

Original Research Article

Study on neonatal morbidity in infants of diabetic mothers

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ABSTRACT

Background: Many infants of diabetic mothers (IDMs) born with specific characteristics like macrosomia, hypoglycemia, respiratory distress syndrome (RDS) and other morbidity risks. The present study was done with the aim to determine morbidity and mortality pattern amongst IDMs admitted into the neonatal intensive care units (NICU) of our tertiary care center.

Methods: Descriptive study was done on 86 infants in the NICU of Government RSRM lying in Hospital and Institute of Social Pediatrics, Govt Stanley Hospital, Chennai Tamil Nadu during the period from August 2007 to October 2008. Data on mode of delivery, gestational age, birth weight, other associated morbidities and investigation results were noted.

Results: Among the 85 mothers, 67 mothers had gestational diabetes mellitus and 18 had diabetes mellitus preceding pregnancy. Among the 86 IDMs, 15 infants were macrosomic, 11 infants were premature, 12 had mild to severe RDS, 11 infants had hypoglycemia, 3 had hypocalcemia, 2 had birth injuries, 3 infants were born as small for gestational age. Polycythemia observed in 3 IDMs, hyperbilirubinemia in 8 infants, external congenital malformations in two infants and congenital heart disease in three infants.

Conclusions: IDMs developed many complications in the study. Macrosomia was the major among them. Perinatal morbidities can be reduced by screening of diabetic mothers from first trimester, maintaining good glycaemic control and adequate management of their infants.

Keywords: Diabetic mothers, Diabetes mellitus, IDMs

INTRODUCTION

It is known that diabetes mellitus is the common complication in pregnancy and may cause significant risk to the mother and the foetus. Congenital malformations and perinatal morbidity and mortality are very common in the offspring compared to non-diabetic pregnancies. Glycemic control before and during pregnancy plays a significant role in the birth of healthy off spring.¹

Gestational diabetes mellitus affects approximately 2-5% of all the pregnancies and pre-existing diabetes mellitus complicates 0.2-0.3% of all pregnancies.^{2,3} In diabetic

pregnancies, the foetus will be exposed to either sustained or intermittent pulses of hyperglycemia that results in persistent stimulation of foetal insulin secretion. This result in the development of foetal hyperinsulinaemia may cause increased foetal body fat (macrosomia) resulting in difficult delivery. It may also cause inhibition of pulmonary development of surfactant resulting in respiratory distress syndrome (RDS) of the neonate.¹

Neonatal hypoglycemia, hyperbilirubinaemia, stillbirth, congenital malformations are other complications in diabetic pregnancies.^{4,5} Successful management of infants

of diabetic mothers is based on prevention or early recognition combined with treatment of these complications.

In view of the high morbidities and mortality associated with these conditions, the current study was done to determine the complications, morbidity and mortality rates in infants of diabetic mothers seen in our newborn unit.

METHODS

This was a descriptive study was carried out on 86 neonates in the neonatal intensive care units (NICU) of Government RSRM lying in Hospital and Institute of Social Pediatrics, Stanley Medical College, Tamil Nadu during the period from August 2007 to October 2008. All neonates, born to diabetic mothers were included in the study and all neonates, born to non-diabetic mothers were excluded.

All the infants of diabetic mothers (IDMs) during the study period were immediately admitted to the neonatal intensive care unit after delivery. The detailed maternal history was obtained in predesigned proforma. Based on duration of diabetes, treatment and associated complications, mothers were classified according to White's Classification.

Glycosylated hemoglobin of mother at the time of delivery was estimated to determine the adequacy of blood glucose control. Detailed physical examination and lab investigations were performed according to proforma and depending upon the needs to detect prematurity, growth abnormalities LGA/SGA, neonatal hypertrichosis, hyper viscosity secondary to polycythaemia, hypoglycemia, hypocalcemia, convulsions, hyperbilirubinemia, congenital malformations, respiratory distress syndrome, cardiovascular anomalies, increased risk of thrombosis, intrapartum asphyxia, trauma, shoulder dystocia, clavicular fracture, brachial plexus injury, facial nerve injury, cephalohematoma and poor feeding.

Blood glucose screening was performed in all study infants according to the protocol for infants of diabetic women. Blood glucose screening was performed with chromogen reagent strips (Accu-Chek®, Roche) read by a reflectance meter; true serum glucose was measured by the glucose oxidase method. The blood glucose screening for infants from the diabetic group included Chemstrip determinations every 60 minutes three times, starting soon after birth and then at 3-hour intervals before each feed for the next 24 hours.

