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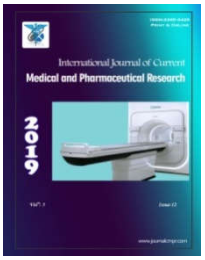

Research Article

BACTERIOLOGICAL PROFILE AND ANTIMICROBIAL SUSCEPTIBILITY PATTERNS OF BLOODSTREAM INFECTIONS IN A TERTIARY CARE HOSPITAL, AIMSR, BATHINDA

Manjot Kaur and Amandeep Kaur*

Deptt. of Microbiology, Adesh Institute of Medical Sciences and Research, Bathinda

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ABSTRACT

Objectives: Blood stream infections have many serious consequences like shock, disseminated intravascular coagulation, multiple organ failure and even death. Blood culture is thus necessary to identify causative agents of BSI's and to choose an appropriate antimicrobial therapy. A cross-sectional study was conducted with an objective to determine the bacteriological profile and antibiogram of organisms causing bloodstream infection for a period of 6 months from January 2019 to June 2019.

Methods: Blood specimens were received in Bacteriology laboratory in blood culture bottles and incubated in BacT/ALERT® 3D system (bioMerieux, Durham, NC, USA) a fully automated blood culture system for detection of aerobic bacteria. Identification of isolates was done by studying their colony characteristics, Gram staining morphology and various biochemical reactions. Antimicrobial susceptibility testing was done by Kirby Bauer disc diffusion method and results were interpreted as per Clinical Laboratory Standards Institute guidelines.

Results: A total of 555 blood samples were processed during the study period. Among them, 94 (16.8%) yielded significant growth and 461 (83.2%) samples showed no growth. Coagulase-negative Staphylococci (CONS) were the most common isolates among Gram-positive cocci whereas *E. coli* was the most commonly isolated Gram-negative bacilli. Gram positive isolates were found to be highly susceptible to vancomycin and linezolid followed by nitrofurantoin, clindamycin and gentamicin. Gram negative bacteria showed maximum susceptibility to colistin followed by amikacin, imipenem and meropenem.

Conclusion: There is an increasing emergence of antimicrobial resistance in both Gram positive and Gram negative bacteria indicating active microbial surveillance in all clinical settings. Monitoring of data regarding the prevalence of bacteria and their resistance patterns would benefit in formulating policies for empirical antimicrobial therapy particularly in developing countries.

INTRODUCTION

Bloodstream infections (BSI's) are associated with a high mortality rate of 20% - 50% and one of the most common health-care associated infections.[1] Invasion of the bloodstream by microorganisms constitutes one of the most serious situations in infectious disease. Microorganisms present in circulating blood whether continuously or transiently is a threat to every organ. The excessive and irrational use of antibiotics has led to an increase in the multidrug resistant bugs and thus worsened the condition. Blood stream infections have serious consequences like shock, disseminated intravascular coagulation, multiple organ failure and even death.[2]

A variety of bacteria have been recovered from the bloodstream, both Gram positive and Gram negative. Common ones are members of family *Enterobacteriaceae, Staphylococcus aureus*, *Streptococcus pneumoniae*, *Enterococci and Pseudomonas areuginosa.* [3] The prevalence of resistance of blood borne isolates is increasing and it also varies in accordance with geographical and regional location. The infection caused by multidrug resistant organisms is more likely to prolong the hospital stay, increase the risk of death and require treatment with more costly antibiotics.[4] BSI is a major cause of morbidity and mortality worldwide. Treatment with antibiotics is the method of treatment of BSI along with management of severe sepsis and septic shock.[5] During last few years, clinicians have witnessed a growing incidence of BSI's along with resistance against commonly used antimicrobials.[6] Therefore, this study was undertaken to detect the prevalence of microorganisms isolated from blood and study their antimicrobial susceptibility patterns in our tertiary care hospital. A cross-sectional study was conducted in Microbiology Department of Adesh Institute of Medical Sciences and Research (AIMSR), over a period of six months from January 2019 to June 2019 after the approval from

Corresponding author:* **Amandeep Kaur
Deptt. of Microbiology, Adesh Institute of Medical Sciences and Research, Bathinda

AIMSR Research committee and Ethics Committee, Adesh University. with following objectives:

1. To isolate bacteria causing blood stream infection.
2. To identify the isolates by various Confirmatory/Biochemical tests.
3. To perform the antimicrobial susceptibility of various bacterial isolates.
4. To study the prevalence of bacteria causing BSI and their antibiogram.

