

DOI: <http://dx.doi.org/10.18203/2320-1770.ijrcog20184691>

Original Research Article

Comparison of one step glucose tolerance test (75 g GTT) and two step glucose tolerance test (100 g GTT) in screening and diagnosis of gestational diabetes mellitus

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Received: 22 October 2018

Accepted: 29 October 2018

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ABSTRACT

Background: Studies suggesting that increasing carbohydrate intolerance among patients not meeting the criteria for the diagnosis of GDM by two step OGTT leads to an increased rate of unfavourable maternal and perinatal outcomes. Patients with abnormal GCT results but a normal OGTT are at increased risk, as are those with one abnormal OGTT value rather than the two required for diagnosis by ADA criteria. Single value of one step GTT is enough to diagnose GDM and to improve the maternal and perinatal complications. The objective is to compare the efficacy of one step OGTT with two step OGTT in screening and diagnosis of gestational diabetes mellitus.

Methods: Hospital based analytical cross-sectional study which was conducted for 1 year among all pregnant women booked at government medical college, Alappuzha. They were subjected to detect GDM by 2 methods at 24-28 weeks.

Results: 2521 pregnant women were subjected for study, among them who were either 75 gm GTT or 50 gm GCT or both positive (332 pregnant women) were analyzed. 232 women (69.88%) were diagnosed as having gestational diabetes mellitus (GDM) by single step 75 gm GTT. Sensitivity of single step GTT was 92.4% and a false negative rate of the same was 7.6%. False negative rate for 50 gm GCT was 35.2%.

Conclusions: Present study concluded that this one step procedure is feasible in terms of better detection rates, saving time, limiting cost on repeated visits to health centre and reducing repeated invasive sampling. Single step GTT will be used both as a screening and a diagnostic procedure for detecting GDM.

Keywords: Fasting plasma glucose, Gestational diabetes mellitus, Glucose challenge test, Oral glucose tolerance test

INTRODUCTION

Gestational diabetes mellitus (GDM) is defined as varying severity of glucose intolerance with an onset or first recognition during the current pregnancy, regardless of whether insulin or diet modification is used for the treatment.¹ The significance of GDM is that both the mother and the fetus are at increased risk of developing diabetes in their future life. During pregnancy, increasing maternal carbohydrate intolerance without GDM is also having direct association with both short and long term

adverse maternal and fetal outcomes.² Universal screening of all pregnant women for GDM identifies more number of cases than selective screening along with improvement in maternal and offspring outcome.³ In the Indian population, all pregnant women should be screened for GDM as the Indian females have an eleven fold higher risk of developing impaired glucose tolerance in the pregnancy than Caucasian females.⁴ Another important area of concern is that, ethnically also the Indian women have the highest frequency of developing GDM.⁵ According to recent data, 16.55% is the

prevalence of GDM in India.⁶ ADA recommends two-step procedure whereas WHO and DIPSI suggest that one-step 75g OGTT. The detection rate of WHO criteria is three times higher than ADA criteria which will be suitable for our Indian scenario. Studies have shown that this one step procedure is feasible because of better detection rates, saving time, limiting cost on repeated visits to hospital and reducing repeated invasive sampling.

METHODS

This study was carried out in the Government TD Medical College and Hospital, Alappuzha. Two thousand five hundred and twenty-one pregnant women who booked at TDMC were subjected to detect GDM by the following 2 methods at 24-28 weeks of pregnancy after informed consent.

50 g oral glucose load was given irrespective of the meal status for glucose challenge test (GCT) and after 1 hour the venous blood samples were collected.⁷ Details included in the proforma were obtained, and the blood pressure measurement and the body mass index were recorded. All of them irrespective of the value after GCT were requested to come after 72 hours in the fasting state for the 75 g oral glucose tolerance test (OGTT) blood was drawn after 2 hours.⁸ The plasma glucose was assessed by glucose oxidation and peroxidation (GOD-POD) method.

Diagnosis of GDM

In the first method, if the venous plasma glucose value $\geq 140\text{mg}\%$ she will be subjected to 100 gm GTT. Blood glucose in the fasting state and after 100 gm of oral glucose in 1 hour, 2 hours and 3 hours will be estimated. If two or more of the blood concentrations met or exceeded the glucose levels given below, diagnosis of GDM will be confirmed.

ADA/ Carpenter Coustan (mg/dL)

- Fasting=95 mg/dL
- 1 hour=180 mg/dL
- 2 hours=155 mg/dL
- 3 hours=140 mg/dL

In the second method, if the venous blood concentration, ≥ 200 -pre-gestational diabetes and >140 -199 gestational diabetes.⁸

Methodology

Study population analysed were,

- Those that were 50 gm GCT positive and 100 gm GTT either positive or negative,
- 75 gm GTT positive either alone or in combination with previous criteria.

Women who were negative for both 50 gm GCT and 75 gm GTT were excluded from the analysis. Sensitivity and specificity of 75 gm GTT is analyzed using 100 gm GTT as gold standard.

