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ORIGINAL ARTICLE

Outcome of Diabetic Pregnancies in a Tertiary Referral Centre, Varanasi

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Abstract

Aim The study was done to determine the maternal and fetal outcome of pregnancies complicated by maternal diabetes either Gestational Diabetes Mellitus (GDM) or preexisting (type 1 or type 2) diabetes over a period from March 2011 to Feb 2013 in a tertiary care hospital, Varanasi.

Methods This is a retrospective audit of the maternal and fetal outcome of women who presented to the Sir Sundar Lal Hospital, Department of Obstetrics and Gynaecology, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India from March 2011 to Feb 2013, with GDM or pre-existing type 1 or type 2 Diabetes with pregnancy. The audit group comprised 65 pregnancies (67 babies), of whom 27 had preexisting diabetes and 38 cases developed gestational diabetes. Pregnant women who were found to be diabetic preconceptionally or in the first trimester were classified as 'pre-existing diabetes'.

Results There were total of 65 diabetic women in this retrospective study, 39 women were GDM (60 %) while 26 women (40 %) were having pre-existing diabetes (24 type 1 diabetes and 2 women were in type 2 diabetes group). There were 35 multigravid women (53.85 %) and 30 primigravid women (46.15 %). There were 39 (60 %) women on Insulin. There were 42 Lower Segment

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Caesarean Section (64.62 %) and 23 Spontaneous Vaginal Delivery (35.38 %). In fetal and neonatal complications, there were three still births, one case of intrapartum death, and one case of shoulder dystocia. Fetal anomalies were less frequent, one case of Gastroschisis with Hydrocephalus associated with Menigomyelocoele, there was one case of isolated Hydrocephalus, and there was also one case of Truncus arteriosus.

Conclusions The study analyses maternal and fetal complication in the GDM group and also preexisting diabetes group. In our centre, the 60 % women were GDM while 40 % were having pre-existing diabetes. Total rate of fetal/neonatal complication rate was 7.69 % and of congenital anomaly rate it was 9.23 %. Proportion of still birth, Intrauterine death, and congenital malformations was higher in the pre-existing diabetes group although the data are not large enough to draw a statistically significant conclusion. LSCS rate was little higher in the GDM group (69.23 %) in comparison to the preexisting diabetes group where it was 57.69 %. SVD (Spontaneous Vaginal Delivery) rate was 30.77 % in GDM and 42.31 % in the pre-existing diabetes group. HbA1c was within normal range 84.62 % of GDM group while in 15.38 % it was raised >6 %. In the pre-existing diabetes group, only 19.23 % of women had HbA1c within acceptable range and 80.77 % had it >6. The aim of St Vincent Declaration is to 'achieve pregnancy outcome in the diabetic woman that is similar to that of the non-diabetic woman.' But, so far we have not been able to achieve this. Our HbA1c level is remarkably high in the pre-existing diabetes group. Only 3 out of 65 patients' women took Folic Acid periconceptionally. We need to work to achieve it our best. It is well known that insulin treatment during pregnancy results in reduction in the rate of macrosomia, fetal/neonatal, and maternal complications. Therefore, we need to use insulin judiciously and advocate its usage in the situations where it is needed.

Keywords Diabetes · Gestational diabetes · Maternal outcome · Fetal outcome · Complications

Introduction

India has become diabetes capital. This is because of the lack of exercise, sedentary life style, fast food, urbanization, more life expectancy, and increasing obesity. Ethnic origin is a major determinant. In a study done in West London, the adjusted odds ratio for women from Indian subcontinent, in comparison with those of Europid origin, was 11.3 (95 % confidence interval 6–8–18.8). Incidence of diabetes is also increasing among women of reproductive age in similar proportion in India [1, 2].

GDM is defined by World Health Organisation (WHO) as 'carbohydrate intolerance resulting in hyperglycaemia of variable severity with onset or first recognition during pregnancy' [3].

More women of childbearing age are having pre-existing (type 1 or type 2) diabetes or they develop gestational diabetes mellitus (GDM) during pregnancy. Therefore, overall incidence of women who are pregnant and have diabetes has increased. The prevalence of GDM is reported to be 18 % in India [4].

