Original Article

Pregnancy Outcome of Women With Gestational Diabetes in a Tertiary Level Hospital of North India

Pikee Saxena, Swati Tyagi[1], Anupam Prakash[2], Aruna Nigam, Shubha Sagar Trivedi

Department of Obstetrics and Gynecology, [1]MBBS Student, [2]Department of Medicine, Lady Hardinge Medical College and Shrimati Sucheta Kriplani Hospital,
New Delhi, India

ABSTRACT

Background: Women with gestational diabetes mellitus (GDM) pose an important public health problem because diabetes not only affects the maternal and fetal outcome, but these women and their fetuses are also at an increased risk of developing diabetes and related complications later in their life. **Objectives:** The study was conducted to determine the maternal and fetal outcomes of 50 diabetic *vs* 50 normoglycemic pregnancies. **Materials and Methods:** This was a retrospective analytical record-based study conducted in a tertiary level hospital. Detailed information regarding maternal, fetal, and labor outcome parameters was recorded in a prestructured proforma and compared in normoglycemic and diabetic pregnancies. **Results:** Patients with obesity, history of diabetes in the family, spontaneous abortions, and gestational diabetes in previous pregnancies had a greater incidence of GDM in current pregnancy ($P<0.05$ for all). Hypertension, polyhydramnios, macrosomia, fetopelvic disproportion, and cesarean sections were more ($P<0.001$) among diabetic pregnancies. Congenital anomalies, polycythemia, hypocalcemia, and hyperbilirubinemia were also observed to be more ($P<0.05$) in neonates born to diabetics, suggesting an adverse effect of hyperglycemia in utero. **Conclusion:** Diabetes during pregnancy is associated with higher maternal and fetal morbidity. Therefore, early screening, detection, close monitoring, and intervention is essential to reduce maternal and fetal short- and long-term adverse effects, especially in high-risk groups. Pregnancy provides an opportunity to the clinician to control the disease process and inculcate healthy lifestyle practices in these patients.

Keywords: Diabetics, hyperglycemia, pregnancy outcome

Introduction

Diabetes has become a global pandemic because of aging population, sedentary life style, urbanization, and increasing incidence of obesity. Prevalence of diabetes is on the rise in developing countries such as India and China. As the incidence of diabetes is rising in epidemic proportion,[1] more women of childbearing age are at increased risk of diabetes during pregnancy. In fact, a high prevalence of gestational diabetes mellitus (GDM) of the order of 18% has been reported from India.[1] Women with GDM are at high risk for developing diabetes later in life. Thus, GDM provides a unique opportunity to study the early pathogenesis of diabetes and to develop interventions to prevent the disease.

Abnormal metabolic environment due to hyperglycemia has a profound impact on maternal and fetal outcome. Indians belong to higher risk for developing diabetes due to their ethnicity.[2] The present study was conducted to determine the maternal and fetal outcomes of pregnancies complicated with diabetes mellitus vis-a-vis nondiabetic pregnancies, in a tertiary level setup of North India.

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Address for correspondence:
Dr. Pikee Saxena, J-36, Saket, New Delhi- 110 017, India. E-mail: pikeesaxena@hotmail.com

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Materials and Methods

A retrospective analytical record-based study was conducted on 100 pregnant women with approval from the Institutional Ethics Committee from January 1 to December 31, 2008. The study group comprised of all 50 women admitted in the maternity ward with diabetes, whose records were complete, and to match it, 50 consecutive women with normal glycemic values during the same study period and without any associated diseases like thyroid disorder, anemia, multiple pregnancy, or previous cesarean constituted the control group.