RESULTS

All antenatal women attending obstetrics OPD at 24-28 weeks, who met the criteria and willing for the study were included. Among them 332 women were found to be positive with either 50gm GCT/ 75gm GTT positive. Out of these 332 positive pregnant women, 232 were 75 gm GTT positive and 100 were negative (Table 1). In those 100 negative pregnant women, 18 were diagnosed as gestational diabetes by two step GTT. False negative rate of single step GTT was 7.6%.

Table 1: 75 g GTT.

| | Frequency | Percentage |
|----------|-----------|------------|
| Positive | 232 | 69.9 |
| Negative | 100 | 30.1 |
| | 332 | 100.0 |

In 144 women, both 50 gm GCT (screening) and 75 gm GTT were positive (Table-2), screen positive women underwent 100 gm GTT. By 100 gm GTT 77 (28.6%) were diagnosed to have gestational diabetes and 67 were not GDM (26.5%). 100 women were screening test (50gm) positive and 75 gm GTT negative, among them 18 were diagnosed as gestational diabetes by 100 gm GTT.

Table 2: 50 g GCT and 75 g GTT.

| | | Positive GTT (75 g) | Negative GTT (75 g) |
|------------|----------|---------------------|---------------------|
| GCT (50 g) | Positive | 144 | 100 |
| | Negative | 88 | E |

E: Excluded from analysis

75 gm GTT missed that 18 women (7.2%). Eighty-eight (88) women who were missed by 50 gm GCT were positive for 75 gm GTT which showed a false negative rate of 35.2% for 50 gm GCT (Figure 1).

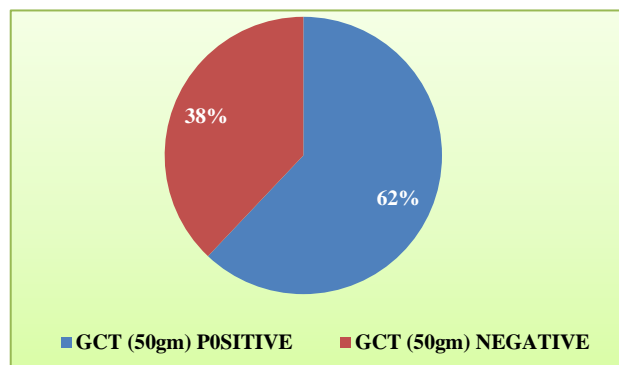


Figure 1: In 75 g GTT positive.

232 pregnant women were diagnosed as gestational diabetes by 75gm single step GTT. In that, 88 was screen negative so they did not undergo 100gm GTT. Sixty-seven were negative by 2 step GTT and 77 were diagnosed as gestational diabetes by 100 gm GTT (Table 3). 155 (46.69%) pregnant women missed by 2step GTT were diagnosed as gestational diabetes by single step GTT. 18 pregnant women missed by single step GTT were diagnosed as GDM by two step GTT.

Table 3: 75 g GTT and 100 g GTT.

| | | Screen negative | Positive GTT (100 g) | Negative GTT (100 g) |
|------------|----------|-----------------|----------------------|----------------------|
| GTT (75 g) | Positive | 88 | 77 | 67 |
| | Negative | E | 18 | 82 |

E: Excluded from analysis

The mean age of the pregnant women in present study was 25±5 years. The prevalence percentage has been increasing with age from 5.9% in the age group of ≤20 years to 21.6% in the age group > 30 years (Figure 2).

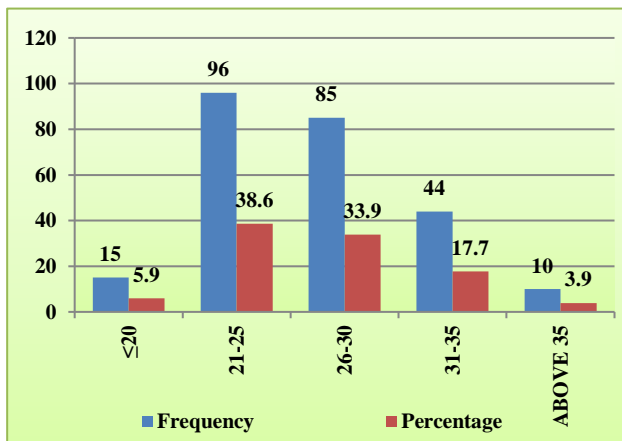


Figure 2: Age wise distribution of GDM.

The prevalence of GDM was more in primigravida 54.6% compared to third gravida 9.2% (Figure 3).

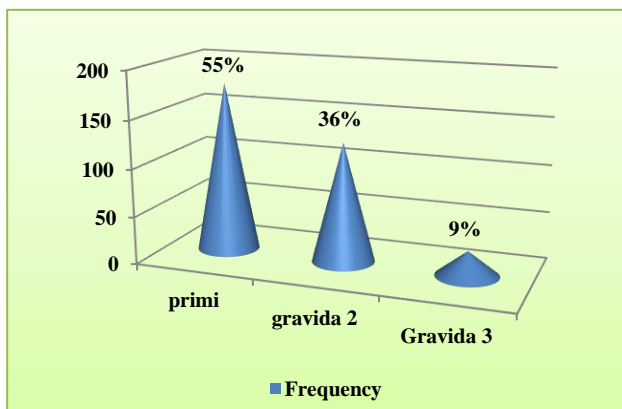


Figure 3: Obstetric score.

