Original Article

DOI: 10.7860/IJNMR/2021/50301.2314

Paediatrics Section

Morbidity and Mortality Profile among Low Birth Weight Neonates- A Cross-sectional Study from Jalandhar, India

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ABSTRACT

Introduction: World Health Organisation (WHO) has defined Low Birth Weight (LBW) as weight at birth of fewer than 2,500 grams in the first hour of delivery. This practical cut-off for international comparison is based on epidemiological observations that infants weighing less than 2,500 gm are approximately 20 times more likely to die than babies with a normal birth weight. LBW is closely associated with neonatal and infant mortality and morbidity and stifled growth and cognitive development of children.

Aim: To know the aetiological profile and outcome of admitted Low birth weight babies in Neonatal Intensive Care Unit (NICU).

Materials and Methods: The present study was hospital based retrospective study conducted on 610 neonates admitted in NICU at a teaching hospital, Punjab Institute of Medical Sciences, Jalandhar, from January 2019 to December 2019. Neonate with birth weight less than 2500 gm and less than 28 days old were included in the study. The total subjects were divided into three groups- Group 1: Extremely Low Birth Weight (ELBW) <1000 gm; Group 2: Very Low Birth Weight (VLBW): 1000-<1500 gm; Group 3: Low Birth Weight (LBW): 1500-<2500 gm. All the babies were investigated and managed as per standard hospital protocol. Data recorded were: demographic profile, aetiology, morbidity and mortality among LBW babies. Data was analysed using Statistical Package for Social Sciences(SPSS) version 21.0 using standard statistical tests.

Results: Total number of LBW babies registered in the study was 610. Among them, weight of 72 (11.8%) of neonates were <1000 g (Group 1), 208 (34.1%) were weighed 1000-<1500 g (Group 2) and 330 (54.1%) were weighed between 1500-<2500 g (Group 3). The mortality rate was 3.77%. The major causes of admission observed in neonates were sepsis (45.2%), hyperbilirubinemia (29.5%), apnoea (24.2%), hypoglycaemia (21.9%) and respiratory distress (17.2%). Highest mortality was observed amongst cases with Extremely Low Birth Weight (ELBW) ($p<0.01$). Two neonates out of total subjects 19 (3.1%) diagnosed with necrotising enterocolitis (NEC) succumbed to death, both belonging to group 1.

Conclusion: The leading cause of morbidity and mortality in LBW babies were sepsis and Necrotising Enterocolitis (NEC) so we need to address this problem more effectively.

Keywords: Extreme low birth weight, Intrauterine growth retardation, Neonatal intensive care unit, Sepsis

INTRODUCTION

A birth weight below 2500 gm is a major bestower to a range of poor health outcomes and is more common in developing than developed countries. The World Health Organisation (WHO) has defined LBW as weight at birth of fewer than 2,500 grams [1]. Every year an estimated four million babies die in the first four weeks of life (the neonatal period). A major proportion of neonatal deaths are reported in the first week of life, with the danger being highest in first 24 hours of postnatal life. Newborns with a birth weight of less than 2500 g are at a 20 times higher risk of mortality as compared to newborns with a normal birth weight. Very Low Birth Weight (VLBW) is defined as <1500 gm and birth weight of less than 1000 gm is classified as ELBW [3].

LBW is closely associated with neonatal and infant mortality and morbidity and stifled growth and cognitive development of children. Increased risks of chronic diseases later in life in LBW babies are also well recognised. Its public health significance is also ascribed to varied factors- high incidence, association with physical and mental retardation, high risk of perinatal and infant mortality and morbidity, human wastage and suffering, logistic concerns with prolonged NICU stays, its association with babies born in families with low socio-economic status [3].

Mortality and morbidity of LBW infants are concerning their birth weight and physiological state age. Quality of care has a major influence on the survival of these infants. In industrial countries, continued improvement in the quality of care has resulted in improvement in survival rates for these infants. However, the situation seems grim in developing countries, which have a meagre 10% of world's resources for newborn care but have approximately 90% incidence of LBW babies [3].

