Dokuz Eylül Üniversitesi
Tıp Fakültesi Dergisi
Cilt 4 Sayı 3 Ekim 1989

SCREENING FOR GESTATIONAL DIABETES MELLITUS WITH THE ONE HOUR 50-G GLUCOSE TEST

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ÖZET: 146 hasta; 50-g Glukoz Challenge Test ve HbA1c değerlerine bakılarak gestasyonel diabetes mellitus yönünden tarandı. GDM yönünden taranan 146 hastanın 129 da (%88.4) 50-g karbonhidrat yüklenmesinden sonra normal glukoz tarama sonuçları elde edilde (serum glukozu değeri 150mg/dL). 17 hastadan (%11.6) abnormal glukoz tarama testi elde edildi ve bunlara 100g oral glukoz tolerans testi uygulandı. Bunların 15'inin (%88.2) diabetik olmadığı, sadece 2'sinin (%11.8) abnormal glukoz tolerans test sonucuna sahip olduğu tesbit edildi. Linear regresyon analizleri kontrol grubunda açlık serum glukozu ile HbA1c değerleri arasında ilişki olduğunu gösterdi (F= 7.49, =0.05) GCT sonuçları ile HbA1c değerleri arasında korelasyon yoktu.

ABSTRACT: Namık DEMİR, Ata ÖNVURAL, Engin TOLGAY, Oktay ERTEN Dokuz Eylül University Faculty of Medicine, Screening for gestational diabetes mellitus with the one hour 50-G glucose test.

One hunderd and forty-six patients were screened for gestational diabetes mellitus (GDM) by one hour 50 -g glucose challenge test and HbA1c values. Of 146 patients who screened for GDM, 129 (88.4%) had normal glucose screening tests after a 50-g crabohydrate load (serum glucose below 150mg/dL). Seventeen patients (11.6%) had abnormal glucose screening tests and went on to 100-g oral glucose tolerance tests, of whom 15(82.2%) were shown to be nondiabetic and 2 (11.8%) had abnormal glucose tolerance tests values. Linear regression analyses demonstrated a correlation between fasting serum glucose levels and glycosylated hemoglobin levels in control group (F= 7.49, :0.05). There was not a correlation between the glucose challenge test (GCT) results and HbA1c values.

Anahtar sözcükler: Gestasyonel diabetes mellitus, glukoz tarama testi
Key words: Gestational diabetes mellitus, Glucose challenge test.

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INTRODUCTION: Diabetes mellitus, by virtue of its frequency and the severity of its metabolic effects, has long been one of the most common and significant medical conditions complicating pregnancy. Prior to the introduction of insulin, 65 per cent of pregnancies complicated by diabetes ended in perinatal death with a 30 per cent risk of maternal death (1).

There has been a drammatic reduction in fetal and neonatal losses in diabetic pregnancies during the past 25 years (1,2). Earlier recognition of gestational diabetes and better control of hyperglycemia in pregnant insulin dependent diabetics have contributed to this decline in mortality (1,2,3).

The Second International Workshop Conference on Gestational Diabetes concluded that all pregnant women should be screened for GDM (4). Several studies have proposed screening test criteria for further testing with an oral glucose tolerance test. These studies vary in patients selection, in documentation of test results and in screening test threshold. O'Sullivan et al (5) found the incidence previous large baby, a poor obstetric history, or family history of diabetes than in their antenatal population.

It was recommended that all pregnant women not identified as having diabetes before 24 th week of gestation be screened with a 50-g oral glucose load between 24 and 28 weeks gestation (1,2,4,5,6).

Blood sugar greater than or equal to 150 mg per dL one hour after ingestion of 50-g oral glucose load is abnormal (5,6). According to some of the studies, it was recommended that decreasing the threshold of the GCT to 140 mg per dL or 135 mg per dL (4,7).

In this study, we have evaluated the importance of the GCT in normal risk gravidae and stated our screening program for abnormal glucose tolerance.

MATERIAL AND METHODS: Any pregnant women presenting for obstetric care at Dokuz Eylül University Medical Faculty, Obstetric and Gynecology Department between October 1, 1988 and April 1, 1989 was scheduled for glucose screening between 20 and 34 weeks' gestation. Patienst were selected at random. Following risk factors were asked to the patient and were recorded.

