SCREENING FOR GESTATIONAL DIABETES BY 50 GRAMS GLUCOSE CHALLENGE TEST

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ABSTRACT

This cross sectional study was an attempt to estimate the prevalence of gestational diabetes among pregnant women in Basrah (using the 50 gm glucose challenge test) and to identify the high risk groups. The study involved 304 pregnant women who were attending the antenatal care clinics of two primary health care centres during a three-month period. All pregnant women included in the study were interviewed, blood samples were drawn, and urine samples were checked for the presence of sugar. The results showed that the prevalence of glucose intolerance was 4.3% according to 50 grams glucose challenge test. Also the results showed that the main risk factors, which were significantly and independently associated with impaired glucose tolerance, were history of habitual miscarriage, history of neonatal death and family history of diabetes mellitus. Urine test for sugar as a screening test for gestational diabetes was found to be neither sensitive nor specific in comparison with 50 grams oral glucose test. It was recommended that pregnant women should be screened for gestational diabetes by the 50 grams glucose challenge test and the screening can be done at least for high risk women.

INTRODUCTION

Gestational diabetes (GD) is defined as carbohydrate intolerance resulting in hyperglycemia of variable severity with an onset first recognized during pregnancy.[1] The most important reason that pregnancy uncovers the diabetic tendencies of asymptomatic woman is the progressive increase in insulin resistance that occurs during gestation. Other reasons for the diabetogenic tendency of pregnancy are the increased lipolysis and the alteration in gluconeogenesis that normally occur.[2] Gestational diabetes remains the subject of much debate, particularly with regards screening and diagnosis. It is also one of the most common clinical issues facing obstetricians and their patients. A lack of data from well-designed studies has contributed to the controversy surrounding the diagnosis and the extent of this condition.[3] Up to our knowledge, no previous study has addressed this problem in Basrah city. Thus the present study was an attempt to estimate the prevalence of gestational diabetes among pregnant women in Basrah (using the 50 gm glucose challenge test) and to identify the high risk groups.

SUBJECTS AND METHODS

This is a cross sectional study involving 304 pregnant women who were attending the antenatal care clinics of two primary health care centres in Basrah city (Al-Basrah and Al-Razie) during a three-month period extending between the 1st of December 2002 and the 28th of February 2003. Both health centres serve women of different socioeconomic status. All pregnant women who were attending the two antenatal care clinics on two selected days per week and had completed 22-32 weeks of gestation were invited to participate in the study. The aim of the study was explained to them and a verbal consent to participate in the study was obtained. Out of the total of 335 pregnant women who were eligible for the study, 31 refused to participate leaving 304 pregnant women to be included in the study (a response rate of 90.75%). Women known to be diabetic (pre-existing diabetes) were excluded from the study. A special questionnaire form was developed for the purpose of the study which, covered the following aspects: Personal characteristics (age, education), present and past medical history (history of urinary tract infection, moniliasis, and any other medical conditions), family history (family history of diabetes), history of present pregnancy (parity, last menstrual period, gestational age, and any history of complications in the first and second trimesters like vaginal bleeding or urinary tract infection). The questionnaire also included past obstetric history (history of diabetes in a previous pregnancy, history of three or more spontaneous miscarriages, stillbirth, delivery of

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a large infant, delivery of infant with congenital anomalies, history of traumatic delivery, and history of neonatal death). One of the investigators filled the questionnaire form for each pregnant woman through direct interview. Each pregnant woman "regardless of her fasting status" was asked to give a mid stream sample of urine, which was sent to the laboratory to test for glucoseuria. All urine samples were tested by the same laboratory technician using Benedict's test.[4] After that the pregnant woman was asked to drink 250mls of water in which 50gms of glucose powder were dissolved. The time of drinking was recorded and exactly after one hour 2mls of venous blood was drawn. The blood was put in a plane tube and sent to the laboratory within one hour. All samples were examined by the same specialist biochemist in Basrah Maternity and Child hospital. Blood glucose was measured enzymatically according to the enzymatic method of biomerieux, France (Ref 61272).[4] Any glucose level exceeding 140mg/dl or 7.8mmol/L was considered positive. Statistical Package for Social Sciences (SPSS) for windows (version 7.5) was used in the analysis. Chi-squared test was used to determine the associations between different variables. The probability of less than 5% was considered significant. Logistic regression analysis was used to determine the independent effect of selected variables on glucose tolerance. Also validity tests including sensitivity and specificity were used to assess the applicability of urine test as a screening test for glucose intolerance.[5]

