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Original Article

Antimicrobial Susceptibility Pattern in Blood Culture at Chattogram

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Abstract

Background: *Blood stream infection is a predominant cause of morbidity and mortality in Bangladesh and needs urgent treatment with antimicrobial drugs. Blood culture is the gold standard for the diagnosis of blood infection. Patient's final outcome might be improved with detailed and organized surveillance studies on bloodstream isolates and their resistance. The present study deals with the isolation of blood culture isolates from patients of a hospital in Chattogram,Bangladesh and their antibiotic susceptibility pattern.*

Materials and methods: *A purposive cross sectional retrospective study was conducted with a total 100 suspected bacteremia patients in 6 months duration in different lab of Chattogram to determine bacteriological profile of blood culture and antibiogram of the isolates. Bacterial isolates and their antibiotic sensitivity test were done according to standard microbiological techniques.*

Results: *Approximately 53% of the cases are female and 75% in the under 5 years of age group. 36% of the culture isolates were Acinetobacter and other common isolates were Klebsiella (22%), Pseudomonas (18%), Salmonella typhi (17%), Staphylococcus aureus (4%), E.coli (3%). However, all the tested isolates were found mostly sensitive against Vancomycin, Gentamycin, Tazobactum. Penicillin had the highest overall resistance of (100%), followed by Ampicillin (100%) and Ceftazidime (90%). Cefepime, Cefuroxime, Cefixime, had overall resistance rates of 89%, 85%, 83% respectively. Highest drug resistance was found with Ampicillin (100%) and Penicillin (100%) against Acinetobacter. There were no isolates completely resistant to all the antibiotics tested.*

Conclusion: *This study highlights that surveillance detection of causative agents of blood stream infections and their antibiogram should be done regularly in the hospital.We expect our present work will be helpful for the healthcare professionals to provide improved treatment.*

Key words: Antibiogram; Bloodstream infection; Resistance; Sensitivity

INTRODUCTION

Bloodstream infection has self-limiting to life-threatening consequences remain one of the most important cause of morbidity and mortality worldwide.[1,2] Bacteremia is a global concern, and rapid increases of community-acquired and nosocomial bloodstream infections have been reported.[3,4] Although blood culture results not always come positive for bacteremia or septicemia patients, it remains the gold standard to diagnose infection in blood.[5] In the perspective of Bangladesh, people are taking medication without consulting with a physician, and this is a true reason in the way of emerging drug resistance. Similar antimicrobial abuse is also commonly observed in surrounding regions like India and Pakistan.[6,7] In contrast, drug resistance is less in Europe and America due to less antimicrobial abuse.[7]

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Therefore, it is reported that 30% of bloodstream infections do not get empirical therapy that leads to their poor outcome and increasing drug resistance.[8,9] The present study was undertaken to determine the types of bacteria and their antibiogram causing blood infection.Incidence of both Gram-positive and Gram-negative bacterial strains are increasing day by day.[10] The emerging of single, multi, and extensively drug resistance bacteria is alarming and a matter of huge concern worldwide.[11] The epidemiology of blood culture infection as well as their antimicrobial resistance varies with different geographic location.[12] Regional surveillance on blood culture isolates and their resistance pattern have a pivotal importance in treatment management. Those studies are not only important to be aware of the growing resistance of selected isolates but also help in providing effective empirical treatment.[13] It has particular importance in countries like Bangladesh,where early treatment is based on patient's clinical symptoms rather than the diagnostic results. Therefore, the patient's final outcome might be improved with kind of those regional studies. Detailed and organized surveillance studies on bloodstream isolates and their resistance are little in Bangladesh. Hence, the present study deals with the isolation of blood culture isolates from patients of a hospital in Chattogram,Bangladesh and their antibiotic susceptibility pattern.

MATERIALS AND METHODS

The study was carried out in Chattagram Maa Shishu O General Hospital, Max Hospital, Chattogram over a period from February 2022 to July 2022. A total of 100 samples of inward and outward patients clinically suspected as having bacteremia were evaluated for our study.The standard microbiological methods were used in this study.Blood samples were collected and directly incorporated into blood culture bottles. The bottles were incubated at 37°C for 24-48 hours in aerobically for visible growth to come. Following visible growth, 2–3 drops of the blood culture were inoculated on blood agar and MacConKey agar media.Blood culture bottles that do not show any significant growth were reported as culture negative.The culture-positive samples were identified by colony morphology, microscopy, and conventional biochemical tests as per the standard protocol followed in microbiology laboratory.[14]

