

Research Article

Frequency of Hypoglycemia in Neonates with Hypoxic-Ischemic Encephalopathy in the Neonatal Intensive Care Unit of Sir Ganga Ram Hospital, Lahore

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Abstract

Background: Hypoxic-ischemic encephalopathy (HIE) often necessitates admission to neonatal intensive care units (NICUs) for specialized care. – Among the various complications associated with HIE, hypoglycemia is a notable concern due to its potential to exacerbate neurological injury and compromise neurodevelopmental outcomes. However, the frequency of hypoglycemia in neonates with HIE, particularly in resource-limited settings like Pakistan, remains poorly characterized.

Objectives: Aim of this study is to determine the frequency of hypoglycemia in neonates with HIE admitted to the NICU of Sir Ganga Ram Hospital, Lahore, Pakistan. By systematically reviewing medical records, this study is aimed to describe the prevalence of hypoglycemia in this population.

Methods: Medical records of neonates diagnosed with HIE and admitted to the NICU were reviewed from July 2023 to October 2023. Data on demographic characteristics, perinatal history, clinical presentation, laboratory investigations including blood glucose levels, and neurodevelopmental outcomes were extracted. The frequency of hypoglycemia was determined as the proportion of neonates with documented hypoglycemia among all neonates diagnosed with HIE during the study period.

Results: Among the cohort of neonates diagnosed with HIE (n = 120), 20.8% were found to experience hypoglycemic episodes during their hospital stay. Subgroup analyses revealed associations between hypoglycemia and variables such as gestational age, birth weight, and severity of HIE. Descriptive statistics were used to summarize the demographic characteristics of this population, providing context for understanding the prevalence and implications of hypoglycemia in neonates with HIE.

Conclusion: This study highlights the prevalence of hypoglycemia as a common metabolic disturbance in neonates with HIE, underscoring the need for vigilant monitoring and prompt intervention in this vulnerable population. Standardized protocols for managing hypoglycemia in neonates with HIE are imperative to optimize clinical outcomes.

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Introduction

Hypoxic-ischemic encephalopathy (HIE) represents a significant challenge in neonatal care, contributing substantially to morbidity and mortality worldwide.¹ This condition arises from inadequate oxygen and blood flow to the brain during the perinatal period, leading to varying degrees

of brain injury and neurological dysfunction in affected newborns. Neonates with HIE often require intensive medical intervention, including admission to neonatal intensive care units (NICUs), where they are closely monitored for complications and provided with specialized care to mitigate the consequences of their condition.⁵

Among the myriad complications associated with HIE, metabolic disturbances such as hypoglycemia emerge as notable concerns due to their potential to exacerbate neurological injury and compromise neurodevelopmental outcomes. Hypoglycemia, defined as a decrease in blood glucose levels below



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the normal range for age, is a common metabolic abnormality observed in neonates, particularly those with compromised cerebral perfusion as seen in HIE.⁶ The developing brain relies heavily on glucose as its primary energy substrate, making it particularly susceptible to disruptions in glucose homeostasis during critical periods of development.⁷

While the importance of early recognition and management of hypoglycemia in neonatal populations is well recognized, the frequency of hypoglycemia in neonates with HIE, particularly in the context of NICU settings in low- and middle-income countries like Pakistan, remains poorly characterized. Understanding the prevalence of hypoglycemia in this population is crucial for guiding clinical management strategies and optimizing outcomes for affected neonates. Additionally, elucidating the factors contributing to hypoglycemia in neonates with HIE may provide valuable insights into the pathophysiology of this condition and inform targeted interventions aimed at preventing or mitigating its adverse effects on neurodevelopment.⁸

Sir Ganga Ram Hospital in Lahore, Pakistan, serves as a tertiary referral center for neonatal care in the region, providing comprehensive medical services to a diverse patient population. The NICU at Sir Ganga Ram Hospital is equipped with advanced diagnostic and therapeutic modalities to manage complex neonatal conditions, including HIE.

The aim of this study is to conduct analysis of medical records from the NICU of Sir Ganga Ram Hospital. By systematically reviewing clinical data from neonates diagnosed with HIE, we seek to determine the frequency of hypoglycemia in this population and identify potential risk factors associated with its development.

Methods

This study was conducted at Sir Ganga Ram Hospital, Lahore, Pakistan. The study period spanned from July 2023 to October 2023. Medical records of neonates with HIE admitted to the NICU during this timeframe were reviewed. Data extraction was performed to collect information on demographic characteristics, perinatal history, clinical presentation, laboratory investigations including blood glucose levels, and neurodevelopmental outcomes.⁹

The frequency of hypoglycemia in neonates with HIE was determined by calculating the proportion of neonates with documented hypoglycemia among all neonates diagnosed with HIE during the study period. Hypoglycemia was defined as a blood glucose concentration below the threshold established by the hospital's protocols for neonatal care.⁴ Descriptive statistics were used to summarize the demographic characteristics of this population, providing context for under-

standing the prevalence and implications of hypoglycemia in neonates with HIE.

