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Frequency of Hypoglycemia in Preterm Newborns

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ABSTRACT

Background: To determine the frequency of hypoglycemia in preterm neonates and to evaluate the associated maternal and neonatal risk factors.

Methods: 'This prospective observational study was conducted over a one-year period from march 2023 to March 2024 at People's University of Medical and Health Sciences Nawabshah. A total of 81 preterm newborns with gestational age less than 37 weeks were enrolled. Relevant clinical and demographic data were collected, and blood glucose was measured within the first few hours of life. Hypoglycemia was defined as a blood glucose level below 40 mg/dL. Data were analyzed using SPSS version 26.0, and associations were evaluated using Chi-square tests.

Results: Out of the 81 preterm neonates, 28 (34.6%) developed hypoglycemia. The condition was significantly associated with gestational age <32 weeks ($p = 0.001$), birth weight <1500 grams ($p < 0.001$), maternal diabetes ($p = 0.002$), and maternal hypertension ($p = 0.016$). Administration of antenatal corticosteroids showed a protective effect ($p = 0.024$).

Conclusion: Hypoglycemia is a common yet preventable complication in preterm infants, particularly among those with lower gestational age, low birth weight, and maternal comorbidities. These findings highlight the need for vigilant monitoring and targeted preventive strategies in neonatal care.

Keywords: *Preterm infants, neonatal hypoglycemia, gestational age, birth weight, maternal diabetes, antenatal steroids*

1. INTRODUCTION

Hypoglycemia remains one of the most frequent and clinically important metabolic disturbances in the neonatal period, especially among preterm infants. Due to their immature glucose regulation mechanisms and limited glycogen reserves, preterm newborns are particularly at risk for developing low blood glucose levels during the critical hours following birth. While transient episodes may be asymptomatic, persistent or severe hypoglycemia has been associated with long-term neurodevelopmental impairments, including cognitive and motor deficits (1-3).

'The incidence of hypoglycemia in preterm neonates varies widely depending on gestational age, birth weight, feeding practices, and maternal factors such as diabetes and hypertension'. Several studies have underscored that infants born before 32 weeks of gestation or with a birth weight below 1500 grams are at higher risk due to underdeveloped hepatic gluconeogenesis and hormonal immaturity. 'Additionally, maternal conditions such as hyperglycemia during pregnancy may predispose neonates to postnatal hypoglycemia through fetal hyperinsulinemia' (4-6).

Despite growing awareness, hypoglycemia in preterm infants often remains underdiagnosed, particularly when asymptomatic. Early identification through routine glucose monitoring and targeted management can significantly reduce morbidity and improve long-term outcomes(7-9).

This study was designed to estimate the frequency of hypoglycemia in preterm newborns admitted to a neonatal care unit and to analyze the maternal and neonatal risk factors associated with its development. Understanding these associations can help in formulating preventive strategies and optimizing neonatal care protocols.

Methodology

This prospective observational study was conducted at People's University of Medical and Health Sciences Nawabshah. over a period of one year from march 2023 to March 2024. 'The primary objective was to determine the frequency of hypoglycemia in preterm newborns and identify any associated maternal and neonatal factors'. Approval for the study was obtained from the Institutional Ethical Review Committee prior to data collection. Informed written consent was taken from parents or legal guardians of all enrolled neonates. 'Confidentiality and anonymity were strictly maintained throughout the study'

'A total of 81 preterm newborns were included in the study through non-probability consecutive sampling'. All eligible neonates who met the inclusion criteria during the study period were enrolled until the desired sample size was reached.

Inclusion Criteria

- Preterm neonates with a gestational age less than 37 weeks, born either at the study center or referred within the first 24 hours of life.
- Neonates who were admitted to the neonatal intensive care unit (NICU) or observed in the postnatal unit for routine monitoring.
- Parental or guardian consent obtained for participation in the study.

Exclusion Criteria

- Term neonates (≥37 weeks gestation).
- Newborns with known inborn errors of metabolism, congenital anomalies, or diagnosed endocrine disorders.
- Neonates who received glucose supplementation prior to initial blood glucose measurement.
- Cases with incomplete medical records or refusal of consent.

Upon admission, each preterm neonate underwent a detailed clinical evaluation. Data on maternal variables were recorded from antenatal records, including age, parity, mode of delivery, diabetes status, hypertension, and use of antenatal corticosteroids. Neonatal variables such as gender, gestational age, birth weight, and APGAR scores were documented.

