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Dr. Mehta Megha Ramshanakar
Assistant Professor, Department of Microbiology, Madha Medical College and Research Institute, Chennai, Tamil Nadu, India

Dr. Dasari Anuradha
Assistant Professor, Department of Pathology, Madha Medical College and Research Institute, Chennai, Tamil Nadu, India

Corresponding Author:
Dr. Dasari Anuradha
Assistant Professor, Department of Pathology, Madha Medical College and Research Institute, Chennai, Tamil Nadu, India

An investigation on bloodstream infections in tertiary care hospital ICU: A prospective cross sectional study

Dr. Mehta Megha Ramshanakar and Dr. Dasari Anuradha

Abstract
Introduction and Background: Bloodstream infections are the primary cause of illness and death in patients in the Intensive Care Unit. Monitoring the causative agents of these infections is crucial for preventing and treating them. The objective of this study was to isolate and identify organisms from patients suspected of having Blood Stream Infection.
Material and Methods: This was the prospective cross sectional study. In this study total 200 samples were included. The study was conducted in the Department of Pathology, Madha Medical College and Research Institute in Chennai, Tamil Nadu, India. The study was conducted from August 2018 to July 2019. Approval was granted by the institutional ethical committee, and the trial began after obtaining informed consent from the patients.
Results: The study found that most of the individuals admitted to the hospital with clinical indications of sepsis were between 41 and 50 years old. The results were consistent with the study, which included individuals aged between 24 and 54 years. The study found that most patients were between 49 and 73 years old, with a mean age of 61. The study reported co-morbid diseases such as respiratory disease, renal disease, and cirrhosis. The independent risk variables identified were diabetes mellitus and hypertension. The predominant co-morbid condition in the study sample is diabetes mellitus, accounting for 36% of cases. A study revealed that diabetes is the primary comorbid disease linked to BSI. A study found that diabetes is a comorbid disease related with 58% of cases.
Conclusion: Consequences for global care of critically ill patients, including surveillance, source control, and proper antibiotic treatment, as well as risk factors for BSIs caused by resistant bacteria, are highlighted in this study.

Keywords: Blood stream infections, intensive care unit, treatment, health

Introduction
Patients admitted to the intensive care unit are at increased risk of death and morbidity due to blood stream infections (BSIs), making it critical to monitor the agents that cause these infections in order to prevent and treat them. Any presence of bacterial cells in the blood should raise red flags due to the blood's sterility. Bacteremia describes the condition in which transitory, live bacteria are present in the bloodstream. Although some bacteremia can occur, the majority of the time only a tiny number of invading bacteria cause symptoms since the immune system quickly eliminates these transients [1-3].
In septicaemia, the infectious agent spreads through the bloodstream because more cells enter the bloodstream than can be successfully eliminated. Local infections (Like pneumonia) or surgical procedures on infected tissues can also lead to septicemia. The exact mechanism by which sepsis develops from an uncontrolled immune response to an infection-which leads to anomalies in physiology, biochemistry, and pathology-remains a mystery. Damage to or overstimulation of other, healthy tissues or organs could result from the reaction. Severe metabolic, cellular, and circulatory problems characterize septic shock. It is a medical mystery while being one of the leading causes of death in healthcare facilities [2-4].
The annual incidence of septic shock in the US is about 750,000 cases, with a mortality rate of 15% to 30%, according to medical professionals. About 18 million people die each year from septic shock, making it one of the top causes of death on a global scale. Cases of sepsis with a high risk of mortality and poor prognosis owing to immune system reaction collateral damage are referred to as septic shock. The medical field has developed the rapid Sequential Organ Failure Assessment to aid in the rapid diagnosis of the illness [5-7].
If a patient exhibits two out of the following three symptoms, their doctor may suspect septic shock and use the qSOFA test to diagnose the condition: A rapid heart rate that is higher than

22 breaths per minute. A reduction in BP to below 100 mm Hg. If a patient meets the qSOFA requirements, their mental activity may change, and they may experience multiple organ failure or perhaps die. Patients with this condition require prompt diagnosis so that they can be treated with antibiotics to eradicate the infection and massive quantities of intravenous fluids to prevent a precipitous decline in blood pressure. With any luck, these steps will soothe the starting hyperactive immune reaction [6-8]. The warning symptoms of septic shock are often overlooked by medical professionals. According to some reports, the risk of death increases by around 7% for every hour when antibiotics are not administered.

