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Using 75 g OGTT in prediction for antenatal insulin need in gestational diabetes mellitus in hung Vuong hospital, Vietnam

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ABSTRACT

Gestational diabetes mellitus (GDM) is on the rise in the world and Vietnam. Primary intervention was a modest diet; some recent studies have documented the high blood glucose level in 75 grams glucose tolerance testing associated with simple dietary control

failure. *Objectives:* To determine the relationship between the level fasting plasma glucose in 75 grams of glucose tolerance test and the needs of insulin therapy in gestational diabetes mellitus at the Department of High-Risk pregnancy, Hung Vuong hospital. *Methods:* A nested case-control study including 160 pregnant women with GDM treated at the Department of High-Risk pregnancy, Hung Vuong Hospital, HCMC from 11/2017 to 11/2019, were eligible for sampling and consent to participate. *Results:* Fasting plasma glucose, 1 hour after ingestion, and 2 hours after ingestion in the 75 grams glucose test were significantly higher in the gestational diabetes mellitus group with insulin compared with the control group diet. *Conclusion:* Fasting plasma glucose values in the 75-gram glucose test - 2 hours can help predict the need for insulin in pregnant women with GDM.

Keywords: gestational diabetes mellitus, simple dietary, fasting plasma glucose, nested case-control study.

1. INTRODUCTION

Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance of varying degrees of severity with onset or first recognition during pregnancy. Its prevalence ranges between 7 and 14%, depending on the population studied (ethnicity, dietetic habits) and the diagnostic strategy used and is directly related to the prevalence of type 2 diabetes. The prevalence of GDM, in line with that of type 2 diabetes and obesity, continues to increase worldwide (Ferrara et al, 2007; Hunt and Schuller, 2007).

Asian ethnicity is a known risk factor for type 2 diabetes and GDM. Asians generally develop diabetes and GDM at comparatively lower BMI compared with Caucasians, partly related to visceral adiposity and beta-cell dysfunction in Asians. Other known risk factors are advanced maternal age, obesity, high parity, excessive weight gain during pregnancy, short stature, increased iron stores, including thalassemia, and hypertension. Risk varies among Asian ethnic groups. Rao etal.found that GDM was more common among Chinese (6.5%) and Filipino (6.1%) women compared with Japanese women (3.4%) (p=0.013).

In 2013, the International Diabetes Conference (IDF) estimated that about 16.6% of newborn babies from mothers with hyperglycemia during pregnancy. The report also noted a significant difference in disease incidence, up to 25% in Southeast Asia to 10.4% in North Americaand the Caribbean.

In particular, up to 91.6% of GDM pregnant women come from low-income and middle-income countries. In Vietnam, GDM is an increasing concern, a series of epidemiological studies have been carried out in recent years, noting that the rate of GDM tends to increase in the population. However, it is worth noting that the incidence of the disease is affected by the study population (done in the hospital or the community) or using the 1-75g diagnostic criteria (according to IADSP). It can cause disease rates much higher than mass screening or using the 2-step standard-100g (WHO). As in the study of Jane Hirst, performed at Hung Vuong Hospital, it was recorded that over 2702 women performed GDM screening with 75 grams of sugar test, with the standard of ADA 2010, 6.1% (164 pregnancies). Womenwere diagnosed positive, but when applying the standards set by IADPSG, up to 20.3% of women had to be treated for GDM.

The majority of studies of GDM have shown that self-glucose monitoring is beneficial to Maintain glycemic control in GDM and can improve pregnancy outcomes. Controlling blood glucose levels is the primary goal in managing women with GDM. Medical nutrition therapy (MNT) and exercise are the mainstaysof treatment for GDM (Trang et al., 2019). Still, if this fails, antenatal insulin treatment (AIT) is needed to reduce glucose levels to ensure normal fetal development and better perinatal outcomes (Crowther et al., 2005). Thus, the need for insulin therapy might be a characteristic of patients with more severe GDM due to greater difficulty in glycemic control (Russell et al., 2008).

This study aimedtoassess the relationship between glucose levels during screening tests and subsequent requirements during pregnancy of insulin toachieve targets of blood glucose control in women with GDM. Clinical features of patients treated with and without insulin were also further evaluated.