1. History of gestational diabetes mellitus
2. Hypertension
3. Thyroid disease
4. Family history of diabetes mellitus

5. Obesity (120% or more of ideal body weight).

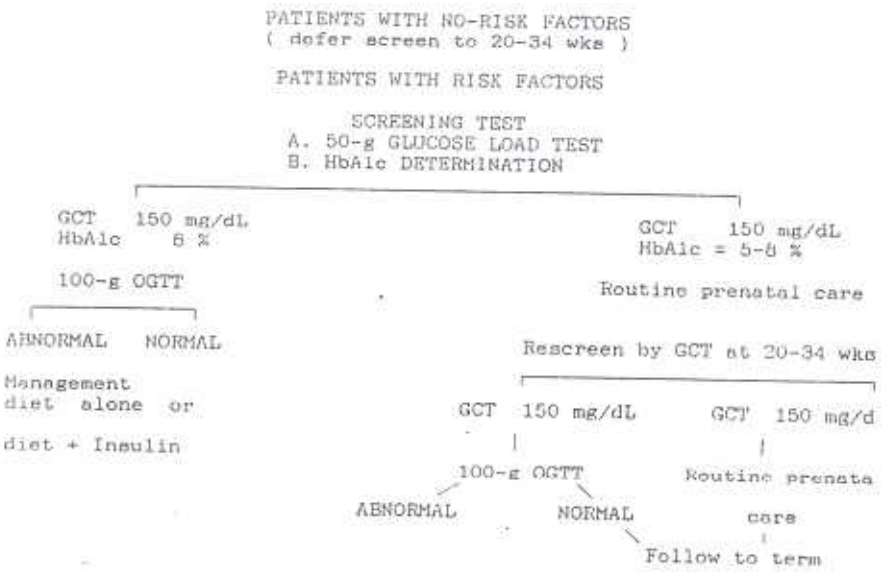
6. Prior pregnancy resulting in an unexplained stillbirth, perinatal death or infant weighing more than 4000 g at birth.

First, fasting venous plasma glucose levels and HbAlc levels of all cases were determined. Than screening for diabetes mellitus was done according to the method described by O'Sullivan and coworkers (5). All of the cases were screened after fasting, using 50-g oral glucose load followed by a glucose determination 1 hour later. Patients with serum glucose levels below 150 mg/dl had no further testing. Patients with serum glucose levels 150 mg/dL or higher were considered to have an abnormal screening test, and were scheduled for a 100-g oral glucose tolerance test.

The 100-g oral glucose tolerance test was administered after an overnight fasting following three days preparation with an unrestricted diet. Plasma glucose values were determined by a glucose oxydase method (Technicon) on a RA-1000 autoanalyser.

Values considered abnormal on the three hour glucose tolerance test were a fasting serum glucose above 105 mg/dL, a one hour serum glucose above 190 mg/dL, a two-hour serum glucose above 165 mg/dL, and a three-Hour serum glucose above 145 mg/dL. Diagnosis of the gestational diabetes was made when any two values were exceeded. The testing protocol has been described on Table 1.

Table 1. Screening Protocol. (OGTT= Oral Glucose Tolerance Test)



Patients were divided into two groups according to the results of their glucose screening test. Those with normal glucose screening tests were termed the control group, whereas those with abnormal screening test were termed the study group.

Statistical analyses were performed using the Student's t test and the X^2 test with Yates correction. Linear regression analyses were performed to correlate the variables.

RESULTS: During the study, 146 patients were screened for gestational diabetes with glucose challenge test. Of these, 129 test were normal (88.4%) and 17 tests were abnormal (11.6%). Fifteen patients with abnormal screening test results had normal oral glucose tolerance test (OGTT) values (82.2%) and two patients had abnormal OGTT values (11.8%).

The mean (+/-standard deviation) age of the study group, 26.00±4.03 years, was not significantly different from that of the control group, 25.89 +/-4.23 years ($t=0.10$, $df=144$, $p < 0.05$).

According to the gestational weeks, frequency distributions of the cases in control group and study were shown on Table 2.

Table 2. Frequency distribution of cases according to gestational weeks

Class Limits	Control Group (%)	Study Group(%)
20 - 22 WKS	13 (10.08)	3 (17.65)
23 - 25 "	26 (20.16)	3 (17.65)
26 - 28 "	32 (24.81)	7 (41.18)
29 - 31 "	19 (14.73)	3 (17.65)
32 - 34 "	39 (30.23)	1 (5.88)

Of the 146 patients, 26(17.8%) had at least one or more risk factor. Of the 26 patients, 6(23.1%) had an abnormal glucose challenge test results. Eleven (9.2%) of the 120 patients with no risk factors had an abnormal glucose challenge test results (see Table 3).

