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Original Research Article

A study of neonatal morbidity and mortality patterns in very low birth weight neonates admitted in the neonatal intensive care unit at Al-Ameen Medical College and Hospital, Vijayapura

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ABSTRACT

Background: Meticulous documentation of morbidity and mortality is essential for elucidating health patterns. The perinatal and neonatal periods, though brief, are pivotal in revealing the health and socio-biological conditions of vulnerable populations. This study seeks to analyze complex morbidity and mortality trends among neonates in a tertiary NICU.
Methods: All VLBW neonates admitted to our NICU from April 2023 to March 2024 were analyzed. We gathered comprehensive maternal data, including age, socioeconomic status, and health risk factors. Excluding congenital anomalies, the study assessed demographic profiles, short-term morbidity, and outcomes.
Results: In our NICU, 280 very low birth weight (VLBW) neonates were admitted, with 155 males (55.3%) and 125 females (44.7%). The mean birth weight was 1.240±0.110 kg for males and 1.270±0.105 kg for females. Among these, 170 (60.7%) were small for gestational age (SGA), 60 (21.4%) appropriate for gestational age (AGA), and 50 (17.9%) intrauterine growth restricted (IUGR). The gestational age distribution was: less than 28 weeks, 17 (6%); 28-32 weeks, 155 (55.3%); 32-34 weeks, 47 (16.9%); and 34-36 weeks, 61 (21.8%). Of the 280 neonates, 208 (74.2%) survived, while 72 (25.8%) did not. The leading causes of mortality were sepsis, with 39 deaths (54.2%), and respiratory distress syndrome, with 27 deaths (37.6%).
Conclusions: Birth asphyxia, prematurity, jaundice, neonatal sepsis, and respiratory issues significantly contribute to neonatal mortality and morbidity. To mitigate these, it is vital to enhance prenatal care, ensure skilled birth attendance, expand NICU facilities, implement routine screenings, enforce stringent infection control and educate parents.

Keywords: VLBW neonates, Morbidity, Mortality, Neonatal sepsis, Respiratory distress syndrome, Prematurity

INTRODUCTION

Prematurity, defined as gestational age (GA) less than 37 weeks, stands as a leading cause of morbidity among neonates, with a profound impact, particularly on very low birth weight (VLBW) neonates. The WHO categorizes VLBW neonates as those weighing less than 1500g at birth, regardless of gestational age. Birth weight, a crucial determinant influenced by gestational length and intrauterine growth, plays a pivotal role in perinatal, neonatal, and postnatal outcomes.

Accurate data on morbidity and mortality patterns are essential for many reasons. The perinatal and neonatal

periods, though brief, are the most critical phases of human life. It reflects the general health and the socio-biological features of the most vulnerable groups of the society, the mothers and the infants.[1] Out of 130 million babies born every year about 4 million die in the neonatal period. About ¼th of global neonatal deaths occur in India. According to the Sample Registration System (SRS) statistical report 2016 the current neonatal mortality rate in India is 24 and ranges from 14 in urban to 27 in rural areas.[2]

Furthermore, preterm LBW leads to prolonged hospital stays in neonates and can lead to adverse neurodevelopmental outcomes, with massive implications for the family and society in the future.[3]

The causes of preterm birth can be divided into multiple categories including, fetal, placental, maternal, uterine, respiratory issues in premature babies, cardiovascular conditions, hematological conditions, gastrointestinal conditions, metabolic conditions, neurological conditions, renal conditions and infections.

Of all the neonatal deaths in the southwestern region of Ethiopia (22.8%), more than two-thirds of these (76%) were caused by LBW and prematurity. Despite the introduction of modern techniques in NICU facilities, preterm LBW neonates are still at a high risk of developing numerous morbidities.[4]

The escalating morbidity and mortality rates in VLBW neonates can be attributed to their physiological and metabolic immaturity, rendering them susceptible to heightened risks of hypoglycemia, jaundice, respiratory distress syndrome (RDS), sepsis, apnea, birth asphyxia, and re-hospitalizations during the neonatal period.[5] Despite advancements in neonatal care, the persistence of high neonatal mortality rates, especially in developing countries, underscores the urgent need for in-depth investigations into the factors associated with morbidity and mortality in VLBW neonates.

