Original Article

Etiological study of blood stream infection in tertiary care teaching hospital

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ABSTRACT

Background & objectives: Bloodstream infections (BSIs) are one of the major life-threatening infections in hospitals. They are responsible for prolonged hospital stays, high healthcare costs, and significant mortality. Primary bloodstream infection (BSI) is a leading, preventable infectious complication in critically ill patients and has a negative impact on patients' outcome.

Material and Methods: This was a retrospective study conducted for a period of one year (January 2015 to December 2015) in a Shri Vasantrao Naik Government Medical College and Hospital, Yavatmal. Blood sample (5-10 ml) was collected from clinically suspected sepsis patients and proceeded with conventional culture and sensitivity methods.

Results: A total of 414 blood samples were processed of that blood culture was positive in 182 (43.96%) cases whereas in 232 (56.04%) cases blood culture was negative. The most common organism causing sepsis was *Klebsiella spp* followed by *Staphylococcus aureus.*

Conclusion: Prompt diagnosis of BSI and antibiotic susceptibility results helps the clinician for further management.

Keywords: Sepsis, Blood stream infections, Antibiotics, Susceptibility.

INTRODUCTION

Due to the failure of our immune system to restrict infection at a focal site Blood stream infections (BSIs) occur leading to widespread disease and it is a major cause of morbidity and mortality.[1] Microorganisms present in the circulating blood whether continuously intermittently are threat to every organ in the body. Approximately 200,000 cases of bacteraemia and fungemia occur annually with mortality rates ranging from 20-50%. Therefore early diagnosis and appropriate treatment of these infections can make the difference between life and death. [2]

Illness associated with blood stream infections range from self limiting infections to life-threatening sepsis that requires rapid and aggressive antibiotic treatment. The incidence of blood stream infections in patients has been reported to correlate with the increasing use of central venous catheters (e.g., oncology and burn and trauma), and other pre disposing factors including intensive care unit (ICU) stay, lapses in hand washing and non adherence to infections control practices of medical staff. Respiratory, genitourinary, and intra abdominal foci are often identifiable sources of blood stream infections. [3]

The diversity of bacteria recovered from blood cultures in the present day medical practice appears endless and published works from leading medical laboratories worldwide appear not to have really come up with final list of this group of organisms.[4] The important factors contributing to this scenario probably being due to: the sources of clinical infections in a locality; the extent and precision of the laboratory procedures carried out; and also very importantly experience of the laboratory personally involved.[5]

Prompt diagnosis of BSI and antibiotic susceptibility results helps the clinician for further management. [6] This aids in reducing complications and hospital stay, resulting in major financial saving for the institution as well as improved care of the patient. [7]

Nowadays, bacterial drug resistance is an important problem and due to wide variations in bacterial drug

resistance, results of studies and reports in one region or in one period of time are not necessarily true for other regions or periods of time. They are related with a series of social, environmental and technological changes. [8,9]

Rational and correct use of these agents requires understanding of common pathogens and drug resistance patterns in the region. [10] Due to constantly evolving antimicrobial resistant patterns there is need for constant antimicrobial sensitivity surveillance.

Aims and Objectives:

A study was conducted to identify the microbial profile and their antibiotic susceptibility patterns of blood culture isolates from clinically suspected septicemic patients at a tertiary care teaching hospital.

MATERIAL AND METHODS

This was a retrospective study conducted for a period of one year (January 2015 to December 2015) in a Shri Vasantrao Naik Government Medical College and Hospital, Yavatmal (Maharashtra). Patients above the age of 12 years admitted to medicine wards with the signs and symptoms of sepsis were included in study. Patients below the age of 12 years were excluded from the study. Blood sample (5-10 ml) was collected with all aseptic precautions. All blood samples were processed by conventional blood culture method (brain heart infusion broth with 0.05% sodium polyanethole sulphonate, blood agar and MacConkey agar).

Various organisms were identified on the basis of colony morphology and standard biochemical tests. [11] The isolates were subjected to antimicrobial susceptibility testing by Kirby Bauer disk diffusion method as per CLSI guidelines 2014. [12,13]

OBSERVATIONS AND RESULTS

A total of 414 blood samples were collected from clinically suspected septicemia patients over a period of one year. Male to female ratio was 2:1.

Out of 414 clinically suspected septicemia patients, blood culture was positive in 182 (43.96%) cases whereas in 232 (56.04%) cases blood culture was negative.

Overall frequencies of isolation of was 52.75% gramnegative organisms, 46.15% gram positive cocci and
1.1% *Candida albicans*.

Table 1: Microbial profile of septicemia cases from blood culture

Organisms	Number (%)
Gram positive organisms	84 (46.15%)
Staphylococcus aureus	57
Coagulase negative staphylococci (CoNS)	15
Streptococcus	8
Enterococci	4
Gram negative organisms	96 (52.75%)
Klebsiella species	72
Escherichia coli	10
Citrobacter species	6
Proteus species	4
Acinetobacter species	2
Pseudomonas aeruginosa	2
Fungi	2 (1.1%)
Candida albicans	2
Total	182

Antibiotic sensitivity pattern of gram positive and gram negative bacteria was as per table 2 and 3.

