

## Evaluation of Bacteriological Profile and Antimicrobial Sensitivity Pattern of Neonatal Sepsis in a Tertiary Care Centre

Jyotsna<sup>1</sup>, Mukesh Kumar<sup>2</sup>, Ankur Priyadarshi<sup>3</sup>

<sup>1</sup>Senior Resident, Department of Pediatrics, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India

<sup>2</sup>Senior Resident, Department of Pediatrics, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India

<sup>3</sup>Professor and HOD, Department of Pediatrics, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India

Received: 05-11-2025 / Revised: 25-11-2025 / Accepted: 21-12-2025

Corresponding author: Dr. Mukesh Kumar

Conflict of interest: Nil

### Abstract

**Background:** Globally, neonatal sepsis is a leading cause of morbidity and mortality. In order to guide effective treatment, improve patient outcomes, and prevent the establishment of antibiotic resistance, it is essential to comprehend the bacterial profiles and antibiotic susceptibility patterns underlying neonatal sepsis. The purpose of this study is to assess the antimicrobial sensitivity pattern and bacteriological profile of neonatal sepsis.

**Methods:** From February 2025 to October 2025, the pediatrics department at Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, conducted this prospective observational study. Ninety neonates with clinically suspected sepsis had their blood samples taken, processed according to the microbiological technique, and their antimicrobial sensitivity pattern identified.

**Results:** Sixty-one (67.78%) of the ninety cases had positive blood cultures. There were 23 (37.71%) Gram negative isolates and 48 (78.79%) Gram positive isolates. Among the isolates, Staphylococcus aureus was the most prevalent organism (75.51%), followed by E. Coli (27.87%), Klebsiella pneumoniae (9.84%), and Streptococcus pneumoniae (3.28%). Ampicillin resistance was 100% present in all three of the common isolates. Gram negative isolates were susceptible to gentamicin and meropenem, while Gram positive isolates were susceptible to amikacin, amoxicillin, and clavulenic acid.

**Conclusion:** In this study, neonatal septicemia was found to be 67.78% supported by blood culture, which is the gold standard investigation for diagnosis. This outcome also demonstrated that the prevalence of antibiotic resistance to widely used antibiotics was rising. These two changes in the microbiological spectrum and antimicrobial susceptibility pattern shown during this investigation will undoubtedly aid in the right antibiotic treatment of such instances, hence reducing infant morbidity and mortality.

**Keywords:** Neonatal sepsis, Coagulase negative bacteria, Antimicrobial susceptibility.

**DOI:** 10.25258/ijcpr.18.1.93

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

### Introduction

Thirty to fifty percent of neonatal deaths globally are caused by neonatal sepsis, which is a major cause of illness and mortality in newborns. It is a potentially fatal illness marked by a systemic inflammatory reaction to infection, mostly brought on by bacterial infections.[1,2] Improving survival rates requires early diagnosis and prompt delivery of the right medications.[3] The incidence of neonatal sepsis varies depending on geographical region, healthcare facilities, and infection control measures.[4] In developing countries, poor hygiene practices, preterm birth, and prolonged hospital stays contribute to higher infection rates.[5] Neonates admitted to Neonatal Intensive Care

Units (NICUs) are particularly vulnerable due to their immature immune systems and increased exposure to invasive procedures.[6,7] Despite advancements in neonatal care, diagnosing and managing neonatal infections remain a challenge due to non-specific clinical symptoms and increasing antimicrobial resistance. The pattern of bacterial isolates and their antibiotic susceptibility vary across different healthcare settings, requiring continuous monitoring to optimize empirical antibiotic therapy.[8]

