



ORIGINAL RESEARCH PAPER

Paediatrics

A COMPARATIVE STUDY OF THE COMPLICATIONS OF INFANTS OF DIABETIC BETWEEN OVERT DIABETIC AND GESTATIONAL DIABETES- PROSPECTIVE STUDY

KEY WORDS: Infant Of Diabetic Mothers; Diabetes In Pregnancy And Glycemic Control

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ABSTRACT

BACKGROUND AND OBJECTIVES: In the present study was investigated that the complications of infants of diabetic between overt diabetic and gestational diabetes. A prospective study was conducted among infants of diabetic mothers born at Meenakshi Medical College Hospital and Research Institute, Kanchipuram between October 2017 to October 2018. The morbidities in IDMs was studied and a comparison was made between infants born to women with pregestational diabetes and gestational diabetes. The perinatal outcome was also studied.

METHODS: All consecutive live born babies born to diabetic mothers at Meenakshi Medical College Hospital and Research institute between October 2017 to October 2018 were included in the study. IDMs were evaluated for morbidities like macrosomia, birth asphyxia, congenital anomalies, birth injuries, respiratory distress, hypoglycemia, hypocalcemia, hyperbilirubinemia and polycythemia. The neonatal complications in IDMs born to pregestational and gestational diabetic mothers were compared and data was analyzed. The perinatal outcome of these IDMs was studied.

RESULTS: The complications seen in IDMs were LGA (20.6%), birth asphyxia (14.7%), Congenital anomalies (32.4%), Respiratory distress (33.3%), RDS (6.1%), hypoglycemia (84.8%), hypocalcemia (3%), hyperbilirubinemia (21.2%) and polycythemia (6.1%). Hairy Pinna was observed in 52.9% of IDMs. Here were no significant statistical differences in the incidence of complications among infants born to women with pregestational and gestational diabetes.

CONCLUSION: we conclude that the early intervention and management of pregnancies complicated by diabetes will good neonatal care will result in decreased complications in IDMs and also will improve outcome in this high risk population.

I. INTRODUCTION

Diabetes Mellitus is a group of metabolic disease characterized by chronic hyperglycemia associated with disturbances of carbohydrate, fat and protein metabolism due to absolute or relative deficiency in insulin and or action¹.

Historically, infants of diabetic mothers have been at significantly greater risk for spontaneous abortion, stillbirth, congenital malformations and perinatal morbidity and mortality. Subsequently, advances in maternal and fetal care have improved the outlook of the infant of a diabetic mother².

The IDMs are at an increased risk for periconceptional, fetal, neonatal and long term morbidities. They have double the risk of serious birth injury, triple the likelihood of cesarean section and quadruple the incidence of admission to a newborn intensive care unit. The causes of the fetal and neonatal sequelae of maternal diabetes are likely multifactorial; however, many of the perinatal complications can be traced to the effect of maternal glycemic control on the fetus and can be prevented or atleast reduced through meticulous prenatal and intrapartum care^{3,4}.

The present study was conducted in infants born to diabetic women at Meenakshi Medical College Hospital and Research Institute. The complications in IDMs were studied and a comparison was made between babies born to mothers with pregestational diabetes and gestational diabetes.

II. METHODOLOGY

All consecutive live born babies born to diabetic mothers in Meenakshi Medical College Hospital and Research Institute, Kanchipuram during the study period (October 2017 to October 2018) formed the study population. Data regarding the diabetic status of the mother was obtained from antenatal records.

Diabetic mothers were grouped into two categories:

- Group-I:** Pregestational (type I DM and type II DM)
- Group-II:** Gestational DM.

The diagnosis of GDM was based on National Diabetes Data Group (NDDG) criteria^{5,6,7}. [NDDG criteria: FBS > 105 mg/dl, 1 hr post prandial value > 190 mg/dl, 2 hr post prandial value > 165 mg/dl and 3 hr post prandial value > 145 mg/dl. If two or more values are met or exceeded, the diagnosis of GDM is established].

