



## Morbidity profile of the neonates admitted in neonatal intensive care unit in a tertiary teaching hospital in Puducherry: A Prospective Observational study

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### Abstract

**Background:** *The neonatal period is defined as the first 28 days after birth for the newborn and is the most critical period of Paediatric age group. One hundred thirty million newborns are born every year, and 4 million (3%) of them pass away within the first 28 days of their lives. 50% of all newborn deaths occur within the first 24 hours of life. The neonatal intensive care unit (NICU) is one of the highly sophisticated facilities equipped to address all types of critical cases.*

**Aim:** *To assess the morbidity pattern of the neonates who were admitted to the Neonatal Intensive Care unit in a tertiary care centre in Puducherry*

**Methods:** *This prospective observational study was conducted in the Department of Paediatrics at Sri Lakshmi Narayana Medical College in Puducherry. The babies received in the labour room or the operative theatre were given an Apgar score at 1 and 5 min. All other vital parameters were recorded, and the sick babies were shifted to the NICU. All the babies were examined within 24 hours of birth and daily until discharge from the hospital and if found sick are shifted NICU*

**Results:** *A total of 320 babies admitted in NICU for a period of one year from June 2023 to may 2024 were included in the study. 58.7% had a birth weight of more than 2.5 kg, 72.2% had a gestation age of more than 37 weeks, and males contributed 62.8%. The majority are from rural areas and low socio-economic status. And 65.6% were born by vaginal delivery. Anaemia (67.5%) is the most common maternal disease, and gestational diabetes mellitus (30.9%), followed by preeclampsia or eclampsia (27.5%), is the most common obstetrical complication encountered in the study. Transient tachypnoea of newborns is the most common morbidity (71.9%) followed by perinatal asphyxia (31.6%), and small for gestational age (27.5%) was noted in the study.*

**Conclusion:** *The transient tachypnoea of the newborn, respiratory distress, prematurity, and systemic infection were the leading causes of the admission in our study. Improvement should be made in neonatal care from the grassroots level to the tertiary level to reduce neonatal morbidity and mortality.*

**Keywords:** *newborn, neonates, NICU, morbidity.*

## Introduction

The neonatal period is defined as the first 28 days of the newborn after birth, and this neonatal period is further divided into three periods, namely the very early neonatal period, the early neonatal period and the alter neonatal period<sup>[1]</sup>. The period between birth and 24 hours of life is the very early neonatal period. The period between birth to less than seven days and from 7 to less than 28 days is taken as the early and later neonatal periods.<sup>[2]</sup> This period is considered the most vulnerable period of life because of the increased rate of morbidity and mortalities occurring during this period<sup>[3]</sup>.

According to the World Health Organization, about 130 million newborns are born every year, and 4 million of them pass away within the first 28 days of their lives. 50% of all newborn deaths occur within the first 24 hours of life, and 75% occur within the first seven days.<sup>[4,5]</sup> Hence, necessary action should be taken to decrease the morbidity and mortality of the newborn during this period, which further helps to reduce the neonatal mortality rate, thereby achieving Millennium Development Goal 4 (MDG4)<sup>[6]</sup>. The rate of newborn mortality is still a problem, and the risk factors that contribute to it are seen to be both a public health and well-being indicator and a quality indicator for enhancing care given in the neonatal intensive care unit (NICU)<sup>[7]</sup>. Although this was still higher than the proclaimed global average for the year 2020 (17 per 1000 live births), India has achieved significant progress in lowering the newborn mortality rate (NMR), which was 29.5 (2016) to 24.9 (2020) per 1000 live births<sup>[8]</sup>. The most common cause of neonatal death was attributed to preterm birth, followed by birth asphyxia, absence of breathing at the time of the birth, secondary to infection and birth abnormalities. And it directly affects the quality of the patient's life and the country's economic standard.<sup>[9]</sup>

The neonatal intensive care unit (NICU) is one of the highly sophisticated facilities equipped to

address all types of critical cases and facilitate the adjustment of the newborn to the extra-uterine life.<sup>[10]</sup> Although the NICU helps to reduce neonatal mortality due to the financial burden on developing countries, there are only a few fluted NICUs present.<sup>[11]</sup> The past 20 years have seen a notable decrease in newborn mortality rates, attributed to advancements in obstetric practice regarding medical screening and surveillance and an increase in neonatal specialisation. The indication of admission to the NICU varies from developed to developing countries. In developed countries, congenital abnormalities are the most common indication of admission. In contrast, in developing countries, conditions such as prematurity, infection, jaundice, and birth asphyxia are the most common reasons for admission<sup>[8]</sup>. According to the information that is currently accessible in this area, sepsis, perinatal asphyxia, prematurity, respiratory distress syndrome (RDS), meconium aspiration syndrome (MAS), and jaundice were the main reasons for NICU hospitalisations in India; the first three of these conditions also accounted for the majority of deaths in the NICU.<sup>[12,13]</sup>

There needs to be more literature regarding the morbidity pattern of neonates who were admitted to the NICU in the southern part of India. So, this study evaluated morbidity predictors among neonates admitted to the NICU in a tertiary care centre in Tamil Nadu, India.

