

Consequences of Low-Birth-Weight Newborns Admitted in A Neonatal Intensive Care Unit: Findings from Paropakar Maternity and Women's Hospital, Kathmandu

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ABSTRACT

Introduction: Low Birth weight (LBW) is a major cause of neonatal morbidity and mortality. LBW poses newborn babies to increased risk of mortality along with cognitive deficits, motor delays, cerebral palsy, and other behavior and psychological problems. This study aims at evaluating the outcome among the LBW neonates.

Methods: A hospital-based descriptive study was carried out in Paropakar Maternity and Women's Hospital (PMWH), Thapathali, Kathmandu among the babies born with weight less than 2500 grams and admitted in Neonatal Intensive Care Unit (NICU), from March, 2019 to December 2020. Descriptive statistics were performed using frequency and percentage. The bivariate and multivariate analyses were performed to determine the causes of mortality in LBW newborn.

Results: LBW formed 45.6% of all the (NICU) admissions. The highest proportion of LBW were among mothers within age group 20-35 years (82.5%), belonging mainly to Janajati ethnic group (50.4%) and having maternal complications (65%). LBW babies with perinatal asphyxia (aOR 0.20, 95% CI:0.12-0.35) and prematurity (aOR 31.54, 95% CI 11.16-89.12) were significantly associated with mortality ($p < 0.0001$). LBW preterm babies were 31.54 times more likely to have mortality than term babies.

Conclusion: LBW newborns, a sequel to prematurity or SGA or both continues to concern of perinatal morbidity and mortality from dreaded comorbidities like sepsis, and perinatal asphyxia which therefore mandates the necessity to address the understanding of the gaps in antenatal care, intrapartum care, quality newborn care in newborn care units, further improvisation maternal and perinatal care to avert or minimize small sick newborns from dying

Keywords: Low birth weight BW(LBW), Neonatal Intensive Care Unit NICU, Neonatal mortality

INTRODUCTION

Birth weight is sensitive indicator for a child's survival as survival is directly associated with normal weight at birth.^{1,2} LBW (birth weight < 2500 grams)

Citation

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is one of the leading causes of neonatal morbidity and mortality and a significant public health burden.^{1,2} Various factors including sociodemographic, cultural, nutritional, lack of health education have been identified as a risk factor for LBW. It is equally invaluable to know the factors which pose these cohort of newborns survival during the course of management in hospitals.^{2,3}

In Nepal, it has been reported that 12 % babies born below the normal weight and are exposed to increased risk of dying. Low APGAR score at birth, Prematurity, Intrauterine growth restriction, Sepsis, respiratory immaturity are comorbidities frequently encountered in babies born small and lead to higher rates of mortality among these babies.^{4,5}

There is an eminent need to gather evidence and address the risk factors for LBW along with the avoidance of factors that lead to death in these vulnerable newborns to achieve the Sustainable Development Goal's (SDG) target of reducing neonatal mortality. As a pioneer in providing services to fairly larger number of small and sick newborns, the findings from this hospital study are valuable to shed light on what kind of care should be focused to combat the problems that may cause mortality in these cohort of babies. In this study, we aim to evaluate the determinants of outcome of LBW in Neonatal intensive care unit in a Tertiary hospital as compared to the babies with normal birth weight.

METHODS

Setting: This study was conducted in PMWH which serves 22000 to 24000 deliveries annually. It provides level 3 care to admitted sick newborns

Study participants: Babies admitted in NICU from 15 March 2019 to 14 December 2021 were included in the study. Babies who were still born were excluded from the study.

Data collection, management and Statistical analysis: All the information regarding the sick new born babies were collected from the new born registers comprising of the details on gestational age, birth weight, delivery type, any complication during delivery, Apgar score, management received and related outcome. The cleaned data were exported into Statistical Package for the Social Sciences (SPSS) for further data analysis. Descriptive statistics using frequency and percentages were used to describe the newborn characteristics and outcome. Pearson's Chi squared test was used to determine the level of significance of the outcome for LBW new born. Variables with $p < 0.05$ from the bivariate analysis were considered for multiple regression analysis.

