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Original Article

Prevalence of gestational diabetes mellitus and results of the screening tests at a tertiary referral center: A cross-sectional study

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ABSTRACT

Objective: This study aimed to identify the gestational diabetes mellitus (GDM) prevalence of low risk pregnant population at a tertiary referral center by different approaches.
Material and methods: A cross-sectional study using retrospective data between 2007-2017 was conducted. During this period 77227 patients underwent either two step or one step glucose tolerance tests.
Results: The median age of the study population was 27 (15–49). Fasting plasma glucose (FPG) testing was evaluated in 144,113 women at the initial antenatal care visit which %21 of these were between 92-126 mg/dL. Of these women %1.25 had FPG>126 mg/dL which showed the prevalence of pregestational diabetes in our cohort. During the study period 74412 women underwent 50-g glucose challenge test where %18 were screen positive and % 2.9 was defined as gestational diabetic without need for further testing (>180 mg/dL). The screening positive patients were sent to 100-g oral glucose tolerance test and the prevalence of GDM with two-step screening was 5.5%. A total of 2815 patients were screened by 75-g glucose tolerance test and the prevalence of GDM with one-step screening was 21%. Overall 4684 patients have been diagnosed as gestational diabetes mellitus with the prevalence of 6.07%.
Conclusion: Fasting plasma glucose >92 mg/dL is challenging in our population due to improper fasting. The FPG dependent GDM prevalence is almost four times higher than two-step glucose screening test results (21.8% vs 5.5%). If FPG levels will be used for diagnosing GDM then the values must be checked in a second laboratory analysis.

1. Introduction

Gestational diabetes (GDM) is historically defined by the World Health Organization (WHO) as 'carbohydrate intolerance resulting in hyperglycemia of variable severity with onset or first recognition during pregnancy' [1]. GDM is defined by ACOG as "Gestational diabetes mellitus is a condition in which carbohydrate intolerance develops during pregnancy" and by ADA as "Gestational diabetes mellitus (GDM) (diabetes diagnosed in the second or third trimester of pregnancy that was not clearly overt diabetes prior to gestation) in 2018 [2,3]. Its estimated prevalence ranges between 5%-10% in all pregnant women depending on the population studied [4–6].

Fetal hyperglycemia followed by maternal hyperglycemia results in shoulder dystocia, birth trauma, perinatal death, neonatal hypoglycemia and long-term risks of obesity and diabetes in the child. The maternal risks include development of type 2 diabetes mellitus after pregnancy and risks of increasing rate of caesarean section [7]. Diabetes following GDM leads to preexisting diabetes which enhances miscarriage, pre-eclampsia, preterm labor, stillbirth, congenital malformations, macrosomia, birth injury, perinatal mortality and postnatal adaptation problems (such as hypoglycemia) [8,9]. Diabetic retinopathy can worsen rapidly during pregnancy in women with pre-existing diabetes (8). Increased risk of complications for both mother and baby, during pregnancy as well as in the postpartum period bring a necessity of screening and identifying these high-risk women. Early diagnosis becomes significantly important to improve short and long-term maternal and fetal outcomes [10,11].

Although the world has a consensus on diagnosis of diabetes mellitus, there is lack of international uniformity for the screening and diagnosis of GDM [12,13]. A large number of procedures and

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cutoffs for the value of glucose is the main reason for diagnostic dilemma on GDM [14].

The first diagnostic criteria defined by O'Sullivan in 1964 and its subsequent modifications (Carpenter and Coustan) were based on the maternal risk of developing type 2 diabetes [14]. In 2010 the International Association of Diabetes and Pregnancy Study Group (IADPSG) redefined GDM in terms of adverse pregnancy outcomes, based on Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study results which has performed in 2008 [15,16].

Subsequent years, several arguments on diagnostic criteria has been fastened on. In the two-step screening approach, a 50-g glucose challenge test (GCT) followed by a 100-g oral glucose tolerance test (OGTT), if the first step is found positive. In the one-step screening approach, 75-or 100-g OGTT is done in all patients, without the preliminary step by GCT [13]. These criteria are being argued by different health professionals for years and several recommendations on various aspects of screening are made. The different viewpoints from professionals and guidelines underscore the fact that there are strong data to support these strategies and the decision to choose one better needs further investigations.

