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Original Research Paper

Microbiology

CLINICO-MICROBIOLOGICAL STUDY OF BLOOD STREAM INFECTIONS AMONG PATIENTS ADMITTED IN TERTIARY CARE HOSPITAL IN JAMMU PROVINCE

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ABSTRACT

Background: Bloodstream infection and bacteremia are synonymously used which generally refer to the significant growth of a microorganism in a blood culture obtained from the patient with clinical signs of infection. Early detection of causative organism and determination of its antimicrobial susceptibility profile are necessary to help clinicians decide appropriate empirical therapy, which ultimately decreases the emergence of resistance.Present study was carried out to investigate the etiology and trends of bacterial pathogens in blood stream infections among the adult patients our at tertiary care hospital in Jammu Province. **Material and Methods:** Present study was conducted in patients with age > 18 years admitted to medicine wards and ICUs with clinical criteria for systemic inflammatory response syndrome and/or sepsis where blood culture sent for bacteremia were considered for study. **Results:** Total 180 patients were studied in present study. Most common age group was >60 years age group (44%) followed by 41-60 years (37%). Male patients (61%) were more than female (39%). We noted positive blood culture report in 23% patients. Most common gram-positive organisms were staphylococci (37%) followed by methicillin-resistant staphylococcus aureus (20%)& staphylococcus epidermidis (5%). Most common gramnegative organisms were escherichia coli (12%), klebsiella pneumoniae (10%) & pseudomonas aeruginosa (7%).In present study meropenem, imipenem, linezolid, vancomycin, clindamycin& piperacillin-tazobactam were sensitive drugs against gram-positive bacteria.In present study imipenem, ertapenem, vancomycin, linezolid, piperacillintazobactam&gentamycin were sensitive drugs against gram-negative bacteria. **Conclusion:** Rational use of antibiotics, formulation of antibiotic policy, and prompt therapy of bloodstream infections for the effective management and prevention of drug resistance are needed to reduce morbidity & mortality due to bloodstream infections.

KEYWORDS : blood stream infections, etiology, Sepsis, Blood culture

INTRODUCTION

Bloodstream infections (BSIs) are defined as the presence of viable infectious microorganism in the bloodstream causing clinical illness.[1] The term bloodstream infection and bacteremia are synonymously used which generally refer to the significant growth of a microorganism in a blood culture obtained from the patient with clinical signs of infection.[2]

Blood stream infections (BSI) are common and associated with morbidity and mortality especially in intensive care unit patients.[3] Bloodstream infections (BSI) are characterized as severe disorders since they are acute events and usually result in serious consequences like shock, disseminated intravascular coagulation, multiple organ failure, and even death. Increased hospital stay and associated costs are the most troublesome consequences.

In the developing countries, changing epidemiology, lack of standard antimicrobial guidelines in locality, emergence of antimicrobial resistance, wide application of new medical technologies like rampant usage of indwelling devices and paucity of good diagnostic facilities are major denominators for surge in BSI associated morbidity and mortality.[5]

Critically ill patients are particularly predisposed to the acquisition of BSIs, which occur in approximately 7% of all patients within the first month of hospitalization in Intensive Care Unit (ICU).[6] Early detection of causative organism and determination of its antimicrobial susceptibility profile are necessary to help clinicians decide appropriate empirical therapy, which ultimately decreases the emergence of resistance.

Present study was carried out to investigate the etiology and trends of bacterial pathogens in blood stream infections among the adult patients our at tertiary care hospital in Jammu Province.

MATERIAL AND METHODS

Present study was conducted in the Department of Microbiology, Govt. Medical College and Hospital, Jammu. Study design was prospective & observational. Study duration was of 1 year (December 2018 to Nov 2019).

Blood samples from patients with age > 18 years from ICUs, medicine/surgery/gynaec wards or OPDs with clinical suspicion of bacteremia sent to microbiology laboratory were considered for study.