The glycemic status of the diabetic mothers was ascertained based on the serial estimation of fasting and post prandial glucose levels. Each patient's fasting and 2hr post prandial blood glucose values were averaged, yielding one mean value per patient per blood glucose type (fasting or 2 hr post prandial). Blood glucose control was defined according to American college of obstetricians and gynecologists guidelines: a mean fasting value of < 95 mg/dl or mean 2 hour post prandial value of < 120 mg/dl. Two groups were identified: women with blood glucose averages within the

recommended guidelines (blood glucose controlled or optimal control) and women with blood glucose averages higher than the recommended guidelines (blood glucose not controlled or suboptimal control).⁸

Mothers antenatal history included data regarding their socio economic status, urban/rural background, family history of diabetes mellitus (in parents) and ultrasonography findings. HbA1c levels during pregnancy (in I trimester in pregestational DM and at diagnosis in GDM) was estimated. Other associated obstetrical and medical problems were noted. Pregnancy induced hypertension was diagnosed if the systolic BP was more than 140 mm Hg and diastolic BP was more than 90 mm Hg. Hypertension prior to conception was diagnosed if BP was above 140/90 mm Hg before pregnancy. Any infections in the mothers during pregnancy was noted.

IIA. INCLUSION CRITERIA

All consecutive live born infants of diabetic mothers born in Meenakshi Medical College Hospital and Research Institute from October 2017 to October 2018 were included under this study.

IIB. EXCLUSION CRITERIA

- Stillborn babies of diabetic mothers.
- Abortions of diabetic mothers.

Babies born to diabetic mothers were evaluated immediately after birth. Those requiring resuscitation were resuscitated according to National Neonatology Forum protocol for newborn resuscitation. Birth asphyxia was defined as an apgar score of ≤ 6 at five minutes.⁹ All babies born to diabetic mothers were then shifted to NICU for monitoring and treatment.

At admission, weight was recorded using digital weighing scale (to nearest 10gms). Gestational age assessment was done by modified Ballard score. Macrosomia was defined as either birth weight greater than the 90th centile for gestational age or > 4000 gm, independent of gestational age or sex.^{10,11} Small for gestational age was defined as birth weight less than the 10th centile for GA. Data regarding detailed.

Examination of the new born was collected in a preformed proforma. Congenital anomalies were identified clinically and supported by Echocardiography. Respiratory distress was defined as respiratory rate of 60/min and/ or presence of subcostal and intercostal retractions.

At admission, blood glucose estimation was done on venous blood sample by glucose oxidase method. Subsequent blood glucose estimation at 1, 2, 3, 6, 12, 24, 36 and 48 hours of postnatal age was done by glucose dextrostix. Infants with blood glucose < 40 mg/dl were subjected to blood glucose estimation by glucose oxidase method. Hypoglycemia was defined as a blood glucose level less than 40 mg/dl in any infant, regardless of gestational age and whether symptomatic or not¹².

Estimation of hemoglobin, hematocrit and serum calcium levels were done in clinical laboratory by automated analyser. Polycythemia was diagnosed if venous hematocrit was greater than 65%. Hypocalcemia was defined as serum calcium level less than 7mg/dl. Bilirubin level estimation was done at the onset of clinical jaundice and repeated if necessary. If jaundice was not clinically evident, then serum bilirubin estimation was done on day 4 of life. Hyperbilirubinemia was diagnosed based on standard guidelines.¹³

Chest x-ray and electrocardiography (ECG) was done for all the babies and findings recorded.

Echocardiography was done for all the infants by an experienced cardiologist using standard 2D-echocardiography and findings recorded.

III. STATISTICAL ANALYSIS

Data were analyzed using the SPSS software package, version 17.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed using range, mean, SD, and median, whereas qualitative data were expressed as frequency and percentage. P value was assumed to be statistically significant at 0.05.

IV. ETHICAL CONCERN

Ethical clearance was obtained from the Ethical committee meeting conducted at Meenakshi Medical College and Research Institute, Kanchipuram, Tamil Nadu. India.