Diabetes during pregnancy has adverse outcome not only for the fetus/neonate but also for the mother. Gestational diabetes also increases the complication rate in the mother and fetus. Indians are at higher risk of developing diabetes and their complications due to their ethnicity and genetic predisposition. Sir Sundar Lal Hospital (SSLH), Department of Obstetrics and Gynaecology, Institute of Medical Sciences (IMS), Banaras Hindu University (BHU), Varanasi, North India is a tertiary referral centre where patients come from far and wide. The catchment area is very wide. Therefore, we planned to do this retrospective study to know the maternal and fetal outcome in cases of GDM and also pre-existing diabetes.

For detection and diagnosis of gestational diabetes mellitus, recommendations are as follows:

1. Screen for undiagnosed type 2 diabetes at the first prenatal visit in those with risk factors using standard diagnostic criteria.
2. Screen for GDM at 24–28 weeks of gestation in pregnant women not previously known to have diabetes.
3. Screen women with GDM for persistent diabetes at 6–12 weeks postpartum using the OGTT and non-pregnancy diagnostic criteria.

We followed the criteria laid down by IADPSG [5].

Materials and Methods

This is a retrospective audit of the maternal and fetal outcome of women who presented to the SSLH, IMS, BHU, from March 2011 to Feb 2013, with GDM or pre-existing type 1 or type 2 diabetes with pregnancy.

The audit group was comprised of 65 pregnancies (67 babies), of whom 27 had pre-existing diabetes and 38 cases developed gestational diabetes. Pregnant women who were found to be diabetic preconceptionally or in the first trimester were classified as 'pre-existing diabetes.' Oral Glucose Tolerance Test (OGTT) as per IADPSG (International Association of Diabetes and Pregnancy study group) was done. This test is also done after 8 h of fasting. First, fasting blood sugar sample is taken. Then 75-gram glucose (WHO) is given and blood sugar is estimated at 1 and 2 h. Blood sugar cut off values are shown in Table 1.

We also did estimation of fasting (normal range 70–110 mg/dl) and postprandial blood sugar (110–140 mg/dl) levels. Our hospital is a tertiary referral centre and patients come from far and wide. It was our fear that some pregnant mothers may not come for follow-up, therefore we did fasting and postprandial sugar level estimation also and if they were deranged then OGTT was done.

High-risk patients had OGTT directly so that treatment on them could be started early. High-risk category included pregnant women who had family history of diabetes mellitus in her first degree relative history of GDM, macrosomia in her previous pregnancies, history of unexplained still birth, gynaecological history of Polycystic Ovarian Syndrome (PCOS) in the past and if the patient is obese. It is also done, if there is suspected macrosomia or polyhydramnios in this pregnancy [6, 7].

Pregnant women with GDM and pre-existing diabetes were managed by a multidisciplinary team involving an obstetrician, physician, pediatrician, ophthalmologist, and dietician. Proforma was used to collect data from the records post-delivery, age of the pregnant mother, parity, bad obstetric history, type of diabetes, on Insulin, gestational age at booking, gestational age at the onset of GDM, fasting blood sugar level, blood sugar level 2 h postprandial, OGTT blood sugar levels, levels of HbA1c at the time of diagnosis, gestational age at the time of delivery, mode of delivery, birth weight of the baby and fetal outcome. Congenital malformations were also noted. Maternal and fetal assessment was done using clinical examination, biochemical estimation, and ultrasonography. Macrosomia was defined as >4 kg for both GDM and pre-existing diabetic group [8].

Pregnancy was assessed using biophysical profile regularly. Amniotic fluid index (AFI) was also measured. Polyhydramnios was defined as an AFI in excess of 25 cm [9].

The collected data were tabulated on windows-based personal computer using Microsoft Excel software. Statistical calculation was done in the department of Community Medicine.

Results

There were total of 65 diabetic women in this retrospective study, 39 women were GDM (60 %) while 26 women (40 %) were having pre-existing diabetes (24 type 1 diabetes and 2 women were in type 2 diabetes group). There were 35 multigravid women (53.85 %) and 30 primigravid women (46.15 %). Our aim was to analyze the data in such a way that we can draw certain inferences regarding pregnant mothers having diabetics.

