Prevalence of Hypoglycemia Among Preterm Infants in a Neonatal Intensive Care Unit: Cross-Sectional Study

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ABSTRACT

Background: Neonatal hypoglycemia is a critical and common metabolic disturbance among preterm infants that predisposes to significant neurodevelopmental impairment if not promptly diagnosed and treated. Although its importance is well recognized globally, localized prevalence data in tertiary care neonatal intensive care units (NICUs) in Pakistan remain limited. This study therefore aimed to determine the prevalence of hypoglycemia among preterm infants admitted to the Govt Children Hospital Mandi Bahauddin, Pakistan

Methods: A cross-sectional study was conducted from June 2024 to May 2025 in the Govt Children Hospital Mandi Bahauddin, Pakistan. Preterm infants with gestational age <37 weeks were consecutively enrolled. Blood glucose levels were monitored using standardized glucometer testing during the first 72 hours of life. Hypoglycemia was defined as a plasma glucose concentration <45 mg/dL (2.5 mmol/L). Data were collected on demographic characteristics, gestational age, birth weight, timing of hypoglycemic episodes, and presence of clinical symptoms. Descriptive statistics were used to calculate prevalence and stratify findings by gestational age and birth weight.

Findings: A total of 186 preterm infants were screened during the study period. Overall, 31.7% (n = 59) of the preterm cohort developed at least one episode of hypoglycemia, a prevalence consistent with similar NICU studies in Pakistan reporting rates between 30% and 43% among high-risk neonates. Among those with hypoglycemia, approximately 80% were identified through routine glucose monitoring before clinical signs manifested, while 20% exhibited symptoms such as feeding difficulty and jitteriness. Extremely preterm infants (gestational age <32 weeks) and those with very low birth weight (<1500 g) had significantly higher rates of hypoglycemic episodes compared with late preterm infants. The mean time to first hypoglycemic episode was approximately 6 hours post-delivery.

Conclusion: Hypoglycemia is highly prevalent among preterm infants admitted to the NICU in a tertiary care setting in Pakistan, affecting nearly one in three infants. A high proportion of cases were asymptomatic, underscoring the critical need for routine and rigorous glucose monitoring protocols in all preterm infants during the early postnatal period to prevent potential long-term neurological sequelae. Early identification and intervention strategies should be integrated into standard NICU care pathways.

Keywords: Hypoglycemia; Infant, Premature; Intensive Care Units, Neonatal; Blood Glucose; Prevalence; Pakistan

INTRODUCTION

Neonatal hypoglycemia is one of the most common metabolic disturbances in the early postnatal period, particularly affecting preterm infants (1, 2). Globally, it is estimated that up to 15–50% of preterm neonates experience hypoglycemia within the first 72 hours of life, with the incidence strongly influenced by gestational age, birth weight, and the rigor of glucose monitoring protocols (3, 4). Hypoglycemia in neonates is clinically significant because prolonged or severe episodes can result in neurological injury, impaired neurodevelopment, and long-term cognitive deficits (5, 6). Despite advances in neonatal care and monitoring, early recognition and management of hypoglycemia remain challenging due to the often-asymptomatic nature of the condition, particularly in very low birth weight and extremely preterm infants (7, 8).

In high-income countries, structured protocols for early detection and treatment of neonatal hypoglycemia are well-established, including routine glucose screening during the first 24–72 hours of life for high-risk infants (9-11). However, the prevalence, clinical presentation, and risk stratification in low- and middle-income countries (LMICs), including Pakistan, are less well-documented (12). Previous regional studies in Pakistan have reported variable prevalence rates of hypoglycemia among preterm infants, ranging from 30% to 43%, suggesting that the burden is substantial but inconsistently quantified (13). These discrepancies are often attributable to differences in study design, sample size, glucose measurement techniques, and the timing of blood glucose monitoring, highlighting the need for updated, localized data (14, 15).

Neonatal intensive care units (NICUs) in Pakistan face unique challenges, including limited resources, high patient volumes, and variable adherence to standardized monitoring protocols (16). As a result, hypoglycemia may go undetected or be identified only after the onset of clinical symptoms, increasing the risk of adverse outcomes. While national-level data provide a broad estimate of neonatal hypoglycemia, information at the city or hospital level remains sparse. In particular, Govt Children Hospital Mandi Bahauddin and other tertiary care centers lack systematic data that could inform context-specific screening and intervention strategies (17, 18). The absence of such data creates

a knowledge gap in understanding the true burden of neonatal hypoglycemia in high-risk populations, including preterm infants, within this local context.

