Section: Pediatrics

Original Research Article

PREDICTORS OF MORTALITY IN SEPSIS AMONG INTRAMURAL NEONATES IN A TERTIARY CARE HOSPITAL

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Received *: 05/03/2025*
Received in revised form *: 13/04/2025*
Accepted *: 01/05/2025*

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DOI: 10.70034/ijmedph.2025.2.203

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

Int J Med Pub Health
2025; 15 (2); 1132-1135

ABSTRACT

Background: Neonatal sepsis remains a major cause of neonatal morbidity and mortality, particularly in developing countries. Identifying predictors of mortality can aid in early intervention and improved outcomes. The objective is to study various antenatal, intranatal, and postnatal factors associated with neonatal sepsis and neonatal mortality, and to evaluate the investigative profile related to neonatal sepsis.

Materials and Methods: This prospective observational study was conducted over 18 months in the NICU of a tertiary care hospital in Ahmedabad, Gujarat. A total of 150 intramural neonates with clinical features of sepsis and positive septic screens were enrolled. Data regarding clinical presentation, investigations, and outcomes were collected and analyzed using SPSS version 21.0, considering $p < 0.05$ as statistically significant.

Results: Male neonates accounted for 65.3% of cases. Although mortality was higher among males, the association was not statistically significant. Lethargy was found to be a significant predictor of mortality ($p = 0.00001$). Mode of delivery and other symptoms such as fever, poor feeding, and vomiting were not significantly associated with mortality.

Conclusion: Lethargy emerged as a strong clinical predictor of mortality among neonates with sepsis. Early recognition of critical symptoms and prompt management are essential to reduce neonatal mortality.

Keywords: Neonatal Sepsis, Mortality Predictors, Lethargy.

INTRODUCTION

Neonatal sepsis remains a significant cause of morbidity and mortality in newborns, particularly in developing countries like India. It is a clinical syndrome characterized by systemic signs of circulatory compromise resulting from the invasion of the bloodstream by bacteria during the first month of life.[1] Conventionally, neonatal sepsis is classified into early-onset sepsis (EOS) and late-onset sepsis (LOS), with the 72-hour mark often serving as the dividing line between the two types.[2]

The neonatal period is widely recognized as the most vulnerable phase for child survival. Globally, nearly 7000 newborns die each day, contributing to an alarming 2.6 million deaths annually during the neonatal period, as reported in 2016.[3] India accounts for approximately 24% of these global neonatal deaths, with a neonatal mortality rate of 25.4 per 1000 live births, although significant variations exist across different states and between rural and urban settings.[4,5] In developing countries, infections (36%), prematurity (28%), and birth asphyxia (23%) are the predominant causes of neonatal mortality, contrasting with developed countries, where prematurity and congenital malformations are the leading contributors.[6]

According to the National Neonatal Perinatal Database (NNPD) 2003, the incidence of neonatal mortality was reported as 38 per 1000 intramural live

births in tertiary care centers, and the incidence of sepsis was recorded at 3%.[7] Furthermore, findings from the Delhi Neonatal Infection Study (DeNIS) collaboration, which enrolled 13,530 neonates from 88,636 live births between 2011 and 2014, demonstrated a total sepsis incidence of 14.3%, with culture-positive sepsis accounting for 6.2% of cases, and a striking 83% of these occurring as early-onset sepsis.[8]

Diagnosing neonatal sepsis presents substantial challenges due to its nonspecific clinical presentation and the variability of laboratory findings. Sepsis often masquerades as other clinical conditions, resulting in both overdiagnosis and underdiagnosis, each carrying significant clinical consequences.[9] Although blood culture remains the gold standard for diagnosis, its positivity rate is suboptimal, ranging from 50% to 80%, and a negative blood culture does not categorically exclude the disease.[10,11] Moreover, several screening tests currently available lack specificity and are often inaccessible in many healthcare settings, particularly in resource-constrained environments.

The risk of neonatal sepsis is influenced by a complex interplay of factors, including maternal-foetal colonization, transplacental immunity, and the neonate's physical and cellular defense mechanisms. Prior research has largely focused on sepsis in hospital-born neonates admitted to neonatal intensive care units (NICUs). However, the sepsis profile among intramural neonates treated in general pediatric wards or suboptimal care settings remains inadequately studied. Outborn neonates — those born at home or transferred from other facilities — are at an elevated risk of community-acquired infections, yet data specific to intramural neonates in tertiary care settings are still scarce.

Given the high burden of neonatal mortality linked to sepsis and the diagnostic challenges it presents, a thorough understanding of antenatal, intranatal, and postnatal factors associated with neonatal sepsis and mortality is essential. Additionally, insights into the investigative profiles of affected neonates could aid in early diagnosis and improved management. With this background, the present study was undertaken with the following aims: (1) to study various antenatal, intranatal, and postnatal factors associated with neonatal sepsis and neonatal mortality, and (2) to study the investigative profile related to neonatal sepsis.

MATERIALS AND METHODS

This was a prospective observational study conducted in the Paediatric Neonatal Intensive Care Unit (NICU) of a tertiary care hospital in Ahmedabad, Gujarat, over a period of 18 months. The study population included all intramural neonates with a gestational age greater than 28 weeks who were admitted to the NICU during the study period. A total of 150 neonates were included, with the sample size calculated using the Cochrane formula (confidence interval 95%, margin of error 7%, assumed prevalence 30%). A convenient sampling technique was used to recruit participants.

Neonates were eligible for inclusion if they were intramural with a gestational age greater than 28 weeks and showed clinical signs of septicemia, such as fever, lethargy, refusal to feed, hypothermia, seizures, respiratory distress, abdominal distension, or a positive septic screen. Additionally, neonates who developed signs of sepsis and tested positive on septic screening during their hospital stay were also included. Neonates with major or life-threatening congenital anomalies, alternative diagnoses like inborn errors of metabolism, or those who were extramural were excluded from the study.

