Thai Journal of Obstetrics and Gynaecology
May 2021, Vol. 29, No. 3, pp. 142-150

OBSTETRICS

Pregnancy and Neonatal Adverse Outcomes in Women with Gestational Diabetes Mellitus Diagnosed by a 50-g Glucose Challenge Test Level ≥ 200 mg/dl Compared with Test Results using the 100-g Oral Glucose Tolerance Test and Carpenter-Coustan Criteria

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ABSTRACT

Objectives: To compare pregnancy and neonatal outcomes between women with gestational diabetes mellitus (GDM) diagnosed by using the 100-g oral glucose tolerance test (OGTT) with the Carpenter-Coustan criteria and 50-g glucose challenge test (GCT) ≥ 200 mg/dl.

Materials and Methods: A retrospective cohort study was conducted based on the medical records of all GDM women who had delivered at Siriraj Hospital, Thailand, between July 2015 and April 2018. The rate of occurrence of a large for gestational age (LGA) neonate (> 90th percentile) was a primary outcome. Secondary outcomes were the rates of preterm delivery, cesarean section, small-for-gestational age neonate (< 10th percentile), fetal macrosomia, fetal hypoglycemia, neonatal intensive care unit admission, and birth asphyxia.

Results: Of the 970 GDM women included in the study, 776 women were diagnosed by 100-g OGTT with the Carpenter-Coustan criteria (Group 1) and 194 women were diagnosed by a 50-g GCT level ≥ 200 mg/dl (Group 2). There were no significant differences in baseline characteristics, pregnancy, and neonatal outcome in the two groups. The rates of LGA in the two groups were 25.8% and 22.7% in group 1 and group 2, respectively (p = 0.154). However, the gestational age at diagnosis and the multipara rate were 21.5 weeks and 53.4% in group 1, and 10.9 weeks and 67.5% in group 2 (p < 0.001), respectively.

Conclusion: There were no significant differences in baseline characteristics and pregnancy and neonatal outcome in both groups. However, gestational age at diagnosis in the 50-g GCT ≥ 200 mg/dl group was earlier than in the 100-g OGTT with the Carpenter–Coustan criteria group. There were limitations of the study including the controlling of all the confounding factors which were how well to Hemoglobin A1C (HbA1C) control and intrapartum blood sugar control in this study.

Keywords: gestational diabetes mellitus, pregnancy outcomes, neonatal outcomes, large for gestational age.

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ภาวะแทรกซ้อนของมารดาและทารกที่ตรวจพบมีภาวะเบาหวานระหว่างตั้งครรภ์ซึ่งวินิจฉัยด้วยการตรวจ 50g GCT ≥ 200 mg/dl เปรียบเทียบกับการตรวจวินิจฉัย 100g OGTT ด้วยเกณฑ์ของ Carpenter and Coustan

สุนิสา กรรณวัฒน์, สายฝน ชวาลไพบูลย์, ดิฐกานต์ บริบูรณ์หิรัญสาร

บทคัดย่อ

วัตถุประสงค์: *เพื่อศึกษาความสัมพันธ์ของภาวะแทรกซ้อนของมารดาและทารกในมารดาที่ได้รับการวินิจฉัยเป็นเบาหวานระหว่างตั้งครรภ์จากการตรวจ 50 g GCT ≥ 200 mg/dl เปรียบเทียบกับกลุ่มที่ใช้วิธีการตรวจคัดกรอง 50 g GCT ที่พบว่าอยู่ในช่วง 140-199 mg/dl และได้รับการตรวจยืนยันการวินิจฉัยด้วยการตรวจวิธี 100 g OGTT โดยใช้เกณฑ์ของ Carpenter and Coustan ต่อไป*