Blood glucose levels were assessed using a standardized glucose oxidase-peroxidase (GOD-POD) method or point-of-care glucometer. The first glucose measurement was performed within the first two hours of life and repeated as per clinical indications or institutional protocol.

For the purposes of this study, neonatal hypoglycemia was defined as a blood glucose level <40 mg/dL. Both symptomatic and asymptomatic cases were included. Clinical signs considered suggestive of hypoglycemia included jitteriness, lethargy, poor feeding, apnea, and seizures.

'Data were entered and analyzed using SPSS version 26.0'. 'Categorical variables were expressed as frequencies and percentages, while associations between hypoglycemia and clinical variables were tested using the Chi-square test'. A p-value of <0.05 was considered statistically significant.

2. RESULTS

A total of 81 preterm newborns were included in this study. The demographic analysis revealed a nearly even distribution between male and female neonates, with a slight male predominance. Most of the neonates were born in the late preterm period (33–36 weeks), followed by those in the very preterm group (28–32 weeks). In terms of birth weight, the majority fell within the 1500–2499 gram range, while a smaller proportion had extremely low birth weights below 1500 grams.

Table 1: Demographic Characteristics of Preterm Newborns (n = 81)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	42	51.9%
Female	39	48.1%
Gestational Age		
<28 weeks (extreme preterm)	11	13.6%
28–32 weeks (very preterm)	29	35.8%
33–36 weeks (late preterm)	41	50.6%
Birth Weight		
<1500 g	18	22.2%
1500–2499 g	52	64.2%
≥2500 g	11	13.6%

Maternal characteristics were also assessed. Most mothers were aged between 26 to 35 years, and cesarean section was the predominant mode of delivery. Approximately 15% of the mothers had diabetes mellitus, while 23.5% had a history of hypertension. Notably, antenatal corticosteroids had been administered to more than half of the participants, which could potentially influence neonatal glucose regulation.

Table 2: Maternal Characteristics (n = 81)

Variable	Frequency (n)	Percentage (%)
Maternal Age (years)		
≤25	35	43.2%
26–35	38	46.9%
>35	8	9.9%
Mode of Delivery		
Vaginal Delivery	33	40.7%
Cesarean Section	48	59.3%
Maternal Diabetes Mellitus	12	14.8%
Maternal Hypertension	19	23.5%
Antenatal Steroids Given	47	58.0%

The primary outcome of the study hypoglycemia was observed in 28 neonates, representing a frequency of **34.6%**. This highlights that more than one in three preterm newborns developed hypoglycemia, underscoring the clinical importance of early glucose monitoring and intervention in this population.

Table 3: Frequency of Hypoglycemia in Preterm Newborns

Hypoglycemia Status	Frequency (n)	Percentage (%)
Present	28	34.6%
Absent	53	65.4%

To better understand which neonatal factors were associated with hypoglycemia, subgroup comparisons were conducted. Hypoglycemia was significantly more common among neonates with a gestational age below 32 weeks ($p = 0.001$) and those with a birth weight below 1500 grams ($p < 0.001$). Gender, however, was not statistically associated with the occurrence of hypoglycemia ($p = 0.489$).

Table 4: Association of Neonatal Characteristics with Hypoglycemia

Variable	Hypoglycemia Present (n=28)	Hypoglycemia Absent (n=53)	p-value
Gender (Male)	16 (57.1%)	26 (49.1%)	0.489
Gestational Age <32w	21 (75.0%)	19 (35.8%)	0.001**
Birth Weight <1500g	13 (46.4%)	5 (9.4%)	0.000**

Further analysis of maternal variables revealed significant associations as well. Neonatal hypoglycemia occurred more frequently among infants born to diabetic mothers ($p = 0.002$) and those with hypertensive pregnancies ($p = 0.016$). Interestingly, antenatal corticosteroid administration was associated with a lower rate of hypoglycemia ($p = 0.024$), suggesting a protective effect.

Table 5: Association of Maternal Characteristics with Neonatal Hypoglycemia

Variable	Hypoglycemia Present (n=28)	Hypoglycemia Absent (n=53)	p-value
Maternal Diabetes	9 (32.1%)	3 (5.7%)	0.002**
Maternal Hypertension	11 (39.3%)	8 (15.1%)	0.016**
Antenatal Steroids Given	11 (39.3%)	36 (67.9%)	0.024*

