

Is glucose tolerance test an appropriate predictive marker in screening of gestational diabetes mellitus?

Glucose tolerance

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Abstract

Aim: Gestational diabetes mellitus (GDM) is defined as any degree of glucose intolerance developed during pregnancy it is a significant danger to both fetus and the pregnant woman, so it should be diagnosed as soon as possible to reduce its related maternal and fetal complications. An early diagnosis highly depends on appropriate screening tests. The purpose of this study is to evaluate the sensitivity of glucose tolerance test in the screening of Gestational diabetes mellitus(GDM). Material and Method: This study was conducted on 460 pregnant women between 24 and 28 weeks of gestations. All the pregnant women underwent 50-g glucose challenge test as our routine screening protocol. Pregnant women with a positive GCT underwent 3-hour 100-g OGTT within seven days. Pregnant women who had normal GTT were followed up with FBS and 2-hour blood sugar in 2 weeks later. The FBS value of 105 mg/dl and the 2hour blood sugar value of 120 mg/dl are accepted as the threshold value for GDM). Results: Based on FBS, the sensitivity of OGTT in the diagnosis of GDM is 66.67%, and due to adverse effects of high glucose on both mother and fetus, this is not a good screening test, and we have to find a better way for screening of GDM. Discussion: We found that patients with abnormal GCT and normal OGTT results are at risk of GDM and maternal and fetal complications. Finally, we should consider the group of women with an abnormal GCT result, but normal OGTT result, to be a high-risk pregnancy group.

Keywords

Diabetes Mellitus; Sensitivity, Predictive Marker; GCT; OGTT

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Introduction

Gestational diabetes mellitus (GDM) is defined as any degree of glucose intolerance developed during pregnancy, and it is associated with fetal and maternal risk [1]. It's a worldwide increasing phenomenon which involved about 15% of pregnant women [2]. GDM is a significant danger to both fetus and the pregnant woman [3]. Identifying women with GDM is important during early pregnancy

to minimize maternal and neonatal morbidity [4]. Improving screening tests is important for early detection and subsequently timely intervention [5]. GDM is screened by administration of a 50-g, 1-hour glucose challenge test (GCT) between 24 and 28 weeks of gestation, if the GCT result is abnormal, then screening is followed by the administration of a 100-g, 3-hour oral glucose tolerance test (OGTT) to confirm the diagnosis [6]. Ravi Retnakaran et al. showed that an abnormal GCT, even in the presence of normal OGTT, is associated with abnormalities in postpartum metabolic function and can lead to both glycemia and beta-cell dysfunction at 3-months postpartum, they also mentioned that these women have a higher risk of cardiovascular disease over 12.3 years of median follow-up [7].

Munira Dudhbhai et al., in the study of characteristics of patients with abnormal glucose challenge test and normal oral glucose tolerance test showed different maternal characteristics and backgrounds compared with patients in whom both test results were normal. They revealed an increased likelihood for the development of overt diabetes mellitus later in life [8].

Authors in a study compared characteristics of patients who had abnormal glucose challenge test and normal oral glucose tolerance test results with normal and gestational diabetic patients, they showed that women who failed the GCT, but not the OGTT and thus did not receive the diagnosis of GDM are still at risk of delivering a macrosomic infant [9].

At present, the status of carbohydrate metabolism in pregnant women with high glucose levels, which exceeds the critical threshold value of GCT, but normal 100-g 3-hour OGTT is not clearly evaluated.

The purpose of this study is to evaluate the sensitivity of glucose tolerance test in the screening of Gestational diabetes mellitus(GDM) in Dr. Rasekh's clinic dependent to Jahrom university of medical science, Iran.

It should be noted that universal agreement on the optimal screening protocol and diagnostic criteria for GDM is lacking [10].

Material and Method

This diagnostic study was conducted from January 2015 to December 2015 on 460 pregnant women referred to Dr. Rasekh clinic between 24 and 28 weeks of gestation in Jahrom city, Iran.

Gestational age was calculated based on last menstrual period and according to a reliable menstrual history confirmed by ultrasonography before 20 weeks of gestation.

All the pregnant women underwent 50-g glucose challenge test as our routine antenatal screening protocol. Fifty grams of glucose was administered orally regardless of day, time or the fasting state.

Venous plasma glucose was measured at the first hour of the glucose load. A plasma glucose value of 130 mg/dL is accepted as the threshold value for the positive glucose challenge test.

Pregnant women with a positive challenge test underwent 3-hour 100-g OGTT within seven days. Blood samples were taken at 8:00 am after 12-hours fast and at 60, 120 and 180 minutes following the 100-g oral glucose load. Plasma glucose levels were measured by hexokinase method using Olympus autoanalyser. (Olympus Diagnostica GmbH-Irish Branch-Lismeehan).

At least two plasma glucose levels exceeding the cut-off values following OGTT were essential for the diagnosis of GDM.

Inclusion criteria in this study were a single pregnancy and a pregnancy between 24 and 28 gestational weeks.

Exclusion criteria included: pregnant women with an abnormal blood sugar in GTT, pregnant women who had diabetes mellitus before pregnancy and those who had an infectious, cardiovascular or coagulative disease or other underlying diseases.

