

Maternal and Neonatal Outcomes in Gestational Diabetes Mellitus

Farooq MU^a, Ayaz A^b, Ali Bahoo L^b, Ahmad I^a

^a Al-Noor Specialist Hospital Makkah, Kingdom of Saudi Arabia ^bBahawal Victoria Hospital, Bahawalpur, Pakistan

To describe antenatal maternal complications and neonatal outcomes caused by gestational diabetes mellitus.

Materials and Methods: This descriptive observational study was conducted in the Department of Obstetrics and Gynaecology (Obs & Gynae), Bahawal Victoria Hospital, Bahawalpur, Pakistan, over a the period of one year, from January 1 to December 31, 2003. Fifty pregnant women diagnosed by glucose tolerance tests as diabetics were enrolled as study subjects and followed regularly at the Obs & Gynae out-patient department. Blood glucose levels were controlled by diet per se or with insulin and subjects were hospitalized for insulin dose adjustment and management of complications. Fetal well being was assessed by ultrasound, kick count and cardiotocography. Time and mode of delivery was decided upon at 36th week of gestation. Intra-partum maternal blood glucose level was monitored and fetal monitoring was done by external cardiotocography.

Results: Out of a total of 1429 women delivered, 50(3.5%) were diagnosed as GDM and studied. Forty-four (88%) patients were above 25 years of age and 38(76%) were multiparous. Thirty-two (64%) subjects required insulin to control GDM. Most frequent maternal and foetal complications were polyhydramnios 9(18%) and macrosomia 18(36%), respectively. One out of fifty subjects had a spontaneous miscarriage and one had intrauterine death. Caesarean section was done in 29(58%) patients. Total number of babies delivered alive were 48(96%).

Conclusion: GDM was diagnosed in 3.5% of pregnant women. Most of the subjects were above 25 years and multiparous. Most common maternal complication was polyhydramnios and caesarean section was a common mode of delivery. Macrosomia and jaundice were most prominent complications among neonates.

Key Words: Bahawal, Pregnancy, Gestational diabetes mellitus, Maternal outcome, Neonatal outcome, Complications

Received: 13.02.2007 Accepted: 17.08.2007

Introduction

Diabetes is the most common pre-existing medical condition complicating 2 to 3% of pregnancies; 90% of these cases present with GDM.¹ Gestational diabetes does recur in about 60% of subsequent pregnancies and 40% of these will develop non-insulin dependent diabetes within 15 years after delivery² which was the background for the original diagnostic criteria.³ It is important to identify pregnant women with gestational diabetes because it is associated with significant metabolic alterations, increased perinatal morbidity and mortality, maternal morbidity and exaggerated long term morbidity among the mothers and their off springs.⁴

If GDM is not properly treated, there is an increased risk of adverse maternal (pre-eclampsia, pregnancy induced hypertension, recurrent vulvo-vaginal infections, increased

Correspondence: Mian Usman Farooq, Al-Noor Specialist Hospital, Health Research Centre, P.O. Box 6251, Holy Makkah, KSA

E-mail: drus76@yahoo.com

incidence of operative deliveries, obstructed labor and development of diabetes mellitus later in life), fetal (macrosomia, polyhydramnios, preterm labour, respiratory distress unexplained intrauterine fetal death, traumatic delivery) and neonatal complications (hypoglycemia, jaundice, polycythemia, tetany, hypocalcaemia, hypomagnesaemia).⁵

GDM is fast becoming a major health problem in developing countries undergoing rapid changes in lifestyle, dietary habits and body mass index. Both maternal and neonatal mortality and morbidity resulting from GDM can be prevented by proper antenatal supervision and institutional care, facilities that exist in our tertiary care units and even in most of the primary health centers. The major hurdles to be crossed in our country include lack of education and socio-cultural taboos leading to improper and substandard antenatal care, failure of screening of high risk pregnancies and their referral to the appropriate health facilities at the proper time.

The objectives of our study were to list maternal complications and outcomes in GDM, and to identify neonatal morbidity associated with this condition.

Materials and Methods

This descriptive observational study was carried out in the department of Obs & Gynaecology of a tertiary care referral teaching hospital in Bahawalpur, Pakistan, the Bahawal Victoria Hospital, from 1st January to 31st December 2003 (one year). Fifty pregnant women diagnosed on the basis of the glucose tolerance test (GTT) as diabetic, were enrolled as study subjects.

The inclusion criteria comprised of all pregnant women attending the out patient department of obstetrics and gynecology, age >35 years, BMI >25, with risk factors in past history i.e. family history of diabetes mellitus in first degree relative, previous history of GDM, repeated miscarriages, unexplained still births, previous macrosomic or congenitally malformed baby & glycosuria in first trimester, glycosuria on two occasions in ei-

ther the second or third trimester, polyhydramnios, macrosomia, large for gestational age fetus in current pregnancy having undergone glucose tolerance tests (GTT) and the patients found to be diabetic were enrolled as our study subjects.