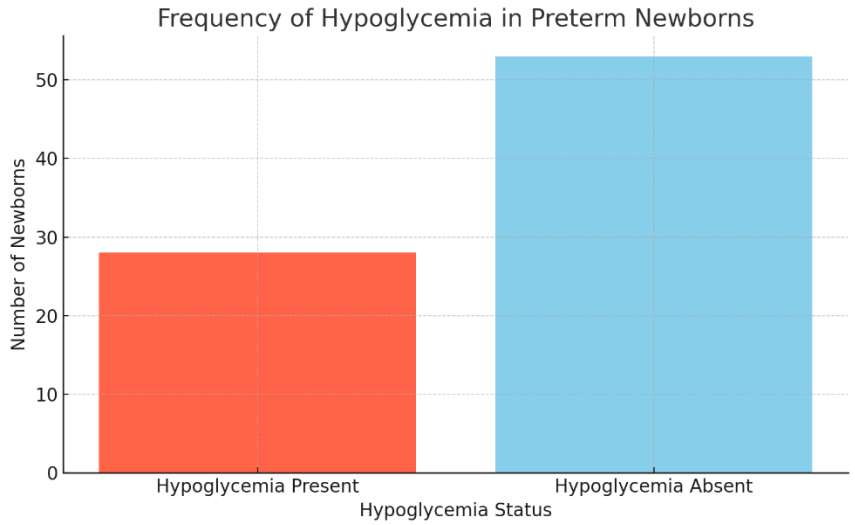

FIGURE 1: bar graph showing the frequency of hypoglycemia in preterm newborns. It clearly illustrates that 28 newborns experienced hypoglycemia while 53 did not.

3. DISCUSSION

The present study investigated the frequency of hypoglycemia among preterm newborns and explored key maternal and neonatal factors associated with its occurrence. Our findings revealed that 34.6% of preterm neonates developed hypoglycemia within the early neonatal period. This frequency is consistent with the range reported in prior research, 'where the incidence of neonatal hypoglycemia in preterm infants typically varies from 20% to 40% depending on gestational age, clinical settings, and screening practices' (10-12).

One of the most significant observations in our study was the higher occurrence of hypoglycemia in neonates born at <32 weeks gestation. This aligns with reports by Harris et al. (2022) and Yao et al. (2021), who found that the degree of prematurity directly correlates with reduced glycogen stores, immature endocrine response, and impaired gluconeogenesis, thereby increasing the risk for hypoglycemia. Similarly, a birth weight below 1500 grams was also found to be a strong predictor of hypoglycemia in our study a finding that resonates with the studies who reported a higher risk in very low birth weight (VLBW) infants due to limited metabolic reserves (13-15).

Maternal health status also showed notable associations. Maternal diabetes, whether gestational or pre-existing, significantly increased the risk of neonatal hypoglycemia ($p = 0.002$). This is consistent with the pathophysiology described by studies, where fetal hyperinsulinemia secondary to maternal hyperglycemia leads to postnatal glucose drops. Additionally, maternal hypertension was associated with a higher frequency of hypoglycemia ($p = 0.016$), supporting studies, who suggested that uteroplacental insufficiency may contribute to intrauterine growth restriction and poor glucose adaptation post-delivery (16-18).

Interestingly, our study also found that administration of antenatal corticosteroids was associated with a reduced risk of hypoglycemia ($p = 0.024$). This may be explained by the maturation effect steroids have on fetal organ systems, including the liver and adrenal glands, enhancing glycogen synthesis and hormonal regulation after birth. This protective trend has been previously documented by studies and is now being increasingly emphasized in perinatal care guidelines (19).

Gender did not significantly influence the frequency of hypoglycemia in our findings, which is consistent with previous studies, who observed no meaningful gender-based variation in neonatal glucose levels in preterm populations (20).

While our results are in line with several national and international studies, it is important to recognize that hypoglycemia in preterm neonates often remains underdiagnosed, especially when asymptomatic. Routine monitoring and early detection protocols are crucial for improving outcomes and minimizing neurodevelopmental consequences.

4. CONCLUSION

This study demonstrated that hypoglycemia is a common metabolic complication in preterm newborns, affecting more than one-third of the sample. The risk was significantly higher among neonates with lower gestational age, low birth weight, and those born to diabetic or hypertensive mothers. On the other hand, antenatal steroid administration appeared to reduce the risk, underscoring its protective role.

Given the significant associations found, our findings advocate for targeted glucose monitoring protocols in high-risk preterm neonates, especially those born before 32 weeks or weighing under 1500 grams. Maternal screening and prenatal optimization of diabetes and hypertension can also contribute to reducing neonatal hypoglycemia rates. Early identification and prompt management remain essential to preventing potential long-term neurodevelopmental harm.

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