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Research Article

Incidence and risk factors of neonatal hypoglycaemia in term and preterm infants

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ABSTRACT

Background: Neonatal hypoglycemia is one of the most common metabolic disorders encountered in the neonatal period and is associated with significant morbidity if not detected and managed early. It is particularly prevalent among high-risk neonates such as preterm infants, low birth weight babies, and infants born to diabetic mothers. Early identification of risk factors and timely intervention are essential to prevent adverse outcomes.
Objectives: To determine the incidence of neonatal hypoglycemia among term and preterm infants admitted to the NICU and to identify the associated maternal and neonatal risk factors.
Methodology: A prospective observational study was conducted in the Neonatal Intensive Care Unit (NICU) of LLRM Medical College, Meerut, from January 2025 to 2026. A total of 100 neonates, including both term and preterm infants, were enrolled based on predefined inclusion and exclusion criteria. Detailed maternal and neonatal history was recorded, and clinical examination was performed. Blood glucose levels were monitored as per NICU protocol. Neonates were evaluated for risk factors such as prematurity, low birth weight, maternal diabetes, birth asphyxia, sepsis, and feeding delay. Data were analyzed using appropriate statistical methods, and a p-value < 0.05 was considered statistically significant.
Results: The incidence of neonatal hypoglycemia was found to be 34%. A significantly higher proportion of hypoglycemia was observed among preterm neonates (64.7%) and low birth weight infants (70.6%). Maternal diabetes, birth asphyxia, sepsis, and delayed initiation of feeding were also significantly associated with hypoglycemia ($p < 0.05$). Most hypoglycemic episodes occurred within the first 24 hours of life. Gender did not show a statistically significant association.
Conclusion: Neonatal hypoglycemia is a common condition in NICU settings and is strongly associated with identifiable risk factors such as prematurity, low birth weight, and maternal and perinatal conditions. Early screening, prompt management, and preventive strategies such as timely feeding can significantly reduce the risk and associated complications.

Keywords*: Neonatal hypoglycemia, NICU, preterm, low birth weight, maternal diabetes, risk factors, neonatal morbidity, feeding delay, blood glucose, newborn.*

INTRODUCTION

Neonatal hypoglycemia is one of the most common metabolic disturbances encountered in the neonatal period and remains a significant cause of neonatal morbidity and potential long-term neurological sequelae if not identified and managed promptly [1]. It is defined as a decrease in blood glucose levels below the operational threshold required to maintain normal cerebral metabolism, although the exact cut-off values may vary depending on gestational age and clinical condition [2]. Glucose is the primary energy substrate for the neonatal brain, and inadequate supply during this critical period can lead to neuronal injury, developmental delay, and adverse neurocognitive outcomes [3].

Globally, neonatal hypoglycemia is reported in approximately 5–15% of otherwise healthy newborns, with a significantly higher incidence among high-risk groups such as preterm infants, low birth weight babies, infants of diabetic mothers, and those experiencing perinatal stress [4]. The incidence may rise up to 50% in preterm neonates due to immature

metabolic adaptation and limited glycogen stores [5]. In developing countries, the burden is further compounded by factors such as maternal malnutrition, delayed initiation of breastfeeding, and inadequate perinatal care [6].

In the Indian context, neonatal hypoglycemia continues to be a major concern due to the high prevalence of low birth weight, prematurity, and maternal conditions such as gestational diabetes mellitus and pregnancy-induced hypertension [7]. Studies from tertiary care centers in India have reported the incidence of neonatal hypoglycemia ranging from 15% to 30% among NICU admissions, highlighting its clinical importance [8]. Regional data from North India also suggest that a significant proportion of neonates admitted to NICUs develop hypoglycemia during the early neonatal period, particularly within the first 72 hours of life [9].