Antifungal susceptibility testing of Candida spp. isolates was not done.

Table 2: Antibiotic sensitivity profile of gram positive cocci (n=84)

Antibiotics	Sensitivity (%)
Azithromycin	46 (54.76%)
Erythromycin	39 (46.43%)
Oxacillin	20 (23.8%)
Cefoxitin	51 (60.71%)
Cotrimoxazole	41 (48.8%)
Ciprofloxacin	60 (71.43%)
Levofloxacin	58 (69.05%)
Amoxicillin	21 (25%)
Ampicillin	22(26.19%)
Tetracycline	32 (38.1%)
Vancomycin	84 (100%)
Tigecyclin	84 (100%)

Table 3: Antibiotic sensitivity profile of gram negative organisms (n=96)

Antibiotics	Sensitivity (%)
Ampicillin	22 (22.92%)
Gentamycin	74 (77.08%)
Amikacin	82 (85.42%)
Cefotaxim	60 (62.5%)
Ceftazidime	56 (58.33%)
Ciprofloxacin	76 (79.17%)
Levofloxacin	76 (79.17%)
Imipenem	90 (93.75%)
Piperacillin	45 (46.88%)
Piperacillin – Tazobactem	82 (85.42%)

DISCUSSION

Blood culture results provide useful information about the incriminating bacteria and their susceptibility patterns. Besides helping in treatment of the patient, profile of the isolated organisms provides useful adjuncts to choice of empiric therapy in a given set up.

In this study blood culture positivity was 43.96%, similar finding (44%) was noted by Khanal et al.[14] Sultana et al reported blood culture positivity rate was 49.28% in contrast to this very low positivity (8.39%) was reported by Vanitha et al.[15,16] Some studies reported blood culture positivity rate ranging from 20 - 23%.[17,18] In India, variation might be due to the fact that most of the patients are given the antibiotics before they come to the tertiary care hospital & other reason is that in most of the cases self-medication is very common as the medicines are available at the counter. Out of 414 cases, in 232 cases there was no growth, this may be because of sepsis by anaerobic organisms (as we had done only aerobic culture).

Out of 182 positive cultures, 180 (98.9%) showed bacterial growth, of which 84 (46.15%) were gram-positive and 96 (52.75%) were gram-negative and 2(1.1%) were candida.

Among gram positive cocci (n=84) *Staphylococcus aureus* (57) was predominant followed by *Coagulase negative staphylococci* (15), *streptococci* (8) and *enterococci* (4).

CoNS have been considered the most common blood culture contaminant but multiple positive cultures from the same patient are considered significant. [19]According to Souvenir et al, clinical significance of CoNS was defined as at least two blood cultures positive for CoNS within 5 days or one positive blood culture plus clinical evidence of infection, which includes abnormal leucocyte count and temperature or blood pressure. [20]

Among gram negative bacteria (n= 96), *Klebsiella spp.* (72) were predominant followed by *E.coli* (10), *Citrobacter spp* (6), *Proteus spp* (4), *Acinetobacter spp* (2), and *Pseudomonas aeruginosa* (2).

Like our study, in most of the studies, gram-negative bacilli have taken over the gram-positive organisms, especially in hospital settings. (Table 4)[15,16,18,21]

In contrast to our study Arora et al found the incidence of gram positive organisms was 52.67 % while 47.33% isolates were gram negative bacilli and similar finding was noted by Qursheed Sultana et al.

Table 4: incidence of gram positive and gram negative bacteria in various studies

Studies	Blood culture positivity	
	Gram negative bacteria	Gram positive bacteria
Vanitha et al	59.1 %	37.7%
Mehta et al	80.96 %	18%
Arora et al	47.33 %	52.67%
Qursheed Sultana et al.	45.24 %	54.77%

We found 1.1% candida albicans like that of Qursheed Sultana et al (1.19%), while Jena et al found 3.1% [15,17].

In our study, the most sensitive antibiotics in case of gram positive bacteria were Vancomycin (100%), Tigecyclin(100%) followed by Ciprofloxacin(71.43%) and Levofloxacin(69.05%). Similar to our study, among the gram-positive organisms, an increased ampicillin resistance of 64%, 87% was also reported by Guha et al and Karki et al respectively in their studies. [22,23]

Similar to the study by Jena et al Methicillin resistance was seen in 20% isolates of S. aureus in our study. (Methicillin Resistant Staphylococcus aureus)

The most sensitive antibiotics case of gram negative bacteria, in our study was Imipenem (93.75%), followed by Amikacin (85.42%), Piperacillin – Tazobactem (85.42%). Vanitha et al also reported

that amikacin and imipenem were highly active against gram negative bacteria. [16]

In present study, we obtained 30% of gram negative isolates as ESBL (Extended spectrum B-lactamases) producers. In these, maximum ESBL production was shown by Klebsiella species.

CONCLUSION

Laboratory blood culture systems are the proven gold standard test for the identification of pathogen recovered from blood stream infection over the years. An appropriate use of antibiotic susceptibility surveillance programme along with good infection control practices and rational use of antibiotics will reduce infection rate, ensure better therapeutic success and prolong the efficacy of available antimicrobials.

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