Section: Paediatrics

Original Research Article

CLINICAL PROFILE OF NEONATES ADMITTED IN NICU WITH SEPSIS: A CROSS-SECTIONAL STUDY

Achyut Patel[1], Shivani Bansal[2], Neetu Gautam[2]

[1]PG Resident, Department of Paediatrics, Rohilkhand Medical College and Hospital, Bareilly, India
[2]Associate Professor, Department of Paediatrics, Rohilkhand Medical College and Hospital, Bareilly, India

Received : 28/02/2025
Received in revised form : 20/04/2025
Accepted : 07/05/2025

Keywords:
Clinical parameters, causative organisms, antibiotic sensitivity, perinatal risk factors, maternal risk factors, neonatal sepsis.

Corresponding Author:
Dr. Achyut Patel,
Email: achyutrameshpatel@gmail.com

DOI: 10.47009/jamp.2025.7.3.52

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (3); 281-286

ABSTRACT

Background: Neonatal sepsis is one of the important causes of neonatal deaths in the community. This study to understand the clinical parameters, identify causative organisms, study the antibiotic sensitivity pattern and assess the correlation of perinatal risk factors and maternal risk factors in causation and outcome of neonatal sepsis. **Materials and Methods:** A hospital-based prospective observational study was conducted to evaluate 105 newborns with neonatal sepsis who were admitted to the Neonatal Intensive Care Unit of Department of Paediatrics at Rohilkhand Medical College and Hospital, Bareilly (U.P.). **Result:** Male neonates constituted 54.3% of the cases, while females accounted for 45.7%. Maternal risk factors were present in 37.1% of cases, with gestational diabetes mellitus (15.2%) and premature rupture of membranes (12.4%) being the most common contributors. Maternal infections were documented in 35.2% of cases. Premature rupture of membranes (15.2%) and leaking per vaginum (13.3%) were significantly associated with neonatal sepsis. Foul-smelling liquor was reported in 11.4% of cases. Klebsiella (36.2%) and Staphylococcus aureus (25.7%) were the most frequently isolated pathogens. A strong correlation was observed between APGAR scores at 1 and 5 minutes, indicating consistency in neonatal recovery trends but emphasizing the need for vigilant monitoring. **Conclusion:** This study underscore the multifactorial nature of neonatal sepsis, highlighting the roles of maternal health, delivery practices, neonatal care, and early interventions in improving neonatal outcomes.

INTRODUCTION

Neonatal sepsis is a major cause of morbidity and mortality in neonates, particularly those admitted to Neonatal Intensive Care Units (NICUs). Despite advancements in neonatal care, sepsis remains a challenging condition to diagnose and treat due to its nonspecific clinical manifestations, rapid progression, and the rising prevalence of multidrug-resistant organisms. The clinical presentation of sepsis in neonates often overlaps with other neonatal conditions, making early recognition difficult. This delay in diagnosis can lead to severe complications such as multi-organ failure, septic shock, and death.[1] The clinical profile of neonates admitted to the NICU with sepsis is a critical area of study due to the high mortality and morbidity associated with this condition. Neonatal sepsis, particularly in preterm and low-birth-weight infants, poses a significant challenge due to their compromised immune systems, frequent use of invasive medical devices, and prolonged hospitalisations. Despite improvements in neonatal care, sepsis remains a leading cause of neonatal mortality, often because its clinical presentation is nonspecific, leading to delayed diagnosis and treatment. Early intervention is key to preventing the rapid progression of the disease, yet the subtle and variable signs of sepsis can make it difficult to identify at an early stage.