The Oral Glucose Tolerance Test (OGTT) was done according to the National Diabetic Data Group. After an over-night fasting of 10-16 hours, venous plasma glucose concentrations were measured in fasting, 1 hour, 2 hours and 3 hours samples after giving 100 gm of glucose in 250 ml of water orally. Patient was diagnosed as a case of GDM if two or more readings equaled or exceeded the levels of fasting 105 mg/dL, 1 hour 190mg/dL, 2 hour 165 mg/dL, 3- Hour 145mg/dL.⁶

Patients with raised fasting ≥ 126 mg/dL and casual levels ≥ 200 mg/dL, and with symptoms of diabetes mellitus for first time in pregnancy were also included in the study group, without performing OGTT.⁷

All diabetic pregnant women also suffering from some other disorders which directly or indirectly may affect the outcome of pregnancy e.g. asthma, epilepsy, known hypertension, thyroid dysfunction, anemia, heart problems were excluded from the study.

Dietary control was advised for all women with GDM. Total calories per day were calculated according to 30-35 cal/kg of body weight and diet charts were given to them. Insulin treatment was initiated in subjects with frank diabetes (Fasting ≥ 126 mg/dL or postprandial ≥ 200 mg/dL), failed dietary therapy (>2 weeks) and fetal macrosomia in 3rd trimester (29-33 weeks) despite apparently good glycemic control, as this decreases macrosomia at birth from 45% to 14%.

Based upon blood glucose values, patients were either hospitalized or managed as out patients with diet control. Blood glucose profile (6 levels) were done fasting, 2 hours post breakfast, pre lunch, 2 hours post lunch, pre dinner, 2 hours post dinner. The dose of insulin was adjusted until fasting and 2hr postprandial blood glucose levels were 70-100 and less than 140 mg/dL respectively accor-

ing to American Diabetes Association criteria.⁸

After adjusting insulin dosage, patients were discharged with instructions to be followed regularly at antenatal clinic with glucose home monitoring (2 levels) and to report immediately in case any complication (PIH, preterm labour, premature rupture of membranes or decrease foetal movement) should occur. Ultrasonography was done early in gestation for fetal anomalies and was repeated if indicated.

Baseline investigations carried out in all the patients at the time of enrollment, were haemoglobin, blood group and Rh factor, complete examination of urine, ultrasonography. Liver functions, serum uric acid and renal functions were advised where indicated.

At each antenatal visit, glucose home monitoring (fasting and 2 hours post prandial) record was checked, maternal and fetal well being were assessed and if there was any complication, the patient was readmitted and managed accordingly. Decision about time and mode of delivery was made at 36 weeks of gestation. Patients, with controlled GDM had no complications and were allowed to go beyond the 38 completed weeks; none, however, were allowed to go beyond 40 weeks of pregnancy. Induction of labour was carried out for indications such as poor glycaemic control, pre-eclampsia, gestational age of 40 completed weeks etc. Elective caesarean section was reserved for those diabetics who had fetal macrosomia or presence of more than one risk factor.

During labour and prior to elective caesarean section, euglycaemia was achieved by administering intravenous insulin via an infusion pump together with intravenous dextrose at a rate of 10 g/h, using 10% solution. Maternal plasma glucose levels were monitored hourly and insulin dose adjusted to maintain the blood glucose concentration between 70-110 mg/dL.⁹ All the newborn babies were assessed by a paediatrician immediately after

delivery. A structured performa were used to collect data after taking informed consent from subjects.

Chi-squared test was applied to categorical data and p value <0.05 was considered as significant.

Results

A total of 1429 women delivered during the study period at department of Obs & Gynae, Bahawal Victoria Hospital, Bahawalpur, fifty patients (3.5%) were diagnosed as a case of GDM through OGTT.

Age was measured as a continuous variable in our study and for the purpose of analysis; it was categorized into ≤ 25 years and above 25 years. Mean age was 32.3 years. More than half of the subjects were above 25 years 44(88%), while percentages for nullipara (no child), multipara (1-5 children) and grand multipara (>5 children) women were 12 (24%), 35 (70%) and 3 (6%) respectively. Thirty-six (72%) were educated up to primary level and, 29 (58%), 13 (26%) and 8 (16%) belonged to low (<5000 PK rupees income), middle (5000-15000 PK rupees) and upper (>15000 PK rupees) socioeconomic status respectively.

