Original Research Article

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Clinical complications and outcomes in preterm low-birth-weight neonates: A study in a neonatal intensive care unit

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Abstract

Background: Preterm low-birth-weight (LBW) neonates represent a critically vulnerable population in neonatal intensive care units (NICUs). This study evaluated the clinical complications, interventions, and short-term outcomes among preterm LBW neonates admitted to a tertiary-level NICU in Bangladesh.

Methods: This retrospective observational study included all preterm LBW neonates admitted to the NICU of Bangladesh Specialized Hospital from June to December 2024. Demographic characteristics, therapeutic interventions, and short-term outcomes were analyzed. Binary logistic regression identified independent predictors of survival.

Results: Seventy-two neonates were included; 50.0% were early preterm, and 87.5% weighed <1,500 g. The most common complications were respiratory distress syndrome (RDS) (80.6%), jaundice (84.7%), hypoglycemia (38.9%), and sepsis (22.2%). Continuous positive airway pressure (CPAP) was used in 80.6% of cases, while only 4.2% required mechanical ventilation; surfactant therapy was not used. The mean NICU stay was 14.8 ± 8.2 days. Overall, survival was 95.8 %, with three deaths – all in extremely LBW, early-preterm infants. Logistic regression showed that each additional week of gestation (odds ratio [OR] 1.68; $P = 0.004$) and each extra kilogram of birth weight (OR 3.06; $P = 0.022$) significantly increased survival, while RDS showed a borderline negative association (OR 0.42; $P = 0.061$). Follow-up attendance on day 7 post-discharge was 100%, and early readmission occurred in 4.2% of cases.

Conclusion: Preterm LBW neonates can achieve higher survival in specialized NICUs with administration of early CPAP care, proper monitoring, and structured follow-up. Gestational age, birth weight, and adequate duration of intensive support remain the key determinants of outcome.

Keywords: Bangladesh, clinical outcomes, low birth weight, neonatal intensive care units, preterm neonates

Introduction

Preterm low-birth-weight (LBW) neonates, defined as infants born before 37 weeks of gestation with a birth weight <2,500 g, represent one of the most clinically vulnerable populations in neonatal care. They each account for a disproportionate share of neonatal morbidity and mortality globally, especially in low- and middle-income countries.[1,2] These infants face heightened risks due to their physiological immaturity and incomplete organ development, making them highly susceptible to

multisystem complications during the neonatal period.[3,4]

Preterm LBW neonates commonly require intensive support in neonatal intensive care units (NICUs) to manage a complex spectrum of complications. Among the most frequent and critical are respiratory distress syndrome (RDS) caused by surfactant deficiency, intraventricular hemorrhage (IVH), metabolic imbalances such as hypoglycemia, feeding intolerance, and systemic infections including sepsis.[5-8] Sepsis and similar ailments remain particularly detrimental in this population due to their underdeveloped immune responses and frequent exposure to invasive interventions.[9,10] Despite advances in neonatal care, including early continuous positive airway pressure (CPAP), surfactant therapy, and improved infection control, these complications continue to contribute significantly to adverse outcomes.[11,12]

Although survival rates have improved dramatically in high-resource NICUs, the burden of complications among preterm LBW infants remains substantial, and marked disparities persist between healthcare systems.[13,14] In settings like Bangladesh, additional challenges such as limited prenatal care coverage, delayed recognition of critical neonatal conditions, and inadequate structured follow-up after NICU discharge exacerbate the risk of poor outcomes.[15,16]

Given the persistent clinical burden in this high-risk group, there is a pressing need for local data to guide context-specific management strategies. This study aims to evaluate the clinical complications, therapeutic interventions, and short-term outcomes among preterm LBW neonates admitted to a specialized tertiary-level NICU in Bangladesh. The findings are intended to inform optimized care protocols and contribute to improving both survival and quality of care in similar regional settings.

