

ACCURACY OF GLUCOSE CHALLENGE TEST IN SCREENING OF GESTATIONAL DIABETES MELLITUS

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ABSTRACT:

OBJECTIVE: To determine the diagnostic accuracy of glucose challenge test for diagnosis of gestational diabetes by taking glucose tolerance test as gold standard.

PATIENTS AND METHOD: It was a cross-sectional validation study. Duration of study was 6 months from June 2010 to December 2010. The study was conducted in OB/GYN unit-I, Allied hospital, Faisalabad. 267 pregnant women were included in the study after explaining the risks and benefits. Glucose challenge test (GCT) and a Glucose tolerance test (GTT) both were carried out on all patients. GTT was taken as the Gold standard test and results of the glucose challenge test were compared with the result of GTT. Main outcome measures were Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy of glucose challenge test.

RESULTS: Out of 267 patients, 74 patients were true positive and 167 patients were true negative as diagnosed by GCT. GCT failed to diagnose 16 diabetics (false negative) and wrongly diagnosed diabetes mellitus (false positive) in 10 normal participants as confirmed by use of the gold standard. The sensitivity of GCT was 82%, specificity was 94%, PPV was 88%, NPV was 91.25 and accuracy of GCT as a screening test for GDM was 90%.

CONCLUSION: In our population, with the high prevalence of GDM, glucose challenge test is found to be an acceptable and useful screening test for GDM.

KEY WORDS: Glucose challenge test, Glucose tolerance test, screening, Sensitivity, specificity, positive predictive value and accuracy.

INTRODUCTION:

Gestational Diabetes mellitus is defined as any degree of glucose intolerance with onset or first recognition during pregnancy^[1]. 5-14% of women are diagnosed with gestational diabetes mellitus (GDM) and the incidence is on the rise^[2,3]. It predicts an increased risk of adverse pregnancy outcomes including miscarriages, congenital malformations, pre-eclampsia, preterm labor, shoulder dystocia, caesarean section, neonatal metabolic complications and increased risk of developing type-2 DM in later life both in the mother and the baby^[4,5].

Regarding screening for GDM, there is a common consensus about the various risk factors like age of the mother, body mass index, past history of gestational diabetes mellitus, history of large fetus previously, diabetes mellitus in the other family members, certain ethnicities and presence of polycystic ovarian

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syndrome. The problems associated with GDM can be lowered down by identifying the risk factors and screening with tests of high sensitivity and specificity. Glucose tolerance test (GTT) is considered as gold standard for diagnosing GDM. Since performing this diagnostic test in all pregnancies is very expensive, effective screening of GDM is vital for increasing cost-benefit ratio. Despite decades of research regarding the optimal screening for gestational diabetes, there is still lack of consensus about the screening test for GDM in high risk patients^[6]. There are different methods for screening of GDM like Random blood sugar (RBS), Glucose challenge test (GCT), Fasting blood sugar (FBS). The 50g GCT is used as a screening test for GDM and has proved to be better than reported by other screening tests^[7]. The aim of this study was to determine the accuracy of "glucose challenge test" against "glucose tolerance test" in screening for gestational diabetes mellitus.

PATIENTS AND METHOD:

This cross-sectional validation study was conducted in OB/GYN unit-I, Allied hospital, Faisalabad from June 2010 to December 2010. Sampling technique was non-probability purposive. The sample size was calculated by using WHO sample size calculator assuming the accuracy of 50%. 267 pregnant women of >20 years of an age attending the outdoor of Allied Hospital at 24-28 weeks of gestation were studied. Women with preexisting diabetes mellitus and women with history of gestational diabetes mellitus were excluded from the study to limit the confounding variables. Risks (problems with taking oral glucose) and benefits (simple and effective testing) were explained. Informed consent and ethical committee approval were taken. Exclusion criteria were strictly followed to limit the confounding variables.

Patients included were given 50gm of glucose in 250 ml of water without any fast. Venous blood sample (1ml) was drawn after one hour. Cut off value for GCT was taken as 140mg/dl. Regardless of results from these tests, all women included in this study underwent 75 Gm GTT on next morning. In this, first venous blood sample (1ml) was drawn after an overnight fast

of 8 hours and after this all patients were given 75 gm of glucose in 250ml of water. Patients remained nil per mouth for two hours and second venous sample(1ml) was drawn after two hours. Cut off the value of GTT was fasting equal or more than 126mg/dl & 2 hrs postprandial equal or more than 200mg/dl. All samples were sent to the hospital laboratory and reported by the pathologist. All observations were collected on attached performa for this purpose. Data was analyzed using SPSS version 23. Descriptive statistics were calculated for all variables. Mean and standard deviation was calculated for quantitative variables like age and gestational age. Frequency and percentages were calculated for all qualitative variables like family history, presence of GDM detected by both GCT and GTT. The accuracy, sensitivity, specificity, PPV and NPV of glucose challenge test was calculated taking OGTT as a gold standard test.

RESULTS:

Out of 267 patients, GCT truly diagnosed 74 patients as having gestational diabetes mellitus (true positive) and 167 patients were found to have a normal glucose metabolism (true negative) during pregnancy. GCT failed to diagnose 16 diabetes (false negative) and wrongly diagnosed 10 normal patients as diabetics (false positive) against as diagnosed by use of a gold standard. Among 267 patients, 90 (TP+FN) were diagnosed as having gestational diabetes mellitus (74 correctly diagnosed by GCT, the other 16 patients were diagnosed as positive by the gold standard). 52% of those diagnosed with GDM were between 25-34 years of age. The distribution of risk factors are given in table1. Out of 90 patients having gestational diabetes mellitus, 50% of patients belonged to lower middle class, 20% belong to lower class and 30% belong to upper middle class. According to this study, the sensitivity of GCT was 82%, specificity was 94%, PPV was 88%, NPV was 91.25 and accuracy of GCT as a screening test for GDM was 90.