RESULTS

Characteristics of the study population

A total of 304 pregnant women were included in the study. The age of the study group ranged between 17 and 43 years with a mean of 28±5.8 years, 39.5 % of them were below 25 years, and only 48(15.8%) were above 35 years of age. The general level of education of group the pregnant women included in the study was considerably high, about one-fifth (19.4%) had completed their higher education. Less than half (42.4%) of the pregnant women were nulliparous, while 26(8.6%) were Para 5 and more. Only 12 (3.9%) were above 28 weeks of gestation with the majority (57.9%) were between 24 and 28 weeks of gestation.

The results of urine & blood tests

Overall 125(41.1%) of all pregnant women included in the study showed a positive urine test for sugar, while only 13 (4.3%) showed a positive 50 gm challenge test (blood glucose level of 140 mg /100 ml or above).

Validity of urine test

A comparison between the results of urine test and that of the 50 gm challenge test (as screening and standard tests respectively) was made. As a result the sensitivity of urine test was found to be 46.2% with a specificity of 59.1%. (Table-1)

Table 1. ***The results of the 50 gm challenge test in relation to the results of urine test for sugar.***

Urine for sugar	Challenge test				Total
	Positive		Negative		
	No.	%	No.	%	No.
Positive	6	46.2	119	40.9	125
Negative	7	53.8	172	59.1	179
Total	13	100.0	291	100.0	304

Risk factors for abnormal challenge test: Age, parity, gestational age

(Table-2), shows the results of the blood glucose challenge test for pregnant women according to age, parity, and gestational age. Overall 2.3% of pregnant women below the age of 30 showed abnormal results compared to 6.8% of those aged 30 years or more. Similarly a consistent significant increase in the percentage of abnormal results with the increase in parity was obtained. The percentage of abnormal results has increased from 2.3% among nulliparous women to 7.7% among grandmultiparous. While no significant association between gestational age and the result of the test was found.

Table 2. ***The results of the challenge test according to selected characteristics.***

Age (years)	Challenge test				Total	
	Positive		Negative			
	No.	%	No.	%	No	%
<30	4	2.3	168	97.7	172	100.0
30+	9	6.8	123	93.2	132	100.0
Total	13	4.3	291	95.7	304	100.0
X^2= 3.68 df=1 P>0.05						
Parity	**Positive**		**Negative**			
	No.	**%**	**No.**	**%**	**No.**	**%**
0	3	2.3	126	97.7	129	100.0
1-4	8	5.4	141	94.6	149	100.0
5+	2	7.7	24	92.3	26	100.0
Total	13	4.3	291	95.7	304	100.0
X^2= 64.66 df=1 *P<0.01 *For calculation of X^2 the last two rows were added together						
Gestational age	**Positive**		**Negative**			
	No.	**%**	**No.**	**%**	**No.**	**%**
<24	6	5.2	110	94.8	116	100.0
24+	7	3.7	181	96.3	188	100.0
Total	13	4.3	291	95.7	304	100.0
X^2=0.346 df=1 P>0.05						

Past Obstetric history

One out of four pregnant women with previous history of gestational diabetes, showed a positive challenge test. While among the 300 women who had no such history, only 12 (4%) were positive. Similarly, the risk of showing abnormal challenge test was markedly high among pregnant women who had a history of miscarriage (15.6%) or a history of still birth (16.7%). The association between history of miscarriage or still birth and abnormal challenge test was very highly significant (Table-3)

Table 3. The results of the 50gm challenge test in relation to previous history of gestational diabetes, &history of pregnancy wastage.

