Original Research Article

Spectrum of organism and their sensitivity pattern in a tertiary care centre in Northern area of Bihar, India

Kumar Shambhu Nath[1*], Ghazi Sharique Ahmad[2], Md Haider Ali[3]

[1]Professor, Department of Pediatrics, Katihar Medical College and Hospital, Katihar, Bihar, India
[2]Professor & Head, Department of Pediatrics, Katihar Medical College and Hospital, Katihar, Bihar, India
[3]Assistant professor, Department of Physiotherapy, Katihar Medical College & Hospital, Katihar, Bihar, India

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Abstract

Objectives: This present study was to evaluate the spectrum of organism and their sensitive pattern with various antibiotics in sepsis children in a tertiary care centre of northern area of Bihar, India. **Methods:** Blood for culture was collected from 426 clinically diagnosed septicemia cases following strict aseptic precautions. One milliliter (neonates) and 5 ml (children) blood was collected and inoculated into 10 and 50 ml, respectively, of brain heart infusion broth (1:10 dilution). The culture bottles were incubated at 37ºC aerobically and periodic subcultures were done onto Mac Conkey's agar, blood agar and chocolate agar after overnight incubation on day 3, day 4 and finally on day 7 [4]. The growth obtained was identified by conventional biochemical tests and the antibiotic sensitivity testing was performed on Mueller–Hinton agar plates by Kirby– Bauer disc diffusion method. Zone diameter was measured and interpreted as per the Clinical and Laboratory Standards Institute (CLSI) guidelines [5]. **Results:** Most of the patients were females 228(54%) and belonged in age group of 1 years to 5 years. Major isolate organisms were E. coli 304(71.36%), P. species 170(39.91%) and S. aureus 154(36.15%). majorities of sepsis patients 304(71.36%) were infected with E.coli. Among of them, positive sensitivity of E.coli was greatly with amikacin 41(13.48%), levofloxacin 35(11.51%), meropenem 34(11.18%), netilmicin 25(8.22%), piperacillinn +tazobactam 24(7.89%) and nalidixic acid 23(7.56%). **Conclusions:** E. coli is the most predominant isolate organism while pseudomonas species and S. aureus are the second most common organisms in the sepsis patients in northern region of Bihar. Amikacin, levofloxacin, meropenem and nalidixic acid may be the best choice of drugs for the treatment of E. coli, S. aureus and P. species infection.

Key words: Spectrum of organism, pattern of sensitivity, sepsis, children

Introduction

Worldwide, ICUs are faced with increasingly rapid emergence and spread of (Antimicrobial) AM-resistant bacteria because of frequent use of broad spectrum AMs, crowding of patients with high levels of disease acuity in relatively small, specialized areas of the hospital, shortage of nursing and other supporting staff due to economic pressures (which increases the likelihood of person-to-person transmission of microorganisms) and the presence of more chronically and acutely ill patients who require prolonged hospitalization [1, 2]. Indiscriminate and inadequately prolonged use of AMs also leads to emergence and proliferation of resistant strains preferentially [3]. Moreover, AMs are prescribed prophylactically and empirically without carrying out sensitivity studies particularly in developing countries. In ICUs, patients may be immune-compromised and many prosthetics and instrumentations are used routinely.

Objective of this present study was to evaluate the spectrum of organism and their sensitive pattern in a tertiary care centre of northern area of Bihar, India.

Materials & Methods

This present study was conducted in department of Pediatrics with the collaboration of department of Pathology of Katihar Medical College and Hospital, Katihar, Bihar, India. Attendants of entire subjects signed an informed consent approved by institutional

**Correspondence*
Dr. Kumar Shambhu Nath
Professor, Department of Pediatrics,
Katihar Medical College and Hospital, Katihar, Bihar, India.
E-mail: krshambhunathbh@gmail.com

ethical of KMCH, Al- Karim, University, Katihar, Bihar, India.