## Methods

This prospective observational study was conducted in the Department of Paediatrics at Sri Lakshmi Narayana Medical College in Puducherry.

The study was conducted between June 2023 and May 2024 for one year. The study was conducted after obtaining permission from the Sri Lakshmi Narayana Medical College Institutional Ethics Committee, Puducherry. The study included all the consecutive babies' bird drugs for one year. The babies who were born outside the hospital

and referred to our centre with the indication of admission to the NICU were also included in the study. The babies born in the labour room or the operation theatre were assigned APGAR scores, and the vital parameters were recorded. Then, all the babies were examined within 24 hours of the birth and daily after that till their discharge from the health care facility. The babies who were found sick with fever, breathing difficulty, decreased intake of breast milk, vomiting, and respiratory distress were immediately shifted to the NICU. Then, they were subjected to proper history-taking, followed by an examination and investigation, depending on the baby's needs, and the details were recorded on the predesigned proforma. The study excluded the newborns with missing data,  $\geq$  two diagnoses, under observation, discharged from the hospital against medical advice, and referred to other institutions for additional medical procedures.

The condition is diagnosed based on the clinical and WHO criteria. Diagnostic support from the laboratory and the radiology department was used to confirm the diagnosis. The primary disease was considered as the final diagnosis for the patient even though the patient had developed complications of the primary disease. Prematurity, LBW, very LBW (VLBW), extra LBW (ELBW), and congenital deformity were defined according to the WHO guidelines. The diagnosis of meconium aspiration syndrome (MAS) was made using the patient's medical history, symptoms, and radiological results. Clinical diagnosis and Apgar score were used to diagnose birth asphyxia syndrome. Clinical and laboratory indicators were used to evaluate sepsis, including total blood counts, erythrocyte sedimentation rates, C-reactive protein, and collective cultures.

### Data Analysis

All the data were analysed using the Statistical Package for Social Sciences (SPSS) version 23 software. A descriptive univariate analysis of the demographic characteristics was performed.

Categorical variables were summarised through frequencies and percentages.

### Results

Three hundred twenty neonates with the indication of admission to the Neonatal Intensive care unit participated in the study. Concerning the birth weight of the infants, about 58.7% of the neonates had a birth weight of more than 2.5 Kg, and the majority of them, 72.2%, had a gestational age of more than 37 weeks. And 62.8% of the neonates who participated in the study were males, and 55.6% were from rural areas. And the majority of them are of a low socio-economic status. About 65.6% of the neonates were born by standard vaginal delivery, as in Table 1.

**Table 1:** Sociodemographic and neonatal profile of the study population

Variable	Frequency (n)	Percentage (%)
Birth weight		
<2.5 Kg	132	41.3
>2.5 Kg	188	58.7
Gestational age (in weeks)		
<37	89	27.8
$\geq$ 37	231	72.2
Gender		
Male	201	62.8
Female	119	37.2
Residence		
Rural	178	55.6
Urban	142	44.4
Socio economic status		
Class I	57	17.8
Class II	71	22.2
Class III	83	25.9
Class IV	109	34.1
Mode of delivery		
Vaginal	210	65.6
Caesarean section	110	34.4

On exploring the maternal profile of the study population, the study showed that about 67.5% of the patients had anaemia, followed by 30.6% had hypertension and diabetes mellitus was found in 23.7% of the patient's mothers, chronic kidney disease and heart disease in 12.8% and 8.4% of the total study population. Concerning the obstetric complications, the study found that gestational diabetes mellitus was noted in 30.9%

of the neonate mothers followed by 27.5% had preeclampsia or eclampsia, and 23.4% had an antepartum haemorrhage and postpartum haemorrhage was seen in 12.8%, as in Table 2.

**Table 2:** Maternal profile of the study population

Variable	Frequency (n)	Percentage (%)
Maternal diseases		
Anaemia	216	67.5
Diabetes mellitus	76	23.7
Hypertension	98	30.6
Chronic kidney disease	41	12.8
Heart disease	27	8.4
Obstetric complications		
Gestational diabetes mellitus	99	30.9
Preeclampsia/ Eclampsia	88	27.5
Antepartum haemorrhage	75	23.4
Postpartum haemorrhage	41	12.8

On evaluating the morbidity pattern for the newborn, the transient tachypnoea of the newborn is the most common entity noted among the neonates; 71.9% followed by 31.6% had prenatal asphyxia, and 27.5% had minor for gestational age. Sepsis was seen in 14.1%, 10.9% had hyperglycemia and jaundice or kernicterus was noted in 9.1% of the neonates. Congenital heart disease, hypothermia and hypocalcemia were seen in 6.6%, 4.4% and 3.4% of the population, as in Table 3.

