

Morbidities and mortalities in very low birth weight newborn a cohort study at tertiary care center of Central India

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ABSTRACT

Background: The survival in neonates is associated with their birth weights, gestation, and severity of illness. Despite all the efforts, the early neonatal mortality represents quite a high percentage. **Objectives:** The objectives of the study were to study the various short-term outcomes in with very low birth weight (VLBW) neonates. **Materials and Methods:** An observational hospital-based prospective cohort study was performed on live VLBW neonates admitted over a period of 1 year at the NICU of a tertiary hospital of Central India. Neonates with birth weight outside the study range or with major congenital anomalies and those with clinically identified chromosomal syndromes were excluded from the study. The hospital records of all neonates enrolled in the study were followed daily until the time of discharge for any morbidity. **Results:** A total of 116 neonates were recruited according to inclusion and exclusion criteria. There were 63 (54.3%) male and 53 (45.7%) female neonates considered in the study. The mean birth weight of VLBW neonates was 1282±136 g. Birth asphyxia was observed in 21% of the patients. Neonatal hyperbilirubinemia was the most common (36%) morbidity in these neonates. **Conclusion:** Almost half of the newborns had sepsis. Due to many factors such as optimization of neonatal care, better knowledge of the pathophysiology of the premature infant, the advent of exogenous surfactant therapy, and neonatal intensive care unit to handle sick infants, the survival rate in VLBW babies was higher in our study.

Key words: Birth asphyxia, Extremely Low birth weight, Morbidity, Mortality

Very low birth weight (VLBW) neonates represent a vulnerable group of newborns with a high mortality rate. The survival in neonates is associated with their birth weights, gestation, and illness severity. The survival rate of VLBW infants varies globally with 40% in developing countries to more than 90% in developed countries [1]. VLBW neonates who survived tend to have a higher risk for neurodevelopmental disabilities causing significant changes to the lives of their families [2]. Varied morbidities have been associated during initial hospitalization of VLBW infants, including respiratory distress syndrome (RDS), bloodstream and central nervous system infections, necrotizing enterocolitis (NEC), chronic lung disease (CLD), intraventricular hemorrhage, periventricular leukomalacia, and retinopathy of prematurity, leading to exposure to additional diagnostic, therapeutic, and surgical interventions. These cause psychological distress to families with an increase in the length of hospital stay, the risk of recurrent hospitalization, and costs of treatment [3].

The morbidities in infants are proved to be associated with neurodevelopmental disabilities developing later including


cerebral palsy, cognitive delay, hearing loss, and visual impairment [4,5]. According to several studies performed about morbidity and mortality and morbidity of neonates in the past two decades, no additional improvements have been seen [6]. Data are scarce on the incidence of short-term morbidities in preterm neonates from India. Bhat and Adhisivam concluded that early weaning from mechanical ventilator support in VLBW infants reduced morbidities such as CLD and infections [7]. The present study was designed and executed to assess the short-term outcomes of neonates with birth weights between 1000 g and 1500 g treated at the tertiary hospital of Central India.

MATERIALS AND METHODS

This prospective cohort study was conducted in the NICU, conducted at the tertiary hospital of Central India from April 2014 to March 2015. It was a level 3 NICU with 20 intensive care beds and 6 bedded kangaroo mother care (KMC) ward with an annual admission of more than 1000 cases. All live VLBW neonates (1000–1500 g), admitted between the study period, were enrolled for the study. Extremely low weight (<1000 g), low birth weight (1500–2500 g), and normal birth weight (>2500 g) neonates

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were excluded from the study. Neonates with major congenital anomalies and those with clinically identified chromosomal syndromes were also excluded from the study. The study was approved by the Institutional Ethical Committee.

All neonates enrolled in the study whose parents gave consent for the study were followed daily until the time of discharge for any morbidity by clinical evaluation and reviewing hospital records. Mode of delivery, parity, and gestation period was noted their percentages were calculated. All the morbidities resulting in admission or readmission of patients after the 1st day of delivery were considered in the study (Table 1).

