

## Morbidity and Mortality pattern in Neonatal ICU in a tertiary care teaching hospital of Puducherry, South India

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**Objectives:** This study was undertaken to know about the morbidity and mortality pattern of neonates admitted in neonatal ICU in a tertiary care teaching hospital. **Materials and Methods:** This is a hospital-based, retrospective, descriptive study, done on newborns admitted to neonatal ICU of Sri Venkateshwara Medical College Hospital and Research Centre, Puducherry from January 2018-December 2019 (24 months). **Results:** As about 935 neonates were admitted to neonatal ICU. About 781 neonates were analyzed. Maternal details showed that (70.6%) were educated and (29.3%) of them were uneducated. Morbidity pattern studied in 773 (98.9%) neonates showed that, neonatal jaundice (19.2%), neonatal sepsis (12.1%), TTNB (11.7%), HIE (10.9%), RDS (10.3%), was the common reason for admission. Feeding difficulties were observed in (6.5%), IDM for blood glucose monitoring (5.9%), LBW/preterm care (5.1%), meningitis (2.9%), seizures (2.7%), NEC (2.4%), MAS (2.1%), congenital anomalies (1.9%). The outcome noted in the morbidity pattern was that 99.7% were discharged and 0.25% were referred. Analysis of mortality pattern 8(1.02%) showed that, according to birth weight <1 kg (37.5%) was the most common cause of death, followed by 1-1.5 kg (25%), 1.5 -2.49 kg (25%), > 2.5 kg (12.5%). Maternal complications contributing to neonatal mortality was observed in (75%), it was not seen in (25%). The cause of death noted was prematurity with RDS and sepsis in (62.5%), septic shock with MODS in (12.5%), aspiration pneumonitis (12.5%), prematurity with HIE and pulmonary hemorrhage (12.5%). **Conclusion:** Neonatal jaundice, neonatal sepsis being the most common etiology for neonatal morbidity. Measures should be taken to diagnose jaundice earlier in high-risk cases. Steps should be taken to control neonatal sepsis by following sterile precautions during delivery. Prematurity and ELBW are the leading cause of neonatal mortality.

**Keywords:** Neonatal ICU, Morbidity, Mortality pattern, Low birth weight, Prematurity

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## Introduction

The neonatal period is defined as up to the first 28 days of life and further divided into very early (birth to less than 24 hrs), early (birth to less than 7 days) and late neonatal period (7 days to less than 28 days). Prematurity defined as less than 37 completed weeks of gestation. Term neonate – neonate born between 37 to 42 weeks of gestation. Post-term neonate-born after 42 weeks of gestational age. ELBW defined as a birth weight less than 1Kg. LBW defined as a birth weight less than 2.5Kg [1]. The neonatal period is the most vulnerable period of human life for diseases and most of these are preventable. Moreover, a neonate is 500 times more likely to die on the first day of life than at one month of age [2]. It is estimated that 130 million neonates are born each year and out of these 4 million dies in the first 28 days of life [3].

A baby is an inestimable blessing and bother. The perinatal and neonatal period in spite of its shortness is considered the most critical phase of life [4]. It reflects the health and various demographic parameters of the mother and baby [5,6]. According to the national family health survey-3(NFHS-3) report, the current neonatal mortality rate (NMR) in India is 39 per 1000 live births, accounts for nearly 77% of all the infant deaths (57/1000) and nearly half of all the under-five child deaths (74/1000). The rate of neonatal mortality varies widely among the different states of India, ranging from 11per 1000live births in Kerala to 48 per 1000 live births in Uttar Pradesh [7]. Understanding the pattern of mortality is essential in improving newborn survival.

Overall, there is a decline in under-5 mortality at the global level, however neonatal mortality still remains high and is a major contributor to under-5 mortality [8]. Currently, several Asian countries, including India are in this phase, despite the development of maternal and child health services [9]. India contributes to nearly 25% of mortality around the world [10]. The challenge ahead of us is to meet every newborn target of ten or fewer neonatal deaths per 1000 live births in every country by 2035 [11]. Information on the admission and mortality pattern of hospitalized neonates should reflect the major causes of illnesses and standard of care provided to neonates in a particular locality. Such information will identify gaps and provide a basis on which interventions to improve neonatal outcomes will be designed [12].

## Materials and Methods

**Study design:** This is a Hospital-based, retrospective, descriptive study.

**Setting:** Hospital based study in a tertiary care center in Puducherry, South India

**Participants:** Neonates(first 28 days of life) admitted and treated in neonatal ICU in the pediatric department from January 2018- December 2019 in Sri Venkateshwara medical college hospital and research center, Puducherry.

