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Original Article

Paediatrics Section

A Study of Incidence of Hypoglycaemia and Hypocalcaemia in Infants Born to Diabetic Mothers and a Correlation with Maternal Third Trimester Glycaemic Control

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ABSTRACT

Introduction: Incidence of anatomical as well as metabolic complications in infants born to diabetic mothers are increasing. Most of them are due to poor maternal glycaemic control during third trimester. Among the metabolic complications, hypoglycaemia and hypocalcaemia are the most common. This study highlights the importance of third trimester glycaemic control in antenatal diabetic mothers to prevent metabolic complications in babies born to such mothers.

Aim: To correlate the relationship between maternal third trimester glycaemic control and metabolic complications in infants born to them.

Materials and Methods: This study was done from August 2011 to July 2012 in diabetic mothers who were admitted in the hospital for delivery and the newborn babies born to them. Maternal HbA1c level was checked during third trimester and blood samples were collected from newborn for the estimation of blood sugar and serum ionised calcium levels. One-way Chi-square test was used.

Results: Among the 52 mothers included in this study, 30 (57.7%) had HbA1c level >6.1 (poor glycaemic control). Among the 30 babies born to these mothers, 18 babies (85.7%) had hypoglycaemia and 4 babies (57.1%) had hypocalcaemia. The statistical interpretations showed that there was no definite relation between incidence of hypocalcaemia in neonates born to diabetic mothers and their glycaemic control.

Conclusion: Hypoglycaemia is common among infants born to diabetic mothers with poor third trimester glycaemic control. Meticulous glycaemic control during pregnancy is essential to avoid complications.

Keywords: Diabetes, Glycated haemoglobin, Pregnancy

INTRODUCTION

Diabetes mellitus during pregnancy is associated with adverse foetal and maternal outcomes. Improved health care and management of diabetes have reduced the incidence of perinatal complications in infants of diabetic mothers. Planning in advance is important if one wants to have a baby without diabetes induced complications [1]. In such pregnancies, outcome could be expected comparable to the general population.

Diabetes mellitus in pregnancy is classified into two types. Pre-gestational diabetes and gestational diabetes mellitus. Complications in infants born to diabetic mothers are both structural and metabolic. Structural complications like neural tube defects, duodenal atresia, cardiovascular diseases etc., are more common especially when the mother has a poor glycaemic control during the first trimester [2]. Even preconceptional glucose control is essential to avoid congenital anomalies in neonates. Metabolic complications like hypoglycaemia, hypocalcaemia, hyperbilirubinemia etc., are more common in neonates born to diabetic mothers with poor third trimester glycaemic control. Pederson's theory of HYPERGLYCEMIC- HYPERINSULINISM is quoted to explain the metabolic complications in the newborn born to diabetic mothers [3]. Hypoglycaemia is seen in 25-40% of babies born to diabetic mother [4].

A number of studies have been done related to metabolic complications in infants born to diabetic mothers. A study from Islamabad shows that hypoglycaemia is the commonest metabolic complication among babies born to diabetic mothers [5]. Another study from India shows that hypoglycaemia is the most common complication and mostly occurs within first 6 hours of life [6]. Yet another study shows a 2 to 4-fold increase in metabolic complications in untreated diabetic mothers during their pregnancy [7]. The above studies were done in general about the glycaemic status of antenatal mothers and not specific about third trimester. This study was done to emphasise the importance of third trimester glycaemic control to prevent metabolic complications. Thus, the aim was to assess the correlation between maternal third trimesterHbA1c value in diabetic mothers and incidence of hypoglycaemia and hypocalcaemia in babies born to them and to emphasise the importance of strict glycaemic control during pregnancy in diabetic mothers.

MATERIALS AND METHODS

This cohort study was conducted for a period of 12 months (from August 2011 to July 2012) in Tirunelveli Medical College Hospital, Tirunelveli, Tamil Nadu, India, after obtaining ethical clearance from Institutional Ethics Committee (Number-095/PAED/IEC/2011).

