International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Study of Neonatal Sepsis and its Associated Risk Factors in level III Neonatal Intensive Care Unit

Dr Saiyam Chopra[1], Dr Surbhi Rustagi[2], Dr Manish Agrawal[3], Dr Amritesh Ranjan[4]

[1]Department of pediatrics, Muzaffarnagar medical college, Muzaffarnagar. 6239134711
[2]Assistant professor, Siddhi Vinayak Medical College, Sambhal, UP
[3]Head and Professor, Muzaffarnagar medical college, muzaffarnagar.
[4]Associate Professor, Muzaffarnagar medical college, Muzaffarnagar.

Corresponding Author:

Dr Saiyam Chopra
Department of pediatrics, Muzaffarnagar medical college, Muzaffarnagar. 6239134711
Email:
Saiyamchopra@icloud.com

Received: 30-04-2026
Accepted: 10-05-2026
Available online: 09-06-2026

ABSTRACT

Introduction: Neonatal sepsis, a systemic infection occurring within the first 28 days of life, remains a leading cause of morbidity and mortality among newborns globally, particularly in low- and middle-income countries (LMICs) where it accounts for nearly 15% of all neonatal deaths. The inflammatory cascade and organ dysfunction, once triggered, can be exceedingly difficult to halt. The cornerstone of reducing the burden of neonatal sepsis lies in a proactive, pre-emptive strategy grounded in a deep and nuanced understanding of its associated risk factors.

Objective: This study aimed to evaluate the prevalence of sepsis and to delineate the key risk factors among neonates in the NICU.

Material &Method: This observational research was executed over 18 months at the Department of Pediatrics, Muzaffarnagar Medical College and Hospital, enrolling 100 neonates (0–28 days) admitted to the NICU with suspected or confirmed sepsis.

Result: This hospital-based study at a tertiary care center in North India reveals a high prevalence of culture-proven neonatal sepsis (53%), dominated by late-onset cases (62.26%) and primarily caused by MRSA and CoNS which being the most common pathogens. The etiology of sepsis in this setting is multifactorial, stemming from a convergence of established neonatal vulnerabilities and modifiable maternal risk factors. Preterm birth and low birth weight were significant biological risk factors, while younger maternal age and maternal unemployment emerged as critical social determinants strongly associated with sepsis occurrence. Clinically, maternal fever and urinary tract infection were prevalent among cases, and respiratory distress, feed intolerance and diarrhoea were the most common symptoms among the neonates. Neonates with sepsis presented with significantly lower APGAR scores and endured markedly prolonged hospital stays. Laboratory findings confirmed elevated inflammatory markers, with both Total Leukocyte Count and C-reactive protein showing highly significant differences between groups.

Conclusion: Based on the data, neonatal sepsis in this setting is driven by a complex interaction of clinical and socioeconomic determinants. The high incidence of late-onset sepsis, coupled with the prevalence of pathogens like MRSA, points to potential lapses in in-hospital infection control. Consequently, a comprehensive prevention strategy is essential. This strategy must integrate robust hospital measures including strict infection prevention protocols and judicious antibiotic use with targeted community initiatives designed to enhance antenatal care and address underlying social vulnerabilities, such as maternal education and employment.

Keywords: Neonatal sepsis, LOS, EOS,NICU, MRSA.

INTRODUCTION

The first 28 days of a baby's life—known as the neonatal period—are the most dangerous in terms of survival. Even though medical care for newborns has improved greatly around the world, neonatal sepsis (a serious bloodstream infection) remains one of the biggest killers of babies, especially in low- and middle-income countries (LMICs). In these places, sepsis causes nearly 15 out of every 100 newborn deaths[1]. The problem is that sepsis in newborns does not show clear, unique signs. Instead, babies might only have trouble breathing, unstable body temperature, or difficulty feeding. This makes it very hard for doctors to diagnose and treat, particularly for very sick infants in a neonatal intensive care unit (NICU)[2].

Doctors usually split neonatal sepsis into two types. Early-onset sepsis (EOS) happens within 72 hours of birth and is usually caused by infections passed from the mother during delivery, especially from her genital tract. Late-onset sepsis (LOS) happens after 72 hours and is often picked up from the hospital environment due to long stays, breathing tubes, or intravenous lines[3-4]. Understanding these risk factors is crucial, particularly in a Level III NICU—a unit that cares for the smallest and sickest babies, including those born very early (preterm), with very low birth weight (VLBW), or needing surgery or breathing support[5].