Among the many crucial tasks carried out by clinical microbiology laboratories, blood cultures rank high. How the blood sample is collected has a direct bearing on the accuracy of this test. How much blood is processed is the single most critical element in determining whether or not a blood culture will be successful. Since over half of all septic patients have less than one organism per millilitre of blood, culture results showing the presence of organisms are 40% more likely to be positive when 20 ml of blood is used instead of 10 ml. When blood samples taken while the patient is feverish and not due to any other medical conditions turn out to be positive for a bacterial or fungal culture, it is considered a blood stream infection [7-9].

If the initial positive blood culture was taken before or within 48 hours of hospitalization and there was no hospital visit in the 30 days prior to admission, then the patient was characterized as having community-acquired bacteremia. When symptoms of a bloodstream infection do not appear until at least 48 hours after hospital admission, or if the patient has been hospitalized within the past two weeks, it is considered a nosocomial infection. In conclusion, patients were considered to have Health Care Associated Bacteremia if pathogenic microorganisms were isolated from blood samples taken during the first two days of admission, but more than 30 days had passed since admission, and the patient had a hospital stay. Bacteria that are typically thought of as non-virulent are really responsible for a significant rise in the occurrence of vascular infections. There must be a clear differentiation between pollutants and pathogens [8-10].

Isolating and identifying organisms from patients suspected of having a bloodstream infection was the goal of this study. Investigating the pattern of antimicrobial sensitivity in isolated organisms is the main aim. Antimicrobial resistance patterns of the organisms that have been isolated will be characterized as a secondary objective.

Materials and Methods

The study was conducted in the Department of Pathology, Madha Medical College and Research Institute in Chennai, Tamil Nadu, India. The study was conducted from August 2018 to July 2019. Approval was granted by the institutional ethical committee, and the trial began after obtaining informed consent from the patients.

Inclusion criteria

Patients over the age of 18 exhibiting symptoms of a blood stream infection, such as a high temperature, profuse perspiration, rapid heart rate (tachycardia), and abnormally low white blood cell count.

Exclusion criteria

- People under the age of 18 are patients.
- Patients who declined to take part in the research.

Results

Table 1: Age of the patients

Sr. No.	Age (Years)	Total	Percent
1.	18-20	5	2.5
2.	21-30	25	12.5
3.	31-40	42	21
4.	41-50	71	35.5
5.	51-60	30	15
6.	>61	27	13.5
7.	Total	200	100

Table number 1 shows the distribution of patients by age. Out of 200 patients, the majority are in the 41-50 age range, followed by the 31-40 age group.

Table 2: Sex distribution

Sr. No.	Sex	Patients	%
1.	Male	101	50.5
2.	Female	99	49.5%
3.	Total	200	100%

Table 2 displays the gender breakdown of patients, with 50.5% being males and 49.5% being females. There were more males than females in this study.

Table 3: Blood culture results

Sr. No.	Blood Culture	Patients	Percent
1.	Positive	40	20%
2.	Negative	160	80%
	Total	200	100%

Table 3 displays the findings of the blood culture, with 20% testing positive and 80% testing negative out of a total of 200 samples.

Table 4: Clinical prognosis of patients with bloodstream infections

Sr. No.	Outcome	Number	%
1.	Recovered	192	96%
2.	Expired	8	4%

Table 4 presents the clinical outcomes of BSI positive patients, showing that 96% recovered successfully while 4% expired.

