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Bacteriological Profile of Blood Culture and Antibiogram of the Bacterial Isolates in a Tertiary Care Hospital

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ABSTRACT

Introduction: Blood stream infections remain one of the most important causes of morbidity and mortality worldwide and needs urgent treatment with antimicrobial drugs.
Methods: A prospective cross sectional study was conducted in 6 months duration in a tertiary care hospital to determine bacteriological profile of blood culture and antibiogram of the isolates. Bacterial identification and their antibiotic sensitivity test were done according to standard microbiological techniques.
Result: 345/3324 (10.3%) bacterial growth was detected in blood culture and *S. aureus*, *Salmonella spp.* and *Acinetobacter spp.* were common isolates. AST report showed gram positive bacteria were sensitive to vancomycin and gentamicin; however, none of the gram negative bacteria isolated from blood stream infections were highly sensitive to commonly used antibiotics.
Conclusion: Surveillance detection of causative agents of blood stream infections and their antibiogram should be done regularly in the hospital.

Keywords: Blood, culture, antibiogram, hospital

INTRODUCTION

Blood stream infections, ranging from self limiting bacteraemia to life threatening septicaemia, remain one of the most important cause of morbidity and mortality worldwide.[1,2] Bacteria isolated from blood stream infections are numerous and diseases related to them need urgent treatment with antimicrobial drugs.[3-6] On the other hand, bacterial resistance to various antimicrobials is another common problem and is topic of concern globally.[3,7,8] So, regular surveillance of blood culture isolates and their antibiogram in the hospital seems essential for determining empiric antibiotic therapy and also for alerting clinicians to emerging pathogens that may pose a threat to the community.[3,9,10] As there are only few published data on etiology of blood culture isolates and their antibiogram in various time durations, it appears necessary to determine bacteriological profile of blood culture and antibiogram of the bacterial isolates in our set-up.

METHODS

After obtaining ethical approval from Nepal Medical College-Research and Ethical Sub-Committee, All blood samples received for culture and sensitivity in Clinical Microbiology Laboratory of Nepal Medical College Teaching Hospital during March, 2016 – August, 2016 (6 months duration) were included and processed in the study. In brief; blood collected aseptically was mixed with BHI broth in a blood culture bottle. 5 ml blood in 45 ml BHI broth in case of adults, and 2 ml blood in 18 ml BHI broth in case of children (In 1:10 ratio) were mixed in blood culture bottle aseptically and further, it was incubated at 37 ^{0}c in incubator. On next day, if turbidity appears, subculture was done or if there was no turbidity, blind subculture

was done onto Blood agar and MacConkey agar. In case of no turbidity, further incubation upto 7 days and blind subculture was done daily and microorganisms were identified by standard microbiological method.[11] The antibiotic sensitivity test was done by Kirby-Bauer disc diffusion method as per Clinical laboratory Standards Institute (CLSI) guidelines.[12]

RESULT

Out of 3,324 blood samples collected for culture and sensitivity, only 345 (10.3%) showed bacterial growth. Among bacterial causes of blood culture positive cases, *Staphylococcus aureus* was most common (26.3%) followed by *Acinetobacter spp.* (18.9%), *Salmonella* Typhi (15.7%), *Salmonella* Paratyphi (4.6%), coagulase negative Staphylococci (10.8%), *Escherichia coli* (8.7%), *Klebsiella spp.* (7.9%) and other various organisms such as *Enterococcus spp.* (0.02%), *Streptococcus pneumoniae* (0.002%), *citrobacter spp.* (0.02%), *Enterobacter spp.*(0.008%), *Pseudomonas spp*. (0.005%), and *Proteus spp.* (0.002%).

Table-1: Table showing bacteriological profile of blood culture isolates.

Gram positive cocci	Number (n=138)
Staphylococcus aureus	91
Coagulase negative Staphylococci (CoNS)	37
Enterococcus spp.	9
Streptococcus pneumoniae	1
Gram negative bacilli	Number (n= 207)
Acinetobacter spp.	65
Salmonella Typhi	54
Salmonella Paratyphi	16
Escherichia coli	30
Klebsiella spp.	27
Citrobacter spp.	9
Enterobacter spp.	3
Pseudomonas aeruginosa	2
Proteus spp.	1

Antibiotic sensitivity test report showed all gram positive bacteria were sensitive to vancomycin, 94.2% of them were sensitive to gentamicin, sensitivity to ciprofloxacin was 79%, and that to clindamycin was 57.2%. Similarly, sensitivity to erythromycin was 47.9%, that to ampicillin was 39.1%, ceftriaxone 74.7%, cefotaxime 79.7% and cotrimoxazole 48.6%.

Table-2: Table showing antibiotic susceptibility pattern of Gram positive cocci.

Name of antibiotics	Sensitive (n/%)	Intermediate sensitive (n/%)	Resistant (n/%)	Total (n/%)
Ampicillin	54(39.1%)	6(4.3%)	78(56.6%)	138 (100%)
Gentamicin	130(94.2%)	0(0%)	8(5.8%)	
Erythromycin	66(47.9%)	1(0.7%)	71(51.4%)	
Clindamycin	79(57.2%)	2(1.4%)	57(41.4%)	
Vancomycin	138(100%)	0(0%)	0(0%)	
Cotrimoxazole	67(48.6%)	3(2.1%)	68(49.3%)	
Ciprofloxacin	109(79%)	1(0.7%)	28(20.3%)	
Ceftriaxone	103(74.7%)	0(0%)	35(25.3%)	
Cefotaxime	110(79.7%)	0(0%)	28(20.3%)	

Similarly, AST report of gram negative bacilli showed; sensitivity to ciprofloxacin was 53.6% and that to ofloxacin was 52.6%. Further, sensitivity of GNB isolates to cefixime was 54.1% and that to amikacin was 77.3%, ceftriaxone 65.2%, cefotaxime 67.1%, ampicillin 41.5% and cotrimoxazole 73.4%.