Instead of simply reacting after a baby gets sick (which is often a losing battle because the body's inflammation and organ damage can be hard to stop), experts say the best approach is to be proactive. Learning about risk factors helps in three key ways. First, it allows doctors to sort babies into low, medium, or high-risk groups so that high-risk infants can be watched more closely. Second, when sepsis is suspected, knowing the most likely germs (based on whether it is EOS or LOS, or whether the baby has a central line) helps doctors choose the right antibiotics immediately, without waiting for test results—while also avoiding overuse of antibiotics that can lead to drug resistance. Third, and most importantly, this knowledge helps prevent infections before they start. Prevention includes steps like treating maternal infections (such as group B streptococcus or urinary infections) before birth, giving preventive antibiotics during labor, and using proven "care bundles" in the NICU for hand hygiene, safe use of breathing tubes and central lines, and promoting breast milk feeding[6]. The rise of multidrug-resistant organisms (MDROs) in NICUs makes this even harder, and sepsis-related death or long-term brain damage remains high[7]. The problem is worst in low- and middle-income countries due to lack of resources[8]. But even in wealthy countries, Level III NICUs see sepsis rates of 15–20% among very low birth weight babies[9]. Current prevention methods (like antibiotics during labor for group B strep) have reduced early-onset sepsis, but they don't work well against newer threats like Klebsiella or E. coli[10]. Because guidelines differ from place to place, each NICU needs its own research to understand its specific risk factors and improve care.

AIM:

This study aims to investigate the prevalence of neonatal sepsis & determine its related maternal and neonatal risk elements in a Level III NICU. By analyzing data from a high-risk cohort, this research seeks to inform tailored prevention strategies, optimize empirical antibiotic regimens, and improve outcomes for critically ill neonates. The findings will contribute to global efforts to reduce sepsis-related mortality and antimicrobial resistance, aligning with the World Health Organization's (WHO) Sustainable Development Goals for neonatal health

MATERIAL AND METHOD:

This hospital-based observational study took place in the Department of Pediatrics at Muzaffarnagar Medical College and Hospital over 18 months (June 2024 to December 2025). The researchers included 100 newborns aged 0–28 days admitted to the NICU with suspected sepsis, after excluding those with major birth defects, transfers from other hospitals, or stays under 24 hours. After taking parental consent, clinical and maternal data was collected and then blood for culture. Babies with positive blood cultures were labeled as sepsis cases; those with negative cultures served as controls. The goal was to find out how common sepsis is and what risk factors (like low birth weight, premature birth, or maternal infections) are linked to it. The researchers used SPSS software for analysis. They calculated percentages and used Chi-square and T-tests to find links between risk factors and sepsis. They first checked each factor alone, then combined them. A p-value less than 0.05 was considered significant, with lower values (0.01, 0.001) showing stronger associations.

RESULTS:

The study included 100 newborns with suspected sepsis. Blood culture confirmed sepsis in 53% (53 babies). Among these, late-onset sepsis (LOS) was more common (62.26%) than early-onset sepsis (EOS, 37.73%) as shown in Figure1.