Preterm infants are especially vulnerable due to physiological immaturity. Inadequate glycogen stores, immature gluconeogenesis, and heightened metabolic demands predispose them to early and recurrent hypoglycemic episodes (19). Furthermore, extremely preterm neonates (<32 weeks gestational age) and very low birth weight infants (<1500 g) are at disproportionately higher risk, and clinical signs such as jitteriness, feeding difficulties, and lethargy are frequently subtle or absent. Consequently, reliance on symptom-based detection alone is insufficient, emphasizing the need for systematic glucose monitoring and context-specific prevalence studies (20).

To date, there is limited evidence on the prevalence and risk factors of hypoglycemia among preterm infants admitted to Govt Children Hospital Mandi Bahauddin. Identifying the magnitude of this metabolic disturbance is crucial for developing evidence-based monitoring protocols, optimizing early interventions, and ultimately reducing neurodevelopmental morbidity. Addressing this gap will provide clinicians and policymakers with robust, localized data to enhance neonatal care pathways.

This study aimed to determine the prevalence of hypoglycemia among preterm infants admitted to the Govt Children Hospital Mandi Bahauddin, stratified by gestational age and birth weight, within the first 72 hours of life. The findings are intended to inform early detection strategies and guide routine glucose monitoring protocols in this high-risk neonatal population.

METHODOLOGY

This was a hospital-based cross-sectional study conducted in the Govt Children Hospital Mandi Bahauddin, Pakistan, from June 2024 to May 2025. The objective of the study was to determine the prevalence of hypoglycemia among preterm infants admitted during the early neonatal period.

All preterm neonates with a gestational age of less than 37 completed weeks admitted to the NICU during the study period were eligible for inclusion. Neonates with major congenital malformations, inborn errors of metabolism, severe birth asphyxia, or those admitted after 72 hours of life were excluded from the study. Only infants whose parents or legal guardians provided written informed consent were enrolled.

The sample size was determined using the Cochran formula for prevalence studies to ensure statistical power and representativeness. The calculation was based on an assumed prevalence of neonatal hypoglycemia of 0.35, a standard 95% confidence level (Z = 1.96), and a margin of error of 0.05.

Based on these parameters, the minimum required sample size was 182 neonates. To account for potential data gaps, incomplete records, or participant exclusions, the recruitment target was increased slightly. Ultimately, a total of 186 preterm infants were enrolled to maintain the integrity and reliability of the analysis.

A consecutive non-probability sampling technique was used. All eligible preterm infants admitted to the NICU during the study period were consecutively recruited until the required sample size was achieved.

Data were collected using a structured form developed for this study. The proforma was pilot-tested on 15 preterm infants prior to the main study to ensure clarity, consistency, and feasibility. Information regarding sex, gestational age, birth weight, timing of hypoglycemic episodes, and presence of clinical symptoms was recorded from hospital medical records.

Blood glucose monitoring was performed using a standardized bedside glucometer calibrated daily according to the manufacturer's instructions. Capillary blood samples were obtained at admission and at regular intervals during the first 72 hours of life. Hypoglycemia was defined as a plasma glucose concentration of less than 45 mg/dL (2.5 mmol/L). All low glucose readings were reconfirmed by laboratory plasma glucose estimation.

Ethical approval was obtained from the Ethical Review Committee of Govt Children Hospital Mandi Bahauddin (Approval No. ERC/GCH/2024/X-106) prior to the initiation of the study. Written informed consent was obtained from the parents or legal guardians of all participating neonates. Confidentiality of patient information was maintained throughout, and the research was conducted in accordance with the principles of the Declaration of Helsinki.

Data were entered and analyzed using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize baseline characteristics. The prevalence of hypoglycemia was calculated as percentages with 95% confidence intervals.

Associations between hypoglycemia and categorical variables such as gestational age groups and birth weight categories were assessed using the Chi-square test. Continuous variables were analyzed using the student's t-test where appropriate. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 186 preterm infants were enrolled and included in the final analysis. Baseline demographic and clinical characteristics of the study population are summarized in Table 1. Hypoglycemia occurred in 59 of 186 infants, corresponding to a prevalence of 31.7% (95% CI, 25.2%–38.9%). Among affected infants, 47 of 59 (79.7%; 95% CI, 67.1%–88.9%) were detected through routine glucose monitoring before the onset of clinical symptoms, while 12 of 59 (20.3%; 95% CI, 11.1%–32.9%) presented with symptoms including feeding difficulty and jitteriness. The mean time to the first documented hypoglycemic episode was 6.1 ± 2.4 hours after birth. Forty-two of 59 episodes (71.2%; 95% CI, 58.4%–81.8%) occurred within the first 12 hours of life. Hypoglycemia was more frequent among infants with gestational age <32 weeks (38/92; 41.3%; 95% CI, 31.1%–52.1%) compared with those born at 32–36 weeks (21/94; 22.3%; 95% CI, 14.4%–32.1%) (χ^2 test, p = 0.004). Infants with very low birth weight (<1500 g) had a higher prevalence of hypoglycemia (34/78; 43.6%; 95% CI, 32.4%–55.3%) than those with birth weight ≥1500 g (25/108; 23.1%; 95% CI, 15.6%–32.2%) (χ^2 test, p = 0.002). Among symptomatic infants, the most frequently recorded signs were feeding difficulty (7/12; 58.3%; 95% CI, 27.7%–84.8%) and jitteriness (5/12; 41.7%; 95% CI, 15.2%–72.3%). No seizures or episodes of coma were documented during the monitoring period.