วัสดุและวิธีการ: *การศึกษาแบบเก็บข้อมูลย้อนหลัง โดยเก็บข้อมูลจากเวชระเบียนของหญิงตั้งครรภ์ที่มาฝากครรภ์และคลอดที่ รพ.ศิริราช ตั้งแต่เดือนกรกฎาคม 2558 จนถึงเดือนเมษายน 2561 โดยศึกษาข้อมูลเปรียบเทียบข้อมูลลักษณะพื้นฐานของหญิงตั้งครรภ์ในแต่ละกลุ่ม และภาวะแทรกซ้อนของมารดาและทารกในมารดาที่ได้รับการวินิจฉัยเป็นเบาหวานระหว่างตั้งครรภ์ที่รวบรวมมา โดยภาวะแทรกซ้อนที่ต้องการศึกษา ได้แก่ ทารกน้ำหนักตัวมากกว่าอายุครรภ์ (> 90th percentile) อัตราการคลอดก่อนกำหนด, อัตราการผ่าตัดคลอด, ทารกน้ำหนักตัวน้อยกว่าอายุครรภ์ (< 10th percentile), ทารกน้ำหนักตัวใหญ่กว่าปกติ (> 4,000 กรัม), ทารกมีน้ำตาลในเลือดต่ำ, อัตราการรักษาต่อในหอผู้ป่วยทารกแรกเกิดวิกฤต, และภาวะขาดออกซิเจนในทารกแรกคลอด*

ผลการศึกษา: *ในจำนวนหญิงตั้งครรภ์ที่มีภาวะเบาหวานขณะตั้งครรภ์จำนวน 970 ราย, 776 รายวินิจฉัยโดยการตรวจ 100g OGTT โดยใช้เกณฑ์การวินิจฉัยของ Carpenter และ Coustan และ 194 รายวินิจฉัยโดยการตรวจ 50g GCT ≥ 200 mg/dl พบว่าลักษณะข้อมูลพื้นฐานของหญิงตั้งครรภ์และภาวะแทรกซ้อนของมารดาและทารกในทั้งสองกลุ่มไม่มีความแตกต่างกันทางสถิติ สำหรับภาวะทารกน้ำหนักตัวใหญ่กว่าปกติ ในกลุ่มที่ 1 และ 2 พบได้ร้อยละ 25.8 และ 22.7 ตามลำดับ (P = 0.154) แต่พบว่าการวินิจฉัยโดยการตรวจ 50g GCT ≥ 200 mg/dl พบในหญิงตั้งครรภ์หลังมากกว่าและตรวจพบภาวะเบาหวานในอายุครรภ์ที่น้อยกว่า อย่างมีนัยสำคัญทางสถิติ*

สรุป: *ไม่พบความแตกต่างของภาวะแทรกซ้อนของมารดาและทารกในมารดาที่ได้รับการวินิจฉัยเป็นเบาหวานระหว่างตั้งครรภ์จากการตรวจ 50 g GCT ≥ 200mg/dl เปรียบเทียบกับกลุ่มที่ตรวจวินิจฉัยด้วยการตรวจ 100 g OGTT โดยใช้เกณฑ์ของ Carpenter and Coustan แต่วิธีการตรวจ 50 g GCT จะวินิจฉัยภาวะเบาหวานในอายุครรภ์ที่น้อยกว่าวิธี 100 g OGTT อย่างไรก็ตามงานวิจัยนี้ไม่ได้ศึกษาเปรียบเทียบการควบคุมระดับน้ำตาลในเลือดของมารดาที่ได้รับการวินิจฉัยเป็นเบาหวานระหว่างตั้งครรภ์ในทั้งสองกลุ่ม*

คำสำคัญ: *ภาวะแทรกซ้อน, ภาวะเบาหวานระหว่างตั้งครรภ์, ทารกน้ำหนักตัวมากกว่าอายุครรภ์*

Introduction

Gestational diabetes mellitus (GDM) is defined as any degree of glucose intolerance that is first recognized during pregnancy[1], regardless of whether the condition may have predated the pregnancy or persisted after the pregnancy[2]. The definition applies whether insulin or only diet modification is used for treatment and whether or not the condition persists after pregnancy[3].

