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OUTCOME OF LOW BIRTH WEIGHT NEONATES ADMITTED TO NICU: A PROSPECTIVE COHORT STUDY

Dr Mohammad Arif[1], Dr Muhammad Kamran[2*], Dr Wasim Akram[3], Dr Marvan Khan[4], Dr Amjad Khan[5], Dr Qaisar Ali[6]

[1]Professor, Department of Pediatrics, North West General Hospital, Peshawar, Pakistan
[2]*SR Pediatrics, North West General Hospital, Peshawar, Pakistan
[3]Resident Pediatrician, North West General Hospital, Peshawar, Pakistan
[4,5,6]Resident Paediatrician, North West General Hospital, Peshawar, Pakistan

***Corresponding author:** Dr Muhammad Kamran,
*SR Pediatrics, North West General Hospital, Peshawar, Pakistan,
Email: kamranbebrak495@gmail.com

ABSTRACT

Background: Low birth weight (LBW), especially in resource-poor environments, accounts for a significant proportion of neonatal mortality and morbidity. These infants face an increased risk of serious complications such as sepsis, respiratory distress, and hypoglycemia that may require them to be in an intensive care unit. Although there is increased focus on the management of neonates, in most situations survival is still not guaranteed. To evaluate the determinants of the outcome in neonates with LBW who are admitted to the NICU and assess the clinical and maternal factors linked with neonatal survival and mortality.

Methods: From February 2023 to February 2024, Northwest School of Medicine and its affiliated hospital undertook a prospective cohort study. There were 98 neonates with a birth weight lower than 2500 grams. SPSS version 25 was utilized for data processing and analysis to capture demographic, clinical, and maternal information. Various relationships between some factors and neonatal outcomes were studied, with statistical significance at the p-value threshold of <0.05.

Results: Out of 98 neonates, 78 (79.6%) survived and 20 (20.4%) died. Prematurity, unbooked antenatal status, presence of sepsis, and the need for mechanical ventilation were significantly associated with higher mortality ($p < 0.05$). Neonates with longer NICU stays and higher discharge weights had better survival. Most survivors had normal neurological findings at discharge.

Conclusion: The complex health risks inflicted on low birth weight neonates due to prematurity and perinatal complications remains significant. Outcomes of these infants stand to improve with risk factor identification and early intervention during NICU stays. Optimising maternal care and augmenting the scope of neonatal intensive care targeting low birth weight neonates at risk holds promise for significantly marginalising avoidable neonatal mortality within this vulnerable population.

Keywords: Low birth weight, Neonatal outcomes, NICU, Neonatal mortality, Prematurity, Sepsis, Mechanical ventilation, Antenatal care, Neonatal survival

INTRODUCTION

Low birth weight (LBW) remains a significant global challenge, especially in developing nations, and is defined as weight at birth being lower than 2500 grams. LBW is still one of the most prominent predictors of neonatal illness and deaths. LBW infants are still at risk because of the immaturity of their organ systems, the underdevelopment of their immunity and the low physiological reserves they have, even after neonatal medicine advancements. Such infants face increased chances of developing sepsis, hypothermia, respiratory distress syndrome, feeding problems, and long term neurodevelopmental complications[1-3].

The World Health Organisation, jointly with other agencies, approximates that over 20 million babies across the globe are born with low birth weight each year, mainly concentrated in South Asia and sub-Saharan Africa. The region of Pakistan still remains in desperate need of improvement when it comes to low birth weight, as the maternal health factors like nutrition and inadequate prenatal care, along with preterm birth rates and socio-economic factors, play tremendously into this issue. Such infants are often in dire need of specialised care within the neonatal intensive care units (NICUS), as with timely support and treatment, their survival and health outcomes can be greatly improved[4-6].

Multiple factors as maternal wellbeing, antenatal care, perinatal issues, intensive neonatal support, and the variable of gestational age, affect the clinical outcome of LBW neonates. Despite the issue being prevalent, there exists scant local data from tertiary care facilities that seeks to explore these relationships in a systematic fashion, especially the predictors pertaining to mortality and survival in LBW neonates. To enhance care practices in neonatology and reduce preventable deaths, these factors absolutely need to be understood[7-9].

