ORIGINAL RESEARCH PAPER

Clinical Microbiology

BACTERIAL PROFILE OF BLOOD CULTURE AND THEIR ANTI-MICROBIAL SUSCEPTIBILITY PATTERN IN PEDIATRIC PATIENTS OF A TERTIARY CARE HOSPITAL

KEY WORDS: Blood stream infection, Antibiotics, Isolates, Paediatric.

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ABSTRACT

Introduction: Blood stream infection are very common in the pediatric age group and these are one of the common causes of morbidity and mortality in children. In developing countries ,the rate of blood stream infection in children is about 20-50%.The present study was undertaken to determine the etiological agents causing blood stream infection and their antibiotic susceptibility pattern in pediatric patients. Patients with bacteremia may have either a transient bacteremia or persistent bacteremia which can be self-limited without development of focal infection or sequelae or may progress to a more serious fatal infection or toxic effects. **Methodology:** The present study in a hospital based single centred, Observational study, of 3 years. Blood sample were collected in BacTec bottle and standard microbiological protocol were applied for the isolation identification of bacteria strains. Antimicrobial susceptibility test was performed by the Kirby Bauer Disc Diffusion Method as per CLSI 2019 guidelines. **Results:** Out of total 350 blood samples received for culture,87(23.14%)were culture positive, out of which 42/87(48.27%) were Gram positive organisms and 39/87(44.82%) were Gram-negative organisms and 6 /87(6.89%) were candida spp. The most common organism was Staphylococcus aureus(31.03%) the predominant organism followed by Klebsiella pneumoniae(21.83%) and Streptococcus pneumoniae (9.19%), Escherichia coli, Enterobacter cloacae each (5.74%). All Gram positive bacteria were susceptibile to vancomycin, teicoplanin and linezolid. 11/27(40.74%)of Staphylococcus aureus were Methicillin resistant Staphylococcus aureus (MRSA) strains. All Gram negative bacteria were susceptibility to amikacin, Colistin,Tigecycline. **Conclusion:** Staphylococcus aureus is the leading cause of childhood septicemia in this locale, has been decline in susceptibility of the pathogens to common antibiotics which ultimately stresses on the need for continuous screening and surveillance for antibiotic resistance in the pediatric ward and calls for increased efforts to ensure more rational use of these drugs.

INTRODUCTION.

Blood stream infections are very common in the pediatric age group and these are one of the common causes of morbidity and mortality in neonates and children[1]. In developing countries, the rate of blood stream infections in children is about 20–50% and is one of the most common health care associated infection.[2,3]

Blood stream infections (BSI) are defined by the presence and active multiplication of microorganisms in the blood stream.[4] BSI by the place of acquisition is categorized either community associated or hospital associated. Blood stream infections occur when bacteria enter the blood stream from either a primary focus of infection in an organ (UTI, Pneumonia, meningitis...), a wound or via an indwelling or implanted device.[5]Health care associated (HCA) BSIs can occur as complications following medical and surgical procedures or the insertion of an intravascular or indwelling device.[6] Blood stream infections (BSIs) have serious consequences such as shock, disseminated intravascular coagulation, multiple organ failure, and even death. Early diagnosis plays a crucial role in managing BSI, and hence, prompt detection of such infections is a critical function of clinical microbiology laboratories.[7] Blood culture is the gold standard for the detection of blood stream infection.[8]

Neonates are particularly vulnerable to infections because of their weak immune barrier. Several risk factors have been identified both in the neonates and children which makes them susceptible to infections [1]. Children with septicemia present with fever, difficulty in breathing, tachycardia, malaise, refusal of feeds or lethargy .[9]BSIs caused by a variety of Gram-positive as well as Gram-negative bacteria and sometimes yeasts[10].

The most common microorganisms isolated in BSIs include on one hand bacteria such as *Klebsiella pneumoniae, Escherichia coli, Enterobacter spp., Staphylococcus aureus, Coagulase Negative Staphylococcus (CONS), Streptococcus pneumoniae, and Streptococcus pyogens* and on other hand fungi such as Candida albicans and other *Candida spp*.[11,12,13]The spectrum of causative organisms changes over times and varies from region to region.

As antibiotics sensitivity pattern to common pathogen has been changing day by day ,so it has been necessary to study about bacteriological analysis and antibiotic susceptibility pattern.Therefore, the purpose of this study was to analyze on data on bacteremia in children, the pathogen involved and susceptibility pattern.

MATERIALS AND METHODS:

In this study 350 blood samples were collected from children (aged from 1 month to 10 years) admitted to the paediatric ward of J.K Lon, Hospital. Blood sample collection and laboratory investigations were performed as a part of routine clinical practice of patient care .

