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ORIGINAL ARTICLE

50 Grams Oral Glucose Challenge Test: Is It an Effective Screening Test for Gestational Diabetes Mellitus?

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About the Author

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Abstract

Aim To find out whether 50 g oral glucose challenge test (OGCT) is an effective screening test for all pregnant women between 24 and 28 weeks gestation.

Method A 50 g OGCT test was administered to 307 unselected women at 24–28 weeks of gestation. When venous plasma glucose (VPG) concentration after 1 h was >7.8 mmol/l, OGCT was positive. Women with a positive OGCT underwent 2 h 75 grams oral glucose tolerance test (OGTT) as a confirmatory diagnosis of GDM. When fasting and 2 h post 75 g OGTT values were >5.5 mmol/I and >8 mmol/l, respectively, women were considered diabetic.

Results We screened 307 women for GDM by OGCT. Total number of women with positive OGCT was 83 (27.03 %). In the low-risk group, total number of women with GDM was 9/168 (5.35 %) while the total number of women with GDM in the high-risk group was 14/139 (10.07 %). There was no significant difference with respect to the total number of women with GDM in the groups.

Conclusions A 50 g OGCT seems to be an effective screening test for both groups. More cases of GDM can be discovered when universal rather than risk-related screening is applied.

Keywords Gestational diabetes · 50 g oral glucose challenge test · 75 g OGTT · Risk factors

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Introduction

Gestational diabetes mellitus (GDM) is a common metabolic disorder of carbohydrate metabolism, and its prevalence ranges from 0.6 to 15 % [1]. It is usually diagnosed after 20 weeks of gestation and disappears either immediately or within 6 weeks after delivery [1].

Others define GDM as glucose intolerance with onset or first recognition during pregnancy; regardless of gestational age, the prevalence of GDM is on the increase globally [2, 3].

The reported prevalence of DM in Oman is about 12 % and equally affects males and females; about 4 % of pregnant women in Oman develop GDM by the time of delivery [4, 5].

Gestational diabetes mellitus can adversely affect both the mother and the fetus during pregnancy and soon after delivery [6, 7]. Women with GDM have a 41 % recurrence rate of developing GDM in subsequent pregnancies and a 16.2 % incidence of overt type 2 DM in later years of life [8, 9].

In addition, the prevalence of obesity and the rate of impaired glucose tolerance in children born to women with GDM is 5 % and 4.9 %, respectively [10].

Diabetes mellitus accelerates fetal growth and causes organomegaly and fetal hyperinsulinemia; it is usually associated with fetal anaerobic glycolysis, which results in lactate production and fetal acidosis which may cause sudden fetal death. Neonatal complications such as neonatal respiratory distress syndrome, polycyhthemia, hypoglycemia, hypocalcemia, and cardiomyopathy are common [11].

Many studies showed that screening, detection, and treating GDM can greatly reduce maternal, fetal, and neonatal morbidities [12].

The OGCT (50 g 1-h) remains the main screening method for GDM in North America as recommended by the American Diabetic Association (ADA), and American College of Obstetrician and Gynecologists [13, 14].

Screening for GDM during pregnancy is either universal where all pregnant women were tested, or only women at increased risk of developing GDM were tested [15, 16].

Gestational diabetes mellitus is usually a symptomatic disease, thus it is necessary to have an effective screening test for its diagnosis, So, in this study, we want to evaluate the effectiveness of 50gm of OGCT, and whether such a screening test should be universal or based on risk factors.

Material and Method

This is a prospective study conducted at Sultan Qaboos University Hospital between 15 September 2013 and 14 September 2014 and was approved by hospital ethical committee.

Healthy Omani pregnant women with singleton pregnancies attending antenatal clinic who were not known to be diabetic were enrolled in this study. Women who were not at higher risk of developing GDM had random blood sugar (RBS) test performed during a booking visit. If blood sugar level was >7 mmol/l, then 0–2 h 75 g OGTT was performed in order to diagnose covert pregestational diabetes mellitus (PGDM).