Variables in the study: For this study purpose, following variables were used

Outcome variables

Neonatal mortality: Death of an infant from the time of birth until 28 days

Preterm birth- Babies born before 37 completed weeks of gestation, estimated by the date of the mother's last menstrual period or based on clinical examination of the newborn

a. LBW(LBW) - baby weighs less than 2500 grams at the time of birth

b. Very LBW (VLBW) - baby weighs less than 1500 grams

c. Extremely LBW (ELBW) - baby weight less than 1000gms

Perinatal asphyxia-babies with low one and five minute APGAR score diagnosed as perinatal asphyxia by attending clinician on the basis of clinical status and Arterial blood gas analysis report.

Appropriate for gestation age (AGA): Birth weight greater than or equal to the 10th percentile according to AGA and sex-specific reference population standards

SGA: Birth weight less than the 10th percentile according to AGA and sex-specific reference population standards

Large for gestational age (LGA): Birth weight more than 90th percentile according to AGA specific reference population standards.

Neonatal sepsis: Blood infection that occurs in newborn less than 28 days.

Congenital malformation: A physical defect present in a baby at birth that can involve many different parts of the body, including the brain, heart, lungs, liver, bones, and intestinal tract.

Meconium aspiration syndrome (MAS): Syndrome that occurs when a new born breathes a mixture of meconium and amniotic fluid into the lung around the time of delivery.

Demographic characteristics

Maternal age-categorized into 15-19 years, 20-34 years and 35 years and above.

Ethnicity-based on Nepal's caste and hierarchical system, categorized into Dalit, Janjati, Madhesi, Muslim, Chhetri/ Brahmin and other.

Obstetric characteristics

Mode of delivery-normal vaginal delivery, instrumental delivery using forceps or vacuum and cesarean section and Twin pregnancy

Neonatal characteristics

Sex of the baby- categorized as male or female

Gestational age (GA) estimation of babies was done using the last menstrual period (LMP) and categorized as less than 37 weeks, 37-40 weeks, 40 to 42 weeks and 42 weeks or more.

Statistical analysis

The entered data were exported to Statistical Package for the Social Sciences (SPSS) version 23 for data analysis.

Descriptive statistics were performed using frequency and percentage. For all categorical variables, bivariate analyses were performed using binary logistic regression. At 95% confidence interval (CI), $p < 0.05$ was considered to be significant. Variables with $p < 0.2$ from the bivariate analysis were considered for multiple regression analysis.

Ethical consideration

Ethical approval from the institutional review committee (IRC) of Paropakar Maternity and Women's Hospital, Thapathali, Kathmandu was obtained before commencing the study. Collected information was kept separately maintaining confidentiality.

RESULTS

Small and sick LBW newborn comprised 1265 (45.6%) /2773 of total newborn babies. They were given birth by mothers between 20- 35 (82.5%) years. Janjati mothers being more vulnerable 50.4%. LBW affected more male (52.5%) than female 65% babies.

It is important to note that 70.3% preterm and 29% term (SGA) baby were LBW.

Table 1 Background Characteristics among LBW and Normal Weight newborn

Variables	Weight (<2500 grams)	Weight (≥2500 Grams)	P-Value
AGE (N=2773) *			0.285
15-19	146 (11.5%)	168 (11.1%)	
20-35	1044 (82.5%)	1270 (84.2%)	
>35	75 (5.9%)	70 (4.6%)	
Total	1265 (45.6%)	1508 (54.3%)	
Ethnicity(N=2883)			<0.0001
Brahmin/Chhetri	482 (36.7%)	463 (29.5%)	
Madhesi	59 (4.5%)	54 (3.4%)	
Muslim	8 (0.6%)	18 (1.1%)	
Janajati	662 (50.4%)	921 (58.7%)	
Dalit	103 (7.8%)	113 (7.2%)	
Admission Complication (N= 839) *			0.006
No	125 (35.0%)	214 (44.4%)	
Yes	232 (65.0%)	268 (55.6%)	
	357	482	

Sex(N=2869)			0.259
Male	688 (52.5%)	919 (58.9%)	
Female	622 (47.5%)	640 (41.1%)	
	1310	1559	
Gestational Age(N=2738)			<0.0001
Preterm(<37 weeks)	874 (70.3%)	120 (8.0%)	
Term (≥37 Weeks)	370 (29.7%)	1374 (92.0%)	
	1244	1494	
Mode of delivery (N=2883)			
Normal	657 (50.0%)	790 (50.4%)	0.125
Instrumental	2 (0.2%)	10 (0.6%)	
CS	655(49.8%)	769 (49.0%)	