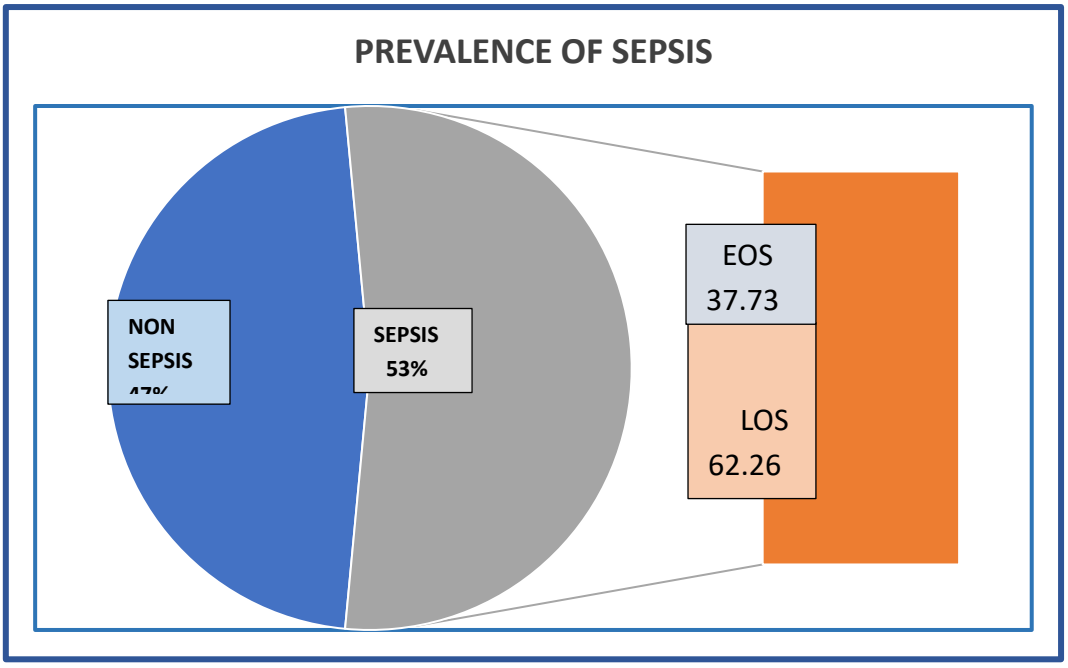

Figure1: Showing Prevalence of sepsis

Younger mothers (age 18–24 years) and unemployment were significantly associated with higher sepsis risk ($p < 0.05$). Maternal fever during labor (39.7%), UTI (32.1%), and prolonged rupture of membranes (16.9%) were common in sepsis cases.

Premature babies (<37 weeks) and low birth weight (<2.5 kg) had significantly higher sepsis rates ($p = 0.023$ and $p = 0.040$ respectively). Sepsis babies had much lower APGAR scores at 1 and 5 minutes, and stayed in hospital three times longer (16.8 vs 5.3 days). Death occurred in 7.54% of sepsis babies versus none in the non-sepsis group.

Among the 53 neonatal sepsis cases studied, respiratory distress was the most common clinical feature (64.15%), followed closely by feed intolerance (62.26%) and diarrhea (60.37%). Meconium Stained Liquor (37.73%) and jaundice (33.96%) were also frequently observed. Hypoglycemia occurred in 11.3% of infants, while Necrotizing Enterocolitis and Hyaline Membrane Disease were rare, affecting only 2 and 1 infant, respectively as shown in Figure2.

