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Original research article

A prospective cross-sectional study looking into bloodstream infections in the intensive care unit of tertiary hospitals

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Abstract

Objective: The most common cause of disease and mortality among patients in the intensive care unit is bloodstream infections. Isolating and characterizing organisms from patients who may have had a blood stream infection was the aim of this study.

Material and Methods: This was the prospective cross-sectional study. A total of 100 samples were used in this investigation. The study was carried out at the Department of Pathology, Narayana Medical College and Hospital, Nellore, Andhra Pradesh, India. The research was carried out between January 2009 and December 2009. The trial got underway after patients gave their informed consent, and approval was given by the institutional ethical committee.

Results: According to the study, the majority of patients with clinical signs of sepsis who were admitted to the hospital were between the ages of 41 and 50. The findings aligned with the study, which had participants ranging in age from 24 to 54. According to the study, the majority of patients had a mean age of 60 and ranged in age from 49 to 73. Co-morbid conditions such cirrhosis, renal disease, and respiratory disease were reported in the study. Hypertension and diabetes mellitus were found to be independent risk factors. With 35% of cases, diabetes mellitus is the most common co-morbid condition in the study group. According to a study, the main comorbid condition associated with BSI is diabetes. According to a study, 57% of occurrences of diabetes are associated with another condition.

Conclusion: This study highlights risk factors for bloodstream infections (BSIs) caused by resistant bacteria as well as implications for global care of critically sick patients, including surveillance, source management, and appropriate antibiotic therapy.

Keywords: Antibiotic, blood stream infections, intensive care unit, treatment, health, diabetes.

Introduction

Assuming that blood is sterile, the presence of any microorganisms in it should cause concern. When live, transient bacteria are found in the circulation, the disease is known as bacteremia. A small percentage of invasive bacteria typically cause symptoms because the immune system swiftly gets rid of these temporary invaders, yet bacteremia can still happen occasionally [1]. Because more cells enter the circulation than can be effectively removed, the infectious agent in septicemia spreads throughout the body. Sclerotherapy on sick tissues or local illnesses (like pneumonia) can potentially result in septicemia. The precise process via which pathological, biochemical, and physiological abnormalities result from an unchecked immune response to an infection and sepsis is still unknown. This reaction may cause harm or overstimulation of other healthy tissues or organs. Septic shock is characterized by severe issues with metabolism, cells, and circulation. Being one of the main causes of death in medical facilities, it remains a medical mystery [2-4].

Septic shock is the term used to describe sepsis cases that have a poor prognosis and a high risk of mortality because to immune system reaction collateral damage. The quick Sequential Organ Failure Assessment was created by the medical community to help with prompt sickness diagnosis [5-7]. A patient's doctor may suspect septic shock and perform the qSOFA test to detect the disease if they show two of the following three symptoms: an elevated heart rate exceeding 22 beats per minute. A drop in blood pressure to under 100 mm Hg. A patient may have altered mental activity, multiple organ failure, or even pass away if they satisfy the qSOFA conditions. Patients suffering from this illness need to be diagnosed as soon as possible in order to receive substantial intravenous fluid replacement and antibiotics to treat the infection and prevent a sharp drop in blood pressure. Hopefully, these actions will reduce the first overactive immune response [6-8]. Medical practitioners frequently ignore the warning signs of septic shock. Some estimates state that for every hour that antibiotics are not given, the chance of death rises by about 7%.

Blood cultures are one of the many important functions performed by clinical microbiology laboratories.

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The method used to obtain the blood sample directly affects the test's accuracy. The single most important factor in determining the outcome of a blood culture is the amount of blood handled. When 20 milliliters of blood are used instead of 10 milliliters, culture findings indicating the presence of organisms are 40% more likely to be positive since more than half of all septic patients have less than one organism per milliliter of blood. A blood stream infection is diagnosed when blood samples obtained while the patient has a fever and is not suffering from any other medical illnesses provide positive results for a bacterial or fungal culture [7-9]. A bloodstream infection is classified as nosocomial if symptoms do not show up for at least 48 hours following hospital admission, or if the patient has been admitted within the last two weeks. In summary, if pathogenic bacteria were isolated from blood samples obtained during the first two days of admission, but more than 30 days had elapsed after admission and the patient required hospitalization, then the patient was diagnosed with Health Care Associated Bacteremia. Vascular infections are becoming much more common, and this is mostly due to bacteria that are generally considered to be non-virulent. Pathogens and contaminants need to be distinguished clearly [8-10]. The aim of this investigation was to isolate and identify organisms from patients who were suspected of having a bloodstream infection. The primary goal is to look into the pattern of antibiotic sensitivity in isolated organisms. A secondary goal will be to characterize the antimicrobial resistance patterns of the isolated organisms.

Methodology

The study was carried out at the Department of Pathology, Narayana Medical College and Hospital, Nellore, Andhra Pradesh, India. The research was carried out between January 2009 to December 2009. The trial got underway after patients gave their informed consent, and approval was given by the institutional ethical committee.

Inclusion Criteria

- Individuals older than eighteen who show signs of a bloodstream infection, including fever, sweating excessively, tachycardia, and an unusually low white blood cell count.

Exclusion Criteria

- Patients are those who are younger than eighteen.
- Patients who opted not to participate in the study.