In the present study, 9 (18%) patients had GDM before 28 weeks, 31 (62%) between 28-32 wks and 10 (20%) after 32 wks of gestation. GDM of 32 (64%) was controlled by insulin and the remaining achieved normoglycemia by diabetic diets only. On the other hand, 36 (72%) were hospitalized for control of GDM during antenatal period while 14 (28%) were managed at out patient clinics.

It was observed that despite good glycemic control, 22 (44%) of 50 patients had no complication, while the remaining did; multiple complications were observed in 6 patients. Regarding the frequency of complications, polyhydramnios occurred in 9 (18%) followed by preterm delivery in 7 (14%) (Table 1).

Table 1. Maternal complications during antenatal period

Complications	Patients frequency*	%
Polyhydramnios	9	18
Preterm Labour	7	14
Pregnancy induced hypertension (PIH)	6	12
Premature rupture of membranes	5	10
Recurrent monilial infections	3	6
Recurrent UTI†	3	6
Miscarriage	1	2

* Six patients had multiple (>1) complications; † Urinary tract infection

Forty-two (84%) delivered between 37-40 weeks while 6 (12%) delivered between 33-36 weeks, one (2%) was between 28-32 and one <28 (2%) weeks of gestation ($\chi^2=74$, $p<0.001$). Elective C-section was done for 22 (44%) of the subjects followed by spontaneous vaginal delivery 17 (34%). Seven women had to have emergency C-section 7 (14%), and 3 (6%) had assisted forcep deliveries while 1(2%) aborted spontaneously ($\chi^2=33.23$, $p<0.001$).

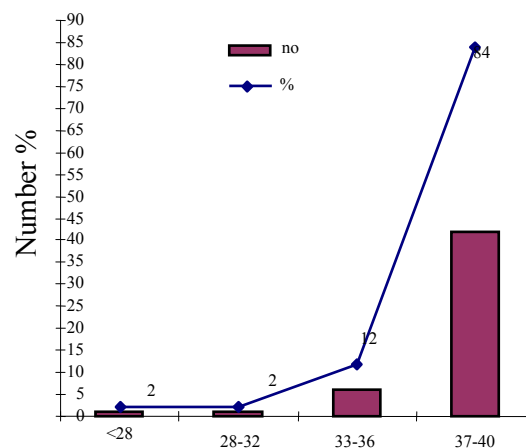
Table 2. Fetal Complications

Complications	Frequency*	%
Macrosomia	18	36
Jaundice	9	18
Hypoglycemia	4	08
Shoulder dystocia	3	06
Miscarriage	1	2
Congenital abnormality	1	2
Respiratory distress syndrome	1	2

* Thirteen babies had multiple (>1) complications.

It was observed that out of 50 babies, 26 (52%) had no complications while 24 (48%) did. Multiple complications were observed in 13 babies of which macrosomia was the most frequent complication in 18 (36%) followed by jaundice in 9 (18%) (Table 2).

APGAR score at first and fifth minutes of birth was documented. Initial resuscitation was required in 11 babies (Fig 1).

**Fig.1. Gestational age in weeks**

Forty-eight (96%) were delivered alive while one was stillborn, there was one miscarriage ($p<0.001$). Neonatal weight was measured as a continuous variable. It was categorized up to 2.6 kg, between 2.7-3.9 kg and 4.0 kg or above. It was observed that out of fifty, 29 (58%) neonates were between 2.7-3.9 kg ($p<0.001$) (Table 3).

Table 3. Fetal Outcomes

	Variables	no	%
Outcome (n=50)	Alive	48	96
	IUD/Still birth	1	2
	Miscarriage	1	2
Birth weight (Kg) (n=50)	≤ 2.6	3	6
	2.7-3.9	29	58
	≥ 4	18	36

Discussion

In this study, 88% of the diabetic pregnant women were above 25 years of age and only 12% women were <25 years of age. Increasing maternal age was associated with higher

frequency of GDM, which was in accordance with other studies,^{10,11} showing that carbohydrate tolerance deteriorates progressively with age especially in females.

Increasing parity, as an associated risk factor for GDM was well demonstrated in this study where 76% of the patients were multiparous and this correlates well with another study¹¹ in which 80% of patients with GDM were multiparous. Presence of illiteracy and poverty adversely affect the outcomes; in the present study, 44% patients had no formal education and belonged to lower socio-economic class.

Minor abnormalities in carbohydrate metabolism during pregnancy can adversely affect pregnancy outcomes. Glucose intolerance increases as pregnancy advances.¹² This trend was also demonstrated by our study, where 82% patients were diagnosed as cases of GDM in the late second and third trimesters, results which can be compared with those of a study conducted at the Civil hospital, Karachi, Pakistan.¹³

Management of gestational diabetes is one of the most rewarding clinical experiences. Current management advocates outpatient care. An effective treatment regimen consists of dietary therapy, self blood glucose monitoring and the administration of insulin if the target blood glucose values are not met with the diet alone.

