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Original Research Article

A prospective comparative study of metabolic and haematological profile of infants born to mothers with pregestational and gestational diabetes mellitus

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ABSTRACT

Background: Diabetes mellitus during pregnancy has long been associated with maternal and neonatal morbidity and mortality. Gestational and pregestational diabetes make up the most common maternal metabolic disorder of pregnancy. Suboptimal control of blood glucose has the potential for serious neonatal adverse effects. Neonates of pregestational diabetic mothers are at risk for congenital malformations, perinatal mortality, preeclampsia, preterm birth, increased birthweight, neonatal hypoglycaemia.
Methods: 100 neonates born to diabetic mothers were enrolled in the study during 1 January 2019 to 30 June 2020 at Mediciti institute of medical sciences, Telangana. Gestational age, birth weight, relevant antenatal history of mothers with diabetes mellitus and examination findings were collected and recorded. Blood samples were collected to perform relevant biochemical tests and managed as per unit protocol.
Results: Of the 100 neonates, 93% were born to mothers with GDM, while the remaining 7% were born to mothers with PGDM. 39% (39/100) of mothers had poor glycemic control. Mean birth of neonates born to PGDM mothers was lower when compared to GDM and was statistically significant (p=0.02). Hyperbilirubinemia was the most common abnormality seen in 53% of neonates. Incidence of hypoglycemia, hypocalcemia, hypomagnesemia, polycythemia, hyperbilirubinemia, were higher in infants born to mothers with PGDM and was statistically significant.
Conclusions: Among the pregnancies complicated by diabetes, PGDM continues to have a major contribution. Metabolic and haematological complications are more in neonates born to mothers with PGDM. Hypocalcemia and hyperbilirubinemia was the most common complications in IDM.

Keywords: Hypoglcemia, Pregestational diabetes mellitus, Hypocalcemia

INTRODUCTION

Diabetes mellitus is a common medical complication in pregnancy. Pregnant mothers are classified into those who are known to have diabetes before pregnancy as pregestational diabetes mellitus (PGDM) and those diagnosed during pregnancy as gestational diabetes mellitus (GDM).[1] GDM is defined as carbohydrate intolerance of variable severity with onset or first recognition during the present pregnancy.[1] Approximately 90% of these women have gestational diabetes.[2,3] HbA1C >6.5% is a secondary measure of glycemic control and is associated with poor outcomes in neonates.[3] Women with pre-existing diabetic mellitus are at higher risk utero-placental insufficiency and preterm birth small for gestational age, hypoglycaemia, hypocalcaemia,

hypomagnesemia, hyperbilirubinemia, polycythemia and respiratory distress.[5] Maternal hyperglycaemia leads to hypoglycemia in neonates immediately after birth with the nadir of 1-4 hours. Also, hypocalcemia, polycythemia, and other metabolic disorders in IDM are usually seen within 24 hours to 7 days. Hence neonates in the early neonatal period are monitored for complications.

Objectives

Objectives of current study were to study the metabolic and hematological profile in infants of diabetic mothers and to compare the early neonatal outcome in gestational and pregestational diabetic mothers.

METHODS

Current study was a prospective comparative study done in neonates born to mothers with diabetes mellitus (both gestational and pregestational) in the early neonatal period, conducted at the Mediciti Institute of Medical Sciences (MIMS), Ghanpur, from 1 January 2019 to 31 December 2019.

Inclusion criteria

All live born, neonates of women with diabetes mellitus during/before pregnancy, registered at antenatal clinic at MIMS during study period were included in the study.

Exclusion criteria

Still born and intrauterine deaths of diabetic mothers, neonates born outside MIMS admitted in NICU, twins born to mother with diabetes mellitus and all unregistered deliveries with diabetes mellitus at MIMS were excluded from the study.

After taking informed written consent from the parent or guardian, the relevant information from history, physical examination and antenatal records were recorded in a predesigned proforma. Mothers with DM were separated into those who were known to have diabetes before pregnancy as pregestational and those diagnosed during pregnancy as gestational. GDM in mothers was diagnosed according to IADPSG 2011 criteria during the study period.[6] The diagnosis of GDM was made if plasma glucose values according to IADPSG guidelines: fasting: >92 mg/dl, 1 hour OGTT >180 mg/dl, 2 hour OGTT >153 mg/dl. Birth weight of babies was recorded and plotted against their gestational age and classified accordingly as large (LGA), small (SGA) or appropriate for gestational age (AGA). Small for gestational age describes a neonate whose birth weight is less than 10th percentile for gestational age as per Fenton growth charts.

