Original Article

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Investigation of the Morbidity and Mortality Patterns in Neonatal Intensive Care Units (NICUs) among Low Birth Weight (LBW) Neonates

K. Dhanunjay Naidu[1], Sachitra Rathod[2]

[1]Assistant Professor, Department of Paediatrics, MMC Kundrathur Main Road, Kovur, Thandalam, Chennai, India.

[2]Assistant Professor, Department of Paediatrics, Patnam Mahender Reddy Institute of Medical Sciences, Chevella, Telangana, India.

Abstract

Background: The neonatal period is widely recognized as the most critical phase of human life in terms of susceptibility to morbidity and mortality. The assessment of neonatal outcome holds significant importance within the realm of obstetric and neonatal healthcare. In developing nations, the mortality rate of infants during the neonatal phase constitutes a significant proportion, ranging from 50% to 70%, of overall infant mortality. In India, the annual mortality rate for infants is estimated to be one million. **Aim:** Investigation of the morbidity and mortality patterns in neonatal intensive care units (NICUs) among low birth weight (LBW) neonates. **Materials and Methods:** The present study involved a comprehensive analysis of data pertaining to the incidence of preterm deliveries, diverse morbidity indicators, mortality trends, and the therapeutic interventions administered within the Neonatal Intensive Care Unit (NICU). The study gathered pertinent information, such as maternal characteristics (age, address, socioeconomic status, educational level), maternal weight, and various risk factors. Additionally, data on the order of birth, gestational age, antenatal steroid use, premature rupture of membranes, and mode of delivery were also collected. **Results:** Among a total of 800 infants, 220 were born with low birth weight (LBW). Of these LBW infants, 120 (54.55%) were born prematurely, while 100 (45.45%) were classified as having intrauterine growth restriction (IUGR) at term. The prevalence of low birth weight (LBW) infants in the present study was found to be 27.5%. The prevalent morbidities observed in low birth weight (LBW) infants were neonatal hyperbilirubinemia, accounting for 45.45% of cases, followed by early-onset sepsis (EOS) at 30.91%, birth asphyxia at 20.45%, respiratory distress at 13.64%, late-onset sepsis (LOS) at 8.18%, and meconium aspiration syndrome (MAS) at 6.82%. The primary factor contributing to early neonatal mortality in preterm low birth weight infants was birth asphyxia, accounting for 47.06% of cases. This was followed by hyaline membrane disease, which accounted for 22.73% of cases, and sepsis, which accounted for 11.76% of cases. **Conclusion:** The findings of this study indicate that preterm infants accounted for 54.55% of the cases of low birth weight infants. The relationship between morbidity and mortality in low birth weight (LBW) infants exhibited an inverse correlation with both birth weight and gestational age.

Keywords: NICU, Neonatal Morbidity, Neonatal Mortality.

Corresponding Author: Dr. Sachitra Rathod, Assistant Professor, Department of Paediatrics, Patnam Mahender Reddy Institute of Medical Sciences, Chevella, Telangana, India.
Email: caprisr20@gmail.com

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Introduction

The occurrence of preterm birth significantly contributes to the mortality and morbidity rates among newborns, thereby placing a substantial strain on the already constrained healthcare resources. Despite the global increase in the occurrence of preterm birth, the survival rates of preterm neonates have experienced a substantial improvement, primarily attributed to the ongoing advancements in neonatal intensive care unit (NICU) facilities. Preterm birth is a leading cause of mortality in the neonatal period, ranking second only to pneumonia among children under the age of five. Prematurity is a significant contributor to both mortality rates and the heightened susceptibility to enduring disabilities throughout an individual's lifetime.[1,2] In the context of India, it is observed that approximately 30% of live births are classified as low birth weight (LBW), resulting in nearly 3 million LBW infants being delivered annually within the country. As per the World Health Organization (WHO), a significant proportion of infant mortality in India, specifically 33%, is attributed to Low Birth Weight (LBW). A comparable finding is reported in a recent survey conducted in India. According to the findings of the National Family Health Survey (NFHS)-3, it was observed that 23% of the children, for whom birth weights were recorded, had a weight below 2.5 kg. The prevalence of low birth weight (LBW) infants was found to be greater in rural regions, accounting for 24.5% of births, in comparison to urban areas where the proportion was 21%.[3-5] There is significant variation in the neonatal mortality rate across the various states of India, with Kerala reporting a rate of 5 per 1000 live births and Uttar Pradesh reporting a rate of 41 per 1000 live births. The neonatal mortality rate in Bihar, as reported by NFHS-4, is 35

