Clinical Forum

Diabetes Mellitus in Pregnancy: The United Arab Emirates Experience

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Abstract

Objective: Diabetes mellitus and obesity are highly prevalent in the United Arab Emirates (UAE), and this may have an adverse effect on the reproductive performance of women. The study was undertaken to define the pattern of obstetric and neonatal complications in pregnancies complicated by gestational (GDM) and pre-gestational diabetes (PGDM). Also, an attempt was made to identify the impact of maternal body mass index (BMI) and glycaemic control on these complications. **Method:** 129 records of diabetic women delivered at Mafraq Hospital, Abu Dhabi over a two year period were reviewed. Of these, 82 had GDM, and 47 had PGDM. Maternal BMI at term and obstetric and neonatal complications were recorded. A mean blood glucose level (MBGL) for each pregnancy was calculated. Mantel- Haenszel Chi square test was used for statistical analysis. **Results:** 96% of our patients were obese (BMI >26) with 42.6% belonging to the morbidly obese category (BMI>35). No patient with a BMI <26 had a macrosomic baby. Patients with PGDM had a significantly higher rate of congenital anomalies (p= 0.003) and caesarean sections (p= 0.0147) compared to GDM. In women with MBGL < 100 mg/dl, there were no still births or congenitally malformed babies and they had a lower incidence of large for gestational age (LGA) babies. **Conclusion:** Obesity was remarkably high in the population studied and BMI was an independent factor for macrosomia in the newborn baby. Perinatal mortality rate was 2.5 times higher in the diabetic pregnancies than in the general population.

Keywords : *Diabetes mellitus, gestational diabetes, pregestational diabetes, Body mass index*

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Introduction

Carbohydrate intolerance is the commonest metabolic complication encountered in pregnancy and its adverse effects on pregnancy and perinatal outcome are well documented.[1,2] In fact there is now growing evidence that the intrauterine environment in maternal diabetes not only endangers the fetus in utero, but also increases the risk of obesity and diabetes at a young age in the offspring. [3]

Diabetes mellitus and obesity are two major public health problems in the Gulf countries, which is reflected in the obstetric population's high incidence of gestational diabetes mellitus (GDM). The incidence of GDM reported from Saudi Arabia is 9.8%.[4] Other factors contributing are the late age into which childbearing continues and grand multiparity, in addition to the genetic predisposition. The problem is compounded because of poor awareness of its adverse effects, poor compliance with therapy, and lack of organised care to meet the specific needs and education of the pregnant diabetics.

We carried out a retrospective study on pregnant diabetic patients in a tertiary care hospital at Abu Dhabi, United Arab Emirates (UAE) to determine the influence of blood sugar control during pregnancy and maternal body mass index on fetal weight, and obstetric and neonatal complications in women with gestational and pre-gestational diabetes (PGDM).

Patients and methods

Records of all pregnant women with a diagnosis of gestational or pre-gestational diabetes delivered at Mafraq Hospital, Abu Dhabi between 1.1.1996 and 31.12.1997, were retrieved. Patients who were unbooked, those who did not have regular blood glucose monitoring, and multiple pregnancies were excluded from the analysis. Hence, out of a total of 170 records, 129 were found to be satisfactory for evaluation.

Age, body mass index (BMI) at term, parity, family history of diabetes, the nature of glucose intolerance – GDM or PGDM, and previous obstetric history were recorded for each patient. The type of treatment- diet or insulin, and the time of gestational age of initiation of insulin therapy were noted.

The blood glucose profiles performed during the entire pregnancy were averaged to calculate a mean blood glucose level for the index pregnancy.[5] The patients were then divided into three groups according to their average mean blood glucose level - good control (90-110 mg/dl), poor control (111-140 mg/dl), and very poor control (>140 mg/dl).

Length of gestation at delivery, type of delivery (spontaneous/ instrumental/ caesarean), live or still born, any shoulder dystocia, and birth weight were noted. Neonatology records were analysed for birth weight- appropriate/ large/ small for gestational age, for any neonatal complications, and for the period of stay in the Neonatal Intensive Care Unit. The number and type of congenital anomalies, if any, were noted. Macrosomia was defined as birth weight more than 4000 grams.[6,7] Mantel-Haenszel chi-square test was used to calculate the relative risk and confidence intervals and Fischer exact test (Pearson's) to ascertain the association between two variables where the numbers were small.