The present study aimed to define prevalence of GDM among patients attending the outpatient clinic of a tertiary referral center in Turkey and to demonstrate the role of fasting plasma glucose level to detect or suspect GDM.

2. Material and methods

This was planned as a retrospective cross-sectional study based on patient records obtained from the outpatient clinic of Zekai Tahir Burak Women Health Care, Training and Research Hospital in Ankara, Turkey. The Institutional review board approved the study protocol. (06/03/2018 #19).

The GDM screening by 75-g or 100-g following 50-g positive GCT was performed between 24 and 28 weeks and fasting plasma glucose was evaluated in the first antenatal visit if there is no risk factor for GDM as recommended by guidelines. These tests were performed free of charge on all pregnant women as a part of routine antenatal care. The data of antenatal outpatient clinic between 2007-2017 were collected. During this period 77227 patients underwent either two step or one step glucose tolerance tests. A total of 144113 fasting plasma glucose (FPG) values were obtained in the initial visit.

Quantitative determinations of blood glucose were done by enzymatic method on Roche automated clinical chemistry analyzer (Hitachi Cobas® 6000 analyzer, Roche Diagnostics GmbH, Germany). Glucose was assayed using a commercial glucose oxidase kit (Glucose HK Gen.3, Roche Diagnostics GmbH, Germany). Measuring range was 2–750 mg/dL (0.11–41.6 mmol/L) and intra- and inter-assay coefficient of variation (CV) values were 0.8 and 1.3% respectively.

SPSS (Statistical Package for the Social Sciences) version 22.0 was used for the statistical calculations. The data were presented with the number of patients and percentage and defined by mean ± standard deviation and median (minimum-maximum) where appropriate.

3. Results

The median age of the study population was 27 (15–49). The median FPG level was 83.6 (34–507). During the study period 144,113 women underwent FPG testing at the initial antenatal care visit which %21 of these were between 92-126 mg/dL (whom can be defined as GDM according to IADPSG criteria). Of these women % 1.25 had FPG>126 mg/dL which showed the prevalence of pregestational diabetes in our cohort. The distribution of FPG levels was reported in Table 1.

During the study period 74412 women underwent 50-g glucose challenge test the results are reported in Table 2 where %18 were screen positive and % 2.9 was defined as gestational diabetic without need for further testing (>180 mg/dL). During the study period 74412 women underwent 50-g glucose challenge test where %18 were screen positive and % 2.9 was defined as gestational diabetic without need for further testing (>180 mg/dL).

The screening positive patients were sent to 100-g oral glucose tolerance test and the prevalence of GDM with two-step screening was 5.5% and the results are reported in Table 3.

A total of 2815 patients were screened by 75-g glucose tolerance test and the prevalence of GDM with one-step screening was 21% and the results are reported in Table 4.

Overall 4684 patients have been diagnosed as gestational diabetes mellitus with the prevalence of 6.07%.

4. Discussion

GDM is associated with an increased risk of complications for both mother and baby, during pregnancy and postpartum period. It is important to screen and identify high-risk patients to be able to improve short and long-term maternal and fetal outcomes [10,17]. Based on available studies' results, universal screening for GDM has to be carried out after 24 weeks (between 24-28 weeks) without any doubt or conflict [18].

There is a controversy about the approach to the screening and diagnosis of GDM between the scientist and this disagreement leads to different guidelines and recommendations [13,19–22].

The first diagnostic criteria defined by O'Sullivan in 1964 and its subsequent modifications (Carpenter and Coustan) were based on the maternal risk of developing type 2 diabetes [14]. In 2010 the International Association of Diabetes and Pregnancy Study Group (IADPSG) redefined GDM in terms of adverse pregnancy outcomes, based on Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study results which has performed in 2008 [4,15]. The relationship between hyperglycemia and adverse pregnancy outcomes was well defined and designated the recent studies' approach to the diagnostic thresholds (Defined by HAPO study) [4].

