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Original Research Article

Hyperglycaemia and Adverse Neonatal Outcomes in Very Low Birth Weight Neonates: A Prospective Observational Study

Deepsikha Mili[1], Bidyut Bhusan Nath[2]

[1]Post Graduate Trainee, Department of Paediatrics, Silchar Medical College and Hospital, Silchar, Assam, India

[2]Associate Professor, Department of Paediatrics, Silchar Medical College and Hospital, Silchar, Assam, India

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Corresponding author: Dr. Deepsikha Mili

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Abstract

Background: Very low birth weight (VLBW) neonates are vulnerable to glucose disturbances that may influence clinical outcomes during neonatal intensive care.

Objectives: This study evaluated the association of hypoglycaemia and hyperglycaemia with morbidity and mortality among VLBW neonates.

Methods: This prospective observational study was conducted in the Neonatal Intensive Care Unit of Silchar Medical College and Hospital, Assam, from January to December 2025. A total of 147 neonates with birth weight below 1500 g, admitted within the first 24 hours of life, were included. Hypoglycaemia was defined as blood glucose below 45 mg/dL and hyperglycaemia as above 180 mg/dL. Associations with neonatal morbidities, including sepsis, respiratory distress syndrome, necrotising enterocolitis, intraventricular haemorrhage, requirement of mechanical ventilation, and mortality, were evaluated. Logistic regression and Cox proportional hazards analyses were used to assess adverse outcomes and survival.

Results: Hypoglycaemia occurred in 12 neonates (8.2%), hyperglycaemia in 17 (11.6%), and normoglycaemia in 118 (80.3%). Hypoglycaemia was significantly associated with sepsis ($p = 0.003$) and mode of delivery ($p = 0.011$). Hyperglycaemia was significantly associated with sepsis ($p = 0.003$) and requirement of mechanical ventilation ($p < 0.001$). In the adjusted Cox model, hyperglycaemia was associated with increased mortality hazard (hazard ratio [HR] = 5.71, 95% confidence interval [CI]: 2.18–14.98; $p = 0.0004$). Hypoglycaemia was not significantly associated with mortality (adjusted HR = 1.15, 95% CI: 0.24–5.39; $p = 0.861$). Kaplan–Meier analysis showed significantly poorer survival among neonates with hyperglycaemia (log-rank $p < 0.0001$).

Conclusion: Hyperglycaemia was associated with greater morbidity and mortality among VLBW neonates. Routine glucose monitoring and timely management may support improved neonatal care.

Keywords: Very Low Birth Weight; Neonatal Hypoglycaemia; Neonatal Hyperglycaemia; Neonatal Morbidity; Neonatal Mortality; Neonatal Intensive Care Unit; Survival Analysis.

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Introduction

Very low birth weight (VLBW), defined as a birth weight below 1500 g, remains an important marker of neonatal vulnerability and is associated with substantial morbidity and mortality. Despite advances in neonatal intensive care, the management of VLBW neonates continues to present considerable clinical challenges because of physiological immaturity, limited metabolic reserves and an increased susceptibility to respiratory, infectious and neurological complications. The early postnatal period is particularly critical, as these infants must adapt rapidly to extrauterine life while maintaining metabolic stability. Among the physiological disturbances encountered during this transition, abnormalities in glucose homeostasis are of particular clinical interest because both low and elevated blood glucose concentrations may accompany an adverse clinical course [1-3]. Glucose is an essential substrate for neonatal energy metabolism, and maintaining an appropriate circulating concentration is especially important in premature infants. However, glucose regulation in this population is complicated by immature endocrine mechanisms, limited glycogen stores and an incompletely developed capacity for endogenous glucose production. Hypoglycaemia may develop when glucose utilisation exceeds its availability,

particularly when metabolic demands are increased or nutritional reserves are inadequate. In contrast, hyperglycaemia may occur because of immature insulin secretion, reduced insulin sensitivity, increased counter-regulatory hormonal activity and the physiological stress associated with critical illness. Nutritional support and other aspects of neonatal management may also influence glucose concentrations. Consequently, dysglycaemia in VLBW neonates may reflect an imbalance between metabolic supply and demand while also serving as a potential indicator of underlying physiological instability [1,2,4].