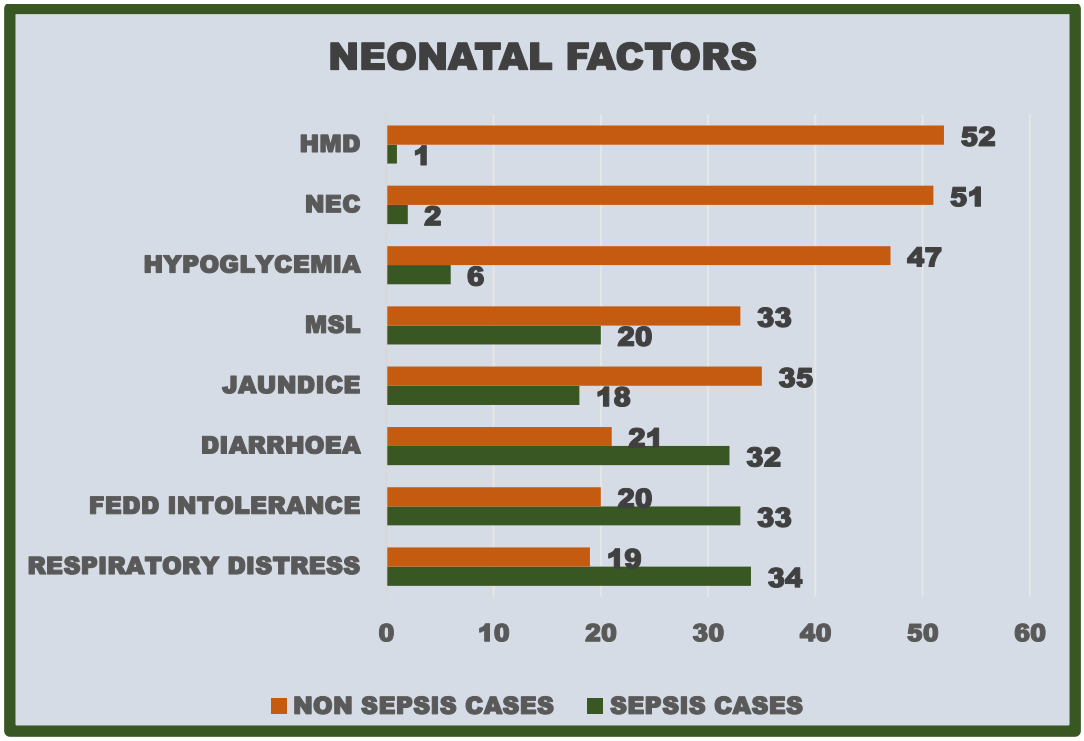

Figure2 : Neonatal Factors Associated with Neonatal Sepsis

Sepsis babies had higher total leukocyte counts (14.6 vs 11.1) and much higher CRP levels (23.2 vs 7.3 mg/L), both highly significant ($p < 0.0001$).

In EOS, Klebsiella and E. coli (40% each) were most common. In LOS, MRSA (48.5%) and coagulase-negative Staphylococcus (30.3%) dominated as shown in table1

Table1: Pathogens in EOS and LOS

Early-Onset Sepsis (n=20)	**Late-Onset Sepsis (n=33)**
E. coli – 40%	MRSA – 48.5%
Klebsiella pneumoniae – 40%	Coagulase-negative Staph – 30.3%
GBS – 15%	E. coli – 9.1%
S. aureus – 5%	Klebsiella – 9.1%
	Candida – 3.0%

DISCUSSION:

This study found that 53 out of every 100 newborns admitted with suspected sepsis actually had blood culture-proven sepsis. This is a very high number, but it matches what other Indian hospitals see[11]. The rate is much higher than in rich countries, where better prevention and cleaner hospitals lower the risk. Most of the sepsis cases were late-onset (62%) , meaning the infection started after 72 hours of life, usually from germs inside the hospital.

Younger mothers (18–24 years) had a much higher chance of having a baby with sepsis. This is likely because young mothers may have less money, less access to good pregnancy care, or untreated infections. Other studies from Ethiopia and India agree with this finding[12-13].

Unemployment was the strongest mother-related risk factor. Most mothers of sepsis babies were not working (37 out of 53), while most mothers of healthy babies had jobs (35 out of 47). This suggests that having a job may mean better access to healthcare, nutrition, and education about pregnancy dangers.

Maternal fever during labor was seen in 40% of sepsis cases. Urinary tract infection (UTI) during pregnancy was seen in 32% of cases. Prolonged rupture of membranes (PROM) over 18 hours was seen in 17% of cases. All of these are well-known risk factors that allow germs to pass from mother to baby before or during birth. Many large studies from Africa and other regions confirm these same links[14-15].

Surprisingly, whether the mother had given birth before (parity) or lived in a city vs. village made no difference. Also, mother's education level only showed a trend but was not statistically significant. This may be because in a hospital setting, other factors like the quality of delivery care matter more.

Premature birth (before 37 weeks) was a major risk factor. Among sepsis babies, 57% were preterm, compared to only 32% in the non-sepsis group. Premature babies have weak immune systems and often need breathing tubes, IV lines, and long hospital stays—all of which increase infection risk. This matches global researches[16-17].

Low birth weight (under 2.5 kg) was also a strong risk factor. Again, 57% of sepsis babies had low birth weight vs. 34% of non-sepsis babies. Small babies are fragile and more likely to get infected. Studies from Ethiopia confirm that low birth weight babies have 1.4 times higher risk of sepsis and 3 times higher risk of dying from it[17].

Baby's gender did not matter in this study. Boys and girls had almost identical sepsis rates. This is interesting because many other studies say boys are at higher risk[18-19]. The lack of difference here may be due to the small sample size.

Place and mode of delivery also did not show a significant link. However, home deliveries were very rare (only 5 total), so the study was too small to detect a real difference. Other larger studies show that unplanned home births can increase infection risk 11-fold[20].