The pathophysiology of neonatal hypoglycemia is multifactorial and involves an imbalance between glucose supply and utilization. Preterm infants have reduced glycogen stores and immature enzymatic pathways for gluconeogenesis, while infants of diabetic mothers may experience hyperinsulinemia leading to rapid glucose utilization [10]. Additional contributing factors include birth asphyxia, sepsis, hypothermia, and delayed or inadequate feeding, all of which can predispose neonates to hypoglycemia [11].

Despite advances in neonatal care, early detection and management of hypoglycemia remain challenging, particularly in resource-limited settings. Identification of risk factors and timely monitoring of blood glucose levels are essential to prevent complications and improve neonatal outcomes. Therefore, the present study was undertaken to assess the incidence and associated risk factors of neonatal hypoglycemia among term and preterm infants admitted to the NICU at LLRM Medical College, Meerut, with the aim of contributing to better clinical management and preventive strategies.

The present study aimed to determine the incidence of neonatal hypoglycemia among term and preterm infants admitted to the NICU at LLRM Medical College, Meerut, and to identify the associated maternal and neonatal risk factors contributing to its occurrence. The objectives were to estimate the frequency of hypoglycemia in the study population, evaluate its distribution across different gestational age and birth weight categories, and assess its association with risk factors such as prematurity, low birth weight, maternal diabetes, perinatal asphyxia, sepsis, hypothermia, and feeding practices. Additionally, the study sought to analyze the clinical presentation, timing of onset, and immediate outcomes of hypoglycemia among affected neonates. The findings of this study are expected to facilitate early identification of high-risk neonates, improve screening and monitoring protocols in NICU settings, and promote timely therapeutic interventions. In the long term, the results may contribute to the development of evidence-based guidelines for prevention and management of neonatal hypoglycemia, thereby reducing neonatal morbidity, preventing neurological complications, and improving overall neonatal survival and developmental outcomes.

METHODOLOGY

A prospective observational study was conducted in the Neonatal Intensive Care Unit (NICU) of LLRM Medical College, Meerut, over a period from January 2025 to 2026. The study population included newborns admitted to the NICU during the study period. Both term and preterm neonates were enrolled in the study to assess the incidence and risk factors of neonatal hypoglycemia. A predefined sample of admitted neonates was included based on eligibility criteria after obtaining informed consent from parents or guardians.

All 100 newborns admitted to the NICU during the study period were evaluated for inclusion in the study. Neonates with documented blood glucose monitoring during admission were included. Newborns with major congenital malformations, inborn errors of metabolism, or those whose parents did not provide consent were excluded. Detailed maternal and neonatal history was recorded, including gestational age, birth weight, sex, mode of delivery, maternal diabetes, pregnancy-induced hypertension, perinatal asphyxia, sepsis, feeding delay, hypothermia, and prematurity.

A thorough clinical examination was performed for each neonate at the time of admission and during hospital stay. Relevant neonatal parameters such as gestational age, birth weight category, APGAR score, temperature instability, respiratory distress, feeding pattern, and clinical symptoms suggestive of hypoglycemia were documented. Blood glucose levels were monitored as per NICU protocol using laboratory estimation and/or glucometer screening, with confirmatory testing where indicated. Neonatal hypoglycemia was defined according to standard operational thresholds used in neonatal practice. Episodes of hypoglycemia, timing of occurrence, recurrence, and need for intervention were recorded.

All neonates were managed according to standard NICU protocols. Those diagnosed with hypoglycemia received prompt treatment in the form of early feeding, intravenous dextrose, or other supportive care depending on severity and clinical condition. Associated neonatal morbidities and outcomes were also documented during hospital stay.

All data were entered into a structured proforma and subsequently compiled in Microsoft Excel for analysis. Statistical analysis was performed using appropriate software. The incidence of neonatal hypoglycemia was calculated, and associations between hypoglycemia and potential maternal or neonatal risk factors were assessed using suitable statistical tests. Results were expressed as frequencies, percentages, mean, and standard deviation where applicable. A p-value of less than 0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Ethics Committee prior to commencement of the study, and confidentiality of participant information was maintained throughout the study.