The clinical significance of neonatal dysglycaemia extends beyond the measured glucose concentration itself. Previous investigations involving premature and VLBW neonates have reported associations between glucose abnormalities and adverse outcomes, including mortality, intraventricular haemorrhage and the need for respiratory support [3, 5–9]. Hyperglycaemia has also been associated with sepsis and increased mortality in observational studies [9, 8]. These relationships are clinically relevant because VLBW neonates frequently experience multiple concurrent complications, making early recognition of potentially important metabolic abnormalities an integral component of their overall assessment. Nevertheless, the direction and nature of these associations remain complex. Severe infection, respiratory compromise and other manifestations of critical illness may precipitate glucose disturbances, while dysglycaemia may coexist with or potentially aggravate physiological dysfunction. Accordingly, observed associations should not automatically be interpreted as evidence of a direct causal relationship.

Interpretation of the available evidence is further complicated by differences in study populations, glucose thresholds, monitoring frequency and outcome definitions. Intermittent capillary glucose measurements, although practical in routine neonatal care, may not capture brief episodes or fluctuations occurring between assessments. The frequency and duration of dysglycaemia may therefore be incompletely characterised when glucose monitoring is not continuous. In addition, findings from one neonatal intensive care unit may not be directly generalisable to another because of differences in patient characteristics, clinical practices and the distribution of neonatal complications. Evaluating glucose abnormalities within individual NICU populations can therefore contribute useful setting-specific evidence, while also identifying questions that require larger, multicentre or more detailed prospective investigations [5–7, 10]. In this context, examining both hypoglycaemia and hyperglycaemia alongside major neonatal morbidities and survival outcomes is important for developing a more comprehensive understanding of their clinical significance. Assessing these associations in relation to outcomes such as sepsis, respiratory distress syndrome (RDS), necrotising enterocolitis (NEC), intraventricular haemorrhage (IVH) and requirement of mechanical ventilation can help clarify whether particular glycaemic categories identify infants who experience a more complicated NICU course. Evaluation of mortality using survival analysis may further characterise the relationship between glycaemic status and survival during hospitalisation. However, such findings must be interpreted in light of the observational study design and the possibility that prematurity, birth weight, illness severity and other clinical factors may influence both glucose concentrations and outcomes.

Against this background, the present prospective observational study was conducted among 147 VLBW neonates admitted within the first 24 hours of life to the neonatal intensive care unit of Silchar Medical College and Hospital, Assam, between January and December 2025. The primary objective was to evaluate the association between glycaemic status and mortality during NICU admission. Secondary objectives were to determine the occurrence of hypoglycaemia and hyperglycaemia and examine their associations with sepsis, RDS, NEC, IVH, requirement of mechanical ventilation and early adverse outcomes. Hypoglycaemia was defined as a blood glucose concentration below 45 mg/dL and hyperglycaemia as a concentration above 180 mg/dL. Survival analysis and regression modelling were additionally used to investigate the relationship between glycaemic abnormalities and mortality and adverse outcomes. By examining these associations in a defined regional NICU population, the study aims to contribute clinically relevant evidence on dysglycaemia among VLBW neonates and provide a basis for further research into neonatal glucose monitoring and outcome assessment.

Materials and Methods

Study Design and Setting: This prospective observational study was conducted in the Neonatal Intensive Care Unit (NICU) of Silchar Medical College and Hospital, Silchar, District Cachar, Assam, India. The study was carried out over a period of 12 months, from 1 January 2025 to 31 December 2025. It aimed to evaluate the association between blood glucose levels and morbidity and mortality among very low birth weight (VLBW) neonates admitted to the NICU.

Study Population and Eligibility Criteria: The study population comprised VLBW neonates admitted to the NICU during the study period. A total of 147 neonates with a birth weight below 1,500 g were included. The inclusion criteria were a birth weight below 1,500 g, gestational age between

22 and 37 weeks, admission to the NICU within the first 24 hours of life, regular blood glucose monitoring during the NICU stay and written informed consent from the parents or legal guardians.

