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# Bacteriological Profile and Antibiotic Sensitivity Pattern of Bloodstream Infections in Pediatric Patients from a Tertiary Health Care Centre at Jodhpur, Rajasthan

[1]Dr. Sakshi Jain, Resident, Dr. S.N. Medical College, Jodhpur

[2]Dr. Sheetal Bohara, Senior Resident, Dr. S.N. Medical College, Jodhpur

[3]Dr. R. S. Parihar, Senior Professor, Dr. S.N. Medical College, Jodhpur

[4]Dr. Mukesh Sharma, Assistant Professor, Dr. S.N. Medical College, Jodhpur

**Corresponding Author:** Dr. Sakshi Jain, Resident, Dr. S.N. Medical College, Jodhpur

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## Abstract

**Introduction**: Bloodstream infections (BSIs), which range from transient bacteraemia to life-threatening septicaemia, represent a major proportion of healthcare-associated infections globally. The causative organisms are often multidrug-resistant organisms, contributing to prolonged hospital stays. Our study aims to collect data about blood culture isolates from a medical college in western Rajasthan, India.

**Materials and Methods:** A retrospective analysis of blood culture isolates obtained at our laboratory for three months from paediatric patients with clinical suspicion of sepsis or infection with the possibility of haematogenous spread was done. Blood samples were initially incubated in BACTEC and then manually processed once they flagged positive.

**Results:** A total of 288 blood samples were received, of which 101 (35%) showed the growth of a pathogenic organism. The frequency of Gram-negative bacteria (59.4%) isolated was more than that of Gram-positive bacteria (40.6%). Acinetobacter baumannii complex [n = 28, 27.7%] was the most commonly isolated organism, followed by Coagulase-Negative Staphylococcus (CoNS) [n = 27, 26.7%].

**Discussion:** This study provides a comprehensive analysis of blood culture findings in paediatric patients. Both Gram-positive and Gram-negative isolates showed reduced susceptibility to commonly used antibiotics, underscoring the need for close surveillance and targeted antimicrobial therapy.

**Conclusion:** Our study reveals important insights guiding clinical practices, antimicrobial stewardship, and infection control strategies.

**Keywords:** Bacteraemia, Gram-positive bacteria, Gram negative bacteria, sepsis.

## Introduction

Bloodstream infections (BSIs) make up the majority of healthcare-associated ailments worldwide[1]. The presence of microorganisms in the bloodstream represents one of the most critical conditions in infectious diseases[2]. The prevalence of bloodstream infections and the antimicrobial susceptibility patterns of these organisms differ across regions. Moreover, the excessive and inappropriate use of antibiotics has contributed to the emergence of multidrug-resistant organisms, further complicating management and outcomes[5,2]. Knowing the bacterial sensitivity patterns is crucial for initiating empirical therapy[5,7]. Our study aims to analyse data about the prevalence and antibiotic susceptibility patterns of blood culture isolates.

**Materials and Methods:**

**Study area and period**

This research aims to retrospectively analyse the blood culture isolates of paediatric patients obtained at the Microbiology Lab, Umaid Hospital, Dr. S N Medical College located in Jodhpur, Rajasthan. The study covers three months, starting from August 2025 and ending in October 2025. This study comprised blood culture specimens obtained from inpatients of paediatric age group for bacteriological inquiry as a standard part of their patient care. A comprehensive inquiry into the records of all relevant cases was carried out using the laboratory register and the medical records department at the hospital.

**Inclusion criteria**

Blood samples were collected from patients suspected of having blood stream infections[2]. The diagnosis of BSI required the presence of positive blood cultures with systemic indications of infection[1]. To identify sepsis in newborns, medical professionals searched for distinct clinical manifestations such as fever (≥38.0°C), respiratory distress, convulsions, hypothermia (≤36.5°C), lethargy, poor feeding, vomiting, jaundice, purulent infections in the umbilical region[19].