Among babies with sepsis, the most common problems were: Respiratory distress (64%) – trouble breathing, feed intolerance (62%), diarrhea (60%), meconium-stained liquor (38%) and jaundice (34%). These findings match other Indian studies[21-22]. Respiratory distress is almost always the first sign of sepsis in newborns.

CRP (C-reactive protein) was much higher in sepsis babies (23 mg/L vs. 7 mg/L in non-sepsis). This is a strong and reliable sign of inflammation and infection. Many studies confirm CRP as a useful marker, though it is not perfect. Total white blood cell count (TLC) was also higher in sepsis babies (14.6 vs. 11.1). However, TLC can be normal even in serious infections, so doctors cannot rely on it alone.

APGAR scores (a measure of baby's health at birth) were much lower in sepsis babies at both 1 minute (5.5 vs. 6.6) and 5 minutes (6.8 vs. 8.4). This means sepsis babies were born in worse condition.

Hospital stay was three times longer for sepsis babies (17 days vs. 5 days). This adds huge costs and suffering.
Deaths occurred in 3 out of 53 sepsis babies (about 6%), while no non-sepsis babies died. This rate is lower than many other Indian studies, possibly because this is a tertiary hospital with better care[23].

In early-onset sepsis: Klebsiella pneumoniae (40%), E. coli (40%), GBS (15%) and S. aureus (5%) and in late-onset sepsis (after 3 days):MRSA (48%) – this is a dangerous, antibiotic-resistant germ, Coagulase-negative Staphylococcus (30%), E. coli and Klebsiella (9% each) and Candida(3%).

The high rate of MRSA is very concerning. It means many infections are coming from inside the hospital environment, not from the mother. This is different from some other Indian studies that found more Gram-negative germs like Klebsiella[24-25]. The finding tells us that this hospital needs very strict cleaning, hand washing, and careful use of antibiotics to prevent these dangerous resistant infections.

Neonatal sepsis in this hospital is very common and is driven by a mix of: Mother factors like young age, unemployment, fever, UTI ; baby factors like prematurity, low birth weight and hospital factors like MRSA and other resistant germs causing late-onset infections.

Prevention must focus on better antenatal care for young and unemployed mothers, careful delivery practices, and very strict infection control inside the NICU.

CONCLUSION:

In a North Indian hospital study, more than half (53%) of newborns had confirmed sepsis, mostly late-onset cases (62%). The main germs were MRSA and CoNS. Sepsis happened due to a mix of medical and social reasons. Key risk factors included preterm birth, low birth weight, young mothers, and mothers without jobs. Among sick newborns, common signs were breathing trouble, feeding issues, and diarrhea. Mothers often had fever or urine infections during pregnancy. Babies with sepsis had lower APGAR scores and much longer hospital stays. Blood tests showed high infection markers like white blood cells and C-reactive protein.

The high rate of late-onset sepsis and hospital-origin germs points to weak infection control in hospitals. To prevent sepsis effectively, hospitals must improve cleaning practices and use antibiotics wisely. At the same time, communities need better pregnancy care and support for poor mothers to reduce risks before birth.

REFERENCES:

1. World Health Organization (2020). Neonatal sepsis: A major killer can be stopped.
2. S. Murthy, M.A. Godinho, V.Guddattu, L.E.S. Lewis, and N.S.Nair(2019), "Risk factors of neonatal sepsis in India: A systematic review and meta-analysis," PLoS One; vol. 14, no. 4, p. e0215683.
3. Shane AL, Sánchez PJ, Stoll BJ.(2017) Neonatal sepsis. The Lancet; 390(10104): 1770-1780.
4. Simonsen KA, Anderson-Berry AL, Delair SF, Davies HD(2014). Early-onset neonatal sepsis. Clinical Microbiology Reviews; 27(1): 21-47.
5. Fu M, Song W, Yu G, Yu Y, Yang Q.(2023) Risk factors for length of NICU stay of newborns: A systematic review. Front Pediatr; 13;11:1121406.
6. Baltimore RS(1998). Neonatal nosocomial infections. Semin Perinatol; 22:25-32
7. Thomas, Reenu et al.(2023) Long-term impact of serious neonatal bacterial infections on neurodevelopment;Clinical Microbiology and Infection;30(1)
8. Dramowski A, Bolton L, Fitzgerald F, Bekker A(2025); NeoNET AFRICA Partnership. Neonatal Sepsis in Low- and Middle-income Countries: Where Are We Now? Pediatr Infect Dis J;44(6):e207-e210.
9. Varvara Dimopoulou, Kirsten Glaser, Eric Giannoni(2025).Central line-associated blood stream infections in newborns: From vulnerability to prevention,Seminars in Fetal and Neonatal Medicine,Volume 30, Issue 4,101665,
10. Lin FY, et al. (2001)The effectiveness of risk-based intrapartum antibiotic prophylaxis for GBS prevention. Pediatrics;108(3):E45.