The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study[4], a large-scale multinational cohort study completed by more than 23,000 pregnant women, demonstrated that the risk of adverse maternal, fetal, and neonatal outcomes continuously increase as a function of maternal hyperglycemia. Women with GDM have a higher risk of developing preeclampsia, undergoing a cesarean delivery, and developing diabetes later in life. Further, the offspring of women with GDM are at an increased risk of macrosomia, large for gestational age (LGA), neonatal hypoglycemia, hyperbilirubinemia, idiopathic respiratory distress syndrome, shoulder dystocia, and birth trauma. There is also an increased risk of stillbirth[5-10]. As such, GDM is one of the most important medical complications of pregnancy.

According to the GDM screening protocol of Siriraj Hospital, a two-step approach is adopted for glucose testing, comprising a 50-g glucose challenge test (GCT) screening, followed by a 100-g oral glucose tolerance test (OGTT) for those who screened positive, as convened by the National Institutes of Health (NIH)[11]. The used cutoff value for the 50-g GCT screening is more than 140 mg/dl. Also, the diagnosis of GDM is made if at least two of the following four plasma glucose levels from the 100-g OGTT are met or exceeded using the Carpenter–Coustan criteria[12]. Moreover, based on the results from a number of international studies[13-16] and a previous Siriraj Hospital study[17], a cutoff level of ≥ 200 mg/dl measured in a 50-g GCT screen was also used to diagnose GDM and did not need a follow-on screening by a 100-g OGTT. This was intended to decrease costs and to aid the early diagnosis of GDM as well as to decrease maternal and neonatal adverse outcomes.

However, after using such a GDM screening protocol, no subsequent study has been performed to thoroughly evaluate the pregnancy and neonatal adverse outcomes in Siriraj Hospital. Consequently, the aim of this study was to compare the pregnancy and neonatal adverse outcomes in women with GDM diagnosed by a 50-g GCT result ≥ 200 mg/dl compared with a 50-g GCT result between 140–199 mg/dl followed by a 100-g OGTT with Carpenter–Coustan criteria based on the hypothesis that a 50-g GCT result ≥ 200 mg/dl could indicate more pregnancy and neonatal adverse outcomes.

Materials and Methods

The study was a retrospective cohort study approved by Siriraj Institutional Review Board and registered in the Thai Clinical Trial Registry with the identification number: TCTR20180824003. In total the medical records of 970 GDM women who had received antenatal care and had delivered at the Department of Obstetrics and Gynecology, Siriraj Hospital, Bangkok, Thailand, between July 2015 and April 2018 were recruited. Women with pre-gestational diabetes, steroid use and maternal medical condition which could had an effect to pregnancy, ie: cardiac disease, HIV were excluded.

According to the institutional clinical practice guideline at Siriraj Hospital, GDM screening and diagnosis by 50-g and 100-g two step screening is offered to all at-risk women with at least one of these risks: age ≥ 30 years, family history of DM, body mass index (BMI) ≥ 25 kg/m^2, previous GDM, previous fetal macrosomia, and previous fetal anomaly or fetal death. The diagnosis was made if the 100-g OGTT met two abnormal results according to the Carpenter–Coustan criteria or the screening 50-g GCT result exceeding 200 mg/dl which was different from others hospital in Thailand. Diet therapy for blood sugar controlling was advised and 2-hour postprandial blood sugar was performed in every antenatal visits. If 2-hour postprandial blood sugar exceeding 120 mg/dl, they

were admitted to control blood sugar and considered to receive insulin therapy in indicated case. The fetal morphology and growth scans were performed during 18-22 and 33-36 weeks, respectively.