**Table 3:** Morbidity pattern of the patients who were admitted to NICU

Clinical diagnosis	Frequency (n)	Percentage (%)
Transient Tachypnoea of newborn	230	71.9
Sepsis	45	14.1
Small for gestational age	88	27.5
Perinatal asphyxia	101	31.6
Congenital heart disease	21	6.6
Jaundice / Kernicterus	29	9.1
Hyperglycemia	35	10.9
Hypocalcaemia	11	3.4
Hypothermia	14	4.4

## Discussion

Documentation of the morbidity pattern of the newborn during the neonatal period is essential and also found to be beneficial for the health care

providers, investigators and researchers to take necessary actions and interventions for the prevention and treatment of many critical situations, thereby increasing the quality of the life of the neonates. because the neonatal period was considered as one of the critical periods in every man's life.

In our study, about 58.7% of the neonates had birth weights of more than 2,5 Kg, and most had a gestational age of over 37 weeks. However, the study by Kumar M et al.<sup>[8]</sup> showed that about 62.2% of the neonates had a birth weight of less than 2.5 kg, but 60% had a gestational age of more than 37 weeks. In our present study, most of the neonates were found to be males (62.8%), from rural areas (55.6%) and belonging to low socioeconomic status, class IV (34.1%) and class III (25.9%), according to modified BG Prasad classification<sup>[14]</sup>. This was similar to the study by Bokade C et al.<sup>[12]</sup>. The males outnumbered the female patients, mostly from rural areas and with low socioeconomic status. The male preponderance was consistent with the study by Rakholia et al.<sup>[15]</sup>. It was shown that males contributed 63.25% of the total. The study's male preponderance may be the result of gender bias in India, where male newborns are more vulnerable biologically and receive greater attention. Most cases were referred from rural areas because our institute is the largest referral tertiary care facility, serving the impoverished and socioeconomically deprived population.

And in our study, about 82.8% of the patient had hospital institutional delivery, and 65.6% had a vaginal delivery. This was similar to the study by Bokade C et al.<sup>[12]</sup>, where most of them had delivered at the hospital, and the majority of them had a standard vaginal delivery. This shows the patient's knowledge regarding the importance and the advantage of institutional delivery over home delivery. And another study by Chaudhary AC et al.<sup>[7]</sup> also showed in his study that about 69.79% of the neonates were born by standard vaginal delivery.

On exploring the maternal profile of the study population, the study showed that about 67.5% of the patients had anaemia, followed by 30.6% with hypertension. Diabetes mellitus was found in 23.7% of the patients' mothers, and gestational diabetes Mellitus is the most common obstetric complication developed in the body in the study. These results were similar to the study by Bokade C et al.<sup>[12]</sup>. This also shows that anaemia is the most common maternal disease encountered in the study, followed by hypertension. Still, in the study, preeclampsia is the most common obstetric complication encountered by the patient's mother, followed by antepartum haemorrhage.

In our study, the transient tachypnea of the newborn (71.9%) is the most common indication for admission to the hospital, followed by perinatal asphyxia (31.6%) is the next most common cause of admission. The other morbid factors encountered in the study are small gestational age (27.5%), sepsis (14.1%) and hyperglycemia (10.9%). In the study by Bokade C et al.<sup>[12]</sup>, sepsis/pneumonia/meningitis (37.57%), followed by perinatal asphyxia (22.29%), was found to be the most common cause of admission to the NICU—the study by Chaudhary AC et al.<sup>[16]</sup> Showed that low birth weight (37.64%) followed by prematurity (15.49%) is the most common cause of admission to the hospital. The study by Kumar MK et al.<sup>[9]</sup> showed that low birth weight is the most common morbidity encountered in the study, consisting of about 39.8%, followed by 23.3% sepsis, and 20.4% found with neonatal jaundice and birth asphyxia was noted in 18.2% of the neonates. Another significant factor contributing to neonatal morbidity is respiratory distress, which differs not just between hospitals but also depending on whether the baby is delivered in an institution or at home. The most common cause of respiratory distress, accounting for 33% of cases, was TTNB, followed by Meconium aspiration syndrome (20.5%). And the study by Al-Momani MM et al.<sup>[17]</sup> Showed that sepsis (27.3%) is the most

common cause of admission to the NICU, followed by respiratory distress syndrome (24.9%) and asphyxia (13.1%).