About 39 (60 %) women were on Insulin. The number of women with LSCS and SVD were 42 (64.62 %) and 23 (35.38 %), respectively. Table 2 reveals pregnancy outcomes in terms of fetal and neonatal complications; there were three still births, one case of intrapartum death, and one case of shoulder dystocia. Fetal anomalies were less frequent, one case of Gastroschisis with Hydrocephalus associated with Menigomyelocoele, there was one case of isolated Hydrocephalus, and there was also one case of Truncus arteriosus.

Two neonates (one male and one female) had major congenital malformation diagnosed antenatally (Gastroschisis, Hydrocephalus with meningomyelocele) and one male neonate had Congenital Heart defect (Truncus arteriosus) diagnosed after birth (expired at 4 months age). Mothers of all three neonates with major malformation had type 1 diabetes and $HbA_{1C} > 9$ %. Among the pregnancies with pre-existing diabetes, there were 2 stillbirths (one of the twin in monochorionic twin-gestation and the other in hydrocephalus with meningomyelocele).

Table 3 shows the distribution of diabetic women according to their pregnancy history. Among the GDM group, 69.23 % were primigravid while multigravida were 30.77 %. In the pre-existing diabetes group, there was reversal trend as 88.46 % of women were multigravida while only 11.54 % primigravid. The association was found to be statistically significant. The Incidence of Bad Obstetric History (h/o recurrent miscarriage, intrauterine death and still birth) was more frequent in pre-existing diabetes group as compared to GDM. The pre-existing diabetes group was found to have higher incidence of recurrent miscarriages (26.92 %), IUD (23.08 %), and still birth (11.54 %) in past.

Insulin use was almost 43.59 % in the GDM group and in the pre-existing diabetes group 84.62 % of pregnant women used Insulin. Only 4 patients (15.38 %) in the pre-existing diabetes group did not use insulin, two of them were type 2 diabetic (continued metformin and dietary

Table 1 Glucose tolerance test

Time	Blood sugar level (mg/dl)
OGTT (Fasting)	<92
OGTT (1 h)	<180
OGTT (2 h)	<153

Table 2 Fatality distribution of pregnancy outcomes in case of diabetic mothers

	Number	Percentage
Uneventful	54	83.0
Fetal/neonatal complication	5	7.69
Congenital anomalies	6	9.23

Table 3 Pregnancy-related history of diabetic women in study

History	Type of diabetes, number (%)		*P* value
	GDM	Pre-existing diabetes group	
Parity			
Multigravida	12 (30.77)	23 (88.46)	0.001
Primigravida	27 (69.23)	3 (11.54)	
Bad obstetric history			
Uneventful	37 (94.87)	10 (38.46)	0.001
Recurrent Miscarriages	2 (5.13)	7 (26.92)	
IUD	0 (0)	6 (23.08)	
Stillbirth	0 (0)	3 (11.54)	
Insulin treatment			
Not on insulin	22 (56.41)	4 (15.38)	0.001
On insulin	17 (43.59)	22 (84.62)	
Mode of delivery			
LSCS	27 (69.23)	15 (57.69)	0.341
SVD	12 (30.77)	11 (42.31)	
Fetal outcome			
Uneventful	35 (89.74)	19 (73.08)	0.209
Fetal/neonatal complication	2 (5.13)	3 (11.54)	
Congenital anomalies	2 (5.13)	4 (15.38)	
HbA1c			
HbA1c < 6	33 (84.62)	5 (19.23)	0.000
HbA1c > 6	6 (15.38)	21 (80.77)	

advice) and other two did not follow the advice. The proportion of use of insulin in pre-existing diabetes group was significantly higher than that of GDM group. LSCS rate was little higher in the GDM group (69.23 %) in comparison to the pre-existing diabetes group where it was 57.69 %. SVD (Spontaneous Vaginal Delivery) rate was 30.77 % in GDM and 42.31 % in the pre-existing diabetes group.

HbA1c was within normal range 84.62 % of GDM group while in 15.38 % it was raised >6 %. In the pre-existing diabetes group, only 19.23 % of women had HbA1c within acceptable range and 80.77 % had it >6 and it was found to be statistically significant.