History of gestational diabetes	Challenge test				Total	
	Positive		Negative			
	No.	%	No.	%	No.	%
Positive	1	25.0	3	75.0	4	100.0
Negative	12	4.0	288	96.0	300	100.0
Total	13	4.3	291	95.7	304	100.0
*Exact Fissure test *P<0.001						
History of miscarriage	Positive		Negative			
	No.	%	No.	%	No.	%
Positive	10	15.6	54	84.4	64	100.0
Negative	3	1.3	237	98.7	240	100.0
Total	13	4.3	291	95.7	304	100.0
X^2 =25.51 df=1 P<0.001						
History of stillbirth	Positive		Negative			
	No.	%	No.	%	No.	%
Positive	9	16.7	45	83.3	54	100.0
Negative	4	1.6	246	98.4	250	100.0
Total	13	4.3	291	95.7	304	100.0
X^2=24.627 df=1 P<0.01						

Family history of diabetes

In the present study 36 pregnant women had a family history of diabetes mellitus, 7 (19.4) of them had abnormal challenge test. This is compared to 2.2% of pregnant women who had no family history of diabetes. The association between positive family history of diabetes & abnormal challenge test was very highly significant. (Table-4)

Table 4. *The results of the 50gm challenge test in relation to family history of diabetes.*

Family history of diabetes	Positive		Negative		Total	
	No.	%	No.	%	No.	%
Positive	7	19.4	29	80.6	36	100.0
Negative	6	2.2	262	97.8	268	100.0
Total	13	4.3	291	95.7	304	100.0
X^2=22.95 df=1 P<0.01						

Delivery &neonatal History

The results of the challenge test according to delivery history are shown in (Table-5). The table shows that 5 (25%) of those with previous history of a delivery of large infant, were having abnormal challenge test compared to 2.8% of those with no such a history. Similarly, 4(11.8%) of the women who had previous history of traumatic delivery showed abnormal

challenge test. This is compared to 3.3% of pregnant women with no such history. The association between history of traumatic delivery and abnormal results was statistically significant. Out of the 304 pregnant women included in the study, 46 gave history of neonatal death, of whom 9 (19.6%) showed abnormal blood glucose challenge test compared to 4(1.6%) out of 258 with no such history. The association between the two variables was significant.

Table 5. ***The results of the 50 gm challenge test in relation to delivery history & history of neonatal death.***

History of large baby	Challenge test				Total	
	Positive		Negative			
	No.	%	No.	%	No.	%
Positive	5	25.0	15	75.0	20	100.0
Negative	8	2.8	276	97.2	284	100.0
Total	13	4.3	291	95.7	304	100.0
X^2=22.46 df=1 P<0.01						
History of traumatic delivery	**Positive**		**Negative**		**Total**	
	No.	**%**	**No.**	**%**	**No.**	**%**
Positive	4	11.8	30	88.2	34	100.0
Negative	9	3.3	261	96.7	270	100.0
Total	13	4.3	291	95.7	304	100.0
X^2=5.25 df=1 P<0.05						
History of neonatal death	**Positive**		**Negative**		**Total**	
	No.	**%**	**No.**	**%**	**No.**	**%**
Positive	9	19.6	37	80.4	46	100.0
Negative	4	1.6	254	98.4	258	100.0
Total	13	4.3	291	95.7	304	100.0
X^2=30.95 df=1 P<0.001						

Logistic Regression Analysis

When logistic regression analysis was performed, the factors, which were independently and significantly affected the results of blood glucose challenge test were family history of diabetes mellitus, history of neonatal death, and history of habitual miscarriage.