### Conclusion

The transient tachypnea of the newborn, respiratory distress, prematurity, and systemic infection were the leading causes of the admission in our study. No mortality had been encountered in the study due to the high level of care for care the neonates admitted to the intensive care unit. This morbidity of the neonates will help to plan and act according to the mothers and neonates with risk factors of the development of the life-threatening illness. The study also recommends proper antenatal care be given to the mother with the risk factors to prevent the morbidity of the neonates and also to improve the quality of life of the patients.

### References

1. Panayiotopoulos CP. Neonatal Seizures and Neonatal Syndromes. In: The Epilepsies: Seizures, Syndromes and Management [Internet]. Bladon Medical Publishing; 2005 [cited 2024 Sep 3]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK2599/>
2. Pathirana J, Muñoz FM, Abbing-Karahagopian V, Bhat N, Harris T, Kapoor A, et al. Neonatal death: Case definition & guidelines for data collection, analysis, and presentation of immunisation safety data. *Vaccine*. 2016 Dec 1;34(49):6027–37.
3. Sankar MJ, Neogi SB, Sharma J, Chauhan M, Srivastava R, Prabhakar PK, et al. State of newborn health in India. *J Perinatol*. 2016 Dec;36(Suppl 3):S3–8.
4. Mahtab S, Madhi SA, Baillie VL, Els T, Thwala BN, Onyango D, et al. Causes of death identified in neonates enrolled through Child Health and Mortality Prevention Surveillance (CHAMPS),

- December 2016 –December 2021. PLOS Glob Public Health. 2023 Mar 20;3(3):e0001612.
5. Jehan I, Harris H, Salat S, Zeb A, Mobeen N, Pasha O, et al. Neonatal mortality, risk factors and causes: a prospective population-based cohort study in urban Pakistan. Bull World Health Organ. 2009 Feb;87(2):130–8.
  6. Gülmezoglu AM, Lawrie TA, Hezelgrave N, Oladapo OT, Souza JP, Gielen M, et al. Interventions to Reduce Maternal and Newborn Morbidity and Mortality. In: Black RE, Laxminarayan R, Temmerman M, Walker N, editors. Reproductive, Maternal, Newborn, and Child Health: Disease Control Priorities, Third Edition (Volume 2) [Internet]. Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2016 [cited 2024 Sep 3]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK361904/>
  7. Alebel A, Wagnew F, Petrucka P, Tesema C, Moges NA, Ketema DB, et al. Neonatal mortality in the neonatal intensive care unit of Debre Markos referral hospital, Northwest Ethiopia: a prospective cohort study. BMC Pediatr. 2020 Feb 15;20:72.
  8. Kumar M, Swati, Biswas B, Kumar A, Kumari A, Kumar R. Pattern and predictors of mortality among inborn and out born neonates on ventilatory support: an unmatched case-control study. Am J Blood Res. 2023 Apr 15;13(2):71–6.
  9. Dhaded SM, Saleem S, Goudar SS, Tikmani SS, Hwang K, Guruprasad G, et al. The causes of preterm neonatal deaths in India and Pakistan (PURPOSE): a prospective cohort study. Lancet Glob Health. 2022 Nov 1;10(11):e1575–81.
  10. Barkiya S, Venugopal N. Clinico-Etiological profile and outcome of neonatal respiratory distress. International Journal of Scientific Study. Int J Sci Study. 2016;1(2):189–92.
  11. Garg P, Bolisetty S. Neonatology in developed and developing nations. Indian J Pediatr. 2007 Feb;74(2):169–71.
  12. Bokade CM, Meshram RM. Morbidity and Mortality Patterns among Outborn Referral Neonates in Central India: Prospective Observational Study. J Clin Neonatol. 2018 Sep;7(3):130.
  13. Nair NS, Lewis LE, Dhyan VS, Murthy S, Godinho M, Lakiang T, et al. Factors Associated With Neonatal Pneumonia and its Mortality in India: A Systematic Review and Meta-Analysis. Indian Pediatr. 2021 Nov 15;58(11):1059–61.
  14. Mathiyalagen P, Davis P, Sarasveni M. Updated BG Prasad Socio-Economic Classification: The 2020 Update. Indian J Pediatr. 2021 Jan 1;88(1):76–7.
  15. Bano M. Neonatal morbidity and mortality of sick newborns admitted in a teaching hospital in Uttarakhand. CHRISMED J Health Res. 2020 Aug 29;
  16. Chaudhary AC. Clinical study of morbidity and mortality pattern of neonatal intensive care unit at a tertiary hospital. MedPulse Int J Pediatr D. 2021 Dec;20(2):56–60.
  17. Al-Momani MM. Admission patterns and risk factors linked with neonatal mortality: A hospital-based retrospective study. Pak J Med Sci. 2020;36(6):1371–6.