*Variables with missing information

Chi-square test

Table 2. Problems in admitted LBW newborn

Co-Morbidities	ELBW <1000 Grams (n=63)	VLBW 1000 -<1500 Grams (n=293)	LBW 1500- <2500 Grams (n=958)
Complication of Prematurity	57 (90.5%)	198(68%)	231(24.1%)
Neonatal Sepsis	45 (71.4%)	193(65.9%)	342(35.6%)
Perinatal Asphyxia	37 (58.7%)	110(37.5%)	226(23.5%)
Congenital Anomaly	8 (12.7%)	20(6.8%)	46(5.6%)

Complications of prematurity gradually increased from LBW (24.1%) - VLBW 6.8% to ELBW (90.5%) latter with prominence of [Neonatal sepsis (71.4%) and perinatal asphyxia (58.7%)]. CMF gradually decreased with lowering of birth weight 12.7%: 6.8% 5.6% in ELBW; VLBW: LBW babies. (Table 2).

Table 3 Bi-variate analysis of association of mortality in admitted LBW babies

Variables	N	Weight (<2500 grams)	Weight (≥2500 Grams)	cOR (95% CI)	P Value
Sepsis					
No	232	150 (47.5%)	83 (65.4%)	1	
Yes	210	166 (52.5%)	44 (34.9%)	2.88 (1.36-3.20)	0.001

Congenital Anomaly					
No	396	286 (90.5%)	110 (86.6%)	1	0.231
Yes	47	30 (9.5%)	17 (13.4%)	0.679 (0.360-1.280)	
Complication of prematurity					
No	247	124 (39.2%)	123 (96.9%)	1	<0.0001
Yes	196	192 (60.8%)	4 (3.1%)	47.61 (17.15-132.18)	
Perinatal Asphyxia					
No	275	240 (75.9%)	35 (27.6%)	1	<0.0001
Yes	168	76 (24.1%)	92 (72.4%)	0.12 (0.07-0.19)	
Meconium Aspiration Syndrome (MAS)					
No	414	308 (97.5%)	106 (83.5%)	1	<0.001
Yes	29	8 (2.5%)	21 (16.5%)	0.13 (0.05-0.30)	

The bivariate analysis showed that comorbidities of LBW babies such as perinatal asphyxia (aOR 0.12, 95% CI:0.07-0.19), p-value<0.0001, MAS (aOR 0.13, 95% CI:0.05-0.30), p-value<0.0001 was associated with mortality among LBW babies.

The odds of mortality due to complication of prematurity in LBW babies were 47.6 times more than normal weight babies (aOR 47.6, 95% CI: 17.15-132.18), p-value<0.0001.

The odds of mortality due to sepsis in LBW babies were 2.8 times more than normal weight babies (aOR 2.88, 95% CI:1.36-3.20, p-value<0.0001) (Table 3).

Table 4. Logistic regression analysis of association among cause of mortality in LBW babies

Vari-ables	N	Weight (<2500 grams)	Weight (≥ 2500 Grams)	aOR (95% CI)	P Value
Sepsis					
No	232	150 (47.5%)	83 (65.4%)	1	0.188
Yes	210	166 (52.5%)	44 (34.9%)	1.44 (0.83-2.48)	
Complication of prematurity					
No	247	124 (39.2%)	123 (96.9%)	1	<0.0001
Yes	196	192 (60.8%)	4 (3.1%)	31.54 (11.16-89.12)	
Perinatal Asphyxia					
No	275	240 (75.9%)	35 (27.6%)	1	

Yes	168	76 (24.1%)	92 (72.4%)	0.20 (0.12-0.35)	<0.0001
Meconium Aspiration Syndrome (MAS)					
No	414	308 (97.5%)	106 (83.5%)	1	0.084
Yes	29	8 (2.5%)	21 (16.5%)	0.43 (0.16-1.11)	