### Material and Methods

This prospective observational study was conducted from February 2025 to October 2025 in the pediatrics department of Jawaharlal Nehru Medical College and Hospital in Bhagalpur, Bihar. Ninety neonates with clinically suspected sepsis had their blood samples taken, processed according to the microbiological technique, and their antimicrobial sensitivity pattern identified. Babies born in the hospital and admission from outside were included. For purpose of all this study, neonatal sepsis was defined a neonates presenting with one or more features like reluctant to feed, lethargy, presence of fever ( $\geq 38^{\circ}\text{C}$ ), or hypothermia ( $\leq 36^{\circ}\text{C}$ ), abdominal distension, vomiting, diarrhea, jaundice, convulsion, bulging fontanel, respiratory distress, hypoglycemia, umbilical discharge were considered as the main clinical features of neonatal sepsis. Mother of those neonates who delivered by either cesarean section or vaginal delivery with history of high risk delivery like premature rupture of membrane  $>12$  hours, prolonged labour, foul smelling liquor, meconium stained amniotic fluid were also included in this study. Suspected neonates who died upon arrival before blood culture report could be obtained or neonates had clinical picture of sepsis without positive blood culture were excluded. Neonates with congenital anomalies, extreme low birth weight babies were also excluded.

A thorough physical examination was carried out after taking detailed and careful history of each case. Patient's care givers were interviewed and only those babies were enrolled where the guardians gave permission for collection of samples. Total 90 neonates were selected who were admitted in the Neonatal intensive care unit (NICU) and neonatal ward during the time of study. Data on the pathogens isolate and their antibiotic susceptibility pattern were collected after laboratory test was done. Data was collected for the subsequent variables: demographic profile, blood culture result and antibiotic sensitivity pattern.

As a sample 1- 2 ml of blood was aseptically obtained from the peripheral vein of every neonates and dispensed into a sterilized universal bottle containing 20 ml of Tryptone Soy Broth (TSB) and Brain Heart infusion Broth to form a 1:10 dilution. The location was cleaned with povidine and chlorhexidine before blood was collected. Blood culture samples were then transported to the laboratory and incubated at 37 c for 24 hours using thermo scientific detection system. After detection of presence of organism, subculture were done on Solid media (blood agar, McConkey agar and chocolate agar media) on appearance of turbidity. On day 1, 2, 3 and 7. Organisms were identified according to the standard microbial procedures including gram stain, colony morphology, motility, and biochemical reactions. All the records of this

study were carefully revised and data including sex, birth weight, preterm or term and Clinical features consistent with sepsis results of culture antibiotic sensitivity were recorded into a data collection sheet. Cerebro spinal fluid was collected by lumbar puncture only when meningitis was a suspicion. Antibiotic susceptibility testing was performed for all blood culture isolates, according to the criteria of the National Laboratory Standard by disk diffusion method.

Data collected was checked for completeness and double entry was done. Data was entered into Microsoft power point and cleaned by cross checking for missing data, duplicates and outliers pathogens isolated from the laboratory investigation and antibiotic susceptibility of the isolates was presented in frequencies and proportions.

### Results

Ninety samples were taken from newborns hospitalized to the neonatal unit and NICU during the study period. Of these, 61 (67.78%) had positive blood cultures, whereas 29 (32.22%) had negative cultures. There were 41 (80.33%) males and 49 females with early onset sepsis among the culture-positive cases. The average birth weight was 2 kg (1.5–2.5 kg), while the average gestational week was 35 weeks (34–38 weeks). The commonest risk factors were mother had premature rupture of membrane and had history of prolonged labour. More common organisms were gram positive bacteria. Staphylococcus aureus were the most isolated prevalent gram positive bacteria (75.51%). Death was low in this study. In this study out of 90 cases of suspected neonates were culture positive sepsis which was 67.78%. We also found that preterm babies (80.33%) and low birth weight babies (72.13%) are more susceptible to infection. The majority of the study population was poor and delivered at home, largely in the hands of untrained birth attendants. In this study, staphylococcus aureus was the commonest isolate, accounting about 75.51% of neonatal septicemia.