In this study 426 blood samples were collected from children (aged from 1day to 10 years) admitted to the paediatric ward of Katihar Medical College & Hospital, Katihar, Bihar, India during a period from January 2020 to November 2020. The patients included all new born babies and children admitted with fever and suspected of having sepsis. Children with fever less than 5 days and with known clinical condition such as malignancies, tuberculosis etc. were excluded. The cases were categorized into 4 clinical groups: Group I [0-1 month–neonates], Group II [1 month-1 year old], Group III [1year-5 years old] and Group IV [5 year -10 years]. Blood for culture was collected from 426 clinically diagnosed septicemia cases following strict aseptic precautions. One milliliter (neonates) and 5 ml (children) blood was collected and inoculated into 10 and 50 ml, respectively, of brain heart infusion broth (1:10 dilution). The culture bottles were incubated at 37ºC aerobically and periodic subcultures were done onto Mac Conkey's agar, blood agar and chocolate agar after overnight incubation on day 3, day 4 and finally on day 7 [4]. The growth obtained was identified by conventional biochemical tests and the antibiotic sensitivity testing was performed on Mueller–Hinton agar plates by Kirby– Bauer disc diffusion method. Zone diameter was measured and interpreted as per the Clinical and Laboratory Standards Institute (CLSI) guidelines [5]. Bacterial sensitivity was tested for the following antimicrobials: Amikacin, Amoxicillin-Clavulanic acid, Ampicillin, Aztreonam, Cefotaxime, Ceftazidime, Ceftriaxone, Cephalexin, Cefoxitin, Ciprofloxacin, Gentamicin, Imipenem, Meropenem, Piperacillin-tazobactam, Tobramycin, linezolid and Vancomycin, levofloxacin, nalidixic acid, etc. Methicillin resistance in Staphylococcus aureus (MRSA)was tested using Mueller-Hinton agar with 4% NaCl with cefoxitin disc (30 micrograms) by Kirby-Bauer disc diffusion method. A zone size of >22 mm was considered sensitive and < 21 was considered resistant [5]. Suspected extended-spectrum beta lactamases (ESBLs) producing organisms were confirmed by double disk synergy test as described previously [6]. Detection of plasmid-mediated AmpC was done by the AmpC disk test and the isolates showing reduced susceptibility to carbapenems (imipenem and meropenem) were selected for detection of metallo-beta lactamases (MBLs) enzymes by imipenem-EDTA disk method [7]. For quality control of disc diffusion tests ATCC control strains of E. coli ATCC 25922 and S. aureus ATCC 25923 strains were used.

Observations

A total of 426 children with age group 01 days to 10 years were enrolled in this study. Most of the patients 194(45.54%) were in age group of 1 years to 5 years. Most of the patients 228(54%) were females

Table 1. Age wise distributions

Age group	No. of patients	% of patients
0-1 months	56	13.14%
1-1 years	115	27%
1-5 years	194	45.54%
5-10 years	61	14.32%
Total	426	100%

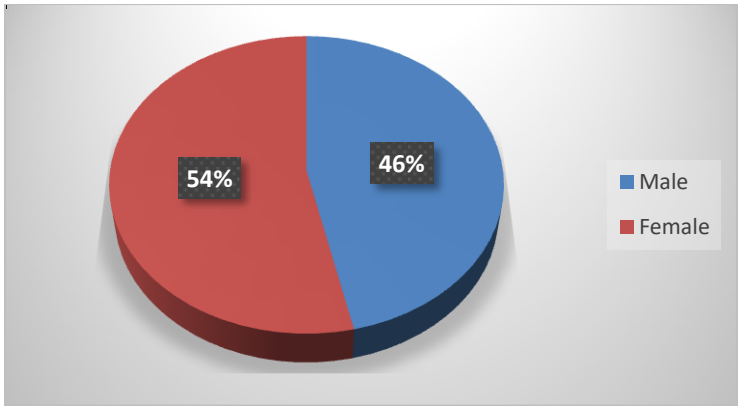

Fig. 1:Showing the gender wise distribution

Table 2:Showing the positive sensitivity of micro-organisms with various antibiotics