Approximately 15% of women with GDM require insulin therapy.¹⁴ Another study carried out at Jinnah hospital, Lahore¹¹ reported that 40% of patients with gestational diabetes require insulin. In the study presented, 64% patients were on insulin for glycemic normalization. Such a high number in the present study was due to illiteracy and lack of awareness about the principles of good diabetic control, and 72% patients were hospitalized for control of diabetes and for the management of complications during antenatal period.

Several obstetric problems occur in diabetic pregnancy, their frequency being directly related to the quality of the diabetic control

achieved.⁹ Despite good glycemic control, the maternal complications were 56% in the present study. Polyhydramnios is a common complication, with a reported incidence of 3-32%¹⁵ in diabetic pregnancies. Perveen¹⁶ in her study also found polyhydramnios the most common maternal complication of GDM. This was comparable to the results of the current study.

Premature labour occurs up to 20% of diabetic pregnancies.⁹ A study done in Lahore has shown that 15 (38%) of diabetic women delivered pre term.¹² Almost 14% of the deliveries in the present study were preterm and unfortunately all the women belonged to lower socio-economic classes. The reason might be that preterm labor, occasionally associated with polyhydramnios and the presence of illiteracy and poverty adversely affect this problem.

Women with good glycemic control and no other complications of pregnancy ideally will be delivered at 39-40 weeks of gestation, as confirmed by a study conducted in Lahore;¹² the results were comparable to the current study.

In the present study, the rate for congenital anomalies was 2%, a figure that correlates well with other studies reporting 3.3%,¹⁷ 3.85%¹² and 4%.¹⁸ Women in whom glucose intolerance develops after mid pregnancy do not expose the developing embryo to hyperglycemia and these infants do not have any increase in malformations; the low rate in this study could hence be due to this fact, as 82% women developed diabetes in late second or third trimester.

The reported incidence of macrosomia is 25-40%,¹⁵ comparable to our study with 36%, but more in another developing world study, i.e 46.6%.¹⁹ This high figure in the current study might be due to the effect of hyperglycemia which largely manifests in the third trimester, leading to fetal overgrowth during that period.²⁰

The majority of women with GDM proceed to term and have a spontaneous vaginal delivery. Abdominal delivery of infants of

mothers with gestational diabetes has been considered a therapy. The known relationship between hyperglycemia and fetal growth and the reported increased risk of shoulder dystocia results in an increased rate of caesarean delivery within all groups of women with a diagnosis of diabetes.²⁰ Woon¹⁹ in their study reported a 41.8% caesarean section rate. Our study showed a 58% caesarean section rate, quite similar to other studies.¹⁸

The high percentage of caesarean deliveries in the present study was due to the fact that we considered macrosomia a risk factor for shoulder dystocia and birth trauma, in planning the mode of delivery. Elective caesarean section was hence reserved for those diabetic women who had fetal macrosomia, history of previous C-section or had more than one risk factor. That is why in this study, caesarean section rate was high but only three babies had shoulder dystocia and none of the babies had birth trauma.

Another study reported hyperbilirubinemia as the most common neonatal complication in the women with gestational diabetes¹² which was comparable to our study. Hypoglycemia during the first few hours of life occurred in 25 to 40% of infants of diabetic mothers¹⁵ which is much higher than that of our study and the study by Mannan.¹⁸ Good maternal glycemic control during pregnancy and normal maternal glucose levels at the time of delivery decrease the risk of neonatal hypoglycemia, as shown in the current study.

One baby had respiratory distress and died on the fifth day of life; The baby had been delivered before 32 weeks of gestation. The Join Clinic reported an incidence of 31% of respiratory distress syndrome in infants of diabetic mothers declining to an average of 5.5% in the same clinic with better glycemic control.^{21,22}

Minor metabolic disturbances in pregnancy, labor and delivery put mother and baby at high risk of developing certain complications and result in long term morbidity; these minor metabolic disturbances hence need to be screened and treated at the appropriate time, reducing the social and financial burdens of managing the results of untreated diabetes. These patients should be cared for in those centers which have facilities of obstetrician, physician and neonatologist with special experience in the field.

To conclude, only 3.5% females were diagnosed with GDM. Nearly three-fourths were hospitalized for control of GDM. Despite good glycemic control complications occurred in more than half of the subjects and polyhydramnios was prominent in the antenatal period. Similarly less than half of the neonates developed complications, of which macrosomia was prominent. Thirty-six percent of neonates weighed >4kg.

Acknowledgements

We are all thankful to Ibrahim Biruar and Moh-Ali Nasa for their technical assistance.

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