Results

Of the 129 records analysed, 82 patients had GDM and 47 patients had PGDM. The age range was between 21 and 47 years, with the majority in the age group of 30-34 years. The parity of 0-4, 5-9, and above 10 were noted in 45.7%, 36.1% and 18.2% patients respectively in the GDM group, and in 47.8%, 39.1% and 13% respectively in the PGDM group. 8.4% GDM patients and 21.7% PGDM patients gave an obstetric history of intrauterine fetal death.

The prevalence of gross obesity in the study population was remarkable. Only 5 out of 129 patients had a normal BMI, whereas 55/129 (42.6%) were morbidly obese with a BMI >35 kg/m^2. The incidence of macrosomia increased with BMI, both in GDM and PGDM groups irrespective of the level of glycaemic control (Table 1). None of the mothers with a normal BMI (less than 26) had a macrosomic baby. The incidence rose to 20.2% in the group with BMI 27-35, and 29.0% with BMI >35, but the difference between these groups did not reach levels of statistical significance.

There was no significant difference in the incidence of LGA in the GDM (39%)

and PGDM (40.4%) groups (Table 2). There were 4(8.5%) stillbirths in the PGDM group as compared to 1(1.2%) in the GDM group, but the numbers were too small for statistical analysis. However the incidence of congenital anomalies was significantly higher in the PGDM group (p = 0.003). The rate of caesarean section was also significantly increased in the PGDM group (p = 0.0147). The neonatal complications of our study population are summarised in Table 3. The difference between GDM and PGDM groups were not statistically significant.

Table 1 : BMI at term and Birth weight

BMI	No. of Patients (%)	Macrosomia (>4 kg)
≤26	5 (3.9%)	0
27-35	69 (53.5%)	14 (20.2%)
>35	55 (42.6%)	16 (29.0%)

Table 2 : Obstetric complications and Diagnosis

OBSTETRIC COMPLICATIONS	GDM n=82	PGDM n=47	RELATIVE RISK (95%CI)
LGA	32 (39.0%)	19 (40.4%)	1.01 (0.63-1.63)
Shoulder Dystocia	2 (2.4%)	2 (4.3%)	-
Still Birth	1 (1.2%)	4 (8.5%)	-
LSCS	15 (18.3%)	21 (44.7%)	0.49 (0.28-0.87)
Congenital Anomaly	3 (3.7%)	9 (19.2%)	0.18 (0.06-0.57)

Table 3 : Neonatal Complications

NEONATAL COMPLICATIONS	GDM n=82	PGDM n=47	RELATIVE RISK (95%CI)
Hypoglycaemia	12	12	0.55 (0.27-1.13)
Jaundice	16	10	0.93 (0.46-1.86)
Polycythaemia	2	2	-
TTN	3	3	-
RDS	1	1	-
Hypocalcaemia	0	1	-
Hypomagnesaemia	0	1	-

RDS- Respiratory distress syndrome
TTN- Transient tachypnoea of the newborn

Table 4: Glycaemic control and Neonatal complications

COMPLICATION	MEAN BLOOD GLUCOSE LEVEL		
	< 110 mg % (n = 43)	110 – 140 mg % (n = 59)	> 141 mg % (n = 27)
LGA	13 (30.2 %)	27 (45.8 %)	9 (33.3 %)
Still Birth	0	1 (1.7 %)	4 (14.8 %)
Congenital Anomaly	0	4 (6.8 %)	6 (22.2 %)
Hypoglycaemia	6 (13.9 %)	13 (22.0 %)	5 (18.5 %)

Of the 82 patients with GDM, 53 complied with diet therapy, 14 received insulin and 15 patients did not comply with the treatment prescribed. 35.8% (19/53) of the patients on diet control delivered a large for gestational age (LGA) baby as compared to 28.6% (4/14) in the insulin treated group, but the difference was not statistically significant.