Results

Table 1: Age of the patients

Sr. No.	Age (years)	Total	Percent
1.	18-20	5	5
2.	21-30	15	15
3.	31-40	22	22
4.	41-50	28	28
5.	51-60	14	14
6.	>61	16	16
7.	Total	100	100

The age distribution of the patients is displayed in Table 1. Out of 100 patients, the age group with the highest percentage is 41–50, followed by 31–40.

Table 2: Sex distribution

Sr. No.	Sex	Patients	%
1.	Male	51	51%
2.	Female	49	49%
3.	Total	100	100%

The gender distribution of the patients is seen in Table 2, with 51% of them being men and 49% being women. In this survey, there were more men than women.

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Table 3: Blood culture results

Sr. No.	Blood Culture	Patients	Percent
1.	Positive	20	20%
2.	Negative	80	80%
	Total	100	100%

Out of 100 samples, 20% tested positive and 80% tested negative in the blood culture. The results are shown in Table 3.

Table 4: Bloodstream infection patients' clinical prognosis

Sr. No.	Outcome	Number	%
1.	Recovered	95	95%
2.	Expired	5	5%

Table 4 displays the clinical results of patients who tested positive for BSI; 96% of them recovered satisfactorily, while 4% passed away.

Discussion

Blood stream infections raise the risk of complications and death for patients in intensive care units. The fact that different institutions, patient types, comorbidities, and periods of stay pose different risks to individuals is reflected in the considerable variance in BSI incidence reports. 38 out of 100 samples had positive blood culture results. This was verified by the study. Bloodstream infection (BSI) can arise due to a variety of variables, including the microorganisms that caused the infection in the intensive care unit (ICU), previous risk factors, the pace at which therapy is administered, and the success of the intervention. Finding the microorganisms causing these infections, the frequency of bacteremia in intensive care units, and the patterns of antibiotic susceptibility observed in blood culture isolates were the main goals of this investigation [11-13].

According to the results of the current study, among patients admitted to the intensive care unit, patients between the ages of 41 and 50 had the highest prevalence of sepsis symptoms. The results of the study were consistent with the experiences of the participants, who were between the ages of 24 and 54. With a mean age of 61, the bulk of the study's patients were in the 49–73 age range [14]. In this study, co-morbid illnesses included renal disease, cirrhosis, and respiratory disease. Two distinct risk variables have been identified: hypertension and diabetes mellitus. With 36% of the study sample affected, diabetes mellitus was the most prevalent co-morbid condition. One study found that the most common co-occurring disorder with BSI is diabetes. The study [15] also found that 58% of those who have this condition also have diabetes.

The respiratory, urinary, gastrointestinal, and biliary systems were among the bloodstream infections (BSIs) that were culture-confirmed to have intravenous catheter devices as their principal infectious agent. The patients' hospital stays were accompanied by these infections. A study that examined RTI, UTI, and IVC found somewhat comparable outcomes. In total, there were nine Gram-positive and thirty-nine Gram-negative isolates [16]. The most common Gram-negative isolates are Klebsiella oxytoca, Pseudomonas aeruginosa, Escherichia coli, Acinetobacter baumannii, and Klebsiella neumoniae. Methicillin-sensitive Staphylococcus aureus, Methicillin-resistant Staphylococcus aureus, Enterococcus species, and Methicillin-sensitive coagulase-negative staphylococcus were the most prevalent Gram-positive bacteria. The most prevalent Gram-positive cocci is Staphylococcus aureus, according to research [17].

Antimicrobial susceptibility testing on nine Gram-positive bacterial isolates showed that MRSA accounted for 11%, MS CoNS, Enterococcus species, and MSSA made up 55.5% of the isolates. Vancomycin and linezolid showed zero efficacy against MRSA. MSSA were shown to be 100% resistant to tetracycline and linezolid, 100% susceptible to penicillin, 83.33 percent susceptible to cotrimoxazole, and 66.66 percent susceptible to erythromycin among the tested medicines [17]. While Erythromycin and Cotrimoxazole were equally effective against MS-CoNS, Tetracycline, Vancomycin, and Linezolid were all entirely efficacious. Vancomycin, Linezolid, and High Level Gentamicin were utterly useless against any type of Enterococcus species. It was demonstrated that an isolate of Enterococcus spp. was totally resistant to erythromycin and penicillin, but totally sensitive to high concentrations of gentamicin, vancomycin, and linezolid [18]. Three of the 14 isolates of Klebsiella pneumoniae developed bacterial toxins with an enlarged spectrum. Among the Gram-negative culture-positive microorganisms, imipenem showed a 71.4% sensitivity rate, cefotaxime a 28.5% sensitivity rate, piperacillin-tazobactam and gentamicin a 64.2% sensitivity rate, and imidacloprid a 78.5% sensitivity rate. Of these, 7.1% was sensitive to ciprofloxacin and 21.4% to cotrimoxazole [19].

Conclusion

Basal system infections (BSIs) rank among the most serious infections that affect patients in intensive

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care units. Antibiotic-resistant bacteria are becoming a more common cause of bloodstream infections in intensive care units. Clinicians should understand the following topics as part of their comprehensive care for critically ill patients: typical mechanisms of resistance, risk factors for bloodstream infections caused by bacteria with resistance, and best practices for antibiotic treatment, source control, and surveillance.

Funding source
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Conflict of interest
None.

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