Blood samples were received from patients of all age groups including IPD and ICU and were processed in Bacteriology Laboratory as per standard microbiological procedures. In case of adults, 5-10 ml (average 7 ml) and pediatrics 1-5 ml (average 3 ml) blood sample was collected aseptically and inoculated into BacT/ALERT® FA and PF plus-aerobic bottles (bioMerieux, Durham, NC, USA), respectively. After inoculation, these bottles were immediately sent to bacteriology laboratory and were incubated in BacT/ALERT® 3D system (bioMerieux, Durham, NC, USA) a fully automated blood culture system for detection of aerobic growth in blood samples. The blood specimens were incubated for a maximum period of 5 days, and if there was no growth, the result was read as negative. In case of positive growth, the BacT/ALERT®system (bioMerieux, Durham, NC, USA) automatically showed an alert.[7] The positive blood culture bottles were taken out and subcultured on blood agar and MacConkey agar plates. Plates were incubated at 37º C for 24-48 hours under aerobic conditions. Provisional identification of isolates was done on the basis of Gram staining morphology and colony characteristics on Blood Agar and MacConkey agar media. A battery of biochemical tests were performed for confirmation of the isolates upto genus and species level.[8] Antimicrobial sensitivity testing was performed as per Institutional antibiotic policy for first line and second line antibiotics by Kirby Bauer disc diffusion method [9] and results were interpreted as recommended by Clinical and Laboratory Standards Instiitute (CLSI) guidelines.[10]

RESULTS

A total of 555 blood samples were processed in this study over a period of six months. Among them, 94 (16.9%) yielded significant growth; 461 (83.2%) samples showed no growth. The prevalence of blood stream infection in present study was found to be 16.9%. Out of 94 isolates, 58 isolates were from ICU and 36 isolates were from IPD including Surgery, Medicine, OBG and Cardiology departments. Out of total 94 isolates, 50 (53%) were from males and 44 (47%) were from females. Maximum isolates (38%) were obtained from age-group of 41-60 years.

Among 94 blood stream infection isolates, 40 were from department of ICU, 20 were from Cardiology, 22 were from emergency, 04 each from surgery and medicine, 02 each from OBG and NICU/ PICU. Bacteriological profile of various isolates is shown in Table 1.

Table 1 Bacteriological Profile of Various Isolates

Sr.No.	Bacterial isolates obtained	No. of bacterial isolates	Percentage of bacterial isolates (%)
1.	*Coagulase negative Staphylococci*	29	30.85
2.	*Escherichia coli*	20	21.2
3.	*Staphylococcus aureus*	07	7.44
4.	*Klebsiella pneumoniae*	10	10.6
5.	*Acinetobacter baumannii*	05	5.31
6.	*Acinetobacter lwoffii*	03	3.19
7.	*Salmonella Typhi*	06	6.38
8.	*Pseudomonas aeruginosa*	02	2.12
9.	*Enterococcus faecium*	02	2.12
10.	Others	10	10.6
	TOTAL	94	100

Antibiogram of Coagulase negative Staphylococci, *Staphylococcus aureus*, *E.coli* and *K. pneumoniae* is shown in Tables 2, 3, 4 and 5 respectively.

In this study, gram positive isolates - CONS & *S.aureus* were found to be highly sensitive to vancomycin followed by linezolid, nitrofurantoin, clindamycin, gentamicin . However, they showed resistance towards oxacillin, levofloxcin and benzylpencillin. Gram negative bacteria- *E.coli, Klebsiella pneumoniae, S.Typhi,&A.baumannii* were isolated and found to be highly sensitive to colistin followed by amikacin, imipenem and meropenem. They showed resistance to ciprofloxacin, ceftazidime and gentamicin.

Table 2 Antibiogram of Coagulase negative Staphylococcus (n=33)

Antimicrobial agents	No. of sensitive isolates (%)	No. of resistant isolates (%)
Benzylpenicillin	0 (0%)	33(100%)
Oxacillin	1 (3%)	32 (97%)
Gentamicin	23(69.6%)	10 (30.3%)
Ciprofloxacin	2 (6%)	31 (94%)
Levofloxacin	2 (6.%)	31 (94%)
Clindamycin	14 (43%)	19 (57%)
Linezolid	30 (91%)	3(9%)
Tetracycline	15 (46%)	18(54%)
Nitrofurantoin	29 (88%)	4(12%)
Vancomycin	31(94%)	2 (6%)

Table 3 Antibiogram of *Staphylococcus aureus* (N=8)

