
OBSTETRICS

Cut-off Values of 50 Grams Glucose Challenge Test for Screening of Gestational Diabetes Mellitus in Antenatal Care Clinic Chonburi Hospital

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ABSTRACT

Objective: To evaluate the cut-off value of the 50 grams glucose challenge test (GCT) for screening of gestational diabetes mellitus (GDM).

Materials and Methods: All pregnant women attending at antenatal care clinic, Department of Obstetrics and Gynecology, Chonburi Hospital were tested with 50 grams GCT during their first visit. Total of 2,106 pregnant women from October 1, 2008 to September 30, 2009 were participated. If 50 grams GCT \geq 140 mg/dL, 100 grams oral glucose tolerance test (OGTT) was done to diagnose GDM. The optimal cut-off value for 50 grams GCT was analyzed by receiver operating characteristic (ROC) curve.

Results: The cut-off values of 50 grams glucose challenge test (GCT) at 176 mg/dL demonstrated the sensitivity and specificity of 58.5% and 88.2%, respectively. The prevalence of GDM in Chonburi Hospital was 16.1%.

Conclusion: The threshold of 176 mg/dL was recommended as the cut-off value of GCT for screening of GDM during the first antenatal visit. The prevalence of GDM in Chonburi Hospital was 16.1%.

Keywords: 50 grams glucose challenge test, screening, gestational diabetes mellitus

Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance of variable severity with onset or first recognition during pregnancy⁽¹⁾. It is the most common medical complication of pregnancy and it carries a significant risk to the fetus and the mother. In the recent Confidential Enquiry in Maternal and Child Health (CEMACH), the outcome of women with diabetes compared with women without diabetes, the congenital malformation rate was four to ten-fold higher, the perinatal mortality rate was four to seven-fold higher, stillbirth was five times more common, and babies were

three times more likely to die in the first 3 months of life⁽²⁾. Gestational diabetes mellitus are at risk of progression of microvascular diabetic complications as well as early pregnancy loss, pre-eclampsia, polyhydramnios and premature labor⁽²⁾. Early diagnosis and treatment are the most important issues in managing these women to control plasma glucose level in order to avoid morbidities and mortalities⁽³⁻⁶⁾. The prevalence of GDM varies worldwide due to different population, and diagnostic criteria, ranging from 1-14%⁽⁷⁻¹⁰⁾. In Thailand, these rates varied from

2.02 to 20.17%⁽¹¹⁻¹⁴⁾. The Fifth International Workshop-Conference on Gestational Diabetes Mellitus recommended universal screening to all pregnant women for gestational diabetes between 24 and 28 weeks' gestation and screening high risk pregnant women at the first antenatal visit⁽¹⁵⁾. Various screening programs have been proposed and utilized by many groups of experts for detection of GDM. The National Diabetes Data Group (NDDG) uses 50 grams GCT for screening GDM with the cut-off value at 140 mg/dL and 100-grams oral glucose tolerance test (OGTT) was done if the results were 140 mg/dL or more⁽¹⁶⁾. However, different institutions use different cut-off values to identify women for further testing. Most of them use the values of ≥ 140 mg/dL. Fifteen percent of pregnant women were indicated for OGTT, but 85-90% of gestational diabetes were detected. Using a cut-off value of 130 mg/dL for the glucose challenge test (GCT) will pick up nearly 100% of GDM, at the cost of 25% or more. However, the false positive rate of this cut-off value > 140 mg/dL was still high and leads to unnecessary diagnostic testing⁽¹⁷⁻¹⁹⁾. Therefore, this study was undertaken to examine the cut-off value in GCT screening of GDM and the prevalence of GDM in potential diabetic pregnancy in Chonburi Hospital.

Materials and Methods

Fifty grams GCT was offered to all pregnant women during their first antenatal visit. Total 2,106 pregnant women from October 1, 2008 to September 30, 2009 were participated. The positive result was defined as plasma glucose of 140 mg/dL or more. OGTT was the performed to confirm GDM. The optimal

cut-off 50 grams GCT was analyzed by receiver operating characteristic (ROC) curve. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and the prevalence were analysed by MedCalc Version 10.4.8.0 programs. The results were considered statistically significant at $p < 0.05$.

