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Correlation Of Cord Blood Glycated Hemoglobin (Hba1c) With Neonatal Hypoglycemia In Term Newborns Born To Diabetic Mothers

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Abstract

This study investigates the relationship between cord blood glycated hemoglobin (HbA1c) levels and the incidence of neonatal hypoglycemia in term newborns born to diabetic mothers. Neonatal hypoglycemia, a common complication in infants of diabetic mothers, can result in severe neurological damage if not promptly identified and managed. This research involved 40 term neonates, divided into hypoglycemic and non-hypoglycemic groups based on their blood glucose levels within the first 24 hours of life. The mean cord blood HbA1c levels were compared between these two groups. The study found that neonates who developed hypoglycemia had significantly higher mean cord blood HbA1c levels compared to those who did not develop hypoglycemia. These findings align with previous studies suggesting that cord blood HbA1c could serve as a reliable predictor of neonatal hypoglycemia, thus emphasizing the importance of close monitoring and early intervention in this high-risk population.

Introduction

Diabetes mellitus (DM) is a global health crisis, with its prevalence rapidly increasing alongside rising obesity rates. In India, the prevalence of diabetes reached 9.3% in 2018, with projections from the International Diabetes Federation indicating further increases in the coming decades. Among pregnant women, diabetes—whether gestational diabetes mellitus (GDM) or pregestational diabetes mellitus (PGDM)—is associated with multiple complications, both maternal and neonatal. Gestational diabetes, defined as glucose intolerance with onset during pregnancy, affects between 6% to 21% of pregnancies in India, with higher rates observed in urban areas.

Neonatal hypoglycemia is one of the most common and serious complications associated with maternal diabetes, characterized by dangerously low blood glucose levels in the newborn. This

condition can lead to both acute and long-term neurological impairments, including brain injury, cognitive deficits, and motor dysfunction, making early detection and management crucial. The incidence of neonatal hypoglycemia is significantly higher in infants of diabetic mothers (IDMs) compared to those of non-diabetic mothers, with studies reporting rates as high as 30% in some populations.

Glycated hemoglobin (HbA1c) is a well-established marker for monitoring long-term glucose control in individuals with diabetes, reflecting average blood glucose levels over the past 2 to 3 months. In the context of pregnancy, maternal HbA1c levels can provide insights into the intrauterine environment and the extent of fetal exposure to hyperglycemia. Elevated maternal HbA1c levels have been linked to adverse neonatal outcomes, including hypoglycemia, due to the hyper insulinemic state induced in the fetus by chronic maternal hyperglycemia.

This study aims to examine the correlation between cord blood HbA1c levels and the incidence of neonatal hypoglycemia in term newborns born to diabetic mothers. By understanding this relationship, we hope to identify a potential predictive marker for neonatal hypoglycemia, which could guide early intervention and improve outcomes in this vulnerable population.

Materials and Methods

This observational study was conducted at Krishna Hospital's Department of Pediatrics between August 2022 and November 2023. The study included 40 term newborns born to mothers diagnosed with GDM, Type 1, or Type 2 diabetes mellitus. Exclusion criteria included preterm births, intrauterine growth restriction, congenital anomalies, and newborns with conditions affecting blood sugar levels, such as sepsis or the use of certain medications during pregnancy.

Cord blood samples were collected immediately after birth and tested for HbA1c levels using Latex Immunoturbidimetry. Neonatal blood glucose levels were monitored using a glucometer at various intervals during the first 24 hours of life, and hypoglycemia was confirmed with a venous blood sample if needed.

Results

The study population consisted of 40 newborns, with a mean gestational age of 38.42 weeks and a mean birth weight of 3.13 kg. The mean cord blood HbA1c level was 5.51%, ranging from 4.0% to 6.9%. Among the 40 newborns, 17 (42.5%) developed hypoglycemia, while 23 (57.5%) did not.

Table 1: Characteristics of Study Population

Characteristic	Mean ± SD	Range
Gestational Age (weeks)	38.42 ± 1.03	37 – 41
Birth Weight (kg)	3.13 ± 0.34	2.6 – 3.9
Cord Blood HbA1c (%)	5.51 ± 1.00	4.0 – 6.9

Table 2: Comparison of Cord Blood HbA1c Levels in Hypoglycemic and Non-Hypoglycemic Newborns

Group	Number of Newborns	Mean Cord Blood HbA1c (%) ± SD	p-value
Hypoglycemic (n=17)	17	6.49 ± 0.28	< 0.001
Non-Hypoglycemic (n=23)	23	4.78 ± 0.64	

Table 3: Blood Glucose Levels at Various Intervals in Hypoglycemic Newborns

Time of Measurement (Hours)	Mean Blood Glucose (mg/dL) ± SD
At Birth	42.33 ± 7.16
30 Minutes	44.28 ± 8.05
2 Hours	46.18 ± 10.48
4 Hours	48.98 ± 12.31
6 Hours	49.10 ± 13.59
10 Hours	51.58 ± 14.59
14 Hours	53.58 ± 15.52
18 Hours	58.00 ± 16.62
24 Hours	60.55 ± 15.68

Discussion

The results of this study demonstrate a significant correlation between elevated cord blood HbA1c levels and the incidence of neonatal hypoglycemia in term newborns born to diabetic mothers. This finding aligns with the study by Sosenko et al. (1982), which also reported higher HbA1c levels in hypoglycemic infants compared to non-hypoglycemic infants born to diabetic mothers. The higher HbA1c levels reflect poor maternal glycemic control during pregnancy, leading to increased fetal exposure to glucose and subsequent neonatal hyperinsulinism, which predisposes the newborn to hypoglycemia.