All eligible neonates admitted with clinical features suggestive of sepsis or who developed sepsis during hospitalization were enrolled after obtaining informed written consent from their parents or guardians. Detailed history, clinical features, investigations, complications, and final outcomes were recorded using a pre-designed proforma. All patients were managed according to standard treatment protocols, and investigations were performed clinically indicated.

Data collection commenced after receiving approval from the Institutional Review Board (IRB) of the hospital. Written informed consent was obtained from the parents or guardians of each participant, and in cases where written consent could not be obtained, verbal consent was considered. Privacy and confidentiality were maintained throughout the data collection process.

Collected data was initially recorded on the pre-designed proforma and subsequently entered into a Microsoft Excel spreadsheet. Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 21.0. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1 shows Gestational Age Distribution & Association with Mortality. In our study, out of 150 newborns, 82 (56.7%) had gestational age <37 weeks & 68 (45.3%) had gestational age >37 weeks. Prematurity ($p \leq 0.05$) is significantly associated with mortality. ($p \leq 0.05$).

Table 2 shows Birth Weight Distribution & Association with Mortality. In our study, 104 (69.3%) newborns had weight less than 2499 grams & 46 (30.6%) newborns had birth weight more than 2499 grams. Low birth weight (p- 0.005) is significantly associated with mortality.

[Table 3] shows the distribution of presenting symptoms and their association with neonatal mortality. Poor feeding (44%) and lethargy (38%) were the most common symptoms. Lethargy showed a highly significant association with mortality ($p = 0.00001$), whereas other symptoms such as fever,

vomiting, high-pitched cry, and diarrhoea did not show statistically significant associations.

Table 1: Gestational Age Distribution & Association with Mortality

GESTATIONAL AGE	NUMBER	DISCHARGED	EXPIRED	CHI SQUARE	P value
<37 weeks	82 (56.7%)	52	30	17.8	0.00003
>37 weeks	68 (45.3%)	63	5		
TOTAL	150	115	35		

Table 2: Birth Weight Distribution & Association with Mortality

BIRTH WEIGHT (KG)	NUMBER	DISCHARGED	EXPIRED	CHI SQUARE	P value
<1.5	19 (12.7%)	74	30	7.9	0.005
1.5 - 1.9	37 (12.7%)				
2.0 – 2.4	48 (32%)				
2.5 – 2.9	23 (15.3%)	41	5		
>3.0	23 (15.3%)				
TOTAL	150	115	35		

Table 3: distribution of symptoms & association with neonatal mortality

Symptoms	Number (%)	Discharged (N=115)	Expired (N=35)	Chi Square	P value
Poor Feeding	66 (44%)	53	13	0.9	0.4
Lethargy	57 (38%)	31	26	25.5	0.00001
Fever	46 (30.7%)	35	11	0.01	0.9
Vomiting	21 (14%)	20	1	4.7	0.3
High Pitch Cry	15 (11.3%)	10	5	0.9	0.3
Diarrhoea	15 (4.7%)	12	3	0.01	0.7

DISCUSSION

Neonatal sepsis continues to be a major cause of morbidity and mortality worldwide, particularly in low- and middle-income countries. In the present study, the overall mortality rate among neonates with sepsis was 23.3%, which is consistent with recent studies highlighting the substantial burden of sepsis-related neonatal deaths in tertiary care settings.[12]

In our study, out of 150 newborns, 82 (56.7%) had gestational age <37 weeks & 68 (45.3%) had gestational age >37 weeks [13] various studies[12,13] stated that the preterm babies have inherent immature complement system, macrophage and neutrophil which are not very effective in mounting a full resistance to infection thus making the preterm more prone for infection.

Newborns with low birth weight were more affected in this study. This was comparable with varous studies who observed that sepsis was predominant in babies with low birth weight.[10,11,12]

Among clinical symptoms, lethargy was significantly associated with higher mortality (p = 0.00001). Lethargy is often indicative of severe systemic involvement and circulatory compromise in neonates with sepsis, necessitating early recognition and aggressive management.[15] Other symptoms such as poor feeding, fever, vomiting, high-pitched cry, and diarrhoea did not demonstrate significant associations with mortality, emphasizing that while these are important indicators of illness, their presence alone may not predict adverse outcomes.

The findings of this study align with previous research emphasizing the need for heightened vigilance in neonates presenting with non-specific but serious symptoms like lethargy. Furthermore, the limited specificity of clinical signs reiterates the importance of using laboratory markers and scoring systems for early diagnosis and risk stratification.[16] Despite advancements in neonatal intensive care, sepsis remains a diagnostic and therapeutic challenge, especially in resource-limited settings where access to advanced microbiological diagnostics is restricted.

In summary, lethargy emerged as a strong clinical predictor of mortality among intramural neonates with sepsis. Although male sex and LSCS delivery were more common among affected neonates, they did not independently predict outcomes. Continuous surveillance, early intervention strategies, and improved diagnostic capacities are essential to reduce sepsis-related neonatal mortality.

CONCLUSION

In the present study of intramural neonates with sepsis, lethargy was identified as a significant clinical predictor of mortality. Although male sex and caesarean section delivery were more common among neonates with sepsis, they were not independently associated with increased mortality. Among the maternal factors, history of prolonged rupture of membranes (PROM>24 Hours) & chorioamnionitis and environmental factors like bag & tube ventilation have shown increased risk of mortality in neonatal sepsis. Early identification of critical symptoms and prompt intervention remain crucial for improving neonatal outcomes. Strengthening diagnostic facilities and adherence to sepsis management protocols are essential steps toward reducing neonatal mortality.

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