The information on different parameters related with pregnancy are given in Table 4. The mean gestational age at booking was 14.67 weeks in the GDM group while it was 13.31 weeks in pre-existing diabetes group. It shows that after long duration pregnant women are reporting to hospital however statement like it is not justified because Sir Sunder Lal hospital is a referral hospital so this type of situation may arise. Maternal age at booking was 22.51 years in GDM group and 28.46 years in pre-existing diabetes group. Gestational age at the time of diagnosis was 25.38 in GDM while 14.27 in the pre-existing diabetes group. HbA1c was 5.34 in GDM group while it was 7.48 in the pre-existing diabetes group. Gestational age at the time of delivery was 38.07 weeks in GDM while 36.69 weeks in the pre-existing diabetes group.

Apart from it the matter of interest was to know the distribution of different characteristics related with Pregnant mothers parity. Table 5 shows the relation between parity and the other variables discussed above i.e., gestational age at booking, maternal age, gestational age at delivery and HbA1c levels. From table, it is clear that irrespective of the type of gravid the reporting time at hospital was more than 3 months. It seems lack of awareness among society. The mean sugar amount at fasting stage, after 2 h, was found to be significantly higher among multigravida in comparison to primagravida. Similarly mean fasting sugar at OGTT, at 1 and 2 h, was again found to be significantly higher among multigravid females, which could be explained due to their advancing age. HbA1C at the time of diagnosis as diabetic was found to be in normal range among primagravida; however, it was at higher level among multigravida cases. This difference was also found to be significant. The gestational age at delivery was also found to be significantly higher in multigravida cases in comparison to primagravida. This difference was about 1 week. The weight of babies at birth of was slight higher among multigravid cases in comparison to primagravid cases. Although it was insignificant. The mean age of babies at birth in diabetic case was found to be higher than normal weight 2.5 kg which could be explained by mothers being diabetic or poorly controlled diabetes.

Discussion

The criteria for diagnosis by National Diabetes Data Group are as follows: Impaired fasting glucose: FPG > 110 mg/dl (6.1 mmol/1) and <126 mg/dl (7 mmol/l). Diagnosis of diabetes is made by either 2 FPG of >126 mg/dl on two different occasions or 2 RBS > 199 mg/dl on two different occasions or I FPG > 126 mg/dl + I RBS > 199 mg/dl [10].

This audit is a retrospective data collection study and therefore has its drawbacks. The information is totally dependent upon the person who is collecting the data.

Incidence of recurrent miscarriage was 5.13 % in GDM while 26.92 % in cases of pre-existing diabetes group which is similar to study done by Shefali et al. This could be because of the effect of abnormal glucose homeostasis [11].

LSCS rate was little higher in the GDM group (69.23 %) in comparison to the pre-existing diabetes group where it was 57.69 % which is nearly similar to study done by

Table 4 Descriptive statistics of pregnancy parameters in case of diabetic history

	Type of diabetes	*N*	Mean	SD	*t* test *P* value
Gestational age at booking	GDM	39	14.67	6.40	0.395
	Pre-existing diabetes group	26	13.31	6.07	
Maternal age at booking	GDM	39	22.51	2.74	0.000
	Pre-existing diabetes group	26	28.46	3.30	
Gestational age at the time of diagnosis	GDM	39	25.38	3.48	0.000
	Pre-existing diabetes group	26	14.67	3.17	
Sugar fasting	GDM	39	117.41	3.95	0.000
	Pre-existing diabetes group	26	123.81	5.59	
Sugar @ 2 h	GDM	39	151.51	8.15	0.000
	Pre-existing diabetes group	26	173.46	7.73	
Fasting sugar of OGTT	GDM	39	102.56	4.29	0.000
	Pre-existing diabetes group	26	111.69	5.60	
OGTT Sugar 1 h	GDM	39	185.72	2.95	0.000
	Pre-existing diabetes group	26	195.69	13.63	
OGTT Sugar 2 h	GDM	39	146.26	4.18	0.000
	Pre-existing diabetes group	26	164.73	6.45	
HbA1c at diagnosis	GDM	39	5.34	0.97	0.000
	Pre-existing diabetes group	26	7.48	2.07	
Gestational age at delivery	GDM	39	38.07692	1.71	0.006
	Pre-existing diabetes group	26	36.69231	2.20	
Birth weight	GDM	39	3.182051	0.50	0.269
	Pre-existing diabetes group	26	3.319231	0.47	