Blood samples were collected under all aseptic & antiseptic measures. Samples were collected by phlebotomy. Disinfection of phlebotomy site was done with 70% alcohol followed by 2% tincture iodine. Five ml blood was collected & inoculated in 50 ml brain heart infusion (BHI) broth . Blood culture bottles were incubated at 37°C aerobically for 24 hrs 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 days of incubation, after doing a final subculture. BSI was confirmed by using microbiological blood culture. The obtained positive blood culture bottles were gram stained and immediately reported to respective wards. The finding was further confirmed by growth on Blood agar and MacConkey agar. Identification and Antibiotic susceptibility tests were performed according to standard guidelines.

Results of the blood culture and antimicrobial sensitivity testing, outcome were documented for all study patients. Collected data was entered in Microsoft excel sheet. Statistical analysis was done using descriptive statistics.

RESULTS

Total 180 patients were studied in present study. Most common age group was >60 years age group (44%) followed by 41-60 years (37%). Male patients (61%) were more than female (39%). We noted positive blood culture report in 23% patients.

Table 1: Demographic and clinical characteristics of patients with suspected bloodstream infections

Characteristics	Number of patients	Percentage
Age groups (years)		
19–40	34	19%
41–60	67	37%
>60	79	44 %
Gender		
Male	109	61%
Female	71	39%
Blood culture report		
Positive	41	23%
Negative	139	77%

Respiratory infection (29%), genitourinary infection (22%) &metabolic disorders (12%) were most common primary clinical diagnosis for source of bacteremia.

Table 2: Primary clinical diagnosis for source of bacteremia

Primary diagnosis Cases Percentage	Number of patients	Percentage
Respiratory infection	53	29%
Genitourinary infection	39	22%
Metabolic disorders	22	12%
Cardiovascular system infection	16	9%
Gastrointestinal infection	13	7%
Central nervous system infections	12	7%
Skin and soft tissue infections	10	6%
Immunosuppressive conditions	7	4%
Autoimmune disorders	5	3%
Nonspecific	3	2%

Most common gram-positive organisms were staphylococci (37%) followed by methicillin-resistantstaphylococcus aureus (20%)& staphylococcus epidermidis (5%). Most common gram-negative organisms were escherichia coli (12%), klebsiella pneumoniae (10%) & pseudomonas aeruginosa (7%).

Table 3: Distribution of organisms in positive samples.

Organism	Number of patients	Percentage
Gram positive		
Staphylococcus aureus	15	37%
Methicillin-resistant Staphylococcus aureus	8	20%
Staphylococcus epidermidis	2	5%
Staphylococcus hominis	1	2%
Enterococcus faecalis	2	5%
Gram negative		
Escherichia coli	5	12%
Klebsiella pneumoniae	4	10%
Pseudomonas aeruginosa	3	7%
Acinetobacter baumannii	2	5%
Acinetobacter lwoffii	1	2%
Enterobacter cloacae	1	2%
Fungi		
Candida glabrata	1	2%
Candida tropicalis	1	2%

In present study meropenem, imipenem, linezolid, vancomycin, clindamycin & piperacillin-tazobactam were sensitive drugs against gram-positivebacteria.

In present study imipenem, ertapenem, vancomycin, linezolid, piperacillintazobactam & gentamycin were sensitive drugs against gram-negative bacteria.

Table 4: Antibiotic Susceptibility Pattern Of Gram-positive Bacteria.

