

Gestational diabetes risk factors modeling in pregnant women

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OBJECTIVES: Gestational diabetes mellitus (GDM) is an impaired glucose tolerance in the pregnancy period. As many as 14-18% of pregnant women are at risk, and 3-4% of pregnancies develop GDM. **METHODOLOGY:** A case control study was conducted in the GYN wards of Shiraz hospitals (November 2005-June 2006). Seventy GDM cases were compared with 350 controls based on the data available from the patients' records. **RESULTS AND DISCUSSION:** In univariate analysis, maternal age, systolic and diastolic blood pressure, BMI, physical activity, live birth, parity, gravidity, gestational age, family history of DM, glycosuria, maternal history of GDM showed a relationship with GDM ($P < 0.002$). Cases of GDM were associated in a multiple logistic regression model with maternal history of GDM, glycosuria, maternal age and family history of DM. Several predictive factors for GDM, such as maternal history of GDM, glycosuria and family history of DM, were found in this study. **CONCLUSIONS:** It is recommended to follow up women in the pregnancy period for glycosuria, particularly accompanying family history of DM and age over 35 years.

KEY WORDS: Gestational diabetes mellitus, logistic regression, modeling

Introduction

Diabetes mellitus (DM) is a metabolic disorder and is the fifth cause of death in developed countries. Gestational diabetes mellitus (GDM) is an impaired glucose tolerance in the pregnancy period. Among all pregnant women, 14-18% are at risk of GDM,^[1] and 3-4% of pregnancies suffer

from GDM.^[2] This disease has higher prevalence among Black, Latino, native American and Asian women.^[3]

GDM has two well-known risk factors: GDM in previous pregnancies and age over 35 years.^[4,5] But there is a controversy about some factors, such as parity, gravidity, history of prenatal death, place of birth and residency, pregnancy BMI, family history of DM, maternal physical activity before and during pregnancy.^[4-7]

Impaired glucose metabolism in pregnancy increases the risk of some complications for mother and fetus. Almost 40% of GDM patients develop diabetes mellitus (DM) in 20 years after pregnancy. Investigators in China found that the prevalence rate of DM among previously reported GDM group was 12 times that of control group.^[7]

GDM produces higher risk of some adverse pregnancy outcomes, such as: macrosomia, hydramnios, episiotomy, gestational hypertension and pre-eclampsia.^[8,9] In numerous studies, the risk factors of GDM in the world have been considered,^[1,4,6-10] but some controversies are seen among these studies. In this paper, some risk factors of GDM have been studied in Shiraz, southern Iran.

Methodology

In this study, 70 GDM patients were compared with 350 non-GDM pregnant women. All cases and controls were followed until termination of pregnancy. Therefore, a hybrid design study was conducted (a case-control and follow-up study). At the first antenatal visit, urine was tested for glycosuria. If found positive or if the patients had the risk factors such as family history of DM, early screening for GDM was performed with 50 g oral glucose challenge test (GCT). If screening test was negative, other screening test was done at 24-48 weeks of gestation. Cases were defined with a glycosuria at first visit or 1-hour serum glucose value over 130 mg/dl according to

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GCT. Five non-GDM pregnant women were selected on the same day to serve as controls. Data were recorded with a five-section questionnaire. These sections included mother's demographic data, history of previous pregnancy, current pregnancy, neonate and mother's follow-up information. Validity of data-gathering tools was confirmed by epidemiologists' and gynecologists' consultation. The majority of data were obtained from

patients' records; but for data quality control, other sources of data such as interview of patients and other gynecologists were used.

Statistical analysis

Two groups were compared using Fisher's exact and Chi-square tests for dichotomous and categorical variables, with two independent sample t-tests for

Table 1: Univariate analysis of gestational diabetes mellitus risk factors in pregnant women