This study is crucial because it will provide detailed insights into the clinical features, risk factors, and microbial profiles associated with neonatal sepsis in the NICU setting. The findings will help improve early recognition of sepsis, facilitate better management practices, and inform hospital policies aimed at reducing the incidence and severity of sepsis in neonates. Ultimately, the study will contribute to enhancing the quality of care in NICUs, improving neonatal outcomes, and reducing the burden of sepsis-related complications.[2]

This study aims to understand the clinical parameters, identify causative organisms, study the antibiotic sensitivity pattern and assess the correlation of perinatal risk factors and maternal risk factors in causation and outcome of neonatal sepsis.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

MATERIALS AND METHODS

A hospital-based prospective observational study was conducted to evaluate 105 newborns with neonatal sepsis who were admitted to the Neonatal Intensive Care Unit of Department of Paediatrics at Rohilkhand Medical College and Hospital, Bareilly (U.P.). Duration of study was 12 months (from May 2023 to April 2024).

Sample Size: The sample size planned for our study was 105

Inclusion Criteria

- All neonates with symptoms and clinical signs suggestive of sepsis, with or without maternal and/or neonatal risk factors.
- Attendants of the neonates who gave informed consent.

Exclusion Criteria

- Neonates with apparent congenital anomalies.
- Out born neonates admitted to the NICU with a prior history of antibiotic treatment in the last 48 hours.

Methodology

Parents of all the neonates were invited to participate in the study. The study population consisted of all neonates admitted with a history and clinical features suggestive of neonatal sepsis, and attendants who gave consent to participate were enrolled in the study.

Procedure

A detailed maternal medical and obstetric history was obtained. Information regarding gestation, including complications during pregnancy, gestational age at delivery, mode of delivery, and birth weight, was recorded. A detailed history of the neonates suggestive of neonatal sepsis was taken. A comprehensive general and systemic examination of the neonates was performed, and neonatal risk factors were identified. Sepsis screen investigations were conducted.

Statistical Analysis: Data was entered into SPSS (Statistical Package for the Social Sciences) licensed version 23.0. Descriptive analysis was performed by calculating proportions, means, and standard deviations. Appropriate statistical tests were applied depending on the type and distribution of the data. The results were displayed in the form of tables and figures. A p-value of less than or equal to 0.05 was considered statistically significant

RESULTS

Out of the total 105 neonates, 57 were male, constituting 54.3% of the sample, while 48 were female, making up 45.7%. The difference in the frequency of sepsis between male and female neonates was assessed using a chi-square test. (p-value > 0.05).

69 neonates (65.7%) were delivered vaginally, while 36 (34.3%) were delivered via Lower Segment Cesarean Section (LSCS). The total sample consisted of 105 neonates. (p-value< 0.001).

Table 1: Distribution of Maternal Risk

Maternal Risk	Frequency	% of Total
PROM	13	12.4 %
PIH	10	9.5 %
None	66	62.9 %
GDM	16	15.2 %
Total	105	100%

χ^2 value- 80.9, p value- < .001

66 neonates (62.9%) had no maternal risk factors, 13 (12.4%) were associated with Premature Rupture of Membranes (PROM), 16 (15.2%) with Gestational Diabetes Mellitus (GDM), and 10 (9.5%) with Pregnancy- Induced Hypertension (PIH). The total number of neonates evaluated was 105.

Out of the total sample of 105 neonates, 37 (35.2%) had maternal infections, while 68 (64.8%) did not. (p-value <0.05) This result suggests that maternal infections are significantly associated with the occurrence of sepsis in neonates. This finding highlights the importance of maternal health in the prenatal period and its potential impact on the health outcomes of neonates, particularly in terms of susceptibility to sepsis.

16 neonates (15.2%) experienced PROM, while 89 (84.8%) did not. The total number of neonates in the study was 105. (p- value <0.001) This significant result indicates a strong association between PROM and the occurrence of neonatal sepsis. It underscores the importance of managing and monitoring PROM effectively to potentially reduce the risk of sepsis in neonates, reflecting the critical need for focused prenatal care and immediate postnatal interventions in cases of PROM.

14 neonates (13.3%) had experienced leaking per vaginum, while 91 (86.7%) had not, with a total sample size of 105 neonates. A chi- square test was conducted to examine the statistical significance of the association between leaking PV and neonatal sepsis. (p value- < .001) This indicates a highly statistically significant association, suggesting that leaking PV is a significant risk factor for the development of sepsis in neonates.