The second commonest organism was E.coli which was seen in 17 neonates. That was 27.87%. Klebsiella was 9.84% and streptococcus also seen in about 3.28% cases. In staphylococcus, common sensitive drug were Amikacin, Amoxicillin & Clavulanic acid, Colistin, Doxycycline, Vancomycin, Ciprofloxacin, Levofloxacin linezolid, which were 45%, 44%, 41%, 38%, 35%, 32%, 31%, 27% respectively. In E. coli most common sensitivity were Gentamicin, Meropenem, Levofloxacin, Linezolid, Ciprofloxacin, Colistin which were 16%, 14%, 14%, 14%, 12%, 12% respectively. In Klebsiella pneumoniae most common sensitive drugs were Meropenem, Piperacillin in preterm and low birth weight babies.

**Table 1: Sex distribution of patients**

Sex	Number of cases			Percentage
	Early onset neonatal sepsis (EONS)	Late onset neonatal sepsis (LONS)	Total	
Male	35	14	49	80.33%
Female	10	2	12	19.67%

**Table 2: Demographic characteristics of the study population**

Blood culture findings	Number of cases	Percentage
Culture positive	61	67.78%
Culture negative	29	32.22%
Total	90	100%
Name of organism		
Staphylococcus	46	75.51%
Echerichia Coli	17	27.87%
Klebsiella	06	9.87%
Streptococcus	02	3.28%
Parameters: Age		
0-7days	46 (61)	80.33%
8-1month	12 (29)	19.67%
Weight		
1.5kg-2.4 kg	44(61)	72.13%
2.5kg-3.9kg	17(61)	27.87%
Gestational age		
<35 week	36(61)	59.01%
36-38 week	25(61)	41%
Mode of delivery		
Normal vaginal delivery	34	55.74%
Cesarean section	27	44.26%
Place of delivery		
In born	35	57.38%
Out born	26	42.62%

**Table 3: Types of organism isolates**

Organism	Number of cases		Percentage
	Early onset neonatal sepsis (EONS)	Late onset neonatal sepsis (LONS)	
Staphylococcus aureus	31	15	75.51%
E. coli	12	5	27.87%
Klebsiella pneumoniae	4	2	09.84%
Streptococcus pneumoniae	2	0	3.28%

**Table 4: Antibiotic susceptibility Pattern**

Antibiotic	Isolate organism		
	Staphylococcus	E. coli	Klebsiella
Amoxicillin & clavulenic	44	21	10
Azithromycin	10	5	11
Amikacin	45	5	15
Ceftriaxone	11	5	8
Ciprofloxacin	32	13	12
Colistin	44	26	12
Doxycycline	38	18	12
Gentamicin	20	14	14
Meropenem	25	14	12
Imipenem	27	11	10
Levofloxacin	31	14	14
Linezolid	27	8	14
Vancomycin	10	7	12

**Discussion**

One of the main causes of neonatal mortality, sepsis is an undesirable health issue, particularly in low birth weight babies. Since there isn't a single accurate test for early sepsis diagnosis, diagnosing neonatal sepsis is one of the most challenging tasks for doctors. The most dependable technique for identifying bacterial infections at the moment is blood culture. A rapid laboratory test with high specificity for neonatal sepsis help in making a therapeutic decision and avoiding the unnecessary future use of antibiotics in patients with clinical signs and symptoms of sepsis but negative blood cultures. In this study, we found that out of 90 clinical neonatal septicemic case, 67.78 % (n = 61) had growth on blood culture. In our study, among the infected newborn, male were predominant, 80.33% (n= 61). Similar observations are made by others; Bhat et al (90.8%) and Shrestha et al (60.64%) [9,10]

The low incidence of gram-positive sepsis in present study are often attributed to low infection rates with CoNS which is typically related to central lines and rarity of B Streptococcus infection in India [11]. It's thanks to the factors regulating the synthesis of globulin situated on the x-chromosome. Male has just one x - chromosome. So, he's immunologically less protected than female.