There are some arguments favoring and opposing two step approach (non-fasting 50-g glucose challenge, followed, if positive, by a fasting OGTT) to GDM diagnosis [23,24]. It has fewer false positive rate and avoids OGTT in more than 75% of the women while missing diagnosis with 75% sensitivity with 84% specificity as compared with single-step 100-g OGTT and misses around 26% of potential GDM diagnoses [18,20,21]. Two step approach also requires patients to make two visits for testing.

A recent study to screen GDM either with a one-step method using a 75-g OGTT using IADPSG criteria and a 100-g OGTT using the Carpenter and Coustan criteria was performed [25]. The study has also aimed to determine the neonatal outcomes of women who has normal glucose levels in one and two step approaches. The one-step method had a GDM prevalence of 14.5%, and the two-step method a prevalence of 6% preoccupying missing diagnosis. Women determined to have normal glucose tolerance in the two-

Table 1
The distribution of FPG levels.

FPG mg/dL	N	%
<92	111935	77.67
92–126	30373	21.08
>126	1805	1.25
Total	144113	100

Table 2
50-g glucose challenge test results.

50-g GCT results (mg/dL)	N	%
<70	1873	2.4
70–140	56394	73
140–180	13898	18
>180	2247	2.9
Total	74412	100

Table 3
100-g glucose tolerance test results.

100-g GTT results	N (14415)	%
1 value abnormal	5846	40.28
2 value abnormal	1329	9.16
3 value abnormal	418	2.88
4 value abnormal	100	0.69
GDM	1847	12.72

Table 4
75-g glucose tolerance test results.

75-g GTT results (mg/dL)	N (2815)	%
FPG>92	485	17.23
1 s t h>180	199	7.07
2 nd h > 153	123	4.37
GDM	590	20.96

step method had a greater risk for preeclampsia and macrosomia compared with the women defined as having normal glucose tolerance in the one-step method [25]. This study advocated to expose two-step process [25]. Endocrine Society of America, World Health Organization and Australasian Diabetes In Pregnancy Society (ADIPS) supports the use of one step screening [26,27].

The American College of Obstetricians and Gynecologists (ACOG) and the National Institutes of Health (NIH) continue to promote the use of the two-step screening strategy with the non-fasting 50-g GCT and if abnormal, followed by the 3-h 100-g OGTT using the Carpenter and Coustan criteria or the National Diabetes Data Group (NDDG) criteria [28]. According to these claims reliance on a single blood glucose result in a one-step screening test, especially using lower thresholds, would have even poorer precision with a need of fasting conditions [29].

The International Federation of Gynecology and Obstetrics (FIGO) which has accepted the IADPSG, recommended to apply one step screening universally with modifications [30].

IADPSG recommended that FPG>5.10 mmol/L at any time of pregnancy should be diagnosed as GDM [31]. As a screening test for GDM, the FPG has several advantages. Although, the value of FPG for GDM screening remains uncertain, it is cheap, reliable, reproducible, does not induce vomiting that seen with the OGTT/GCT. It can be administered in women unable to tolerate glucose drink and it takes less time than GCT. Incomplete fasting or an inability to fast for at least 8 h is the main problem to trust FPG. It has an acceptable sensitivity, the poor specificity and high-false positive rate depending on the thresholds determined. In our study FPG dependent GDM prevalence is almost four times higher than two-step glucose screening test results (21.8% vs 5.5%) as a result of a probable improper fasting.

GDM prevalence determined using 75-g OGTT is found higher than 50-g GCT in our study. This result is probably detected as a consequence of including selected-high risk patients to 75-g OGTT group. In our population 75-g OGTT group is not evaluated as universal screening.

FPG values are more than the cases applied glucose tolerance tests according to our data. Recurrent FPG requests, inconsistency to follow up after first trimester screening, missing the screening time and refuses to the screening are claimed to be the main reasons of this results.

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Conflicts of interest

The authors report no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.dsx.2018.08.019.

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