The antibiotic susceptibility pattern of bacterial isolates was performed by Kirby–Bauer disc diffusion method on Mueller–Hinton agar plates and the results were recorded following the Clinical and Laboratory Standards Institute guidelines).[15] Various categories of antibiotics were used in our study, including aminoglycosides (Amikacin and gentamycin) beta-lactamases including penicillin (Tazobactum, vancomycin, ampivillin, cephalosporin, carbapenems (Imipenem, meropenem) cephalosporins (Ceftriaxone, cefuroxime, cefixime, ceftazidime, cefotaxime, cefepime) colistin, tigecyclin, amoxiclav, chloramphenicol, fluoroquinolones (Nitrofurantoin, levofloxacin and ciprofloxacin) macrolides (Azithromycin) and sulfonamides (Cotrimoxazole).

Ethical approval was taken from the Ethical Committee of Chattagram Maa Shishu O General Hospital.

RESULTS

Of all patients, 47% were male and 53% were female [Figure 1].

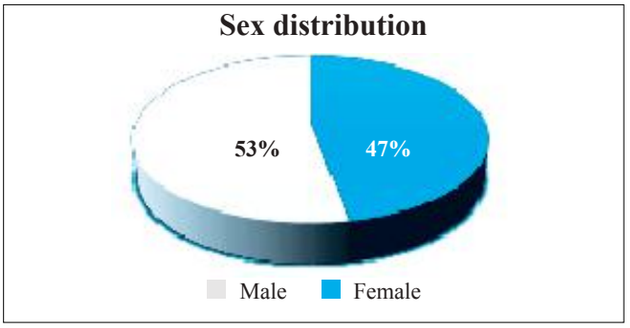

Figure 1 The percentage of sex-wise distribution of total patients

Table I The table showing the age-wise distribution of different age group of patients

Age	Percentage
Age interval (Years)	Total (%)
0 to 5	75%
6 to 10	7%
11 to 15	3%
16 to 20	1%
21 to 25	4%
26 to 30	4%
31 to 35	3%
36 to 40	1%
46 to 50	1%
81 to 85	1%

There was no very prominent difference in the age group of patients. Of a total of 100 patients 0–5, 6-10 and 21 to 25 years patients were 75%, 7% and 4%, respectively [Table I].

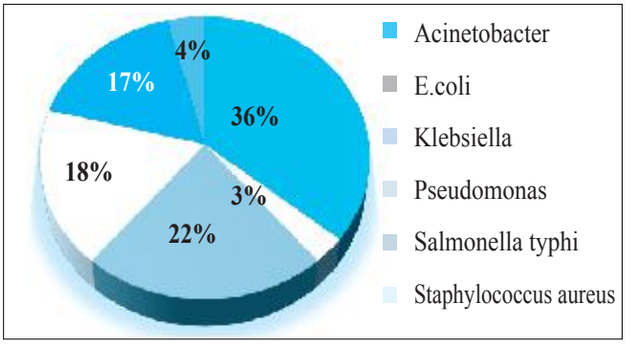

Figure 2 The total bacterial isolates obtained from positive blood culture samples

The frequently isolated species belonged Acinetobacter (36%) Klebsiella (22%) Pseudomonas (18%), Salmonella typhi (17%) Staphylococcus aureus (4%) E.coli (3%). The highest count was observed for Acinetobacter that was 36 among 100 isolates [Figure 2].

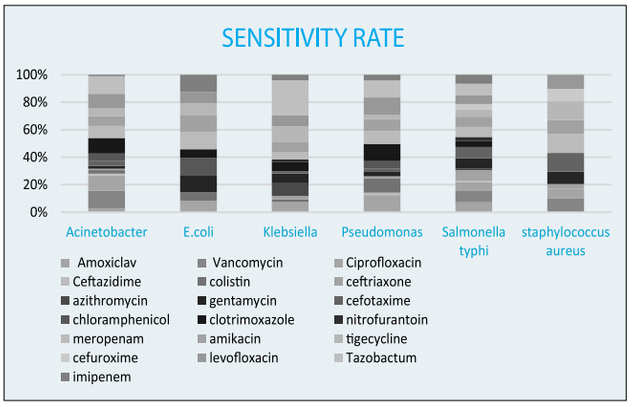

Figure 3 Antibiotic sensitivity profile of blood culture isolates

Antibiotic sensitivity test report showed all the tested isolates were found mostly sensitive against Vancomycin, Tazobactum, Levofloxacin, Ciprofloxacin [Figure 3]