Pregnant patients who were diagnosed to have diabetes preconceptionally or in the first trimester were labeled as "Pre-gestational diabetes." As a protocol, universal screening of all nondiabetic pregnancies is performed employing either a 1-hour 50 g glucose challenge test or by an oral glucose tolerance test (GTT) depending on low- or high-risk criteria (American College of Obstetricians and Gynecologists Committee (ACOG) and American Diabetes Association (ADA)).[3] Patients with obesity, polyhydramnios, suspected macrosomia, history of GDM or macrosomia in previous pregnancy, unexplained stillbirth, medical/familial type 2 diabetes in a first-degree relative, or patients treated for polycystic ovary syndrome were considered to be high-risk patients and were screened directly by GTT.[2,3] Diagnosis of GDM was confirmed on the basis of NDDG criteria by performing oral GTT.[4]

All cases diagnosed as GDM and pregestational diabetes were managed by a multidisciplinary team involving an obstetrician, physician, dietician, ophthalmologist, and a pediatrician. On scrutiny of inpatient records, information was obtained regarding maternal factors like age, parity, nutritional status, prepregnancy weight, weight gain during pregnancy, and blood sugar levels, hematological, biochemical, and ultrasonographic findings. Associated maternal illnesses like hypertension, thyroid disorder, dyslipidemia, pre-eclampsia, or other diabetic complications like neuropathy, nephropathy, retinopathy, or ketoacidosis were also noted.

The four quadrant amniotic fluid index (AFI) method was used to measure the amount of liquor. On the basis of this measurement, polyhydramnios was defined as an AFI in excess of 25 cm.[5] The timing, mode of delivery, and outcome were recorded. Birth weight, Apgar score, general physical examination, capillary blood sugar level, need for nursery admission or neonatal intensive care unit monitoring along with the reason and duration of admission were also noted. Fetal outcome parameters evaluated were birth weight, intrauterine growth retardation, neonatal hypoglycemia, asphyxia or respiratory distress, hypothermia, and metabolic complications like hypocalcemia, hypomagnesemia, hyperbilirubinemia, congenital anomaly, polycythemia, and hypertrophic cardiomyopathy (diagnosed by performing fetal echocardiography). Macrosomia was defined as the birth weight >4 kg in diabetic and >4.5 kg in nondiabetic pregnancy.[6]

The collected data were tabulated on a Windows-based personal computer using Microsoft Excel software and the comparisons between the two groups were made employing chi-square test. $P<0.05$ was taken as the cut-off level for statistical significance.

Results

Of 50 diabetic pregnancies, 32 (64%) were picked up by glucose challenge test and 18 (36%) by oral GTT directly. The average age did not differ significantly in the two groups (28.9±4.5 years for diabetic pregnancies and 25.9±7.2 years for nondiabetic pregnancies). However, 52% of diabetic pregnancies were obese preconceptionally as observed from the file notes/dietitian records as against only 12% of nondiabetic pregnant women ($P=0.001$). Table 1 shows that the family history of diabetes, history of spontaneous abortions, and history of GDM were higher in diabetic pregnancies vis-à-vis nondiabetic pregnancies.

Hypothyroidism was observed in 8 (16%) and hydronephrosis of maternal kidneys in 3 (6%) of diabetic pregnancies, while none of these were noted in the nondiabetic pregnancies. The incidence of pregnancy-induced hypertension (PIH); hypothyroidism and polyhydramnios were also observed more in diabetic pregnancies [Table 2]. Another noteworthy observation was that 42% of diabetic pregnancies ($n=21$) had to undergo a cesarean operation, while all nondiabetic pregnancies in the study group delivered vaginally. The indications for cesarean were fetopelvic disproportion ($n=15$, 71.4%), taken up as elective cesarean sections, and non progress of labor ($n=6$).

Table 1: Clinical features in the diabetic and nondiabetic pregnancies

Risk factor	Diabetic pregnancies (Study group) $n = 50$	Nondiabetic pregnancies (Control) $n = 50$	*P* value
Obesity	26 (52)	6 (12)	0.001
Family history of DM	9 (18)	Nil	0.002
History of spontaneous abortions	12 (24)	2 (4)	0.004
History of IUD*	7/42 (16.7)	3 (6)	NS
History of GDM in previous pregnancy*	5/42 (11.9)	Nil	0.022

*Primigravida were excluded from the analysis. DM: Diabetes mellitus, IUD: Intrauterine death, GDM: Gestational diabetes mellitus. Figures in parenthesis are in percentage

Hypertensive retinopathy was noted in 10% (5/50) of diabetics on fundus examination in patients having PIH/chronic hypertension. Neuropathy or nephropathy was not observed in any patient of either group.