The neonatal period is a crucial phase for a newborn child, as during this phase, the neonate is highly susceptible to various morbidities. It denotes the beginning of a large number of the physiologic changes required for life outside the uterus. Hence, the high rates of mortality and morbidity. Worldwide more than, 4,000,000 infants die in the first month of life each year; out of which 99% are from low and centre pay nations [2]. In India alone, 26 million babies are brought into the world, and out of this, 1.2 million die in the initial month of life, which represents a quarter of worldwide neonatal mortality [4]. High neonatal mortality rate in a nation mirrors the low availability of quality care to neonates.

The five common causes of neonatal mortality in India are prematurity, birth asphyxia, sepsis, LBW, and congenital abnormalities. Improved level of newborn care can bring down the mortality rates [5]. Present study aimed to view the burden of neonatal disease and to determine the morbidity and mortality pattern among the neonates admitted to a NICU and areas of care requiring special attention.

MATERIALS AND METHODS

This hospital-based retrospective study was done at a NICU, at a teaching hospital, Punjab Institute of medical sciences, Jalandhar, Punjab, India. The study was started from January 2019 to December 2019. The Institutional Ethics Committee of the Punjab Institute of Medical Sciences in Jalandhar granted Ethical Clearance (Approval no. IEC/21/56).

Sample size calculation: Formula used for sample size calculation was:

$n=\{3.84\times(p\times q)\}/\}^2$.

Here, p=28% (incidence of LBW in India is 28% as per United Nations Children's Fund [UNICEF]), q=100-p, l=desired, precision, here it is 5% [6]

Inclusion criteria: All neonates less than 28 days of life with birth weight less than 2500 g, admitted in NICU during the study period were included in the study.

Exclusion criteria: Babies discharged against medical advice, those referred to higher center and the ones greater than 28 days older were excluded from the study.

The present study comprised of 610 admitted neonates of the hospital and were divided into three groups:

Group 1: Extremely Low Birth Weight (ELBW): neonates with birth weight <1000 gm.

Group 2: Very Low Birth Weight (VLBW): neonates with birth weight from 1000 gm - <1500 gm.

Group 3: Low Birth Weight (1500 gm- <2500 gm)

Procedure

The source of data for this study was the NICU registers of both inborn and outborn patients at PIMS, Jalandhar, Punjab, India which consisted of new-born information recorded at admission such as date of admission, age, weight of the child, diagnosis, outcome status and records of maternal information like parity, antenatal follow-up, mode of delivery. All these data were collected in an excel sheet format created by taking into account all the relevant variables in the standard NICU register.

Parameters Assessed

Weight: measured using an electronic weighing machine (accuracy±10 gm). Weight was put into OLSEN IE'S [6] intrauterine growth chart to classify small for gestational age (SGA) and appropriate for gestational age (AGA).

Length (Crown to heel length): was recorded with the help of an Infantometer.

Gestational age: was also calculated and registered.

Neonatal morbidities: relied upon recommendations of the National Neonatology Forum of India [6].

Respiratory Distress Syndrome (RDS): was diagnosed based on the onset of respiratory distress within six hours and characteristic radiological findings, ground glass appearance on X-ray.

Sepsis: was diagnosed based on clinical features, positive septic screen, {Erythrocyte Sedimentation Rate (ESR), C Reactive Protein (CRP), Total Leukocyte Count (TLC), Immature to Total neutrophils (I/T ratio), Absolute Neutrophil Count (ANC)} and positive blood cultures.

Hypoglycaemia: was defined as random blood glucose <40 mg/dL.

Congenital anomalies: newborns were evaluated and a note was made of LBW newborns having single or multiple congenital anomalies [8].

Necrotising Enterocolitis (NEC): was diagnosed based on modified Bells staging criteria [9].

