"Microbiological Profile of Blood Culture Isolates of Septicemia at A Tertiary Care Center In Kanpur"

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Abstract:

Introduction: Bloodstream infections (BSIs) have serious consequences such as shock, disseminated intravascular coagulation, multiple organ failure, and even death. Increased mortality due to sepsis and bacteremia impacts health-care activities severely early diagnosis plays a crucial role in managing BSI, and hence, prompt detection of such infections is a critical function of clinical microbiology laboratories.

Aim: The aim is to study the prevalence of microorganism causing bloodstream infections leading to septicemia in a tertiary care center.

Material and Methods: A total of 1030 blood samples were received in the Microbiology Department of a teritiary care Hospital from November 2017, to october 2018. The samples were processed as per standard techniques. Identification and antimicrobial susceptibility testing were done by and Kirby–Bauer disc diffusion method as per the Clinical and Laboratory Standards Institute guidelines.

Results: Of total 1030 blood culture samples received in laboratory, 68 (6.6%) were culture positive. The Gram-negative bacteria 35 (51.4%) were isolated in majority followed by Gram-positive bacteria 23 (33.82%) and Candida spp. 10 (14.70%). Klebsiella pneumoniae (71.4%%) was most common isolate among the Enterobacteriaceae. Whereas among the non-fermenting Gram-negative bacteria isolates, Pseudomonas spp. (80%) was most common. Gram-negative bacteria were resistant to commonly used antibiotics. 60–80% resistance was observed against carbapenems. Least resistance was seen to last resort antibiotics, i.e., tigecycline and colistin. Among the GPC isolates Staphylococcus aureus were 65.21% and Enterococcus spp was34.78%. Gram-positive bacteria were resistant to commonly used antibiotics.GPC isolates were 100% sensitive to Vancomycin, Linezolid and Teicoplanin .Candida albicans was 60%,Candida krusei (20%), and Candida glabrata (20%).

Conclusion: The increased isolation of multidrug-resistant Gram-negative bacteria is distressing, and further studies are advocated to help in the formulation of treatment and preventive strategies so as to curb such emergence.

Key words: Bloodstream infection, gram-negative bacteremia, sepsis.

Introduction

Invasion of the bloodstream by microorganisms constitutes one of the most serious situations in infectious disease. Microorganisms present in circulating blood whether continuously, intermittently, or transiently are a threat to every organ in the body.[1] Clinical presentation ranges from benign transient bacteremia with little or no symptoms to fulminate septic shock with high mortality. Bloodstream 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. Blood culture is a vital tool for the detection of BSI and remains the gold standard for bacteremia detection. Empiric antimicrobial therapy is based on knowledge of the microbial profile and their antimicrobial sensitivity Patterns, clinical and epidemiological data. Prevalence and susceptibility patterns of microorganism vary according to geography and even within the same hospital with time. [1,2] Changes in the local patterns of bacterial infection and susceptibility to various antibiotic should be critically evaluated periodically.[3]Therefore, this study was aimed at finding the resistance pattern of the Gram-negative bacteria isolates from blood in a tertiary care center and formulate strategy for empirical treatment in septicemia patients.

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Material and Methods

A total of 1031 blood culture samples were received in the Microbiology Department from (Nov 2017 to Oct 2018). Before administration of any antimicrobial therapy, blood culture sample was collected with aseptic precautions. 70% alcohol followed by 2% tincture iodine was used for surface disinfection at the site of collection. Adult and pediatric BACTEC blood culture bottles were inoculated with 10 ml and 3–5 ml of blood from adults and children, respectively. The bottles were then placed in BACTEC 9050 blood

culture instrument (Becton Dickenson, USA) and incubated at 37°C. After BACTEC instrument flagged positive, the vials were subjected to Gram staining and further inoculation on sheep blood agar and MacConkey agar (HiMedia). The culture plates were then incubated aerobically at 37°C for 18–24 h. Identification was done by standard protocols, and antimicrobial susceptibility testing were done by Kirby–Bauer disc diffusion method on Mueller–Hinton agar as per the CLSI guidelines. Strains of Staphylococcus aureus (ATCC25923), Escherichia coli (ATCC25922), and P. aeruginosa (ATCC27853) were used for culture and susceptibility testing as controls. [4, 5, 6]

