ORIGINAL ARTICLE

Glycemic Status of Infant of Diabetic Mother Neonates Presenting to Tertiary Care Hospital of Peshawar: A Cross-Sectional Study

Jelwa Sani, Hina Parvaiz*, Noman Khan, Mansoor Safi, Ibrarullah

ABSTRACT

Objective: To determine the impact of sepsis on the glycemic status of infants of diabetic mothers presenting to Lady Reading Hospital, Peshawar.

Study Design: A cross-sectional study.

Place and Duration of Study: The study was conducted at the Pediatric Department, Medical Teaching Institute, Lady Reading Hospital, Peshawar, Pakistan, from 1st March 2025 to 31st September 2025.

Methods: Neonates presenting to the nursery department with a history of maternal diabetes (Type 1 or Type 2) were enrolled after obtaining informed written consent from parents. Hypoglycemia was checked with an Accu Check Abbot glucometer as per protocol for IDM neonates and monitored serially. Sepsis was evaluated clinically, and septic markers were sent to confirm sepsis. Data were analyzed using SPSS version 27, and descriptive analyses were conducted. Scale variables results were documented as mean and standard deviation, and categorical variables as frequency and percentages.

Results: The mean age of the neonates in our study was 3.42 ± 2.3 hours (mean ± S.D.), and the mean weight was 4 ± 0.59 kg (mean ± S.D.). The male neonates were 60.3%, and the female neonates were 39.7%. The mean Random blood sugar recorded at 24 hours was 50.2 ±8.1 mg/dl (mean ± S.D.) The mean recovery time from hypoglycemia was 38 ±18 hours (mean±S.D.). The mean hospital stay was 4.49 ± 3.6 days (mean ± S.D.). The *P*-value was significant for the association between RBS at 24 hours of age below 50mg/dL and sepsis. There was a significant association between recovery time from hypoglycemia and the presence of sepsis in neonates.

Conclusion: The presence of sepsis accentuates the presence of hypoglycemia in already compromised IDM neonates**.**

Keywords: *Diabetes, Diabetes Mellitus, Newborn, Sepsis.*

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Introduction

The term "neonatal hypoglycemia" describes the transient state of a lower blood sugar level in a newborn, which is particularly common among babies whose mothers have diabetes.[1] The global incidence of diabetes in pregnancy is increasing day by day.[2] Understanding effects of impaired metabolism processes on reproductive and maternal health, pregnancy, and fetal outcomes is increasingly important, as maternal obesity significantly affects the health of both mothers and infants.[3] Diabetes mellitus is a chronic endocrine/metabolic disease with a wide range of clinical manifestations and diverse etiologies, mostly through insulin resistance and/or insulin insufficiency.[4] Every diabetic complication increases the burden on both the afflicted person and society. Families, friends, and public health initiatives are all impacted by the direct and indirect expenditures (healthcare and associated lost productivity).[4] Infants of Diabetic Mothers (IDM) are neonates born to mothers with

Department of Pediatrics
Medical Teaching Institute, Lady Reading Hospital, Peshawar, Pakistan
Correspondence:
Dr. Hina Parvaiz
Assistant Professor, Pediatrics
Medical Teaching Institute, Lady Reading Hospital, Peshawar, Pakistan
E-mail: hnprvz@gmail.com
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uncontrolled diabetes, either pre-existing (Type 1 or Type 2) or gestational diabetes that develops during pregnancy.[5] Pregestational and gestational diabetes are risk factors for increased mortality and severe newborn morbidity.[6,7]

The prevalence rate of GDM is high in our country (Pakistan). Baluchistan had the largest subgroup pooled estimate of GDM (35.8%), followed by Islamabad (23.9%), Khyber Pakhtunkhwa (17.2%), Sindh (13.2%), and Punjab (11.4%).

With studies showing a prevalence between 8.42% and 35.80%, and specifically 17.2% in Khyber Pakhtunkhwa.[8] In 5–27% of IDM cases, hypoglycemia develops in a study done in Norway.[9]

After birth, cord clamping abruptly stops the newborn's glucose delivery, which causes hypoglycemia in the first few hours due to increased fetal insulin levels. Between the first and third hours of life, the newborn's blood glucose levels drop to their lowest points. For up to 72 hours and, in extreme circumstances, even up to 7 days, hypoglycemia may be an issue.[10,11] These neonates are at risk for various complications due to an altered intrauterine environment, such as hyperglycemia. This condition can lead to fetal complications like macrosomia (birth weight >4 kg), polyhydramnios, intrauterine growth restriction (IUGR), and congenital abnormalities.[12] Certain congenital abnormalities are linked to diabetic embryopathy and are more prevalent in IDMs. Compared to the general population, birth defects are two to three times more likely in newborns with pregestational diabetes.[13] Other neonatal complications include neonatal hypoglycemia, cardiovascular and respiratory insufficiency, delayed lung maturity, cardiomegaly, and hypertrophy of the interventricular septum.[5] IDM babies are associated with poor perinatal outcomes, including negative impacts on neurodevelopmental outcomes.[14]