IV. RESULTS:

1. SECTOR WISE DISTRIBUTION OF MOTHERS OF STUDY SAMPLE

Table.1. shows that the 34 infants were included in the study. 2 infants were born of twin pregnancy. So, totally 33 mothers formed mothers of the study sample. In this study, IDMs were seen more commonly in Mothers from Urban Sector compared to Rural Sector.

Table 1: Sector wise distribution of mothers of study sample

Sector	Number
URBAN	25 (75.8%)
RURAL	08 (24.2%)
TOTAL	33 (100%)

Chi Square = 8.758, P < 0.003

2. DISTRIBUTION OF MOTHERS OF STUDY SAMPLE BASED ON SOCIO-ECONOMIC STATUS (SES)

Table.2 showed that the distribution of mothers of study sample based on socio-economic status. The most of the mothers were from upper, upper middle and lower middle classes. The highest number of gestational diabetic mothers belonged to upper middle class.

Table 2: Distribution of mothers of study sample based on socio-economic status (SES)

Ses	Number
Upper	4 (12.1%)
Upper middle	14 (42.4%)
Lower middle	10 (30.3%)
Upper lower	4 (12.1%)
Lower	1 (3%)
Total	33 (100%)

Chi Square = 16.848 P < 0.002

3. Family history of diabetes mellitus in mothers of the study sample

Table. 3. indicated that the Family History of DM (in parents of the mothers of the study sample) was present in 39.4% of the mothers of the study population.

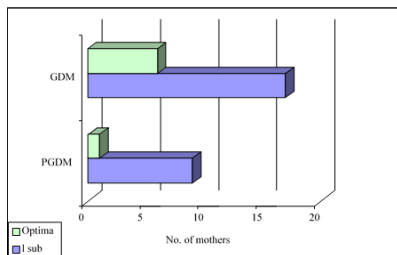
Table 3: Family history of diabetes mellitus in mothers of the study sample

Family History of DM	DM		Total
	Pregestational	Gestational	
ABSENT	5 (71.4%)	15 (57.7%)	20 (60.6%)
PRESENT	2 (28.6%)	11 (42.3%)	13 (39.4%)
TOTAL	7 (100%)	26 (100%)	33 (100%)

4. Maternal glycemic control in pregestational and gestational diabetes mellitus

Family History of DM was present in 28.6% of pregestational diabetic mothers and 42.3% of gestational diabetic mothers.

Figure.1. Maternal Glycemic control in Pregestational and gestational diabetes mellitus



5. Complications seen in infants of diabetic mothers

Table.4. indicated that the Hypoglycemia was the commonest complication seen in 28 (84.8%) IDMs followed by Respiratory distress in 11 (33.3%) and congenital anomalies in 11 (32.4%) IDMs. Hypocalcemia was the least common complication seen in 1 (3.0%) IDM. None of the IDMs sustained any birth injuries. One baby with a major congenital malformation (Sirenomelia) died within 20 minutes of birth.

Table 4 : Complications seen in infants of diabetic mothers

Complication	Number
Macrosomia (n=34)	7 (20.6%)
Birth Asphyxia (n = 34)	05 (14.7%)
Congenital anomalies (n = 34)	11 (32.4%)
Birth Injuries (n = 34)	00
Respiratory Distress (n = 33)	11 (33.3%)
Respiratory Distress Syndrome (n = 33)	2 (6.1%)
Hypoglycemia (n = 33)	28 (84.8%)
Hypocalcemia (n = 33)	1 (3.0%)
Hyperbilirubinemia (n = 33)	7 (21.2%)
Polycythemia (n = 33)	2 (6.1%)

V. DISCUSSION

Diabetes Mellitus is the most common medical complication of pregnancy. The burgeoning problem of childhood obesity across the world has led to an increasing incidence of Type – II DM early in life. The first manifestation of this could be variable degree of glucose intolerance first detected during pregnancy. More than half women with GDM ultimately develop overt diabetes in the ensuing 20 years, and there is mounting evidence for long-range complications that include obesity and diabetes in their offspring.