Discussion

Patients in intensive care units are at increased risk of complications and death due to blood stream infections. The wide variation in BSI incidence reports is a reflection of the fact that different institutions, patient types, comorbidities, and lengths of stay pose different risks to individuals. Blood culture results showed that 38 out of 200 samples were positive. The study confirmed this. The origin of the infection in the intensive care unit (ICU), the microorganisms involved, preexisting risk factors, the speed of intervention, and the efficacy of therapy all have a role in the development of bloodstream infection (BSI). The purpose of this study was to identify the prevalence of bacteremia in intensive care units, the pathogens responsible

for these infections, and the patterns of antibiotic susceptibility found in blood culture isolates [11-13].

The current study found that patients between the ages of 41 and 50 exhibited the highest prevalence of sepsis symptoms among those hospitalized to the intensive care unit. The study's findings were in line with those of the participants, whose ages ranged from 24 to 54. The majority of patients in the study were between the ages of 49 and 73, with a mean age of 61 [14-16]. Respiratory disease, renal disease, and cirrhosis were all listed as co-morbid disorders in this study. Diabetes mellitus and hypertension were identified as independent risk factors. In this study sample, diabetes mellitus was the most common co-morbid disease, affecting 36% of the total. Diabetes is the most common co-occurring disorder with BSI, according to one study. Additionally, 58% of people with this illness also have diabetes, according to the study [17, 18].

Intravenous catheter devices were identified as the primary infectious agent in culture-confirmed bloodstream infections (BSIs) that affected the respiratory, urinary, gastrointestinal, and biliary systems. These infections persisted throughout the patients' hospital stays. Somewhat similar results were noted in a study that documented IVC, RTI, and UTIs. There were 29 Gram-negative and 9 Gram-positive isolates in the whole [19, 20]. The bacteria Klebsiella neumoniae, Acinetobacter baumannii, *Escherichia coli*, Klebsiella oxytoca, and *Pseudomonas aeruginosa* are the most prevalent Gram-negative isolates. The most common Gram-positive bacteria were Methicillin-sensitive *Staphylococcus aureus*, Methicillin-resistant *Staphylococcus aureus*, *Enterococcus* species, and Methicillin-sensitive coagulase-negative staphylococcus. According to research, *Staphylococcus aureus* is the most common Gram-positive cocci [21-23].

Among the nine Gram-positive bacterial isolates tested, antimicrobial susceptibility testing revealed that MSSA made up 55.5%, MRSA 11%, MS CoNS, and *Enterococcus* species. Both vancomycin and linezolid were completely ineffective against MRSA. Among the antibiotics tested, MSSA were completely susceptible to penicillin, 83.33 percent to cotrimoxazole, 66.66 percent to erythromycin, and 100 percent resistant to linezolid and tetracycline [23, 24]. Tetracycline, Vancomycin, and Linezolid were all fully effective against MS-CoNS, whereas Erythromycin and Cotrimoxazole were equally effective against them. High Level Gentamicin, Linezolid, and Vancomycin were completely ineffective against all of the *Enterococcus* spp. An isolate of *Enterococcus* spp. was shown to be completely susceptible to high doses of gentamicin, vancomycin, and linezolid, but completely resistant to penicillin and erythromycin [24-26]. Of the 14 Klebsiella pneumoniae isolates, 3 produced extended-spectrum bacterial toxins. Imidacloprid had a 78.5% sensitivity rate, imipenem a 71.4% sensitivity rate, piperacillin-tazobactam and gentamicin a 64.2% sensitivity rate, and cefotaxime a 28.5% sensitivity rate among the Gram-negative culture-positive pathogens. Of those, 21.4% were sensitive to cotrimoxazole and 7.1% to ciprofloxacin [25-27].

Conclusion

When it comes to infections in intensive care unit patients, BSIs are right up there with the BIG guns. In intensive care units, antibiotic-resistant bacteria are a growing source of bloodstream infections. As part of their comprehensive care for critically ill patients, clinicians should be knowledgeable of the following topics: risk factors for bloodstream infections caused by bacteria with resistance, typical mechanisms of resistance, and the best practices for antibiotic treatment, source control, and surveillance.

Funding

None.

Conflict of Interest

None.

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