This research endeavors to fill a critical gap by examining the factors contributing to morbidity and mortality in VLBW neonates admitted to our NICU. The risk of developing morbidities varied among different categories of preterm LBW neonates. Extremely low birth weight (ELBW) and extremely preterm neonates have higher rates of morbidity and mortality.[6] A comprehensive understanding of these factors is essential to formulate targeted interventions aimed at reducing neonatal mortality in this vulnerable population. Remarkably, this study represents a pioneering effort within our hospital, offering valuable insights into VLBW care that can serve as a benchmark for future improvements.

In addition to exploring the causative factors of preterm birth, such as fetal distress, placental dysfunction, uterine issues, maternal conditions, and other contributing factors, the paper will delve into the myriad of complications faced by premature low birth weight neonates. Respiratory, cardiovascular, hematological, gastrointestinal, metabolic, central nervous system, renal, and infectious complications will be systematically analyzed, providing a comprehensive overview of the challenges encountered by these neonates.

Through this study, we aspire to unravel the intricacies surrounding VLBW neonatal care, ultimately paving the way for targeted interventions that can significantly enhance the quality of life for these fragile infants. Currently, some trials aim to implement novel techniques for the prevention of preterm VLBW births and aim to achieve this through different interventions including kangaroo mother care and extra support for feeding VLBW and preterm babies with breast milk as well as other interventions during the postnatal period.[7] The findings from this research may serve as a catalyst for future advancements in neonatal care, offering a ray of hope for improved outcomes in this high-risk population.

The present study aimed to investigate the morbidity and mortality patterns in VLBW neonates and examine the maternal risk factors associated with VLBW. Additionally, it seeks to develop targeted preventive and advanced treatment strategies in critical areas and outline future research plans in regions with higher rates of admission and mortality.

METHODS

This prospective COHORT study was conducted in the NICU at Al-Ameen Medical College and Hospital. The study involved all VLBW neonates admitted to the NICU, based on specific inclusion and exclusion criteria. The study period spanned from April 2023 to March 2024 for a period of one year.

All VLBW neonates were included in the study following written informed consent from their parents for the use of clinical data, and ethical committee clearance was obtained. The study enrolled every VLBW neonate admitted to our NICU between April 2023 and March 2024. Data collected encompassed maternal details (age, address, socioeconomic status, educational level, weight, risk factors such as hypertension, anemia, gestational diabetes, multiple gestation, chronic illnesses, hypothyroidism, HIV status, hepatitis B, maternal fever), as well as birth details (order of birth, gestational age, antenatal steroids, premature rupture of membranes, mode of delivery). Neonatal data recorded included sex, need for resuscitation, APGAR score, gestational age, birth weight, illness, and requirements for mechanical ventilation and surfactant therapy. Neonates with major congenital anomalies and clinically identified chromosomal syndromes were excluded from this study. The sample size for our study was 280 VLBW neonates, selected by enumeration and simple random sampling. The data obtained was entered in a Microsoft Excel sheet,

and statistical analysis was performed using SPSS v.22 software. Descriptive analysis was performed using mean±SD, quantitative variables were compared with Independent t test and categorical variables were compared using Chi square test. Other statistical methods were used as required and p value <0.05 was considered statistically significant.

RESULTS

A total of 280 very low birth weight neonates were admitted to our NICU, with males accounting for 55.3% (155) and females for 44.7% (125) (Table 1).

Table 1: Gender distribution.

Gender	Number	Percent
Male	155	55.3
Female	125	44.7
Total	280	100

Table 2: Mean birth weight of VLBW neonates.

Gender	Mean	SD	Standard error
Male	1.240	0.110	0.005
Female	1.270	0.105	0.007

Table 3: Gestational age.

Gestational age	VLBW neonates	
	N	Percent
SGA	170	60.7
AGA	60	21.4
IUGR	50	17.9

Table 4: Gestational age in weeks.