Out of the total of 105 neonates, 12 (11.4%) were exposed to foul- smelling amniotic fluid, whereas 93 (88.6%) were not. A chi-square test was performed to assess the statistical significance of this condition in relation to neonatal sepsis. (p-value <0.001).

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Table 2: Distribution of Prolonged Labour

Prolonged Labour	Frequency	% of Total
Yes	41	39.0 %
No	64	61.0 %
Total	105	100%

χ^2 value- 5.04, p value- 0.025

41 neonates (39.0%) experienced prolonged labor, while 64 (61.0%) did not, from a total of 105 neonates. A chi-square test was conducted to evaluate the statistical significance of the relationship between prolonged labor and neonatal sepsis. (p value- < 0.05) indicating a statistically significant association.

Table 3: Distribution of Neonatal Complication

Neonatal Complication	Frequency	% of Total
Asphyxia	21	20.0 %
None	61	58.1 %
Neonatal Jaundice	14	13.3 %
RDS	9	8.6 %
Total	105	100%

χ^2 value- 64.1, p value- < .001

The complications listed are asphyxia, occurring in 21 neonates (20.0%), neonatal jaundice in 14 (13.3%), and respiratory distress syndrome (RDS) in 9 (8.6%). A total of 61 neonates (58.1%) had no complications. The entire sample size was 105 neonates. (p value- < .001) This significant result suggests that neonatal complications, particularly asphyxia, jaundice, and RDS, are strongly associated with the incidence of sepsis in neonates.

Table 4: Distribution of Resuscitation Required

Resuscitation Required	Frequency	% of Total
Yes	14	13.3 %
No	91	86.7 %
Total	105	100%

χ^2 value- 56.5, p value- < .001

Out of 105 neonates, 14 (13.3%) required resuscitation, while 91 (86.7%) did not. A chi-square test was performed to analyse the association between resuscitation and neonatal sepsis. (p value- < .001) This finding suggests that the need for resuscitation is strongly associated with the occurrence of sepsis in neonates.

Table 5: Distribution of Symptoms

Symptoms	Frequency	% of Total
Poor Feeding	34	32.4 %
Fever	28	26.7 %
Respiratory Distress	17	16.2 %
Lethargy	26	24.8 %
Total	105	100%

χ^2 value- 5.67, p value- 0.129

The most common symptom was poor feeding, reported in 34 neonates (32.4%), followed by fever in 28 neonates (26.7%), lethargy in 26 neonates (24.8%), and respiratory distress in 17 neonates (16.2%). A chi-square test was conducted to assess whether there was a statistically significant difference in the distribution of these symptoms among the neonates. (p value- >0.05) This suggests that while these symptoms are common among neonates with sepsis, no single symptom showed a significant predominance in this study population.

Table 6: Distribution of Causative Organism

Causative Organism	Frequency	% of Total
Staphylococcus aureus	27	25.7 %
Klebsiella	38	36.2 %
No Growth	17	16.2 %
E. coli	23	21.9 %
Total	**105**	**100%**

χ^2 value- 8.94, p value- 0.03

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Klebsiella was the most common organism, identified in 38 neonates (36.2%), followed by Staphylococcus aureus in 27 neonates (25.7%) and E. coli in 23 neonates (21.9%). In 17 cases (16.2%), no organism growth was detected. (p value- < 0.05). This finding suggests that Klebsiella and Staphylococcus aureus were predominant pathogens associated with neonatal sepsis, emphasizing the need for targeted antimicrobial therapy and infection control measures.

The mean birthweight was 2.49 kg (95% CI: 2.4–2.58, SD: 0.465), indicating that most neonates had low-to-normal birthweights. The mean gestational age was 33.72 weeks (95% CI: 33.11–34.33, SD: 3.149), suggesting that many were preterm. The mean number of antenatal visits was 4.7 (95% CI: 4.29–5.12, SD: 2.13), indicating varying levels of antenatal care. (p value- <.001) These findings underscore the potential roles of low birthweight, preterm delivery, and inadequate antenatal care in contributing to the risk of neonatal sepsis. Enhanced prenatal care may mitigate these risks.