Neonates with major congenital anomalies or chromosomal abnormalities that could affect survival or glucose metabolism were excluded. Neonates with severe birth asphyxia, defined as an Apgar score of 0–3 at 10 minutes, were also excluded. Neonates whose parents or legal guardians did not provide consent were not included in the study.

Sample-Size Calculation: The sample size was calculated using Daniel's formula for estimating a proportion:

[n= {Z^2p(1-p)}/{d^2}]

Where (n) represents the required sample size, (Z) is the standard normal deviate corresponding to a 95% confidence level (1.96), (p) is the estimated prevalence of glucose abnormalities among VLBW neonates, and (d) is the allowable error.

Based on the prevalence estimates, the anticipated prevalence of glucose abnormalities was taken as 25%, and the allowable error was set at 7%. Using these assumptions, the calculated sample size was approximately 147 neonates. Accordingly, 147 VLBW neonates were included in the study.

Glucose Measurement and Classification: Blood glucose levels were monitored using capillary blood samples obtained by heel prick. The samples were measured using a bedside glucometer, with subsequent confirmation by blood glucose examination. Measurements were performed according to the NICU protocol during the neonates' hospital stay.

For the study, hypoglycaemia was defined as a blood glucose concentration below 45 mg/dL, while hyperglycaemia was defined as a blood glucose concentration above 180 mg/dL. Based on the recorded glucose values, neonates were categorised as hypoglycaemic, hyperglycaemic or normoglycaemic. The incidence of hypoglycaemia and hyperglycaemia was determined, and glycaemic status was evaluated in relation to demographic characteristics, perinatal variables and neonatal outcomes.

Study Variables and Clinical Outcomes: Relevant maternal and neonatal information was collected using a structured study proforma. The demographic and perinatal variables recorded included sex, gestational age, birth weight and mode of delivery. Blood glucose status was the principal exposure variable.

The neonatal morbidities assessed included sepsis, respiratory distress syndrome (RDS), necrotising enterocolitis (NEC), intraventricular haemorrhage (IVH) and the requirement for mechanical ventilation. Early adverse outcomes (EAO) and mortality during NICU admission were also evaluated.

Neonatal sepsis was defined by clinical signs of infection with laboratory evidence suggestive of infection, such as a positive blood culture or elevated inflammatory markers, requiring antibiotic therapy. RDS was defined by respiratory distress in preterm neonates due to surfactant deficiency, characterised by clinical features such as tachypnoea, grunting and chest retractions, together with radiological findings consistent with RDS. NEC was defined as a neonatal gastrointestinal disease characterised by intestinal inflammation and necrosis, diagnosed using clinical findings and radiological features such as pneumatosis intestinalis. IVH was defined as bleeding into the ventricular system of the brain and was diagnosed by cranial ultrasonography. Mechanical ventilation was recorded when ventilatory support using a mechanical ventilator was required during the NICU stay.

Mortality was defined as death occurring during NICU admission. EAO was defined as the occurrence of any significant neonatal morbidity or death during NICU admission.

Covariates and Data Collection: Demographic, perinatal and clinical information was recorded systematically using the study proforma. The variables evaluated included sex, gestational age, birth weight, mode of delivery and the presence of neonatal complications. Gestational age category, birth weight and five-minute Apgar score were included as covariates in the adjusted Cox proportional hazards model for mortality. The associations between glycaemic status and the recorded demographic, perinatal and clinical variables were examined as part of the statistical analysis.

Statistical Analysis: Data were entered into Microsoft Excel and analysed using statistical software. Categorical variables were summarised using frequencies and percentages. The chi-square test was used to assess associations between blood glucose status and categorical variables. Fisher's exact test was applied when expected cell frequencies were small.

Binary logistic regression analysis was performed to examine the association between hyperglycaemia and adverse outcomes, including EAO morbidity and mortality. Kaplan–Meier survival analysis was used to compare survival probabilities between neonates with and without glucose abnormalities.

Cox proportional hazards regression was performed to evaluate the association between glycaemic status and mortality. Both unadjusted and adjusted Cox models were reported, with the adjusted model accounting for gestational age category, birth weight and five-minute Apgar score. A p-value below 0.05 was considered statistically significant.