Variables	Cases (n=70)	Controls (n=350)	OR (95% CI)	P value
Maternal age	31.2 ± 6.0	26.3 ± 5.0	-	0.001
Systolic blood pressure	123.2 ± 12.8	116.5 ± 12.6	-	0.001
Diastolic blood pressure	79.6 ± 9.0	74.3 ± 9.9	-	0.001
Physical activity (min/d)	12.9 ± 29.4	25.8 ± 38.4	-	0.002
Pre-gravid BMI	27.1 ± 5.6	23.4 ± 3.9	-	0.001
Post-gravid BMI	29.1 ± 5.2	26.0 ± 3.8	-	0.001
Live birth	1.6 ± 1.7	0.8 ± 1.0	-	0.001
Gravidity	2.7 ± 1.8	1.8 ± 1.1	-	0.001
Parity	1.7 ± 1.7	0.8 ± 1.0	-	0.001
Gestational age	262.4 ± 23.4	271.8 ± 11.8	-	0.002
Family history of diabetes mellitus	37 (52.6)	42 (12)	8.2 (4.7-14.5)	0.001
History of:				
Gestational diabetes mellitus	20 (28.6)	8 (2.3)	17.1 (7.1-40.8)	0.001
Hypertension	10 (14.3)	18 (5.1)	3.1 (1.4-4.3)	0.009
Stillbirth	22 (31.4)	56 (16)	2.4 (1.4-4.3)	0.003
Infertility	10 (14.3)	26 (7.4)	-	0.057
Malformation	3 (4.3)	3 (0.9)	-	0.061
Preterm delivery	5 (7.1)	22 (6.3)	-	0.479
Macrosomia	8 (11.4)	10 (2.9)	4.4 (1.7-11.6)	0.004
Twine pregnancy	1 (1.4)	4 (1.1)	-	0.6
Toxemia	5 (7.1)	11 (3.1)	-	0.11
C-section	32 (45.7)	73 (20.9)	3.2 (1.9-5.5)	0.001
Lab data				
Preeclampsia	14 (20)	22 (6.3)	3.7 (1.8-7.7)	0.001
Urinary tract infection	17 (24.3)	61 (17.4)	-	0.121
Hydramnios	11 (15.7)	5 (1.4)	12.9 (4.3-38.4)	0.001
Glycosuria in first trimester	19 (29.2)	9 (2.3)	17.6 (7.3-42.5)	0.001
Iron deficiency anemia	18 (25.7)	50 (14.3)	2.1 (1.1-3.8)	0.017

Table 2: Multivariable analysis of gestational diabetes mellitus risk factors in pregnant women

Variables	B	SE	Wald	Exp (B)	P value	95% CI	
						Lower	Upper
Maternal age > 35	2.26	0.671	11.34	9.57	0.001	2.57	35.65
Family history of diabetes mellitus	2.1	0.448	21.86	8.13	0.001	3.38	19.57
History of gestational diabetes mellitus	3.09	0.607	25.9	21.93	0.001	6.68	72
Preeclampsia	1.34	0.571	5.49	3.81	0.019	1.24	11.68
Glycosuria	2.35	0.695	11.31	10.34	0.001	2.65	40.38
Constant	-4.95	1.22	16.45	0.007	0.001	-	-

quantitative variables in univariate analysis. Multiple binary logistic regression analysis with forward Wald's method for modeling of several risk factors in a single model was used ($\alpha = 0.05$).

Results

Table 1 shows univariate analysis results. As shown in Table 1, the majority of variables showed a significant difference between two groups. Only the history of infertility, history of malformation, previous preterm delivery, history of twin pregnancy and history of toxemia together with urinary tract infection from lab data have not shown any relationship with GDM. But in multiple logistic regression analysis, maternal age over 35 years, family history of DM, history of GDM, pre-eclampsia and glycosuria remained in a multivariable model [Table 2]. The most important variables according to odds ratios (OR) were the history of GDM and glycosuria in the first trimester. Other variables, which were excluded from the model, are not shown in this table.

Discussion

This hybrid design study was able to examine the risk factors of GDM. The most important factor according to logistic model was history of GDM, which increased the risk of GDM as high as 21 times approximately. This study, as well as other studies, has revealed that GDM has multifactorial features.^[4,6-10] Another clinically important factor is maternal age over 35 years. This factor increases the risk of GDM about 10 times. Although in one study this factor showed 9% increased risk,^[8] it was significant. Also, glycosuria, particularly in the first trimester, is an important predictor of GDM. Therefore, it is recommended to consider the history of GDM and glycosuria in the first trimester as important predictors of GDM.

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