per 1000 live births, which exceeds the national average. This disparity can be attributed to the inadequate presence of health infrastructures in the region. Preterm birth is a significant clinical challenge within the fields of obstetrics and neonatology due to its correlation with heightened rates of perinatal mortality and morbidity.[6]The rise in premature births has been associated with various factors. These include the proliferation of fertilization techniques leading to an increase in twin and multiple pregnancies, a growing trend of women giving birth after the age of 35, and an expanding array of medical indications for pregnancy termination due to the augmented utilization of pregnancy monitoring technology. The survival rates of extremely premature infants have experienced a substantial increase over the past two decades. The prevalence of complications associated with prematurity is increasing due to the prolonged stays of survivors in the Neonatal Intensive Care Unit (NICU).[7] Advanced neonatal care is typically required for the survival of most preterm infants. Despite the progress made in neonatal care, which has resulted in enhanced survival rates and improved quality of life for infants in developed nations, the incidence of morbidity and mortality among preterm infants remains disproportionately high in developing and underdeveloped countries. In high-income nations, the survival rate for preterm infants stands at 95%, with 90% of these individuals experiencing no impairments. Conversely, in numerous low-income countries, the majority of extremely premature births result in mortality due to inadequate access to fundamental healthcare services. Conversely, a significant proportion of middle-income nations experience enduring ramifications and impairments resulting from preterm births, particularly those classified as extremely preterm. According to research findings, the gestational age at birth is a significant factor in determining the likelihood of negative outcomes for newborns. However, it is worth noting that the specific subtype of preterm birth also plays a crucial role in this regard. Infants born prematurely to women who experience spontaneous onset of labor exhibit more favorable outcomes compared to infants delivered through clinician-initiated methods.[9-11] The primary aims of this study were to provide a comprehensive description of the demographic characteristics of preterm infants admitted to the Neonatal Intensive Care Unit (NICU), investigate the potential factors contributing to premature delivery, analyze the various morbidity patterns that emerged during the clinical course, and ascertain the causes of mortality among this population.

Materials and Methods

The present investigation constitutes a retrospective descriptive study conducted within the confines of a neonatal intensive care unit. The study population consisted of neonates who were admitted to the Neonatal Intensive Care Unit (NICU) and had a gestational age of less than 37 completed weeks. This retrospective study involved the collection of data from the medical records department, specifically focusing on the medical records of low birth weight babies who were admitted to the Neonatal Intensive Care Unit (NICU). The present study involved a comprehensive analysis of data pertaining to the incidence of preterm deliveries, diverse morbidity indicators, mortality trends, and the therapeutic interventions administered within the Neonatal Intensive Care Unit (NICU). The study gathered pertinent information, such as maternal characteristics (age, address, socioeconomic status, educational level), maternal weight, and various risk factors (hypertension, anemia, gestational diabetes mellitus, multiple gestations, chronic medical illness, hypothyroidism, HIV status, hepatitis B, maternal fever). Additionally, data on the order of birth, gestational age, antenatal steroid use, premature rupture of membranes, and mode of delivery were also collected. The pertinent information regarding the newborn includes their biological sex, requirement for resuscitation, Apgar score, gestational age, birth weight, as well as any existing illnesses. Additionally, the necessity for mechanical ventilation and surfactant therapy was documented. Data is gathered on various conditions that are linked to premature birth. The diagnosis of respiratory distress syndrome (RDS) was made in accordance with the European Consensus Guidelines on the Management of Neonatal Respiratory Distress Syndrome. This diagnosis was based on specific criteria, including a PaO2 level below 50 mmHg when breathing room air, the presence of central cyanosis when breathing room air, the requirement for supplemental oxygen to maintain a PaO2 level above 50 mmHg or to maintain a pulse oximeter saturation above 85% within the first 24 hours after birth. Additionally, the diagnosis was supported by the findings of a classical chest radiograph, which exhibited characteristics such as a ground-glass appearance and air bronchogram.

Results

Table 1: Gender of the low birth weight babies

Gender	Number of babies	Percentage
Male	88	40
Female	132	60

Overall female to male ratio was 1.5:1.