Ethical Considerations: Ethical approval for the study was obtained from the Institutional Ethics Committee of Silchar Medical College and Hospital.

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Written informed consent was obtained from the parents or legal guardians of all participating neonates before their inclusion in the study.

Confidentiality was maintained by anonymising and coding the collected data. The information obtained was used solely for research purposes and kept secure to protect participant privacy. No additional invasive procedures were performed beyond the routine clinical investigations required for neonatal management. Participation was voluntary, and parents or legal guardians were informed of their right to withdraw their neonate from the study at any time without affecting ongoing treatment.

Results

Participant Characteristics and Glycaemic Status: A total of 147 VLBW neonates were included. Females accounted for 55.1% (n = 81), and the largest gestational-age group was 32–34 weeks (36.7%). Most neonates weighed 1100–1499 g (74.8%), and 57.8% were classified as early preterm/appropriate for gestational age. Vaginal delivery occurred in 51.7% of neonates.

Hypoglycaemia (blood glucose <45 mg/dL) was reported in 12 neonates (8.2%), while hyperglycaemia (>180 mg/dL) occurred in 17 (11.6%). Overall normoglycaemia was reported in 118 neonates (80.3%) (Table 1).

Table 1: Participant characteristics and glycaemic status (N = 147)

Characteristic	n (%)
Sex	
Female	81 (55.1)
Male	66 (44.9)
Gestational age (weeks)	
28–30	24 (16.3)
30–32	35 (23.8)
32–34	54 (36.7)
34–36	32 (21.8)
36 to <37	2 (1.4)
Birth weight (g)	
<900	9 (6.1)
900 to <1100	28 (19.0)
1100–1499	110 (74.8)
Gestational-age/growth category	
EPT/AGA	85 (57.8)
EPT/SGA	28 (19.0)
LPT/SGA	34 (23.1)
Mode of delivery	
Vaginal	76 (51.7)
Caesarean section	71 (48.3)
Overall glycaemic status	
Normoglycaemia	118 (80.3)
Hypoglycaemia	12 (8.2)
Hyperglycaemia	17 (11.6)

Abbreviations: AGA, appropriate for gestational age; EPT, early preterm; LPT, late preterm; SGA, small for gestational age.

Associations between glycaemic abnormalities and clinical outcomes: Hypoglycaemia was significantly associated with sex (p = 0.040), gestational-age/growth category (p = 0.004) and mode of delivery (p = 0.011). Most hypoglycaemic neonates were female (83.3%), belonged to the EPT/SGA category (50.0%), and were delivered by caesarean section (83.3%). The association between hypoglycaemia and gestational age in weeks was not significant (p = 0.573). Hyperglycaemia was significantly associated with gestational age in weeks (p = 0.002) and gestational-age/growth category (p = 0.005), but not with sex (p = 0.743) or mode of delivery (p = 0.254).

Among hyperglycaemic neonates, 47.1% were in the 28–30-week group and 47.1% were classified as

EPT/SGA. Sepsis was significantly associated with both hypoglycaemia and hyperglycaemia. Sepsis occurred in 83.3% of neonates with hypoglycaemia versus 39.3% without hypoglycaemia (p = 0.003), and in 76.5% with hyperglycaemia versus 38.5% without hyperglycaemia (p = 0.003).

Hyperglycaemia was also associated with requirement of mechanical ventilation: 76.5% of hyperglycaemic neonates required ventilation compared with 18.5% of those without hyperglycaemia (p < 0.001). No statistically significant associations were found with RDS, NEC or IVH; interpretation of NEC and IVH comparisons was limited by the small number of cases (Table 2).

Table 2: Associations between glucose abnormalities and neonatal morbidity

Outcome	Hypoglycaemia, n/N (%)	No hypoglycaemia, n/N (%)	p-value	Hyperglycaemia, n/N (%)	No hyperglycaemia, n/N (%)	p-value
Sepsis	10/12 (83.3)	53/135 (39.3)	0.003	13/17 (76.5)	50/130 (38.5)	0.003
RDS	1/12 (8.3)	46/135 (34.1)	0.067	8/17 (47.1)	39/130 (30.0)	0.156
NEC	1/12 (8.3)	1/135 (0.7)	0.157	1/17 (5.9)	1/130 (0.8)	0.219
IVH	0/12 (0)	1/135 (0.7)	1.000	0/17 (0)	1/130 (0.8)	1.000
Mechanical ventilation	3/12 (25.0)	34/135 (25.2)	1.000	13/17 (76.5)	24/130 (18.5)	<0.001

Abbreviations: IVH, intraventricular haemorrhage; NEC, necrotising enterocolitis; RDS, respiratory distress syndrome.