Bronchopulmonary dysplasia: was diagnosed based on criteria of supplementary oxygen requirement 36 weeks postmenstrual age or 28 postnatal days.

Intraventricular haemorrhage: Ultrasonogram was done on 3, 7, and 21 days to detect Intraventricular haemorrhage (IVH).

Hyperbilirubinemia: for diagnosing the cause of jaundice, tests were carried out as per our NICU protocol (direct and indirect bilirubin levels, Coomb's test, red blood cell counts, reticulocyte count and glucose-6-phosphate dehydrogenase (G6PD) levels).

STATISTICAL ANALYSIS

All data were collected, compiled, and subjected to statistical analysis with the help of Microsoft (MS) Word 2016 and MS Excel 2016 were used to generate the tables, graphs, pie charts etc. Categorical variables were compared in two groups with the help of the chi-square test. The software SPSS version 21.0 was used for statistical analysis. A p-value of <0.05 was considered statistically significant.

RESULTS

Total number of LBW babies registered was 610. Maximum infants belonged to group 3 with birth weight between 1500-<2500 gm (330, 54%), out of which 231 (70%) were males and 99 (30%) were females. No gender preponderance was observed in birth weight distribution [Table/Fig-1].

Groups	Birth weight (gm)	Total number of neonates	Male	Female
Group 1	<1000	72 (11.8%)	50 (69.4%)	22 (30.6%)
Group 2	1000-<1500	208 (34.1%)	140 (67.3%)	68 (32.7%)
Group 3	1500-<2500	330 (54.1%)	231 (70%)	99 (30%)
Total		610 (100%)	421 (69%)	189 (31%)

[Table/Fig-1]: Division of neonates according to birth weight.
Chi-square value 0.439, p-value 0.81

All the cases in group 1 were born before 34 weeks while in group 3, most of the cases (70.3%) were born after 36 weeks. A significant association was observed between birth weight and weeks of gestation (p<0.001) [Table/Fig-2].

Gestational age (weeks)	Group 1 (n=72)	Group 2 (n=208)	Group 3 (n=330)
<28	28 (38.9%)	-	-
28-34	44 (61.1%)	110 (52.9%)	-
>34-36	-	80 (38.5%)	98 (29.7%)
>36	-	18 (8.65%)	232 (70.3%)

[Table/Fig-2]: Division of neonates according to gestational age.
Chi-square value 571.1, p<0.001

As for mode of delivery, 281 (46%) babies were delivered vaginally and 329 out of 610 (53.9%) were delivered by LSCS. A total of 336 (55.1%) newborns were borne to primipara mothers and 274 (45%) were borne to multipara mothers.

The [Table/Fig-3] indicates major presenting complaints among LBW neonates' poor cry (52.8%), respiratory distress (47.2%) and poor feeding (47.2%). Significant association between birth weight of ELBW was observed in symptoms like poor feeding, abdominal distension and poor cry (p<0.05).

Major cause of morbidities observed in neonates was sepsis (45.2%), hyperbilirubinemia (29.5%), apnoea (24.2%), hypoglycaemia (21.9%),

Symptoms	Group 1 (n=72)	Group 2 (n=208)	Group 3 (n=330)	Chi-square; p-value
Poor cry	38 (52.8%)	56 (27%)	91 (27.6%)	**<0.01**
Respiratory distress	34 (47.2%)	92 (44.2%)	142 (43%)	0.80
Seizures	2 (2.8%)	21 (10%)	36 (11%)	0.103
Poor feeding	34 (47.2%)	88 (42.3%)	113 (34.2%)	**0.047**
Jaundice	20 (27.8%)	72 (34.6%)	93 (28.2%)	0.25
Apnoea	3 (4.2%)	12 (5.8%)	23 (34.8%)	0.63
Abdominal distension	20 (27.7%)	23 (11.05%)	39 (11.8%)	**<0.01**
Bleeding	1 (1.4%)	0	9 (2.7%)	0.051

[Table/Fig-3]: Division of LBW neonates according to presenting complaint.