Results

Of total 1030 blood culture samples received in laboratory, 68 (6.6%) were culture positive as shown in Table:1 The Gram-negative bacteria 35 (51.4%) were isolated in majority followed by the Gram-positive organisms 23 (33.82%) as shown in Table:2 Among Gram-positive organisms, S. aureus (15) was most common isolate followed by Enterococcus spp. (8). as shown in Table:1 Ten isolates (14.7%) of Candida spyware also isolated. as shown in Table:3 Among the Gram-negative bacteria isolates, 25 isolates were Enterobacteriaceae and 10 were non-fomenters. K. pneumoniae (25) was most common isolate among the Enterobacteriaceae followed by E. coli (8) and Enterobacter spp. (2). Among the non-fermenting Gram-negative bacteria, Pseudomonas spp. (8) was most common isolate followed by Acinetobacter spp. (2), respectively Among the Gram-positive isolates (23), and S. aureus (15) was most common followed by Enterococcus spp. (8). The prevalence of methicillin-resistant S. aureus (MRSA) was 73.3%. Highest resistance was observed with amoxiclav followed by ciprofloxacin (Figure 1). Among the 8 isolates of Enterococcus spp., 87.5% were resistant to ampicillin and 75% to high-strength gentamicin. All Gram-positive bacteria isolates were sensitive to linezolid, vancomycin, and teicoplanin.Gram-negative bacterial isolates were resistant to common antimicrobial agents. Among the Enterobacteriaceae family, 60-80% resistance was observed against carbapenems. Least resistance was seen to last resort antibiotics, i.e., tigecycline and colistin .Among the 10 isolates of Candida spp,Candida albicans was 60%,Candida krusei(20%), and Candida glabrata(20%).

Table no1: Prevalence of blood culture isolates

No. Of Samples	Positive Cultures	Percentage
1031	68	6.6%

Table 2: GNB isolates causing Septicaemia

Organism	N=35	Percentage
Klebsiella pneumonia	25	71.4%%
E.coli	8	22.8%
Enterobacter aerogenes	2	5.71%

Table 3: GPC isolates causing Septicaemia

Organism	N=23	Percentage
S.aureus	15	65.21%
Enterococcus spp	8	34.78%

Table 4: Fungal isolates causing Septicaemia

Organism	N=10	Percentage
C.albicans	6	60%
C.krusei	2	20%
C.glabrata	2	20%

Table 5: AST of the GNB isolates causing Septaecemia

Antibiotic	E. coli (8)	Klebsiella pneumonia (25)	Pseudomonas aeroginosa (8)
Amoxicillin-clavulanic acid	3 (37.5%)	4 (16%)	NA
Piperacillin tazobactum	4 (50%)	18 (72%)	7 (87.5%)
Cefataxime	3 (37.5%)	5 (20%)	NA
Ceftazidime	3 (37.5%)	4 (16%)	8 (0%)
Cefaperazone sulbactum	5 (62.5%)	5 (20%)	8(0)
Imipenem	7 (87.5%)	20 (80%)	7 (87.5%)
Meropenem	7 (87.5%)	20 (80%)	7 (87.5%)
Amikacin	6 (75%)	18 (72%)	7 (87.5%)
Gentamycin	5 (62.5%)	10 (40%)	6 (75%)
Ciprofloxacin	4 (50%)	10 (40%)	6 (75%)
Levofloxacin	4 (50%)	10 (40%)	6 (75%)
Colistin	8 (100%)	25 (100%)	8 (100%)
Tigecycline	8 (100%)	25 (100%)	-

Discussion

BSI is a challenging problem, and sometimes, it may be life threatening; therefore, timely detection, identification, and antimicrobial susceptibility testing of blood borne pathogens are one of the most important functions of diagnostic microbiology laboratory. In the present study, the culture positivity was 6.6%. This rate of isolation is consistent with many studies from India [7-10] and abroad. [11,12] High culture positivity ranging from 33.9% to 52.10% were reported by various other authors.[13],Such variation in blood culture positivity can be explained by various factors such as volume or the number of blood culture samples taken for study as explained by Lee et al.[14].