Samples were processed in Bacteriology laboratory of Microbiology department of S.M.S Medical College and hospital,Jaipur (Rajasthan) from (January 2019 to January 2021).Ethical approval was taken from the institutional ethical committee before the commencement of the study.

Blood specimen (2-4 ml) was collected and bed side inoculation was made aseptically in paediatric BD BACTEC culture bottle and transferred immediately to microbiology laboratory and loaded in BD BacTec FX 40 system (Automated blood culture system). When a bottle flagged red indicates inside the system then it is the positive bottle. Bottle when flagged green after 5 days indicates ,it is negative culture. Positive blood cultures bottles were further processed for

microbiological confirmation of BSIs as per standard laboratory protocol.

Positive blood culture samples were processed by conventional culture technique using blood agar, MacConkey agar & Chocolate agar plates . Plates were incubated under aerobic condition in 5-10% carbon dioxide atmosphere at 37°C for 24-48 hours and MacConkey agar plate incubated aerobically at 35-37°C for 18-24 hours. Identification of microorganisms was done by colony characteristic and biochemical tests using standard laboratory protocol. Antimicrobial susceptibility testing was done on Muller Hinton Agar by Kirby Bauer disc diffusion method according to CLSI guidelines 2019.[14]

RESULTS

Out of 350 blood samples collected 87 (24..85%) were culture positive, out of which 42/87(48.27%) were Gram positive organisms and 39/87(44.82%) were Gram-negative organisms and 4/87(4.59%) were candida spp. Out of 350 cases, 242(64.14%) were males and 108(30.85%) were females. Maximum cases of Positive blood culture were seen children in the age group of 0-1 year (68.96%) followed by (29.14%) children in age group 1-5 years and (2.85%) in 5-10 years of age group. Among the gram positive cocci , the predominant organism were *Staphylococcus aureus* 27 (33.33%) followed by *Streptococcus pneumoniae* 8(9.87%) and *Enterococcus species7*(8.64%). Among Gram Negative bacilli, the most common organism were *Klebsiella pneumoniae 19*(23.45%), followed by *Escherichia .Coli* 7 (9.52%) ,*Enterobacter cloacae* 5(6.17%).

Table 1: Distribution of microorganisms isolated from blood Samples (N=.87)

Gram positive cocci	N	%	Gram negative bacilli	N	%
Staphylococcus aureus	27	31.03	Klebsiella pneumoniae	19	21.83
Streptococcus pneumoniae	8	9.19	Escherichia coli	7	8.04
Enterococcus species	7	8.04	Enterobacter cloacae	5	5.74
			Pseudomonas aeruginosa	5	5.74
			Acinetobacter species	5	5.74

Table 2: Antimicrobial susceptibility pattern of gram positive bacteria isolate from blood sample

Name of antibiotic	Staphylococcus aureus n=27	Streptococcus Pneumoniae n=8	Enterococcus species n=7
	N(%)	N(%)	N(%)
Ampicillin	8(29.62)	-	2(28.57)
Penicillin	-	2(25)	-
Piperacillin+ tazobactam	17(62.96)	0	0
Cefoxitin	16(59.25)	0	0
Vancomycin	27(100)	8(100)	7(100)
Teicoplanin	27(100)	-	7(100)
Gentamycin	23(85.18)	-	-
High Gentamycin	-	-	6(85.71)
Doxycycline	25(92.59)	3(37.5)	6(85.71)
Erythromycin	2 (7.40)	2(25)	0
Clindamycin	22(81.48)	5(62.5)	-
Linezolid	27(100)	8(100)	7(100)
Ciprofloxaacin	20(74.07)	0	5(70.42)
Cotrimoxazole	14 (51.85)	4(50)	4 (57.14)
Levofloxacin	-	8(100)	0
Chloramphenicol	0	8(100)	0

Table: 3 Antimicrobial susceptibility pattern of gram negative bacteria isolate from blood sample

Name of antibiotic	Klebsiella pneumoniae n =19	E. coli n=7	Enterobacter cloace n=5	Acinetobacter spp n=5	Pseudomonas aeruginosa n=5
	N(%)	N(%)	N(%)	N(%)	N(%)
Ampillicin	0	0	0	0	-
Pepracillin+ tezobectum	7(36.84)	3(42.85)	3(60)	3(60)	2(40)
Ceftazidime	4(21.05)	3(42.85)	3(60)	2(40)	3(60)
Ceftriaxone	0	2(28.57)	2(40)	2(40)	2(40)
Cefepime	6(31.57)	0	4(80)	2(40)	4(80)
Imipenem	11(57.89)	5(71.42)	4(80)	3(60)	5(100)
Polymyxin B (MIC)	19(100)	7(100)	5(100)	5(100)	-
Colistin (MIC)	-	-	-	-	5(100)
Amikacin	19(100)	7(100)	3(60)	2(40)	5(100)
Gentamycin	7(37.84)	5(71.42)	3(60)	3(60)	3(60)
Tobramycin	-	-	-		3(60)
Minocyclin	16(84.21)	7(100)	5(100)	2(40)	-
Aztreonam	-	-	-	-	4(80)
Ciprofloxacin	14(73.68)	6(85.71)	2(40)	4(80)	2(40)
Cotrimoxazole	5(26.31)	2(28.57)	2(40)	1(20)	_
Tigecyclin	19(100)	7(100)	5(100)	5(100)	-