The effect of glycaemic control on neonatal complications is shown in Table 4. No stillbirth occurred in the good control group, whereas there was 1 (1.8%) stillbirth in the poor control, and 4(14.8%) in the very poor control group. Similarly, no patient with a good control had an abnormal baby, but 4 (7.3%) newborns in the poor control group and 6 (22.2%) in the very poor control group were found to have congenital malformations. The incidence of LGA and neonatal hypoglycaemia was also the least in the good control group. Using Fischer exact test the differences in still birth (p= 0.0047) and in incidence of congenital abnormalities (P<0.0036) between the very poor control group and the good control group were both found to be significant

Table 5: Complications in diabetic pregnancies versus all pregnant women

Complications	Diabetic pregnancies	All pregnancies
LGA	37.9%	7.4%
LSCS	27.9%	10.5%
Still Birth	38.7/1000 births	13.9/1000 births
Perinatal Mortality	54.2/1000 births	20.0/1000 births

The incidence of LGA, lower segment caesarean sections (LSCS), stillbirth and perinatal mortality in the 129 pregnant diabetic patients were significantly higher compared to the overall figures among pregnant women in our department during the study period (Table 5).

Discussion

There is enough evidence [8,9,10] to support the idea that control of blood glucose levels during pregnancy in gestational and pregestational diabetes mellitus significantly reduces the risk of large for date babies, still births and the incidence of neonatal complications. But the exact definition of hyperglycaemia in pregnancy is still disputed. There is no worldwide consensus on the diagnostic criteria,[11] screening strategies and the optimal glycaemic level in the gestational and pregestational diabetes,[12] and the need for tertiary level care for pregnant diabetic women.[13,14] Despite the recommendations issued by the American College of Obstetricians and Gynecologists regarding insulin therapy in 1986, a survey conducted in the United States[15] revealed that only 22% of the obstetricians and maternal fetal specialists who responded, followed the ACOG recommendation.

Blood glucose control during diabetic pregnancy is a major, if not the sole determinant of the outcome of the pregnancy. Poor glycaemic control in the immediate preconception period and in the early weeks of pregnancy significantly increases the risk of delivering a malformed baby. Kitzmiller et al[16] compared the outcome of 84 women with insulin dependent diabetes (IDDM) recruited before pregnancy for intensive management of their diabetes with another group of 110 women booked at 6 to 30 weeks of gestation. One major malformation occurred in the 84 infants (1.2%) when mothers were treated before conception, compared to 12 (10.9%) in the late treated group.

Uncontrolled diabetes has been shown to be associated with a higher incidence of unexplained still births, macrosomia with its attendant risks of shoulder dystocia, increased maternal and fetal trauma, operative deliveries, and a high rate of neonatal complications. In an unselected population of pregnant mothers with

NIDDM, the stillbirth and infant mortality rate were found to be 25.0/ 1000 total births and 19.9/ 1000 live births respectively, as compared to 5.0/ 1000 and 6.8/ 1000 [17] in the general population. However, with close monitoring of the glycaemic control and with an active participation of an obstetrician – diabetic physician team, it has been shown that it is possible to reduce the still birth rate to that of the control population.[18]

In the present series, the rate of LGA was lower when blood glucose levels were well controlled during pregnancy. Treatment with insulin in GDM patients reduced the incidence of LGA from 35.8% to 28.6%. No stillbirth or congenital malformations occurred when mean blood sugar level was below 110 mg/l. But in those with mean blood glucose levels > 141mg%, the incidence of still birth and congenital abnormalities were significantly higher. However, other parameters of long term glycaemic control like HbA1C and fructosamine levels were not available in this study population. Another setback of this study was the number of patients who were non-compliant, and therefore excluded from the initial analysis (out of the initial 170 patients). The inclusion of this group with likely poor metabolic control would have altered our data.

The incidence of obesity was remarkable in the study population, only 3.8% had a normal BMI and nearly half (42.6%) had a BMI over 35. Maternal BMI was an independent contributory factor for macrosomia and it was observed that none of the patients with a normal BMI (<26) had a macrosomic baby.

There was an overall trend towards poorer pregnancy outcome in patients who had PGDM compared to GDM, although significant differences were found only with regards to the incidence of congenital malformations and caesarean sections. Similar observation was made from Kuwait by Johnstone[19] who reported a perinatal mortality rate (PNMR) nearly four times in established diabetics which compared to gestational diabetics. However, in the United Kingdom, Hawthorne[20] has reported a lower PNMR (8.2/1000) in PGDM compared to patients with gestational glucose intolerance (49.2/1000) and the background population (11.6/1000). In our study the PNMR in diabetic pregnancies was 54.2/1000 as compared to 20.0/1000 found in women delivered at our hospital during the same period.

It appears that an abnormal glycaemic milieu in early pregnancy results in an increased beta cell proliferation in fetal pancreas[21] and hyperinsulinemia, which not only affects organogenesis, but also interferes with the development of an effective utero-placental circulation, and fetal metabolic processes. Therefore, protocols for regulation and supervision of glycemic control in pregnant diabetic patients are strongly recommended.

