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# BACTERIOLOGICAL PROFILE AND ANTIMICROBIAL SUSCEPTIBILITY OF BLOOD SAMPLE FROM PAEDIATRIC PATIENTS AT A TERTIARY CARE INSTITUTE - A RETROSPECTIVE STUDY

Microbiology

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## ABSTRACT

**Background:** Bloodstream infections (BSIs) are a significant cause of morbidity and mortality globally, necessitating prompt diagnosis and treatment. Understanding the epidemiology and antimicrobial resistance patterns of bloodstream pathogens is crucial for guiding therapy and implementing infection control measures. **Objective:** This retrospective study aimed to investigate the prevalence, etiology, antimicrobial susceptibility patterns, and clinical implications of bloodstream infections among patients in a medical setting. **Materials and Methods:** A total of 184 patients were included in the study, with blood samples collected between September 1, 2021, and August 31, 2023. Blood cultures were processed using the BACTEC system, and isolates were identified using standard microbiological techniques. Antimicrobial susceptibility testing was performed following Clinical and Laboratory Standards Institute (CLSI) guidelines. **Results:** Out of 184 patients, 54 were positive for bacteraemia, resulting in a positivity rate of 29.35%. Gram- positive cocci (GPC) accounted for 68.51% of isolates, with Methicillin-resistant coagulase-negative Staphylococci (MRCONS) and coagulase-negative Staphylococci (CONS) being the most common. Gram-negative bacilli (GNB) comprised 31.48% of isolates, with Escherichia coli and Acinetobacter among the predominant species. Antimicrobial resistance was notable, particularly among MRCONS and Acinetobacter isolates. **Conclusion:** Bloodstream infections remain a significant health concern, emphasizing the importance of timely diagnosis, antimicrobial susceptibility testing, and appropriate treatment. Antimicrobial stewardship and infection control measures are essential for combating the spread of antimicrobial resistance. Further research is needed to explore novel treatment options and improve patient outcomes in the management of bloodstream infections.

## KEYWORDS

bloodstream infections, bacteraemia, antimicrobial susceptibility, and resistance.

## INTRODUCTION:

Bacteraemia, defined as the presence of viable bacteria in the bloodstream, is a serious medical condition associated with significant morbidity and mortality.[1] Under normal circumstances, the bloodstream is considered sterile, and the presence of bacteria in the bloodstream indicates an underlying infection that can lead to severe complications. Bacteraemia can be classified into transient, continuous, and intermittent types based on the duration and pattern of bacterial presence in the bloodstream..[2,3] Common pathogens associated with bloodstream infections include Staphylococcus aureus, Escherichia coli, Klebsiella species, and Pseudomonas aeruginosa.The factors on which mortality depends are age, hospital stay, comorbidity, antibiotic sensitivity and biofilm formation. [4,5,6,7,8] Early diagnosis of bacteraemia is essential for initiating prompt and appropriate antimicrobial therapy, which can significantly impact patient outcomes. Blood culture remains the gold standard for diagnosing bacteraemia, with automated blood culture systems offering faster isolation times and higher sensitivity compared to conventional methods. [9] Preventive measures, such as aseptic catheter insertion techniques and barrier precautions, play a crucial role in reducing the incidence of catheter-related bloodstream infections.[10] The spread of multi drug resistant organism increases a global risk to public health. ESBL producing Enterobacteriaceae are primarily responsible. The number of cases of infection with fluoroquinolone resistant and third generation cephalosporin resistant Escherichia.coli and Klebsiella spp. are increasing.[11]

**Aim and Objective:** The aim of this study was to investigate the prevalence, etiology, antimicrobial susceptibility patterns, and clinical implications of bloodstream infections among patients in a medical setting.

The objectives were to determine the prevalence of bloodstream infections, identify the predominant pathogens, assess their antimicrobial susceptibility patterns, and analyse the clinical characteristics and outcomes associated with bloodstream infections.

### Materials and Methods Study Design and Period:

This retrospective study received ethical clearance from the Institutional Research Committee and Institutional Ethical Committee on 27th March 2024 (IEC/IIMSR/2024/60). It was conducted at the Department of Microbiology, IIMSR, Lucknow, over a period of four months.

### Data Collection:

A total of 184 paediatric patients attending the Tertiary care hospital were included in the study, and blood samples were collected for bacteraemia screening between September 1, 2021, and August 31, 2023, from various departments within the medical facility. Clinical data, including patient demographics and outcomes, were collected from medical records.

### Laboratory examination:

Blood cultures were processed using the BACTEC system, a widely used automated blood culture system that detects microbial growth by monitoring changes in carbon dioxide production. Positive blood cultures were sub cultured onto appropriate media for organism identification. Gram staining, biochemical tests, and commercial identification systems were used for species identification. Antimicrobial susceptibility testing was performed using the Kirby-Bauer disk diffusion method or automated systems, following Clinical and Laboratory Standards Institute (CLSI) guidelines.

### Data analysis and interpretation:

Data analysis was performed using MS Excel, SPSS software and presented in number and percentages using graphs as well as tables.

## RESULTS:

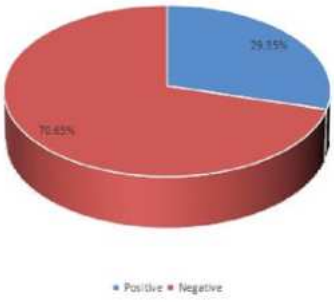
In the present study, a total of 184 patients whose blood samples were received from various departments between September 1, 2021, and August 31, 2023, were included for screening of bacteraemia using the BACTEC system. Out of the 184 patients, 54 were found positive for bacteraemia, resulting in a positivity rate of 29.35%.