11/27(40.74%)of Staphylococcus aureus were Methicillin resistant Staphylococcus aureus (MRSA) strains.

Gram negative bacteria showed highest susceptibility against, amikacin, Colistin, Tigecyclin (100%) each followed by Ciprofloxacin (66.66%), Imipenem (69.23%), Gentamycin (63.41%).

All candida species were susceptible to casofungin, micofungin followed by flucytosin and Amphotericin B.

DISCUSSION

Despite advances in diagnosis and treatment, bacterial sepsis remains a major cause of pediatric morbidity and mortality, particularly among neonates in developing countries.

In present study out of the 350 blood culture samples ; 87 were culture positive with a blood culture positivity rate of 24.85% . Similar positivity rate of 25% was reported by other study by Tiwari Dk et al [18].Higher positivity rates of (43.78%) was observed by Prabhu K et al[16] .The prevalence of blood stream infection varies across regions and even among hospitals in the same city.[17,18]

In present study, it was observed that the incidence of bacteremia was higher in males (70.57%) compared to females (29.43%). Nimri et al [19](60.6%) and Karki et al (63.3%)[20] reported a higher incidence of bacteremia in males similar to our study.

In present study bacteremia was more common in the age group between 1month to 1 year(68%) however another studie done by Karki S et al (27.5%)[20] reported that bacteremia was most frequently encountered in newborns.Out of 87 isolates found in present study , 48.27%

were Gram positive cocci and 47.12% were Gram negative bacilli while 4(4.59%) were Candida species ; the present study is in concordance is in by Asma Ejaz et al [21] who reported Gram positive cocci to be (49%) and Gram negative bacilli -50 and Candida species -1%.

Among Gram positive cocci isolated ,the predominant isolate was Staphylococcus aureus 27(31.03%) followed by Streptococcus pneumoniae 8(9.19%) ; these finding are in agreement with the study by H Crichton at al[22] who observation (Staphylococcus aureus 32.8% and Streptococcus pneumoniae 10.3%) .

Among Gram negative bacilli isolated the most common organism isolated was Klebsiella pneumoniae (21.83%) followed by E.coli (8.04%).Similar finding were observed is the study of Ogunkunle et al [23] who reported Klebsiella pneumoniae to be (21.83%) and E.coli-56%.

In present study antibiotic susceptibility revealed that majority of Gram negative organisms were 100 % susceptible to both Polymyxin B , Tigecycline followed by Amikacin (82.92%) . Similar finding have also been observed by Dechen C Tsering et al [24]Amikacin (80%) .Karki S et al[18] found Klebsiella pneumoniae to be (91.7%) susceptible to Amikacin.

The Gram positive cocci showed 100% susceptibility to Linezolid , Vancomycin and Teicoplanin each . This is comparable to study done by Tiwari DK et al[15] (100%), K.Vidyasagar et al[25] (100%) and Asma Ejaz et al [21](100%) .

All Candida species isolate were 100% susceptible to Capsofungin, Micofungin, Flucytosine and AmphotericinB. Similar finding were observed in the study by Dash M et al [26] (100%).

The causative agents of BSIs and their antibiotic susceptibility patterns also varies from time to time and from place to place.

Detection of bacteria in blood has an important role in diagnosis for a febrile patient; to establish the presence of infection, to reassure the clinician about the chosen empirical therapy, and to provide up-to date information on the local etiologic patterns and antibiotic susceptibility as this will guide the clinician in the management of the patient. The study of bacteriological profile along with the antimicrobial susceptibility pattern plays a great role in effectively managing BSIs in children for better clinical outcome.

CONCLUSION.

.The current study identified Both Gram-positive and Gram-negative bacteria to be responsible for blood stream infections . *Staphylococcus aureus* and *Klebsiella pneumoniae* are the leading cause of childhood BSIs in this locale; has been decline in susceptibility of the pathogens to common antibiotics which ultimately stresses on the need for continuous screening and surveillance for antibiotic resistance among the pediatric age group. Current scenario calls for increased efforts to ensure more rational use of antimicrobial agents .

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