The mean number of PV examinations was 2.56 (95% CI: 2.36–2.77, SD: 1.06), indicating frequent examinations during labor. The mean APGAR score at 1 minute was 6.98 (95% CI: 6.62–7.34, SD: 1.88), suggesting mild to moderate distress at birth, while the 5-minute mean APGAR score was 8.34 (95% CI: 8.03–8.66, SD: 1.64), reflecting improved neonatal outcomes post-resuscitation. (p value- < .001) These findings emphasise the impact of frequent PV examinations and initial APGAR scores on neonatal health and the potential association with sepsis.

Birthweight showed a weak positive correlation with gestational age (Pearson's r = 0.231, p = 0.018), indicating that higher birthweights are associated with longer gestational periods. Gestational age also had a weak negative correlation with APGAR scores at 1 minute (r = -0.206, p = 0.035), suggesting that shorter gestational age may impact immediate post-birth conditions. No significant correlation was found between antenatal visits and other variables. APGAR scores at 1 and 5 minutes were strongly correlated (r = 0.884, p < 0.001), highlighting consistency in neonatal recovery over time.

DISCUSSION

In our study, we found that 54.3% of the neonates admitted to the NICU with sepsis were male, and 45.7% were female. Berhane M et al,[3] found that 176 (70.5%) male neonates had sepsis, while 124 (70.5%) males were affected, and 52 females (29.5%) were affected. The male predominance was significant, with a higher number of male neonates in the sepsis group compared to the female group. This study indicated a greater male incidence compared to our study, though no significant statistical tests were reported.

In our study, we found that 65.7% of neonates were delivered vaginally, while 34.3% were delivered by LSCS. (p value- < .001). Berhane M et al,[3] found that 188 (62.2%) neonates were delivered vaginally, and 104 (37.1%) were delivered by cesarean section. (p > 0.05). Although vaginal delivery was more common in both studies, our study found a statistically significant association, while Berhane M et al,[3] study did not.

In our study, we found that 12.4% of neonates had Premature Rupture of Membranes (PROM), 15.2% had Gestational Diabetes Mellitus (GDM), and 9.5% had Pregnancy-Induced Hypertension (PIH). Maternal infections were present in 35.2% of cases. Comparing our findings with Shetty S et al,[4] they found Gestational Diabetes in 24.6% of their cases, which is higher than our 15.2%. Similarly, PROM was observed in 17.7% of their cohort, slightly higher than our 12.4%.

In our study, 35.2% of neonates had maternal infections, (p value- < 0.05) This high percentage reflects the significant association between maternal infections and neonatal sepsis. Comparing this to Shetty S et al,[4] they found maternal infections in 8.5% of cases, much lower than our result. This could be due to differences in healthcare practices, the presence of fever during labor, or how infections are diagnosed and managed.

In our study, 15.2% of neonates (16 out of 105) had a history of PROM, and we found a significant association between PROM and neonatal sepsis, with a p-value of less than 0.001. PROM is widely recognized as a significant risk factor for neonatal sepsis, as it increases the likelihood of ascending infection from the maternal genital tract into the uterus, which can lead to sepsis in neonates after delivery. This finding is in line with Berhane M et al,[3] who found that 12.4% of their study participants with sepsis had PROM, and the correlation between PROM and neonatal sepsis was statistically significant.

Our study found that 13.3% (14 out of 105) of neonates had leaking per vagina (PV) during labor, and this factor was strongly associated with neonatal sepsis (p < 0.001). Berhane M et al,[3] observed that only 7.8% of neonates with sepsis had leaking PV, and while the association was statistically significant (p < 0.05), the percentage was lower than our findings. This discrepancy could be explained by variations in study settings, where the occurrence of PV leakage may be less common, or differences in clinical management and diagnostic thresholds used to identify PV leakage.