Antenatal mothers with diabetes and babies born to them who fulfilled the inclusion criteria and gave consent during the study period were included in this study. Thus, 52 diabetic mothers and their babies were included in this study. Mothers having fasting blood sugar value more than 90 mg/dL and post-prandial blood sugar value more than 120 mg/dL were diagnosed to have diabetes.

Inclusion Criteria

Antenatal mothers with gestational and pre-gestational diabetes and neonates born to them.

Exclusion Criteria

1. Preterm and IUGR neonates born to diabetic mothers.
2. Neonates who had birth asphyxia.
3. Neonates who had congenital anomalies which showed poor first trimester glycaemic control.

Blood sample for calculating HbA1c was collected from antenatal diabetic mothers during third trimester. HbA1c value less than 6.1 was taken as having good glycaemic control according to recent guidelines. Babies born to diabetic mothers were examined clinically and blood samples for estimating sugar and calcium were collected. Blood samples were collected at 1 hour, 2 hour, 3 hour, 6 hour, 12 hour, 24 hour, 36 hour and 48 hour and sent to laboratory for estimating blood sugar values by glucose oxidase method. Blood sugar values less than 45 mg/dL was taken as hypoglycaemia [8]. Blood sample for estimating Ionised calcium by Ion Selective Electrode technique was taken from the new-born at 24th hour of life. Ionised calcium value less than 4 mg/dL was taken as hypocalcaemia [9].

STATISTICAL ANALYSIS

Data collected were entered in Microsoft Excel spread sheet and analysed using SSPS software version 16. Percentages, proportions and mean values were derived. One-way chi-square test was used.

RESULTS

Among the 52 antenatal diabetic mothers included in this study, 42.3% had good third trimester glycaemic control and 57.7% had poor third trimester glycaemic control. Among 52 babies, 21 babies (44.2%) had hypoglycaemia. In 14 out of 21 babies, hypoglycaemia was documented during first day of life [Table/Fig-1-4].

HbA1c level	Frequency	Percentage
<6.1	22	42.3%
>6.1	30	57.7%

[Table/Fig-1]: Third trimester diabetic status of mothers.

Blood sugar value taken at	Minimum value	Maximum value	Mean value
1 hr	32	97	64.04
2 hr	27	121	67.10
3 hr	22	156	80.10
6 hr	25	158	91.94
12 hr	37	156	98.21
24 hr	71	176	107.19
36 hr	62	168	103.38
48 hr	72	178	111.77

[Table/Fig-2]: Blood sugar values of newborn.

Hypoglycaemia	Frequency	Percentage
Yes	21	44.2%
No	31	59.6%

[Table/Fig-3]: Incidence of hypoglycaemia in new born (p-value-0.008).

Hypoglycaemia	HbA1c category		Total
	Higher (>6.1)	Lower (<6.1)	
Yes	18 (85.7%)	3 (14.2%)	21 (100%)
No	12 (38.7%)	19 (61.2%)	31 (100%)
Total	30 (57.7%)	22 (42.3%)	52 (100%)

[Table/Fig-4]: New born hypoglycaemic status Vs maternal third trimester glycaemic status.

Among those 52 babies, only 07 babies had hypocalcaemia [Table/Fig-5]. Among the 21 babies with hypoglycaemia 07 babies were asymptomatic, 05 babies presented with seizures, 05 babies presented with lethargy and refusal of feeds, 03 babies presented with respiratory distress and 01 baby presented with hypothermia. Among babies with hypocalcaemia, 04 babies had jitteriness and 03 babies were asymptomatic.

Hypocalcaemia	Frequency	Percentage
Yes	7	13.5%
No	45	86.5%

[Table/Fig-5]: Incidence of hypocalcaemia in newborn (p-value-0.975).