Morbidity, Mortality and Survival Analysis: Early adverse outcome (EAO) morbidity was recorded in 91 neonates. Hyperglycaemia was present in 15 (16.5%) of these neonates, compared with 2 (3.6%) of the 56 neonates without EAO morbidity (p = 0.017). Binary logistic regression showed higher odds of EAO morbidity among hyperglycaemic neonates (OR = 5.33, 95% CI: 1.17–24.27; p = 0.031).

There were 25 deaths during NICU admission. Mortality occurred in 9 of 17 hyperglycaemic neonates (52.9%), compared with 16 of 130 neonates without hyperglycaemia (12.3%; p < 0.001). Binary logistic regression also showed higher odds of mortality among hyperglycaemic neonates (OR = 8.02, 95% CI: 2.70–23.76; p < 0.001). In the adjusted Cox proportional hazards model, hyperglycaemia remained significantly associated with mortality after adjustment for gestational-age category, birth weight and five-minute Apgar score (adjusted HR = 5.71, 95% CI: 2.18–14.98; p = 0.0004). Hypoglycaemia was not significantly associated with mortality (adjusted HR = 1.15, 95% CI: 0.24–5.39; p = 0.861). Kaplan–Meier analysis showed lower survival among hyperglycaemic neonates (log-rank p < 0.0001), whereas survival did not differ significantly by hypoglycaemia status (log-rank p = 0.67) (Table 3).

Table 3: Regression analyses of EAO morbidity and mortality

Model	Predictor	Estimate (95% CI)	p-value
Logistic regression: EAO morbidity	Hyperglycaemia	OR 5.33 (1.17–24.27)	0.031
Logistic regression: mortality	Hyperglycaemia	OR 8.02 (2.70–23.76)	<0.001
Unadjusted Cox model	Hypoglycaemia	HR 0.83 (0.19–3.55)	0.801
Unadjusted Cox model	Hyperglycaemia	HR 4.98 (2.17–11.45)	<0.001
Adjusted Cox model*	Hypoglycaemia	HR 1.15 (0.24–5.39)	0.861
Adjusted Cox model*	Hyperglycaemia	HR 5.71 (2.18–14.98)	<0.001

The Cox model was adjusted for gestational-age category, birth weight and five-minute Apgar score. Covariate adjustment was not documented for the logistic regression models. CI, confidence interval; EAO, early adverse outcome; HR, hazard ratio; OR, odds ratio.

Discussion

Principal Findings: This prospective observational study evaluated the relationship between blood glucose abnormalities and clinical outcomes among 147 very low birth weight (VLBW) neonates admitted to the neonatal intensive care unit of Silchar Medical College and Hospital, Assam. Using blood glucose thresholds of less than 45 mg/dL for hypoglycaemia and greater than 180 mg/dL for hyperglycaemia, hypoglycaemia was documented in 12 neonates (8.2%) and hyperglycaemia in 17 (11.6%). The majority of neonates were classified as normoglycaemic in the overall study summary. Despite the relatively small number of affected neonates, hyperglycaemia showed important associations with adverse clinical outcomes.

Hyperglycaemia was significantly associated with sepsis (p = 0.003) and the requirement for mechanical ventilation (p < 0.001). It was also associated with morbidity and mortality. In the adjusted Cox proportional hazards model,

hyperglycaemia remained associated with a higher hazard of death (hazard ratio [HR], 5.71; 95% confidence interval [CI], 2.18–14.98; p = 0.0004), after adjustment for gestational-age category, birth weight and five-minute Apgar score.