TABLE.1: FREQUENCY OF INDIVIDUAL RISK FACTORS IN DIABETICS (n=90)

Sr.No	RISK FACTORS	Number	Percentage (%)
1	Maternal obesity(BMI> 30)	10	11%
2	Maternal age >20 years	61	68%
3	Family history of diabetes	35	39%
4	Previous birth of a congenitally malformed	5	5.5%
5	Previous unexplained still birth	24	27%
6	Previous delivery of a large baby	2	2.2%

Table 2: CHARACTERISTICS OF GLUCOSE CHALLENGE TEST (GCT)

		True Class		
		Positive	Negative	Measures
Predicted Class	Positive	True Positive TP = 74	False Positive FP= 10	Positive Predictive Value (PPV) = 88%
	Negative	False Negative FN = 10	True Negative TN = 167	Negative Predictive Value (NPV) = 91.25 %
	Measures	Sensitivity = 82 %	Specificity = 94 %	Accuracy = 90 %

DISCUSSION:

Glucose tolerance test (GTT) is considered as a gold standard for diagnosing GDM. It is fairly expensive to perform in all the pregnant women, an effective screening test to diagnose GDM is pivotal for an acceptable cost-benefit ratio.^[6] Random blood sugar, GCT and FBS are the various tests available for the screening of GDM. The 50g GCT is a commonly used screening test for GDM and has proved to be better than reported by other screening tests like RBS which has sensitivity of 40%^[7]. A careful review of literature indicated that studies evaluating GCT in Pakistani population is very scarce. As indicated by several studies that this test may have population-specific

effects, it was therefore, desirable to carry out a systematic study in larger population. The present work presents data in respect of 267 subjects coming from 80 km radius around the 3rd biggest city of Pakistan. The participants represented various cultures in the region. The results obtained in this study clearly demonstrated that GCT possessed very high sensitivity, specificity and accuracy. In this study, the sensitivity with a cut off value off 140 mg/dl for GCT was found to be 82% and specificity was 94%. The PPV being basic parameter to judge the effectiveness of any screening test was found to be 88%. The results of this study are in line with a research conducted by Inan C et al^[8]. According to this study, GCT was found to be an acceptable

and useful screening test for GDM. In another study done by Rebarber A et al^[9], they found good sensitivity and specificity for GCT comparable to ours so considered appropriate for the screening of gestational diabetes mellitus. In a study conducted by Erika B et al^[10], GCT was found to be having a sensitivity of 90%. Several other studies have suggested the utility of GCT in screening of GDM and support the findings of my research^[11,12,13].

In a survey by WHO, it was shown that in 1995, Pakistan was 8th on the list of top ten countries with high prevalence of diabetes and had 4.3 million people with diabetes mellitus. However, it is estimated that in 2025, Pakistan is going to be 4th on the list with 14.5 million people with this disease. The requirement for successful screening test is that the condition should be prevalent in the target population; therefore, screening for GDM should be performed for all pregnant women in Pakistan.

A number of risk factors are associated with development of GDM. All patients in this study had some of these risk factors. Increased maternal age and family history of diabetes in 1st degree, relatives were two most common risk factors present in patients with GDM in this present study. Pregnant women of age from 15 to 39 years were included in this study. Out of total 90 diabetic women, 67% women were of age more than 25 years. According to this study, the risk of GDM becomes significantly and progressively increased from 25 years onwards. In the present study, family history of diabetes in 1st degree relative was present in 35 (39%) out of 90 diabetic women, showing a strong association of family history of diabetes with the development of GDM. Out of 90 diabetic women 10 (11%) women had weight >90 kg. These findings are consistent with the study conducted by Shrestha A et al^[11].

Although all patients diagnosed as having GDM in this study had one or more risk factors, but presence of risk factors does not necessarily indicate that the patient has GDM, as many patients in this study had risk factors but were not diabetic. Hence, all pregnant women should have screening for GDM irrespective of the presence or absence of risk factors.

When choosing a screening test, one considers performance (sensitivity and specificity) at specific thresholds. We believe that the major

parameter to consider in choosing a screening test for glucose tolerance abnormalities in pregnancy should be sensitivity and that the minimal acceptable sensitivity should be 80%. A high sensitivity decreases the number of women with glucose intolerance who are missed by the screening test. According to the present study sensitivity of GCT is 82%.

GCT is time-saving test which uses minimal resources. Therefore, it can be specifically useful in low resourced health settings as prevalent in underdeveloped and developing countries like Pakistan.

CONCLUSION:





In a population with highly prevalent GDM, universal screening for this disease is the ideal approach.

In my study, results show that glucose challenge test has good sensitivity and specificity so, glucose challenge test can be a useful screening test for GDM.

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Submitted for publication: 04.10.2017

Accepted for publication: 20.07.2018
After Revision

“YOU'RE SUPREMACY OVER OTHERS IS IN PROPORTION TO
THE EXTENT (size) OF YOUR KNOWLEDGE AND WISDOM.”

Hazrat Ali (Karmulha Wajhay)