Table 2: Distribution of low birth weight babies as per their body weight

LBW babies as per birth weight in kg	Number of babies	Percentage	P- value
1.5-2.499	200	90.91	
1-1.499	17	7.73	
<1	3	1.36	0.14

During the study period, a total of 815 deliveries were recorded. The study period yielded a total of 15 instances of stillbirth. The total number of live births observed was 800, with stillbirths excluded from the count. Among a total of 800 infants, 220 were born with low birth weight (LBW). Of these LBW infants, 120 (54.55%) were born prematurely, while 100 (45.45%) were classified as having intrauterine growth restriction (IUGR) at term. The prevalence of low birth weight (LBW) infants in the present study was found to be 27.5%. Out of the total sample of 220 infants born with low birth weight (LBW), the majority (90.91%) fell within the weight range of 1.5-2.499 kg. A smaller proportion (7.73%) belonged to the very low birth weight (VLBW) group, with weights ranging from 1-1.499 kg. Only a minimal percentage (1.36%) of infants had an extremely low birth weight (ELBW) of less than 1 kg.

Table 3: Distribution of LBW baby as per gestation

LBW babies	Number of babies	Percentage
Term IUGR	100	45.45
Preterm AGA	85	38.64
Preterm SGA	35	15.91
Total LBW	220	100

In the total 220 babies, 100(45.45%) were Term IUGR, 85(38.64%) were preterm appropriate for gestational age whereas the rest 35 (15.91%) were small for gestational age preterm (Table 3).

Table 4: Morbidities in Preterm and Term LBW babies in the early neonatal period

Morbidities	Preterm-LBW	Term IUGR-LBW	Total =220	Percentage	P- value
NNH	81	19	100	45.45	0.22
EOS	50	18	68	30.91	
Birth asphyxia	38	7	45	20.45	0.04
Respiratory distress	25	5	30	13.64	0.0001
LOS	12	6	18	8.18	
Meconium aspiration syndrome	10	5	15	6.82	
Sepsis	8	2	10	4.55	0.0003
AOP	9	0	9	4.09	0.0001
NEC	4	3	7	3.18	0.52
Septic Ileus	3	2	5	2.27	0.69
Polycythemia	3	2	5	2.27	0.47
AKI	3	0	3	1.36	0.26
Congenital anomalies	8	5	13	5.91	0.17

The study examines the morbidities observed in both preterm and term infants with intrauterine growth restriction (IUGR) and low birth weight. The prevalent morbidities observed in low birth weight (LBW) infants were neonatal hyperbilirubinemia, accounting for 45.45% of cases, followed by early-onset sepsis (EOS) at 30.91%, birth asphyxia at 20.45%, respiratory distress at 13.64%, late-onset sepsis (LOS) at 8.18%, and meconium aspiration syndrome (MAS) at 6.82%. The incidence of morbidities was found to be significantly higher in preterm-low birth weight (LBW) infants compared to term infants with intrauterine growth restriction (IUGR)-LBW. This difference was found to be statistically significant. The prevalence of respiratory distress, birth asphyxia, sepsis, and AOP was found to be significantly higher in preterm infants compared to term infants, as indicated by the statistical analysis presented in Table 4.

Table 5: Causes of early neonatal mortality in LBW babies

Causes in LBW	No. of deaths among Preterm-LBW	No. of deaths among Term -LBW	No of deaths	Percentage
Birth asphyxia	8	3	11	50
HMD	5	0	5	22.73
Aspiration of feeds	2	1	3	13.64
Sepsis	2	1	3	13.64
Total	17	5	22	100

The mortality rate during the early neonatal period among infants with low birth weight (LBW) is being examined. Out of the total population of 220 infants with low birth weight (LBW), a total of 22 fatalities were observed during the

neonatal phase. The current study observed a neonatal mortality rate of 2.2 per 1000 live births. A significant proportion of early neonatal deaths, specifically 77.27%, can be attributed to infants born prematurely with low birth weight. The remaining deaths are accounted for by infants born at term with intrauterine growth restriction. The primary factor contributing to early neonatal mortality in preterm low birth weight infants was birth asphyxia, accounting for 47.06% of cases. This was followed by hyaline membrane disease, which accounted for 22.73% of cases, and sepsis, which accounted for 11.76% of cases, as indicated in Table 4. The mortality rate for infants with a birth weight less than 1 kg was 100%, while it was 25% for those in the very low birth weight (VLBW) group and 10% for those in the 1.5-2.499 kg group.