In contrast, hypoglycaemia was not significantly associated with mortality in the adjusted model (HR, 1.15; 95% CI, 0.24–5.39; p = 0.861). These findings identify hyperglycaemia as a potentially important prognostic marker in this cohort, although the observational design does not establish a causal relationship. [10-14, 8]

Interpretation of Hyperglycaemia: The association between hyperglycaemia and adverse outcomes may reflect the complex metabolic response of premature neonates to physiological stress. VLBW neonates have immature glucose-regulatory mechanisms and limited metabolic reserves. Acute illness, infection and respiratory compromise may further disturb glucose homeostasis. Hyperglycaemia may therefore represent both altered metabolic regulation and the severity of the underlying illness. [13, 4, 15]

The association with sepsis in the present study is particularly relevant. Sepsis was recorded in 76.5% of neonates in the hyperglycaemia group, compared with 38.5% of those without hyperglycaemia. Similarly, 76.5% of hyperglycaemic neonates required mechanical ventilation, compared with 18.5% of neonates without hyperglycaemia.

These findings suggest that hyperglycaemia identifies a group with substantial clinical instability. However, the temporal relationship between glucose abnormalities and the onset of sepsis or respiratory deterioration cannot be established from these associations alone.

Severe illness may precipitate hyperglycaemia, while metabolic disturbance could also contribute to adverse physiological effects. [6, 12] The persistence of the association between hyperglycaemia and mortality after adjustment for selected neonatal factors strengthens its prognostic relevance. Nevertheless, residual confounding remains possible because illness severity, maternal diabetes, nutritional exposure, medication use and other clinical factors may influence both glucose levels and survival. The adjusted HR should therefore be interpreted as an association conditional on the variables included in the model, rather than proof that hyperglycaemia independently causes death. [16]

Hypoglycaemia: Hypoglycaemia occurred in 8.2% of the cohort and was associated with sepsis (p = 0.003). Its association with mode of delivery was also statistically significant, with a greater proportion of hypoglycaemic neonates delivered by caesarean section. This latter finding should be interpreted cautiously because the study does not establish whether mode of delivery itself influenced glucose regulation or whether underlying maternal and neonatal circumstances contributed to both outcomes.

The adjusted mortality analysis did not demonstrate a statistically significant association between hypoglycaemia and death. However, only 12 neonates were classified as hypoglycaemic, and the confidence interval around the HR was wide. The result therefore does not establish the absence of a clinically important relationship; rather, the study may have had limited precision to detect one. In addition, intermittent glucose measurements may have missed brief episodes, recurrent events or fluctuations in glucose concentration.

Previous literature has emphasised that the clinical consequences of hypoglycaemia may depend on its severity, duration and recurrence. The systematic review by Boluyt and colleagues reported more consistent adverse neurodevelopmental associations for severe or recurrent hypoglycaemia than for isolated transient episodes [10,16].

Although the present study focused on morbidity and mortality during the NICU stay, this evidence highlights why the absence of a statistically significant mortality association should not be interpreted as evidence that hypoglycaemia is harmless. [4,7]

Comparison with Previous Studies: The principal finding of an association between hyperglycaemia and mortality is consistent with previous studies. Kao and colleagues reported that severe hyperglycaemia was associated with increased mortality and late-onset infection among extremely low birth weight (ELBW) infants, while Mohamed and colleagues described higher rates of both sepsis and mortality in hyperglycaemic neonates [14]. Hays and colleagues likewise reported increased mortality and sepsis among VLBW infants with glucose concentrations above 180 mg/dL [6]. These observations are directionally consistent with the present findings, in which hyperglycaemia was associated with sepsis, requirement of mechanical ventilation and increased mortality hazard. Furthermore, the association between hyperglycaemia and mortality after adjustment for confounding variables is comparable to the multicentre cohort findings reported by Wilson et al., in which glucose instability remained associated with mortality following multivariable analysis [11].Roberts and colleagues similarly reported increased mortality among VLBW neonates with hypoglycaemia or hyperglycaemia, with sustained hyperglycaemia associated with particularly high risk [5,6]. Differences in cohort characteristics, glucose-monitoring frequency, definitions of dysglycaemia and adjustment for illness severity

may explain variation in the magnitude of associations across studies.