All diabetic pregnancies were managed by a multidisciplinary team and glucose monitoring was performed on a regular basis. All diabetic pregnancies were initiated on a diabetic diet, 44% did not achieve normoglycemia and were initiated on insulin therapy which mainly included short-acting regular insulin or premix insulin. Three patients who were earlier taking oral hypoglycemic agents prior to admission were shifted to insulin because of continued hyperglycemia. Average dose of insulin administered was 24.4 units per day.

Fetal outcome measures in diabetic pregnancy are depicted in Table 3. Mean birth weight for neonates of diabetic mother was 3.1±0.9 kg, whereas for control group, it was 2.7±0.5 kg (P=0.008). Biochemical and metabolic assessment revealed that hypocalcemia, hyperbilirubinemia, and polycythemia were significantly higher in neonates born to diabetic mothers. Congenital anomalies were also significantly more in neonates of diabetic mothers and were not noted in neonates of nondiabetic pregnancies. Cleft lip with palate (n=1), foot drop (n=1), hip dislocation (n=1), pericardial effusion (n=1), and anencephaly with meningocele (n=1) were the various anomalies identified. There were more babies with respiratory distress in the study group (10%) and greater number of intrauterine deaths, but the difference was not significant. Neonates born to nondiabetic pregnant mothers were transferred to the mother soon after birth, but neonates of diabetic pregnancies were first transferred to nursery for glucose monitoring.

Table 2: Maternal outcome in diabetic and nondiabetic pregnancies

Maternal outcome	Study group n = 50	Control group n = 50	P value
Hypertension/pregnancy-induced hypertension	20 (40)	5 (10)	0.001
Polyhydramnios	10 (20)	1 (2)	0.004
Cesarean delivery	21 (42)	Nil	0.001
Fetopelvic disproportion	15/21 (71.4)	Nil	0.001
Hypertensive retinopathy	5 (10)	Nil	0.022

Figures in parenthesis are in percentage

Table 3: Fetal outcome in diabetic and nondiabetic pregnancies

Fetal outcome	Study group n = 50	Control group n = 50	P value
Macrosomia	14 (28)	Nil	0.001
Hypocalcemia	7 (14)	1 (2)	0.027
Hyperbilirubinemia	17 (34)	3 (6)	0.001
Respiratory distress	5 (10)	2 (4)	NS
Polycythemia	4 (8)	Nil	0.04
Congenital anomaly	5 (10)	Nil	0.04
Preterm births	6 (12)	2 (4)	NS
IUGR babies	12 (24)	17 (34)	NS
Intrauterine demise	3 (6)	Nil	NS

Figures in parenthesis are in percentage

Discussion

The present study is a retrospective study and has inherent limitations. The information obtained is solely dependent on the entries made in the case records and this is one reason why accurate prepregnancy body mass index (BMI) was not available and the entries from clinical notes had to be relied upon for determining obesity. Although pregestational and gestational diabetes differ in terms of pathophysiology, a distinction is difficult to make in this study, since prepregnancy patient records were not available.

Obesity was more common in the diabetic group. In fact, obesity in itself is an insulin-resistant state, but pregnancy is also known to be associated with elevated levels of maternal hormones like estrogen, progesterone, prolactin, cortisone, human placental lactogen, and placental growth hormone, many of which promote insulin resistance and weight gain. Spontaneous abortions were also commoner in the diabetics. Abnormal glucose homeostasis in previous pregnancies which might have gone undetected could be responsible for these adverse events. Higher rates of abortions have been reported with hyperglycemia (10.1%) in pregestational diabetes group; 2.7% with GDM, and nil in nondiabetic controls.[7] Although history of intrauterine death (IUD) deliveries was more in diabetics, the difference was not statistically significant and this could be because of a small sample size.