The IDMs are at an increased risk of complications compared to infants of non diabetic mothers. The causes of the fetal and neonatal sequelae of maternal diabetes are likely multifactorial; however, many of the perinatal complications can be traced to the effect of maternal glycemic control on the fetus. Many of the perinatal complications in IDMs can be prevented by appropriate periconceptional and prenatal

care.

In the present study conducted at Meenakshi Medical College Hospital and Research Institute, 34 infants born to diabetic mothers formed the study group. 2 infants were born of twin pregnancy to a gestational diabetic mother whose glycemic control was suboptimal and one infant was alive only for 20 minutes after birth. No further investigations could be carried out for this infant. This infant had a major congenital malformation which was diagnosed as Sirenomelia. Sirenomelia was previously thought to be the severe form of caudal regression syndrome but it is now proven to be a different entity. The sex of this anomalous baby could not be determined even after autopsy as no genital organs were identified at autopsy. 34 infants were born to 33 mothers, 7 to pregestational diabetic (type – I and type – II DM) mothers and 27 to gestational diabetic mothers.

Most of the diabetic mothers in our study belonged to urban sector. Mothers from upper, upper middle and lower middle classes were more in the present study.

Family History of Diabetes Mellitus was present in 39.4% of the mothers in the present study. In a study done by Ranade et al in 1989 at B.J. Wadia hospital in Mumbai, family history of diabetes was present in 20%¹⁴. The higher percentage in our study could be due to the increasing incidence of type – II DM in our country.

In the present study, 22 infants were male and 11 infants were female which showed a male preponderance. In the present study, 30.3% of the mothers had optimal glycemic control during pregnancy and 69.7% had suboptimal control. The number of mothers with suboptimal control was more in the present study. Among pregestational diabetic mothers, 85.7% had suboptimal control and 65.4% among gestational diabetic mothers had suboptimal control.

COMPLICATIONS IN INFANTS OF DIABETIC MOTHERS

In the present study, hypoglycemia was the commonest problem observed in IDMs seen in 84.4% of IDMs. The incidence of hypoglycemia in IDMs varies from 15-50%. The high incidence of hypoglycemia in the present study may be because cut off level considered for diagnosis of hypoglycemia was 40 mg/dl irrespective of gestational age. In some studies, a lower cut off level has been used to define hypoglycemia in preterm babies and also the cut off level used to define hypoglycemia in general is also less.

The rate of congenital anomalies was also high in the present study (32.4%). The reasons could be because all IDMs were subjected to 2D – Echocardiography irrespective of symptoms and so asymptomatic congenital Heart Disease, mainly ASD was detected in 10 out of 33 IDMs subjected to ECHO. One infant who had ASD also had VSD and PDA. Another infant who could not be subjected to any investigation, had a major malformation, sirenomelia and the baby died with in 20 minutes of birth. Autopsy done on this baby did not detect any cardiac abnormality. The other complications seen in IDMs are comparable to other studies with some differences.

Comparison of complications seen in IDMs in various studies

Complication	Sudarshanet al ¹⁵ , 1987, Delhi	Deorariet al ¹⁶ , 1991, Delhi	Mangala et al ¹⁷ , 1991, B.lore	Gabbe SGet al ¹⁸ , 1978, US	Present study, 2018, Kanchipuram
Macrosomia	16.0%	20.2%	36.8%	-	20.6%
Birth Asphyxia	20.4%	9.1%	-	-	14.7%
Congenital anomalies	-	3.8%	7.9%	6%	32.4%
Birth injuries	-	-	-	-	-
Respiratory Distress	28.6%	8.0%	-	-	33.3%
Respiratory Distress Syndrome	10.2%	3.8%	5.2%	9%	6.1%

Hypoglycemia	28.6%	16.3%	18.4%	31%	84.8%
Hypocalcemia	-	2.0%	-	13%	3%
Hyperbilirubinemia	42.9%	8.4%	15.3%	37%	21.2%
Polycythemia	-	1.5%	10%	8%	6.1%