Antibiotics	Sensitive (Percentage)		
	Staph (n=15)	MRSA (n=8)	enterococcus (n=2)
Meropenem	15 (100%)	8 (100 %)	2 (100%)
Imipenem	15 (100%)	8 (100 %)	1 (50%)
Linezolid	15 (100%)	8 (100 %)	2 (100%)
Vancomycin	12 (80%)	6 (75 %)	1 (50%)
Clindamycin	12 (80%)	8 (100 %)	1 (50%)
Piperacillin-tazobactam	9 (60%)	3 (38 %)	1 (50%)
Gentamicin	11 (73 %)	7 (88 %)	1 (50%)
Levofloxacin	6 (40%)	2 (25 %)	1 (50%)
Ciprofloxacin	4 (27 %)	3 (38 %)	1 (50%)
Cefotaxime	4 (27 %)	3 (38 %)	1 (50%)
Erythromycin	4 (27 %)	5 (63 %)	1 (50%)
Cotrimoxazole	4 (27 %)	3 (38 %)	1 (50%)
Trimethoprim-sulphamethoxazole	4 (27 %)	5 (63 %)	1 (50%)
Doxycycline	4 (27 %)	6 (70 %)	1 (50%)
Teicoplanin	4 (27 %)	3 (38 %)	2 (100%)

Table 5: Antibiotic susceptibility pattern of gram-negative bacteria.

Antibiotics	Sensitive (Percentage)			
	E coli (n=1)	psedomonas (n=3)	klebsiella (n=4)	acenobacter (n=1)
Imipenem	1 (100%)	3 (100%)	4(100%)	1 (100%)
Vancomycin	1 (100%)	2 (67%)	4(100%)	1 (100%)
Ertapenem	1(100%)	3 (100%)	4(100%)	1(100%)
Linezolid	1(100%)	2 (67%)	3 (75%)	1 (100%)
Piperacillin-tazobactam	1(100%)	3 (100%)	4(100%)	1 (100%)
Gentamicin	1(100%)	3 (100%)	4 (100%)	1(100%)
Levofloxacin	Resistant	2 (67%)	2 (50%)	1(100%)
Clindamycin	Resistant	2 (67%)	3 (75%)	Resistant
Ciprofloxacin	Resistant	1 (33%)	1 (25%)	Resistant
Cefotaxime	Resistant	1 (33%)	1 (25%)	Resistant
Ampicillin	Resistant	1 (33%)	1 (25%)	Resistant
Erythromycin	1(100%)	1 (33%)	1 (25%)	Resistant
Cotrimoxazole	Resistant	1 (33%)	1 (25%)	Resistant
Meropenem	1(100%)	2(67%)	4(100%)	Resistant
Amikacin	1(100%)	2(67%)	3(75%)	1(100%)
Azithromycin	Resistant	2(67%)	1 (25%)	Resistant
Nitrofurantoin	Resistant	2(67%)	1 (25%)	Resistant
Trimethoprimsulphamethoxazole	Resistant	1 (33%)	1 (25%)	1(100%)
Doxycycline	Resistant	1 (33%)	1 (25%)	1(100%)

DISCUSSION

Clinically, bacteremia may range from self-limiting infections to life threatening septicemia that requires prompt and rational antimicrobial treatment. Despite the vast improvement in diagnostic techniques, blood culture remains the gold standard for the diagnosis.[7]

Blood culture bacterial isolates vary as per the geographical area. Changes in the local patterns of bacterial infection and susceptibility to various antibiotic should be critically evaluated periodically. Understanding the regional epidemiological and microbiological data is of great importance when handling potentially life-threatening infections such as BSI, since accuracy in predicting pathogens and the resistance profile are crucial for successful therapy.[8]

Diabetes mellitus is a metabolic disorder where there is increased risk of opportunistic infections. Studies have shown that diabetic subjects had a much higher rate of infections like bone and joint infection or cellulitis, compared to non-diabetic controls.[9] Diabetes is also an important cause of infection-related hospitalisation and death.[9]

Catheter-related BSIs (defined as the growth of the same pathogen from catheter tip and peripheral blood culture), which represent up to 30% of cases, and primary BSIs, accounting for around 35% of cases, are the most common types of BSI.[10] VentilatorAssociated-Pneumonia (VAP), which is a frequent complication when mechanical ventilation is required, is bacteremic in around 15% of cases, and represent the most common source of secondary bacteremia in critically ill patients.[11]