Respiratory distress syndrome was arbitrarily classified into nonspecific mild or nonspecific moderate (clinical signs and/or supplemental oxygen requirements lasting less than 6 or less than 48 hours, respectively), and

hyaline membrane disease and transient tachypnea were diagnosed by clinical and radiological signs.

Gestational age was assessed based on New Ballard score for preterm babies. All newborns admitted to the NICU are prescribed 10% dextrose in water, 80 ml/kg per day, intravenously if their birth weight is more than 1000 g, and 5% dextrose in water, 100 ml/kg per day, if less than 1000 g. Asymptomatic infants whose mothers have preexisting diabetes or gestational diabetes also received intravenous dextrose supplementation in the NICU along with breast feeding.

Statistical analysis

Data were expressed as percentage, mean and standard deviation, where applicable. The Student t test for independent samples was used to compare continuous variables. The test was used to test differences in all categorical variables. The Mann-Whitney U test was used to compare noncategorical variables. A p value of less than 0.05 was considered to be statistically significant.

RESULTS

Between August 2007 and October 2008, 85 women with diabetes mellitus were delivered. Among the 85 patients, 67 patients had gestational diabetes mellitus and 18 had diabetes mellitus preceding pregnancy. They delivered 84 singletons and 1 set of twins. As per White classification, out of 85 women, 35 falls in the category of A1, 34 in A2, 15 in B and 1 in C1 category. Mean maternal age was 25.3 years. Number of infants delivered by normal delivery was 12, by forceps it was 2 and by LSCS it was 72. Mean birthweight of the infants was 3.12 kgs. Mean gestational age was 38.8 months, 15 of the 86 infants were LGA, 68 were AGA, and only 3 were SGA (Table 1).

Table 2 presents the complications noticed in the infants after delivery. Among the 86 IDMs, 15 infants were macrosomic, 11 infants were premature, 12 had mild to severe RDS, 11 infants had hypoglycemia, 3 infants had hypocalcemia, 2 had birth injuries and 3 infants were born as small for gestational age (SGA). Polycythemia was observed in 3 IDMs and hyperbilirubinemia was seen in 8 infants. Two infants with external congenital malformations and three infants with congenital heart disease were also found. No significant difference in the complications among the IDMs born to mothers in various White classes was observed ($p > 0.05$ which is not significant).

Twelve (14%) of the 86 infants were presented with RDS of varying severity and 17 (20%) infants had transient tachypnea of newborn. RDS, by maternal diabetes classification, was present in 5 (6%) of class A1, 4 (5%) of class A2 and 3 (4%) of class B. Of all infants with RDS, 6 (7%) had nonspecific mild RDS and 3 (4%) had nonspecific moderate RDS. The differences in the rate of

occurrence of RDS, among the various White classes of mothers were statistically not significant ($p>0.05$) (Table 3).

Table 1: Demographic and clinical characteristics of mother and infants.

White classification	No. of Patients	Mean maternal age (in years)	No. of infants	No. infants by LSCS	Mean birth wt	Mean GA	GA \leq 33 weeks	GA 34-36 weeks	GA \geq 37 weeks	LGA	AGA	SGA
A1	35	24.7	35	28	3.18	39.1	0	4	31	7	28	0
A2	34	25.0	35	29	3.1	38.6	2	3	30	6	26	3
B	15	27.8	15	14	3.06	38.1	1	1	13	2	13	0
C1	1	21	1	1	2.5	39.3	0	0	1	0	1	0
Total	85	25.3	86	72	3.12	38.8	3	8	75	15	68	3

Table 2: Complication in IDMs.

White classification	No. of IDMs	Macrosomia	Prematurity	RDS	Hypoglycemia	Hypocalcemia	Birth injuries	Polycythemia	Hyperbilirubinemia	Congenital malformation	Congenital heart disease
A1	35	7	4	5	4	1	2	1	3	0	1
A2	35	6	5	4	4	1	0	1	3	2	1
B	15	2	2	3	3	1	0	1	2	0	1
C	1	0	0	0	0	0	0	0	0	0	0
Total	86	15	11	12	11	3	2	3	8	2	3

Table 3: RDS and its distribution among IDMs.

White class	No. of infants	RDS Total	Mild RDS	Moderate RDS	HMD	TTN
A1	35	5	4	1	0	6
A2	35	4	1	1	2	6
B	15	3	1	1	1	4
C	1	0	0	0	0	1
Total	86	12	6	3	3	17

Hyaline membrane disease was found in 3 (4%) of the RDS infants. Of these, two were from class A2 and one was from class B. All three were preterm (32 weeks or less) and had low birth weight (1 kg, 1.25 kg and 1.7 kg). All the three infants with RDS were treated with mechanical ventilation.