**Exclusion Criteria**

- Patients who were excluded from the analysis had autoimmune/chronic diseases, including tuberculosis, weakened immune systems, steroid use, heat stroke, or suspected viral and parasitic infections.
- Contaminated samples.

**Specimen collection and processing**

As per the hospital's standard sample collection protocol, blood samples were collected using strict aseptic precautions. Before collection, the skin was cleaned thoroughly with 2% chlorhexidine to reduce contamination and maintain sample quality. Preferred sites for blood collection were the antecubital and median cubital veins. In patients with central venous access, blood was drawn from one lumen after proper disinfection of the port hub with 2% chlorhexidine.

For paediatric patients, 2–4 mL of blood was collected for each sample and immediately transferred into BACTEC aerobic blood culture bottles. The samples were then promptly sent to the Microbiology laboratory, where they were incubated in the BD BACTEC FX40 automated blood culture system and followed for 7 days.

When a blood culture showed positive growth, the broth was subcultured onto blood agar and MacConkey agar plates, which were incubated at 37°C. Growth of organisms such as diphtheroids, *Bacillus* spp., *Micrococcus* spp., and viridans streptococci was considered contamination. Bottles which did not showed growth after 7 days were discarded.

The bacterial growth on the agar plates in the case of pathogens was determined and characterized based on the colony morphology, Gram staining, and traditional biochemical testing procedures, all conducted using established laboratory techniques[20,21]. Antibiotic susceptibility testing was carried out using the Kirby-Bauer disk diffusion method, employing antibiotic discs and interpreting the results based on the guidelines provided by the Clinical and Laboratory Standards Institute (CLSI)[21].

**Quality Control and Data Analysis**

Standard reference strains—Escherichia coli ATCC 25922, Enterococcus faecalis ATCC 29212, Pseudomonas aeruginosa ATCC 27853, and Staphylococcus aureus ATCC 25923—were used for quality control during biochemical testing and antibiotic susceptibility testing. Antibiotic sensitivity pattern was analysed and data was compiled into a single chart using Microsoft Excel.

**Results and Discussion**

During the study period, a total of 288 blood samples were collected from in patients of paediatric age group. Among the patients, 61.38% were male, and 38.62% female. Patients exhibited a diverse array of signs and symptoms, so those involving the same system were combined in the data presentation. The most common presentation of the patients was fever followed by respiratory signs and symptoms. Of the 288 samples, 101 (35.06%) showed growth of a pathogenic organism, while 10 (3.4%) showed growth of contaminants. The remaining 177 samples (61.45%) did not show any growth, as per Figure 1. The 10 samples which showed contamination were excluded from further analysis.

