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Research Article

Clinical and metabolic profile of neonates of diabetic mothers

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ABSTRACT

Background: Diabetes mellitus is the most common metabolic disorder complicating pregnancy. About 1-14% of all pregnancies are complicated by diabetes mellitus, 90% of them are Gestational Diabetes Mellitus (GDM). The present study was undertaken to describe clinical outcome & metabolic profile of neonates born to mothers with diabetes mellitus.
Methods: It was a hospital based prospective, non-randomized study conducted at department of paediatrics in G.B. pant hospital (neonatology section) an associated hospital of GMC Srinagar. The hospital is a referral tertiary care hospital of entire Kashmir valley. All infants born to diabetic mothers admitted at G.B. Pant hospital during the study period of one year (March 2011 to February 2012) were included in study.
Results: A total of 96 new-borns of diabetic mothers were included in study. 38 (40%) of these new-borns were large for gestational (LGA), 56 (58%) were Appropriate for Gestational Age (AGA) & two (2%) were Small for Gestational Age (SGA). Hypoglycemia was the leading morbidity & occurred in 34 (36%) of these new-borns. Hyperbilirubinemia (26 babies - 27%), Hypocalcemia (5 babies - 5%) & Hypomagnesemia (5 babies - 5%) were other morbidities present. Out of all babies respiratory distress syndrome occurred in 12 (13%), birth asphyxia in 10 babies (12%), polycythemia in 9(10%), congenital heart disease in 3 babies (3%) & other congenital malformations in 3 babies (3%), viz - myelomeningocele, tracheoesophageal fistula, cleft lip & palate respectively. All these morbidities were managed as per standard protocols outlined for these conditions. Out of these 96 study neonates death occurred in 1 neonate having congenital heart disease (mortality of ≈1/100 cases).
Conclusions: Infants born to diabetic mothers remain at high risk for development of clinical &metabolic complications. Optimal care of these infants is based on prevention, anticipation, early recognition & treatment of these conditions.

Keywords: Infants of diabetic mothers, Hypoglycemia, Respiratory distress syndrome, Hypocalcemia

INTRODUCTION

Diabetes mellitus is the most common metabolic disorder complicating pregnancy.[1] About 1-14% of all pregnancies are complicated by diabetes mellitus, 90% of them are Gestational Diabetes Mellitus[2] (GDM).

Diabetes has long been associated with maternal and perinatal mortality & morbidity.[3] The Neonatal mortality rate is over five times that of infants of non-diabetic mothers & is higher at all gestational ages & in every birth weight for gestational age category.[4]

Compared with weight matched controls Infants of Diabetic Mothers (IDM's) have double the risk of serious birth injury, triple the likelihood of caesarean section & quadruple the incidence of admission to new-born intensive care unit. Studies have indicated that the

magnitude of risk of maloccurences is proportional to the level of maternal hyperglycemia. Therefore to some extent, the excessive fetal & neonatal morbidity of diabetes in pregnancy is preventable or atleast reducible through meticulous prenatal & intrapartum care.[5]

Increased awareness, screening & identification have led to greater number of successful pregnancies among women with diabetes mellitus.[6] Although mortality in new-borns of diabetic mothers has declined[7] especially in the developed countries, excess neonatal morbidity remains a significant challenge.[8-10]

Suboptimal prenatal care along with poor maternal glycemi control, vasculopathy, infection, & pregnancy induced hypertension are factors associated with poor perinatal outcome.[5]

The major morbidities associated with infants of diabetic mothers include congenital malformations, macrosomia, respiratory distress syndrome, growth restriction, polycythemia, hypoglycemia, hypocalcemia, hypomagnesemia[11,12] & hyperbilirubinemia.[13]

Other morbidities include myocardial dysfunction (in form of transient hypertrophic subaortic stenosis), renal vein thrombosis, and small left colon syndrome.[14]

Successful management of infants of diabetic mothers is based on prevention or early recognition combined with treatment of these complications. For example Neonatal hypoglycaemia known to effect 5% to 30% of IDM`s can be avoided in some cases by early breast feeding, proper monitoring &/or by i.v. dextrose administration wherever indicated.[15,16]

Comprehensive care of pregnant women with diabetes mellitus has been extensively described yet guidelines regarding the care of their infants are less well established. Moreover there are scanty reports on infants born to diabetic mothers in India. The aim of this study is to highlight the specific problems (clinical as well as metabolic) of infants of diabetic mothers.