Table 5 Descriptive statistics of sugar and HBA_1C in case of diabetic history

	Parity code	*N*	Mean	SD	*t* test *P* value
Gestational age at booking (weeks)	Multigravida	35	14.29	5.65	0.823
	Primagravida	30	13.93	6.99	
Maternal age (years)	Multigravida	35	27.31	3.83	0.000
	Primagravida	30	22.07	2.41	
Gestational age at the time of diagnosis	Multigravida	35	17.86	6.18	0.000
	Primagravida	30	24.53	4.61	
Sugar fasting	Multigravida	35	121.60	6.04	0.010
	Primagravida	30	118.07	4.43	
Sugar @ 2 h	Multigravida	35	165.91	13.92	0.000
	Primagravida	30	153.73	9.37	
Fasting sugar of OGTT	Multigravida	35	109.09	6.90	0.000
	Primagravida	30	102.87	4.32	
OGTT @ 1 h	Multigravida	35	191.86	12.68	0.063
	Prima gravida	30	187.20	4.92	
OGTT @ 2 h	Multi gravida	35	158.43	10.44	0.000
	Primagravida	30	148.07	7.40	
HbA1C at diagnosis	Multigravida	35	6.99	2.00	0.000
	Primagravida	30	5.26	1.02	
Gestational age at delivery (weeks)	Multigravida	35	36.97143	2.01	0.016
	Primagravida	30	38.16667	1.88	
Birth weight (kg)	Multigravida	35	3.308571	0.48	0.202
	Primagravida	30	3.153333	0.48	

Saxena et al. [12] SVD (Spontaneous Vaginal Delivery) rate was 30.77 % in GDM and 42.31 % in the pre-existing diabetes group. The rate of caesarean delivery was relatively higher in the GDM group in this retrospective audit. Many Caesareans were due to cephalopelvic disproportion, failed induction, failed progress of labor and abnormal presentation. Our departmental policy is to admit uncomplicated diabetic women at 36 weeks although poor blood glucose control will need earlier admission. Insulin therapy was started when diet and exercise were unable to maintain glucose homeostasis. Delivery was planned at 38 weeks in IDDM and at 40 weeks in GDM group.

There were two fetuses weighing 4.2 kg, while four fetuses weighed 4 kg. Macrosomia is due to elevation of fetal growth factors due to hyperglycaemia. As glucose is transported to the fetus it causes hyperinsulinaemia. This excess insulin increases blood triglyceride level and also results in fat deposition [13].

Two neonates (one male and one female) had major congenital malformation diagnosed antenatally (Gastroschisis, Hydrocephalus with Meningomyelocele) and one male neonate had Congenital Heart defect (Truncus arteriosus) diagnosed after birth (expired at 4 months age). Mothers of all three neonates with major malformation had type 1 diabetes and $HbA_{1C} > 9$ %. In women with pre-existing diabetes group, there were two stillbirths (one of the twin in Monochorionic twin-gestation and the other in Hydrocephalus with Meningomyelocele) [14]. The rate is nearly similar to study done by Saxena et al. [13].

In this audit, there was one intrauterine death and three still births. This unfortunate event took place in women who had poor glycaemic control and were not on insulin when the reported to us. One of our patients was booked and had demise due to congenital malformations, which is nearly similar to study done by Saxena et al.

In the present audit, the neonates of diabetic women were a managed as per protocol. They had regular blood sugar monitoring and other investigation to rule out further complications.

This audit reconfirms that hyperglycaemia during pregnancy (either due to GDM or Type 1 or type 2) is associated with higher maternal, fetal/neonatal morbidity. Pregnant women should be regularly followed up, diet control, exercise should be explained. Insulin should be started if above measures are unable to control blood sugar. Diabetic women should be managed by multidisciplinary team and regular antenatal fetal surveillance should be done. GDM women should be explained about the risk of developing diabetes when they are in their middle age. Mother should be counseled that baby has a potential to develop metabolic syndrome in his or her life. The best course of action for the management of diabetes is screening, early detection, and intervention when necessary [15, 16].