Among 970 GDM women included in the present study, 776 women were diagnosed with GDM by their screening results exceeding 140 mg/dl in a 50-g GCT but not exceeding 200 mg/dl, followed by them undertaking a 100-g OGTT to diagnose GDM using the Carpenter–Coustan criteria. The other 194 women were diagnosed GDM by their screening results exceeding 200 mg/dl in a 50-g GCT. However, we did not study about how well blood sugar and HbA1c were controlled in those two groups.

The controlled and the study group were classified into two subgroups as GDMA1 and GDMA2. There was no difference between the control and the study group in monitoring blood sugar during intrapartum. In GDMA1 from those of the control and study groups were not routinely monitoring blood sugar during intrapartum period at Siriraj Hospital. Blood sugar monitoring was performed in GDMA2 groups, and no maternal hypoglycemia reported in both the control and the study group.

After delivered, neonates were separated from their mothers into nursery ward. The newborn was monitoring with point of care blood glucose testing (POCT) within 1 hour at nursery ward. If the POCT glucose was less than 50 mg/dl, hypoglycemia was confirmed by peripheral blood sugar testing. If there was no complication of both mothers and their neonates, the breast feeding was started within 24 hours.

Baseline characteristics and related clinical data were recorded, including age, pre- and post-gestational weight, height, parity, and additional risks for GDM, including diabetes in relatives, BMI over 25 kg/m^2, GDM or fetal macrosomia in previous pregnancy, and stillbirth or congenital disease in previous pregnancy. Pregnancy outcomes and neonatal outcomes in both groups were also recorded, including gestational age at delivery, cesarean delivery rate, preeclampsia rates, fetal weight for age, fetal hypoglycemia, neonatal intensice care unit (NICU) need, and birth asphyxia. Fetal large for gestational age was a primary adverse outcome.

From the hospital study, the sample size calculation using two independent proportions (i.e., a two-tailed test) was based on a 4:1 ratio of a group of GDM patients diagnosed by a 100-g OGTT with the Carpenter–Coustan criteria and by a 50-g GCT result ≥ 200 mg/dl. Also, the rate of a LGA fetus was 30% in the group of GDM patients diagnosed by a 100-g OGTT with Carpenter–Coustan criteria compared with 20% diagnosed by a 50-g GCT result ≥ 200 mg/dl.

Descriptive statistics were used to describe various baseline characteristics and the 50-g GCT and a 100-g OGTT results, using the number, percentage, mean, and standard deviation, as appropriate. A p value < 0.05 was considered statistically significant. All the analyses were performed using Statistical Package for the Social Science (SPSS).

Results

Among pregnant with risk of GDM who received antenatal care in Siriraj Hospital during July 2015 and April 2018, a total 970 GDM women were included in this study, of which 776 were diagnosed through recording a 50-g GCT level between 140-199 mg/dl followed by a further diagnosis test by a 100-g OGTT with Carpenter–Coustan criteria (group 1), with the other 194 women diagnosed by recording a 50-g GCT result ≥ 200 mg/dl (group 2) as shown in Fig.1. Table 1 shows the baseline characteristics of the GDM women in both groups. The mean maternal ages were 34.0 (±4.6) and 34.8 (±4.6) years in group 1 and group 2 ($p = 0.03$). The mean BMI scores were 24.0 (±4.7) and 23.5 (±4.8) kg/m^2, with most of the women being of normal weight; 453 (58.4%) and 105 (54.1%), respectively, in group 1 and group 2 ($p = 0.20$). There were 414 (53.4%) multipara women in group 1, and 131 (67.5%) women in group 2 ($p < 0.001$). Gestational age (GA) at diagnosis in group 1 was at late diagnosis (> 20 weeks GA) for 420 women (54.1%); however, group 2 involved an early diagnosis (< 20 weeks GA) for 174 women (89.7%) ($p < 0.001$). The mean GA at diagnosis was 21.5 (±9.3) and 10.9 (±6.1) weeks in

group 1 and group 2, respectively (p < 0.001). The GDM women carried one or two risk factors for GDM, which were age ≥ 30 years, family history of DM, and BMI ≥ 25 kg/m^2, 695 women (89.6%) and 171 women (88.1%) in group 1 and group 2, respectively (p = 0.952) (Table 2).