Sensitivity	Micro-organisms							
Antibiotics	E. coli	S. aureus	P. species	E.species	K.species	Actinobacter sps	Sterile	No growth of organism
Amikacin	41(13.48%	20(12.99%)	20(11.7%)	3(4.84%)	-	-	123	135
Ampicillin	-	1(0.65%)	-	-	-	-		
Amoxycillin	-	4(2.6%)	-	-	-	-		
Amoxyclav	1(0.3%)	-	1(0.58%)	-	1(2.38%)	-		
Azithromycin	-	1(0.65%)	-	-	-	-		
Aztreonam	5(1.64%)	2(1.3%)	9(5.3%)	1(1.61%)	-	-		
Carbenecillin	9(2.96%)	1(0.65%)	9(5.3%)	-	-	-		
Ciprofloxacin	-	2(1.3%)	-	-	-	-		
Cefazolin	4(1.32%)	4(2.6%)	-	-	-	-		
Ceftazidime	1(0.3%)	-	2(1.17%)	-	1(2.38%)	-		
Ceftriaxone	8(2.63%)	1(0.65%)	4(2.35%)	-	-	-		
Cefixime	4(1.32%)	-	1(0.588%)	-	1(2.38%)			
Cefadroxil	18(5.92%)	1(0.65%)	-	-	-	-		
Cefazolin	2(0.66%)	3(1.95%)	-	-	-	-		
Cefuroxime	-	-	-	-	-	-		
Cefoperazone	-	-	-	-	-	-		
Cefoperazone sulbactum	7(2.30%)	-	-	-	-	-		
Cephalexin	1(0.33%)	-	-	-	-	-		
Cefotaxime	-	-	-	-	-	-		
Clindamycin	-	11(7.14%)	-	-	-	-		
Colistin	-	-	-	-	7(16.67%)	-		
Co-trimoxazole	5(1.64%)	-	7(4.11%)	-	-	-		
Erythromycin	1(0.33%)	-	-	3(4.84%)	-	-		
Ertapenem	17(5.6%)	-	9(5.29%	-	-	-		
Gentamycin	10(3.29%)	-	7(4.11%)	6(9.67%)	-	-		
Imepenem	5(1.64%)	-	3(1.76%)	-	-	-		
Linezolid	3(0.99%)	-	-	2(3.22%)	-	-		
Levofloxacin	35(11.51%)	22(14.28%)	21(12.35%)	19(30.64%)	20(47.62%)	-		
Meropenem	34(11.18%)	25(16.23%)	24(14.11%)	-	-	-		
Nalidixic Acid	23(7.56%)	21(13.63%)	21(12.35%)	-	-	-		
Netilmicin	25(8.22%)	18(11.69%)	14(8.23%)	11(17.75%)	8(19.04%)	5(100%)		
Norfloxacin	-	-	-	-	4(9.52%)	-		
Piperacillinn +Tazobactam	24(7.89%)	4(2.59%)	5(2.94%)	1(1.61%)	-	-		
Rifampicin	-	2(1.29%)	-	-	-	-		
Teicoplanin	-	-	-	2(3.22%)	-	-		
Tobramycin	7(2.30%)	-	13(7.65%)	-	-	-		
Tetracycline	-	4(2.6%)	-	13(20.97%)	-	-		
Tigecycline	-	1(0.65%)	-	1(1.61%)	-	-		
Vancomycin	14(4.60%)	6(3.89%)	7(4.11%)	-	-	-		
Total=426	304(71.36%)	154(36.15%)	170(39.91%)	62(14.55%)	42(9.86%)	5(1.17%)	123(28.87%)	135(31.69%)

In this present study, majorities of sepsis patients 304(71.36%) were infected with E.coli. Among of them, positive sensitivity of E.coli was greatly with amikacin 41(13.48%), levofloxacin 35(11.51%), meropenem 34(11.18%), netilmicin 25(8.22%), piperacillinn +tazobactam 24(7.89%) and nalidixic acid 23(7.56%). 154(36.15%) patients were infected with S. aureus. Among them, most of the S. aureus was positive sensitive with nalidixic acid 21(13.63%), amikacin 20(12.99%) and netilmicin 18(11.69%). 170(39.91%) of cases were infected with P. species. Among them, most of the cases of P. species had positive sensitive with meropenem 24(14.11%), levofloxacin 21(12.35%) and 20(11.7%). 62(14.55%) patients were infected with E.species. out of them, positive sensitivity was greatly seen in 19(30.64%) levofloxacin and 13(20.97%) tetracyclin. 42(9.86%) patients were infected with K.species. Among them, positive sensitivity was greatly seen 20(47.62%) levofloxacin and 8(19.04%) netilmicin. 5(1.17%) patients of actinobacter species were positive sensitive with netilmicin. 123(28.87%) patients were sterile. 135(31.69%) patients had no growth of organisms.