References:

1. Gabbe SG, Mestman JH, Freeman RK. Management and outcome of Class A diabetes mellitus. Am J Obstet Gynecol 1977; 127: 465-469.

2. Casey BM, Lucas MJ, McIntire DD, et al. Pregnancy outcomes in women with gestational diabetes compared with the general obstetric population. Obstet Gynecol 1997; 90(6): 869-873.

3. Pettitt DJ, Knowler WC. Long term effects of the intrauterine environment, birth weight, and breast feeding in Pima Indians. Diabetes Care 1998; 21(Suppl 2): B138-41.

4. El Mallah KO, Narchi H, Kulayat NA, et al. Gestational and pre-gestational diabetes: comparison of maternal and fetal characteristics and outcome. Int J Gynecol Obstet 1997; 58:203-209.

5. Hosamane US, Malhotra S, Narang A, Dhall K. Perinatal outcome in relation to maternal glycaemic control in diabetic mothers. Indian J Med Res 1990 Aug; 92:216-219.

6. O'Sullivan JB. Prospective study of gestational diabetes and its treatment. In: Sutherland HW, Stowers JM, eds. Carbohydrate metabolism in pregnancy and the newborn. Edinburgh, Churchill Livingstone 1975; Pages 195-204.

7. Okun N, Verma A, Mitchell BF, Flowerdew G. Relative importance of maternal constitutional factors and glucose intolerance of pregnancy in the development of newborn macrosomia. J Matern Fetal Med 1997; 6(5):285-290.

8. Rey E, Monier D, Lemonnier MC. Carbohydrate intolerance in pregnancy: incidence and neonatal outcomes. Clin Invest Med 1996; 19(6): 406-415.

9. Drexel H, Bichter A, Sailer S, et al. Prevention of perinatal morbidity by tight metabolic control in gestational diabetes mellitus. Diabetes Care 1988; 11:761-768.

10. Steel JM, Johnstone FD. Guidelines for the management of insulin- dependent diabetes mellitus in pregnancy. Drugs 1996 Jul; 52 (10): 60-70.

11. Solomon CG, Willet WC, Rich-Edwards J, et al. Variability in diagnostic evaluation and criteria for gestational diabetes. Diabetes Care 1996; 19(1): 12-16.

12. Sacks DA, Chen W, Greenspoon JS, et al. Should the same glucose values be targeted for type 1 as for type 2 diabetics in pregnancy? Am J Obstet Gynecol 1997;77(5): 1113-1119.

13. Jackson EA, Francke L, Vasilenko P. Management of gestational diabetes by family physicians and obstetricians. J Fam Pract 1996; 43(4): 383-388.

14. Bienstock JL, Blakemore KJ, Wang E, et al. Managed care does not lower costs but may result in poorer outcomes for patients with gestational diabetes. Am J Obstet Gynecol 1997; 177(5): 1035-1037.

15. Landon MB, Gabbe SG, Sachs L. Management of diabetes mellitus and pregnancy: A survey of obstetricians, and maternal fetal specialists. Obstet Gynecol 1990; 75: 635-640.

16. Kitzmiller JL, Gavin LA, Gin GD, et al. Preconception care of diabetes. Glycemic control prevents congenital anomalies. JAMA 1991; 265:731-736.

17. Casson IF, Clarke CA, Howard CV. Outcomes of pregnancy in Insulin dependent diabetic women: results of a five year population cohort study. BMJ 1997; 315: 7103, 275-278.

18. Coustan DR. Pregnancy in diabetic women. N Engl J Med 1988; 319: 1663-1665.

19. Johnstone FD, Nasrat AA, Prescott RJ. The effect of established and gestational diabetes on pregnancy. Br J Obstet Gynaecol 1990; 97(11):1009-15.

20. Hawthorne G, Snodgrass A, Tunbridge M. Outcome of diabetic pregnancy and glucose intolerance in pregnancy: an audit of fetal loss in Newcastle General Hospital 1977-1990. Diabetes Res Clin Pract 1994; 25(3):183-190.

21. Reiher H, Furhmann K, Noack S, et al. Age dependent insulin secretion of the endocrine pancreas in vitro from fetuses of diabetic and nondiabetic patients. Diabetes Care 1983; 6 : 446 – 451.