Table II Specific antibiotic sensitivity profile of blood culture isolates

	SENSITIVITY RATE					
	Acinetobacter	E.coli	Klebsiella	Pseudomonas	Salmonellatyphi	staphylococusaureus
Imipenem	8%	100%	16%	33%	80%	
Tazobactum	100%		100%	100%	100%	
Levofloxacin	80%	67%	32%	100%	81%	75%
Cefuroxime					50%	67%
Tigecycline	46%	67%	46%	25%	62%	100%
Amikacin	55%	100%	29%	71%	92%	75%
Meropenam	68%	100%	20%	75%	90%	100%
Nitrofurantoin			7%		33%	
Clotrimoxazole	87%	50%	27%	100%	56%	
Chloramphenicol	43%	100%		43%		
Cefotaxime	26%		7%	20%	100%	100%
Gentamycin	17%	100%	28%	25%	92%	67%
Azithromycin			36%		14%	
Ceftriaxone	8%		10%	12%	92%	25%
Colistin	19%	50%	8%	84%		
Ceftazidime	11%			14%	14%	
Ciprofloxacin	85%	67%	29%	100%	80%	50%
Vancomycin	100%				100%	75%
Amoxiclav	22%				88%	

Species specific antimicrobial sensitivity rates are displayed in Table II. Acinetobacter, the most frequently isolated bacterium, showed sensitivity rates (80%-100%) to Vancomycin, Tazobactum, Clotrimoxazole and Levofloxacin.

Penicillin had the highest overall resistance of (100%) followed by Ampicillin (100%) and Ceftazidime (90%). Cefepime, Cefuroxime, Cefixime, had overall resistance rates of 89%, 85%, 83% respectively [Table III]

Table III Overall antimicrobial susceptibility profiles of bacteria isolates from patients

Antimicrobial agents	No. of Antimicro-bials agents	Resistant No (%)	Sensitive no (%)	Intermediate sensitive No (%)
Amikacin	87	34(39%)	52(60%)	1(1%)
Gentamycin	86	52(60%)	32(37%)	2(2%)
Penicillin	8	8(100%)	0(0%)	0(0%)
Tazobactum	18	1(6%)	16(89%)	1(6%)
Vancomycin	6	1(17%)	5(83%)	0(0%)
Ampicillin	32	32(100%)	0(0%)	0(0%)
Imipenem	34	19(56%)	10(29%)	5(15%)
Meropenem	62	17(27%)	42(68%)	3(5%)
Ceftriaxone	82	59(72%)	19(23%)	4(5%)
Cefuroxime	65	55(85%)	9(14%)	1(2%)
Cefixime	80	66(83%)	9(11%)	5(6%)
Ceftazidim	81	73(90%)	7(9%)	1(1%)
Cefotaxime	54	36(67%)	16(30%)	2(4%)
Cefepime	63	56(89%)	6(10%)	1(2%)
Colistin	58	38(66%)	19(33%)	1(2%)
Tigecyclin	63	23(37%)	30(48%)	10(16%)
Amoxiclav	39	26(67%)	13(33%)	0(0%)
Chloramphenicol	26	16(62%)	10(38%)	0(0%)
Nitrofurantoin	19	16(84%)	2(11%)	1(5%)
Levofloxacin	98	13(13%)	71(72%)	14(14%)
Ciprofloxacin	92	12(13%)	66(72%)	14(15%)
Azithromycin	27	8(30%)	6(22%)	13(48%)
Cotrimoxazole	52	15(29%)	36(69%)	1(2%)

Species specific antimicrobial resistance rates are displayed in Table IV. Acinetobacter, the most frequently isolated bacterium, showed high resistance rates (100%) to Penicillin, Ampicillin, Cefepime and 97% to Cefuroxime.The other two most common isolates (Klebsiella spp. and Pseudomonas spp.) exhibited resistance rates (80%-100%) to Ampicillin, Cefixime and Cefuroxime.

E. coli isolates were susceptible to Imipenem (100%), Meropenem (100%) And Gentamycin (100%) with resistance rate of 00%, 00% and 00% respectively. Klebsiella spp. were 100% sensitive to Tazobactum. Pseudomonas showed the highest resistance against Ampicillin (100%), Chloramphenicol (100%) and Ciprofloxacin (100%). Salmonella typhi showed the highest resistance against Penicillin (100%), Ampicillin (100%) and Colistin (100%). No isolates showing 100% resistance against all the antibiotics.