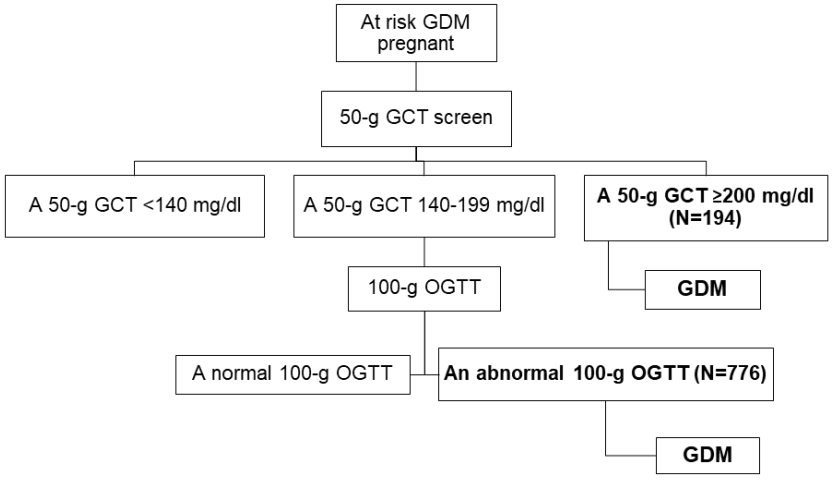

Fig. 1. Schematic diagram of study.

Table 1. Baseline characteristics of gestational diabetes women included in the study (n=970).

Characteristics	50-g GCT = 140-199 mg/dl (n = 776)	50-g GCT ≥ 200 mg/dl (n = 194)	p value
Age (years)	34.0 (± 4.6)	34.8 (± 4.6)	0.03
BMI1 (kg/m^2)	24.0 (± 4.7)	23.5 (± 4.8)	0.203
Weight status (BMI)			
Normal (18.5 - 22.9)	453 (58.4%)	105 (54.1%)	0.131
Underweight (< 18.5)	58 (7.5%)	23 (11.9%)	
Overweight (23 - 24.9)	171 (22.0%)	48 (24.7%)	
Obese (> 25)	94 (12.1%)	18 (9.3%)	
Multipara, n (%)	414 (53.4%)	131 (67.5%)	< 0.001
Gestational age at diagnosis	21.5 (±9.3)	10.9 (±6.1)	< 0.001
Early diagnosis[1], n (%)	356 (45.9%)	174 (89.7%)	< 0.001
Late diagnosis[2], n (%)	420 (54.1%)	20 (10.3%)	
Gestational weight gain[3] (kg)	11.5 (±5.1)	11.8 (±5.1)	0.459
Normal, n (%)	284 (36.6%)	73 (37.6%)	0.611
Under, n (%)	296 (38.1%)	67 (34.5%)	
Over, n (%)	196 (25.3%)	54 (27.8%)	

BMI: Body mass index, kg: kilogram

[1] Early diagnosis referred to diagnosis prior to 20 weeks of gestational age

[2] Late diagnosis referred to diagnosis after to 20 weeks of gestational age

[3] modified from Institute of Medicine Weight Gain Recommendations for Pregnancy

Table 2. Risk factors for gestational diabetes (n=970).