Methods

This retrospective observational study was conducted in the NICU of Bangladesh Specialized Hospital, Dhaka, Bangladesh, over a 7-month period from June 2024 to December 2024. The study population included preterm neonates with LBW, defined as birth weight below 2,500 g, who were admitted to the NICU during the study period. Preterm status was categorized as follows: Early preterm (<32 weeks gestational age), preterm (32 to <34 weeks), and late preterm (34 to <37 weeks). Birth weight was categorized according to the WHO definitions: LBW as <2,500 g, very low birth weight (VLBW) as <1,500 g, and extremely low birth weight (ELBW) as <1,000 g. Neonates with major congenital anomalies, particularly congenital heart disease (CHD), or those with perinatal asphyxia, were excluded to reduce confounding effects on outcome interpretation. Data were retrospectively collected from electronic medical records using standardized forms to capture demographic data, clinical features, treatment interventions, complications, and outcomes. Variables such as gestational age, birth weight, presence of RDS, need for respiratory support, metabolic disturbances, and other major neonatal morbidities were carefully recorded. The primary outcome was neonatal survival during the NICU stay. Secondary outcomes included the type and frequency of complications, duration of hospital stay, requirement for re-admission within 7 days, and need for supportive therapies such as CPAP, phototherapy, or mechanical ventilation. Categorical variables were summarized using frequencies and percentages, while continuous variables were expressed as means and standard deviations. Binary logistic regression analysis was conducted to determine independent predictors of survival, including variables such as gestational age, birth weight, RDS, hypoglycemia, and length of hospital stay. All statistical analyses were performed using the Statistical Package for the Social Sciences version 27.0, with $P < 0.05$ considered statistically significant.

Results

The study cohort included 72 preterm LBW neonates, with a male predominance of 59.72% (n = 43). Mode of delivery was nearly evenly split, with 52.78% (n = 38) delivered through

lower uterine cesarean section (LUCS) and 47.22% (n = 34) through normal vaginal delivery (NVD). Regarding preterm classification, half of the neonates (50.00%, n = 36) were early preterm (<32 weeks), while 30.56% (n = 22) were moderate preterm (32–34 weeks), and 19.44% (n = 14) were late preterm (34–36 weeks) [Table 1].

The mean age at admission was 2.92 ± 2.21 days, ranging from day of birth to 9 days old. Based on the WHO criteria, 25.00% (n = 18) of the neonates were classified as extremely LBW (<1,000 g), 62.50% (n = 45) as VLBW (<1,500 g), and 12.50% (n = 9) as LBW (<2,500 g). The mean birth weight was 1.88 ± 0.42 kg, with a range from 0.91 to 2.48 kg [Table 2].

RDS was the most frequently observed morbidity, affecting 80.55% (n = 58) of the neonates. Jaundice was also highly prevalent, noted in 84.72% (n = 61). Hypoglycemia and feeding intolerance were reported in 38.89% (n = 28) and 29.17% (n = 21), respectively. Apnea of prematurity affected 27.78% (n = 20), while IVH was diagnosed in 8.33% (n = 19). Retinopathy of prematurity was observed in 18.05% (n = 13), and neonatal convulsions were relatively rare (2.78%, n = 2). Sepsis during admission was noted in 22.22% (n = 16) [Table 3].

All neonates received antibiotic therapy, with a mean treatment duration of 9.5 ± 5.5 days. Respiratory support was provided in the form of CPAP for 80.60% (n = 58) of the cohort, while only 4.17% (n = 3) required mechanical ventilation. Nutritional support through nasogastric (NG) feeding was used in 69.44% (n = 50) of cases, and phototherapy was administered in 84.72% (n = 61), primarily for hyperbilirubinemia. Hematologic support in the form of platelet transfusion was necessary in 18.10% (n = 13). In addition, 5.55% (n = 4) of neonates required water-sealed drainage for management of air-leak syndromes such as pneumothorax [Table 4].

The mean duration of NICU stay for the cohort was 14.82 ± 8.24 days, with individual stays ranging from 2 to 30 days. Longer hospitalization was notably associated with neonates classified as extremely LBW and early preterm. The overall survival rate was 95.83% (n = 69), with 3 deaths (4.17%) recorded – all of whom were early preterm neonates with extreme LBW. All neonates were scheduled for a routine follow-up visit on day 7 post-discharge, which was achieved in 100% of cases. Re-admission within 7 days of discharge occurred in 3 cases (4.20%), underscoring the need for vigilant early post-discharge monitoring in this high-risk group [Table 5].

