

ORIGINAL STUDY

The Impact of Diabetes on Pregnancy in Qatar

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Abstract:

Objectives: To investigate maternal and neonatal outcomes of pregnancies in women with different types of diabetes in Qatar.

To identify factors such as age, family history of diabetes and obesity contributing to the increased risk of GD.

Design:

The design of this study is retrospective.

Materials and Methods:

14 pregnant women with different types of diabetes including 143(28%) Impaired Glucose Tolerance Test (IGTT), 334(65%) Gestational Diabetes (GD), 26(5%) Insulin Dependent Diabetes Mellitus (IDDM) and 11(2%) Non Insulin Dependent Diabetes Mellitus (NIDDM) who delivered between Jan – June 2004 formed the subject of this study. Data extracted from the files included maternal characteristics, fetal and maternal complications.

Result:

Eight women had abortions and two had stillbirths, leaving a final dataset comprising 504 women (141 IGTT, 332 GDM, 21 IDDM and 10 NIDDM). Two hundred and eighty three (56.2%) were Qatari. 53% (n=267) aged >30 years, 57.5% (n=290) had family history of diabetes, only 16.1% (n=81) treated by insulin. Polyhydramnios was the most common antenatal complication occurred in 15% (n=76). No maternal mortality. The overall Cesarean section was 6.2% (n=31), Preterm delivery 5.8% (n=29). Macrosomia appeared in 7.3% (n=37) infants and congenital malformations in 2% (n=10) infants.

Conclusions:

We observed that the risk factors for GDM found in other studies are generally valid for our population. Also

we found that IDDM has a poorer outcome than NIDDM. However a future prospective study is need it to draw firm conclusions regarding the relative magnitudes of the adverse effects between the different diabetic groups.

Introduction

Before 1922 fewer than 100 successful pregnancies in diabetic women had been reported, with a 30% maternal mortality rate and an infant mortality rate greater than 90% [1]. Even in the mid-1970s physicians were still counseling diabetic women to avoid pregnancy [2]. However in 1989 the St. Vincent Declaration (SVD) proposed a strategy to ensure a better outcome of pregnancy in diabetic women [3] by improving pre-pregnancy counseling, facilitating more home-based blood glucose monitoring, and developing specific treatment guidelines. One of its declared aims was that within five years the pregnancy outcome of diabetic women should approximate that of non-diabetic women. In 2003 the International Diabetes Federation of Europe concluded that these goals had not been achieved [4] but the World Health Organization (WHO) still maintained that the SVD contained the key features necessary for the future development of diabetes-related health services [5]. However, awareness by itself is not sufficient to improve the outcome of diabetic pregnancies. In a study from Pakistan [6] the higher rate of complications found in pregnant women with gestational diabetes (GDM) was partly due to poor medical and obstetric facilities. In a more recent study, Platt et al [7] also found disappointing outcomes of pregnancy in diabetic women in the UK where the level of awareness is high and a multidisciplinary approach to the management of GDM is the norm.

The prevalence of diabetes mellitus (DM) continues to increase everywhere. The overall prevalence of DM in the USA is now estimated to be 7% of the population [8]. In the USA gestational DM (GDM) affects between 2% and 8% of all pregnancies [9], i.e. about 135,000 annually. DM is commonly encountered in the Middle-East [10,11] where a recent survey of the Qatari population [12] indicated a prevalence of 15%. There is therefore some concern that the associated prevalence

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of GDM could also be particularly high [13]. A number of studies have been carried out in Saudi Arabia and the Gulf States [14-20] which support this notion. In 1993 Nabeel Isseh et al [21] conducted a study of diabetes and pregnancy in Qatar and found that the perinatal mortality was high in both pre-GD (6%), GD (3.7%) groups and the perinatal morbidity was also high. However the study did not include the IGTT group and focused only on Qatari pregnant women. The overall effect of GDM on the maternal and fetal outcomes of pregnancies among Qatari women is unknown although in 2000 a review of 83 cases of stillbirth in Qatar Women's Hospital concluded that 9.6% were caused by GDM [22].