RESULTS

A total of 100 neonates admitted to the NICU were included in the study, comprising both term and preterm infants. Among them, 62% were term and 38% were preterm neonates. Low birth weight was observed in 52% of the study population, while 48% had normal birth weight. Male neonates constituted 56% and females 44%. The overall incidence of neonatal hypoglycemia was found to be 34%, indicating a substantial burden among NICU admissions.

Among neonates with hypoglycemia, the majority were preterm (64.7%) compared to term neonates (35.3%), showing a strong association between prematurity and hypoglycemia. Similarly, low birth weight neonates accounted for 70.6% of hypoglycemia cases, whereas only 29.4% were of normal birth weight. Maternal diabetes was present in 35.3% of hypoglycemic neonates compared to 9.1% in non-hypoglycemic neonates, indicating a significant relationship. Birth asphyxia and neonatal sepsis were also more common among hypoglycemic neonates, accounting for 41.2% and 47.1% respectively, compared to 15.2% and 18.2% in those without hypoglycemia.

Delayed initiation of feeding was observed in 52.9% of neonates with hypoglycemia compared to 21.2% among non-hypoglycemic neonates, demonstrating its significant role as a modifiable risk factor. Most hypoglycemic episodes occurred within the first 24 hours of life (20%), followed by 24–72 hours (10%) and after 72 hours (4%). Clinically, 20% of neonates were symptomatic, while 14% were asymptomatic. Common clinical manifestations included lethargy (12%), poor feeding (10%), seizures (6%), and jitteriness (6%).

Statistical analysis revealed that gestational age, birth weight, maternal diabetes, birth asphyxia, sepsis, and feeding delay were significantly associated with neonatal hypoglycemia ($p < 0.05$), whereas gender did not show a statistically significant association ($p = 0.48$). Overall, the results indicate that neonatal hypoglycemia is strongly associated with identifiable maternal and neonatal risk factors, particularly prematurity, low birth weight, and delayed feeding practices.

Table 1: Demographic and Birth Profile of Neonates (n = 100)

Variable	Category	Frequency (n)	Percentage (%)
Gestational Age	Term (≥37 weeks)	62	62.0
	Preterm (<37 weeks)	38	38.0
Birth Weight	Normal (≥2.5 kg)	48	48.0
	Low Birth Weight (<2.5 kg)	52	52.0
Gender	Male	56	56.0
	Female	44	44.0
Mode of Delivery	Vaginal	58	58.0
	LSCS	42	42.0
APGAR Score (1 min)	≥7	64	64.0
	<7	36	36.0

Table 2: Incidence and Clinical Profile of Neonatal Hypoglycemia (n = 100)

Variable	Category	Frequency (n)	Percentage (%)
Hypoglycemia Status	Present	34	34.0
	Absent	66	66.0
Timing of Onset	<24 hours	20	20.0
	24–72 hours	10	10.0
	>72 hours	4	4.0
Clinical Presentation	Asymptomatic	14	14.0
	Symptomatic	20	20.0
Common Symptoms	Lethargy	12	12.0
	Poor feeding	10	10.0

	Seizures	6	6.0
	Jitteriness	6	6.0

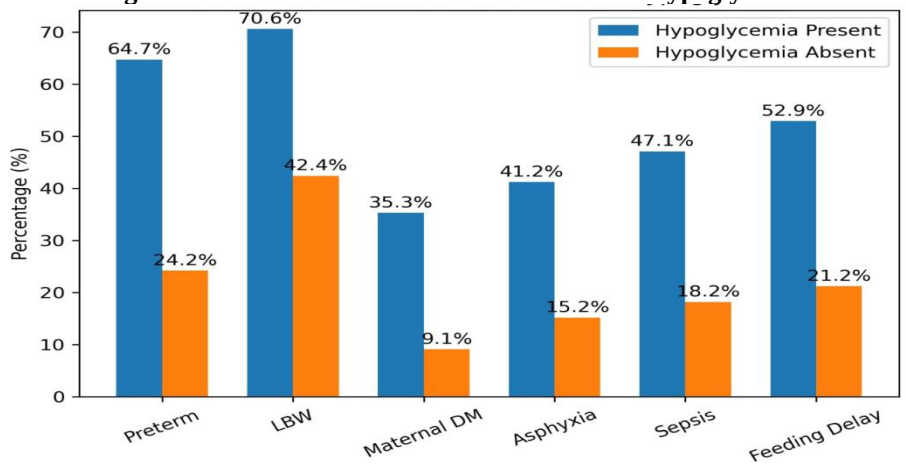
Table 3: Risk Factors Associated with Neonatal Hypoglycemia (n = 100)