2. MATERIAL AND METHODS

Pregnant women diagnosed with gestational diabetes by 75 grams of glucose were admitted to Hung Vuong hospital from November 2017 to November 2019. Criteria for insulin administration: patients were given a 1-step legal test - 75 grams of glucose had a positive result, failed with MNT in combination with a designated insulin motor. Criteria for anon-insulin group: patients were tested in a1-step method - 75 grams of glucose had positive results, stable blood glucose with diet moderately combined with exercise. We choose a method of calculating the sample size for diagnosis with a blood sugar threshold of 102.42mg / dl, the sensitivity is pse = 67.2%,and the specificity is 79.7% for the need for insulin treatment, according to Ya Zhang's study in 2016 (Ya et al, 2016). Select ω = 0.16.

$TP+FN=\frac{Z_\alpha{}^2 x P_{se}(1-P_{se})}{\omega^2}$

The rate of insulin treatment in Arendz's study in 2013 was p = 22.8%.

$N=\frac{TP+FN}{p}$

So the minimum sample size is 146 subjects. Sample selection technique:

For each patient selected as the disease group, which means that they failed to consume on the 7th day and met the sampling criteria, we will choose cases with gestational diabetes and stable blood sugar during that time as the control group. The control group also met the criteria for gestational age at no more than one week difference from gestational age for cases belonging to the control group. We only sampled at seven days after treatment, and patients in the control group if after that time, the need for insulin was used would not be our research target. Data entry using epidata software 3.1. Data processing using software stata 10.0

3. RESULTS

Table 1. Clinical variables and characteristics of patients with AIT and those with MNT only

Variable	AIT N=16	MNT N=144	RR	95% CI	P*
Hypertension					
Yes	1 (6.25)	3 (2.08)	3.13	0.31-32.04	0.336
No	15 (93.75)	141 (97.92)			
Systolis blood pressure	117.11±10.02	113.57±10.73	1.03	0.98-1.08	0.21
Diastolis blood pressure	72.38±10.16	69.9±8.35	1.03	0.97-1.1	0.273
Frequency of prior pregnancy (%)					
0	9(56.25)	71(49.31)	0.76	0.27-2.14	0.559
≥1	7(43.75)	73(50.69)			
Single fetus	14(87.5)	143(99.31)	20.43	1.74-239.69	0.016
Twins	2(12.5)	1(0.69)			
Pregestational BMI, mean ± SD (kg/m2)	23.88±4.66	21.51±2.67	1.26	1.07-1.47	0.005
Family history of diabetes					
Yes	3(18.75)	16(11.11)	1.85	0.47-7.18	0.376
No	13(81.25)	128(88.89)			
Past history of the demise					
Yes	2(12.5)	13(9.03)	1.44	0.29-7.04	0.653
No	14(87.5)	131(90.97)			
Past history of GDM					
Yes	3(18.75)	6(4.17)	5.31	1.19-23.74	0.029
No	13(81.25)	138(95.83)			
Past history of macrosomia					
Yes	1(6.25)	2(1.39)	4.73	0.41-55.33	0.22
No	15(93.75)	142(98.61)			
Gestational age of OGTT, mean ± SD (week)	25.8±2.89	25.6±2.93	1.02	0.851-1.23	0.807
FBG at time of OGTT, mean ± SD (mg%)	109.65±14.15	84.72±10.48	1.13	1.08-1.18	<0.001
Frist OGTT 1 h plasma glucose, mean ± SD (mg%)	249.43±37.37	185.61±26.31	1.08	1.04-1.07	<0.001
Frist OGTT 2 h plasma glucose, mean ± SD (mg%)	216.15±51.22	154.32±26.72	1.05	1.03-1.07	<0.001

Table 2. Regression analysis showing OGTT fasting glucose level as an independent predictor of insulin requirement in gestational diabetes mellitus

Variable	RR	RR adjusted	95% CI	P**
BMI	1,26	1,21	0,89-1,64	0,216
Past history of GDM	5,31	15,47	0,33-728,08	0,163
Twin	20,43	0,07	0,00-1240	0,854
FBG at time of OGTT	1,13	1,09	1,00-1,19	0,046
Frist OGTT 1 h plasma glucose	1,08	1,03	0,99-1,07	0,148
Frist OGTT 2 h plasma glucose	1,05	1,03	0,99-1,08	0,096

P** Regression logistic multivariable.

4. DISCUSSION

During pregnancy, beta cells usually increase their insulin secretion to compensate for a decrease in insulin sensitivity (Catalanoet al, 1993; Homkoet al, 2001). Therefore, a potential etiology for gestational diabetes mellitus (GDM) is a limitation in beta cell reserves(Xiang et al, 1999; Homkoet al, 2001). Available evidence concerning beta-cell dysfunction in GDM is based on studies conducted in Caucasian and Hispanic women. Asian subjects are classified as genetically highly susceptible to glucose intolerance (i.e., GDM, type 2 diabetes, and impaired glucose tolerance)(Dabeleaet al, 2005). Since Asians are less obese than Caucasians, their metabolic features might be different from those found in Caucasians (Yoon et al, 2006).