Pregnant women who had normal GTT were followed up with FBS and 2-hour glucose challenge test in 2 weeks later. The FBS value of 105 mg/dl and the 2HPP value of 120 mg/dl are accepted as the threshold value for GDM (Gestational diabetes mellitus).

Assessment method

The follow-up of the cases were performed by a gynecologist in Dr. Rasekh clinic in Jahrom city, Iran.

Results

The subjects with abnormal GCT were 122 pregnant women who were assessed by OGTT, and the women with normal OGTT were followed up with FBS and 2hr BS in 2 weeks later. The subjects were divided into four groups:

a= 20: pregnant women with abnormal GTT and abnormal FBS or 2 hr BS.

b= 0: pregnant women with abnormal GTT but normal FBS or 2 hr BS.

c= 10: pregnant women with normal GTT but abnormal FBS or 2hr BS who have gestational diabetes in the follow-up.

d= 92: women with normal GTT and normal FBS who didn't have gestational diabetes in the follow-up.

The sensitivity of OGTT in the diagnosis of GDM based on FBS is 66.67 %, and due to the adverse effect of high glucose on both mother and fetus, this is not a good screening test, and we have to find a better way for screening of GDM.

Discussion

The diagnosis of GDM is confirmed if more than two values of GTT is abnormal [11]. Our results showed that the pregnant women with abnormal GCT and normal GTT are at risk of GDM. A few studies also have shown that pregnant women with positive GCT but normal OGTT are still at increased risk of the adverse perinatal outcome [12].

Langer et al. also revealed that treatment of pregnant women with borderline glucose intolerance leads to less maternal and fetal complications [13]. Gezer et al. have suggested that the pregnant women who were screened for GDM and had a normal GTT result are predisposed to obstetric complications related to the glucose intolerance [14]. Mello et al. also have shown

that the patients with abnormal GCT results and subsequently normal GTT are prone to have macrocosmic infants [15]. Authors in another study showed that one step screening test might decrease the rate of macrosomia [16]. The findings of these studies support our results.

Although guidelines have shown that screening of GDM is based on 100 g, 3-hour oral glucose tolerance test (OGTT) which confirms the diagnosis of GDM, the studies were done on the screening of GDM have shown that GDM screening tests might have a low sensitivity and specificity [17].

R Bhat et al. in a study conducted in 2005 mentioned that Patients with abnormal glucose challenge test (GCT) and normal oral glucose tolerance test (OGTT) are also at increased risk for complications, such as macrosomia and pre-eclampsia [18].

Researchers in another study found that GCT lacks specificity (41.8%) and they believed that diagnosis of GDM by OGTT based on initial GCT screening leaves 21.5% undiagnosed and they suggest a single glucose challenge test with 75 g of oral glucose load and diagnosing GDM if 2 hour PPG is > 140 mg/dL as WHO recommended [19].

On the other hand, some authors have focused on HbA1C as determining factor in the screening of GDM [20,21,22,23]. The hemoglobin A1C test is frequently used to evaluate long-term glucose control in diabetics [24].

Paula Breitenbach Renz et al. have shown that combined HbA1c and OGTT measurements may be useful in diagnosing GDM [25].

In a recently published study, researchers found that a HbA1C score of 5.45% or more had a sensitivity of 86% and a specificity of 61% for gestational diabetes. However, HbA1C can be useful for the screening of GDM but its specificity is somewhat low, and more research is needed before it can be routinely recommended.

Table 1. Classification of patients

Patients number in each group	GTT	FBS
20	abnormal	abnormal
0	abnormal	normal
10	normal	Abnormal
92	normal	Normal

Results

Diagnostic or Screening Test Evaluation

Single Table Analysis

	Positive	Negative	Total
Positive	20	0	20
Negative	10	92	102
	30	92	122

Parameter	Estimate	Lower - Upper 95% CIs	Method
Sensitivity	66.67%	(48.78, 80.77)	Wilson Score
Specificity	100%	(95.99, 100)	Wilson Score
Positive Predictive Value	100%	(83.89, 100)	Wilson Score
Negative Predictive Value	90.2%	(82.89, 94.59)	Wilson Score
Diagnostic Accuracy	91.8%	(85.57, 95.49)	Wilson Score
Likelihood ratio of a Positive Test	'undefined'	('?' - 'undefined')	
Likelihood ratio of a Negative Test	0.3333	(0.274 - 0.4055)	
Diagnostic Odds	'undefined'	('?' - 'undefined')	
Cohen's kappa (Unweighted)	0.751	(0.5792 - 0.9229)	
Entropy reduction after a Positive Test	'?'%		
Entropy reduction after a Negative Test	23.7%		
Bias Index	-0.08197		

Conclusion

We found that patients with abnormal GCT and normal OGTT results are at risk of GDM and maternal and fetal complications. Finally, the group of women with an abnormal GCT result, but subsequently normal OGTT result should be considered to be a high-risk pregnancy group. This group has more tendency of overt diabetes mellitus later in life. The sensitivity and specify of GDM screening tests Also should be increased.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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Declaration of interest

The authors certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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