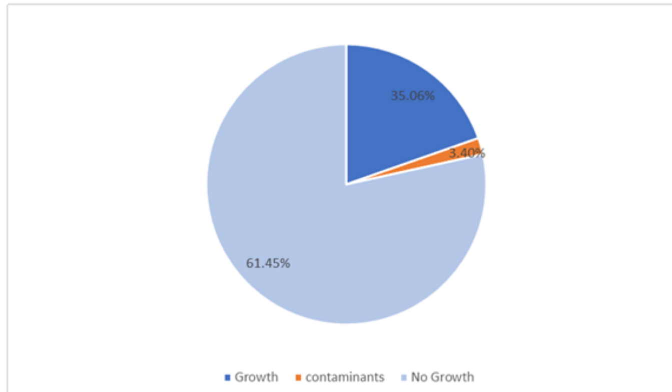


Figure 1: Growth in blood culture

Table 1: Antibiotic Sensitivity Pattern of Gram Negative Bacteria

| GNB | AK | MRP | IPM | PIT | CTX | CIP | IE | A/S | LE | CPM |
|---|---|---|---|---|---|---|---|---|---|---|
| Klebsiella | S | S | S | R | R | R | S | R | S | S |
| Pseudomonas | S | S | S | S | R | R | S | R | S | S |
| Pseudomonas | S | R | S | R | S | S | S | S | S | S |
| Acinetobacter | R | R | R | R | R | R | S | R | R | S |
| Klebsiella | R | S | S | R | R | R | R | R | R | S |
| Acinetobacter | S | S | S | R | R | S | S | S | S | R |
| Klebsiella | S | S | R | R | R | R | S | R | R | R |
| Klebsiella | S | S | R | R | R | R | S | R | R | R |
| Klebsiella | S | S | S | R | R | R | S | R | R | R |
| Pseudomonas | S | R | S | R | S | S | S | S | S | S |
| Acinetobacter | S | S | S | R | R | S | S | S | S | R |
| Acinetobacter | S | S | S | R | R | R | R | R | S | S |
| Citrobacter | S | R | R | R | R | R | S | R | S | R |
| E.Coli | S | S | S | R | R | R | S | R | R | R |
| E.Coli | S | S | S | R | R | R | R | R | R | R |
| Klebsiella | S | S | S | R | R | R | S | R | R | R |
| Klebsiella | R | S | S | R | R | R | S | R | S | R |
| Acinetobacter | R | S | R | R | R | R | R | S | S | S |
| E.Coli | S | S | R | R | R | S | S | R | S | S |
| Citrobacter | S | R | R | R | R | R | S | R | R | R |
| E.Coli | S | S | S | R | R | R | S | R | S | R |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Klebsiella | S | S | S | R | R | R | R | R | R | R |
| Klebsiella | R | S | S | R | R | R | R | R | R | R |
| Acinetobacter | R | S | S | R | R | R | S | R | R | S |
| E.Coli | S | S | S | R | R | S | S | S | S | S |
| Klebsiella | R | R | R | R | R | R | S | R | R | S |
| Acinetobacter | S | R | R | R | R | R | R | R | S | R |
| Klebsiella | S | S | S | R | S | S | R | S | S | S |
| Klebsiella | S | S | S | S | S | S | S | S | S | S |
| E.Coli | S | S | S | R | R | S | S | R | S | S |
| Acinetobacter | S | R | R | R | R | S | S | R | S | R |
| Acinetobacter | R | S | S | R | R | R | S | R | R | R |
| Acinetobacter | S | S | S | R | R | R | S | R | R | R |
| Acinetobacter | R | R | R | R | R | S | R | R | R | R |
| Acinetobacter | S | S | S | R | R | R | R | S | S | R |
| Acinetobacter | S | S | S | S | R | S | R | S | S | R |
| Acinetobacter | R | S | S | S | R | S | S | S | S | R |
| Acinetobacter | S | S | R | S | S | S | S | S | S | S |
| Acinetobacter | R | S | S | S | R | S | S | S | S | S |
| Acinetobacter | R | R | R | R | R | R | S | S | S | R |
| Acinetobacter | S | S | S | R | S | S | S | R | S | S |
| Acinetobacter | S | S | S | S | S | S | R | S | S | S |
| Acinetobacter | S | S | R | S | R | R | S | S | R | R |
| Acinetobacter | S | S | R | R | R | R | S | R | R | R |
| Acinetobacter | R | R | R | R | R | R | S | R | R | R |
| Acinetobacter | S | S | S | S | S | S | R | S | S | R |
| Klebsiella | R | R | R | R | R | S | S | S | S | R |
| Klebsiella | R | R | R | R | R | R | S | R | R | R |
| Acinetobacter | R | S | S | R | S | S | S | R | R | S |
| Acinetobacter | S | R | R | R | S | S | S | S | R | S |
| Pseudomonas | S | S | S | R | R | S | S | S | R | S |
| Acinetobacter | S | S | S | S | S | S | S | S | R | S |
| Acinetobacter | S | S | S | S | R | S | S | R | S | S |
| Acinetobacter | R | S | S | S | R | S | S | R | S | R |
| E.Coli | R | S | S | R | R | R | S | R | S | R |
| Klebsiella | R | S | S | R | R | S | S | S | S | R |
| E.Coli | S | S | S | R | R | R | R | S | R | R |
| Citrobacter | S | S | S | S | S | S | S | S | S | R |
| Klebsiella | R | R | R | R | S | S | S | R | S | R |
| Citrobacter | S | R | R | R | R | R | S | R | S | R |
| Total S | 40 | 44 | 39 | 13 | 13 | 28 | 46 | 24 | 35 | 24 |
| Total R | 20 | 16 | 21 | 47 | 47 | 32 | 14 | 36 | 25 | 36 |
| % Sensitivity | 66.67% | 73.33% | 65.00% | 21.67% | 21.67% | 46.67% | 76.67% | 40.00% | 58.33% | 40.00% |