Table-3: Table showing antibiotic susceptibility pattern of Gram negative bacilli.

Name of antibiotics	Sensitive (n/%)	Intermediate sensitive (n/%)	Resistant (n/%)	Total (n/%)
Amikacin	160(77.3%)	0(0%)	47(22.7%)	207(100%)
Ceftriaxone	135(65.2%)	3(1.4%)	69(43.4%)	
Chloramphenicol	138(66.7%)	0(0%)	69(33.3%)	
Ofloxacin	109(52.6%)	35(16.9%)	63(30.5%)	
Cefixime	112(54.1%)	1(0.4%)	94(45.5%)	
Cefotaxime	139(67.1%)	0(0%)	68(32.9%)	
Ampicillin	86(41.5%)	4(1.9%)	117(56.6%)	
Ciprofloxacin	111(53.6%)	39(18.8%)	57(27.6%)	
Cotrimoxazole	152(73.4%)	1(0.4%)	54(26.2%)	

DISCUSSION

Out of 3,324 blood samples collected for culture and sensitivity, only 345 (10.3%) showed bacterial growth. Growth rate in blood culture and sensitivity varies according to different set up. In developed countries growth rate ranges high (13.9%-29.4%).[13,14] However, in underdeveloped and developing countries, it has shown similar growth rate as ours (13.3%).[3] Technique applied for the isolation in different set up, awareness of people regarding not to use antibiotics before sample collection for culture and sensitivity may vary with different locations. Similarly, self medication prior to hospital visit by patients themselves and practice of clinicians for requesting blood culture in proper duration of infection are the major factors for variation in growth rate from blood culture.[3,7]

S. aureus, Salmonella Species, Acinetobacter Species, E. coli are the common isolates in blood culture. The growth patterns of bacterial isolate in blood culture varies in different set up.[3] Our study showed *Acinetobacter, Salmonella, E. coli, Klebsiella, Pseudomonas, Proteus, Enterobacter* were gram negative and *S. aureus, CoNS. S. pneumoniae* were gram positive as bacterial isolates. The findings were similar to other several studies. However, among growth rate of individual bacterial isolates S. aureus was the chart topper followed by Acinetobacter, Salmonella, E. coli, Klebsiella etc. Different research studies have revealed that S. aureus is the common cause of bacteremia and septicaemia in comparision with gram negative bacilli however they can be of significant number in samples from inpatients especially those having post operative surgical site infections, CVP lines etc.[15-17] This could be the reason for more number of isolates from blood samples which is not analysed in our study.

Acinetobacter baumannii, non-fermenting Gram-negative baciili has become an emerging pathogen especially in the hospitals owing to its ability to survive in adverse environmental conditions.[18] Increasing multidrug resistance pattern by Acinetobacter species has narrowed range of drugs for treatment. Our study has also reported high level of resistance by Acinetobacter. This develops concern for clinicians as these microorganisms are related to high level of antibiotic resistance. However, contrasts with these findings are shown by Gupta and Kashyap on similar study done in India and Kholoujinim *et al* in Iran and in other various studies.[7, 19-20]

Similarly, CoNS were considered as contaminants in the past but nowadays they have become one of the leading cause of blood stream infections due to increasing use of medical devices such as prosthetic heart valves, vascular grafts, indwelling catheters etc.[21-22] This might be related with our study findings that CoNS was one of the important organism related to blood stream infection (10.8%) in our study.

Moreover, Salmonella, the causative agent of enteric fever, appeared as other common organism in blood stream infection (20.3%) in our study. This indicates endemicity of enteric fever in peri-urban area of Kathmandu valley and its prevalence in our study is slightly higher compared to previous few studies.[23-27] Different studies done in Kathmandu Nepal over the various duration has reflected presence of Salmonella in the community. This study showed 20.3 % of Salmonella which indicates endemicity of Salmonella in our community due to lack of awareness, water sanitation, improper sewage management and ineffective control measures.[28]

Antibiotic sensitivity test report showed all gram positive bacteria were sensitive to vancomycin. Similarly, 94.2% isolates were sensitive to gentamicin and 79% of them were sensitive to ciprofloxacin. Among the antibiotics used for gram negative bacilli, 77.3% of them were sensitive to amikacin followed by co-trimoxazole. This showed none of the commonly used antibiotics were sufficiently active against gram negative bacterial isolates from blood stream 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 resistant organisms.

CONCLUSION

Despite sensitivity of gram positive isolates to vancomycin, resistance pattern of gram negative bacilli to various commonly used drugs has alarmed clinicians and hospital formulary group for the need of alternative effective antimicrobial to treat blood stream infections. Our findings also indicate need for periodic surveillance detection of causative agents of blood stream infections and their antibiogram in the hospital which can guide for selection of appropriate choice of empiric therapy.

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