VI. REFERENCE

- Expert committee on the diagnosis and classification of Diabetes Mellitus: Report of the expert committee on the diagnosis and classification of Diabetes Mellitus. *Diabetes care*, 2003; 26 (1): S5 – S20.
- Gabbe SG. Pregnancy in women with Diabetes Mellitus – The Beginning. *Clinics in perinatology*, 1993; 20 (3) : 507 – 515.
- Gabbe SG, Graves CR. Management of Diabetes Mellitus complicating pregnancy. *Obstetrics and gynecology*, 2003; 102 (4) : 857 – 868.
- Diabetes. In: Cunningham GF, Leveno KJ, Bloom SL, Editors. *Williams obstetrics*, 22nd edition. Mc. Graw Hill. 1997 : 1169 – 1188.
- Lucas MJ. Diabetes complicating pregnancy. *Obstetrics and gynaecology clinics of North America*, 2001; 28(3): 513 – 536.
- Metzger BE, Buchanan TA, Coustan DR, et al. Summary and recommendations of the fifth international workshop conference on gestational diabetes mellitus. *Diabetes care*, 2007; 30(2): 251-260.
- Setji TL, Brown AJ, Feinglos MN. Gestational Diabetes Mellitus. *Clinical Diabetes*, 2005; 23(1) : 17-24.
- Quintero VH, Istwan NB, Rhea DJ, et al. The impact of glycemic control on neonatal outcome in singleton pregnancies complicated by gestational diabetes. *Diabetes care*, 2007; 30 : 467-470.
- NNPD 2000. Report of the National Neonatology Forum, India: 2000.
- Chmait R, Moore TR. Endocrine Disorders in pregnancy. In: Taeush, Ballard, Gleason, editors. *Avery's Diseases of the Newborn*, 8th edition. 2005: 71-86.
- Catalano PM, Alicia T. RD, Presley H. Phenotype of infants of mothers with gestational diabetes. *Diabetes care*, 2007; 30 (2) : S 156 – S 160.
- Lee KG and Cloherty JP. Identifying the high risk newborn and evaluating gestational age, prematurity, postmaturity, large for gestational age and small for gestational age infants. In: Cloherty JP, Eichenwald EC, Stark AR, editors. *Manual of Neonatal care*, 5th edition; Philadelphia: Lippincott Williams and Wilkins. 2004: 42-56.
- Martin CR, Cloherty JP. Neonatal Hyperbilirubinemia. In: Cloherty JP, Eichenwald EC, Stark AR, editors. *Manual of neonatal care*, 5th edition: Philadelphia: Lippincott Williams and Wilkins. 2004: 185-221.
- Ballard JL, Rosenn B, Khoury JC, et al. Diabetic fetal macrosomia: significance of disproportionate growth. *The Journal of Pediatrics*, 1993; 122 (1): 115-119.
- Sudarshan K, Jain S, Jain RK, et al. Study of morbidity and mortality pattern in infants born to diabetic mothers. *Journal of Obstetrics and Gynaecology of India*, 1987; 37: 481 - 484
- Deorari AK, Kabra SK, Paul VK, et al. Perinatal outcome of infants born to diabetic mothers. *Indian Pediatrics*, 1991; 28: 1271-1275.
- Mangala R, Mhaskar R, Mhaskar A, et al. Perinatal outcome in pregnancies complicated by diabetes. *International journal of diabetes in developing countries*, 1991; 11: 22 – 24.
- Watson D, Rowan J, Neale L, et al. Admissions to neonatal intensive care unit following pregnancies complicated by gestational and type 2 diabetes mellitus. *The Australian and New Zealand journal of Obstetrics and Gynaecology*, 2003; 143 (6): 429 – 432.
- Gabbe SG, Lowensohn RI, Wu PY, et al. Current patterns of neonatal morbidity and mortality in infants of diabetic mothers. *Diabetes care*, 1978; 1(6): 335 – 339.