Multi-variate regression analysis

The multivariate analysis showed that there was risk but no significant difference in odds of mortality due to sepsis (aOR 1.44, 95% CI:0.83-2.48, p-value=0.188). There was significant association of mortality with perinatal asphyxia (aOR 0.20, 95% CI:0.12-0.35, p-value<0.001), meconium aspiration syndrome (aOR 0.43, 95% CI:0.16-1.11, p-value<0.0001), among the LBW babies. The risk of mortality due to complication of prematurity was 31.5 times higher among the LBW babies (aOR 31.54, 95% CI 11.16-89.12). (Table 4)

Table 5 Duration of stay among LBW and normal weight admission

Duration of Stay(N=2785)	Weight (<2500 grams) N=1260	Weight(≥ 2500 Grams) N=1525	P-Value
0-3 Days	291(23.1%)	381(25.0%)	<0.0001
4-7 Days	452(39.3%)	642(42.1%)	
8-14 Days	427(32.1%)	466(30.6%)	
15-21 Days	64(5.1%)	24(1.6%)	
> 21 Days	26(2.1%)	12(0.8%)	

Chi-square test

It was noted that there was increased stay more than 7 days mostly for LBW babies compared with normal weight admission (p value<0.0001). The duration of stay among low birth and normal weight babies was mostly 4 to 7 days. (Table 5)

Figure 1. Bar diagram for outcome of discharge among LBW and normal weight babies

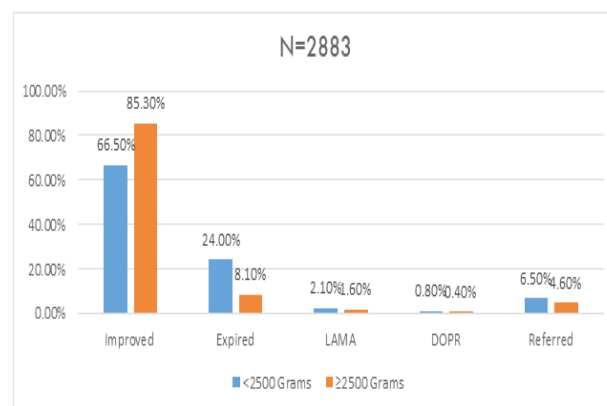


Figure 1. shows the discharge outcome among LBW and normal weight babies. The LBW babies had higher

proportion of mortality as compared to normal weight babies (24.0% vs 8.10%). There was higher proportion of referral among LBW babies compared to normal weight babies (6.5% vs 4.6%). Similarly Left against medical advice (LAMA) and Discharged on Patient's Request (DOPR) was higher among LBW babies (2.1% vs 1.6%) and (0.8%vs 0.4%) respectively. The duration of hospital stay was more for LBW babies compared to normal weight babies.

DISCUSSION

LBW is a key driver and indirect cause of neonatal mortality. Every year LBW babies are born worldwide, and more frequently in occurring in Low - and middle-income countries mainly in Asia. LBW newborns associated with prematurity/extreme prematurity are inherently is predisposed to perinatal asphyxia and sepsis, leading causes of neonatal morbidities and mortality globally, with variable inter or intra country differences both in numbers/ rates.⁶

Early neonatal death (END) related to perinatal asphyxia has been elaborated from study carried in Taiwan and Brazil.^{7,8}

In our own hospital nearly half of the LBW newborns required specialized care in NICU and only a third being take home neonates. Similar tallying figures is available from Thailand research showing 63% survival till discharge.⁹ Sepsis and late onset sepsis common culprit inflicting disastrous result in ELBW newborns imparting worst prognosis.⁹⁻¹¹

It has been speculated that prioritizing national programs related to maternal nutrition, micronutrient supplementation, health education, antepartum care can reduce the burden of LBW and avert neonatal deaths apart from promisingly, identification of clinical problems during the course of treatment which is conducive to provide quality care, that has been identified to effectively decrease mortality to some extent. Out of scope, our study, mainly centered on LBW related mortality, does not provide spectrum of reason behind neonatal mortality.

CONCLUSION

LBW newborns, a sequel to prematurity or SGA or both continues to concern of perinatal morbidity and mortality from dreaded comorbidities like sepsis, and perinatal asphyxia which therefore mandates the necessity to address the understanding of the gaps in antenatal care, intrapartum care, quality newborn care in newborn care units, further improvisation maternal and perinatal care to avert or minimize small sick newborns from dying

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