DISCUSSION

Gestational diabetes constitutes a metabolically distinct entity with definitely associated perinatal and maternal morbidities on short and long term. Hence, warrants timely diagnosis and prompt management. Authors now understand that there is a continuum of increasing carbohydrate intolerance associated with increased risk for adverse pregnancy outcomes. Authors were motivated to compare the one step GTT and two step GTT in screening and diagnosis of GDM and also analysed the maternal and perinatal outcome. Three thirty-two pregnant women were analysed.

In the two step GTT, the pregnant female have to visit the hospital more than once and give blood samples for 3 to 5 times. Single step GTT with 75 gm of oral glucose and a 2-hour plasma glucose value of ≥140 mg/dL is used to diagnose GDM during pregnancy. This method serves both as screening and a diagnostic procedure which is recommended by WHO and DIPSI. It is easier to perform, is economical and has better compliance.

It was observed that the incidence of abnormal values were more in the low risk age group of 20-25 years. Seshiah et al study, same was 23±4 years.⁹ No significant associations were observed between abnormal GCT / GTT values and educational or socioeconomic status, with more or less similar distribution among the different strata. Abnormal GCT/ GTT values and gestational diabetes were seen more in primigravidae (54.6%) than multigravidae (9.2%). This is much similar to the increased incidence of gestational diabetes noted among primigravidae. In contradictory, Seshiah et al study it was 16.3% among primi and 25.8% in multigravida.⁹

Sensitivity and false negative rate of 75gm GTT was 92.4% and 7.6% respectively. Slight higher false positive rate was also noted with 75 gm GTT but with diabetic diet if the blood sugar values were normal they were not intervened. Significant past history associated were primary infertility and PCOS. Large proportion had family history and previous obstetric history of diabetes mellitus although it was not significant.

Maternal hyperglycemia is directly related to increasing pregnancy morbidity and increased chance of developing diabetes in the mother.^{10,11} In addition, over the next 10-20 years, the number of reproductive group females with diabetes mellitus in the world will be approximately 80 million. Among them 20 million females will belongs to India and contribute to increased rates of maternal and infant morbidity.¹²

Regarding 50 g GCT, Magee et al reported that in their follow up among 457 screen positive pregnant women, 91 failed to return for diagnostic test.¹³ De Aguiar et al study also 23% of screen positive individuals did not undergo OGTT.¹⁴ This non-compliant is due to the fact that the

pregnant women have to attend the hospital for the 2 step GTT on more than one occasion.

In present study, 88 (35.2%) pregnant women who were negative as per GCT screening were diagnosed having GDM. Seshiah et al study it was 21.5%.⁹ Usually, OGTT will be done only for the pregnant women who were GCT screening positive, so they had been missed from diagnosis if 2 step GTT only followed for diagnosis. Actually, ADA criteria were validated against the risk of developing maternal diabetes in future but not evaluating the adverse perinatal outcome. Pettit also favored WHO recommendation in his study.¹⁵ Furthermore, in routine practice also single step GTT is preferred for detecting GDM.^{16,17}

In present study the detection rate of GDM was 28.6% by applying ADA criteria whereas according to WHO criteria 69.9% and it was approximately 3 times more with WHO criteria than with ADA criteria. Schmidt et al study, the prevalence was 2.4% by using the ADA criteria and 7.2% by applying WHO criteria and diagnosed 3 times more GDM with WHO criteria.¹⁸ Seshiah et al study it was 3.9% and 16.2% respectively and the detection rate was 4 times than WHO criteria.⁹ Using single step GTT for identifying more number of cases and treating GDM effectively may prevent further complications, which have been confirmed by Meltzer et al also.^{18,19} From the above discussed factors along with published and discussed evidences establish the preference of WHO criteria than the ADA criteria.

Ethnically Indian females are more prevalent to develop diabetes and their risk for developing diabetes during the pregnancy is 11 times more than the White women, warrants the importance of screening all Indian pregnant women for abnormal glucose tolerance.⁴ The two step GTT is practically difficult as the pregnant women have to attend the clinic two times and 3 to 5 times blood samples had to be taken. Single step GTT, serves both as screening and a diagnostic procedure which is recommended by WHO and DIPSI. It is easier to perform, economical and has better compliance. Pregnant females with GDM are at an increased risk for developing adverse obstetric and perinatal outcomes. By early diagnosis, intervention and meticulous antenatal care fetal maternal outcome will be optimized.

CONCLUSION

Present study concluded that this one step procedure is feasible in terms of better detection rates, saving time, limiting cost on repeated visits to health centre and reducing repeated invasive sampling. Single step GTT will be used both as a screening and a diagnostic procedure for detecting GDM.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Saranya N, Suganthi M, Dhinakaran S, Navina N. Comparison of one step glucose tolerance test (75 g GTT) and two step glucose tolerance test (100 g GTT) in screening and diagnosis of gestational diabetes mellitus. *Int J Reprod Contracept Obstet Gynecol* 2018;7:4814-8.