Original article:

A Single Glucose Challenge Test procedure for diagnosis of Gestational Diabetes Mellitus

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ABSTRACT

Background: In India where prevalence of GDM is 8-17% which is comparatively very high, thus there is need for the screening for glucose intolerance so that we can save both mother as well as child from the adverse future outcomes. With a huge population in the reproductive age in India, a significant segment developing abnormal glucose tolerance is a matter concern.GDM women are thus an ideal group for the primary prevention of diabetes**.**

Aim: The objective of the study was to compare the efficacy of A Single Glucose Challenge Test with conventional 2hr Oral Glucose Tolerance Test for diagnosing GDM.

Materials and Methods: This is a prospective study for a period of one year from Nov.2010 to Oct.2011performed at Obstetric & Gynaecology deptt. of GMC,Jammu. Out of 460 pregnant women, 334 gave their consent to participate in the study. Out of 334, 200 pregnant women completed the study. Subjects at 16-32 weeks of gestation have been evaluated for presence of GDM by doing single Glucose Challenge Test followed by conventional 2hr Oral Glucose Tolerance Test after 3 days**.**

Results: The present study very effectively supports that 75gm GCT performed on pregnant women is an easy, economical as well as less cumbersome procedure. Hence, this one step procedure serves as both screening as well as diagnostic procedure in a country with limited resources but requiring universal screening.

Keywords: glucose challenge test, oral glucose tolerance test, gestational diabetes mellitus

Background:

Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance of variable severity with onset or first recognition during pregnancy (NATIONAL Diabetes Data Group, 1979)[1]. The incidence of GDM has been estimated at between 3% to 12% and varies with the population studied and diagnostic criteria used. Certain populations are especially vulnerable to developing this condition because of genetic, social and environmental factors. Some studies recently found increased perinatal morbidity[2,3,4], associated with hyperglycemia during pregnancy. Women diagnosed to have GDM are at increased risk of future diabetes predominantly type2 DM[5] and glucose intolerance in offspring [6,7] as are their children. In the Indian context, screening is essential in all the pregnant women as the Indian women have an eleven fold increased risk of developing glucose intolerance during pregnancy as compared to Caucasian womem [8]. In South Asian countries , Indian women have highest frequency of GDM. The recent data shows 16.55% prevalence of GDM in our country. It has been known for more than a century that fetal neonatal outcomes are adversely affected by diabetes antedating pregnancy [9]. It was recognised that increased perinatal mortality was seen among babies of women who developed diabetes years later[10],thus leading to the coining of the term “Prediabetes in Pregnancy”. Belgian researcher **J.P.Hoet**

published a study on "Carbohydrate Metabolism During Pregnancy" and first used the term Metagestational Diabetes" in 1954**, Jorgen Pederson** probably was the first to use the modern term GESTATIONAL DIABETES" in 1976, and this was the term promoted by **Dr. Norbert Freinkel** and his associates, later adopted by the First International Workshop-Conference on Gestational Diabetes Mellitus.

Materials and Methods:

The present prospective study has been conducted in ante-natal clinics in GMC, Jammu and its associated hospital SMGS Hospital for a period of one year from Nov. 2010 to Oct. 2011. Out of 334 pregnant women, 200 pregnant women completed the study and were available for analysis. Subjects at 16-32 weeks of gestation have been evaluated for presence of GDM by doing a single Glucose Challenge Test followed by conventional 2hour OGTT after 3days. All subjects under study were subjected to detailed history, clinical examination, systemic examination and laboratory investigations. Paired t test has been employed to examine the difference of plasma glucose values between the WHO OGTT and GCT women. Mc Nemar test and the Bland & Altman plot has been used to compare the two methods in diagnosing GDM.

Results:

A total of 200 pregnant women in the gestational age of 16-32 weeks were subjected to single Glucose Challenge Test (GCT) followed by conventional Oral Glucose Tolerance Test (OGTT). Out of them 22 were diagnosed to have Gestational Diabetes Mellitus (GCT) by both the methods, where as 178 were normal glucose tolerant (NGT). The present study concluded the following observations.

Table 1: Association of Mean age of patients with GDM

	GDM	NGT
Mean age (in years)	29.68	25.89

In the present study the mean age is more in GDM Group compared to NGT which implies that with the increasing age the risk of GDM goes on increasing. The mean age is significantly higher in GDM Group ($P<0.05$).

Table 2: Association of Gravity with GDM

Gravidity	**GDM**	**NGT**
Primigravida		
No. of patients	5	110
%age	22.7	61.8
Multigravida		
No. of patients	17	68
&age	77.3	38.2
Total	**22(100%)**	**178(100%)**

In this present study, GDM is more common in multigravida which means that with the increase in gravidity prevalence of GDM goes on increasing. The prevalence of GDM is significantly higher in multigravida group as compared to NGT group ($p<0.0001$).

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Table 3: Association of Body Mass Index with GDM

BMI (Kg./m^2)	GDM	NGT
≥ 30		
No. of patients	12	49
%age	54.5	27.5
≤ 30		
No. of patients	10	129
&age	45.5%	72.5%
Total	**22(100%)**	**178(100%)**

The present study reveals that the prevalence of GDM is significantly higher in patients with BMI ≥ 30 Kg/m^2 ($p<0.0001$) which is highly significant.