In our study, 11.4% (12 out of 105) of neonates had foul-smelling liquor, which was significantly associated with neonatal sepsis (p < 0.001). Berhane M et al,[3] reported a similar finding, where 7% of sepsis cases had foul-smelling liquor, although the association with sepsis was not statistically significant (p = 0.33). This lower percentage in their cohort might reflect differences in the diagnostic approach or the threshold for considering foul-smelling liquor as a significant clinical sign.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

In our study, 39% (41 out of 105) of neonates were born after prolonged labor, and this factor was statistically significantly associated with neonatal sepsis ($p = 0.025$). Berhane M et al,[3] found that 35% of neonates with sepsis had prolonged labor, with 83.3% of those experiencing sepsis, a notably higher association than our study's findings. This higher percentage in their study could be due to regional differences or clinical practices, as prolonged labor is often managed more aggressively in some settings.

In our study, 20% of neonates (21 out of 105) had asphyxia, 13.3% (14 out of 105) had neonatal jaundice, and 8.6% (9 out of 105) had respiratory distress syndrome (RDS). ($p < 0.001$). Shetty S et al,[4] (reported that among neonates with sepsis, 29.2% had lethargy, 28.5% had respiratory distress, and 20.8% experienced feed intolerance. In their study, respiratory distress was the second most common symptom, which aligns with our findings. However, their study also included additional complications like hypoglycaemia (11.5%) and abdominal distension (8.5%), which were less common in our cohort.

In our study, 13.3% of neonates with sepsis required resuscitation, and this requirement was statistically significant ($\chi^2 = 56.5$, $p < 0.001$). Shetty S et al,[4] study found that 15.4% of neonates with sepsis required resuscitation, which is very close to our finding of 13.3%. Both studies highlight the importance of resuscitation in neonates with sepsis, emphasizing the critical nature of these cases. Bekele et al,[5] study, 151 (80.3%) neonates required resuscitation, which is considerably higher than the findings in our study.

In our study, 15.2% of neonates (16 out of 105) did not cry immediately after birth, which was significantly correlated with neonatal sepsis ($p < 0.001$). This finding is consistent with Bekele et al,[5] who reported that 50.1% of neonates did not cry at birth, indicating a significant percentage of neonates in their cohort faced immediate respiratory challenges. The link between this symptom and neonatal distress, such as asphyxia or respiratory compromise, is well established in both studies.

In our study, the most common symptoms in neonates with sepsis were poor feeding (32.4%), fever (26.7%), and lethargy (24.8%). ($p = 0.129$) This aligns with the findings of Shetty S et al,[4] where lethargy (29.2%) and respiratory distress (28.5%) were the most frequently observed symptoms, with poor feeding being a less common symptom. Their study also reported other symptoms like hypoglycaemia and abdominal distension.

In our study, Staphylococcus aureus (25.7%), Klebsiella (36.2%), E. coli (21.9%), and no growth (16.2%) were the most common pathogens isolated in neonates with sepsis. These findings are consistent with previous studies, but some variations exist in terms of the frequency of specific pathogens. Jatso J et al,[6] analyzed neonatal sepsis cases and reported a distribution of pathogens with Klebsiella pneumoniae (33.3%) and E. coli (21.9%) being the predominant organisms. In comparison to our findings, Klebsiella is similarly the most frequent pathogen in both studies (36.2% in our study vs. 33.3% in Jatso J et al.[6]

In our study, the mean birthweight was 2.49 kg (SD = 0.465), the mean gestational age was 33.72 weeks (SD = 3.149), and the mean number of antenatal visits was 4.7 (SD = 2.13). All these parameters were significantly associated with neonatal sepsis. Devkota K et al,[7] study, 25.36% of neonates had low birth weight, and 56.52% had normal birth weight, while 18.12% were very low birth weight (VLBW).