Characteristics	50-g GCT = 140-199 mg/dl (n = 776)	50-g GCT ≥ 200 mg/dl (n = 194)	p value
Age ≥ 30 years	670 (86.3%)	174 (89.7%)	0.214
Family history of DM	280 (36.1%)	66 (34.0%)	0.592
BMI ≥ 25 kg/m^2	265 (34.1%)	66 (34.0%)	0.973
Previous GDM	6 (0.8%)	3 (1.5%)	0.394
Previous fetal macrosomia	10 (1.3%)	4 (2.1%)	0.497
Previous fetal anomaly or fetal death	7 (0.9%)	3 (1.5%)	0.428
One risk factor	385 (49.6%)	95 (49%)	0.952
Two risk factors	310 (39.9%)	76 (39.2%)	
More than two risk factors	81 (10.4%)	23 (11.8%)	

BMI: Body mass index

Table 3 and 4 show the pregnancy and neonatal outcomes. The mean gestational age at delivery in group 1 and group 2 was 38.1 (±1.4) and 38.0 (±1.4) weeks (p = 0.413). Vaginal delivery and primary cesarean delivery were 316 women (40.7%) and 276 (35.6%) in group 1 and 80 (41.2%) and 67 (34.5%) in group 2, respectively (p = 0.964). Fetal LGA and fetal hypoglycemia occurred with 200 (25.8%) and 97 (12.5%) women in group 1 and 44 (22.7%) and 20 (10.3%) in group 2 (p = 0.154 and p = 0.402, respectively). Other outcomes, including preeclampsia, birth asphyxia, NICU need, and fetal macrosomia, showed relatively no significant difference between both groups.

Table 3. Pregnancy adverse outcomes (n=970).

Outcomes	50-g GCT = 140-199 mg/dl (n=776)	50-g GCT ≥ 200 mg/dl (n=194)	p value
Gestational age at delivery: mean (±SD)	38.1 (± 1.4)	38.0 (± 1.4)	0.413
Route of delivery			
Vaginal	316 (40.7%)	80 (41.2%)	0.964
Primary cesarean section	276 (35.6%)	67 (34.5%)	
Previous cesarean section	184 (23.7%)	47 (24.2%)	
Preeclampsia	41 (5.3%)	13 (6.7%)	0.448
Insulin therapy	9 (1.1%)	14 (7.2%)	0.432

Data presented as n (%)

Table 4. Neonatal outcomes (n=970).

Neonatal outcomes	50-g GCT = 140-199 mg/dl (n = 776)	50-g GCT ≥ 200 mg/dl (n = 194)	p value
Neonatal birth weight	3,147.8 (±460.8)	3,113.9 (±462.4)	0.36
Birth asphyxia	27 (3.5%)	11 (5.7%)	0.16
NICU need	13 (1.7%)	5 (2.6%)	0.405
Fetal hypoglycemia	97 (12.5%)	20 (10.3%)	0.402
Fetal macrosomia	27 (3.5%)	6 (3.1%)	0.79
Fetal weight for age			
SGA	41 (5.3%)	17 (8.8%)	0.154
AGA	535 (68.9%)	133 (68.6%)	
LGA	200 (25.8%)	44 (22.7%)	

Data presented as n (%)
Birth asphyxia referred to 1-minute Apgar score ≤ 7
SGA: small for gestational age, AGA: appropriate for gestational age, LGA: large for gestational age

Discussion

Gestational diabetes develops during pregnancy. It can harm the pregnant women and her babies. Pregnant women with non-diagnosed gestational diabetes can lead to large baby, preeclampsia, maternal cardiomyopathy and high cesarean section rate[5, 8, 14]. Early screening and diagnosis of gestational diabetes can prevent both mothers and babies from serious complications.