Neonates born before 37 completed weeks were classified as preterm and 42 weeks or more as post-term. Neonates born at 34 to 36 weeks was categorized as late preterm and those born between 37 to 41 6/7 weeks as term baby. Gestational age assessment was confirmed by the new Ballard score. Mode of delivery, APGAR score, baby weight (using digital weighing scale with an error of ±10 grams) was recorded. Blood glucose levels were checked at 0, 1, 2, 3, 6, 12, 24, 36, 48 hours by glucostix (capillary blood glucose). Hypoglycaemia was defined as blood glucose level of less than 40 mg/dl. Complete blood picture with PCV and serum calcium levels were measured through automated analyser, for all neonates whenever symptomatic or at 24 hours of life if not symptomatic. Serum magnesium was done if hypocalcemia was not corrected by the treatment. Hypocalcemia is defined as total serum calcium level less than 7 mg/dl.[7] Polycythemia is defined as venous hematocrit more than 65% or a venous hemoglobin concentration in excess of 22.0 g/dl.[7] Serum bilirubin was taken at the onset of clinical jaundice according to Kramer's scale and phototherapy given as per AAP charts.[8] Blood sample of 2 ml was collected in EDTA and gel tubes for the above purpose. Admissions and treatment of neonates were done according to unit protocol. All neonates were monitored up to the 7th day of life. Neonates from the postnatal ward are discharged on 3rd day of life and all also those discharged from the hospital before 7 days, were followed up as outpatient on 7th day of life.

The clinical profile was then compared between the two sub groups PGDM and GDM. Mothers of both groups with HbA1c levels less than 6.5% were labelled as having a good glycemic control whereas mothers with HbA1c levels more than 6.5% as poor glycemic control. All the details were documented and All the relevant data was collected as per proforma and tabulated in Microsoft Excel and Analysis was done by using computer software SPSS (statistical package for social sciences). Categorical variables are expressed as number of patients and percentage of patients and compared across the groups using Fisher's exact test/Pearson's Chi square test for independence of attributes as appropriate. An alpha level of 5% has been taken, if any p value was less than 0.05, it had been considered as significant.

RESULTS

A total number of 1531 registered deliveries were conducted at MIMS during the study period, out of which 103 mothers had diabetes mellitus (both gestational and pregestational). A total of 100 neonates were included in the study after applying exclusion criteria and neonates who were lost to follow-up. Out of the above, 93 neonates (93%) were born to GDM mothers and 7 (7%) were born to PGDM mothers. Among 93 neonates born to GDM mothers 34.4% were born to mothers with poor glycemic control and among 7 neonates born to PGDM 100% neonates were born to mothers with poor glycemic control which was statistically significant (p=0.02) (Table 1). 54 neonates were males and 46 neonates were females in the present study. Most neonates born to mothers with

GDM were born term 87% (81/93) and most neonates born to mothers with PGDM were born preterm 57.1% (4/7) and was statistically significant (p=0.005).

Table 1: Distribution of maternal glycemic control.

Glycemic control	Good control	Poor control	Total (n=100)
Gestational DM, N (%)	61 (65.6)	32 (34.4)	93
Pre gestational DM, N (%)	-	7 (100)	7
Total (%)	61	39	100

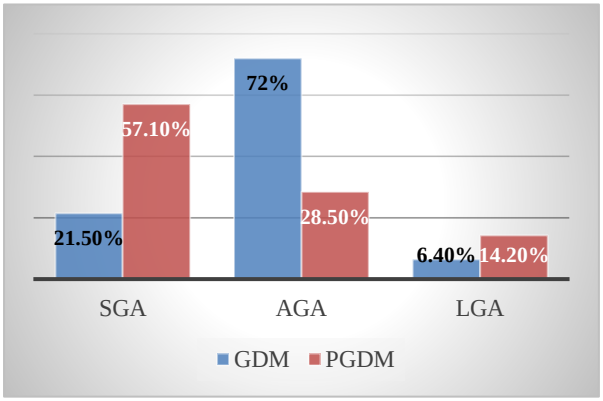

Figure 1: Distribution of neonates according to birth weight and gestational age.

Neonates born to GDM mothers were mostly AGA 72% (67/93) and neonates born to PGDM were mostly SGA 57.1% (4/7) and was statistically significant (p<0.05) (Figure 1). Most neonates (61%) were between birth weight of 2.5 kg to 3.5 kg (Table 2).

Table 2: Distribution of birth weights of IDMs (n=100).

Parameters			N (%)
Birth weight (kgs)	Type	N	
<2.5	GDM	22	26 (26)
	PGDM	4	
2.5-3.5	GDM	59	61 (61)
	PGDM	2	
3.6-4.0	GDM	10	11 (11)
	PGDM	1	
>4.0	GDM	2	2 (2)
	PGDM	0	

Mean birth weight of neonates born to mothers with GDM was 2.9±0.5 kg. and with PGDM was 2.45±0.6 kg. Mean birth weight of PGDM was lower than PGDM and was statistically significant (p=0.02). Among 100 neonates 66% of neonates needed NICU admission. 63% of neonates (59/93) born to GDM mothers and 100% neonates (7/7) born to PGDM mothers were admitted in NICU. Hypoglycemia was seen in 10 neonates. The mean blood glucose levels were lower in neonates born to mothers with PGDM than GDM and was statistically significant (p=0.002) (Table 3).