Table 3. Detection of abnormal GCT and risk factors

	GCT (-)	GCT (+)	TOTAL
Patients with no-risk factor	109 (74.7%)	11 (7.5%)	120 (82.2%)
Patients with one or more risk factors	20 (13.7%)	6 (4.1%)	26 (17.8%)
TOTAL	129 (88.4%)	17 (11.6%)	146 (100.0%)

The mean (+/-SD) gestational week was 28.09±4.03 in the control group and 26.58±3.50 in the study group.

Glucose screening test results ranged from 57-192 mg/dL. One of the two patients with gestational diabetes mellitus had an abnormal fasting glucose value (123 mg/dL). The mean GCT results was 102.4±20.9 mg/dl in the control group and 164.5±11.8 mg/dL in the study group.

Taking GCT into consideration, there was not a significant difference between the patients who had clinical risk factors and those who did not (X^2= 3.45, df= 1, α =0.05).

The mean (+/-SD) HbAlc value was 6.07±1.10 in the control group and 6.94 ± 1.09 in the study group. We could not find a correlation between the glucose challenge test results and HbAlc values (r 0.05). There was not a correlation between the fasting serum glucose levels and HbAlc values in study group (r 0.5). But, linear regression analysis demonstrated a correlation between fasting serum glucose levels and glycosylated hemoglobin levels (F= 7.49 α =0.05).

DISCUSSION: It has long been recognised that pregnant women have decreased carbohydrate tolerance, and gestation is often regarded as diabetogenic. In earlier descriptions of diabetic pregnancies, physicians have relied on the classification of White, as described on table 4 (3,8). In White classification, classes A through C include patients with diabetes of increasing duration and chemicial severity but without demostrable angiopathy. Classes D through T comprise a group of insulin dependent diabetics with overt vascular disease.

Table 4. White's Classification in diabetes in pregnancy

CLASS A	: Abnormal glucose tolerance test. Asymptomatic. Diet alone can maintain normoglycemia.
CLASS B	: Adult onset (age 20) and short duration (10 years)
CLASS C	: Early onset (age 10-19) or long duration (10-19 years)
CLASS D	: Onset under age 10 or very long duration (20 years). Or evidence of minimal vascular disease (calcifications of vessels of leg. benign rethynopathy or hypertension).
CLASS F	: Renal disease
CLASS R	: Proliferative rethynopathy.
CLASS RF	: Renal disease and proliferative rethynopathy.
CLASS H	: Aeterosclerotic heart disease.
CLASS T	: Pregnancy after renal transplantation.

The National Diabetes Data Group (9) delineated a new nomenclature in USA, which replaces the older White classification (Table 5).

Table 5. The National Diabetes Data Group classification of diabete

TYPE I : IDDM	= Insulin Dependent Diabetes Mellitus
TYPE II : NIDDM	= Non Insulin Dependent Diabetes Mellitus
TYPE III : GDM	= Gestational Diabetes Mellitus

Gabbe has proposed a simpler classification in 1981 (see Table 6) (10).

Table 6. A modified classification of diabetes in pregnancy

GROUP I :	Abnormal glucose tolerance test. Asymptomatic Diet maintains normoglycemia
GROUP II :	Insulin Dependent Diabetes. No vascular disease
GROUP III :	Insulin Dependent Diabetes. Demonstrable vascular disease

The NDDG (National Diabetic Data Group) classificationis more didactic than the others and we use this classification in our department

In early pregnancy (up to 20 weeks), maternal carbohydrate metabolism is affected primarily by the large rise in estrogen and progesteron levels which stimulates the pancreatic beta cell hyperplasia and insulin secretion (1,2).

During the latter half of the pregnancy, carbohydrate metabolism is stressed by rising levels of human chorionic somatomammotropin, prolactin, cortisol and glucagon (2). These hormonal changes contribute to decreased glucose tolerance and insulin resistance.

Most investigators recommend screening all pregnant women with 50-g oral glucose load between 24 and 32 weeks of gestation (3,5,6,7,11). The issue of when and how often to screen for diabetes during pregnancy is unresolved. Jovanovich and Peterson (11) found six gestational diabetics at 33-36 weeks gestation in addition to their 587 patients who had been screened at 27-31 weeks gestation. Lavin et al (6), however, found no additional diabetics among 211 patients rescreened after 28 weeks. Our two patients with GDM were identified at 22 and 26 weeks of gestation and one of them had no risk factor. For this reason, we performed screening test to all the pregnant women between 20 and 34 weeks of gestation.