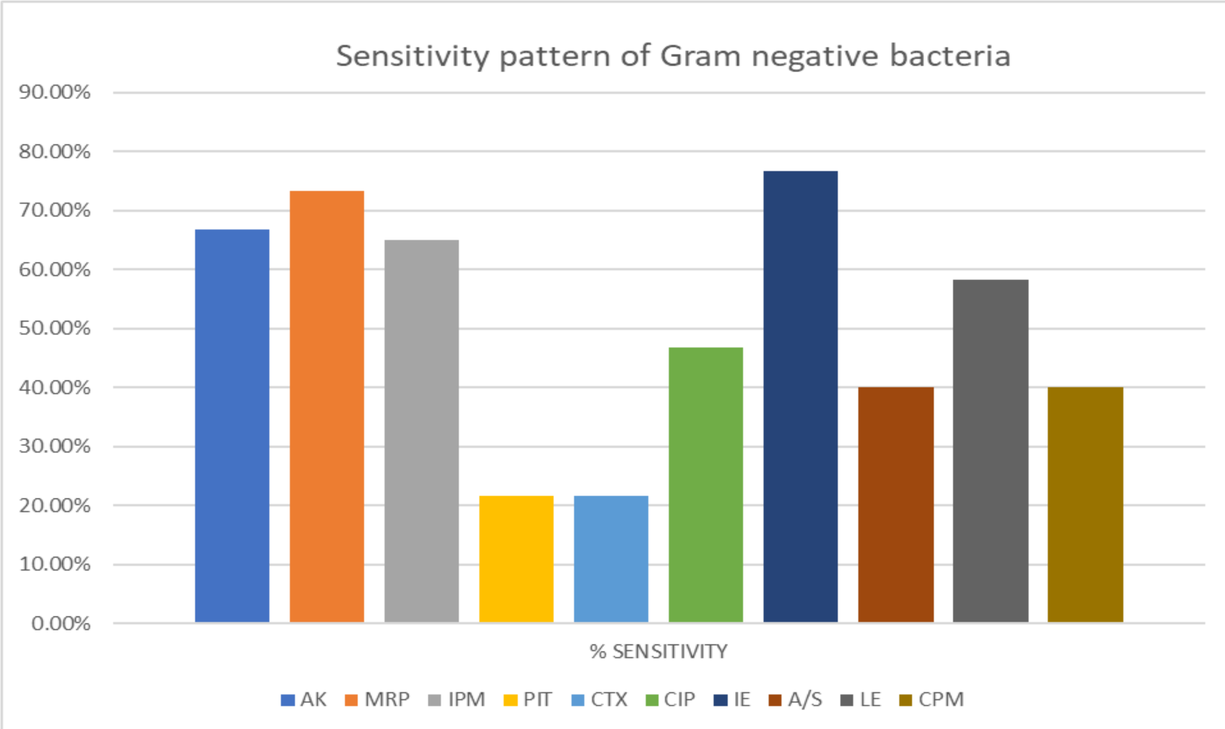


Figure 2: AK – Amikacin, MRP- Meropenem, IPM – Imepenem, PIT – Pipracillin And Tazobactam, CTX- Cefotaxime, CIP- Ciprofloxacin, IE – Imepenem And Cilastatin, A/S – Ampicillin And Sulbactam, LE – Levofloxacin, CPM - Cefepime