Early detection and treatment of BSI is very important for improved clinical outcome of the patient. Isolation of the etiological agent is the gold standard method of diagnosis. We noted 23% bloodstream infections (BSIs) among study patients. Isolation rates of bacteria from other Indian studies performed by routine microbiological blood culture showed a wide variation. Our findings of BSI are similar to the reported rates by Alam et al.[12] (20.9%), Arora and Devi[13] (20.02%). Singh et al.[14] (10.16%) and Gupta and Kashyap[15] (16.5%) noted less BSIs than present study. The variation in the BSI rates among these studies may be attributable to sampling volume of blood culture, culture system, and medium formulation as well as type of patients enrolled in the study.

In India, isolation rate of BSI pathogens differs due to the inappropriate administration of broad-spectrum antibiotics to patients before coming to tertiary care hospitals. Staphylococcus aureus, MRSA, enterococci, Coagulase negative staphylococci (CoNS)and alpha-hemolytic streptococci, Acinetobacter species, Pseudomonas aeruginosa, Escherichia coli, Klebsiella pneumoniae have been reported as a predominant Gram-positive and Gramnegative bacteria implicated in causing blood stream infection.[16,17]In study by Kumar P et al.[18], isolation rate is 32.2%. Of these, S.aureus were (42.23%) followed by E.coli (16.77%), CONS (14.90%), Klebsiella spp (11.20%), Pseudomonas (6.83%), Proteus spp (4.97%) and Citrobacter spp (3.10%).

Candida bloodstream infections (BSI) have become a major problem in tertiary-care hospitals worldwide. Candidemia has been observed particularly among patients hospitalized for long periods, who have been exposed to antibiotics, immunosuppressive therapy, parenteral nutrition, and multiple invasive medical procedures.[19]

Overall, 12% of patients included in the present study had BSI due to MDR pathogens. A recent study found that the male sex, age ≥ 60, previous antimicrobial therapy, liver disease and bacteremia caused by K. pneumoniae were independent factors associated with MDR infection.[20]

In India, the main reason for development of antimicrobial resistance could be due to irrational use of antibiotics, over the counter availability of higher / broader antimicrobial agents, higher prevalence of infection and poor monitoring of antibiotic susceptibility surveillance in hospitals.[21]BSIs results in increased suffering and costs for patients in the form of prolonged stays and sepsis. 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

Blood stream infections are a significant source of morbidity & mortality among critically ill patients. Rise in BSIs due to gram negative organisms along with overall incidence of multidrug resistance is worrisome. Rational use of antibiotics, formulation of antibiotic policy, and prompt therapy of bloodstream infections for the effective management and prevention of drug resistance are neededto reduce morbidity & mortality due to bloodstream infections.

Antibiotics	Sensitive Percentage						
	Staph (n=15)	MRSA (n=8)	enterococcus (n=2)	E coli (n=1)	psedomonas (n=3)	klebsiella (n=4)	acenobacter (n=1)
Imipenem	15	8	1	1	3	4	
Vancomycin	12	6	1	1	2	4	
Linezolid	15	8	2	1	2	3	
Piperacillintazobactam	9	3	1	1	3	4	1
Gentamicin	11	7	1	1	3	4	1
Levofloxacin	6	2	-	-	2	-	1
Clindamycin	12	8	-	-	-	-	
Ciprofloxacin	4	-	-	-	-	-	
Cefotaxime	-	-	-	-	-	-	
Ampicillin	-	-	-	-	-	-	
Erythromycin	-	5	1	1	-	-	
Cotrimoxazole	-	-	-	-	-	-	
Meropenem	-	-	-	1	2	4	
Amikacin	-	-	-	1	2	3	1
Azithromycin	-	-	-	-	2	-	
Nitrofurantoin	-	-	-	-	2	-	
Trimethoprimsulphamethoxazole	-	5	-	-	-	-	1
Doxycycline	-	5	1	-	-	-	1
Ertapenem	-	-	-	-			1
Teicoplanin	-	-	5	-			

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