Antimicrobial agents	No. of sensitive isolates (%)	No. of resistant isolates (%)
Benzylpenicillin	1(12%)	7(88%)
Oxacillin	0(0%)	8(100%)
Gentamicin	6(75%)	2(25%)
Ciprofloxacin	1(12%)	7(88%)
Levofloxacin	0(0%)	8(100%)
Clindamycin	4(50%)	4(50%)
Linezolid	6(75%)	2(25%)
Tetracycline	4(50%)	4(50%)
Nitrofurantoin	7(88%)	1(12%)
Vancomycin	8(100%)	0(0%)

Table 4 Antibiogram of *Escherichia coli* (n=20)

Antimicrobial agent	No. of sensitive isolates (%)	No. of resistant isolates (%)
Piperacillin/Tazobactum	7(35%)	13(65%)
Ceftazidime	1(5%)	19(95%)
Imipenem	10(50%)	10(50%)
Meropenem	11(55%)	9(45%)
Gentamicin	10(50%)	10(50%)
Colistin	19(95%)	1(5%)
Cotrimoxazole	02(10%)	18(80%)
Ciprofloxacin	01(5%)	19(95%)
Amikacin	13(65%)	7(35%)

Table 5 Antibiogram of *Klebsiella pneumoniae* (N=10)

Antimirobial agent	No. of sensitive isolates (%)	No. of resistant isolates (%)
Piperacillin/Tazobactum	1(10%)	9(90%)
Ceftazidime	2(20%)	8(80%)
Imipenem	5(50%)	5(50%)
Meropenem	7(70%)	3 (30%)
Genatamicin	2(20%)	8 (80%)

Colistin	9(90%)	1(10%)
Cotrimoxazole	3(30%)	7(70%)
Ciprofloxacin	2(20%)	8 (80%)
Amikacin	4(40%)	6 (60%)

DISCUSSION

In the present study, a total of 94 isolates were obtained from 555 blood samples processed for bacterial culture. The prevalence of blood stream infection in present study was found to be 16.9%. A study by Singh *et al* [11] reported that out of 4862 blood samples, 494 samples were positive for blood stream infection with 10.16% prevalence. Mansury *et al* [12] reported that out of 491 blood cultures 74 samples showed growth with 15.1% prevalence. Dash *et al*[13] and Sarwariya *et al*[14] reported 16.38% and 17.2% prevalence which is almost similar to this study.

In the present study, blood stream infection was highest (37.2%) in age group 41-60 years followed by 27.6% in age group 61-80 yrs, 26.5 % from age group 21-40 years, 8.5% in age group 0-20 years, and lowest 2.1% from age group above 80 years. The results of this study are quite similar to Vasudeva *et al*[15] and Mehta *et al*[16] who also recorded maximum prevalence of blood stream infection in age group of 41-60 years. In our study, higher prevalence of BSI was seen in males which coincides with that of Mohamadi *et al*[17], Vaniya *et al*[18], Jhajhria *et al*.[19]

In our study, Coagulase-negative staphylococci (CONS) were the most common isolates among Gram-positive cocci whereas *E. coli* was the most commonly isolated Gram-negative bacilli which corerelates with many other studies. [13][15] [18]

In this study, Gram positive isolates- CONS and *S. aureus* were commonly found to be highly sensitive to vancomycin (100%).They showed resistance towards oxacillin, levofloxcin and benzylpencillin. In a study by Dash *et al*[13] ; Vasudeva *et al* [15] and Pandey *et al*[20] maximum susceptibility of Gram positive isolates was recorded towards vancomycin and linezolid.

Among gram negative bacteria- *E.coli, Klebsiella pneumoniae, S.Typhi* and *Acinetobacter baumannii* were isolated and to be highly sensitive to colistin followed by amikacin, imipenem and meropenem. Similar results were observed in the studies done by Dash *et al*. [13] and Vasudeva *et al*[15]

CONCLUSION

Coagulase negative Staphylococci , *Escherichia coli* and *Klebsiella pneumoniae* were the predominant blood borne pathogens isolated in our hospital . Gram-negative bacilli were sensitive to colistin, imipenem and meropenem. The majority of Gram-positive cocci were sensitive to vancomycin, clindamycin and linezolid. There is an increasing emergence of antimicrobial resistance in both Gram positive and Gram negative bacteria indicating active microbial surveillance in all clinical settings. Monitoring of data regarding the prevalence of bacteria and their resistance patterns would benefit in formulating policies for empirical antimicrobial therapy particularly in developing countries.

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Conflict of interest statement

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