Table 2: Antibiotic Sensitivity Pattern of Gram Positive Bacteria

| GPC | LZ | VA | AK | A/S | CZ | CX | CIP | HLG | AMC |
|---|---|---|---|---|---|---|---|---|---|
| Cons | S | S | S | R | R | R | R | S | S |
| Staph Aureus | S | S | S | S | S | R | R | S | S |
| Cons | S | S | R | R | R | R | R | S | S |
| Cons | S | S | S | S | S | R | S | R | R |
| Enterococcus | S | S | R | R | R | R | R | R | R |
| Enterococcus | S | S | R | S | R | R | R | S | S |
| Cons | S | S | R | S | S | S | S | S | R |
| Enterococcus | S | S | R | R | R | R | R | R | R |
| Cons | S | S | R | S | R | R | R | S | R |
| Enterococcus | S | S | R | S | R | R | S | S | R |
| Cons | S | S | R | S | S | S | S | S | S |
| Cons | S | S | S | R | R | R | S | S | R |
| Cons | S | S | S | S | S | S | S | R | R |
| Enterococcus | S | S | R | R | R | R | R | R | R |
| Enterococcus | S | S | R | S | R | R | R | R | S |
| Cons | S | S | S | S | R | R | S | S | S |
| Enterococcus | S | S | R | R | R | R | R | R | S |
| Enterococcus | S | S | R | R | R | R | S | R | S |
| Cons | S | S | S | S | S | S | S | S | R |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cons | S | S | S | R | R | R | R | S | S |
| Cons | S | S | S | S | S | S | S | S | S |
| Cons | S | S | S | R | R | R | R | S | S |
| Cons | S | S | S | R | R | R | R | S | S |
| Staph Aureus | S | S | R | R | S | R | R | S | S |
| Staph Aureus | S | S | R | R | R | R | S | S | S |
| Staph Aureus | S | S | S | R | S | S | R | S | S |
| Cons | S | S | S | R | R | R | R | S | S |
| Cons | S | S | S | R | R | R | R | R | R |
| Staph Aureus | S | S | S | S | S | S | R | R | S |
| Cons | S | S | S | S | S | S | S | R | S |
| Cons | S | S | S | S | S | S | S | R | S |
| Staph Aureus | S | S | S | R | R | R | R | S | S |
| Cons | S | S | S | S | S | S | S | S | S |
| Cons | S | S | R | R | R | R | R | R | R |
| Staph Aureus | R | S | R | S | R | R | R | S | S |
| Staph Aureus | S | S | R | S | R | R | R | S | S |
| Staph Aureus | S | S | S | S | S | S | S | S | S |
| Staph Aureus | S | S | S | S | S | S | S | S | S |
| Cons | S | S | S | S | S | S | R | R | S |
| Cons | S | S | R | S | R | R | R | R | S |
| Staph Aureus | S | S | S | S | S | S | S | R | S |
| Total S | 40 | 41 | 23 | 23 | 17 | 14 | 17 | 25 | 29 |
| Total R | 1 | 0 | 18 | 18 | 24 | 27 | 24 | 16 | 12 |
| % Sensitivity | 97.56% | 100.00% | 56.10% | 56.10% | 41.46% | 34.15% | 41.46% | 60.98% | 70.73% |