Neonatal sepsis is an invasive infection. Reduced spontaneous activity, less vigorous sucking, apnea, bradycardia, temperature instability, respiratory distress, vomiting, diarrhea, abdominal distention, jitteriness, convulsions, and jaundice are among the numerous, nonspecific symptoms.[15] Chronic hypertensions, gestational diabetes, and maternal diabetes mellitus all raise the risk of sepsis in infants.[16]

Glycemic status reporting is very important during the perinatal period in infants of diabetic mothers. Literature regarding documentation of coexistent sepsis in infants of diabetic mothers is lacking, which can significantly impact the prognosis in such children. Our study will highlight the impact of sepsis on the glycemic status of IDM babies and recovery time.

Methods

This cross-sectional study was conducted at the Department of Pediatric and Neonatology, Medical Teaching Institute, Lady Reading Hospital, Peshawar, Pakistan from 1st March 2025 to 31st September 2025. To determine the impact of sepsis on the glycemic status of infants of diabetic mothers (IDM). Data were collected over 6 months after obtaining ethical approval from the hospital's Institutional Review Board vide letter no: 127/LRH/MTI, dated: 15th February 2025. Data was collected by a consecutive sampling technique. The sample size was calculated using OpenEpi software, assuming a prevalence of 5% (8) and a 95% confidence interval with a 5% margin of error. The calculated sample size is 73. Neonates born to diabetic mothers or mothers with gestational diabetes were included in this study. Neonates with inborn errors of metabolism were excluded. The following standard definitions were considered while conducting this study.

Infants of Diabetic Mothers (IDM): Babies born to a mother with either pre-existing (Type 1/Type 2) diabetes before the 20th week of gestation or gestational diabetes that develops after the 20th week of gestation.

Sepsis: Neonatal sepsis is a serious bacterial infection that presents with a wide range of nonspecific symptoms, including feeding difficulty, lethargy, cardiorespiratory instability, gastrointestinal disturbances, neurologic signs, and jaundice.[15]

Neonatal hypoglycemia: American Academy of Pediatrics definition of hypoglycemia will be used, taking RBS below 47mg/dl for preterm or full-term neonates.[17,18]

All IDM neonates presenting to the nursery department were enrolled after taking informed written consent from parents. The status of maternal diabetes was confirmed from the maternal medical

record, maternal risk factors for sepsis, including prolonged, difficult labour, Premature rupture of membranes for >18 hours, maternal fever, and chorioamnionitis. Neonates were examined for signs and symptoms of sepsis, such as lethargy, reluctance to feed, jaundice, and vomiting. Gestational age and the presence of any complications were documented. The septic workup including Complete blood count. C-reactive protein and blood culture were sent to confirm or refute sepsis. Neonates were then grouped as septic and non-septic IDM neonates. Hypoglycemia was checked upon arrival at the nursery and then serially thereafter, as per protocol: hourly for 6 to 8 hours and 2 hourly for 48 hours. Random blood sugars (RBS) were taken with an Accu-Chek glucometer after cleaning the skin with an alcohol swab and pricking the heel side of the neonate with a sterile needle. Neonates were managed for hypoglycemia as per protocol and their random blood sugar was checked per protocol. RBS at 24 hours, time for improvement or recovery from hypoglycemia were noted in the questionnaire. The type of fluids needed based on the strength of dextrose, that is, 10% dextrose or 12% dextrose, was documented. Neonates were allowed oral feed if they could take it, and documented whether they could or not. Neonates were followed for recovery from hypoglycemia, and RBS levels at 24 hours of age were considered for comparison between septic and non-septic IDM neonates.

Data was analyzed using SPSS version 27, descriptive analysis was done for both scale and categorical variables. For scale variables, results were documented as mean and standard deviation. For categorical variables, results were written as frequencies and percentages. *A P-value* <0.05 was taken as significant for the study.

Results

The mean age of the neonates in our study was 3.42 ± 2.3 hours (mean ± S.D.), the mean weight was 4±0.59kg (mean ± S.D.). The male neonates were 60.3%, and the female neonates were 39.7%. The mean Random blood sugar recorded at 24 hours was 50.2 ± 8.1 (mean ± S.D.). Neonates were managed as per protocol for transient hypoglycemia. The mean recovery time from hypoglycemia was 38±18 hours (mean±S.D.). The mean hospital stay in days was 4.49±3.6 (mean±S.D.). The description of the categorical variables is given in Table 1.