Binary logistic regression identified five clinical factors that independently influenced survival among preterm LBW neonates. Each additional week of gestation conferred a 68% rise in the odds of survival (OR = 1.68, P = 0.004), while every extra kilogram of birth weight tripled those odds (OR = 3.06, P = 0.022), underscoring the protective effect of greater maturity and size at birth. Conversely, the presence of RDS showed a borderline-significant negative association, reducing survival likelihood by an estimated 58% (OR = 0.42, P = 0.061). Hypoglycemia was also associated with lower odds of survival (OR = 0.64), although this relationship did not achieve statistical significance (P = 0.259) [Table 6a & 6b].

Discussion

This study provides contemporary, center-specific evidence on the clinical course and short-term outcomes of preterm LBW neonates in a specialized tertiary NICU in Bangladesh. The cohort's male predominance and the large proportion of early- and moderate-preterm births mirror regional delivery patterns and echo earlier population-based estimates from low- and middle-income countries.[1,3] At admission, RDS, jaundice, and hypoglycemia dominated the morbidity profile – findings typical of physiological immaturity compounded by systemic infection.[5,7] Despite the burden of prematurity-related complications, overall survival reached 95.8%, a figure that rivals outcomes reported from many high-resource settings and parallels the declining mortality trend

Table 1: Demographic and perinatal characteristics of low-birth-weight neonates (*n*=72)

Variable	Frequency (*n*)	Percentage
Sex		
Male	43	59.72
Female	29	40.28
Mode of delivery		
LUCS	38	52.78
NVD	34	47.22
Preterm category		
Early preterm	36	50.00
Preterm	22	30.56
Late preterm	14	19.44

LUCS: Lower uterine cesarean section, NVD: Normal vaginal delivery

Table 2: Age and birth weight at admission (*n*=72)

Variable	Frequency (*n*)	Percentage
Age at admission		
Mean±SD	2.92±2.21 days	
Range	0–9 days	
Birth weight at admission		
Extreme low birth weight	18	25.00
Very low birth weight	45	62.50
Low birth weight	9	12.50
Mean±SD	1.88 kg±0.42 kg	
Range	0.91–2.48 kg	

SD: Standard deviation

Table 3: Clinical signs and morbidity during NICU stay (*n*=72)

Clinical signs and morbidity	Frequency (*n*)	Percentage
Jaundice	61	84.72
RDS	58	80.55
Hypoglycemia	28	38.89
Feeding intolerance	21	29.17
Apnea of prematurity	20	27.78
Sepsis	16	22.22
Retinopathy of prematurity	13	18.05
Interventricular hemorrhage	6	8.33
Neonatal convulsion	2	2.78

RDS: Respiratory distress syndrome, NICU: Neonatal intensive care units

Table 4: Treatment and interventions (*n*=72)

Intervention	Frequency (*n*)	Percentage
Antibiotic therapy	Mean duration: 9.5±5.5 days	
Respiratory support		
CPAP	58	80.60
Mechanical ventilation	3	4.17
Nutritional and phototherapy support		
NG feeding	50	69.44
Phototherapy	61	84.72
Hematological support		
Platelet transfusion	13	18.10
Supportive interventions		
Water-sealed drainage	4	5.55

CPAP: Continuous positive airway pressure, NG: Nasogastric

Table 5: Clinical outcomes of preterm LBW neonates (*n*=72)

Outcome parameter	Frequency (*n*)	Percentage
NICU stay duration	Mean: 14.82±8.24 days	
Range	2–30 days	
Survival status		
Survived	69	95.83
Death	3	4.17
Post-discharge follow-up		
Follow-up visit on day 7	72	100
Re-admission within 7 days	3	4.20

LBW: Low birth weight, NICU: Neonatal intensive care units

documented in large US and European neonatal cohorts.[14,13] Crucially, favorable survival was achieved with early CPAP alone; and only 3 infants (4.17%) required mechanical ventilation. These results reinforce international guidance that advocates for CPAP as first-line support to minimize ventilator-associated lung injury.[11,12,17] The borderline negative association between RDS and survival (OR 0.42, $P = 0.061$) nevertheless suggests residual risk in severe surfactant deficiency and highlights a potential therapeutic gap should surfactant become accessible in future. Complications during admission remained substantial. Air-leak syndromes necessitating water-sealed drainage occurred in 5.5% of

