Gestational diabetes mellitus in pregnancy women monitoring at 108 Military Central Hospital: Prevalence, risk factors and pregnancy outcomes

Le Thi Cuc, Ho Trung Hieu, Nguyen Thu Ha, Le Minh Hang, Tran Thi Nga, Nguyen Ba Trinh

108 Military Central Hospital

Summary

Objective: To assess the prevalence, risk factors, and pregnancy outcomes of women with gestational diabetes mellitus. *Subject and method:* This was a cross-sectional descriptive study. The cohort included 430 pregnant women who visited 108 Military Central Hospital between May 2020 and August 2020. A 75-g 2-h oral glucose tolerance test (OGTT) was conducted for each participant at 24 - 28 gestational weeks. *Result:* The mean age of participants was 28.5 ± 4.2 years; (range 19 - 44 years). The incidence of gestational diabetes in our study was 29.5% based on 2019 ADA criteria. Women diagnosed with GDM tended to be older and have greater body mass index (BMI) with p<0.001. We also found that some risk factors such as gravidity, previous preterm birth were associated with GDM, p=0.002 and 0.031, respectively. *Conclusion:* The prevalence of GDM in our study is quite high compared to other studies. Advanced maternal age and higher BMI were associated with increased prevalence of GDM. Thus, early prevention and management of GDM is vital to minimize the risks to both the mother and fetus.

Keywords: Gestational diabetes mellitus, 2019 ADA, glucose tolerance.

1. Background

The 2019 American Diabetes Association (ADA) defines gestational diabetes mellitus (GDM) as diabetes diagnosed in the second or third trimester of pregnancy that was not overt diabetes before gestation [5]. There are various risk factors for GDM including a history of unexplained stillbirth, history of delivering a macrosomic fetus (defined as birth weight > 90th percentile), obesity, age > 25 years, congenital malformations, and a strong family history of type 2 diabetes. Gestational diabetes mellitus affects both the mother and the fetus. The effects on the mother include mild or severe preeclampsia, eclampsia, a higher likelihood of preterm delivery, induction of labor, and cesarean section. The effects of GDM on the child can be classified into fetal and neonatal defects (including macrosomia, delayed organ maturity, hypocalcemia, and hypoglycemia); and fetal compromise (including intrauterine growth restriction and fetal death). Early identification of GDM and appropriate management are vital to prevent these complications. Patients usually undergo screening for GDM between the 24th to 28th gestational week, unless the patient is at high risk of developing GDM;

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Correspondence to: *Le Thi Cuc - A1A Department - 108 Military Central Hospital*

Email: *Lecuc060387@gmail.com*

in those cases, screening is conducted at the first antenatal visit. Early GDM treatment is associated with better pregnancy outcomes and is cost-effective [5].

Nevertheless, up to now, there has been no gold standard criterion for the diagnosis. Different countries use different diagnostic criteria in determining their prevalence. Although the estimated prevalence of GDM worldwide is 7.0%, the prevalence varies from 5.4% in Europe to 14.0% in Africa. In Asia, it ranges from 0.7 to 51.0% and varies from 5.9% to 24.3% in Viet Nam. This vast disparity in prevalence rates may be due to differences in ethnicity, diagnostic criteria, screening strategies, and population characteristics. It has been shown that the 2019 ADA criteria with 75g two-hour test are more practical and convenient compared to the 100-g three-hour test. Furthermore, the 75g two-hour test appears to be more sensitive in predicting the pregnancy complications like gestational hypertension, preeclampsia, and macrosomia than the 100-g three-hour test [7]. Therefore, this study aims to estimate the prevalence of GDM based on 2019 ADA criteria. We also examine the risk factors and pregnancy outcomes of gestational diabetes mellitus women.