We have studied the impact of diabetes type 1, type 2, GDM and IGT on the pregnancy outcomes of both mother and fetus among women who gave birth at the Qatar Women's Hospital in Doha during a six-month period in 2004. The WHO defines GDM as carbohydrate intolerance resulting in hyperglycemia with the onset or first recognition during pregnancy [23]. On the other hand impaired glucose tolerance (IGT) is a lesser degree of abnormal Oral Glucose Tolerance which has only recently been recognized as such [23]. Like GDM, IGT may also be detected for the first time during pregnancy [24] but there have been few publications that have documented the extent of IGT in pregnant women. We have taken care to distinguish cases of IGT from GDM and have compared the maternal and fetal outcomes across all four diabetic groups: GDM, IGT, IDDM and NIDDM. Our study is a follow up, update and more comprehensive than the study conducted in that field in Qatar 1993 [21] and our results provide necessary data for any future studies of GDM and pre-gestational diabetes in Qatar.

Methods

This study is a retrospective analysis of a case-series of pregnant women who were admitted to the Qatar Women's Hospital for delivery between January 1st and June 30th 2004 with a primary diagnosis (i.e. cause of admission) of "DM in pregnancy" or "abnormal glucose tolerance". The study included women who were diagnosed with type 1 or type 2 diabetes, GDM or IGT. Pregnant women who attend antenatal clinics in Qatar (and who do not already have a diagnosis of DM type 1 or type 2) are routinely screened for GDM at 24-28 weeks gestation using a 50g oral glucose tolerance test (OGTT) unless they have previously demonstrated a high fasting blood sugar (FBS) content (FBS > 7 mmol L-1) during this pregnancy (in which case they will already have been diagnosed as gestationally diabetic). An initial 50g OGTT result ≥ 7.3 mmol L-1 results in a follow-up 100g OGTT, which confirms a diagnosis of GDM if any two of the readings (FBS, 1-hr, 2-hr, 3-hr) exceed their normal thresholds (5.37mmolL-1, 10mmol-1, 8.6mmolL-1 and 7.8mmolL-1 respectively). If only one value exceeds its threshold, then the diagnosis is IGT.

Pregnant women with abnormal glucose tolerance were treated initially using dietary control (alone) for two weeks. If,

at this stage, their FBS was ≤ 5.3 mM L-1 and their 2-hour post-prandial level was ≤ 6.7 mM L-1, they continued using dietary control alone; otherwise they were given insulin. Patients were regularly followed-up at both antenatal and diabetic clinics, and some were admitted either for pregnancy complications or for poor diabetic control. Pregnancy was allowed to continue to term, with a delivery conducted by the expected date of confinement if there were no complications. Caesarian section was carried out only where there were obstetrical indications.

Patients were identified for this study by staff in the Medical Records Department at Qatar Women's Hospital, who searched computerized inpatient discharge summaries for patients whose primary discharge ICD-9 diagnosis was either 64801 or 64881. The patients' medical charts were reviewed and information about the mother and delivery were retrieved, including: age, family history of diabetes, consanguinity, type of diabetes, treatment during pregnancy, fetal gestational age at delivery and mode of delivery. Maternal and fetal complications were also recorded: pre-eclampsia, and urinary infections for the mother and polyhydramnios, respiratory distress syndrome, congenital malformations, hypoglycemia, shoulder dystocia, hyperbilirubinemia and macrosomia for the fetus. Where available the height and weight of the mother (at the beginning of the third trimester) were also recorded and used to calculate the body mass index (BMI).

Data-entry was facilitated using the Epi-Info software package v3.3 (Center for Disease Control and Prevention, Atlanta, USA). Statistical analysis was carried out using the SPSS software package version 14 (SPSS Inc., Chicago, USA).

