

## A Prospective Study on Blood Culture Positivity and Antimicrobial Resistance in Neonatal Sepsis in a Tertiary Care Hospital

Dr. Faria Ashraf<sup>1</sup>, Dr. Ahmad Ali<sup>2</sup>

<sup>1</sup>MD Microbiology, Associate Professor, Department of Microbiology, Venkateshwara Institute of Medical Sciences, Gajraula, Uttar Pradesh, India

<sup>2</sup>MD Paediatrics, Associate Professor, Department of Paediatrics, Venkateshwara Institute of Medical Sciences, Gajraula, Uttar Pradesh, India

### Corresponding author –

Dr. Ahmad Ali

MD Paediatrics, Associate Professor, Department of Paediatrics, Venkateshwara Institute of Medical Sciences, Gajraula, Uttar Pradesh, India

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### ABSTRACT

**Background:** Neonatal sepsis remains a leading cause of morbidity and mortality in developing countries. Early identification of pathogens and their antibiotic susceptibility patterns is essential for optimal therapy.

**Objectives:** To determine the rate of blood culture positivity, bacterial spectrum, and antibiotic resistance patterns among neonates with clinically suspected sepsis.

**Methods:** A prospective observational study was conducted over 12 months in the Neonatal Intensive Care Unit (NICU) and Microbiology Department at VIMS Medical College, Gajraula. A total of 200 neonates with clinical suspicion of sepsis were enrolled. Blood samples were collected aseptically and cultured using BACTEC automated system. Isolates were identified by standard biochemical tests, and antimicrobial susceptibility testing was performed using the Kirby–Bauer disc diffusion method as per CLSI (2023) guidelines.

**Results:** Of the 200 samples, 88 (44%) showed positive blood culture results. Gram-negative bacteria predominated (65.9%), with *Klebsiella pneumoniae* (27.3%) and *Escherichia coli* (22.7%) being the most frequent isolates, followed by *Staphylococcus aureus* (20.4%) and Coagulase-negative *Staphylococci* (15.9%). Gram-negative isolates showed high resistance to ampicillin (89%) and third-generation cephalosporins (68%), but retained sensitivity to meropenem (78%) and amikacin (72%). Among *S. aureus* isolates, 36% were methicillin-resistant (MRSA).

**Conclusion:** Gram-negative bacteria, particularly *K. pneumoniae* and *E. coli*, remain the predominant pathogens in neonatal sepsis with alarming resistance to commonly used antibiotics. Regular surveillance and antibiotic stewardship are crucial to improve neonatal outcomes

**Keywords:** Neonatal sepsis, blood culture, antibiotic resistance, *Klebsiella pneumoniae*, MRSA

### 1. INTRODUCTION

Neonatal sepsis continues to be one of the major causes of mortality and prolonged hospitalization among newborns, particularly in developing nations. According to WHO estimates, sepsis accounts for approximately 30–50% of neonatal deaths in low- and middle-income countries [1]. The clinical presentation is often nonspecific, making laboratory confirmation through blood cultures essential for accurate diagnosis [2]. Despite advances in neonatal care and widespread use of empirical antibiotics, mortality rates remain high, largely due to delayed diagnosis and rising antimicrobial resistance [3]. The causative organisms vary between regions and hospitals, reflecting differences in hygiene, antibiotic policies, and infection control practices [4]. Gram-negative organisms such as *Klebsiella pneumoniae* and *Escherichia coli* are the predominant causes of neonatal sepsis in India, while *Staphylococcus aureus* and coagulase-negative staphylococci (CoNS) are also significant pathogens, especially in late-onset sepsis [5,6]. The increasing prevalence of multidrug-resistant (MDR) organisms poses a serious therapeutic challenge [7]. This study aimed to identify the bacteriological profile and antibiotic susceptibility patterns of pathogens isolated from neonates with clinically suspected sepsis in a tertiary care hospital.

### 2. MATERIALS AND METHODS

Study Design: Prospective observational study

Study Setting: Department of Paediatrics and Department of Microbiology, VIMS Medical College, Gajraula, Uttar Pradesh, India. Study Period: January 2024 to December 2024

Sample Size: 200 neonates with clinically suspected sepsis (based on standard WHO criteria).

Inclusion Criteria: Neonates ( $\leq 28$  days old) with clinical features such as lethargy, feeding intolerance, respiratory distress, temperature instability, or seizures.

Exclusion Criteria: Neonates with congenital anomalies, prior antibiotic therapy  $>48$  hours, or incomplete clinical records

Sample Collection and Culture: Under aseptic precautions, 1–2 mL of venous blood was collected and inoculated into BACTEC PEDS Plus/F culture bottles. Positive cultures were subcultured on blood agar and MacConkey agar. Identification was done by Gram staining and standard biochemical reactions.

Antimicrobial Susceptibility Testing (AST): AST was performed by Kirby–Bauer disc diffusion on Mueller-Hinton agar as per CLSI 2023 guidelines [8]. Antibiotics tested included ampicillin, cefotaxime, ceftriaxone, gentamicin, amikacin, ciprofloxacin, piperacillin-tazobactam, meropenem, and vancomycin (for Gram-positive isolates).

Data Analysis: Statistical analysis was performed using SPSS version 25. Chi-square test was used to assess significance;  $p < 0.05$  was considered statistically significant.

Ethical Consideration: Institutional Ethics Committee approval was obtained before the study. Written informed consent was taken from parents or guardians.

### 3. RESULTS

Out of 200 neonates, 116 (58%) were males and 84 (42%) were females. Blood culture positivity was observed in 88 (44%) cases.