In this study, Gram-negative bacteria 35 (51.4%) were isolated in increased numbers as compared to the Gram-positive bacteria 23 (31.82%). Other studies also report Gram-negative bacteria as the most common cause of BSIs. [15, 16]

Isolation of 10 (14.7%) Candida spp. is similar to Kohli-Kochhar et al. [17] and Banik et al.[18] Among the Gram-positive bacteria isolates (23), S. aureus (15) was most common followed by Enter ococcus spp. (8). Similar findings were reported by Banik et al.[18] The prevalence of MRSA was 73.3 %. High susceptibility of Gram-positive bacteria isolates to vancomycin and teicoplanin is in conjunction with other studies. [18, 19]In the present study, K. pneumonia (25) was most common isolate among the Enter obacteria ceae family, followed by E. coli (8) and Enterobacter spp. (2). The antimicrobial susceptibility pattern, among the Enterobacteriaceae family, revealed a high level of resistance to common antimicrobials such as cephalosporin's (80%) and fluoroquinolones (67–80%). Similar results were noted in study done by Swati et al.[20]With regard to the third-generation cephalosporin's, quinolones, beta-lactam, and beta-lactamase inhibitor combinations, the in vitro efficacy against members belonging to family Enter obacteria ceae did not reveal good results. These antibiotics have been used and abused to a significant extent in our health-care settings, thus making the base for the development of resistance. Gram-negative bacteria are being reported with significant increase in resistance to these group of antibiotics in studies done worldwide.[21-23]Susceptibility (31.2%) to amikacin, however, revealed encouraging results against members of family Enter obacteria ceae similar to study done by Fayaaz et al.[24], followed by tigecycline and colitis in this study.[17] 60–80% resistance was observed against carbapenems. Impanel was found to be most effective among carbapenems. With expeditious development of resistance to carbapenems by Enter obacteriaceae members, its use should be advocated only according to susceptibility report in the hospital. Active surveillance is need of the hour in institutions treating immune compromised patients to curtail the rapid emergence of antibiotic resistance and help formulate guidelines for empirical therapy. Monitoring of the development of antimicrobial resistance would positively boost ongoing regimens in developing country like India.Carbapenem susceptibility against all Gram-negative bacteria is less than reported in studies done in other part of the country.[25]Among the NFGNBs (10), Pseudomonas spp. (8) was most common isolate followed by Acinetobacter spp. (2), respectively. Pseudomonas was reported as the most common isolate among the non-fomenters by Saghir et al.[26]In case of NFGNB isolated from blood, netilmicin and tobramycin displayed better in vitro efficacy than carbapenems. Similarly, beta-lactam/beta-lactamase inhibitor combinations comprising ampicillin/sulbactam, piperacillin/tazobactam, and cefoperazone/sulbactam as well as carbapenems revealed better results when compared to cephalosporins and fluoroquinolones. These results are in conformity to work done at othe centers.[18,19] can be caused by multidrug-resistant bugs. Active surveillance of resistance developing to antibiotics used in our hospital is the need of the hour for formulating better treatment strategy. Unless strict measures are implemented for promoting good prescription practices, the goal to control antibiotic resistance seems difficult. The emergence of multidrug-resistant Gram-negative organisms is alarming, and further studies are advocated to help in the formulation of treatment and preventive strategies so as to curb such emergence

Conclusion

With rampant injudicious use of antibiotics and increase in carbapenem-resistant isolates, we need to look into strict compliance of antimicrobial stewardship program to avoid the catastrophe that can be caused by multidrug-resistant bugs. Active surveillance of resistance developing to antibiotics used in our hospital is the need of the hour for formulating better treatment strategy. Unless strict measures are implemented for promoting good prescription practices, the goal to control antibiotic resistance seems difficult. The emergence of multidrug-resistant Gram-negative organisms is alarming, and further studies are advocated to help in the formulation of treatment and preventive strategies so as to curb such emergence.

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