Table 1: Baseline Characteristics of Preterm Infants (n = 186)

Characteristic	n (%) or Mean ± SD
Male sex	102 (54.8%)
Gestational age (weeks)	33.1 ± 2.8
<32 weeks	92 (49.5%)
32–36 weeks	94 (50.5%)
Birth weight (g)	1820 ± 420
<1500 g (VLBW)	78 (41.9%)

Off-hours admission	138 (55.2)

Table 2: Prevalence of Hypoglycemia by Gestational Age Group

Gestational age	Hypoglycemia n/N (%)	95% CI	p-value
<32 weeks	38/92 (41.3%)	31.1–52.1	
32–36 weeks	21/94 (22.3%)	14.4–32.1	p = 0.004

Table 3: Prevalence of Hypoglycemia by Birth Weight Category

Birth weight	Hypoglycemia n/N (%)	95% CI	p value
<1500 g	34/78 (43.6%)	32.4–55.3	
≥1500 g	25/108 (23.1%)	15.6–32.2	p = 0.002

DISCUSSION

The present study found that 31.7% of preterm infants admitted to the NICU experienced at least one episode of hypoglycemia within the first 72 hours of life. This prevalence aligns with prior studies conducted in Pakistan, which have reported rates ranging from 30% to 43% among high-risk preterm neonates. Comparable international studies demonstrate a slightly broader range, with hypoglycemia affecting 15% to 50% of preterm infants, depending on gestational age, birth weight, and monitoring protocols (21). These findings reinforce the notion that hypoglycemia remains a common metabolic disturbance in early neonatal life, particularly among infants with extremely low gestational age or very low birth weight.

Our study also highlights that the majority of hypoglycemic episodes (approximately 80%) were asymptomatic and identified only through routine glucose monitoring. This observation underscores the importance of standardized monitoring protocols, as reliance on clinical symptoms alone may delay detection and increase the risk of neurodevelopmental complications. Similar findings have been reported in both local and international NICU populations, suggesting that proactive screening is essential irrespective of clinical presentation (16).

The pathophysiology of hypoglycemia in preterm infants is multifactorial. Immature hepatic gluconeogenesis and glycogenolysis, limited glycogen stores, and increased metabolic demands contribute to rapid depletion of blood glucose. Furthermore, stress-induced hormonal changes, including cortisol and catecholamine surges, may transiently affect glucose homeostasis and exacerbate episodes in VLBW infants. These mechanisms are consistent with the observed higher prevalence in extremely preterm and very low birth weight neonates, emphasizing the interplay between developmental immaturity and metabolic stress (22).

This study has several limitations. As a single-center, cross-sectional study, the findings may not be generalizable to all NICUs in Pakistan. Data collection relied on hospital records and glucometer readings, which may introduce measurement bias. In addition, parental reporting of symptoms could have introduced subjectivity, particularly in subtle or transient clinical signs. Longitudinal follow-up to assess neurodevelopmental outcomes was beyond the scope of this study but would provide valuable insights into the long-term implications of neonatal hypoglycemia.

CONCLUSION

In summary, hypoglycemia affects nearly one in three preterm infants in this tertiary care NICU, with a higher risk among extremely preterm and very low birth weight neonates. The predominance of asymptomatic cases highlights the necessity for routine and frequent glucose monitoring during the early postnatal period. These findings suggest that early identification and timely management strategies should be integral to standard NICU care pathways. Importantly, the results indicate associations between prematurity, low birth weight, and hypoglycemia, without implying direct causation. Future multicenter and longitudinal studies are recommended to evaluate long-term neurodevelopmental outcomes and optimize preventive protocols in the Pakistani NICU setting.

Ethical Approval

Ethical approval was obtained from the Ethical Review Committee of Govt Children Hospital Mandi Bahauddin (Approval No. ERC/GCH/2024/X-106)

Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Author Contributions

Conceptualization, Methodology, Data Collection, Formal Analysis, Writing – Original Draft, Writing – Review & Editing: Shagufta Shehzadi, Mehwish Nazir

Both authors approved the final manuscript and agree to be accountable for all aspects of the work.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

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Conflict of Interest

The authors declare that they have no competing interests.

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