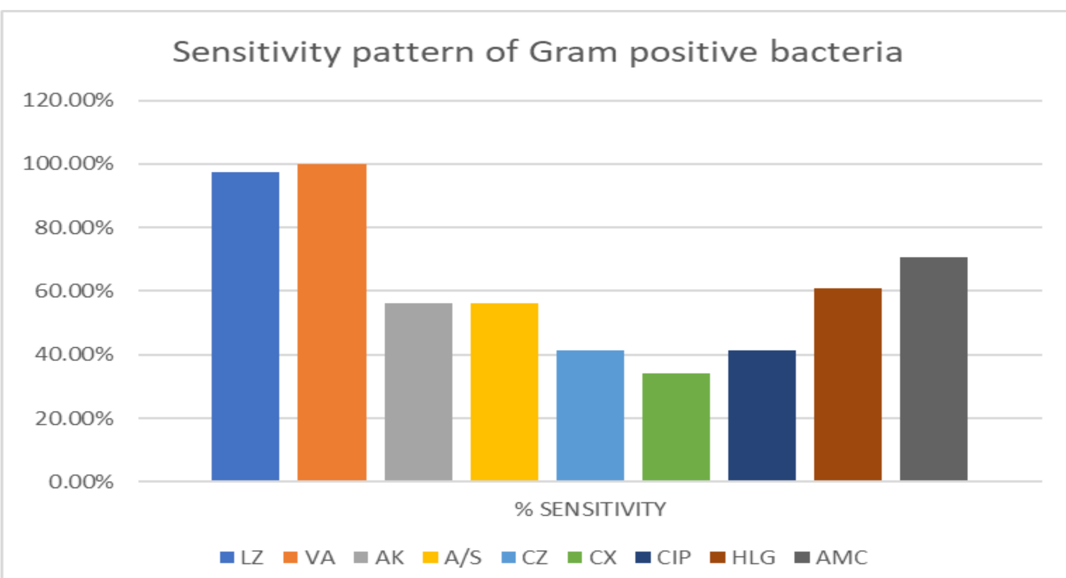


Figure 3: LZ- Lenezolid, VA- Vancomycin, AK- Amikacin, A/S- Ampicillin And Sulbactam, CZ – Cefazolin, CX – Cefoxitin, CIP – Ciprofloxacin, HLG – High Level Gentamycin, AMC - Amoxicillin And Clavulanic Acid.

The results of the blood cultures taken from patients revealed that the frequency of Gram-negative bacteria (59.4%) isolated was more than that of Gram-positive bacteria (40.6%). Acinetobacter baumannii complex [n = 28, 27.7%] was the most commonly isolated organism, followed by Coagulase-Negative Staphylococcus (CoNS) [n = 27, 26.7%].

Our research shows high degree resistance among Gram negative organisms. With highest resistance shown by piperacillin and tazobactam (78.33% resistance) and cefotaxime (78.33% resistance), with highest sensitivity shown by Imipenem and cilastin (76.67% sensitivity) followed by meropenem (73.33 % sensitivity). Pease refer to Table 1 for further details.

Among Gram positive organisms, they showed high degree methicillin resistance i.e., 65.85% resistance. With maximum sensitivity for Vancomycin (100% sensitivity) followed by Linezolid (97.56 % sensitivity). Please refer to Table 2 for further details.

## Conclusion

In conclusion, this study provides important insights into the epidemiology of bloodstream infections (BSIs) and the antibiotic resistance patterns of bacterial isolates. The findings highlight the complex nature of BSIs and emphasize the need to adapt clinical management strategies according to local epidemiological trends. Early identification of causative organisms can help primary care physicians choose appropriate empirical antibiotics, thereby reducing the risk of progression to sepsis and other serious complications.

Further multicentric studies are needed to broaden the existing evidence base and improve our understanding of effective antibiotic options for these infections. Such studies would also help build a larger database to support better clinical decision-making. Additionally, the study emphasizes the importance of a comprehensive infection control strategy, including strict aseptic measures during invasive procedures, careful use of indwelling devices, and proper management of underlying illnesses. The diverse demographic profile of the study population also improves the applicability of these findings to a wider patient population.

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