11. Samaga, M. P et al.(2017) Prevalence of neonatal septicaemia in a tertiary care hospital in Mandya, Karnataka, India. International Journal of Research in Medical Sciences;4(7), 2812–2816.
12. Bulto GA, Fekene DB, Woldeyes BS, Debelo BT.(2021) Determinants of Neonatal Sepsis among Neonates Admitted to Public Hospitals in Central Ethiopia: Unmatched Case-control Study. Glob Pediatr Health;8:2333794X211026186.
13. Kumar S, Bhattacharya P, Kaur S, Ray P, Chattopadhyay N.(2024) Risk factors and etiology of early-onset neonatal sepsis in Northeastern part of India: Case-control study. J Family Med Prim Care;13(1):54-58.
14. Ratnesh et al. (2025) Retrospective Cohort Study of the Incidence and Risk Factors of Neonatal SepsisInternational Journal of Current Pharmaceutical Review and Research; 17(2); 695-700.
15. Kvalvik, S.A., Zakariassen, S.B., Overrein, S. et al. (2024) Obstetric infections and clinical characteristics of maternal sepsis: a hospital-based retrospective cohort study. Sci Rep; 14, 6067.
16. Belachew A, Tewabe T.(2020) Neonatal sepsis and its association with birth weight and gestational age among admitted neonates in Ethiopia: systematic review and meta-analysis. BMC Pediatr;20(1):55.
17. Rubio-Mora E, Bloise-Sánchez I, Quiles-Melero I, Cacho-Calvo J, Cendejas-Bueno E.(2025) Neonatal sepsis: Epidemiology and comparison between preterm and term newborns. Enferm Infecc Microbiol Clin (Engl Ed);43(4):197-204.
18. Wu M, Deng Y, Wang X, He B, Wei F, Zhang Y.(2024) Development of risk prediction nomogram for neonatal sepsis in Group B Streptococcus-colonized mothers: a retrospective study. Sci Rep;14(1):5629.
19. Soman M, Green B, Daling J. (1985) Risk factors for early neonatal sepsis. Am J Epidemiol;121(5):712-9.
20. Chang CJ, Chi H, Jim WT, Chiu NC, Chang L.(2022) Risk of infection in neonates born in accidental out-of-hospital deliveries. PLoS One;17(2):e0263825.
21. Sweta O, Sanjay JM, Kikani MK, Sunil GO.(2016) Bacteriological profile and antibiogram of blood culture isolates from patients of rural tertiary care hospital. Indian J Microbiol Mycol;4(3):1-7.
22. Aggarwal R, Sarkar N, Deorari AK, Paul VK.(2001) Sepsis in the newborn. Indian J Pediatr.;68(12):1143-7.
23. Ambaye K, Yimer A, Mislu E, Wendimagegn Z and Kumsa H.(2024) Time to recovery from neonatal sepsis and its determinants among neonates admitted in Woldia comprehensive specialized hospital, Northeast Ethiopia: a retrospective cohort study. Front. Pediatr.;11:1289593.
24. S.S F amey et al.(2013) Early-onset sepsis in a neonatal intensive care unit in Beni Suef, Egypt: bacterial isolates and antibiotic resistance pattern;Clin Exp Pediatr.;56(8):332-337.
25. Mohakud NK, Mishra JP, Nayak MK, Mishra J, Pradhan L, Panda SS, et al. (2022) Bacteriological profile and outcome of culture-positive neonatal sepsis in a special newborn care unit setting, Odisha. Cureus.;14:e25539.