### Inclusion criteria

Neonates born in our hospital and admitted to the neonatal ICU of the Paediatric department. Complete patient information along with the investigation reports in the medical records.

### Exclusion criteria

Medical records with incomplete information.

Neonates referred from outside.

**Data source:** The patients needed for this study were identified by reviewing our neonatal ICU nominal register. The hospital records of these newborns admitted to Neonatal ICU were retrieved from the medical records department following due permission.

**Study size:** 935 neonates

**Quantitative variable:** morbidity and mortality pattern

**Statistical analysis:** simple proportion test.

The following data was collected from the medical records department (MRD) about the neonates included in this study.

\*Gender, mode of delivery, booking and immunization details of the mother, maternal education, maternal complications (if any), gestational age and birth weight of the newborn, APGAR score, Ballard score, the provisional and final diagnosis of the neonate, date of admission/discharge/death of the baby.

\*History, examination details, investigations were noted (CBC, CRP, serum bilirubin, blood group, coombs test, chest X-ray, USG abdomen, USG cranium, ABG, CSF analysis, urine routine, microscopy, stool for occult blood, LFT, RFT), the course in the hospital and treatment given were recorded.

## Results

Out of the 935 neonates admitted to neonatal ICU, 154 were excluded. Morbidity and mortality pattern of the remaining, 781 neonates were analyzed.

**Table-1: Distribution of neonates according to maternal, sociodemographic data. (n=781).**

Data	Number	Percentage (%)
Baseline details of mother maternal education		
Educated	552	70.6
Uneducated	229	29.3
Maternal complications		
Present	472	60.4
Absent	309	39.5
Mode of delivery		
LSCS	403	51.6
SVD	312	39.9
Instrumental Delivery	66	8.4
Baseline details of the neonate		
Gender		
Male	366	46.8
Female	415	53.1
Birth weight		
< 1 Kg	3	0.38
1-1.5 Kg	96	12.2
1.5 -2.49 Kg	283	36.2
>2.5 Kg	399	51.0
Gestational age		
Preterm	175	22.4
Term	549	70.2
Post-term	57	7.2

According to Table 1- It was seen that out of 781 neonates admitted to ICU, the baseline details of the mother showed that 552(70.6%) of mothers were educated. 229 (29.3%) of mothers were uneducated. Maternal complications were seen in 472(60.4%) of mothers. 309 (39.5%) of mothers did not have any complications during pregnancy. The mode of delivery was LSCS in 403 (51.6%), SVD in 312 (39.9%), instrumental delivery in 66 (8.4%). Baseline details of the neonates admitted to neonatal ICU showed that males were 366 (46.8%). Female neonates were 415 (53.1%). Distribution according to birth weight of neonates showed that < 1 kg were 8 (1%), 1-1.5 kg were 96 (12.2%), 1.5-2.49kg were 283 (36.2%), >2.5 kg 394(50.4%). The pattern according to gestational age showed that preterm neonates were 175 (22.4%), term neonates were 549 (70.2%), post-term neonates were 57 (7.2%).

**Table-2: Distribution of neonates according to morbidity pattern (n=773).**

Data	No.	Percentage
Diagnosis		
Neonatal jaundice	149	19.2
Sepsis	94	12.1
TTNB	91	11.7
HIE	85	10.9
RDS	80	10.3
Feeding difficulties	51	6.5
IDM (blood glucose monitoring)	46	5.9
Preterm/LBW care	40	5.1
Meningitis	23	2.9
Seizures	21	2.7
NEC	19	2.4
MAS	17	2.1
Congenital anomalies	15	1.9
Cephalhematoma	13	1.6
Hypothermia	12	1.5
Hypoglycemia	10	1.2
Polycythemia	2	0.25
Subgaleal bleed	2	0.25
Thigh abscess	1	0.12
Brain abscess	1	0.12
CAH	1	0.12
Outcome		
Discharged	771	99.7
Referred	2	0.25

According to Table-2, Morbidity pattern was studied in 773 neonates and it was observed that, neonatal jaundice was the most common diagnosis 149 (19.2%) for admission in neonatal ICU. This was followed by neonatal sepsis 94 (12.1%), TTNB 91 (11.7%), HIE 85 (10.9%), RDS 80 (10.3%), Feeding difficulties were observed in 51 (6.5%), IDM neonates admitted for blood glucose monitoring were 46 (5.9%), neonates for LBW/preterm care were 40 (5.1%), meningitis 23(2.9%), seizures 21 (2.7%), NEC 19 (2.4%), MAS 17 (2.1%), Congenital anomalies 15 (1.9%), Cephalhematoma 13 (1.6%), hypothermia 12 (1.5%), hypoglycemia 10 (1.2%), polycythemia 2 (0.25%), Subgaleal bleed 2 (0.25%), Thigh abscess 1 (0.12%), brain abscess 1 (0.12%), CAH 1 (0.12%). The outcome noted was, out of 773 neonates admitted to neonatal ICU, 771(99.7%) were discharged. 2(0.25%) neonates were referred at parents request (CAH, Sepsis).