2. Subject and method

This was a cross-sectional study carried out between May 2020 and August 2020. The study was conducted in an obstetrics clinic at 108 Military Central Hospital. Eligibility criteria were: (1) ≥ 18 years of age; (2) At 24 - 28 weeks of gestation; (3) No serious preexisting health condition, such as cancer or ischemic heart disease; and (4) ability to read the information sheet and sign the consent form. Exclusion criteria were: Pregnant women were diagnosed with type 2 diabetes before pregnancy; pregnant women have diseases affecting glucose metabolism such as Graves, hypothyroidism, Cushing, liver or kidney failure, etc.; taking drugs that affect glucose metabolism such as corticosteroids, salbutamol, antihypertensive drugs; having an acute illness: Infection, tuberculosis, hepatitis, etc. and pregnant women who did not agree to participate in the study.

Consented participants were invited to attend a baseline interview at 24 - 28 weeks of gestation. Information on sociodemographic characteristics was collected, including age, marital status, education level, occupation, residency, and parity. Their medical history such as stillbirth, induced abortion, preterm birth (delivered earlier than 37 weeks completed), macrosomia (birth weight ≥ 4000g), previous GDM or preeclampsia, cesarean section, and family history of diabetes, or hypertension, were also recorded. The gestational age at delivery, mode of delivery, gender of the baby, and birth weight were obtained from the labor and delivery notes.

To determine the prevalence of GDM, the methods of FBG and RBG were used for diagnosing the blood samples according to the 2019 ADA criteria. A pregnant woman with GDM was confirmed if the level of her FBG or RBG was: Fasting blood glucose: ≥ 5.1mmol/l (92mg/dl) or blood glucose after 1 hour: 10.0mmol/l (180mg/dl) or blood glucose after 2 hours: ≥ 8.5mmol/l (153mg/l).

Preeclampsia was defined as high blood pressure (140mmHg or higher systolic or 90mmHg or higher diastolic) and proteinuria (≥ 0.3g protein in a 24-hour urine collection or 1+ or higher on a urine dipstick test). The woman had Polyhydramnios if the Amniotic Fluid Index (AFI) was ≥ 25cm in the ultrasound scan.

Data analysis: Data were coded, checked, and input into EPI Data 3.1 and exported for analysis using Statistical Package for Social Sciences (SPSS) version 20.0. Quantitative variances were shown by the mean ± standard deviation. Qualitative data were represented as n (%). T-tests were used to compare the means of quantitative independent variables. Chi-square statistics were used to analyze the relationship between the qualitative independent variables and GDM. For qualitative independent variables with small, expected

numbers, Fisher-exact tests were used. Statistical significance was set at $p<0.05$.

3. Result

3.1. General characteristics

Table 1. Patient's characteristics

Characteristic		n = 430 (%)
Age (mean ± SD)		28.5 ± 4.29
Body mass index (kg/m^2)		20.7 ± 2.51
Residence	Urban	127 (29.5)
	Rural	303 (70.5)
Education	Junior high school	14 (3.3)
	Senior high school	64 (14.9)
	College & University	308 (71.6)
	Postgraduate	44 (10.2)
Times of pregnancy	1	181 (42.1)
	2	148 (34.4)
	3rd time and more	101 (23.5)
Gestational diabetes mellitus	Yes	127 (29.5)
	No	303 (70.5)
Values are presented as number and percentages (%).		

A total of 430 women were included in this study, and their baseline characteristics are shown in Table 1. Included patients had a mean age of 28.5 ± 4.29 years (range, 19 - 44 years) and BMI was 20.7 ± 2.51 kg/m^2.

3.2. The prevalence of gestational diabetes and risk factors

Table 2. Association between demographic, laboratory test variables and gestational diabetes mellitus (n = 430)

Variables		GDM (n = 127)	Non-GDM (n = 303)	p-value
Age (mean ± SD)		29.9 ± 4.57	27.9 ± 4.02	<0.001
BMI (mean ± SD)		21.5 ± 2.74	20.4 ± 2.34	<0.001
Age categories	Younger than 25	13 (10.2)	54 (17.8)	<0.001*
	25 to 29	51 (40.2)	167 (55.1)	
	30 to 34	42 (33.1)	63 (20.8)	
	35 and older	21 (16.5)	19 (6.3)	
BMI categories	Underweight, < 18.5	11 (8.7)	62 (20.5)	<0.001#
	Normal, 18.5 - 24.9	103 (81.1)	230 (75.9)	
	Overweight, 25 - 29.9	12 (9.4)	8 (2.6)	