Arumugam and Abdul Majeed (2011) further support our findings, highlighting that glycated hemoglobin is a strong predictor of neonatal hypoglycemia in pregnancies complicated by diabetes. Similarly, the study by Taylor et al. (2002) reported that higher maternal HbA1c levels were associated with an increased risk of neonatal hypoglycemia, particularly in cases of poorly controlled diabetes. These studies underscore the importance of tight glycemic control during pregnancy to reduce the risk of neonatal hypoglycemia.

In contrast, Meenakshi et al. (2014) observed no significant correlation between cord blood HbA1c and neonatal hypoglycemia in a cohort of tightly controlled diabetic pregnancies. This discrepancy may be attributed to differences in study design, population characteristics, and the degree of glycemic control achieved during pregnancy. Tight glycemic control can mitigate the adverse effects of maternal hyperglycemia on the fetus, thereby reducing the incidence of neonatal hypoglycemia.

Our study also found that symptomatic hypoglycemia occurred earlier in infants with higher cord blood HbA1c levels, particularly within the first few hours of life. This finding aligns with the study by Raj and Mahapatra (2015), which observed that cord blood HbA1c levels above 6% were associated with a higher risk of neonatal hypoglycemia and macrosomia. Additionally, a study by Grazyna et al. (2009) identified a similar trend, noting that infants of diabetic mothers with higher HbA1c levels were more likely to experience early-onset hypoglycemia. These results suggest that elevated HbA1c not only predicts the occurrence of hypoglycemia but also its severity and timing, emphasizing the need for early and frequent glucose monitoring in newborns at risk.

On the other hand, the study by Ashworth et al. (1983) found that while HbA1c levels were higher in diabetic pregnancies, there was no significant correlation with neonatal hypoglycemia when maternal diabetes was well-controlled. This suggests that maternal glycemic control is a critical factor in determining neonatal outcomes. Well-controlled maternal diabetes may reduce the risk of neonatal hypoglycemia, even in the presence of elevated HbA1c levels. This finding is further supported by research conducted by Widness et al. (1989), who emphasized that maintaining

optimal maternal blood glucose levels can prevent neonatal hypoglycemia and its associated complications.

The negative correlation observed between cord blood HbA1c and blood glucose levels at later time points in asymptomatic hypoglycemic infants may indicate that higher HbA1c levels could be a marker for prolonged or delayed hypoglycemia. This observation is consistent with the findings of Garcia-Patterson et al. (2012), who noted that maternal BMI and weight gain during pregnancy were predictors of neonatal hypoglycemia, potentially due to their impact on maternal and fetal glucose metabolism. The combination of maternal HbA1c, BMI, and pregnancy weight gain may offer a more comprehensive assessment of the risk of neonatal hypoglycemia.

The differences in findings across various studies highlight the complexity of predicting neonatal hypoglycemia and suggest that a combination of factors, including maternal HbA1c, glycemic control, and maternal BMI, should be considered in assessing the risk. Further research with larger and more diverse populations is necessary to fully understand the interplay of these factors and to develop robust predictive models.

Conclusion

This study demonstrates that higher cord blood HbA1c levels are significantly associated with the development of neonatal hypoglycemia in term newborns of diabetic mothers. The findings support the use of cord blood HbA1c as a predictive marker for neonatal hypoglycemia, potentially improving early diagnosis and management. However, the study's results also underscore the need for comprehensive maternal glucose management during pregnancy to minimize the risk of adverse neonatal outcomes. Further research is recommended to validate these findings and to explore the influence of maternal factors on neonatal health.

References

1. Sosenko JM, Kitzmiller JL, Fluckiger R. Umbilical cord glycosylated hemoglobin in infants of diabetic mothers: Relationships to neonatal hypoglycemia, macrosomia, and cord serum C-peptide. Diabetes Care. 1982;5:566-70.
2. Ashworth L, Home PD, Gerrard J, Lind T, Anderson J, Alberti KGMM. Glycosylated Haemoglobin in Cord Blood Following Normal and Diabetic Pregnancies. Diabetologia. 1983;25:482-485.
3. Arumugam K, Abdul Majeed N. Glycated haemoglobin as a predictor of neonatal hypoglycaemia in pregnancies complicated by diabetes. Malaysian J Pathol. 2011;33(1):21-24.
4. Garcia-Patterson A, Aulinas A, María MÁ et al. Maternal body mass index as a predictor of neonatal hypoglycemia in gestational diabetes mellitus. J Clin Endocrinol Metab. 2012;97:1623-1628.
5. Taylor R, Lee C, Kyne-Grzebalski D et al. Clinical outcomes of pregnancy in women with type 1 diabetes. Obstetrics & Gynecology. 2002;99:537-541.
6. Grazyna D, Horodnicka-Józwa A, Petriczko E, Biczysko-Mokosa A. Diabetes in pregnancy: cord blood insulin level and neonatal outcome in relation to maternal glycated hemoglobin A1c in the last trimester of pregnancy. J Endocrinol Invest. 2009;32(4):320-325.
7. Widness JA. Fetal risks and neonatal complications of diabetes mellitus. In: Brody SA, Ueland K, Kase N, editors. Endocrine Disorders in Pregnancy. Norwalk CN: Appleton and Lange; 1989. pp. 273-297.