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Original Research Article

Maternal and fetal outcome among gestational diabetes mellitus mothers treated at a tertiary care maternity hospital

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ABSTRACT

Background: Incidence of gestational diabetes mellitus (GDM) in India is alarming. The present study was designed to determine the association between the maternal and fetal outcome with the blood sugar control status at the time of delivery.
Methods: It was an analytical follow up study that included 180 antenatal women who met the criteria for GDM with singleton pregnancy irrespective of age, gestational period, parity were included into the study. Those with pre-existing diabetes mellitus, scarred uterus, multiple pregnancy, chronic medical disease and ante partum hemorrhage were excluded. Based on the blood sugar level at the time of delivery GDM mothers were classified into four groups excellent control, optimal control, poor control and no control group. The maternal and fetal outcomes were compared between groups.
Results: Nearly 7500 antenatal women were screened and 198 eligible GDM women were selected. Of which 180 cases were successfully completed the follow up. Among the 180 cases of GDM, 74 (41.1%) were in excellent control group, 40 (22.2%) under optimal control, 41 (22.8%) belonged to poor control and 25 (13.8%) were not controlled at the time of delivery. There was statistically significant positive association between poor glycemic control and bad maternal and fetal outcome.
Conclusions: Bad maternal and fetal outcomes were statistically higher among mothers with poor and no glycemic control. Strict glycemic control during antenatal period is mandate to avoid bad outcomes. Neonatal care center needs to be well equipped where GDM mothers seek care for delivery.

Keywords: Fetal, Gestational diabetes, Glycemic status, Maternal, Outcome

INTRODUCTION

Gestational diabetes mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy.[1,2] The prevalence of GDM in India was alarming at 16.5%.[3] The diabetic explosion is mainly due to obesity pandemic which is attributable to more sedentary life style, diet changes, and epidemic of childhood and adolescent obesity. Indians have an eleven-fold risk of developing DM during the pregnancy.[4]

Patients with GDM are at higher risk for excessive weight gain, preeclampsia, and caesarean sections. Infants born to mothers with GDM are at higher risk for macrosomia, birth trauma, and shoulder dystocia.[5-8] After delivery, these infants have a higher risk of developing hypoglycemia, hypocalcemia, hyperbilirubinemia, respiratory distress syndrome, polycythemia, and subsequent obesity and type-2 diabetes. In addition, having a history of GDM puts the mother at risk for development of type-2 diabetes or recurrent GDM in the future. Some recent data suggest an increased risk of cardiovascular disease, as well.[9,10]

Appropriate diagnosis and management of GDM can improve maternal and perinatal outcome. This study was undertaken to evaluate the maternal and fetal outcome of gestational diabetes mellitus cases and to determine the association between the maternal and fetal outcome with the blood sugar control status at the time of delivery.

METHODS

Study design and setting

Analytical follow up design was adopted to address the study objectives. The study was carried out in Rajiv Gandhi Government Women and Children Hospital, Puducherry. It is a district referral center government facility where all services are provided free of cost. Nearly 100 GDM deliveries are conducted every year in the study setting. It was carried out for a period of two years. The study was carried out for a period of two years from April 2017 to March 2019.

Study participants

Antenatal women who were attending the OPD of antenatal check-up clinic were randomly screened for gestational diabetes mellitus. Those who met the criteria for GDM as per the International Association of Diabetes and Pregnancy Study Group (IADPSG) criteria were the study participants.[11] Those with singleton pregnancy irrespective of age, gestational period, parity were included into the study. Those with pre-existing diabetes mellitus, scarred uterus, multiple pregnancy, chronic medical disease and ante partum hemorrhage were excluded.

Sample size and sampling

It was decided to include all patients who were fulfilling the eligibility criteria and seek antenatal care at the study setting during the data collection period of two years. Hence 180 cases of GDM who completed the follow up successfully were included into the study.