Gestational age (in weeks)	VLBW neonates	
	N	Percent
<28	17	6
28-32	155	55.3
32-34	61	21.8
34-36	47	16.9

The mean birth weight was 1.240±0.110 kg for males and 1.270±0.105 kg for females (Table 2).

Among the VLBW neonates, 170 (60.7%) were small for gestational age (SGA), 60 (21.4%) were appropriate for gestational age (AGA), and 50 (17.9%) were intrauterine growth-restricted (IUGR) (Table 3).

The distribution by gestational age was as follows: <28 weeks-17 (6%), 28-32 weeks-155 (55.3%), 32-34 weeks-47 (16.9%), and 34-36 weeks-61 (21.8%) (Table 4).

The maternal risk factors for very low birth weight neonates included gestational hypertension in 165 cases (58.9%), anemia in 42 (15%), and gestational diabetes, hypothyroidism, and HIV in 4 (1.4%), 3 (1%), and 1 (0.3%) cases, respectively. No risk factors were present in 65 mothers (23.4%) (Table 5).

Table 5: Material risk factors.

Maternal risk factors	Number	Percent
No Risk	65	23.4
Gestational hypertension	165	58.9
Anemia	42	15
Hypothyroid	3	1
Gestational diabetes	4	1.4
HIV	1	0.3
Multiple gestation	0	0
Chronic medical illness	0	0
Hepatitis B	0	0

Table 6: Morbidity pattern in VLBW neonates.

Diseases	VLBW neonates	
	N	Percent
Sepsis	80	28.6
Respiratory distress syndrome	65	23.2
Transient tachypnea of newborn	35	12.6
Hypoglycemia	25	8.9
Neonatal hyperbilirubinemia	13	4.7
Asphyxia	11	4
Meningitis	11	4
Intraventricular hemorrhage	7	2.6
Shock	6	2.1
Pneumonia	3	1
Hydrocephalus	4	1.4
Patent ductus arteriosus	4	1.4
Apnea of prematurity	4	1.4
Necrotising enterocolitis	3	1
Retinopathy of prematurity	3	1
Infant of diabetic mother	2	0.7
Pneumothorax	2	0.7
Meconium aspiration syndrome	2	0.7

Table 7: Outcome.

Outcome	Number	Percent
Survival	208	74.2
Death	72	25.8
Total	280	100

Neonatal morbidity was primarily due to sepsis (80 cases, 28.6%), followed by respiratory distress syndrome (65 cases, 23.2%), hypoglycemia (25 cases, 8.9%), and neonatal hyperbilirubinemia (13 cases, 4.7%). Other conditions included asphyxia and meningitis (11 cases each, 4%), intraventricular hemorrhage (7 cases, 2.6%), shock (6 cases, 2.1%), and pneumonia (3 cases, 1%). Hydrocephalus, patent ductus arteriosus, and apnea of prematurity each occurred in 4 cases (1.4%). Necrotizing

enterocolitis, retinopathy of prematurity, pneumothorax, and meconium aspiration syndrome were each present in 2 cases (0.7%) (Table 6).

Among the 280 low birth weight neonates, survival was 208 (74.2%) and mortality was 72 (25.8%) (Table 7).

Table 8: Mortality.

Mortality	Number	Percent
Sepsis	39	54.2
RDS	27	37.6
Asphyxia	0	0
Meningitis	1	1.4
Pneumothorax	2	2.7
Prematurity	1	1.4
IVH	2	2.7
Total	72	100

The leading causes of mortality were sepsis (39 cases, 54.2%), respiratory distress syndrome (27 cases, 37.6%), and intraventricular hemorrhage (2 cases, 2.7%). Other causes included pneumothorax and meningitis (2 cases, 2.7%, and 1 case, 1.4%, respectively), and prematurity (1 case, 1.4%) (Table 8).