This study was conducted to evaluate the short-term outcomes of low birth weight neonates admitted to the NICU and to determine the maternal, perinatal, and clinical variables associated with survival and mortality. By identifying key risk factors within the local healthcare context, this research aims to provide insights that can guide clinical management and support public health interventions to improve neonatal outcomes.

METHODOLOGY

The prospective cohort study was conducted between February 2023 and February 2024 with patients in the Neonatal Intensive Care Unit (NICU) of Northwest School of Medina and its affiliated teaching hospital. The teaching hospital acts as a tertiary care center, both housing and referring neonates from the local districts. The Institutional Ethical Review Board of Northwest School of Medicine granted ethical clearance and all parents or guardians provided consent prior to including their neonates into the study.

A total of 98 low birth weight neonates were included in the study through non-probability consecutive sampling. All neonates with a birth weight of less than 2500 grams admitted within the first 48 hours of life were eligible for inclusion, irrespective of gestational age. Neonates with major congenital anomalies, those discharged or referred within 12 hours of admission, and cases with incomplete records were excluded.

After obtaining informed consent from parents or guardians, detailed clinical and demographic information was recorded using a structured proforma. Data included birth weight, gestational age, gender, Apgar scores, maternal age, antenatal booking status, comorbidities, and delivery details. Clinical variables such as sepsis, respiratory distress syndrome (RDS), hypoglycemia, jaundice, the requirement for mechanical ventilation, and duration of NICU stay were noted. Each neonate was followed until discharge or death. Outcome parameters such as survival status, neurological condition at discharge, and discharge weight were carefully documented.

For analysis, data were entered into SPSS version 25. Frequencies and percentages were calculated for categorical variables, and Chi-square tests were applied to assess associations with outcomes. Continuous variables were expressed as mean ± standard deviation and compared using independent t-tests where appropriate. A p-value of less than 0.05 was considered statistically significant.

RESULT

The analysis of maternal and demographic characteristics of low birth weight neonates revealed several important findings. Gender did not show a significant association with neonatal outcome; both male and female infants had nearly similar survival rates, suggesting that sex did not influence mortality in this cohort. However, gestational age was significantly linked to outcome, with a higher death rate among preterm infants, emphasizing the vulnerability of neonates born before 37 weeks of gestation. While the mode of delivery—whether vaginal or caesarean did not yield statistically different outcomes, a trend toward better survival among cesarean-born neonates was noted. One of the most significant associations was with antenatal care. Neonates born to mothers who received regular prenatal checkups had much better survival rates than those of unbooked mothers, indicating the vital role of prenatal monitoring in improving neonatal outcomes. Maternal age did not show a statistically significant effect, but younger mothers (under 20) had relatively higher neonatal mortality, possibly reflecting underlying socioeconomic or biological vulnerabilities.

Table 1: Association of Demographic and Maternal Characteristics with Neonatal Outcome (n = 98)

Variable	Total (n)	Survived (n=78)	Died (n=20)	p-value
Gender				0.631
- Male	55	43	12	
- Female	43	35	8	
Gestational Age				0.042*
- Preterm (<37 wks)	64	47	17	
- Term (≥37 wks)	34	31	3	
Mode of Delivery				0.327
- Vaginal	45	34	11	
- Cesarean Section	53	44	9	
Antenatal Care				0.017*
- Booked	60	53	7	
- Unbooked	38	25	13	
Maternal Age (years)				0.289
- <20	21	14	7	
- 20–30	54	44	10	
- >30	23	20	3	

*Significant at $p < 0.05$

Table 2 explores the association between neonatal clinical conditions and their survival outcomes. A strong and statistically significant relationship was observed between birth weight and mortality, where extremely low birth weight neonates (below 1500g) had a much higher risk of death. The Apgar score at 5 minutes was also a critical indicator; neonates with scores below 7 had significantly poorer outcomes, highlighting the importance of initial neonatal health. Clinical complications such as sepsis and respiratory distress syndrome (RDS) were strongly associated with mortality. More than half of the neonates with sepsis died, suggesting it as a major contributor to early neonatal death. Similarly, RDS significantly increased the risk of death, underlining the fragility of pulmonary function in low birth weight infants. Other conditions such as hypoglycemia and jaundice, while common, did not show statistically significant differences in outcome, possibly due to timely management.