Definite diagnosis of GDM was defined by NDDG diagnostic criteria (FBS ≥ 105 mg/dL, one hour ≥ 190 mg/dL, two hour ≥ 165 mg/dL, three hour ≥ 145 mg/dL)⁽¹⁶⁾.

Sample size was calculated using sensitivity and specificity from the study of Juntarat W et al⁽¹³⁾. The maximum permissible error (d) was not more than 15% and $\alpha = 0.05$. The calculated sample size was 378.

Results

All 2,106 pregnant women participated from October 2008 to September 2009. A total of 404 pregnant women had positive results of 50 gram GCT. The demographic data including maternal age, gestational age, body mass index (BMI) and value of 50 grams GCT are shown in Table 1.

There were 65 pregnant women with positive results of OGTT with the false positive rate of 83.91% (339 in 404 cases). The cut-off value 50 gram GCT for screening of GDM at 176 mg/dL had maximum area under the receiver operating characteristic curve (ROC) (Fig. 1).

The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and the prevalence were 58.5%, 88.2%, 48.7%, 91.7% and 16.1%, respectively (Table 2).

Table 1. Demographic data in the populations (N = 404)

Demographic data	Mean \pm S.D. (n=404)
Age (years)	29.34 \pm 6.72
Gestational age (day)	184.24 \pm 61.00
BMI (kg/m ²)	23.44 \pm 4.49
Value of 50 grams GCT	162.79 \pm 23.72

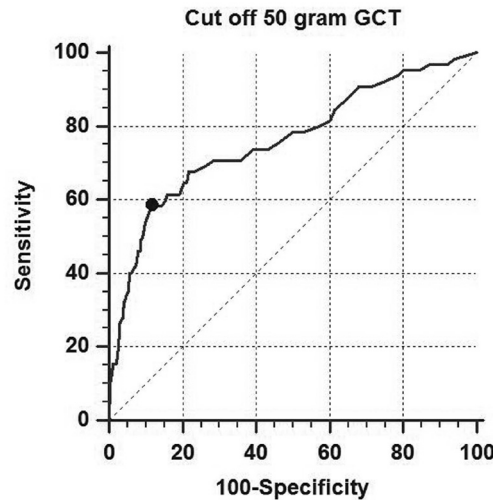


Fig. 1. The cut-off value of GCT (N=404)

Table 2. Sensitivity, specificity, PPV, NPV, prevalence of the cut-off value of GCT

Cut-off value of GCT=176 mg/dL	
Sensitivity (95% CI)	58.5%(45.6-70.6)
Specificity (95% CI)	88.2% (84.3-91.4)
PPV (95% CI)	48.7% (37.2-60.3)
NPV (95% CI)	91.7% (88.2-94.5)
Prevalence	16.1%

PPV = Positive predictive value

NPV = Negative predictive value

95% CI = 95% confidence interval

GCT = Glucose challenge test

Discussion

Variable cut-off value of GCT for screening of GDM have been reported in previous studies⁽²⁰⁻²²⁾. The level of 130-140 mg/dL are used for screening of GDM⁽²⁰⁻²²⁾. However, the false positive rate of this cut-off point is still high, leading to unnecessary diagnostic testing (100 grams OGTT). Vitoratos N et al recommended the value of 126 mg/dL⁽²³⁾, Tanir et al used 185 mg/dL⁽⁸⁾ while Punthumapol et al recommended the value of 177 mg/dL⁽²⁴⁾. This study recommended the cut-off value of 176 mg/dL similar to Punthumapol et al's study. This cut-off value had sensitivity 58.5%

and specificity 88.2% (Table2). These findings may be due to the differences in race, nutrition of the population and criteria for diagnosis GDM.