Our study recorded similar results with Ya Zhang's study conducted in 2016 in China, probably because of Asian racial characteristics, geography, eating culture quite identical. Hence, fasting glucose level,our study is similar to the results of Ya Zhang's research. However, the rate of insulin treatment in this study is quite high (44.8%)(Ya et al, 2016), probably due to the retrospective study,and the study subjects were not hospitalized, so the patient's compliance with treatment was not guaranteed.

When compared with the results of Okan Bakiner 2013 study in Turkey, our study showed significantly higher fasting glucose levels in the glucose tolerance test. However, in this study, the difference in fasting blood glucose between the two groups of patients was also statistically significant. Perhaps due to racial as well as cultural characteristics, different diet, different diabetes monitoring regimen. At the same time, in this study, the prenatal weight of the two groups of patients was significantly higher than our study, respectively 30.2 ± 4.6 and 31.6 ± 4.9 kg / m2 in MNT and AIT group, so insulin resistance is higher so insulin demand will be higher for patients with low fasting blood glucose threshold. In the results of Wantanabe's research in Japan in 2016, the author found no difference in fasting blood sugar in the glucose tolerance test, but only the difference in blood sugar 1 hour and 2 hours after ingestion 75 grams of glucose.

In this study, the sample size was only 37 women,and the time of diagnosis of gestational diabetes was quite early (18.9 weeks in the AIT group and 21.6 weeks in the MNT group). Results in our research. Our explanation is that, at the time of such an early diagnosis, insulin resistance is not as high as previous morning sickness such as vomiting, and patients who have not recovered after morning sickness may be affected by fasting blood sugar results.

Regarding the age of pregnant women, the results of Vicent W. Wong's study in Australia in 2011, with 612 patients divided into two groups, the fasting glucose level in the 75 gram glucose tolerance test also differ significantly(Wong et al, 2011).

This study has an average age of 31.9 and 30.9 years, respectively, quite similar toour study age of 31.06 and 31.12 years of age, but the average BMI is significantly higher.

Based on a review of different studies on geographical characteristics, age, ethnicity, and criteria for choosing insulin therapy, it was found that there was a strong correlation between fasting glucose levels in a 75 gram glucose tolerance test. Two hours and prognosis of insulin treatment needs in patients with gestational diabetes;the underlying disorders can explain this in each patient's basal insulin secretion. Saisho's 2010 study in Japan noted the dysfunction of pancreatic beta cells in patients with gestational diabetes, which showed a decrease in insulin sensitivity and secretion, and correlated with Average daily fasting glucose and capillary blood glucose of patients in the AIT group compared with the MNT group(Yoshifumi et al, 2010).

After univariate analysis, we found that the serum glucose level after taking 75 grams of glucose at 1 hour and 2 hours was higher in the AIT group than in the MNT group alone, with RRs of 1.08 and 1, respectively. 05, p <0.001. However, after multivariate analysis, this relationship no longer exists, with adjusted RR levels of 1.03 and 1.03, respectively (p> 0.05). Searching for literature around the world, we note that this relationship also varies in different studies. According to Ya Zhang's research, 2-hour blood glucose was an independent factor associated with insulin therapy OR = 1.16, 95% CI [1.07-1.27] (Ya et al, 2016), before which blood

glucose 1 hour and 2 hours were significantly higher in the univariate analysis model. In Watanabe's study, after multivariate analysis, both 1-hour blood glucose and 2-hour blood glucose were independent predictors of insulin treatment in two patient groups.

Limitation:

Recollection error: pregnant women remember incorrectly or do not know the information about their family history of diabetes or not. Pregnant women also recall information about pre-pregnancy weight, so it can be misleading, leading to inaccuracy in calculating body mass index.

5. CONCLUSION

Our study confirmed that women with GDM might predict insulin demand relative to fasting blood glucose levels. Recognizing patient characteristics that predict failure of MNT at an early stage after diagnosis of GDM may assist the diabetes team in prioritizing care and resource allocation to serve the patient's medical interests better.

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Conflict of Interest: The authors declare that they have no conflict of interest.

Informed consent: Informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

Ethical approval for study protocol: The study was approved by the Medical Ethics Committee of Hung Vuong Hospital (ethical approval code: 27-HVH).

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