We also found that pre term babies (80.33%) and low birth weight babies (72.13%) are more susceptible to infection. The majority of the study population was poor and delivered reception, largely within the hands of untrained birth attendants. Home deliveries are common in Bangladesh, and these deliveries also are significantly related to birth asphyxia, which was highly prevalent in our study population and which successively, is associated with an increased risk of great neonatal infection.

In this study, staphylococcus aureus was the commonest isolate, accounting about 75.51% of neonatal septicemia. Whereas many studies reported Klebsiella to be the most common organism.[10,12-15] Some authors had found Staphylococcus aureus as the most common organism[16,17].

Intrapartum antibiotic prophylaxis has also led to a substantial change in the bacterial flora responsible for early onset neonatal sepsis. The second commonest organism was E. coli which was seen in 17 neonates. That was 27.87%. Klebsiella was 9.84% and streptococcus also seen in about 3.28% cases. In staphylococcus, common sensitive drug were Amikacin, Amoxicillin & Clavulanic acid, Colistin, Doxycycline, Vancomycin, Ciprofloxacin, Levofloxacin linezolid, which were 45%, 44%, 41%, 38%, 35%, 32%, 31%, 27% respectively. In E. coli most common sensitivity were Gentamicin,

Meropenem, Levofloxacin, Linezolid, Ciprofloxacin, Colistin which were 16%, 14%, 14%,14%,12%,12% respectively. The greater prevalence of resistance to commonly used antibiotics has also been reported in recent studies [18,19].

In Klebsiella pneumoniae most common sensitive drugs were Meropenem, Piperacillin in preterm and low birth weight babies. These might be due to low level of IgG and lower defense mechanism. The alarming finding in our study were the development of multi drug resistance pathogens to commonly used antibiotics in our neonatal ward and neonatal intensive care unit. In this study most of the strains showed a low sensitivity to Azithromycin, Cefixime, and Ceftazidime. When compared with other studies, Cefotaxime was found less sensitive. Low sensitivity of Gentamicin to gram positive pathogens were found in our study whereas high degree sensitivity of gram-negative pathogen to gentamicin observed in reports. Antimicrobial sensitivity pattern differs in different places, in different studies at different time in the same hospital. Indiscriminate use of antibiotics lead to emergences. Resistance observed in this study may be primarily due to excessive and inadequate doses use of antibiotics at primary health facilities from where neonates are referred to our tertiary level centers.

### Conclusion

In this study with 90 hospitalized patients of neonatal sepsis, (61) 67.78% were found culture positive. The main causative gram-positive organism were Staphylococcus aureus and gram negative organism were klebsiella pneumoniae. Incidence of antimicrobial resistance among different organism occur from time to time. Continuous evaluation at different levels of local pattern of bacterial profile and antibiotic sensitivity of pathogen should be reviewed to develop empirical therapy.

### References

1. Thakur S, Thakur K, Sood A, Chaudhary S. Bacteriological profile and antibiotic sensitivity pattern of neonatal septicaemia in a rural tertiary care hospital in North India. Indian J Med Microbiol. 2016 Jan-Mar;34(1):67-71.
2. Pokhrel B, Koirala T, Shah G, Joshi S, Baral P. Bacteriological profile and antibiotic susceptibility of neonatal sepsis in neonatal intensive care unit of a tertiary hospital in Nepal. BMC Pediatr. 2018 Jun 27;18(1):208.
3. Siddiqui T, Dubey A, Kar M, Patel SS, Sahu C, Ghoshal U. Bacteriological profiles and antibiotic susceptibility of neonatal sepsis in a