Table 2: Association of Neonatal Clinical Variables with Outcome (n = 98)

Variable	Total (n)	Survived (n=78)	Died (n=20)	p-value
Birth Weight				0.011*
- <1500g	40	27	13	
- 1500–2499g	58	51	7	
Apgar Score (5 min)				0.008*
- <7	33	21	12	
- ≥7	65	57	8	
Sepsis				0.001*
- Present	36	20	16	
- Absent	62	58	4	
RDS				0.002*
- Present	29	17	12	
- Absent	69	61	8	
Hypoglycemia				0.137
- Yes	24	17	7	
- No	74	61	13	
Jaundice				0.351
- Yes	47	39	8	
- No	51	39	12	

*Significant at $p < 0.05$

Table 3 focuses on the NICU interventions and hospital course of the neonates. Mechanical ventilation was significantly associated with neonatal mortality. Among the 28 neonates who required ventilatory support, nearly half did not survive, indicating that respiratory failure remains a critical challenge in this population. Use of intravenous antibiotics was common and did not show a statistically significant difference in survival, possibly because most neonates were empirically treated regardless of confirmed infection status. The duration of NICU stay also revealed a pattern—survivors generally had longer stays, reflecting the time needed for stabilization and recovery, while deaths often occurred early during hospitalization. Neurological status at discharge was normal in most survivors, though three neonates were discharged with suspected developmental delays, emphasizing the need for long-term neurodevelopmental follow-up. Lastly, discharge weight was higher in survivors, underscoring the importance of postnatal weight gain as a recovery indicator in low birth weight infants.

Table 3: NICU Interventions and Hospital Course with Neonatal Outcome (n = 98)

Variable	Total (n)	Survived (n=78)	Died (n=20)	p-value
Mechanical Ventilation				0.004*
- Required	28	15	13	
- Not required	70	63	7	
IV Antibiotic Use				0.092
- Yes	74	56	18	
- No	24	22	2	
NICU Stay Duration (≥7 days)				0.037*
- ≥7 days	60	52	8	
- <7 days	38	26	12	
Neurological Status at Discharge				-
- Normal	75	75	NA	
- Suspected Delay	3	3	NA	
Discharge Weight (mean ± SD)		2080 ± 210 g	1620 ± 185 g	0.001*

*Statistically significant at $p < 0.05$

NA = Not applicable (death precludes discharge evaluation)