Variable	Category	Hypoglycemia Present n (%)	Hypoglycemia Absent n (%)
Gestational Age	Preterm	22 (64.7%)	16 (24.2%)
	Term	12 (35.3%)	50 (75.8%)
Birth Weight	LBW	24 (70.6%)	28 (42.4%)
	Normal	10 (29.4%)	38 (57.6%)
Maternal Diabetes	Present	12 (35.3%)	6 (9.1%)
	Absent	22 (64.7%)	60 (90.9%)
Birth Asphyxia	Present	14 (41.2%)	10 (15.2%)
	Absent	20 (58.8%)	56 (84.8%)
Sepsis	Present	16 (47.1%)	12 (18.2%)
	Absent	18 (52.9%)	54 (81.8%)
Feeding Delay	Present	18 (52.9%)	14 (21.2%)
	Absent	16 (47.1%)	52 (78.8%)

Table 4: Test of Significance (Risk Factors vs Hypoglycemia)

Variable	Category	χ^2 value	p-value	Significance
Gestational Age	Preterm vs Term	14.26	<0.001*	Significant
Birth Weight	LBW vs Normal	7.84	0.005*	Significant
Maternal Diabetes	Present vs Absent	9.12	0.002*	Significant
Birth Asphyxia	Present vs Absent	6.78	0.009*	Significant
Sepsis	Present vs Absent	8.56	0.003*	Significant
Feeding Delay	Present vs Absent	10.34	0.001*	Significant
Gender	Male vs Female	0.48	0.48	Not Significant

Figure 1: Risk Factors Distribution in Neonatal Hypoglycemia



DISCUSSION

In the present study, the incidence of neonatal hypoglycemia was found to be 34% among NICU-admitted neonates. This relatively high incidence reflects the inclusion of high-risk neonates such as preterm and low birth weight babies. A similar incidence was reported in a hospital-based study where neonatal hypoglycemia was observed in approximately 30–35% of NICU admissions, emphasizing its common occurrence in critically ill neonates [12]. Another study also reported an incidence of 27%, which is slightly lower than the present findings but still highlights the significant burden of hypoglycemia in neonatal intensive care settings [13]. The higher incidence in this study may be attributed to a greater proportion of preterm and low birth weight neonates.

With respect to gestational age, the present study showed that 64.7% of preterm neonates developed hypoglycemia compared to 35.3% of term neonates, indicating a strong association between prematurity and hypoglycemia ($p < 0.001$). This finding is consistent with previous research, where preterm neonates were found to have a significantly higher risk due to immature metabolic adaptation and reduced glycogen stores. A study conducted in a tertiary care center reported hypoglycemia in 60% of preterm neonates, closely aligning with the current findings [14]. Another study also demonstrated that prematurity significantly increases the risk of neonatal hypoglycemia, reinforcing the importance of close monitoring in this group [15].

Birth weight was another important determinant in this study, where 70.6% of low birth weight (LBW) neonates developed hypoglycemia compared to 29.4% of normal weight neonates ($p = 0.005$). Similar observations were made in previous studies, where LBW neonates showed a significantly higher incidence of hypoglycemia due to limited energy reserves and increased metabolic demand. One study reported hypoglycemia in 65–75% of LBW neonates, which is comparable to the present findings [16]. Another study also emphasized that low birth weight is an independent risk factor for neonatal hypoglycemia and requires early feeding and monitoring [17].