Table 6a: Binary logistic regression table for neonatal outcome (dependent variable: Survival)

Predictor variable	β coefficient	Standard error	Odds ratio	95% CI for OR	*P*-value
Gestational age (weeks)	+0.52	0.18	1.68	1.19–2.36	0.004**
Birth weight (kg)	+1.12	0.49	3.06	1.18–7.95	0.022*
RDS (yes=1)	–0.87	0.47	0.42	0.17–1.04	0.061
Hypoglycemia (yes=1)	–0.44	0.39	0.64	0.29–1.39	0.259

RDS: Respiratory distress syndrome, CI: Confidence interval

Table 6b: Interpretation table: Factors associated with neonatal survival

Variable	Odds ratio	95% confidence interval	*P*-value	Interpretation
Gestational age	1.68	1.18–2.39	0.004	Each additional week increases survival odds by 68%. Significant
Birth weight	3.06	1.18–7.93	0.022	Higher weight increases survival odds 3-fold. Significant
RDS	0.42	0.17–1.08	0.061	RDS reduced survival odds by 58%. Borderline significant
Hypoglycemia	0.64	0.29–1.39	0.259	Decreased odds, but not statistically significant

RDS: Respiratory distress syndrome

infants, while necrotizing enterocolitis (NEC) was observed in 11.1%, figures comparable with contemporary multicenter series.[6,18,19] Platelet transfusion was required in 18.1%, slightly lower than North-American databases and possibly reflecting stricter transfusion thresholds.[20] These morbidities underscore the continuing vulnerability of extremely and VLBW neonates even within a well-equipped facility. Multivariable analysis confirmed gestational age and birth weight as powerful, dose-responsive protectors of survival, in line with global pooled analyses.[3,21] Each additional week of gestation increased survival odds by 68%, and each extra kilogram of birth weight tripled them. Hypoglycemia did not significantly influence outcome, plausibly because rigorous glucose monitoring and prompt intervention attenuated its downstream impact.[8,7] Post-discharge performance was encouraging: Universal attendance at the day-7 follow-up and an early readmission rate of only 4.2% compare favorably with the 10–15% reported for very-preterm cohorts elsewhere, underscoring the value of structured caregiver counseling and early outpatient review.[22] The principal strength of this work is that it reflects outcomes in a specialized, well-resourced Bangladeshi NICU, demonstrating that high survival is attainable when evidence-based CPAP, vigilant infection control, targeted nutrition, and systematic follow-up are rigorously applied. Persistent rates of RDS, IVH, and air-leak syndromes, however, call for ongoing quality-improvement focused on antenatal corticosteroid coverage, gentle ventilation strategies, and early ultrasound screening. Implementing evidence-based bundles to prevent IVH and NEC, and establishing long-term neurodevelopmental surveillance would further advance care. In summary, preterm LBW neonates can achieve survival outcomes comparable to high-income settings in a specialized Bangladeshi NICU when gestational maturity, birth weight, and sustained high-quality supportive care are prioritized.

Limitations of the study

This single-center, retrospective study over 7 months limits generalizability. Reliance on routine electronic records may have led to under-documentation or misclassification of events. Outcomes were confined to in-hospital survival and early readmission without long-term neurodevelopmental follow-up. Microbiological profiles were not analyzed.

Conclusion

In this study, 72 preterm LBW neonates treated in the NICU of Bangladesh specialized hospital, the overall survival was 95.8%, and only three deaths were occurred which were ELBW, early preterm infants. RDS, jaundice, hypoglycemia, and sepsis were the most common complications found here. Multivariate analysis showed that each additional week of gestation increased the odds of survival by 68%, and each additional kilogram of birth weight tripled them, RDS exerted a borderline negative effect. These data underscore gestational maturity and birth weight as the dominant drivers of short-term outcome in this population and demonstrate that early CPAP administration and comprehensive NICU care can achieve survival rates comparable to high-income settings.

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Conflicts of Interest

None declared.

Ethical Approval

The study was approved by the Institutional Ethics Committee.

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