METHODS

It was a hospital based, prospective, observational, and descriptive study. The study was done for a period of one year from 1st Mar 2011 to 29th Feb 2012. The study was conducted at postgraduate department of pediatrics in G.B Pant hospital, an associated hospital of government medical college Srinagar. The hospital has a catchment area of both rural and urban population and is a referral tertiary care hospital.

Study group & inclusion criteria: All neonates born to women known to have diabetes mellitus before conception (infants of diabetic mothers) and those born to women who developed diabetes mellitus during pregnancy (infants of gestational diabetic mothers) admitted at G.B Pant hospital for at least 72 hours during the study period were included in the study. A total of 96 neonates fulfilled the above criteria and were included in the study.

On all neonates included in the study, detailed examination was performed at the time of admission and then daily during hospital stay and finally at time of discharge from hospital.

Weight of each baby was recorded and gestational age was calculated from New Ballard's gestational scoring chart, subsequently they were grouped as Appropriate for Gestational Age (AGA), Large for Gestational Age (LGA) and Small for Gestational Age (SGA) by plotting their weight and gestational age on Lubchenco charts.

All neonates underwent investigations like complete blood count, X-ray chest, metabolic profile including blood sugar, serum calcium, serum magnesium. Wherever indicated, serum bilirubin, ABG analysis & hematocrit was done on need basis. Blood sugar was done 6 hourly for 1st 24 hours of life followed by 12 hourly upto 72 hours of life. Blood sugar was done by Glucostick method & any abnormal values if found were sent to laboratory for confirmation by glucose oxidase method. All the study neonates suspected of having congenital heart disease on clinical grounds or chest X-ray underwent transthoracic Doppler echocardiography.

Hypoglycemia: It was defined as a blood glucose level <40 mg/dl in first 24 hours & <45 mg/dl after first 24 hours of life.[14]

Hypocalcemia: It was defined as a total serum calcium concentration of <7 mg/dl or an ionized calcium concentration of <4 mg/dl.[14]

Hypomagnesemia: It was defined as a serum magnesium concentration of <1.6 mg/dl.[14]

Polycythemia: It was defined as a venous hematocrit of at least 65% or more.[14]

Any other clinical or metabolic complication if identified was defined on the basis of criteria outlined for it in Standard Textbooks of Neonatology (Avery's Diseases of Newborn & Cloherty's Manual of Neonatal Care). All the information was recorded in a pre-structured proforma. Any neonatal complications if identified, in particular hypoglycemia, were managed as per standard protocols outlined for these conditions.

RESULTS

During the study period of one year from 1st Mar 2011 to 29th Feb 2012 a total of 4314 neonates were admitted in our hospital. Out of these, 96 neonates were infants of diabetic mothers who fulfilled the inclusion criteria for the study. Out of these 96 neonates 82 babies (85.41%)

were born to mothers who developed glucose intolerance during pregnancy (Gestational diabetes mellitus) while as 14 babies (14.59%) were born to mothers who were known diabetics before conception. The Male:Female ratio was 0.92:1. Out of these 96 babies, 38 babies (39.58%) were Large for Gestational Age (LGA), 56 (58.33%) were Appropriate for Gestational Age (AGA) while only 2 babies (2%) were Small for Gestational Age (SGA).