**Table-3: Distribution of neonates according to mortality pattern (n=8).**

Data	No/percentage (%)
Factors contributing to mortality	
Birth weight	
<1 kg	3 (37.5)
1-1.5 kg	2 (25)
1.5-2.49 kg	2 (25)
>2.5 kg	1(12.5)
Gestational age	
Preterm	6 (75)
Term	2 (25)
Post-term	Nil
Maternal complications (PIH, APH, GDM, Hypothyroidism, BOH)	
Present	6 (75)
Absent	2 (25)
Cause of death	
Prematurity with RDS and sepsis	5 (62.5)
Septic shock and MODS	1 (12.5)
Aspiration pneumonitis	1 (12.5)
Prematurity with birth asphyxia and pulmonary hemorrhage	1 (12.5)

According to Table -3, it was seen that among the factors that contributed to mortality, the pattern of distribution among birth weight observed was <1 kg, 3 (37.5%), 1-1.5 kg, 2 (25%), 1.5-2.49 kg, 2 (25%), >2.5 kg, 1 (12.5%). According to the gestational age, mortality was maximum in preterms 6 (75%), term neonates 2 (25%), no mortality was observed in post-term neonates. Maternal complications contributing to neonatal mortality was observed in 6 (75%), it was absent in 2 (25%). The cause of death noted was prematurity with RDS and sepsis in 5 (62.5%), Septic shock with MODS 1 (12.5%), Aspiration pneumonitis in 1 (12.5%), prematurity with birth asphyxia and pulmonary hemorrhage 1 (12.5%).

## Discussion

Good and regular antenatal care, good care at the time of birth including appropriate and timely intervention and proper care of sick neonates are important in reducing perinatal deaths [13]. Prevention of preterm births, better care during the intrapartum period, more intensive care of very low birth weight and preterm babies would help in reducing the present high perinatal mortality [14]. Neonatal mortality is becoming increasingly important not only because of its share of under-five deaths has been increasing, but also the health interventions needed to address the major causes of neonatal deaths generally differ from under-five deaths and are closely linked to those needed to

Protect maternal health [15]. Failure to improve birth outcomes by 2035 will result in an estimated 116 million deaths, 99 million survivors with a disability or lost developmental potential, and millions of adults at increased of non-communicable diseases after low birth weight [16]. In the present study it was seen, out of 781 neonates admitted to neonatal ICU, the baseline maternal sociodemographic features showed, about 552 (70.6%) of mothers were educated. Only 229 (29.3%) of mothers belonged to uneducated category. It was noticed that maternal complications were present in 472(60.4%), absent in 309 (39.5%) of mothers. Mode of delivery was LSCS in 403(51.6%), SVD in 312(39.9%), instrumental delivery in 66 (8.4%). Similar findings were noted in a study conducted in Brazil [17].

Baseline details of neonates admitted to neonatal ICU showed that females (53.1%) outnumbered male neonates (46.8%). But other authors have reported male preponderance [4,18,19]. Distribution according to birth weight of neonates showed that, < 1kg were least common, 3 (0.38%), 1-1.5 kg were 96(12.2%), 1.5-2.49 kg were 283(36.2%), > 2.5kg 399(51.0%), maximum in number. A study done in Gauhati showed that the least number of births were < 1kg and maximum being in 1.5Kg -2.49 Kg [19]. The pattern according to gestational age showed that preterms were 175(22.4%) second most common, term neonates 549(70.2%) being maximum, post term neonates were 57(7.2%), the least. A similar pattern was observed by the study conducted in Gujarat [20]. It was observed that out of 773 (98.9%) morbidity patterns in neonates studied, the most common morbidity in neonates admitted to ICU was neonatal jaundice 149 (19.2%). This was followed by neonatal sepsis 94 (12.1%), TTNB 91 (11.7%), HIE 85 (10.9%), RDS 80 (10.3%) Feeding difficulties 51 (6.5%), IDM babies admitted for blood glucose monitoring 46 (5.9%), LBW/ Preterm care 40 (5.1%), meningitis 23 (2.9%), seizures 21 (2.7%), NEC 19 (2.4%) MAS 17 (2.1%), Congenital anomalies 15 (1.9%), Cephalhematoma 13 (1.6%), Hypothermia 12 (1.5%), Hypoglycemia 10 (1.2%), Polycythemia 2(0.25%), Subgaleal bleed 2 (0.25%). Other rare disorders were Thigh abscess 1 (0.12%), Brain abscess 1 (0.12%), CAH 1 (0.12%). Similar findings were seen in a study conducted in Chandigarh, which showed that neonatal hyperbilirubinemia, followed by neonatal sepsis and respiratory distress as the most common cause of neonatal morbidity [21].