	Obese, ≥ 30	1 (0.8)	3 (1.0)	
Residence	Urban	81 (63.8)	222 (73.3)	0.049*
	Rural	46 (36.2)	81 (26.7)	

Table 2. Association between demographic, laboratory test variables and gestational diabetes mellitus (n = 430) (Next)

Variables		GDM (n = 127)	Non-GDM (n = 303)	p-value
Education	Junior high school	4 (3.1)	10 (3.3)	0.863#
	Senior high school	20 (15.7)	44 (14.5)	
	College & University	88 (69.3)	220 (72.6)	
	Postgraduate	15 (11.8)	29 (9.6)	
Parent has diabetes	Yes	13 (10.2)	16 (5.3)	0.62*
	No	114 (89.8)	287 (94.7)	
Glycosuria	Positive	5 (3.9)	9 (3.0)	0.567#
	Negative	122 (96.1)	292 (97.0)	
Proteinuria	Positive	22 (17.3)	52 (17.2)	0.979*
	Negative	105 (82.7)	250 (82.8)	
Ketonuria	Positive	11 (8.7)	12 (4.0)	0.049*
	Negative	116 (91.3)	290 (96.0)	

*Chi-squared test was used.
#Fisher-exact test was used.
GDM: Gestational diabetes mellitus

The prevalence of GDM was 29.5% (127/430) in the population. Gestational diabetes mellitus group patients were significantly older, relative to the non-GDM group (mean age, 27.9 ± 4.02 versus [vs.] 29.9 ± 4.57 years; p<0.001). Furthermore, 52.5% (21/40) of women aged > 35 years were diagnosed with GDM, which accounted for 16.5% of the entire GDM group. In comparison, only 19.4% (13/67) of women aged less than 25 years were diagnosed with GDM; these values were significantly different (p<0.001). In addition, women with a higher BMI index suffered from GDM more than women with a normal BMI index. Furthermore, education status, family history of diabetes, laboratory test variables such as proteinuria, glycosuria was not associated with GDM in the present study (Table 2).

3.3. The relationship between gestational diabetes and obstetric history and obstetric outcomes

Table 3. Association between obstetric history, pregnancy outcome and gestational diabetes mellitus (n = 430)

Variables		GDM (n = 127)	Non-GDM (n = 303)	*p*-value
Gravidity	1	43 (33.9)	138 (45.5)	0.002*
	2	40 (31.5)	108 (35.6)	
	≥ 3	44 (34.6)	57 (18.8)	
Previous preeclampsia	Yes	2 (1.6)	1 (0.3)	0.21#

	No	125 (98.4)	302 (99.7)	
Previous miscarriage	Yes	27 (21.3)	47 (15.5)	0.15*
	No	100 (78.7)	256 (84.5)	

Table 3. Association between obstetric history, pregnancy outcome and gestational diabetes mellitus (n = 430) (Next)

Variables		GDM (n = 127)	Non-GDM (n = 303)	*p*-value
Previous preterm birth	Yes	9 (7.1)	8 (2.6)	0.031*
	No	118 (92.9)	295 (97.4)	
Previous macrosomia	Yes	5 (3.9)	3 (1.0)	0.53#
	No	122 (96.1)	300 (99.0)	
Polyhydramnios	Yes	5 (3.9)	4 (1.3)	0.133#
	No	122 (96.1)	298 (98.7)	
Preeclampsia	Yes	0 (0.0)	1 (0.3)	1.000#
	No	127 (100)	302 (99.7)	
Preterm birth	Yes	9 (7.1)	6 (2.0)	0.017#
	No	118 (92.9)	297 (98.0)	
Mode of Delivery	Vaginal	70 (55.1)	187 (61.7)	0.203*
	Cesarian	57 (44.9)	116 (38.3)	
Macrosomia	Yes	11 (8.7)	16 (5.3)	0.196*
	No	116 (91.3)	287 (94.7)	