The prevalence observed in the present cohort was lower than the hyperglycaemia frequencies of approximately 38–44% reported in several studies [12,13,14]. This difference should not automatically be interpreted as a lower underlying burden of dysglycaemia. The prevalence of dysglycaemia may be influenced by the use of intermittent capillary glucose testing, variations in the timing and frequency of measurements, and differences in the clinical characteristics of the study population. Ribeiro and colleagues, in a study using continuous glucose monitoring, observed that continuous monitoring detected a greater number of glucose fluctuations than intermittent capillary measurements [10]. This suggests that some episodes of glucose abnormalities may have remained undetected in the present study.

Evidence concerning glycaemic variability is also relevant. Studies by Zamir and colleagues and by Thomas and colleagues,reported associations between greater glucose variability and mortality or prolonged respiratory support [37,17]. The present study classified neonates according to glucose abnormalities but did not quantify glycaemic variability. Consequently, it cannot determine whether the duration, recurrence or fluctuation of hyperglycaemia provides additional prognostic information beyond the categorical classification used here. [17-19]

Clinical Implications: The findings support careful glucose surveillance in VLBW neonates, particularly when sepsis, respiratory deterioration or other indicators of clinical instability are present. An abnormal glucose result should prompt clinical assessment in context, including evaluation for associated illness and review of nutritional and treatment-related factors. Monitoring should aim to identify both low and high glucose concentrations rather than focusing exclusively on one abnormality. [2,12,13] However, this study does not establish that glucose-lowering treatment itself improves survival. Hyperglycaemia may be a marker of severe illness, a contributor to adverse outcomes, or both. Decisions about treatment should therefore follow established neonatal protocols and account for the neonates overall condition, glucose trajectory and risk of treatment-related hypoglycaemia.[6] The observed associations support recognition and evaluation of dysglycaemia, but they do not justify a causal claim about the benefit of any particular intervention.

Strengths and limitations

A key strength of this study was its prospective observational design, with data collected from 147 VLBW neonates over a defined one-year period. The study evaluated several clinically relevant outcomes and included an adjusted time-to-event analysis, allowing the association between hyperglycaemia and mortality to be examined beyond selected baseline neonatal factors. Several limitations should be acknowledged. First, the study was conducted at a single centre, which may limit generalisability to settings with different neonatal populations and care practices. Second, glucose measurements were intermittent, potentially resulting in missed episodes and underestimation of dysglycaemia. Third, the hypoglycaemia and hyperglycaemia groups were small, limiting statistical precision, particularly for less frequent outcomes such as necrotising enterocolitis and intraventricular haemorrhage. Fourth, adjustment was limited to the covariates specified in the model, leaving the possibility of residual confounding by illness severity and other maternal or neonatal factors. Finally, follow-up was restricted to the NICU admission; long-term neurodevelopmental outcomes were not assessed. The reported prevalence estimates and associations should also be interpreted in light of the glucose classification and monitoring approach used.

Future Research: Larger multicentre prospective studies are needed to clarify the relationship between dysglycaemia and outcomes in VLBW neonates across different clinical settings. Standardised monitoring schedules and clearly defined thresholds would improve comparability between studies. Recording the timing, duration and recurrence of glucose abnormalities, alongside measures of glycaemic variability, may help distinguish transient abnormalities from sustained metabolic instability. Future analyses should also account more comprehensively for illness severity, maternal factors, and nutrition and medication exposures. Finally, studies incorporating long-term neurodevelopmental follow-up and carefully designed evaluations of management strategies are needed to determine whether improved detection and treatment of dysglycaemia translate into better outcomes. [18-21]

Conclusion

In this prospective study of 147 very low birth weight neonates, hyperglycaemia was significantly associated with sepsis, requirement of mechanical ventilation, early adverse morbidity and increased mortality. Importantly, the association with mortality persisted after adjustment for gestational-age category, birth weight and five-minute Apgar score, highlighting hyperglycaemia as a potential prognostic marker in this vulnerable population.

However, the observational design, small dysglycaemic subgroups and possibility of residual confounding preclude causal conclusions.

Larger multicentre studies using standardised glucose monitoring and comprehensive adjustment for illness severity are needed to validate these findings and determine whether targeted glycaemic management improves neonatal outcomes.

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