DISCUSSION

The importance of early diagnosis and management of gestational diabetes has become clear because of its severe and morbid effects on the mother and the fetus. The subject of glucose intolerance in pregnancy and gestational diabetes, however, is confused by variable definitions and the lack of well controlled researches resulting in frequent debate in literature as to its relevance.[6] Minor degrees of glucose intolerance are not associated with adverse pregnancy outcome, whilst more marked abnormalities are almost certainly putting the fetus at similarly increased risks in late pregnancy as those found in women with established diabetes.[6] Diabetes complicates approximately 3-4 per 1000 pregnancies, 90% of them are due to gestational diabetes.[7] Studies have shown that some of the factors associated with an increased risk of gestational diabetes are obesity, a family history of diabetes, having given birth previously to a very large infant (>4.5kg), a stillbirth or a child with birth defect, or having too much amniotic fluid (polyhydramnious). Also women who are older than twenty-five are at a greater risk than younger individuals.[8]According to the results of the present study the prevalence of gestational diabetes based on the 50gm challenge test was 4.3% using a cut off point of 140 mg/dl. These results are similar to those reported in a study of gestational diabetes in Saudi Arabia at 4.4% using the same test & the same cut off point.[9] The main risk factors, which were found to be significantly and independently associated with impaired glucose tolerance, were previous history of miscarriage, history of neonatal death and family history of diabetes mellitus. These findings are in agreement with the results of the Saudi Arabian study, which found that history of neonatal death was a very important risk factor.[9] The association between history of miscarriage (particularly habitual miscarriage) and abnormal challenge test may partly indicate the presence of previously undiagnosed gestational diabetes, with all the well-known effects of this condition on pregnancy. Gestational diabetes can induce miscarriage through its association with an increased risk of congenital anomalies.

Screening for gestational diabetes

About 90% of the cases of diabetes, which complicate pregnancy, are gestational diabetes,[10] the detection of gestational diabetes is, therefore, an important diagnostic challenge. Women with high plasma glucose level, glucosuria, and ketoacidosis present no problem in diagnosis. Similarly those with a random plasma glucose level greater than 200mg/dl plus classical signs and symptoms such as polyurea, polydypsia and weight loss should be considered to have overt diabetes (American Diabetes ASS 1991).[11] However, women at the opposite end of the spectrum with only minimal metabolic derangement may be difficult to identify.[7] Traditionally obstetricians have relied on historical and clinical risk factors to select those patients whom likely to develop GD. Internationally, however, over half of all patients who exhibit an abnormal Glucose Tolerance Test lack the risk factors for gestational diabetes.[2] Neiger & Cousten have reported that in a series of 6214 women using historical risk factors and an arbitrary age cut-off of 30 years for screening would miss 35% of all cases.[12] On the other hand other researchers suggested that selective screening for GD based on person risk assessment can reduce the need for testing with negligible loss of diagnostic efficiency.[13,14] Helton et al. found that less than 1% of prenatal patients without risk factors for gestational diabetes were ultimately found to have gestational diabetes & suggested that selective screening deemed fine for women at low risk.[15] In Dublin, selective screening for glucose intolerance is only performed in women with risk factors, usually previous macrosomic baby or an unexplained stillbirth. One reason for this restrictive approach arises from concerns of reducing unnecessary anxiety in women who have positive screening test. While, the council on diabetes in pregnancy of the American diabetes association strongly recommends that all pregnant women should be screened for GD.[16] The most commonly used screening test for GD is the 50 grams glucose challenge test. This test is some times called mini glucose tolerance test. This method of screening is now widely used and if glucose level is greater than 7.8 mmol/L a full glucose tolerance test is arranged.[1] Studies have shown that the 50

grams challenge test has a sensitivity and specificity ranging between 88-90% & 84-95% respectively.[9,17] Furthermore it has been suggested that the sensitivity of 50gm glucose challenge test can be increased if it is done in fasting state and for high-risk group of GD.[18] These results suggest that the 50 gram challenge test is a good screening test for GD in comparison with other screening tests and it provides the best of ease and economy.[19] The test is an easy and relatively of low cost, requires single blood sample, and generally acceptable. Therefore we recommend the use of the 50 gram glucose challenge test as a screening test for GD. If mass screening of all pregnant women is currently not feasible, the test should be used for those with risk factors for gestational diabetes.

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