*Chi-squared test was used.
#Fisher Exact test was used.
GDM: Gestational diabetes mellitus

In our study, women who became pregnant in the later pregnancy were more likely to have GDM than in the first pregnancy. Women with 3rd or more pregnancies having GDM accounted for 34.6% of the total number of patients with GDM. This value was statistically significant with p=0.002. Similarly, previous preterm birth and preterm birth were also associated with GDM with p<0.05 (0.031 and 0.017 respectively). In contrast, mode of delivery and macrosomia were not associated with GDM.

4. Discussion

4.1. General characteristics

The mean age of pregnant women in our study was 28.5 ± 4.29 years, similar to that in some studies. In Hanoi, Ta Van Binh's studies in 2002 showed that the mean age was 28.3 ± 4.3 [2], in 2009 Vu Bich Nga's study was 29.2 ± 4.4 [4], 2012 (Thai Thi Thanh Thuy) was 28.1 ± 4.1 [3]. In Ho Chi Minh City (Jane et al. 2011), the mean age of the non-GDM group was 27.85 ± 4.73, the GDM group was 31.21 ± 4.16 (the overall mean was 28.3 years) [6].

According to Jane et al (2011), the average BMI before pregnancy of pregnant women in the normal group was 20.45 ± 2.63, and the GDM group was 21.81 ± 3.12 [6], higher in our study. According to Vu Bich Nga (2009), BMI before pregnancy of Hanoi women from 15 to 34, the average was 20.3 ± 2.2 [4], similar in our study was 20.4 ± 2.34. Like women's age, the higher the BMI is, the greater risks of GDM increase.

4.2. The prevalence of gestational diabetes and risk factors

The prevalence of 29.5% based on the 2019 ADA criteria in the present study may be considered high, compared to Nguyen Le Huong's study in 2012 was 11.4% [1]. This can be explained by dietary habits, and by the reasoning that the metabolism is in overdrive during pregnancy, which can exacerbate glucose intolerance and lead to GDM. This may be attributed to better healthcare systems and the available access to health care facilities in the modern city.

Regarding the risk factors, we found that advanced maternal age or gravidity and higher BMI were significantly associated with GDM. A study conducted among Asian subgroups (Indian, Chinese, Filipino, Japanese, Korean, and Vietnamese), Hispanics, and Africans in 2015 showed a strong relationship between overweight/obesity, advanced maternal age, family history of type 2 diabetes, foreign-born status, and an increased risk of GDM. Furthermore, maternal age and BMI exhibited interactions with race in terms of their relationship with GDM prevalence. Both factors are important in the development of GDM, particularly among African and South Asian women [8].

Gestational diabetes mellitus mothers are at high risk of pregnancy complications. However, there were not many bad pregnancy outcomes in our study. This may be explained by the fact that pregnant women with GDM were screened and managed well by endocrinologists.

We are aware that our research may have two limitations. Firstly, the number of candidates participating in our study is limited. Secondly, we did not bring into analyzing the correlation between the quality of glycemic control and maternity outcomes to emphasize the significance of GDM management.

5. Conclusion

In conclusion, the mean age of pregnant women in our study was 28.5 ± 4.29 and the prevalence of GDM in our study was quite high compared to others research, with 29.5%. Furthermore, 52.5% (21/40) of women aged > 35 years were diagnosed with GDM, which accounted for 16.5% of the entire GDM group. In comparison, only 19.4% (13/67) of women aged less than 25 years were diagnosed with GDM. Similarly, previous preterm birth and preterm birth were also associated with GDM with $p<0.05$ (0.031 and 0.017 respectively).

Gravidity and higher BMI were also associated with increased prevalence of GDM. Early prevention and management of GDM are vital to minimize the risks to both the mother and fetus.

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