Bacteriological Analysis of Blood Culture Isolates in Patients with Sepsis in A Tertiary Care Hospital of Eastern India

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ABSTRACT

Introduction: Bacteraemia and bloodstream infections cause significant morbidity and mortality among hospitalized patients worldwide. Blood culture is the single most important procedure for bacterial isolation and detection. The predominant organisms present in blood cultures varies among different healthcare facilities and geographical areas. The present study was conducted to determine the prevalence of various bacterial isolates among sepsis patients in a tertiary hospital.

Material and Methods: During a one-year study period, 100 patients with sepsis admitted to the Department Of Medicine of Kalinga Institute of Medical Sciences (KIMS), Bhubaneswar were studied regarding the pattern of bacteriological isolates in blood culture of sepsis patients.

Results: Among the 100 patients included in the study, 26 had a growth of the organism in the blood culture. Out of them, six were *Staphylococcus aureus;* 2 were *Staphylococcus hemolyticus*, 9 *Escherichia coli*, 7 *Klebsiella pneumonia and* 2 *Acinetobacter baumannii.* The rest of the blood culture of 74 patients did not show any growth. The maximum resistance was shown against ampicillin (65.4%).

Conclusion: In our present study, both Gram-negative and Gram-positive bacteria were responsible for sepsis in adult. *S. aureus* and *E. coli* were among the most common Gram-positive and Gram-negative organisms identified causing adult sepsis, respectively. It is important to know the bacteriological patterns to draft local antibiotic policy.

Keywords: Bloodstream infections, Sepsis, Blood culture, Bacterial resistance.

INTRODUCTION

Bacteremia and other bloodstream infections (BSIs) are one of the most significant serious infections, which cause morbidity and mortality among hospitalized patients worldwide.[1] Blood culture is the single most important procedure to detect systemic infection due to bacteria.[2] Blood cultures of patients have isolated a wide range of organisms in BSIs. These include *Acinetobacter spp., Escherichia coli, Pseudomonas aeruginosa,* and *Klebsiella pneumoniae* among Gram-negative bacteria and *Staphylococcus aureus*, coagulase-negative staphylococci (CoNS), enterococci and alpha-hemolytic streptococci among Gram-positive bacteria. There is a wide variation of predominant organisms in blood cultures among different health facilities.[1]

Antimicrobial susceptibility test assists a great deal in precise identification of the most appropriate choice of drug administered in the patients. Emerging antimicrobial drug resistance among bacterial pathogens causing BSI can limit therapeutic options and complicate patient management.[3] A large proportion of patients presenting at a tertiary care hospital are already treated with antibiotics elsewhere previously. This is leading to low positive yield in blood culture.[4]

Sepsis is the leading cause of death in non-coronary intensive care units (ICUs) and has a lot of influence on the healthcare burden. Many infectious processes including bacterial, viral, fungal and parasitic infection in critically ill patients can lead to sepsis. Sepsis syndrome is a spectrum of diseases from SIRS (systemic inflammatory response syndrome) with possible infection to severe sepsis, septic shock, and multiple organ failures.[5]

Therefore, the aim of the present study was to determine the prevalence of various bacterial isolates causing sepsis in a tertiary care hospital and help physicians in the choice of the empirical antibiotics.

MATERIAL AND METHODS

This study was a prospective study conducted for a period of one year from July 2015 to June 2016.

100 patients with sepsis admitted to the Department Of Medicine of Kalinga Institute of Medical Sciences (KIMS), Bhubaneswar were studied regarding the pattern of bacteriological isolates in blood culture of sepsis patients.

The study included adult patients ≥18 years of age who presented to medicine department during the study period with two or more of the systemic inflammatory response syndrome (SIRS) criteria as defined by ACCP/SCCM consensus conference like temperature >38°C or <36°C, heart rate >90 beats/ minute, or respiratory rate >20 breaths/minute, WBC >12,000 cells/mm3, <4000 cells/mm3 or >10 % immature (band forms) and had a suspected infection according to medical record.[6]

The patients excluded from the study are postoperative patients, known cases of chronic kidney disease, acute stroke or acute coronary syndrome and patients who are HIV positive.

Procedure

The demographic, clinical and laboratory data of 100 patients were collected.

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Two blood samples (5 ml from two different sites) were collected from each patient for routine blood culture before the beginning of empirical antibiotic treatment. All aseptic measures were taken while collecting blood.

Samples were transferred into blood culture bottles and labelled with the details of the name of the patient, the identification number of the patient, date and time of collection of the blood samples. The bottles containing specimens were transported within 30 minutes to the laboratory of medical microbiology, KIMS. Blood culture bottles were incubated at 37°C. The inspection was done daily for the presence of visible microbial growth for 7 days by observing visually for the changes like the visualization of discrete colonies and other characteristics like haemolysis, gas production, turbidity or coagulation of broth.

For blood cultures that showed signs of microbial growth, subcultures were made. Bacterial growth on the subcultures was identified by their characteristic appearances such as morphological characteristics of bacterial colony, Gram reaction results and other specific biochemical reactions.

Members of the family enterobacteriaceae and other Gram-negative bacteria were identified by indole, urease, H_2S and gas production, citrate utilization, motility test, lysine decarboxylase in LIA (Lysine Iron Agar), oxidase test and carbohydrate fermentation reaction in KIA (Kliger Iron Agar). For the detection of Gram-positive bacteria, the following tests were used: coagulase, catalase, and optochin susceptibility.