Results

Data were abstracted for 514 pregnant women: 143 IGTT (28%), 334 GDM (65%), 26 IDDM (5%) and 11 NIDDM (2%). Eight women had abortions (1 GDM, 1 IGTT, 1 NIDDM, 5 IDDM) and two had stillbirths (1 GDM and 1 IGTT), leaving a final dataset of 504 women (141 IGTT, 332 GDM, 21 IDDM and 10 NIDDM). Two hundred and eighty-three (56.2%) of the pregnant women were Qatari.

The demographic characteristics of these women exhibit some variation across the different diabetic categories (Table 1). Maternal age is significantly different ($p=0.001$), and women with diabetes type 1 or type 2 appear more likely to have a family history of diabetes ($p=0.041$). No statistically significant differences were observed for consanguinity ($p=0.633$). The body mass index (BMI) at the beginning of the third trimester was highest for the NIDDM group followed by IDDM, GDM and IGTT. However because this was a retrospective study the pre-pregnancy body mass index (BMI) was unavailable and occasional absence of height or weight information led to missing BMI information in 59 cases.

The antenatal, labor and delivery characteristics of the pregnancies are shown in Table 2. There was no maternal mortality

among the pregnancies studied. Polyhydramnios was the most common antenatal complication (observed in 76 patients; 15%), followed by pre-eclampsia (43 patients; 8.5%). Although there was a statistically significant difference in the proportion of polyhydramnios between the different DM groups, the small number of other complications made it difficult to establish any statistical significance.

The majority of the women with IGTT and GDM were treated by diet while all the women with IDDM and NIDDM were treated with insulin ($p=0.00$) (Table 2). Statistically significant differences were found between the proportions of women who required induced labor ($p=0.02$). Thirty one pregnant women (6.2%) underwent Cesarean section; four of these required emergency treatment.

Few fetal complications were observed (Table 3). Overall perinatal mortality was ten (1.9%) ($p=0.001$). No infant had an apgar score less than 7 at five minutes and there were 29 (5.8%) premature babies ($p=0.006$). No statistically significant difference was found between the DM groups for any of the observed fetal outcomes: RDS ($p=0.195$), hyperbilirubinemia ($p=0.195$), congenital malformation ($p=0.54$), macrosomia ($p=0.21$). Congenital malformation accounted for the highest percentage of fetal complication (10, 2%) followed by RDS and hyperbilirubinemia. Hypoglycemia appeared in only one infant (from a mother with GDM). Macrosomia was present in 37 (7.3%) births, while shoulder dystocia appeared only in two (0.4%) babies from mothers with IGTT and NIDDM ($p=0.001$).

The age of one hundred fifty six (55.1%) of the Qatari pregnant women was more than 30 years and two hundred and two (71.3%) of them had a positive family history of diabetes. Maternal and fetal complications, pre-eclampsia, urinary infection, hypoglycemia, respiratory distress syndrome, hyperbilirubinemia and macrosomic infants appeared more frequently in the Qatari group, while congenital malformation appeared more frequently in the non-Qatari group.

Discussion:

In our study of 514 pregnant women with diabetes, diabetes types GDM and IGTT appeared much more frequently than IDDM or NIDDM. This was observed also during a similar study in Kuwait [25], although the Kuwaiti prevalences were substantially different: IGTT (35%), GDM (43%), IDDM and NIDDM (22%). In our study there were ten diabetic women who did not complete their pregnancies; two had stillbirths and eight had abortions. In a comparable study conducted in Qatif Central Hospital, Saudi Arabia on 133 diabetic pregnancies from 1988-1992 there were six stillbirths [17].

It is thought that women who have a positive family history of diabetes, high body mass index and are older are more likely to develop gestational diabetes during pregnancy [20]. Our results support this view: approximately 57.5 % of

pregnant women with GDM had a positive family history of diabetes mellitus, 53% were older than 30 years and their mean BMI was ranged between 32-36.6 kg/m² in the four groups. This picture is broadly consistent with that from the Fatemiteh hospital in Iran [20].

