits the therapeutic options. It implies that blood cultures must always bedone in all cases ofsuspected bacteremia and septicemia and once the sensitivity pattern of the isolate is known de-escalation of the high-end antimicrobials should be considered to reduce the antimicrobial pressure. Moreover stringent hospital infection control measures and a good antibiotic policy for the hospital is the need of the hour.

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