Conclusion

The aim of St Vincent Declaration is to 'achieve pregnancy outcome in the diabetic woman that is similar to that of the non-diabetic woman.' But, so far we have not been able to achieve this. Our HbA1c level is remarkably high in the pre-existing diabetes group. Only 3 out of 65 patients' women took Folic Acid periconceptionally. We need to work to achieve it our best.

It is well known that insulin treatment during pregnancy results in reduction in the rate of macrosomia, fetal/neonatal, and maternal complications. Therefore, we need to use insulin judiciously and advocate its usage in the situations where it is needed. Good education and training is also needed in our set-up for Insulin administration and storage [17].

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Compliance with Ethical Requirements and Conflict of Interest There were no conflicts of interest/or financial disclosure. This study is a retrospective study and followed the norms of the Institute of Medical Sciences, Banaras Hindu University, Varanasi, where this retrospective study was undertaken.

References

1. Dornhorst A, Paterson CM, Nicholls JS, et al. High prevalence of gestational diabetes in women from ethnic minority groups. Diabet Med. 1992;9:820–5.
2. Yue DK, Molyneaux LM, Rss GP, et al. Why does ethnicity affect prevalence of gestational diabetes? The underwater volcano theory. Diabet Med. 1996;13:748–52.
3. WHO. Definition, diagnosis and classification of diabetes mellitus and its complications. Geneva: WHO; 1999.
4. Seshiah V, Balaji V, Balaji MS, et al. Gestational diabetes mellitus in India. J Assoc Physicians India. 2004;52:707–11.
5. International Association of Diabetes and Pregnancy Study Groups Consensus Panel. International association of diabetes and pregnancy study groups recommendations on the diagnosis and classification of hyperglycaemia in pregnancy. Diabetes Care. 2010;33:676–82.
6. American College of Obstetricians and Gynaecologists Committee on Practice Bulletins—Obstetrics. ACOG Practice Bulletin. Clinical management guideline for obstetricians-gynaecologists. Obstet Gynecol. 2001;98:525–38.
7. Naylor CD, Sermer M, Chen E, Toronto Trihospital Gestational Diabetes Project Investigators, et al. Selective screening for gestational diabetes mellitus. N Engl J Med. 1997;337:1591–6.
8. Ballard JL, Rosenn B, Khoury JC, et al. Diabetic fetal macrosomia: significance of disproportionate growth. J Pediatr. 1993;122:115–9.

9. Phelan JP, Ahn MO, Smith CV, et al. Amniotic fluid index measurements during pregnancy. J Reprod Med. 1987;32:601–4.
10. National Diabetes Data Group. Classification and diagnosis of diabetes mellitus and other categories of glucose intolerance. Diabetes. 1979;28:1039–57.
11. Shefali AK, Kavitha M, Deepa R, et al. Pregnancy outcomes in pre-gestational and gestational diabetic women in comparison to non-diabetic women. A prospective study in Asian Indian mothers. J Assoc Physicians India. 2006;54:613–8.
12. Saxena P, Tyagi S, Prakash A, et al. Pregnancy outcome of women with gestational diabetes in a tertiary level hospital of North India. Indian J Community Med. 2011;36(2):120–3.
13. Farell PM, Engle MJ, Frantz ID, et al. Complications of pregnancy and fetal development. Diabetes. 1982;31:89–94.
14. Ylinen K, Aula P, Steinman UH, et al. Risk of minor and major fetal malformation in diabetics with high HbA1c values early in pregnancy. Br Med J. 1984;289:345–6.
15. Moses RG, Cheung NW. Universal screening for gestational diabetes mellitus. Diabetes Care. 2009;32:1349–51.
16. Berger H, Sermer M. Selective screening for gestational diabetes mellitus. Diabetes Care. 2009;32:1352–4.
17. Sermer M, Naylor CD, Farine D, et al. The Toronto Tri-hospital Gestational Diabetes Project. A preliminary review. Diabetes Care. 1998;21(suppl 2):B33–42.