Brief procedure

The study was initiated after obtaining Institute Ethical Committee clearance. Written informed consent was obtained from all eligible study participants before collecting data. All patients were admitted to hospital for assessment of blood glucose profile and control. Blood glucose control was achieved in the first instance by instituting a diabetic diet. In women whose blood glucose profile remained unsatisfactory, i.e. pre-prandial >95 mg/100 ml and 2-hours postprandial blood glucose >120 mg/100 ml subcutaneous insulin was prescribed so as to maintain euglycaemia. The women were subsequently discharged for follow-up in the outpatient department. Monitoring of the diabetic condition included every 15 days by pre-prandial and a 2-hour postprandial blood glucose in each clinic visit. If the diabetic control was unsatisfactory, they were then readmitted. At 20-22 weeks, a fetal abnormality scan was performed, Followed by a repeat growth scan at 32 weeks. Subsequently, growth scans and non-stress tests and amniotic fluid index assessments were used for fetal surveillance as necessary.

At the time of delivery those included in the study were classified into four groups according to blood glucose control level. They were (1) excellent control (2) optimal control (3) poor control and (4) no control group. Maternal outcomes namely polyhydramnios, pre-eclampsia, mode of induction, caesarean section, shoulder dystocia and postpartum hemorrhage were assessed at the end of delivery. Fetal outcomes like macrosomia, birth trauma, hypoglycemia, birth asphyxia, hyperbilirubinemia, respiratory distress syndrome and need for phototherapy, perinatal mortality were recorded and compared between each diabetic blood glucose control groups.

Operational definitions

Excellent control group was one with either pre-prandial or 2 hours postprandial blood glucose levels showing 0-25% of abnormality from the normal values at the time of delivery. Optimal control group was one with showing 26-50% of abnormality from the normal values at the time of delivery. Poor control group was one showing more than 50% of abnormality from normal values at the time of delivery and those with 100% abnormal values were grouped under no control group.

Statistical analysis

Data were entered in Microsoft office Excel and analysed using SPSS for window version 24.0. Percentages were calculated for categorical variables. Two-sided p values were calculated using Chi-square test and ANOVA to ascertain the association between maternal and fetal outcomes with blood sugar control status. All p values were two tailed and <0.05 was considered statistically significant.

RESULTS

During the study period nearly 7500 antenatal women were screened and 198 eligible GDM women were selected which had a prevalence of nearly 2.6%. Of which 180 cases successfully completed the follow up and delivered at the study setting that accounts for 9% lost to follow up. Among the 180 cases of GDM, 74 (41.1%) were in excellent control group, 40 (22.2%) under optimal control, 41 (22.8%) belonged to poor control and 25 (13.8%) were not controlled at the time of delivery. The average age in years of the participants and their gestational age at diagnosis of GDM, who belonged to various status of blood sugar control was mentioned in the Table 1. There was no major difference with respect to age and gestational period. The average age in years ranged from 28.3 to 31.8. The gestational period in weeks ranged from 20.5 to 21.7 weeks.

Table 1: Background characteristics of study participants at the time of enrolment into the study (N=180).

Maternal characteristics	Group based on blood sugar control, Mean (SD)			
	Excellent control n=74 n (%)	Optimal control n=40 n (%)	Poor control n=41 n (%)	No control n=25 n (%)
Age in years	28.3 (8.3)	27.6 (7.6)	31.8 (6.8)	29.2 (4.9)
Gestational age at diagnosis (weeks)	21.3 (2.6)	20.5 (3.1)	21.7 (2.9)	20.8 (2.6)

Table 2: Association between maternal outcome and their blood sugar status during antenatal period (N=180).