All infants with hyaline membrane disease received exogenous surfactant. All the three infants were expired in spite of adequate management. Two babies were born to GDM mother of White class A2 and another baby was born to pregestational diabetic mother of White class B with hypothyroidism. All infants were delivered by vaginal route which included two vertexes and one breech delivery.

DISCUSSION

Increased diabetes awareness, screening, and identification have led to a greater number of successful pregnancies among women with gestational diabetes mellitus (GDM) and pre-existing diabetes mellitus. Although perinatal mortality among this group has declined, excess neonatal morbidity remains a significant challenge. Most frequently observed condition in the offspring's of diabetic women are macrosomia, RDS, Congenital malformations, hypoglycaemia, hyperbilirubinemia and hypocalcaemia. The ratio of GDM and pre gestational diabetics was 3:1. This was similar to the findings of Cordero et al (2:1).⁶

Majority of pregnant women belongs class A1 (41%), followed by class A2 (40%) and class B (18%). Class C had only one mother and no mother with class D or above. Class A1 and B had incidence comparable with Cordero et al study.⁶

Number of vaginal deliveries are less in our study, compared to the study of Mangala et al.⁷ The high number of LSCS in this study may be due to being a tertiary referral centre, more number of mothers with associated other maternal complications were managed here. Average weight of IDMs (3.12 kg) in our study is comparable with studies by Cordero et al, and Mangala et al, (3.15 kg and 3.2 kg respectively).^{6,7}

Macrosomia remains an important morbidity because it is associated with increased risk for traumatic birth injury, obesity, and diabetes in later life.⁸ Although some of the variation in incidence may be related to definition, most authors agree that excess macrosomia is in part related to maternal glucose control.⁹ In this series, the incidence of macrosomia was seen in 17.4% infants. This was in accordance with the findings of Said et al.¹⁰ In his study the prevalence of fetal macrosomia was 2.3% (103 out of 4528 deliveries).

Hypoglycemia was one of the common complications seen in IDMs than in non IDMs. The rate of incidence of hypoglycemia in this study is similar to the findings of previous studies.^{11,12} This was due to poor control of blood glucose by the mother. This is in agreement with previous studies that poor diabetes control is positively correlated with increased maternal and perinatal morbidity and mortality.¹³ In this study death was noticed in 3 infants.

Hypocalcaemia is the other common metabolic manifestation noticed in IDMs (3 patients). It has also been documented as a problem of IDMs by other authors.^{11,13,14} Hypocalcaemia may be due to functional hypoparathyroidism of IDMs.

Birth injuries was very less in this study (2 patients). Similar findings was seen in the study of Opara et al.¹⁶

The frequency of RDS in this study was 14% (n=12). This incidence of RDS was comparable to findings of Cordero et al.⁶ Congenital pneumonia and TTN were common causes of RDS in all the infants in the study. TTN is a known complication of IDMs especially in caesarean cases, which is known risk factor.¹⁶ In this study TTN was seen in 17 infants.

Congenital malformations were seen in 2 cases and congenital heart defects was seen in 3 cases of IDMs. Previous studies shown that the incidence of congenital malformations was 2-5 times more in IDMs than in other infants with cardiac malformations.¹⁷ The tendency towards incidence of congenital malformations might be due to poor diabetes control in the first and second

trimester of pregnancy. This is because organogenesis occurs in early pregnancy that may lead to congenital malformation when infant is exposed to poor metabolic control during this period.^{18,19}

This study was done in tertiary care centre where more number of mothers with complications were referred. This may have impact on the morbidity pattern of this study. Also in this study, there were no control groups to assess the relative risk on infants born to mothers with diabetes complicating pregnancy, these were the few limitations of the study.

CONCLUSION

From the study findings, it is evident that perinatal outcome is compromised in pregnancy complicated by diabetes mellitus. However, no differences were observed in the gestational diabetes mellitus group and those who had diabetes mellitus preceding pregnancy. Poor glycaemic control by the mothers explains some but not all diabetic malformations and there might be a multifactorial etiology. The study showed high incidence of macrosomia and hypoglycemia as an important morbidity more likely in caesarean delivery cases.

Screening of diabetic women from first trimester, good glycaemic control and adequate management of their infants will reduce the perinatal morbidity and mortality.

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