Table IV Specific antibiotic resistant profile of blood culture isolates

	RESISTANCE RATE					
	Acinetobacter	E.coli	Klebsiella	Pseudomonas	Salmonella typhi	staphylococcus-aureus
Cefipime	100%	100%	80%	93%	62%	
Imipenem	92%		42%	67%		
levofloxacin	11%	33%	27%		6%	
Cefuroxime	97%	100%	100%	93%	40%	33%
Tigecycline	35%	33%	37%	75%	13%	
Amikacin	45%		71%	29%		25%
Meropenam	22%		80%	19%	10%	
Nitrofurantoin		50%	93%		67%	
Clotrimoxazole	13%	50%	73%			33%
Chloramphenicol	57%			100%	57%	
Cefixime	96%	67%	90%	93%	31%	100%
Cefotaxime	74%	50%	86%	80%		
Gentamycin	80%		67%	75%	8%	33%
AMPICILLIN	100%	100%	100%	100%	100%	100%
Azithromycin					29%	100%
Ceftriaxone	84%	67%	85%	88%	8%	75%
Colistin	81%	50%	92%	8%	100%	
Ceftazidime	89%	100%	95%	86%	86%	100%
Ciprofloxacin	85%	67%	29%	100%	80%	
PENICILLIN	100%				100%	
Amoxiclav	78%		80%	88%		

DISCUSSION

Blood stream infection has a high morbidity and mortality worldwide. Physical signs and symptoms, though useful in identifying possible cases, have limited specificity. Definitive diagnosis is by bacteriologic culture of blood samples to identify organisms and establish antibiotic susceptibility. Rational and appropriate use of antibiotics requires understanding of common pathogens and drug resistance patterns in a community. Overall female patients suspected with bacteremia were higher (53%) in comparison to male patients (47%).Our findings showed that the higher percentage (75%) of suspected bacteremia patients was belonging to the under 5 aged group (0–5 years). In our study, Acinetobacter spp. was found predominant (36%). Acinetobacter Spp. (Non fermenting Gram negative bacilli) once considered as opportunistic pathogen, has recently been emerged as an important nosocomial pathogen worldwide,mostly involving patients with impaired host defence. Pneumonia and urinary tract infections are the most frequent menifestations. Increasing multidrug resistance pattern by Acinetobacter has narrowed range of drugs for treatment.In our study Acinetobacter showed highest resistance rates (100%) to Penicillin, Ampicillin, Cefepime and 97% to Cefuroxime. And Acinetobacter showed the sensitivity rates (80%-100%) to Vancomycin, Tazobactum, Clotrimoxazole and Levofloxacin. Klebsiella is emerging as common bacteria in hospital settings and it was the predominant Gram-negative organism in the present study. In this study, Klebsiella pneumoniae was found in 22% cases following Pseudomonas (18%), Salmonella typhi (17%), Staphylococcus aureus (4%) and E.coli (3%).

There were no isolates showing 100% resistance against all the antibiotics. Our data revealed that most of the isolates were MDR. There is no choice, but to mitigate the indiscriminate use of antibiotics.

Vancomycin, Tazobactum, Ciprofloxacin and Levofloxacin are found to be most effective against the majority of the organisms. Imipenem, Gentamicin and third-generation cephalosporins which previously had good sensitivity, also are becoming resistant. This observation shows that the problem of antibiotic resistance is a serious threat for treating serious bacterial infections. This increasing rate of drug resistance to commonly used antibiotics alarms clinicians and microbiologists for need of other effective antibiotics against infections caused by these drug resistance orgsnisms. The practice of prudent or judicious use of antibiotics is very important. This change in the sensitivity pattern of antimicrobials could be attributable to the fact that microorganisms tend to become resistant to commonly used antibiotics while remaining sensitive to the rarely used ones. In addition, antimicrobial sensitivity may differ in studies and at different times.

CONCLUSION

The present study emphasizes the age and sex-wise distribution of suspected patients and the prevalence of bacterial pathogens responsible for bloodstream infection with their antimicrobial resistance throughout the study period.Despite sensitivity of isolates to Vancomycin, Ciprofloxacin,Tazobactum and resistance pattern of isolates to various commonly used drugs is alarming for clinicians and hospital formulary group for the need of alternative effective antimicrobial to treat blood stream infections.However, this is not yet late if we can still alleviate the use of antibiotics through their rational use, stringent policy from hospital and government with implementation for effective management and drug resistance policy. Besides, a routine surveillance study for the baseline drug resistance pattern is simultaneously required to go far in combating drug resistance among pathogens.

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DISCLOSURE

All the authors declared no competing interest.

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