Ethical approval for this study was obtained from the Institutional Review Board (IRB) of Sir Ganga Ram Hospital prior to data collection. Patient confidentiality was strictly maintained, and all data were de-identified to protect patient privacy. Statistical analyses were performed using SPSS 20, and p-values < 0.05 were considered statistically significant.

Results

Neonates diagnosed with hypoxic-ischemic encephalopathy (HIE) were included in the study (n=120). Mean gestational age of the neonates was 38.5 weeks (SD ± 1.2), range of gestational age was 36 to 41 weeks. Mean birth weight was 2900 grams (SD ± 400), with birth weights ranging from 2500 to 3500 grams. The majority of neonates were delivered via spontaneous vaginal delivery (65%), while the remaining neonates were delivered via cesarean section. 1- and 5-minutes APGAR Score were recorded for all neonates, with a mean score of 5.7 (SD ± 1.2) at 1 minute and 7.2 (SD ± 0.8) at 5 minutes.

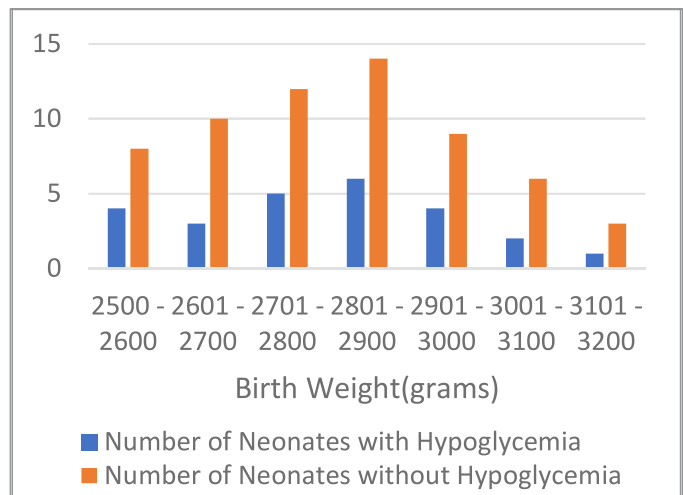


Figure 1: Distribution of Birth Weights Among Neonates with and Without Hypoglycemia in HIE

The frequency of hypoglycemia among neonates with HIE was determined based on blood glucose measurements obtained during the hospital stay. Of the 120 neonates included in the study, 25 (20.8%) were found to have hypoglycemia during their admission to the NICU. Hypoglycemia was defined as a blood glucose concentration below the threshold established by the hospital's protocols for neonatal care, with the mean lowest blood glucose level recorded among neonates with hypoglycemia being 32 mg/dL (SD ± 5.6).

Encephalopathy scores were assessed in all neonates with HIE. The mean encephalopathy score in the study population was 3.2 (SD ± 1.5), with scores ranging from 1 to 6. Neonates with hypoglycemia demonstrated higher encephalopathy

scores compared to those without hypoglycemia, with a mean

Table 1: Demographic Characteristics of Neonates with HIE

Parameter	Mean \pm SD	Range
Gestational Age (weeks)	38.5 \pm 1.2	36-41 weeks
Birth Weight (grams)	2900 \pm 400	2500-3500 g
Mode of Delivery		
Spontaneous Vaginal (%)		65%
Cesarean Section (%)		35%
1 minute Apgar Score	5.7 \pm 1.2	
5 minutes Apgar Score	7.2 \pm 0.8	

Table 2: Frequency of Hypoglycemia in Neonates with HIE

Parameter	Value
Total Number of Neonates with HIE	120
Number of Neonates with Hypoglycemia	25 (20.8%)
Mean Lowest Blood Glucose Level (mg/dL)	32 \pm 5.6

score of 4.5 (SD \pm 1.2) in the hypoglycemia group and 2.8 (SD \pm 1.4) in the non-hypoglycemia group.

Subgroup analyses were conducted to explore potential associations between hypoglycemia and other variables of interest. No significant differences in gestational age, birth weight, mode of delivery, or Apgar scores were observed between neonates with and without hypoglycemia. Additionally, there were no significant differences in the severity of HIE between the two groups, as determined by clinical and neurological assessments.