The antibiotic susceptibility of blood isolates was determined by the disc diffusion NCCLS (Clinical and Laboratory Standards Institute) method. The antibiotics tested on Gram-positive cocci included amoxyclav, ciprofloxacin, gentamicin, cephalexin, erythromycin and vancomycin. The antibiotics tested on Gram-positive bacilli included amikacin, ampicillin, amoxyclav, ciprofloxacin, ceftriaxone, ceftazidime, cefuroxime and gentamicin. Finally, two antibiotic combinations, cefoperazone+sulbactum and piperacillin/tazobactum were used for Gram-negative bacteria only. Ethical approval for the study was obtained from KIMS Ethical committee for this study.

STATISTICAL ANALYSIS

All the results collected were subjected to descriptive statistics like mean and percentages. Microsoft Excel 2007 was used for making tables, graphs, and calculations.

RESULTS

Among the 100 patients, those were included in this study, 26 had a growth of the organism in the blood culture. Out of them, six were *Staphylococcus aureus*, 2 were *Staphylococcus hemolyticus*, nine *E coli*, 7 *Klebsiella pneumonia and two Acinetobacter baumannii.* The rest of the blood culture of 74 patients did not show any growth (Table-1, Figure-1). The maximum resistance was shown against ampicillin (65.4%). None of the isolates were resistant to vancomycin (Table-2).

Types of Organism grown in blood culture	No. of patients	Percentages (%)
Klebsiella	7	26.9
Acinetobacter baumannii	2	7.7
E.coli	9	34.6
Staphylococcus aureus	6	23.1
Staphylococcus hemolyticus (CoNS*)	2	7.7
CoNS - Coagulase negative staphylococcus		

Table-1: Types of Organisms isolated in Blood Culture

Resistance to drug	No. of isolates	Percentage
Ampicillin	17	65.4
Amoxyclav	8	30.8
Ceftriaxone	2	7.7
Ceftazidime	1	3.8
Cefuroxime	1	3.8
Imipenem	1	3.8
Ciprofloxacin	8	30.8
Amikacin	4	15.4
Gentamicin	4	15.4
Piperacillin/Tazobactum	1	3.8
Vancomycin	0	0
Cefoperazone + sulbactum	2	7.7

Table-2: Antibiotic resistance profile of the bacterial isolates.

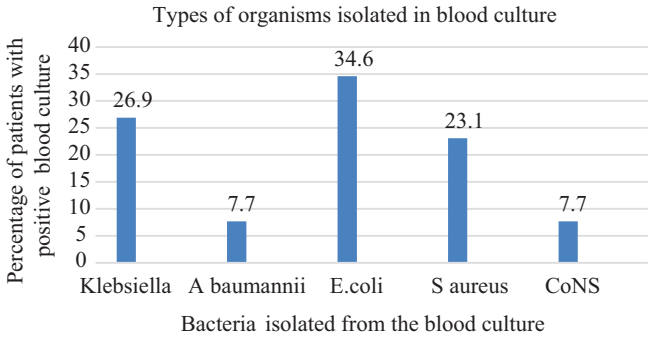

Figure-1: Bar diagram showing types of Organisms isolated in Blood Culture

DISCUSSION

There is a substantial burden of sepsis worldwide on health care. The gold standard of diagnosis is blood culture to isolate the etiologic agents for sepsis. BSIs have been a challenge for the clinicians due to changing bacterial resistance profile.[1]

This study found that 26 out of 100 total blood sample screened from suspected sepsis cases were positive for the presence of bacteria (Table 1). The isolation rate of this study is comparable with the rates reported from some other studies where routine blood culture was performed like Gulrez M et al[4] (12.2%), Alam et al. (20.9%)[7], Arora et al. (20.02%)[8], Sharma et al (33.9%)[9], and Roy et al. (16.4%)[10] and Gohel K et al (9.2%).[11]

In the present study, gram-positive organisms were found to be 30.8% among all isolates causing sepsis, whereas the Gram-negative bacteria were 69.2% of all isolates. However, our finding was a little different from Gohel K et al (2014).[11] Gram-positive bacteria accounted for 58.3% of cases with staph aureus predominance and Gram-negative bacteria accounted for 40.2% with enterobacteriaceae predominance. The etiologic agent varies due to geographical locations, epidemiological variation/ difference in etiologic agents. The other factors might also be due to nature of the patient population, limited sample size and span of study time. Among blood sample isolated, Gram-positive organisms especially S. aureus (6/26; 23.1%) was the predominant cause of sepsis in adult, this was lower than reports from developing countries where they found 61%[12] and 59.2%[13] of their total isolates were S. aureus.

The rate of resistance was higher in Gram-negative

microorganisms than that in Gram-positive microorganisms to most of the tested antimicrobial agents. It is important for clinicians to be updated with current data concerning the prevalence of common bacterial infections as well as the efficacy of the currently prescribed drugs. The selection of antimicrobials should be based on the local rates of susceptibility and the site of infection.[14]

CONCLUSION

In the present study, both Gram-negative and Gram-positive bacteria were responsible for adult sepsis. *S. aureus* and *E.coli* were among the most common Gram-positive and Gram-negative organisms identified causing adult sepsis, respectively. A knowledge of these patterns is essential when locally policies on the uses of antibiotics are being devised.

The report on the current knowledge of bacterial resistance profile of the patient, which is provided by microbiology laboratory from time to time, is necessary for early diagnosis and treatment.

This information is also important for clinicians to make the right decisions.

The information of predominant organisms and their sensitivity among sepsis patients is important for making the right decisions in the management of sepsis. Blood cultures must be obtained from all suspected cases of bacteraemia or sepsis before prescribing antibiotics. This will help in obtaining the bacteriological pattern as well as their antibiotic susceptibility from time to time for a given health care centre of the specific geographical region.

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