- university hospital of Northern India. *J Family Med Prim Care*. 2023 Mar;12(3):493-498.
4. Kumhar GD, Ramachandran VG, Gupta P. Bacteriological analysis of blood culture isolates from neonates in a tertiary care hospital in India. *J Health Popul Nutr*. 2002 Dec;20(4):343-7.
  5. Gyawali N, Sanjana RK. Bacteriological profile and antibiogram of neonatal septicemia. *Indian J Pediatr*. 2013 May;80(5):371-4. .
  6. Muley VA, Ghadage DP, Bhore AV. Bacteriological Profile of Neonatal Septicemia in a Tertiary Care Hospital from Western India. *J Glob Infect Dis*. 2015 Apr-Jun;7(2):75-7
  7. Yadav NS, Sharma S, Chaudhary DK, Panthi P, Pokhrel P, Shrestha A, Mandal PK. Bacteriological profile of neonatal sepsis and antibiotic susceptibility pattern of isolates admitted at Kanti Children's Hospital, Kathmandu, Nepal. *BMC Res Notes*. 2018 May 15;11(1):301.
  8. Aku FY, Akweongo P, Nyarko K, Sackey S, Wurapa F, Afari EA, Ameme DK, Kenu E. Bacteriological profile and antibiotic susceptibility pattern of common isolates of neonatal sepsis, Ho Municipality, Ghana-2016. *Matern Health NeonatolPerinatol*. 2018 Jan 23;4:2.
  9. Bhat YR, Lewis LES Vandana KE. Bacterial isolates of early-onset neonatal sepsis and their antibiotic susceptibility pattern between 1998 and 2004: an audit from a center in India. *Ital J Pediatr*. 2011; 37:32-7.
  10. Shrestha S, Shrestha NC, Singh S, Shrestha RPB, Kayestha S, Shrestha M et al. Bacterial isolates and its antibiotic susceptibility pattern in NICU. *Kathmandu Univ Med J*. 2013; 41:66-70.
  11. Kuruvilla KA, Thomas N, Jesudasan MV, Jana AK. Neonatal group B streptococcal bacteraemia in India: ten years' experience. *ActaPaediatr*. 1999; 88:1031-2.
  12. Patel D, Nimbalkar A, Sethi A, Kungwani A, Nimbalkar S. Blood culture isolates in neonatal sepsis and their sensitivity in Anand district of India. *Indian J Pediatr*. 2014; 81:785-90.
  13. Fahmey SS. Early-onset sepsis in a neonatal intensive care unit in BeniSuef, Egypt: bacterial isolates and antibiotic resistance pattern. *Korean J Pediatr*. 2013; 56:332-7.
  14. Jyothi P, Basavaraj MC, Basavaraj PV. Bacteriological profile of neonatal septicemia and antibiotic susceptibility pattern of the isolates. *J Nat SciBiol Med*. 2013; 4:306-9.
  15. Saleem AF, Qamar FN, Shahzad H, Qadir M, Zaidi AKM. Trends in antibiotic susceptibility and incidence of late-onset Klebsiellapneumoniae neonatal sepsis over a six-year period in a neonatal intensive care unit in Karachi, Pakistan. *Int J Infect Dis*. 2013; 17:961-5
  16. Nepal HP, Acharya A, Gautam R, Shrestha S, Paudel R. Bacteriological profile of neonatal septicemia cases and the antimicrobial resistance pattern in a tertiary care hospital of central Nepal. *Int J of Biomed Res*. 2013; 4:26-31.
  17. Draz NI, Taha SE, Shady NMA, Ghany YSA. Comparison of broad range 16S rDNA PCR to conventional blood culture for diagnosis of sepsis in the newborn. *Egyptian J Med Human Genetics*. 2013; 14:403-11.
  18. Draz NI, Taha SE, Shady NMA, Ghany YSA. Comparison of broad range 16S rDNA PCR to conventional blood culture for diagnosis of sepsis in the newborn. *Egyptian J Med Human Genetics*. 2013; 14:403-11.
  19. Tsering DC, Chanchal L, Pal R, Kar S. Bacteriological profile of septicemia and the risk factors in neonates and infants in Sikkim. *J Global Infect Dis*. 2011; 3:425.