Pregnant women who were not known to be diabetic but had risk factors to develop GDM such as previous history of recurrent miscarriages, macrosomic baby, fetal malformations, unexplained stillbirth, previous gestational diabetes, and family history of diabetes mellitus (DM) had 0–2 h 75 g OGTT performed at booking visit. If either fasting or 2 h VPG values exceeded 5.5 & 8 mmol/l, respectively, the woman was considered having covert PGDM. All women with RBS $\leq$ 7 mmol/l and/or normal OGTT whether at increased risk to develop GDM or not had a 50 g OGCT done between 24 and 28 weeks of gestation, regardless of fasting state. If 1 h VPG concentration was >7.8 mmol/l, then the screening test was considered positive. Women with a positive OGCT underwent a 75 g 2 h OGTT, which was the actual diagnostic test for GDM. If either fasting or 2 h VPG exceeds 5.5 & 8 mmol/l, respectively, the woman was considered to have GDM.

Data recorded including booking details such as maternal age, parity, gestational age at screening, and body mass index (BMI) were considered. In addition, maternal and fetal risk factors which may be caused by DM were studied such as history of GDM, unexplained stillbirth, recurrent miscarriage, macrosomic baby (birth weight >4000 g), polyhydramnios and family history of DM in first-degree relatives.

Statistical Analysis

Statistical analysis was performed using Chi-square- test, Mann–Whitney test, and Fisher's exact test as appropriate, and the difference between values was considered significant when $P \leq 0.05$.

Results

A total of 307 women were screened for GDM by 50 g 1 h OGCT, of whom 168 (54.70 %) women were in low-risk group and 139 (45.32 %) were in the high-risk group.

As shown in Table 1, women in both groups were of similar age (28.90 $\pm$ 5.83 vs. 29.50 $\pm$ 5.30, $P = 0.33$).

There was no significant difference with respect to the parity in low-risk group when compared with the high-risk group (1.82 $\pm$ 2.77 vs. 1.76 $\pm$ 1.59, respectively, $P = 0.82$).

Table 1 Demographic characteristics and blood sugar results of the two groups

	Low-risk women ($n = 168$)	high-risk women ($n = 139$)	P value
Age (years)	28.90 ± 5.83[a]	29.50 ± 5.30	0.35
Parity	1.82 ± 2.77	1.76 ± 1.59	0.82
Body mass index (kg/kg/m^2)	27.81 ± 6.28	28.61 ± 6.05	0.25
Gestational age at screening (weeks)	24.46 ± 1.34	24.51 ± 1.50	0.53
50 g 1 h Glucose challenge test >7.8 mmol/l, *n* (%)	39 (23.2)	44 (31.7)	0.12
75 g OGTT 0 h >0.5 mmol, *n* (%)	4 (2.38)	3 (2.15)	1.000
75 OGTT 2 h >8 mmol/l, *n* (%)	7 (4.16)	12 (8.62)	0.15
Women with GDM, *n* (%)	9 (5.35)	14 (10.07)	0.13

[a] Value are mean ± standard deviation

Women in both groups were generally obese and BMI did not differ significantly (27.81 ± 6.28 vs. 28.61 ± 6.05 kg/m^2 , respectively, $P = 0.25$).

There were no significant statistical differences with respect to the total number of women with positive OGCT, 0 h OGTT, and 2 h OGTT between the low- and high-risk groups ($P = 0.12$, 1.000, 0.15, respectively). Although there were more women with positive OGCT in the high risk group compared with low risk group, this difference was not statistically significant.

Total number of women with positive OGCT in both groups was 83/307 (27.03 %). In the low risk group, 4 women (2.38 %) had raised 0 h 75 g OGTT and 7 women (4.16 %) had raised 2 h 75 g OGTT. Two out of 3 women with raised 0 h 75 g OGTT had normal 2 h 75 g OGTT, this makes the total number of women with GDM in low-risk group 9/168 (5.35 %). In the high risk group, 3 women (2.15 %) had raised 2 h 75 g OGTT and 12 women (8.62 %) had raised 2 h 75 g OGTT. Two out of 3 women with raised 0 h 75 g OGTT had normal 2 h 75 g OGTT, this makes the total number of women with GDM in the high-risk group 14/139 (10.07 %).

Table 2 shows risk factors associated with GDM in the high-risk group of women. The most common risk factor was history of DM in first-degree relative (mother, father and siblings), which was observed in 82.70 % of women, followed by history of recurrent miscarriages (8.6 %), previous polyhydramnios (7.90 %), GDM in previous pregnancies (5.70 %), previous delivery of macrosomic baby (5.70 %), and previous unexplained still birth (2.20 %). Fourteen women (10.07 %) with GDM had 2 or more risk factors.