The distribution of cases on the basis of clinical features is shown in Table 1. Respiratory distress syndrome (in 12 babies), birth asphyxia (in 10 babies), polycythemia (in 9 babies), congenital heart diseases (in 3 babies) & other congenital malformations (in 3 babies) were the various clinical morbidities present. Out of these 96 neonates studied death occurred in 1 neonate having congenital heart disease viz. transposition of great arteries with a ventricular septal defect (a mortality of 1/100 cases). The metabolic profile of these neonates is shown in Table 2. Hypoglycemia was the leading morbidity & occurred in 36% of these babies. Hyperbilirubinemia (in 26 babies), hypocalcemia (in 5 babies) & hypomagnesemia (in 4 babies) were the other metabolic complications.

Table 1: Distribution of cases on the basis of clinical features.

Clinical feature	Total number of cases (n=96)	Percentage
Macrosomia	38	39.58 %
Respiratory distress syndrome (RDS)	12	12.5 %
Birth asphyxia	10	10.41 %
Polycythemia	9	9.37 %
Congenital heart diseases (CHD's)	3	3.12 %
Congenital malformations (excluding CHD's)	3	3.12 %

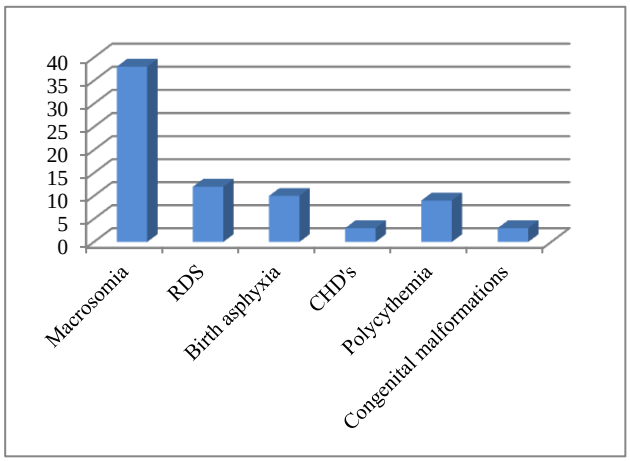

Figure 1: Showing the distribution of cases on the basis of clinical features.

Description of Figure 1 as follow:

Macrosomia: 38 cases
RDS: 12 cases
Birth asphyxia: 10 cases
CHD's: 3 cases (VSD=1, TGA with VSD=1, PDA=1)
Polycythemia: 9 cases
Congenital malformations: 3 cases

Table 2: Table showing metabolic profile of cases.

Metabolic parameter	Total number of cases (n=96)	Percentage (%)
Hypoglycemia (<40 mg/dl)	34	35.41 %
Hyperbilirubinemia	26	27.08%
Hypocalcemia (<7 mg/dl)	5	5.2%
Hypomagnesemia (<1.6 mg/dl)	4	4.16%

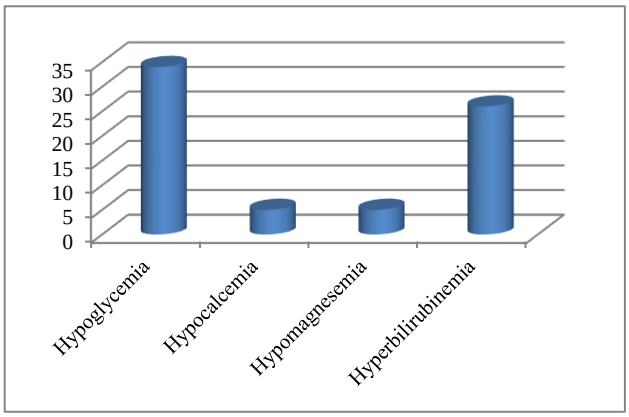

Figure 2: Showing metabolic profile of cases.