Studies done in Nigeria and Gauhati revealed HIE, sepsis, and prematurity as a major cause of morbidity [12,19]. The outcome noted in the morbidity pattern was that, out of 773 neonates admitted to ICU, 771 (99.7%) were discharged and 2 (0.25%) of them were referred at parents' request. Similar outcomes were noted by studies done in Gujarat and South India [4,8].

Factors that contributed to mortality 8(1.02%) were analyzed. The present study revealed that maternal complications were seen in 6(75%), not seen in 2(25%) of neonatal deaths. Similar findings were noted by Saini et al in a study done in Chandigarh [21]. Maximum number of deaths were seen in neonates < 1kg 3(37.5%), followed by 1-1.5 kg 2 (25%), 1.5-2.49 kg 2 (25%), minimum death was noted in >2.5 kg 1 (12.5%). These findings were similar to the studies done in Kenya and Trinidad [22,23]. According to the gestational age, maximum mortality was noted in preterms 6 (75%), followed by terms 2 (25%) and there were no deaths in post-term babies. A similar analysis was seen in the studies done in Gauhati and Trinidad [19,23]. The cause of death was prematurity with RDS and sepsis in 5 (62.5%), septic shock and MODS in 1(12.5%), aspiration pneumonitis in 1 (12.5%), prematurity with birth asphyxia and pulmonary hemorrhage 1(12.5%). The present study noted that the most common cause of mortality in neonates was ELBW and prematurity with its complications. This is in accordance with a study done in Trinidad [23].

The major limitation of the present study was, it is a hospital-based study which lacks a full-fledged community data. Since it is a retrospective study, it lacks follow up in neonates admitted to ICU and also referred to neonates. In addition, outborn neonates were excluded. The morbidity and mortality profile reported in this study may, therefore, be an underestimation.

## Conclusion

The present study has revealed that maternal complications play an important role in neonatal morbidity and mortality profile, which can be prevented if good antenatal care is given. Neonatal jaundice, neonatal sepsis being the most common etiology for admission in neonatal ICU, measures should be taken to diagnose jaundice earlier in high-risk cases. Steps should be taken to control neonatal sepsis by following sterile precautions during delivery.

TTNB is in the increasing trend, probably due to an increase in LSCS, as the mode of delivery, which should be avoided unless there is a definite indication. A rare diagnosis like thigh abscess, brain abscess are being diagnosed. Emphasis is therefore placed on a high index of suspicion for these types of conditions.

## What does the study add to the existing knowledge?

Prematurity and ELBW are the leading cause of mortality. Optimal health care services for pregnant women should be given to improve birth weight as well as prevent premature deliveries. But since this is a retrospective study with a small sample size, the authors would like to recommend further detailed prospective studies in the future, with emphasis on the awareness of the most common and emerging rare etiology of neonatal morbidity profile.

## Author's contribution

The first author contributed to study design and data collection from MRD. The corresponding author contributed to data analysis and interpretation of results.

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## Abbreviation

HIE –Hypoxic Ischemic Encephalopathy

TTNB- Transient Tachypnea of Newborn

RDS – Respiratory Distress Syndrome

IDM- Infant of Diabetic Mother

LBW- Low Birth Weight

ELBW- Extremely Low Birth Weight

NEC – Necrotizing Entero Colitis

MAS – Meconium Aspiration Syndrome

CAH- Congenital Adrenal Hyperplasia

PIH – Pregnancy Induced Hypertension

APH – Antepartum Hemorrhage

GDM – Gestational Diabetes Mellitus  
 BOH- Bad Obstetric History  
 MODS- sMulti-Organ Dysfunction Syndrome  
 LSCS-Lower Segment Caesarean Section  
 SVD- Spontaneous Vaginal Delivery  
 CBC- Complete Blood Count  
 CRP- C- Reactive Protein  
 CSF- Cerebro Spinal Fluid  
 USG- Ultrasonography  
 ABG- Arterial Blood Gas  
 LFT- Liver Function Test  
 RFT- Renal Function Test

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