DISCUSSION

Accurate data on the morbidity and mortality profile of neonates are crucial for healthcare providers and administrators. This information aids in designing and implementing effective interventions for prevention and treatment and in evaluating healthcare programs. In the present study, the number of male neonate admissions exceeded that of females, likely due to the biological vulnerability of males and societal preferences for male children. Similar trends have been reported in various studies conducted across different regions of India.

According to the United Nation Children's Fund (UNICEF), the state of the world's children's report 28% of neonates were born with low birth weight in India.[8] But in our study most of the neonates were born in SGA period 170 (60.7%), and IUGR 50 (17.9%) and the gestational age in weeks shows most of the deliveries occurred in early period. This showed that most of the VLBW neonates were due to prematurity which reflects poor maternal health. A study done by Ravikumar et al in his study showed that 47% of neonates were LBW and 31% of neonates are born prematurely.[9] Various studies from all over India reported much higher LBW rates. As in Modi et al (72%) and Babu et al (70%).[9,11] This may be due to much higher pre-term deliveries in their studies.

In our study the most common maternal risk factors associated with VLBW were gestational hypertension, anemia, gestational diabetes. This leads to inadequate intake and increased risk of infections and leading to anemia which indirectly leads to LBW babies.

The major causes for the morbidity of the VLBW were sepsis, RD, hypoglycemia, transient tachypnea, hyperbilirubinemia, asphyxia, meningitis, intraventricular hemorrhage.

In Schinder et al study, IVH followed acute respiratory illness and sepsis was the most common cause of death. In study done by Ravikumar et al perinatal asphyxia (15.7%), prematurity (14.6%), neonatal jaundice (14.0%) and sepsis (12.9%) among which major cause was asphyxia. But in our study, sepsis and RDS were the major causes, which was consistent with the study done by Schinder et al in which he found that IVH followed acute respiratory illness and sepsis were the most common cause of death.[12]

The mortality rate observed in this study was 25.8%. In studies done by Saharia et al mortality rate was (13%) and Malik et al (26%) the causes of mortality were RDS (33.6%), birth asphyxia (25.3%), sepsis (25.3%) which is consistent with studies conducted in South India, Sridhar et al.[13-15] Babu et al in a study conducted in JIPMER, systemic infections (52%) were found to be the major causes of death followed by birth asphyxia (29%), but our present study showed sepsis and RDS were the most common cause of death which could be due to more preterm admissions.[16] This reflects poor antenatal care and poor nutritional status, especially in rural areas.

Low birth weights accounted for 60% of the total deaths which is similar to the study conducted by Kumar et al.[17] Present study showed that babies with VLBW and gestational less than 32 weeks were strongly attached with high mortality which was similar to study conducted by Yasmin et al.[18]

The study highlights the critical need for timely perinatal interventions in both primary and secondary care. For infants over 2500 grams at birth, mortality is largely influenced by obstetric management, whereas for low birth weight (LBW) infants, neonatal care quality significantly impacts outcomes. The study identified respiratory distress syndrome (RDS), intraventricular hemorrhage (IVH), and neonatal sepsis as major causes of death. This underscores the need for advancements in obstetric and neonatal units, including the adoption of more sophisticated technologies.

A limitation of this retrospective institutional study was that it primarily involved patients from low socio-economic and rural areas, which may not accurately represent the broader population. Additionally, maternal illnesses impacting neonatal outcomes were not addressed in this study.

CONCLUSION

Uplifting the socioeconomic status of women, nutritional counselling to reduce anemia should be considered to reduce the incidence of very low birth weight babies.

Antenatal steroid therapy needs to be more vigorously implemented. Sepsis and RDS were the major cause of death. Prematurity is the primary cause behind the neonatal deaths. This emphasizes the need to prevent preterm deliveries. Effective preventive strategies to decrease the preterm birth can only be the next big step to decrease the perinatal morbidity rate of our state.

Recommendations

Appropriate and recurrent training sessions must be conducted at all district levels to ensure proper essential newborn care. These sessions should impart adequate knowledge on maintaining warmth, feeding, cleanliness, and preventing asphyxia. By doing so, India can strive to achieve its millennium development goals.

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