Lavin and coworkers (6) have conducted the GCT in 2072 pregnant women. An oral 3-hour glucose tolerance test was performed in women with a glucose value greater than 150mg/dL. The numbers of patients with GDM were similar in women who had clinical risk factors (1.5 per cent) and those who did not (1.4 per cent). We found only two cases of GDM among 146 patients with or without risk factor (1.4 per cent)b

Lekin et al. (12) and Sacks et al (7) have found the rate of positive GCT 15.7 per cent 24.0 per cent in their study groups respectively.

Coustan et al (13) have conduced a 50-g oral glucose screening test in the fasting state and one hour after standard 600 calorie breakfast in a randomized crossover trial. There were 46 confirmed normal patients and 24 gestational diabetics studied. There were no differences in test results under the two conditions among normal individuals. The test result was significantly higher among gestational diabetes if they were fasted (173.9 ± 28.8 mg/dL) than if the test followed standard breakfast (154.8 ±24.1 mg/dL). We performed the GCT in the fasting state and the mean (+/- SD) GCT results was 164.5±11.8 mg/dL in our study group.

The screening test should have a high sensitivity, identifying most individuals having the disorder, but need not have the high specificity demanded of the diagnostic test. The suggested threshold of 150 mg/dL may be to insensitive. We could not evaluate the sensitivity and specificity of our test result, because of our small study group. We have no patient with gestational diabetes mellitus having an normal GCT result.

O'Sullivan et al (5) have fount that GCT has a sensitivity of 79% and specificity of 87% at a cutoff level of 130 mg/dL using Somogyi-Nelson methods in whole blood.

The interpretation of these threshold, in term of the present day methodologies (usually glucose oxidase in plasma) is unresolved. If these changes are taken into account, O'Sullivan's screening test criteria of 130 mg/dL becomes approximately 143 mg/dL (14).

Cousins et al (15) have performed the GCT and detected the HbAlc values in 806 consecutive prenatal patients. They performed glucose tolerance testing on all subjects with a challenge test result 150 mg/dL. They calculated the specificity of the GCT to be 92 % at 150 mg/dL. A HbAlc threshold of 6.8 % achieved a sensitivity of 80 % but had a specificity of only 57% at these cutoff. If the HbAlc threshold is increased (9.2%), so that a specificity of 92% is reached, the sensitivity falls to about 36%. These data do not support the use of

glucosylated hemoglobin as a screening test for gestational diabetes in an unselected population of gravidae.

We found that the mean HbAlc value was 6.07+1.10 in the control group and 6.94+1.09 in the study group. There was not a correlation between the fasting serum glucose levels and HbAlc values. We also could not find a correlation between the GCT results and HbAlc values.

The prevalance of GDM among patients screened with one hour 50-g glucose load and 100-g glucose tolerance test was presented on Table 7.

Table 7. Prevalance of GDM patients screened with GCT and 100-g OGTT (G.O.= Glucose Oxydase, S.N.= Somogyi-Nelson)

AUTHOR	N	+GCT (%)	FREQUENCY OF GDM of patients with +GCT(%)	of population (%)	When Tested	Fasting	Threshold (mg/dL)	Assay
Larkin et al. (12)	2276	357 (15.7)	181 (50.7)	181 (7.9)	26-30 wks	No	135	G.O.
Sacks et al. (7)	4116	991 (24.0)	158 (15.9)	158 (3.4)	(24 wks)	No	135	G.O.
O'Sullivan et al.(5)	752	109 (15.0)	15 (14.0)	15 (2.0)	2nd-3rd trimester	No	130	S.N.
Lavin et al. (6)	2077	137 (6.6)	30 (22.0)	30 (1.4)	28-32 wks	No	150	G.O.
Carpenter and Coustan (14)	381	109 (29.0)	24 (22.0)	24 (6.3)	24-32 wks	Yes	130	G.O.
Jovanovich and Peterson(11)	569	173 (29.0)	12 (7.0)	12 (2.0)	27-31 wks	Yes	150	G.O.
Dewir et al.	146	17 (11.6)	2 (11.8)	2 (1.4)	20-34 wks	Yes	150	G.O.

As shown in Table 7 meaningful comparison of the prevalance of diabetes among different studies is very difficult. Because, various factors including gestational age at testing, fasting before the glucose screening test, threshold value selected to indicate a OGTT, and assay method may influence the prevalence.

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