Recently, there has been a global increase in the prevalence of both obesity and type 2 diabetes. Recent reports demonstrated the high prevalence of GDM⁽¹⁵⁾. The prevalence of GDM among younger was higher than the older pregnant women⁽¹⁵⁾. These results may be affected from various confounders including lack of uniformity in glucose tolerance testing (glucose load, glycemic thresholds, and number and timing of test results required to define GDM)⁽¹⁵⁾.

The prevalence of GDM in Chonburi Hospital (16.1%) is consistent with the previous reports, ranging from 1.4 to 14%⁽¹⁸⁻²¹⁾ but higher than Chanprapaph et al's (7.05%)⁽¹²⁾ and Punthumapol et al's (13.2%)⁽²³⁾.

The limitation of this study was only pregnant women with positive 50 grams GCT were tested by 100 grams oral glucose tolerance test (OGTT) for diagnosis of GDM. Consequently, this cut-off value and prevalence may be inconsistent to determine the prevalence of GDM.

Conclusion

Prevalence of gestational diabetes mellitus in Chonburi Hospital was 16.1%. The cut-off value of the 50 grams glucose challenge test (GCT) for screening of gestational diabetes mellitus (GDM) in pregnant women attending at first visiting antenatal care clinic, Chonburi Hospital was 176 mg/dL.

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จุดตัดค่าการตรวจคัดกรองโรคเบาหวานขณะตั้งครรภ์โดยใช้ 50 grams glucose challenge test ในสตรีตั้งครรภ์ที่เข้ารับบริการที่คลินิกฝากครรภ์โรงพยาบาลชลบุรี

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วัตถุประสงค์: เพื่อหาจุดตัดค่าการตรวจคัดกรองโรคเบาหวานขณะตั้งครรภ์โดยใช้ 50 grams glucose challenge test ที่เหมาะสมในสตรีที่เข้ารับบริการฝากครรภ์ครั้งแรกโรงพยาบาลชลบุรี ที่สามารถวินิจฉัยโรคเบาหวานขณะตั้งครรภ์ และเพื่อหาความชุกของโรคเบาหวานขณะตั้งครรภ์

วัสดุและวิธีการ: สตรีตั้งครรภ์ที่มาฝากครรภ์ครั้งแรกที่โรงพยาบาลชลบุรี ตั้งแต่ 1 ตุลาคม 2551 ถึง 30 กันยายน 2552 จำนวน 2,106 คนได้รับการตรวจ GCT ถ้าผลการตรวจ GCT ให้ผลเป็นบวกคือมากกว่าหรือเท่ากับ 140 มก/ดล. จะได้รับการตรวจ 100 grams oral glucose tolerance test (OGTT) เพื่อยืนยันว่าเป็นโรคเบาหวานขณะตั้งครรภ์ ทำการเก็บข้อมูลพื้นฐาน ผลการตรวจ GCT และ OGTT และใช้ Receiver operating characteristic (ROC) curve เพื่อหาจุดตัดที่เหมาะสมของ GCT เพื่อตรวจคัดกรองโรคเบาหวานขณะตั้งครรภ์

ผลการศึกษา: จุดตัดค่าการตรวจคัดกรองโรคเบาหวานขณะตั้งครรภ์โดยใช้ 50 grams glucose challenge test คือ 176 มก/ดล. โดยมีความไวและความจำเพาะเท่ากับ ร้อยละ 58.5 และ 88.2 ตามลำดับ ค่าความชุกของโรคเบาหวานขณะตั้งครรภ์มีค่า 16.1%

สรุป: ค่า 176 มก/ดล เป็นจุดตัดที่เหมาะสมของ GCT ในการตรวจคัดกรองโรคเบาหวานขณะตั้งครรภ์ที่ฝากครรภ์ครั้งแรกที่โรงพยาบาลชลบุรี และมีค่าความชุกของสตรีตั้งครรภ์ที่เป็นโรคเบาหวานขณะตั้งครรภ์ ในโรงพยาบาลชลบุรี เท่ากับ 16.1 %