The use of insulin as a treatment for diabetes in pregnancy is the last choice if the diet fails to control the blood sugar. Table 2 shows that the majority of the women with IGTT or GDM were successfully treated by diet while all women with IDDM or NIDDM were treated by insulin. This is a major difference from a recent Malaysian study [26] in which the majority of patients with GDM were treated with insulin and the majority with IGTT were treated by diet.

As was also reported by Sobande et al [19] from the Abha Maternity Hospital, the most common antenatal complication was polyhydramnios; the differing proportions between the diabetic groups might be related to the varying degrees of glucose intolerance. Pre-eclampsia and urinary infections were found within all the groups in our study except NIDDM, although this may be due to the much smaller number of NIDDM patients. The proportions are higher among IDDM patients. Once again this is also similar to the observations by Sobande et al [19].

Often the decision for Cesarean Section was made because of the likelihood of complications during labor (e.g. macrosomia, shoulder dystocia or pre-eclampsia) or because the patient had already had two previous cesarean sections. Contrary to the findings of Sobande et al [19] we found that pregnant women with NIDDM are more likely to have Cesarean Section than those with IDDM. The IDDM group was associated with the highest proportion of premature deliveries, followed in decreasing order by NIDDM, GDM and IGTT. This may reflect the overall severity of the four types of diabetes and suggests that pre-gestational diabetes (IDDM, NIDDM) have more adverse effects on pregnancy than gestational diabetes or IGTT.

We found no significant difference in perinatal morbidity between the four diabetic groups although congenital malformation accounted for the highest percentage of fetal complications and was only manifested in infants from mothers with GDM and IGTT. Probably this is due to the small sample size because the critical period of organogenesis for those organs affected by congenital malformations in infants of diabetic mothers is 3-6 weeks after conception, where GDM and IGTT most of the time does not yet appear [27]. The respiratory distress syndrome appeared in five infants (GDM 4 (1.2%), IDDM 1 (4.8%)), which is good compared to another study done in California in 1991 [28], where the percentages of respiratory distress syndrome among different types of diabetes were GDM 3%, IDDM 8%, NIDDM 4%.

Hypoglycemia occurred in only one infant from a mother with GDM. This is not high compared to other studies [19, 28] and indicates a good maternal metabolic control and treatment. Diabetes increases the risk of fetal macrosomia [29] and increases the risk of shoulder dystocia

in macrosomic infants [30]. However, in spite of the occurrence of macrosomic infants in all four diabetic groups, no associated shoulder dystocia was observed.

Compared to the study conducted in 1993 [21] among Qatari pregnant women [Table 4] the rate of fetal complications in the Qatari group is lower. This may reflect the improvement in health care and management such as the establishment of mother and fetus clinics responsible for following complicated pregnancies. However the incidence of pre-eclampsia is now higher and the rate of perinatal mortality among the pre-GDM group has more than doubled.

In conclusion, we observed that the risk factors for GDM found in other studies are generally valid for our population. Also we found

that IDDM has a poorer outcome than NIDDM (contrary to the finding by Roland et al [31]). However a future prospective study is needed to draw firm conclusions regarding the relative magnitudes of the adverse effects between the different diabetic groups.

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	IGT	GDM	IDDM	NIDDM	Total
Number	141	332	21	10	504
Nationality					
Qatari	79(56.0%)	181(54.5%)	16(76.2%)	7(70.0%)	283(56.2%)
Non-Qatari	62(44.0%)	151(45.5%)	5(23.8%)	3(30.0%)	221(43.8%)
Maternal Age (Years)					
≤ 30	85(60.0%)	144(43.4%)	8(38.1%)	0(0.0%)	237(47.0 %)
> 30	56(39.0%)	188(56.6%)	13(61.9%)	10(100%)	267(53.0 %)
Family History of DM					
Yes	72(51.0%)	195(58.7%)	16(76.2%)	7(70.0%)	290(57.5%)
No	69(49.0%)	137(41.3%)	5(23.8%)	3(30.0%)	214(42.5%)
Consanguinity					
Yes	24 (17.0 %)	68(20.5%)	3(14.3%)	0(0.0%)	95(18.8%)
No	117(83.0%)	264(79.5%)	18(88.7%)	10(100%)	409(81.2%)
BMI					
Mean (SD)	32 (5.42)	33.3(5.93)	33.9(8.39)	36.6(5.14)	-
N	[126]	[291]	[20]	[8]	