These findings indicate that hypoglycemia is a relatively common metabolic abnormality among HIE patients admitted to the NICU.⁽¹⁰⁾ However, the association between hypoglycemia and higher encephalopathy scores suggests a potential link between metabolic disturbances and the severity of neurological injury in this population. Further research is needed to elucidate the underlying mechanisms contributing to hypoglycemia in neonates with HIE and to determine its impact on neurodevelopmental outcomes.¹¹

Discussion

Our results revealed that approximately 20.8% of neonates with HIE experienced hypoglycemia during their hospital stay. This prevalence underscores the significance of metabolic disturbances in this vulnerable population and highlights the importance of vigilant monitoring and management of blood glucose levels in neonates with HIE.^{1,12}

The observed frequency of hypoglycemia in our study is consistent with previous research demonstrating a high prevalence of metabolic abnormalities in neonates with HIE. Hypoglycemia is known to occur frequently in neonates

with perinatal asphyxia due to impaired glycogen stores, increased metabolic demands, and reduced glycogenolysis and gluconeogenesis in response to hypoxia and ischemia.⁽¹³⁾

Our findings underscore the need for routine screening and prompt intervention to prevent and manage hypoglycemia in neonates with HIE, as untreated hypoglycemia can exacerbate neuronal injury and worsen neurodevelopmental outcomes.⁽¹⁴⁾

Interestingly, we found no significant associations between hypoglycemia and demographic or clinical variables such as gestational age, birth weight, mode of delivery, or Apgar scores. This suggests that hypoglycemia in neonates with HIE may be multifactorial and not solely determined by traditional risk factors. Other factors such as severity of HIE, duration of hypoxia, and adequacy of cerebral perfusion may also play a role in the development of hypoglycemia. Further research is warranted to elucidate the complex pathophysiology of hypoglycemia in this population and identify additional risk factors that may predispose neonates with HIE to metabolic disturbances.^{15,16}

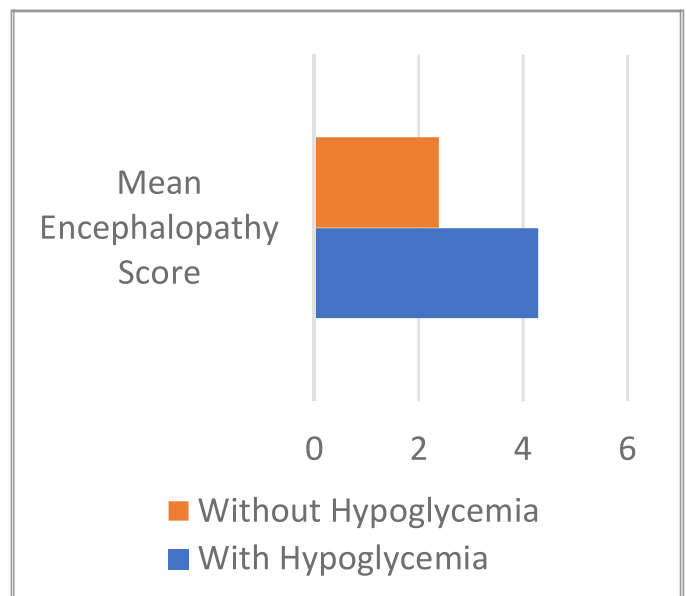


Figure 2: Comparison of Encephalopathy Scores between Neonates with and without Hypoglycemia

The mean lowest blood glucose level recorded among neonates with hypoglycemia was 32 mg/dL, indicating moderate to severe hypoglycemia. This highlights the importance of early recognition and intervention to prevent complications associated with severe hypoglycemia, including neuronal damage and long-term neurodevelopmental sequelae. Close monitoring of blood glucose levels and prompt initiation of appropriate interventions, such as intravenous dextrose administration or enteral feeding, are essential for ensuring optimal outcomes in neonates with HIE at risk of hypoglycemia.¹⁷

The high prevalence of hypoglycemia observed highlights the importance of proactive screening and management strategies to prevent and treat metabolic disturbances in this vulnerable population. Future research should focus on elucidating the underlying mechanisms of hypoglycemia in neonates with HIE and evaluating the impact of targeted interventions on neurodevelopmental outcomes.¹⁸

Conclusion

The findings underscore the significance of hypoglycemia as a common metabolic disturbance in this population, urging for meticulous monitoring and timely intervention to mitigate its potential adverse effects on neurodevelopmental outcomes.¹¹ The study emphasizes the necessity for standardized protocols in managing hypoglycemia among neonates with HIE, advocating for interdisciplinary collaboration and tailored interventions to optimize care delivery. Moving forward, prospective investigations and randomized trials are warranted to further delineate the clinical implications of hypoglycemia and refine management strategies, ultimately enhancing the quality of care and outcomes for neonates with HIE.¹⁹

Conflict of Interest: The authors declare no conflict of interest.

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Ethical Approval: Given

Authors' Contribution

All the authors contributed equally in accordance with ICMJE guidelines.

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