Table 3: Comparison of mean metabolic values in neonates born to mothers with PGDM and GDM.

Metabolic abnormality	PGDM (mean)	GDM (mean)	P value
Hypogylcemia (n=10)	38±1.04	40±0.8	0.002
Hypocalcemia (n=14)	6.83±0.4	7.17±0.6	0.07
Hypomagnesemia (n=4)	1.07±0.3	1.17±0.8	0.48

Hypocalcemia in neonates born to mothers with PGDM was 42.8% (3/7) and in GDM was 11.8% (11/93). Hypomagnesemia in neonates born to mothers with PGDM was 28% (2/7) and in GDM was 2.1% (2/93). The mean values of calcium in neonates born to PGDM &GDM was 6.83±0.4 and 7.17±0.6 respectively. The mean values of magnesium in neonates born to mothers with PGDM and GDM was 1.07±0.3 and 1.17±0.8 respectively. Mean values of calcium and magnesium were lower in neonates born to mothers with PGDM than in GDM though statistically not significant (Table 3). Polycythemia in neonates born to PGDM was 71.4% (5/7) and in GDM was 18.2% (17/93). The mean values of haematocrit in neonates born to mothers PGDM and GDM was 68.7±0.9 and 67.1±0.8 respectively and was significantly higher in neonates born to mothers with PGDM. Hyperbilirubinemia in neonates born to PGDM was 100% (7/7) and in GDM was 49.4% (46/93).The mean values of serum bilirubin in neonates born to mothers with PGDM and GDM 18±0.6 and 17±1.2 respectively and was significantly higher in neonates born to mothers with PGDM (Table 4).

Table 4: Comparison of mean hematological values in neonates born to mothers with PGDM and GDM.

Haematological abnormality	PGDM (mean)	GDM (mean)	P value
Polycythemia (n=22)	68.7±0.9	67.1±0.8	0.002
Hyperbilirubinemia (n=53)	18±1.06	17±1.02	0.04

DISCUSSION

Cloherty et al in manual of neonatal care states that GDM complicates 6-8% of all pregnancies.[9] In the present study the prevalence of total diabetes mellitus in pregnancy was 6.8%, GDM was 93% and pregestational DM was 7%, which was comparable to the study done by Anjum et al where GDM was 86% and PGDM was 14%.[10] Among GDM 65.5% had good glycemic control and in PGDM 100% of mothers had poor glycemic

control and it was statistically significant. These results were comparable with the study done by Elango et al where mothers with GDM (56.8%) had good control and mothers with PGDM (58.1%) had poor glycemic control.[11] 84% neonates were born term, 15% were born preterm and 1% were born post term. Incidence of term, preterm and post term were comparable to the study done by Elango et al and Senthilkumar et al (81.3%, 17.3%, 1.3%) and (84%, 15.2%, 0.7%) respectively.[11,12] In the present study 57.1% of neonates were born preterm to mothers with PGDM which was statistically significant. This brings out the fetal complications experienced in pregnancy with long standing diabetes mellitus. Sutton et al stated that mothers with T1DM or long-standing T2DM complicated by vascular disease or renal disease are at high risk for fetal growth restriction (FGR), especially asymmetrical FGR, thought to be secondary to uteroplacental vasculopathy.[13] Mean birth weight of neonates born to mothers with GDM was higher when compared to neonates born to mothers with PGDM. This was comparable to the study done by Joewono et al where mean birth weight was less in PGDM and neonates were mostly IUGR and was statistically significant.[14] Hypoglycemia was seen in 10% of neonates and was most common among neonates born to PGDM (42.8%) which was similar to study done by Mahmood et al.[15] Incidence of hypoglycemia was less in the present study when compared to study done by Anjum et al (54%) due to initiation of oral feeds immediately after birth.[10] Incidence of hypocalcemia and hypomagnesemia was higher in neonates born to mothers with PGDM higher 42.8% and 28% respectively. This was comparable with the study done by Girish et al.[16] Incidence of polycythemia and hyperbilirubinemia was higher in neonates born to mothers with PGDM and was statistically significant. These results were comparable to the study done by Elango et al.[11] No deaths occurred among study group during the study period.

Limitations

Limitations of current study was that maternal factors like pre-pregnancy weight and BMI and adherence to treatment was not considered in the present study.

CONCLUSION

The mean blood glucose levels were significantly lower in neonates born to mothers with PGDM. The mean values of polycythemia and hyperbilirubinemia were significantly higher in neonates born to mothers with PGDM. Significantly lower birth weights were observed in infants born to mothers with PGDM than in GDM. The incidence of neonates born preterm were higher in mothers with PGDM than in GDM.

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