DISCUSSION

The study was done over 96 infants born to mothers with gestational diabetes mellitus or pre-existing diabetes mellitus who were admitted at our hospital for atleast 72 hours. Diabetes mellitus in mothers was defined as per criteria laid by American Diabetes Association. They include, symptoms of diabetes (polyuria, polydipsia & unexplained weight loss) with one of the following:

1. A random plasma glucose of ≥200 mg/dl; or
2. Fasting glucose level of >126 mg/dl. Fasting is defined as no calorie intake for atleast 8 hours; or
3. Two hour plasma glucose of >200 mg/dl during a 75 gm oral glucose challenge test.

Gestational diabetes mellitus is defined as glucose intolerance that begins or is first recognized during pregnancy.[5]

The hospital based annual incidence of infants of diabetic mothers in our study was 22.3 cases/1000 neonates admitted (2.25 %). Deorari AK et al.[19] found an annual hospital incidence of 30 cases/1000 neonates admitted i.e. 3%, which is almost similar to our study. In our study regarding weight for gestational age, 56 (58.3%) out of 96 neonates studied were appropriate for gestational age while only 38 were large for gestational age & 2 were small for gestational age. Leandro C et al.[6] studied 530 IDM's over a period of 2 years. 36% of babies were LGA, 62% of babies were AGA & only 2% were SGA. This shows that most of infants of diabetic mothers are appropriate for gestational age.

Macrosomia was found in 38 babies (39.58%), the pathogenesis of which is not completely understood. It is hypothesised that maternal hyperglycemia leads to fetal hyperinsulinism which in turn causes neonatal macrosomia. Alam M et al.[18] studied 40 infants of diabetic mothers & found that macrosomia occurred in 18 babies (45%).

Among metabolic complications/derangements, hypoglycemia was the leading morbidity. It occurred in 34 babies out of studied 96 infants of diabetic mothers (35.41%). Lemons et al.[17] & Alam M et al.[18] had found similar results. Most of these babies (70.5%) with hypoglycaemia were asymptomatic. Besides hypoglycaemia, hypocalcemia (5 out of 96 babies), hypomagnesemia (4 out of 96 babies) were other metabolic morbidities found. Neonatal jaundice developed in 26 babies (27%), all these babies were treated with phototherapy except 2 cases which required double volume exchange transfusion. Similarly polycythemia occurred in 9 babies (9.37%), eight of them were asymptomatic while as 1 was symptomatic & required partial exchange transfusion. Deorari AK et al.[19] in their analysis of 263 infants born to diabetic mothers found that polycythemia (hematocrit >65%) occurred in 11% of babies.

In our study 12 babies developed distress syndrome (13%). Infants of diabetic mothers are more prone for respiratory distress because of increased incidence of Hyaline membrane disease. Transient tachypnea, birth asphyxia, congenital malformations & metabolic causes like hypoglycemia are other causes of respiratory distress in them. In our study congenital heart diseases were found in 3 babies (3.12 %). The 3 CHD's found were dextrotransposition of great arteries with a ventricular septal defect, an isolated small VSD, a patent ductus arteriosus. Leandro C et al.[6] found in their study that CHD's occurred in 6 babies (3.37%). The CHD's found were TGA (n=2), double outlet right ventricle (n=2) & VSD (n=2). Besides CHD's other major congenital malformations occurred in 3 of our studied infants (3.12%). These major malformations were myelomeningocele, tracheo esophageal fistula & a cleft lip and palate. The factors that contribute to this diabetic embryopathy include hyperglycemia, ketoacidosis, somatomedin inhibitors & vasculopathy.[20] These malformations can be reduced to minimum by optimum control of maternal glucose homeostasis during preconceptional period & throughout pregnancy.

Out of these 96 study neonates death occurred in 1 neonate having a CHD-TGA with VSD due to irreversible cardiogenic shock. Early detection of the complications, their appropriate treatment & satisfactory metabolic control of maternal diabetes are crucial for reduction of perinatal mortality.

CONCLUSION

To conclude infants born to diabetic mothers remain at high risk for development of clinical & metabolic complications. Optimal care of these infants is based on prevention, anticipation, early recognition & treatment of these conditions.

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