RDS (17.2%). Among these, ELBW babies were found to be significantly associated with hypoglycaemia, RDS, sepsis, hyperbilirubinaemia, NEC and IVH (p<0.01) [Table/Fig-4]. Mothers with 3 or more antenatal visits were considered to have adequate antenatal visits. All babies included in the study had mothers with adequate antenatal follow-ups. This was mainly attributed to study done in urban settings and ease of healthcare accessibility to nearby rural areas as well.

As seen in [Table/Fig-5], mortality rate among ELBW vs VLBW vs LBW was 16.7%, 2.9% and 1.5%. The association of mortality with ELBW was significant. Among the 12 mortalities seen in ELBW cases, half of them were due to RDS (50%) and (33.3%) due to sepsis. Among VLBW/LBW cases, sepsis was the common cause of mortality [Table/Fig-6].

DISCUSSION

The incidence of LBW babies and their outcome is a sensitive parameter for nation's health and development. This is evident from the stark difference between incidence of LBW in developing and developed nations as published by the WHO, which is 28% in South Asia and 9% in Latin America [7]. Out of the total neonates (610) in the study, the incidence of ELBW (<1000 gm) babies is comparatively high in the current study (11.8%) as compared to studies from Turkey (3.3%) and Nepal (4.1%) [7,8] but comparable to other studies in similar settings in India as seen in table below [9-12].

The [Table/Fig-7] shows comparison of incidence of most common morbidities in present study in comparison with earlier studies done in similar settings. The common causes for morbidity were neonatal sepsis and hyperbilirubinemia. There was a substantial incidence of sepsis (45.2%) amongst babies weighing <2500 g in the current report. Incidence of neonatal sepsis was at par with other studies conducted in Gujarat, Pakistan, and Bihar [13-15]. Sepsis was however a more common finding in group 3 as compared to ELBW in present study.

Morbidity	Group 1 (n=72)	Group 2 (n=208)	Group 3 (n=330)	Total (n=610)	(Chi-square test), p-value
Hypoglycaemia	30 (41.67%)	72 (34.6%)	32 (9.7%)	134 (21.9%)	**<0.01**
RDS	23 (31.9%)	67 (32.2%)	15 (4.54%)	105 (17.2%)	**<0.01**
Sepsis	16 (22.2%)	85 (40.8%)	175 (53.03%)	276 (45.2%)	**<0.01**
Hyperbilirubinemia	41 (57%)	53 (18.9%)	86 (26.1%)	180 (29.5%)	**<0.01**
Necrotising enterocolitis	4 (5.56%)	10 (4.8%)	5 (1.5%)	19 (3.1%)	**0.04**
Apnoea	23 (31.9%)	90 (43.2%)	35 (10.6%)	148 (24.2%)	**<0.01**
Seizures	0	3 (1.44%)	5 (1.5%)	8 (1.3%)	0.57
BPD	0	2 (1%)	2 (0.6%)	4 (0.6%)	0.67
HDN	0	1 (0.4%)	7 (2.1%)	8 (1.3%)	0.15
IVH	4 (5.56%)	3 (1.44%)	0	7 (1.2%)	**<0.01**
Congenital anomalies	2 (2.8%)	2 (1%)	15 (4.5%)	19 (3.1%)	0.06

[Table/Fig-4]: Morbidity profile of LBW babies.
RDS: Respiratory distress syndrome; BPD: Bronchopulmonary dysplasia; IVH: Intraventricular haemorrhage; HDN: Haemorrhagic disease of newborn

Outcome	Group 1 (n=72)	Group 2 (n=208)	Group 3 (n=330)	Total (n=610)
Death	12 (16.67%)	6 (2.9%)	5 (1.5%)	23 (3.77%)
Discharged	60 (83.3%)	202(97.1%)	325(98.4%)	587 (96.2%)