Table 1. Maternal characteristics of the living babies.
(Note that missing data reduced the total number of observation for BMI to 445)

	IGT	GDM	IDDM	NIDDM	Total
Number					
Sample-Size	141	332	21	10	504
Complications					
Pre-Eclampsia	7(4.9%)	33(9.9%)	3(14.2%)	0(0.0%)	43(8.5%)
Polyhydramnios	16(11.4%)	50(15.0%)	6(28.6%)	4(40.0%)	76(15.0 %)
Urinary Infections	1(0.7%)	5(1.5%)	2(9.5%)	0(0.0%)	8(1.6%)
Type of Treatment					
Diet Only	136(96.5%)	287(86.4%)	0(0.0%)	0(0.0%)	423(83.9%)
Insulin	5(3.5%)	45(13.6%)	21(100.0%)	10(100.0%)	81(16.1%)
Labor and delivery					
Normal Delivery	137(97.1%)	310(93.3%)	18(85.7%)	8(80.0%)	473(93.8%)
Induction of Labor [N] [% in normal delivery]	25(18.2%)	56(18.1%)	3(16.7%)	5(62.5%)	89(18.8%)
Cesarian Section	4(2.8%)	22(6.6%)	3(14.3%)	2(20.0%)	31(6.2%)
Birth Weight (g)					
Mean (SD)	3310.9 (484.04)	3295.2 (443.55)	3308.2 (511.21)	3260.2 (540.26)	-

Table 2. Antenatal, labor and delivery characteristics and complications.

	IGT	GDM	IDDM	NIDDM	Total
Number	141	332	21	10	504 (100%)
Premature*	5(3.5%)	19(5.7%)	4(19%)	1(10%)	29 (5.8%)
Neonatal Complications					
RDS**	0(0.0%)	4(1.2%)	1 (4.8%)	0 (0.0%)	5 (1.0%)
Hyperbilirubinemia	0(0.0%)	2(0.6%)	1 (4.8%)	0 (0.0%)	3 (0.6%)
Congenital malformation	2(1.4%)	8 (2.4%)	0 (0.0%)	0 (0.0%)	10 (2.0%)
Shoulder Dystocia	1(0.7%)	0(0.0%)	0 (0.0%)	1(10.0%)	2 (0.4%)
Hypoglycemia	0(0.0%)	1(0.3%)	0 (0.0%)	0 (0.0%)	1 (0.2%)
Macrosomia >4000gm	8 (5.7%)	24 (7.2%)	3 (14.3%)	2 (20.0%)	37 (7.3%)

Table 3. Fetal complications.

(* = babies <37 weeks, ** = Respiratory Distress Syndrome)

	GDM		PreGDM	
	163(1993)	182(2004)	48(1993)	27(2004)
Maternal Complications				
Pre-Eclampsia	2 %	10.4 %	4 %	11.1 %
Polyhydramnios	16 %	12.6 %	35 %	26 %
Urinary Infections	6 %	2.2 %	4 %	7.4 %
Perinatal Mortality	3.7 %	0.5 %	6 %	15 %
Labor and delivery				
Normal Delivery	77 %	91 %	44 %	81.5 %
Cesarian Section	22 %	7.7 %	56 %	3.7 %
Premature Labor	9 %	5.5 %	23 %	14.8 %
Infants Complications				
Macrosomia	21%	6.1%	31%	11.1%
Hypoglycemia	13 %	0.5 %	31 %	0
RDS	5 %	1.1 %	29 %	3.7 %
Congenital malformation	5.5 %	0.5 %	17 %	0
Shoulder Dystocia	1.8 %	0	4 %	3.7 %

Table 4. Comparison between Labor and delivery characteristics, maternal and fetal complications among Qatari pregnant women in 1993[21] and 2004.

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