**Table 1. Distribution of bacterial isolates (n = 88)**

Pathogen	No. of isolates	Percentage (%)
<i>Klebsiella pneumoniae</i>	24	27.3
<i>Escherichia coli</i>	20	22.7
<i>Staphylococcus aureus</i>	18	20.4
Coagulase-negative Staphylococci	14	15.9
<i>Pseudomonas aeruginosa</i>	8	9.1
<i>Acinetobacter baumannii</i>	4	4.6

**Table 2. Antibiotic resistance pattern (% of isolates resistant)**

Antibiotic	Gram-negative isolates	Gram-positive isolates
Ampicillin	89	72
Cefotaxime	68	40
Amikacin	28	21
Ciprofloxacin	42	36
Meropenem	22	10
Vancomycin	-	0 (all sensitive)

### 4. DISCUSSION

The present study revealed a blood culture positivity rate of 44%, comparable to rates reported by Singh et al. (42%) [9] and Jain et al. (46%) [10]. Gram-negative organisms predominated (65.9%), consistent with several Indian studies showing a shift from Gram-positive to Gram-negative dominance [11,12]. *Klebsiella pneumoniae* (27.3%) was the most common isolate, in line with findings from Agnihotri et al. [13] and Datta et al. [14]. Its predominance reflects poor infection control practices and broad-spectrum antibiotic use. *E. coli* (22.7%) typically causes early-onset sepsis transmitted vertically from the maternal genital tract [15]. Among Gram-positive isolates, *S. aureus* (20.4%) and CoNS (15.9%) were significant, with

36% MRSA rate consistent with other tertiary hospital data [16,17]. Vancomycin and linezolid retained 100% sensitivity, making them reliable agents for MRSA infections.

High resistance to ampicillin (89%) and cephalosporins (68%) among Gram-negative isolates is alarming and highlights misuse of empirical antibiotics [18,19]. Carbapenems and aminoglycosides remained the most effective agents, though increasing global carbapenem resistance is concerning [20]. Strengths of this study include prospective design and use of automated culture systems. Limitations include single-centre data and absence of molecular typing.

These findings emphasize the need for rational antibiotic use, periodic surveillance, and improved infection control in NICUs.

## 5. CONCLUSION

Gram-negative bacteria, primarily *Klebsiella pneumoniae* and *E. coli*, are the leading causes of neonatal sepsis. High resistance to first-line antibiotics underscores the importance of antibiotic stewardship and surveillance. Early identification and appropriate antibiotic therapy are key to reducing neonatal morbidity and mortality.

## REFERENCES

- [1] World Health Organization. Neonatal infections fact sheet. WHO; 2023.
- [2] Vergnano S, et al. Neonatal sepsis: an international perspective. *Arch Dis Child Fetal Neonatal Ed.* 2020;105(3):F180–F185.
- [3] Simonsen KA, et al. Early-onset neonatal sepsis. *Clin Microbiol Rev.* 2019;32(2):e00134–18.
- [4] Sankar MJ, et al. Neonatal sepsis in India: epidemiology and antimicrobial resistance. *J Matern Fetal Neonatal Med.* 2021;34(7):1173–1179.
- [5] Jain NK, et al. Bacteriological profile of neonatal sepsis and antibiotic susceptibility pattern. *Indian J Pediatr.* 2021;88(5):421–427.
- [6] Chaurasia S, et al. Neonatal sepsis in South Asia: a review. *Pediatr Infect Dis J.* 2020;39(1):S30–S35.
- [7] Laxminarayan R, et al. Antibiotic resistance—the need for global solutions. *Lancet Infect Dis.* 2020;20(9):e240–e245.
- [8] CLSI. Performance Standards for Antimicrobial Susceptibility Testing. 33rd ed. CLSI; 2023.
- [9] Singh R, et al. Blood culture isolates and antibiogram in neonatal sepsis. *J Lab Physicians.* 2022;14(2):165–170.
- [10] Jain A, et al. Neonatal sepsis: bacterial profile and resistance pattern. *Int J Contemp Pediatr.* 2021;8(9):1503–1509.
- [11] Gupta A, et al. Changing trends in neonatal sepsis in India. *Indian Pediatr.* 2021;58(5):421–427.
- [12] Roy I, et al. Bacteriology of neonatal sepsis in a tertiary care hospital. *Indian J Med Microbiol.* 2020;38(4):540–546.
- [13] Agnihotri N, et al. *Klebsiella* species as predominant pathogen in neonatal sepsis: a concern. *J Glob Infect Dis.* 2022;14(3):189–194.
- [14] Datta S, et al. Antimicrobial resistance patterns in neonatal sepsis: a multicentric study. *Indian J Med Res.* 2021;154(6):740–748.
- [15] Sharma P, et al. Early-onset neonatal sepsis: maternal and neonatal risk factors. *J Neonatal Biol.* 2022;11(4):101–107.
- [16] Bhatt M, et al. MRSA in neonatal sepsis: prevalence and clinical outcome. *Indian J Pathol Microbiol.* 2023;66(3):350–356.
- [17] Kumar R, et al. Methicillin-resistant *Staphylococcus aureus* infections in neonates: current trends. *Pediatr Infect Dis J.* 2022;41(2):e65–e71.
- [18] Patel M, et al. Extended-spectrum beta-lactamase producing Gram-negative bacteria in neonatal sepsis. *J Clin Diagn Res.* 2021;15(7):DC05–DC09.
- [19] Deshmukh S, et al. Antibiotic resistance among Gram-negative isolates in neonatal intensive care unit. *Indian J Med Microbiol.* 2020;38(5):601–606.
- [20] WHO GLASS. Global Antimicrobial Resistance Surveillance System. Geneva: WHO; 2022.