In our study, we found that the mean number of per vaginal (PV) examinations was 2.56, with APGAR scores at 1-minute averaging 6.98 and APGAR scores at 5 minutes averaging 8.34. The results showed high statistical significance (p-value <0.001), underscoring the importance of early neonatal resuscitation and effective postnatal monitoring. When comparing these findings with Jatso J et al.[6], they reported that 55% of clinical sepsis cases had APGAR scores ≤ 6 at 1 minute, and 94.1% had APGAR scores > 6 at 5 minutes. This suggests that our findings of 6.98 for 1 minute APGAR scores and 8.34 for 5 minute scores are relatively better and suggest effective early resuscitation and monitoring practices in our setting.

A weak positive correlation was observed between gestational age and birthweight ($r = 0.231$, $p = 0.018$), which implies that neonates born at later gestational ages generally had higher birth weights. In contrast, antenatal visits showed no significant correlation with gestational age ($r = 0.064$, $p = 0.518$) or birthweight ($r = 0.102$, $p = 0.303$), suggesting that the frequency of antenatal visits did not have a direct impact on these neonatal parameters. Regarding per vaginal (PV) examinations, the data showed weak and non-significant correlations with APGAR scores at 1 minute ($r = -0.016$, $p = 0.871$) and at 5 minutes ($r = -0.168$, $p = 0.086$). In a study, Bekele et al,[5] examined various risk factors associated with neonatal sepsis, focusing on maternal and perinatal factors. They found that gestational age and birthweight were significant factors, with preterm neonates and those with low birth weight being at increased risk for neonatal sepsis ($p < 0.001$).

CONCLUSION

The findings of this study underscore the multifactorial nature of neonatal sepsis, highlighting the roles of maternal health, delivery practices, neonatal care, and early interventions in improving neonatal outcomes. Enhanced prenatal and perinatal care, along with timely identification and management of risk factors, can significantly reduce the burden of neonatal sepsis.

REFERENCES

1. Sreedhar A, Pratima M, Pankaj K. Neonatal Sepsis STANDARD TREATMENT GUIDELINES 2022. Upendra

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Kinjawadekar IAP President- Elect 2022. Under the Auspices of the IAP Action Plan 2022.
2. Seale AC, Obiero CW, Berkley JA. Rational development of guidelines for management of neonatal sepsis in developing countries. Curr Opin Infect Dis. 2015 Jun;28(3):225–30.
3. Berhane M, Gidi NW, Eshetu B, Gashaw M, Tesfaw G, Wieser A, Bårnes GK, Froeschl G, Ali S, Gudina EK. Clinical Profile of Neonates Admitted with Sepsis to Neonatal Intensive Care Unit of Jimma Medical Center, A Tertiary Hospital in Ethiopia. Ethiop J Health Sci. 2021 May;31(3):485-494.
4. Shetty S, Basavaraj, Pushpalatah K. Cross sectional study of risk factors, clinical and bacteriological profile of neonatal sepsis in tertiarty care hospital. Int J Contemp Pediatr 2023;10:1695-8.
5. Bekele K, Bekele F, Edosa D, Mekonnen M, Benayew M. Magnitude and associated factors of neonatal sepsis among neonates admitted to neonatal intensive care unit of Northern Oromia hospitals, Ethiopia: A multicenter cross- sectional study. Ann Med Surg. 2022 Jun;78:103782.
6. Jatsho J, Nishizawa Y, Pelzom D, Sharma R. Clinical and Bacteriological Profile of Neonatal Sepsis: A Prospective Hospital-Based Study. Int J Pediatr.
7. Devkota K, Kanodia P, Joshi B. Sepsis among Neonates Admitted to a Neonatal Intensive Care Unit in a Tertiary Care Centre. JNMA J Nepal Med Assoc. 2024 Feb 24;62(270):76-78. PMID: 38409987; PMCID: PMC10924525.

ISSN (O): 2687-5365; ISSN (P): 2753-6556