Blood sugar level was monitored as per the NICU protocol in all the neonates under study. The statistical analysis was done using SPSS version 25.0. $p < 0.05$ was considered statistically significant.

RESULTS

A total of 116 neonates were recruited according to the inclusion-exclusion criteria. Of 116 VLBW neonates, 63 (54.3%) were male and 53 (45.7%) were female. A total of 71 (61.2%) neonates were appropriate for gestational age. Out of a total of 116 mothers of infants, 58 each were primi and multiparous. Maximum births (28.4%) took place at 34 weeks of gestation, whereas only 1 (0.9%) birth took place at the 38th week of gestation. A total of 66 mothers (56.9%) gave birth by lower segment cesarean section and 50 mothers (43.1%) gave birth by vaginal delivery.

PIH was observed in 16% of mothers of VLBH neonates. About 22% of mothers of VLBW neonates were anemic. About 19% of mothers did not receive any supplementation in the form of calcium, iron, and folic acid. No significant difference in mean birth weight was observed with different parity of mothers ($p = 0.149$). However, we observed significantly lower birth weight of infants born to anemic women as compared to non-anemic women ($p = 0.039$) (Table 2).

Table 1: The morbidities assessed during the study

Hypoxic-ischemic encephalopathy	It is the brain injury caused by oxygen deprivation to the brain, also commonly known as intrapartum asphyxia
Need of resuscitation	It is the process of correcting physiological disorders in an acutely ill patient
Hypoglycemia	Blood glucose level < 40 mg/dL
Jaundice	Clinically visible jaundice requiring phototherapy/exchange transfusion as per hour specific total serum bilirubin nomogram
Respiratory distress	If patient shows any of the following criteria respiratory rate > 60 /min, subcostal/intercostal recessions, expiratory grunt/groaning requiring oxygen therapy
Sepsis	Probable sepsis was considered when 2 of 5 parameters; namely, total leukocyte counts $< 5000/\text{mm}^3$ or $> 22,000/\text{mm}^3$, band to total polymorph ratio of > 0.2 , absolute neutrophil count $< 1800/\text{mm}^3$, C-reactive protein > 0.5 mg/dL, and micro-ESR > 15 were positive. The sepsis is proven when the pathogens are isolated from blood, urine, or CSF samples

Sepsis was the most common observed morbidity observed in the current study and affects 45% of VLBW neonates followed by neonatal hyperbilirubinemia (36%). RDS was present 34% of the VLBW neonates while 21% of the patients had birth asphyxia. Apnea was observed in 11% of cases, hypoglycemia in 13%, NEC in 8%, and hypocalcemia in 5% of VLBW neonates. Hypoxic-ischemic encephalopathy (HIE) was observed in 55 neonates while the neonatal seizure was observed in 4% of VLBW neonates. Congenital cardiac defects were observed in 3% of the VLBW neonates. Among the hematological problems, anemia was observed in 6% while polycythemia was present in 3% of cases. The most common organism observed in the blood culture of septic patients was *Klebsiella pneumoniae* (52%), followed by *Staphylococcus* (21%), *Candida* sp. (14%), *Enterobacter* (10%), and *Enterococcus* sp. (3%).

In our study, mortality rate was 19% (22/116). As per the recommended guidelines for the management of RDS, continuous positive airway pressure (CPAP) was started in 58.9% of cases and surfactant was given to 41.0% of cases; however, 30.7% of these newborns still required mechanical ventilation. Despite these measures, 35.8% of patients died. The sepsis-related mortality rate of VLBS neonates was 32.6%.

DISCUSSION

The rise in the survival of the VLBW preterm is due to advances in both perinatal and neonatal care over the past two decades [8]. The survival of VLBW babies depends on several factors such as optimization of neonatal care, better knowledge of the pathophysiology of the premature infant, the advent of exogenous surfactant therapy, and the NICU handling sick infants. Rate of overall survival for VLBW newborns has been widely different in studies from different parts of the world; 63% and 84.2% from India [9,10], 35.6% from a study in Iran [11], 74.5% from Turkey [12], 87.5 and 85% from the USA [13], and 90% from New Zealand [14]. Differences among the patient population,