In this study, among the 52 mothers, 09 had pre-gestational diabetes and 43 had gestational diabetes [Table/Fig-6]. Among the pre-gestational diabetics, 07 mothers (77.8%) had poor glycaemic control and 02 (22.2%) had good glycaemic control. Among mothers with gestational diabetes, 23 mothers (53.5%) had poor glycaemic control and 20 mothers (46.5%) had good glycaemic control. This shows that whether it is pre-gestational or gestational diabetes, the number of mothers with HbA1c value >6.1 was higher than mothers with HbA1c value <6.1.

GDM/DM	HbA1c category		Total
	Higher (>6.1)	Lower (<6.1)	
DM	7 (77.8%)	2 (22.2%)	9 (100%)
GDM	23 (53.5%)	20 (46.5%)	43 (100%)
TOTAL	30 (57.7%)	22 (42.3%)	52 (100%)

[Table/Fig-6]: Diabetic status of pre gestational and gestational diabetic mothers.

Out of 07 babies with incidence of hypocalcaemia, 04 babies (57.1%) were born to mothers with poor third trimester glycaemic control and 03 babies (42.9%) were born to mothers with good third trimester glycaemic control [Table/Fig-7].

Hypocalcaemia	HbA1c category		Total
	Higher (>6.1)	Lower (<6.1)	
Yes	4 (57.1%)	3 (42.9%)	7 (100%)
No	26 (57.8%)	19 (42.2%)	45 (100%)
Total	30 (57.7%)	22 (42.3%)	52 (100%)

[Table/Fig-7]: New born hypocalcaemia status Vs maternal third trimester glycaemic status.

DISCUSSION

Diabetes mellitus complicating pregnancy is increasing in trend worldwide. Complications arise out of it is unique in mothers as well as their babies. Change in treatment modalities to prevent those complications are in trend with rapidly advancing new studies in it.

In this study, out of 21 babies with hypoglycaemia, 18 babies (85.7%) were born to mothers with poor third trimester glycaemic control and 03 babies (14.2%) were born to mothers with good third trimester glycaemic control. Percentage comes to 44.2%. Studies from India [10-12] show the percentage of gestational diabetes to be higher than percentage of pre-gestational diabetes, similar to this study. But in studies from Middle East countries, the incidence of pre-gestational diabetes was higher [13,14]. This might be due to difference in dietary habits and lifestyle. Incidence of hypoglycaemia also varies from 35% to 63% as reported by various authors [5,6,14-16]. These study results are comparable with the current study.

Langer O et al., found a 2 to 4-fold increase in metabolic complications in infants born to untreated diabetic mothers [7]. Similarly, Al-Nemri AM et al., also showed a positive correlation among poor glycaemic control and metabolic complications in neonate born to them but not the exact incidence of hypoglycaemia [17].

From the present study, results and comparative analysis with similar studies, it can be clearly inferred that hypoglycaemia in neonates born to diabetic mothers is more common in pregnancies with poor glycaemic control. HbA1c levels of diabetic mothers can be used as a screening marker to monitor, anticipate hypoglycaemic episodes in new born.

For calcium levels, 13.5% of babies in the study were found to have hypocalcaemia. Literature reports a varied range from 15% to 9%

[10,11,15,18]. However, this is comparable with the present study. With respect to the sample analysed (p-value is 0.975, which is statistically not significant) and from the similar study results, it can be inferred that hypocalcaemia can be seen in new-borns born to mothers with poor third trimester control but the association was not supported by statistical analysis [Table/Fig-7].

Limitation(s)

Sample size taken-up for the study was not representative of the target population, since the study sample included mostly referral cases. Glycaemic control of the mothers during their first and second trimesters were not included for the same reason. Foetal insulin levels in cord blood sample to confirm hyperinsulinemia, complications due to impaired glycaemic control such as congenital malformations can be avenues for further studies.

CONCLUSION(S)

Complications in new born, born to diabetic mothers are a preventable problem. Gestational diabetes seems to be more common than pre-gestational diabetes. Hypoglycaemia is the most common metabolic complication in infants born to diabetic mothers and it correlates well with third trimester glycaemic control in mothers. Early recognition, prompt management of complications as per recent guidelines would reduce the mortality and morbidity among babies born to diabetic mothers.

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