Table 2 shows inferential statistics, that is, Chi-

Table 1: Descriptive statistics for categorical variables

Variables	Category	Frequency	Percentage
Gestation	Premature	7	9.6 %
	Full term	66	90.4 %
Maternal Diabetes	Gestational diabetes only	38	52.1 %
	Diabetic	35	47.9 %
Complication	None	30	41.1 %
	Hyperbilirubinemia	16	21.9 %
	Respiratory Distress Syndrome	16	21.9 %
	Hypocalcemia	7	9.6 %
	Hypomagnesemia	2	2.7 %
	Hypertrophic cardiomyopathy	2	2.7 %
Sepsis	No	46	63 %
	Yes	27	37 %
Dextrose Strength Used	None	2	2.7 %
	10% dextrose	68	93.2 %
	12% dextrose saline	3	4.1 %
Oral Feeding	No	64	87.7 %
	Yes	9	12.3 %

Table 2: Comparison of septic and non-septic Infants of Diabetic Mothers (IDM) neonates regarding random blood sugars (RBS) and recovery time

Variable	Category	Sepsis		*Chi-Square* value	*P*-value
		No	Yes		
RBS at 24hours	<50	52.20%	74.10%	3.4	0.05
	>50	47.80%	25.90%		
recovery time in hours	<48 hours	89.10%	63.00%	7.1	0.01
	>48 hours	10.90%	37.00%		

Square test results. It shows the association between Sepsis and RBS at 24 hours of age and recovery time from hypoglycemia.

The *P*-value was significant for the association between RBS at 24 hours of age when taken below 50 and sepsis with a value of 0.05. The *P*-value was significant at 0.01 for the association between recovery time from hypoglycemia and the presence of sepsis in neonates.

Discussion

A neonate born to a woman with diabetes during pregnancy is referred to as an infant of a diabetic mother. Pregnant women who have been diagnosed with type 1 or type 2 diabetes or gestational diabetes during pregnancy are referred to as diabetic mothers.[4] Neonates born to these mothers are prone to hypoglycemia. It is crucial to emphasize that in these high-risk babies, early detection and treatment of hypoglycemia episodes are important to prevent long-term neurological damage and change the outcomes.[14,17-19]

Hypoglycemia was not significantly associated with gender or weight of neonates in our study, similar to a study by Manoharan et al., who also reported that hypoglycemia did not significantly correlate with prematurity but was significantly associated with gestational diabetes in neonates of already diabetic mothers.[20]

Parvathi et al reported that neonatal sepsis frequently results in altered glycemic status. In their study among septic newborns with hypoglycemia, mortality was found to be greater. The subgroups with hypoglycemia, hyperglycemia, and normoglycemia had respective mortality rates of 50.0, 33.3, and 7.2%.[21]

Another cohort study done in China by Zhang C et al. discovered that the incidence rate of sepsis was substantially greater in neonates of mothers with gestational diabetes than that of the neonates of non-diabetic mothers.[22] Continuous or recurrent episodes of severe hypoglycemia can harm the central nervous system and even result in death.[22]

Begum S et al found that routine blood glucose monitoring within the first 24 hours aids in the early detection and suitable treatment of hypoglycemia. According to them, 85.6% of IDMs, hypoglycemia appeared within 6 hours of birth.[23] In our study, we found a significant correlation between the presence of sepsis in IDM neonates and the presence of hypoglycemia in neonates within the first 24 hours of age. The hospital stays of neonates were related to the presence of sepsis, but they were also affected by the presence of other complications like RDS, hyperbilirubinemia, and pneumonia.

Rehman A et al., in a study conducted in Multan, reported that while the majority of IDMs had hypoglycemia in the first two hours of life, many developed hypoglycemia in the first six hours. Mothers with longer-term diabetes, LGA, and premature IDMs were observed to have a markedly higher risk of hypoglycemia in their study.[24] According to the Pediatric Endocrine Society guidelines, newborns who are unable to maintain pre-prandial blood glucose levels of more than 50 mg/dL during the first 48 hours of life or more than 60 mg/dL after that are at risk for chronic hypoglycemia and need additional testing before being sent home.[25]

This was a cross-sectional study and involved a smaller sample size. More studies should be done in the same area to further examine the correlation of septic markers and recovery from hypoglycemia in IDM neonates.

Multicenter studies are recommended with other study designs, in our setup, to further elaborate on the role of sepsis-related markers in impacting the recovery time of IDM neonates.

Conclusion

The presence of sepsis accentuates the presence of hypoglycemia in already compromised IDM neonates**.** Septic IDM neonates required longer recovery time for more than 48 hours than non-septic IDM neonates, so the presence of sepsis should always be screened in IDM neonates, and early investigations should be done, as it can accentuate the hypoglycemia and can hamper their recovery. Timely treatment can prevent long term sequalae in these neonates.

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Author Contributions

JS: Manuscript writing for methodology design and investigation

HP: Conception and design of the work, data acquisition, curation, and statistical analysis, validation of data, interpretation, and write-up of results, revising, editing, and supervising for intellectual content, writing the original draft, proofreading, and approval for final submission

NK: Data acquisition, curation, and statistical analysis

MS: Validation of data, interpretation, and write-up of results

I: Revising, editing, and supervising for intellectual content