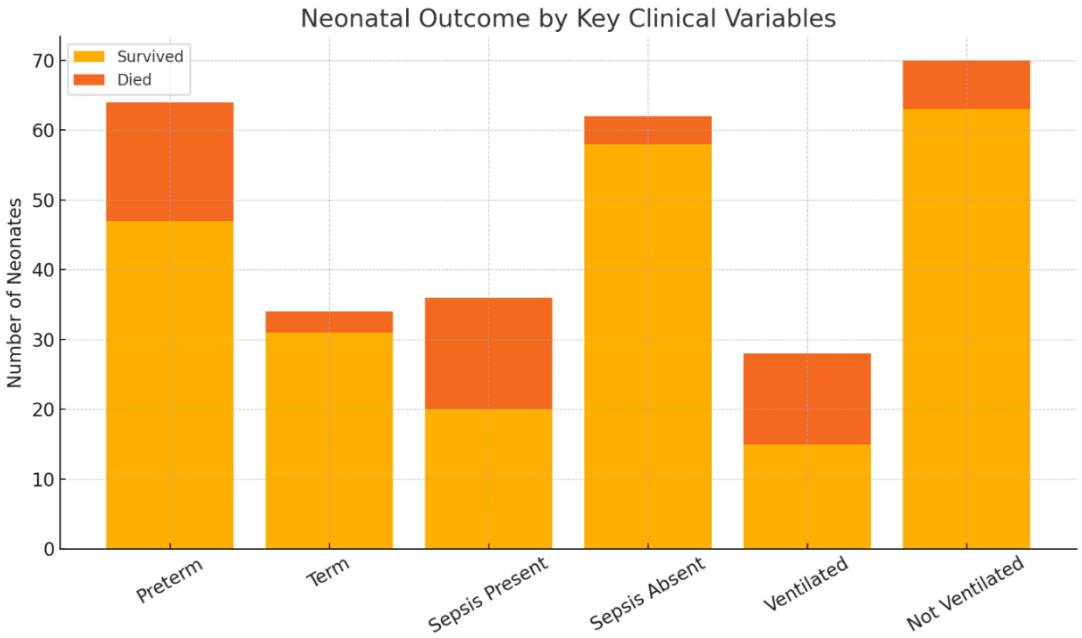

Figure 1

The graph illustrates the outcomes of low birth weight neonates based on critical clinical factors: gestational age, sepsis status, and mechanical ventilation. Preterm neonates experienced a noticeably higher mortality compared to term neonates, reinforcing the vulnerability of babies born before 37 weeks. The presence of sepsis was also linked to poorer outcomes, with a substantial number of deaths among infected neonates, highlighting sepsis as a major contributor to neonatal mortality. Additionally, neonates requiring mechanical ventilation had a significantly higher death count than those who did not, suggesting that respiratory failure requiring intensive support is a strong predictor of adverse outcomes. In contrast, neonates without these complications generally showed higher survival, underscoring the importance of early detection and aggressive management of such risk factors in NICU settings.

DISCUSSION

The present study assessed the outcomes of low birth weight neonates admitted to the NICU of a tertiary care hospital over a one-year period. Our findings highlight that prematurity, inadequate antenatal care, clinical complications such as sepsis and respiratory distress, and the need for mechanical ventilation were all significantly associated with increased neonatal mortality. These observations were consistent with previous studies conducted in similar settings[10-12].

A notable association was observed between prematurity and adverse outcomes. Preterm neonates in this study experienced significantly higher mortality than term neonates, underscoring the well-established vulnerability of premature infants. Studies similarly reported that preterm birth compounded with low birth weight increases the risk of death due to immature organ systems, particularly the lungs and immune defences [13-15].

The lack of adequate antenatal care was another significant factor contributing to poor neonatal outcomes. Neonates born to unbooked mothers had higher mortality, reinforcing findings from a studies which concluded that maternal health supervision during pregnancy plays a pivotal role in neonatal survival[16-18]. Proper antenatal care not only allows for early detection of maternal and fetal complications but also ensures preparedness for delivery in a well-equipped facility.

Sepsis emerged as one of the strongest predictors of mortality in our study. More than half of the neonates with sepsis did not survive, which aligns with research studies emphasized that early-onset neonatal sepsis remains a leading cause of death in NICUs, particularly in low- and middle-income

countries where delayed diagnosis and limited resources hinder timely intervention[19]. The need for mechanical ventilation also carried a significant risk, reflecting the severity of underlying respiratory compromise in critically ill neonates.

Interestingly, while jaundice and hypoglycemia were relatively common, they did not show significant associations with mortality. This may be due to prompt identification and treatment of these conditions, which are manageable with standard NICU protocols. However, this does not diminish their clinical relevance, as delayed treatment of these issues in other settings has been shown to lead to severe complications.

Length of NICU stay was another notable variable; neonates who survived had longer hospitalizations compared to those who died early. This finding mirrors the results of a studies noted that critically ill neonates often succumb within the first few days of admission, while those who stabilize typically require longer recovery periods before discharge[20].

Moreover, most of the neonates who survived had normal neurological status at discharge, which is a positive indicator. Nonetheless, the few who showed signs of neurodevelopmental delay point toward the need for post-discharge monitoring and early intervention services, as advised in studies which emphasized the importance of follow-up for NICU graduates to detect and manage developmental issues early[21].

Overall, the outcomes in our study reinforce the importance of early gestational monitoring, timely referral, and comprehensive neonatal care. The high survival rate among neonates who received timely interventions and prolonged care in the NICU is encouraging, but the mortality among those with preventable risk factors calls for stronger perinatal healthcare systems.

CONCLUSION

Low birth weight remains a significant determinant of neonatal morbidity and mortality, particularly when accompanied by prematurity, inadequate antenatal care, and complications such as sepsis and respiratory distress. The study highlights that early diagnosis, timely intervention, and continuous monitoring in NICU settings can improve survival in this vulnerable group. Strengthening antenatal services, improving maternal education, and equipping neonatal care units with adequate staff and resources are essential steps toward reducing avoidable neonatal deaths. Moreover, long-term follow-up should be integrated into routine care to monitor developmental outcomes in survivors. Our findings call for targeted clinical and public health strategies to safeguard the health and future of low birth weight infants.

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