Table 4: Association of Family History with GDM

Family History	GDM	NGT
Positive		
No. of patients	14	30
%age	63.6	16.8
Negative		
No. of patients	08	148
&age	36.4	83.2
Total	**22(100%)**	**178(100%)**

The present study reveals that prevalence of GDM is significantly higher in patients with positive family history compared to NGT group ($p<0.0001$).

Table 5: Association of Gestational with GDM

Age of Gestational	No. of Patients	% age
16-20 Weeks	4	18.1
21-24 Weeks	8	36.3
25-28 Weeks	4	18.1
29-32 Weeks	6	27.2

In the present study detection of GDM is increased by including women is gestational age group 16-20 weeks and 29-30 weeks which are not include in the conventional GCT. Normally women in these age group are missed by the conventional GCT.

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Table 6: Comparison of GCT and Conventional OGTT

	WHO OGTT		Total
	+ GDM	**- GDM**	
GCT			
+ GDM	22	0	22
- GDM	0	178	178
Total	22	178	200

Sensitivity 100%, Specificity 100%.Thus the present study proves that the sensitivity and specificity to detect GDM is equal in both conventional OGT and GCT.

DISCUSSION:

Increasing maternal hyperglycemia is associated with increasing pregnancy morbidity and increased likelihood of subsequent diabetes in the mother. In addition, maternal hyperglycemia has a direct effect on the development of fetal pancreas and is associated with increased susceptibility to future diabetes in the infant, an effect which is independent of genetic factors. Over the next two to three decades there will be 80 million reproductive age women with diabetes in the world of these 20 million will live in India alone creating a potential for extremely high rates of maternal and infant morbidity. A recent national survey reported the prevalence of 20-29 years and 30-39 years as 12.2% and 15.3% respectively in the general population. No gender difference was seen in the prevalence of IGT (impaired glucose tolerance).

The importance of any screening procedure is not only to identify women with GDM but also to exclude NGT (normal glucose tolerance) women. **Sack et al** [11] and **Daniele et al** [12] have observed that measuring FPG (fasting plasma glucose) is an easier screening procedure and suggested cut-off value of 95mg/dl for GDM. However, such level is insufficient as the sole marker of GDM since most cases have FPG values below the putative threshold. Very few women are diagnosed with GDM on the basis of elevated fasting plasma glucose alone.

ADA (American Diabetes Association) [13] recommends 50g of oral glucose for screening without regard to time of the last meal and the PG (plasma glucose) of ≥ 140 mg/dl 1 hr after the glucose load as a positive screen test, In them, the diagnosis of GDM needs confirmation by 100g OGTT (oral glucose tolerance test). **Magee et al** [2] reported that in their follow up 91 of the 457 positive screen individuals failed to undergo diagnostic test. **De Aguiar et al** [14] also observed in their study that 23% of their screen positive women did not return for OGTT. In the present study also 134 of the 334 positive screen individuals did not return for diagnostic OGTT. This two step procedure is thus cumbersome and also the phenomenon of no show occurs since the woman has to visit the antenatal clinic twice.

In the present study, we estimated the 2h plasma glucose after 75g GCT without regard to the time of the last meal just like 50-g ADA screening procedure. They also underwent WHO OGTT with overnight fasting after 3 days. We found non-fasting GCT identified women with GDM similar to that of OGTT. Plasma glucose for each subject in non-fasting GCT and OGTT varied, but yet all the values were found to be above the diagnostic criteria of 2h PG ≥ 140mg/dl. At the same time, women who were diagnosed to be NGT by GCT (Glucose Challenge Test) were diagnosed as NGT by OGTT too. Their plasma glucose also varied but was ≤ 140 mg/dl. Thus this procedure assumes clinical relevance, as **Pettitt et al** [15] also observed that WHO criteria based on the glucose concentration 2h after 75g of load administered to non-fasting women correctly identified subjects with

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GDM. The non-fasting 2h post 75g glucose concentration strongly predicts adverse outcome for the mother and her offspring. **Meltzer et al** [16] have also confirmed that with the availability of effective treatment, WHO criteria of 2h PPG ≥ 140 mg/dl identifying a large number of cases may have a greater potential for prevention.

The 75g of glucose challenge though larger than the 50g recommended by ADA, the difference in the glycemic load is not expected to result in a higher glycemic excursion in NGT subjects. Further, ADA also permits both 100g and 75g OGTT for diagnosis of GDM. Though the glucose loads are different, the cut-off values (FPG ≥ 95 mg/dl, lh PG ≥ 180 mg/dl, 2h PG ≥ 155 mg/dl) for diagnosis of GDM are the same implying that the quantity of glucose load has little influence on the PG levels in a normal person, whereas in a metabolically deranged state like GDM, both 50g and 75g glucose load would unmask the glucose intolerance. The advantage of 75g GCT is that there is no necessity to repeat OGTT; however, for 50g glucose challenge it is.

CONCLUSION:

The conventional OGTT detects GDM in the gestational age of 24-28 weeks only while the GCT (Glucose Challenge Test) detects between 16-32 weeks of gestation. So, the probability of detection of GDM is increased and the chance to miss GDM in pregnant women is decreased by the GCT method. With a huge population in the reproductive age in India, a significant segment developing abnormal glucose tolerance is a matter concern. GDM women are thus an ideal group for the primary prevention of diabetes. This implies that universal screening for detection and care of women with GDM may be considered as mandatory, and for this we need a simple and acceptable test procedure.

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