In the present study, hypothyroidism, hypertension, and polyhydramnios were observed more with the diabetic pregnancies, which are expected. Endocrinopathies like hypothyroidism[8] are known to be associated with diabetes and so is PIH or chronic hypertension and polyhydramnios. Primary hypothyroidism observed in 16% diabetics does not reflect the true prevalence since routine screening for thyroid disorders was not being done for all diabetic pregnancies. Polyhydramnios in diabetes is probably related to fetal polyuria due to fetal hyperglycemia. Polyhydramnios complicating diabetic pregnancies is associated with higher perinatal mortality and morbidity rates than diabetics with normal amniotic fluid. Mild to moderate hydronephrosis observed in 6% of diabetic pregnancies could present a physiological change of pregnancy.

The rate of cesarean delivery was 71.4% in diabetic pregnancies, among which most were elective cesarean (15/21) to prevent the potential risk of shoulder dystocia and birth trauma. As a policy, decision for elective cesarean is made after evaluating for fetopelvic disproportion, especially when fetal weight is more

than 4000 g in a diabetic mother. Non-progress of labor, failure of induction, and abnormal presentations are other reasons for cesarean deliveries. In the control group, the mean birth weight was lower and incidentally, fetopelvic disproportion, operative delivery, or non-progress of labor was not seen, probably because of a small sample size and stringent selection criteria of uncomplicated pregnancies.

The present institute policy is to admit all uncomplicated diabetic pregnancy cases at 34 to 36 weeks of gestation, while poor glycemic control warrants earlier admission. Insulin therapy is initiated when diet and lifestyle measures are unable to achieve pre-meal values between 70 to 105 mg/dl and post-meal values <130 mg/dl.

Macrosomia was diagnosed in one-in-five diabetic pregnancies. Initial hyperglycemic episodes lead to elevation of fetal growth factors, increased expression of basal membrane GLUT1 receptors, and eventually sustained acceleration of fetal growth leading to macrosomia. Similar high rates have been reported from other parts of India.[9] Diabetic pregnancies had significantly greater adverse perinatal events including metabolic abnormalities like hypoglycemia, hypocalcemia, and hypomagnesemia. Elevated erythropoietin levels cause polycythemia, further contributing to postnatal hyperbilirubinemia.

In the present study, three intrauterine deaths in diabetics were observed—all had poor glycemic control and were not on insulin therapy at the time of admission. In fact, one patient was booked and had IUD at 25 weeks of gestation—fetus was anencephalic with meningomyelocele. The other two patients had accompanying pre-eclampsia with macrosomia (birth weight, 4.5 and 4.8 kg) and one had history of previous term IUD.

Congenital malformations were also identified in 10% of diabetic pregnancies which were largely anatomical defects (cleft lip, cleft palate, foot drop, hip dislocation), or involved the cardiovascular (pericardial effusion) or nervous system (anencephaly, meningocele). The present figure is much higher than reported by another Indian study—3.8% in pregestational diabetics and 1.4% in GDM.[7]

In the present study, neonates of diabetic mother were all transferred to nursery for blood sugar monitoring and further biochemical investigations to identify neonatal complications associated with diabetes. In case of congenital anomaly or respiratory distress, special care and management was provided to the neonate. Neonates of nondiabetic mother without any complication like respiratory distress or low birth weight were transferred to the mother.

The present study thus supports that diabetes during pregnancy contributing to a state of hyperglycemia is a state of concern and is associated with risk factors as well as high maternal and fetal morbidity. Regular follow-up, controlled diet and life style are essential to control the hyperglycemia in diabetic pregnancies. Insulin or drug therapy, preferably the former, should be initiated to achieve euglycemia. Multidisciplinary team management and antepartum fetal surveillance can go a long way in preventing adverse fetal outcomes. GDM also identifies women who are at high risk of developing diabetes later in their lives.[10] Maternal hyperglycemia also primes the intrauterine environment, increasing the propensity of the offspring to develop metabolic syndrome including type 2 diabetes mellitus.[11] So, screening, early detection, and intervention for "diabetes in pregnancy" provide the treating doctor an opportunity to initiate prompt treatment to avoid maternal and fetal adverse outcomes, implement life style changes, and delay development of diabetes in high-risk individuals.

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