Maternal outcome	Group based on blood sugar control (N=180)				P value#
	Excellent control n=74 n (%)	Optimal control n=40 n (%)	Poor control n=41 n (%)	No control n=25 n (%)	
Usage of induction for labour	39 (52.7)	20 (50)	26 (63.4)	11 (44)	0.434
Maternal morbidity	29 (39.2)	11 (27.5)	27 (65.9)	12 (48)	0.004*
Pre-eclampsia	3 (4.1)	0	5 (12.2)	2 (8)	0.094
Polyhydramnios	0	1 (2.5)	8 (19.5)	5 (20)	< 0.001*
Caesarean section	28 (37.8)	12 (30)	19 (46.3)	13 (52)	0.262
Preterm labour	3 (4.1)	0	5 (12.2)	6 (24)	0.002*
Shoulder dystocia	0	0	0	2 (8)	0.006*
Genital tract injury	0	0	1 (2.4)	0	0.333
Wound infection	2 (2.7)	0	2 (4.9)	5 (20)	0.002*

Note: # p value based on Pearson chi-square test, * statistically significant (p<0.05).

Table 3: Association between fetal outcome and mother's blood sugar status during antenatal period (N=180).

Fetal outcome		Group based on blood sugar control (N=180)				P value
		Excellent control n=74 n (%)	Optimal control n=40 n (%)	Poor control n=41 n (%)	No control n=25 n (%)	
Fetal complication		7 (9.5)	2 (5)	16 (39)	18 (72)	<0.001*
Macrosomia		1 (1.4)	0	8 (19.5)	2 (8)	<0.001*
Jaundice		0	0	5 (12.2)	2 (8)	0.004*
Preterm		2 (2.7)	0	7 (17.1)	8 (32)	<0.001*
Birth asphyxia		1 (1.4)	2 (5)	11 (26.8)	9 (36)	<0.001*
Respiratory distress syndrome		0	0	3 (7.3)	8 (32)	<0.001*
Hypoglycemia		0	0	2 (4.9)	8 (32)	<0.001*
Neonatal seizure		3 (4.1)	1 (2.5)	6 (14.6)	5 (20)	0.017*
Neonatal mortality		0	0	1 (2.4)	4 (16)	<0.001*
APGAR score	0-3	0	2 (5)	2 (4.9)	5 (20)	<0.001*
	4-7	1 (1.4)	2 (5)	11 (26.8)	6 (24)	<0.001*
	8-10	73 (98.6)	36 (90)	28(68.3)	14 (56)	<0.001*
Duration of stay in NICU days Mean (SD)@		2.57 (0.8)	2.4 (0.9)	5.37 (0.8)	7.2 (1.5)	<0.005*
Birth weight (Kg) Mean (SD)@		2.92 (0.2)	3.1 (0.9)	3.43 (0.8)	3.14 (1.1)	<0.005*

Note: # p value based on Pearson chi-square test, @ p value based on one way ANOVA, SD- standard deviation, * statistically significant (p<0.05).

The maternal outcomes against all four groups of blood sugar control at the time of delivery were mentioned in Table 2. The induction of labour was more in the poor control group that was 63.4% however this difference was not statistically significant. The incidence of preeclampsia, Caesarean section, and genital tract injury was not statistically different across the groups. The incidence of polyhydramnios was 20% and 19.5% among those with poor and no blood sugar control however it was lesser among those with well controlled group and this difference was statistically significant (p<0.001). Similarly, the incidence of preterm labour, shoulder dystocia, wound

infection and maternal morbidity were higher among cases with poor blood sugar control compared against excellent and optimal control group and all these differences were statistically significant as well (Table 2).

The fetal outcomes against all four groups of blood sugar control among GDM mothers at the time of delivery were mentioned in Table 3. The highest incidence of macrosomia, jaundice, preterm and birth asphyxia among babies born to GDM mothers were 19.5%, 12.2%, 17.1% and 36% respectively. All these were seen among mothers who belonged to poor blood sugar control group and they were less among those with excellent or optimal blood sugar control mothers. These differences were statistically significant across groups ($p<0.001$). Respiratory distress syndrome, hypoglycemia, neonatal seizure, and neonatal mortality were highly incident among GDM mothers belonged to no and poor blood sugar control group and these differences were also statistically significant. The duration of say in NICU and birth weight were also significantly higher among poor control group (Table 3).