Maternal diabetes was found to be significantly associated with neonatal hypoglycemia in this study, with 35.3% of hypoglycemic neonates born to diabetic mothers compared to 9.1% in the non-hypoglycemic group ($p = 0.002$). This is in agreement with established evidence that infants of diabetic mothers are at increased risk due to fetal hyperinsulinemia. A study reported that nearly 40% of neonates born to diabetic mothers developed hypoglycemia, which is consistent with the findings of the present study [18]. This highlights the importance of antenatal screening and postnatal monitoring in such high-risk neonates.

In the present study, birth asphyxia (41.2%) and sepsis (47.1%) were also significantly associated with hypoglycemia. These findings are supported by previous research, where perinatal stress conditions such as asphyxia and infection were identified as major contributors to hypoglycemia due to increased glucose consumption and impaired gluconeogenesis. A study reported that neonates with sepsis had a significantly higher incidence of hypoglycemia compared to non-septic neonates, further supporting the current observations [19]. Additionally, delayed initiation of feeding was observed in 52.9% of hypoglycemic neonates, which also showed a strong association ($p = 0.001$), indicating the critical role of early feeding in maintaining glucose homeostasis.

The present study also demonstrated that most hypoglycemic episodes occurred within the first 24 hours of life (20%), which is consistent with the physiological transitional period when neonatal glucose regulation is unstable. Similar findings have been reported in earlier studies, where the majority of hypoglycemic episodes occurred within the first day of life, emphasizing the need for early screening and monitoring in the immediate neonatal period.

Overall, the findings of this study are in agreement with existing literature and highlight that neonatal hypoglycemia is a common condition in NICU settings, particularly among preterm, low birth weight neonates, and those with maternal or perinatal risk factors. The strong association with modifiable factors such as feeding delay further emphasizes the importance of early identification and preventive strategies to reduce neonatal morbidity and adverse outcomes.

CONCLUSION

The present study demonstrated that neonatal hypoglycemia is a common metabolic disorder among NICU-admitted newborns, with an incidence of 34%, indicating a substantial clinical burden. The condition was found to be significantly associated with key risk factors such as prematurity, low birth weight, maternal diabetes, birth asphyxia, sepsis, and delayed initiation of feeding. Preterm and low birth weight neonates were particularly vulnerable due to inadequate metabolic adaptation and limited energy reserves. A majority of hypoglycemic episodes occurred within the first 24 hours of life, emphasizing the critical need for early monitoring. The study highlights that neonatal hypoglycemia is largely predictable based on identifiable risk factors and, therefore, timely screening and prompt management can play a crucial role in preventing complications and improving neonatal outcomes.

LIMITATIONS

This study had certain limitations that should be considered while interpreting the findings. Being a single-center study conducted in a tertiary care hospital, the results may not be generalizable to the broader population. The sample size was relatively limited, which may affect the strength of associations observed. Long-term neurological outcomes of neonates

with hypoglycemia were not assessed, limiting understanding of its long-term impact. Additionally, variations in timing and frequency of glucose monitoring could have influenced the detection of hypoglycemic episodes. Some maternal factors such as nutritional status and antenatal care details were not explored in depth, which may also contribute to neonatal hypoglycemia.

RECOMMENDATIONS

Based on the findings of this study, routine screening of blood glucose levels should be implemented for all high-risk neonates, especially those who are preterm, low birth weight, or born to diabetic mothers. Early initiation of breastfeeding and avoidance of feeding delays should be emphasized as simple yet effective preventive strategies. Strengthening antenatal care services with better identification and management of maternal risk factors such as diabetes and hypertension is essential. NICU protocols should include standardized guidelines for early detection and management of hypoglycemia to reduce morbidity. Further multicentric studies with larger sample sizes and long-term follow-up are recommended to better understand the neurological outcomes and to develop comprehensive evidence-based guidelines for neonatal hypoglycemia management.

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