Gram-positive cocci (GPC) accounted for 68.51% of the isolates, while Gram-negative bacilli (GNB) comprised 31.48%. The most common GPC isolates were Methicillin -resistance coagulase negative Staphylococcus (38.88%), Coagulase negative Staphylococcus (18.52%), and Staphylococcus aureus (5.55%). Among Gram negative bacteria, Escherichia coli (7.40%), Acinetobacter (5.55%), and Pseudomonas (5.55%) were the most common isolates. Other isolates included Salmonella Typhi, Citrobacter spp., and Klebsiella.spp.

Most patients enrolled in the study were males (53.80%), although the incidence of bacteremia was slightly higher in females (30) compared to males (24) (Table 1). The age group 0-2 years had the highest number of patients (44.02%), while the lowest number of patients was found in the age group 9-10 years (7.61%) (Graph 2).Regarding the sensitivity pattern, Methicillin -resistance coagulase negative Staphylococcus demonstrated 100% sensitivity to Teicoplanin, with

varying sensitivity to other antibiotics ranging from 23.81% to 90.47%. Resistance was notably high against Cefoxitin (76.19%), Erythromycin (71.42%), and Levofloxacin (61.90%).

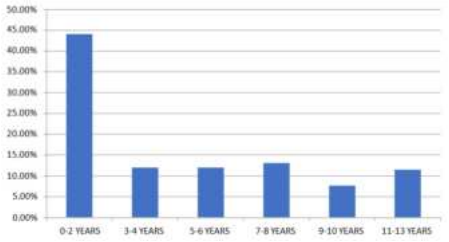
**Figure 1**, showing positive blood culture from BACTEC (an automated system)Out of 184 patients, 54 patients were found positive for bacteremia, hence positivity was 29.35% (54/184) as shown in figure.2




**Graph 1,** showing percentage of positive cases among patients enrolled in this study

**Table No. 1 Distribution Of Patients According To Their Gender**

| | POSITIVE | NEGATIVE | TOTAL | PERCENTAGE |
|---|---|---|---|---|
| MALE | 24 | 75 | 99 | 53.80% |
| FEMALE | 30 | 55 | 85 | 46.20% |




**Graph 2,** Represents Patients According To Their Age Group

## DISCUSSION:

54 of the 184 patient blood samples were culture positive; the isolation rate was 29.35%, which was in line with findings from other studies conducted in India and outside. Similar results were also shown by studies conducted in India by Sharma et al. (2002) [12] (33.9%) and Arora et al. (2007)[13] (20.02%). Geographical locations, patient types, timing, and the quantity of blood cultures, as well as differences in the blood culture system, can all contribute to slight variations in blood culture results.

Due to its resistance to environmental stressors, Acinetobacter baumannii, a non fermenting Gram-negative bacillus, has emerged as a dangerous pathogen, particularly in hospital settings. The variety of medications available for therapy has shrunk due to Acinetobacter species' increasing multidrug resistance trend. Acinetobacter spp. resistance was also shown to be quite prevalent in our investigation. Clinicians get concerned about this because of the high level of antibiotic resistance associated with these microbes. On the other hand, Gupta and Kashyap's similar study conducted in India [14]

Numerous researchers have looked into the large range of organisms that can cause bloodstream infections (BSIs). Gram positive bacteria accounted for 68.51% of the illnesses in our study, while Gram negative bacteria caused 31.48% of the infections. Numerous studies conducted in various parts of the world have demonstrated that Gram positive organisms are more common than Gram negative ones. For example, Wasihun et al. (2015)[15] found that Gram positive bacteria caused 72.2% of infections, while Gram negative bacteria caused 27.8%. Dagnew et al. (2013)[15] found that Gram positive bacteria caused 69% and 31% of infections at Gonder Ethiopia, and Obi and Mazarura in Zimbabwe 1996 reported 71.9% and 28.1% of infections.[16,17]We also observed in our analysis that a sizable portion of the septicaemia cases were in newborns. Additionally, earlier research has revealed a greater incidence of newborn septicaemia [18, 19].

The most common causative agents of Blood stream infection isolated in the study were Coagulase-negative Staphylococcus and Staphylococcus aureus which were also remain predominated isolates in other studies[20,21], .. The emerging infection with Enterococcus (8.01%) was observed in this study which was also found in other studies [22].

In this study most of the organism isolates observed were Methicillin resistance coagulase negative Staphylococcus (38.88%) followed by 15.68% of Klebsiella each in contrary to other study which showed the children were most frequently affected with Escherichia coli and Coagulase-negative Staphylococcus [23].

## CONCLUSION:

Bloodstream infections remain a significant health concern, emphasizing the importance of timely diagnosis and antimicrobial susceptibility testing. Limiting antibiotic use and implementing strict aseptic precautions are essential for preventing the spread of bloodstream infections.

Vancomycin and Teicoplanin remain effective against Methicillin-resistance Staphylococcus aureus and Methicillin -resistance coagulase negative Staphylococcus infections, while judicious use of carbapenems and combination therapy is recommended for Multi drug resistance Gram-negative bacteria.

Controlled antibiotic use and robust policies to combat antibiotic resistance are imperative. Vaccination strategies should also be emphasized to prevent infections caused by specific bacteria.

Automated systems like BacT/Alert and VITEK II play a crucial role in expediting diagnosis and treatment, potentially saving lives in paediatric patients with bloodstream infections.

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