Table 2 Obstetric and non-obstetric risk factors in the high-risk group ($n = 139$)

Risk factor	*n* (%)
Family history of diabetes mellitus (first-degree relatives)	115 (82.7)
Recurrent miscarriages	12 (8.6)
Previous polyhydramnios	11 (7.9)
Previous GDM	8 (5.7)
Previous macrosomia, birth weight >4000 g	5 (10.1)
Previous unexplained sill birth	3 (2.2)
More than one risk factor	14 (10.07)

Discussion

At our unit, we screen pregnant women for DM twice, first at booking visit to diagnose women with PGDM with RBS for women with no risk factors and with 75 g OGTT for women with risk factors. For diagnosis of GDM, women who are not found to be diabetic are screened again between 24 and 28 weeks of gestation.

In this study, A positive 50 g OGCT was obtained in a total of 83/307 (27.03 %) of women: 23.20 % in the high-risk group, and 31.70 % in low-risk group. Based on the positive OGCT, 75 g OGTT was performed to confirm the diagnosis of GDM.

We detected 23/307 cases of GDM, so the prevalence of GDM was 7.49 %. Total number of women with GDM in high-risk group was 14/139 (10.07 %), while in the low-risk group, GDM was detected in 9/168 (5.35 %). With a GDM detection rate of 7.49 %, 50 g OGCT proved to be a reliable test for screening for GDM. This opinion has been shared by other investigators: Shrestha et al., concluded that the 50 g OGCT is a reliable test to detect GDM. This test is easy to administer and cost-effective for screening purpose [17]. A systemic review by van Leeuwen et al., in 2010 concluded that the 50-g OGCT is acceptable to screen for GDM [18].

The benefit of universal screening is shown clearly here; if we relied only on risk-based screening, then we would have missed at least 9/23(39.13 %) of women with GDM. The 14 women who were found to be having GDM in the

high-risk group were screened at booking visit with 75 g OGTT and were found to be normal; when they were screened again at 24–28 weeks, they were found to be having positive 50 g OGCT and 75 g OGTT for GDM. Those cases would have been missed if we relied only on the screening of women at risk to develop GDM conducted at booking visit.

It is a well-known fact that risk factors increase the likelihood of developing GDM during pregnancy as we found in our study, but at the same time GDM was diagnosed in women with no risk factors as clearly shown in this study.

There are investigators who recommend universal screening for GDM because selective screening will require a large number of pregnant women to be tested and some cases will definitely be missed [19]. The ADA does not share this view and recommends selective screening for GDM using 50 g OGCT [13]. The ADA found that with selective screening, only 0.6 % of cases were missed but saved unnecessary screening of 17 % of women without GDM [20]. Lacaria et al., also recommended selective screening for GDM [21].

The total number of women diagnosed to have GDM in this study was 23/307(7.49 %) and this is certainly more than what was reported by Barkat et al., i.e., prevalence rate is 4.17% in Omani pregnant women [5]. This may be due to continuous changes in the diagnostic criteria for GDM and changes in life style, as we found that Omani pregnant women are generally obese whether they are at risk or not of developing GDM.

Majority of women included in this study, i.e., 201/307 (65.47 %), had a BMI $\geq$ 25 kg/m^2. This shows that there is a strong relation between obesity and GDM which is in agreement with other investigations which found that the risk for GDM increases with the increase in pregravid BMI. In addition, pregravid BMI is a strong predictor for GDM requiring insulin treatment [22].

The most common risk factor among all women screened for GDM in our study was family history of DM, in first-degree relative 115/307(37.45 %); this reflects high prevalence of DM in Omani population as reported by Al-Lawati et al. [4]. They found the prevalence of diabetes among Omanis aged 30-64 years reached 16.10 % in the year 2000 and nearly half of the study population had a BMI > 25 kg/m^2. Al-Moosa et al. reported a DM prevalence of 17.70 % in the city of Muscat [23].

The limitation of this study is the relatively small number of women screened.

It may be advisable to perform other prospective study comparing 50 g OGCT and 75 g OGTT as screening tests for GDM between 24 and 28 weeks of gestation in women who were not diagnosed to be diabetic at booking visit.

Conclusion

As a result of this study, we may conclude that 50 g OGCT is an effective screening test and can detect GDM in more women when performed universally at 24–28 weeks gestation to detect those women who escaped from screening tests at booking visit.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflicts of interest.

Ethical approval All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5).

Informed consent Informed consent was obtained from all patients for being included in the study.

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