Discussion

Bacteremia may be transient, continuous or intermittent. Microorganisms present in the circulating blood, whether continuously, intermittently, or transiently, are a threat to every organ in the body. They can have serious consequences like shock, multiple organ failure, disseminated intravascular coagulation, etc. Thus, the blood stream infections constitute one of the most serious situations and, as a result, timely detection and identification of blood stream pathogen is important [8]. Blood culture plays an integral role in the evaluation of sepsis [9]. 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 [10]. Children with septicaemia present with fever, difficulty in breathing, tachycardia, malaise, refusal of feeds or lethargy [10]. A relative number of bacterial species causes the vast majority of bacteremia in normal children. Streptococcus pneumoniae, Haemophilus influenzae type B and Neisseria meningitidis are among the most common isolates and each may be associated with occult bacteremia as well as severe sepsis. Staphylococcus aureus, Salmonella species and Group A streptococci are also pathogenic that may be isolated from blood cultures in children who usually have moderate or severe illness. In otherwise normal children gram negative enteric species may cause bacteremia in association with pyelonephritis or diarrhea. The presence of foreign material such as catheter or central line enhances the risk of bacteremia with both gram positive (Coagulase negative Staphylococci, Staphylococcus aureus, and Streptococcus species) and gram negative bacteria [10]. In our study, a total of 426 sepsis patients were enrolled. Bacterial sensitivity was tested for the following antimicrobials: Amikacin, Amoxicillin-Clavulanic acid, Ampicillin, Aztreonam, Cefotaxime, Ceftazidime, Ceftriaxone, Cephalexin, Cefoxitin, Ciprofloxacin, Gentamicin, Imipenem, Meropenem, Piperacillin tazobactam, Tobramycin, linezolid and Vancomycin. And, it was observed that the incidence of bacteremia was higher in females (54%) compared to males (46%). Nimri et al., [11] and Joshi et al., [12] were observed a higher incidence of bacteremia in males. Bacteremia was more common in the age group of 1-5 years which was in contrast to studies done by Tsering et al., [13] and also Meremkwer et al., [8] who reported that bacteremia was most frequently encountered in newborns. Similar positivity rates were reported by other studies also [14,13]. Higher positivity rates of (43.78%) have been observed by Prabhu K et al., [15].

In this present study, majorities of sepsis patients 304(71.36%) were infected with E.coli. Among of them, higher positive sensitivity of E.coli was seen with amikacin 41(13.48%), levofloxacin 35(11.51%) and meropenem 34(11.18%). 154(36.15%) patients were S. aureus sepsis. Among them higher positive sensitive was seen with nalidixic acid 21(13.63%) and amikacin 20(12.99%).

170(39.91%) of cases had P. species sepsis. Among them, higher positive sensitive was with meropenem 24(14.11%) and levofloxacin 21(12.35%). 62(14.55%) patients were with E.species sepsis. Among them, higher positive sensitivity was seen with 19(30.64%) levofloxacin and 13(20.97%) tetracyclin. This study shows that amikacin, levofloxacin, meropenem and nalidix acid may represent current best empirical antibiotics for suspected E. coli, P.species and S. aureus infection. E. coli 304(71.36%), P.species 170(39.91%) and S. aureus 154(36.15%) were the most common bacteria were isolated in this study.

Resistance to broad-spectrum cephalosporins has emerged in strains of members of the family Enterobacteriaceae frequent use of cephalosporin drugs in the hospital setting. Endemic and epidemic nosocomial infections caused by ESBL producing Escherichia coli and Klebsiella pneumoniae cells represent a persistent problem in many parts of the world [16]. Epidemic strains of cephalosporin resistant E. coli and K. pneumoniae have been associated with increased morbidity and mortality in hospitalized patients. Appropriate isolation measures need to be taken, hand hygiene procedures may need reinforcement, possible environmental reservoirs need elimination, and antibiotics policies may need reconsideration [17,18].

The pattern of bacteria causing infections and their antibiogram vary widely from one country to another as well as from one hospital to other and even among the Intensive Care Units with one hospital. There also appears to be asignificant lack of studies highlighting susceptibility patterns of locally prevalent organisms [19]. Antibiotic treatment can be administered once the symptoms of infection were manifested on the conditions that the common bacterial agents causing infection in these patients as well as their antibiotic sensitivity and resistance patterns were known. Administration of antibiotic treatment at the beginning of manifestation of symptoms of the disease can even prevent the spread of the disease and may ultimately reduce rates of deaths, disabilities, and complications due to septicemia.

Conclusion

Sepsis is a very common in age 1 years to 5 years of children. E. coli infection was a very common micro-organism found in sepsis. Higher positive sensitivity of amikacin, levofloxacin and meropenem were seen with E. coli. Meropenem, levofloxacin and nalidixic acid were shown higher positive sensitivity with S. aureus. P. species had higher positive sensitive with levofloxacin, meropenem, nalidixic acid and levofloxacin. E. species had higher positive sensitivity with levofloxacin.

Hence, we concluded that the E. coli is the most predominant isolate organism while pseudomonas species and S. aureus are the second most common organisms in the northern region of Bihar. Amikacin, levofloxacin, meropenem and nalidixic acid may be the best choice of drugs for the treatment of E. coli, S. aureus and P. species infection.

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