DISCUSSION

In the present study the prevalence of GDM was found to be nearly 2.6% and 63.3% of GDM mothers had satisfactory blood sugar control with 41.1% belonging to excellent blood sugar control, and 22.2% had optimal control. The incidence of preterm labour, polyhydramnios, wound infection and maternal morbidity were higher among cases with poor blood sugar control compared and all these differences were statistically significant however there was no statistically significant difference with regards to the incidence of preeclampsia, cesarean section, and genital tract injury among mothers of various groups. Fetal outcomes namely macrosomia, shoulder dystocia, jaundice, preterm and birth asphyxia, respiratory distress syndrome, hypoglycemia, neonatal seizure, and neonatal mortality were higher among mothers who belonged to poor or no blood sugar control group and these differences were statistically significant.

In the present study there was no significant difference in induced labour between controlled and uncontrolled groups and similar finding was noted by a study conducted by Heinz et al.[12] Also in the current study there was no significant difference in incidence of preeclampsia as a maternal outcome among groups and these finding was in alignment with previous studies done across various countries.[13-15] Incidence of polyhydramnios was statistically higher among poor glycemic control group in our study and it was same in studies conducted in other parts of world as well.[16,17] Usage of induction was uniformly spread out in the four groups in our study and there was no difference in incidence of caesarean section among four groups. The two above facts could have exercised bias regarding degree of control and outcome. Since these two factors had uniform occurrence in our study the outcomes which had significance namely polyhydramnios, preterm labour, shoulder dystocia, wound infection and maternal morbidity have to be strongly weighed up.[18]

In the present study shoulder dystocia was statistically higher among GDM mothers belonged to poor control group in our study and this finding was same as that of a study done in Uganda and London.[15,19] Neonatal hypoglycemia, respiratory distress, NICU admission and longer duration of stay and lower APGAR score were higher among mothers with poor glycemic control similarly these findings were higher in a previous study among those diagnosed with GDM.[20-23] In the present study macrosomia was higher among those babies born to poor glycemic control group. Studies reveal that prophylactic insulin therapy will reduce the incidence of macrosomia among infants of GDM.[24] This is also in conformity with a previous study done in BIRDEM hospital, Bangladesh which included both pre GDM and GDM cases.[25] There was no neonatal mortality seen among mothers who had good blood sugar control and they were higher among poor and no control group of GDM mothers in our study and similar finding was also found in studies done in other countries.[18,26]

Our study had much strength and few limitations. Prospective analytical design was adopted for this study that avoided various biases associated with cross sectional studies namely temporality of association and recall bias. Most of the previous studies done were comparing fetal and maternal outcomes between GDM mothers and non-GDM mothers whereas our study was the one that clearly demarcated the GDM mothers into four groups based on their blood sugar control status. This helped us to establish the association between glycemic control status and various fetal and maternal outcomes between groups. We had fairly higher number of participants across groups that increased the power to the group comparison. Irrespective of two years follow up we had lesser proportion of loss to follow up and this could be due to the free and quality service provided at the study setting.

The limitation of our study was that the blood sugar status ascertained at the time of delivery was used to classify the GDM mothers however this might have masked the effect of change in glycemic status over the time frame from diagnosis till delivery.

CONCLUSION

In our study it was found that poor maternal and fetal outcomes were common among GDM mothers who belonged to poor or no blood sugar control group. Induction usage and caesarean section rates were similar in all four groups in our study. The incidence of neonatal morbidity such us macrosomia, jaundice, preterm, birth asphyxia, respiratory distress syndrome, hypoglycemia, neonatal seizure and neonatal mortality were statistically higher among mothers belonging to poor blood sugar control group.

This reiterates strongly that glycemic control among GDM mothers should be the important parameter in their management and neonatal back up is essential for the category of GDM with lesser controlled blood glucose.

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