Table 2: Mean birth weight according to different parameters

Parameters	Birth weight (g)	p-value
Gender		
Male	1273±147	0.412
Female	1294±122	
Parity		
Primi	1292±124	0.419
Multi	1272±148	
Pregnancy-induced hypertension		
Present	1264±128	0.550
Absent	1285±138	
Supplement received		
Yes	1286±135	0.519
No	1265±144	
Maternal anemia		
Present	1234±125	0.039
Absent	126±137	

antenatal care, intranatal care, aggressive neonatal care, and availability of NICU facilities are a few reasons responsible for these varied results. The survival rate in VLBW babies in our study was 81.0% which is quite similar to the previous studies.

RDS occurred in 34% of neonates in this study which is contrast to a previous study which reported RDS in 90% of cases [15]. We followed recommended guidelines in our patients who developed RDS, with CPAP (in 58.9%) and surfactant (in 41.0%); however, we had to start mechanical ventilation in 30.7% of these newborns. Despite these measures, 35.8% died, which underlines the severity of RDS in our patients, although the use of CPAP and surfactant failure was compatible with the earlier studies [16-19].

NEC was observed in 8% of the study population which is similar to the results of National Institute of Child Health and Human Development (NICHD) Neonatal Research Network report in 2001 which reported 7% incidence. As per the National Neonatal-Perinatal Database, 5% of all newborns in India develop significant jaundice with total serum bilirubin of more than 15 mg/dL. In our study, we observed neonatal hyperbilirubinemia in 36% of VLBW babies which is much lower than the earlier reports of 60% [20].

According to the study of Cornblath *et al.* [21], 6.1% of the neonates admitted in NICU during the first 24 h of life showed hypoglycemia and all were LBW or VLBW. We observed hypoglycemia in 13% of the neonates in the present study which was higher as compared to the previous studies. Hypocalcemia occurs frequently in LBW infants during the first 48–72 h of life [22,23]. However, we observed hypocalcemia in only 2% of neonates.

According to the study by Ferri *et al.* [24] in 2014 and MacQueen *et al.* [25] in 2017, a high prevalence of anemia of 26.5% and 17%, respectively, was observed in VLBW infants. In the present study, we observed only 6% of VLBW neonates with anemia. We observed 5% of the VLBW neonates developed HIE which was higher as compared to the other studies [26,27] from developed countries due to better antenatal and perinatal monitoring and care.

The incidence of sepsis was 45% in our study and was much higher than the report from the NICHD. The sepsis-related mortality rate of VLBS neonates was 32.6% which was higher when compared to the rates reported in the literature of 17.3%–29% [28-32]. VLBW neonates with Gram-negative sepsis were at the greatest risk of death. *K. pneumoniae* was the most aggressive agent of sepsis, responsible for the highest sepsis-related mortality, whereas *Pseudomonas aeruginosa* was the main organism in the study done by Gordon and Isaacs in 2006 [31]. There is a discrepancy in the literature regarding the incidence of sepsis in VLBW and the causative organisms, due to poor perinatal aseptic precautions in the developing countries as compared to the Western world. The mortality was 19% in our study and the most common cause was sepsis.

In a study performed by Richards *et al.* [32], mean birth weight was lower in infants of PIH mothers (18.4%) than infants

of non-PIH mothers. In our study, we observed PIH in 16% of mothers of VLBW neonates which was lower as compared to the previous results [33]. RDS occurred in 34% of VLBW neonates in the current study which was low as compared to a recent study done by Wen *et al.* [34] in 2019 who observed the incidence of 86% and that of severe RDS as 41.2%. In the current study, apnea observed was comparatively less with 11% of the VLBW neonates affected, whereas, in a study done by Zhao *et al.* [35], it was around 54%.

Our study had a few limitations. The study had a small number of infants enrolled. This study represents outcomes in a single tertiary care center; thus, our results cannot be generalized to all VLBW infants.

CONCLUSION

Knowledge of the incidence of complications is important for parent counseling as well as anticipating and planning before birth. In addition, accurate knowledge of trends in incidence is important for quality improvement. Future clinical trials are required to further assess the outcomes in such infants.

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