Discussion

Accurate data pertaining to morbidity and mortality holds significant utility for a multitude of reasons. Designing interventions for prevention and treatment, as well as implementing and evaluating healthcare programs, holds significant importance for primary care providers, investigators, local and national health administrators, and decision makers. There is a scarcity of data available from hospitals located in smaller cities and from neonatal intensive care units (NICUs) in low resource settings. In smaller urban areas, the quantity of neonatal intensive care units (NICUs) is comparatively lower, with an even scarcer presence of level 3 NICUs. Furthermore, there exists a limited availability of published reports originating from these healthcare facilities. The strategies implemented in various five-year plans, such as the National Health Mission, Millennium Development Goals, India's Newborn Action Plan, and the more recent Sustainable Development Goals (SDG), aim to decrease perinatal mortality, infant mortality rate, and low birth weight (LBW). The Sustainable Development Goal (SDG) for the year 2017 includes a specific objective to achieve a 30% reduction in the incidence of low birth weight (LBW) by the year 2025, in order to meet the nutrition targets set by the World Health Assembly. The current study observed a prevalence of low birth weight (LBW) infants at 27.5%, a rate that aligns with the incidence reported in the National Family Health Survey-3 (NFHS-3) of India, which was documented at 22%. However, the findings of this study indicate that within the group of low birth weight (LBW) infants, 54.55% were born preterm and 45.45% were classified as term infants with intrauterine growth restriction (IUGR). Our findings align with previous studies that have also reported that approximately 50% of low birth weight (LBW) infants are attributed to preterm birth. Prematurity is a prominent factor contributing to neonatal mortality rates in India.[12,13]The findings of this study indicate that a significant proportion of the preterm neonates fell within the gestational age range of 30-34 weeks and exhibited birth weights ranging from 1500 to 2000 grams. These findings are corroborated by a separate cross-sectional study, which demonstrated that preterm infants with gestational ages ranging from 31 to 34 weeks accounted for 44% of the sample. Additionally, it was observed that 23% of the preterm infants had birth weights between 1500 and 2000 grams.[14] In a study conducted by Karegoudar (2014) in Belgaum, it was observed that 41.61% of premature infants had a birth weight ranging from 1501 to 2000 grams (Karegoudar, 2014, p. 15). In a research conducted in Ethiopia, the occurrence of preterm birth was found to be 25.9%. However, in the current study, it was observed that the proportion of preterm birth among the admissions to the Neonatal Intensive Care Unit (NICU) was higher.[16] The ratio of low birth weight (LBW) among females to males was 1.5:1. This finding aligns with previous studies conducted by Agarwal et al.[17] and Felke et al.[18] which also reported a higher prevalence of LBW among females.Low birth weight (LBW) is a significant indicator of neonatal well-being and mortality. In the present study, it was observed that neonatal jaundice was the predominant morbidity among low birth weight (LBW) infants, which aligns with the findings of a previous study conducted by Sangamam R et al.[19]

In this study, the prevalence of hyperbilirubinemia among severe and moderate preterm infants was found to be 45.45%. This finding stands in contrast to a previous study conducted at BP Koirala Institute of Health Sciences in Dharan, which reported a significantly higher incidence of 73.6% in a similar population. In this study, the prevalence of hyperbilirubinemia in late preterm infants was found to be 26%, which is notably higher when compared to the 14% reported in a previous study conducted in Taiwan [20]. HMD emerged as the primary etiology of respiratory distress in the population of premature infants. The results of our investigation align with the findings reported in a study conducted by Hasthi UR et al.[21] The present study found that preterm babies accounted for over 77.27% of the observed mortality cases. In our study, it was observed that Birth Asphyxia accounted for 50% of deaths, while HMD (Hyaline Membrane Disease) accounted for 22.73% of deaths among low birth weight (LBW) infants. These two causes combined contributed to a total of 72.73% of mortality in the LBW population under investigation. The results of our investigation align with the research conducted by Felke Y et al.[18] In a previous study conducted by Kumar MK et al.[7] at our institute, findings revealed that the neonatal mortality rate among patients admitted to the Neonatal Intensive Care Unit (NICU) was 13.6% (32 out of 236). Additionally, it was observed that the mortality rate among low birth weight (LBW) infants was 11 (34.8%). There was no statistically significant disparity observed in the outcome between the male and female neonates. The present study was conducted within a hospital setting, which may limit its generalizability to the broader community in terms of neonatal morbidity and

mortality statistics. Due to the nature of this study being record-based, direct examination of the study subjects was not feasible. Consequently, the study relied on the analysis of case notes and reports documented in the medical records.

Conclusion

The findings of this study indicate that preterm infants accounted for 54.55% of the cases of low birth weight infants. The relationship between morbidity and mortality in low birth weight (LBW) infants exhibited an inverse correlation with both birth weight and gestational age. The prevention of a significant portion of morbidity and subsequent mortality can be achieved through the establishment of infrastructure and the provision of comprehensive training for healthcare personnel, specifically focusing on the delivery of effective antenatal and peripartum obstetric care, as well as neonatal care and resuscitation.

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