[Table/Fig-5]: Outcome profile.
(Chi-square test) p<0.01

Cause of death	Group 1 (n=12)	Group 2 (n=6)	Group 3 (n=5)
Sepsis	3 (33.3%)	3 (50%)	3 (60%)
Respiratory Distress Syndrome (RDS)	6 (50%)	2 (33.3%)	-
Necrotising Enterocolitis (NEC)	2 (16.6%)	-	-
Apnoea	1 (8.3%)	1 (1.7%)	1 (20%)
Congenital anomalies (Pierre Robin sequence)	-	-	1 (20%)

[Table/Fig-6]: Mortality profile.

Comparative characterstics	Present study	Das S et al., [10]	Bandyopadhyay S et al., [11]	Manikayamba D et al., [9]	Rahman K and Begum R; [12]
Sample size	610	2157	404	700	5649
Study design	Retrospective	Prospective	Prospective	Prospective	Retrospective
Year/Place of study	2021/Punjab	2019/Tripura	2017/West Bengal	2013/Andhra Pradesh	2019/Assam
Mortality	3.77%	18.49%	23.50%	24.00%	11.4%
Number of ELBW	11.8%	8.06%	9.4%	11.8%	1.15%
Number of VLBW	34.1%	23.36%	33.2%	22.5%	9.1%
LBW	54.1%	43.25%	57.4%	73.8%	39.4%
Morbidities					
Sepsis	45.20%	23.22%	47.80%	54.00%	10.80%
Hyperbilirubinemia	29.5%	18.08%	31.9%	42%	19.9%

Apnoea	24.2%	-	20%	18%	-
Hypoglycaemia	21.90%	0.2%	17.60%	15.00%	3.70%
RDS	17.2%	9.17%	13.1%	13%	5.25%

[Table/Fig-7]: Comparison of similar studies [9-12].
ELBW: Extremely low birth weight; VLBW: Very low birth weight; LBW: Low birth weight; RDS: Respiratory distress syndrome

Overall, 29.5% (180 out of 610) of babies developed hyperbilirubinemia and the incidence was significantly more in ELBW group. This difference could be because of larger number of preterm births with low gestational period in group 1 and 2. It is well established that preterm babies have a higher frequency of neonatal hyperbilirubinemia (NNH) [1-4,6].

Other significant causes of neonatal morbidity were apnoea, hypoglycaemia, RDS and NEC with babies in group 1 being affected the most. These findings are similar to studies conducted under similar settings [9,10].

IVH was shown to be strongly correlated with LBW (p<0.0003) in the current study. There were 7 (1.2%) babies with IVH, four of whom were ELBW babies and three of whom were VLBW. The results were comparable with study conducted in Hyderabad, India under similar settings [9]. However, the incidence of IVH reported is much higher at 19.5% in a study conducted at Agartala, India [16]. In the present study mortality was found to be 3%. Among ELBW babies most of deaths were caused by RDS (50%), Sepsis (33.3%) and amongst VLBW babies sepsis (50%) and RDS (33%) were common causes leading to mortality.

Limitation(s)

As this was a record based study, it relied on the reports and case notes in the medical records and the examination of study subjects was not possible.

CONCLUSION(S)

LBW itself a significant health issue posing a threat to neonatal well being. Mortality was highest in ELBW. Sepsis and RDS were the most common cause of mortality rate among LBW babies. Effective policies need to be incorporated to include in utero referral, improving maternal well being, education, and nutrition to decrease the incidence of LBW and to follow strict aseptic protocol in the NICUs for effective management and a better morbidity mortality profile of preterms and LBW babies.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Jun 05, 2021
- Manual Googling: Jun 18, 2021
- iThenticate Software: Jul 01, 2021 (19%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **May 11, 2021**
Date of Peer Review: **Sep 22, 2021**
Date of Acceptance: **Nov 19, 2021**
Date of Publishing: **Dec 31, 2021**