Many studies were performed to identify the early screening and diagnostic test of gestational diabetes mellitus (GDM). The study of Ankumah, et al[15] presented that the diagnostic test of GDM by 1-hour glucose challenge test (GCT), ≥ 200 mg/dl was better than the screening test by 1-hour GCT, 135-199 mg/dl, following with confirmatory diagnostic test 3-hour GTT using Carpenter-Coustan criteria. They showed that the incidence of preeclampsia (16.4% versus 10.6%) and shoulder dystocia (3.1% versus 1.0%) was higher in the women group with the diagnostic test of GDM by 1-hour glucose challenge test (GCT), ≥ 200 mg/dl. The results confirmed that the diagnostic test of GDM by 1-hour glucose challenge test (GCT), ≥ 200 mg/dl, can be used as a diagnostic test for GDM during pregnancy. The study of Cheng, et al[18] also presented that among women not diagnosed with GDM but with a 50-g GCT ≥ 200 mg/dl, the adjusted odds ratio (aOR) for cesarean delivery was 4.18, higher aORs for preterm delivery < 32 weeks (aOR = 8.05 (1.02–63.6)), shoulder dystocia (aOR = 15.14 (1.64–140)), and their neonates were more likely to have a 5-minute Apgar score < 7 (aOR = 6.41 (1.23–33.3)), compared to women with a GCT result < 200 mg/dl.

Our study has been shown that maternal morbidity including preeclampsia, cesarean section rate and neonatal adverse outcomes including birth asphyxia, NICU admissions, neonatal hypoglycemia and macrosomia were not different between the methods of diagnostic test for GDM by 50-g GCT and screening test by 50-g GCT, 140-199 mg/dl, following with confirmatory diagnostic test 100-g OGTT using Carpenter-Coustan criteria. However, the test of 50-g GCT is the uncomplicated test and can be performed with short period for only 90 minutes in single visit. Pregnant women can get the faster result than the previous method with the test by 1-hour GCT, 140-

199 mg/dl, following with confirmatory diagnostic test 100-g OGTT which takes a longer time. Therefore, early diagnosis of GDM and prompt intervention and management can be proceeded.

The previous method, a screening test by 50-g GCT, 140-199 mg/dl, following with confirmatory diagnostic test 100-g OGTT using Carpenter-Coustan criteria, need two visits and the pregnant women have to prepare themselves prior to having a test. If the screening 50-g GCT positive, the pregnant women will be appointed for a next visit. They have to fasting 6 hours before a blood sugar test and waiting for blood sugar test 1 hour, 3 consecutive times. This previous method takes a longer time for diagnosis of GDM which relates to delay diagnosis and treatment of high risk cases. Some pregnant women can loss to follow-up and get in trouble with the complication during labor period.

The cutoff value of 50-g GCT are different in many studies. The study at Siriraj Hospital[17] was shown that the risk of GDM increased with increased 50-g GCT. The positive predictive value (PPV) of 50-g GCT in GDM diagnosis were 90.5% and reached 100% at the cut-off value of ≥ 230 and ≥ 240 mg/dL, respectively. When stratified by common risk factors, Positive predictive value (PPVs) have reached 90% and 100% at lower cut-off values among those with family history of DM (at ≥ 210 and ≥ 230 mg/dl cut-off, respectively), and among obese women (at ≥ 200 and ≥ 220 mg/dl cut-off, respectively). Siriraj Hospital cutoff value of 50-g GCT was > 200 mg/dl with the PPVs of 76.4%. However, the false positive of 50-g GCT screening test was not stated in the study. While other study by Wong, et al[16] used the cut-off point of 11 mmol/l (198.1 mg/dl) with the PPV of 85.3 %, which was higher than those of 10 mmol/l (180.18mg/dl) with the PPV of 74.6%.

The study of Yee, et al[14] showed that the higher cutoff value of 50-g GCT were related to the higher perinatal morbidity, especially > 180 mg/dl. They found that the higher rate of hyperglycemic level and both pregnancy and neonatal adverse outcomes were continuous increasing. They concluded that no single cut-off value could adequately distinguish those GDM at all. Moreover, they also noticed that a group of pregnant women with 50-g GCT level > 200 mg/dl also had a false positive result.

The strength of our study was the large sample size. We recruited all 970 GDM women with complete data retrieval for analyses. The outcomes of both mothers and neonates after insulin therapy in both groups of pregnant women with GDM were not different. The blood sugar during insulin therapy may affect to the outcomes of both mothers and neonates. However, our study was not shown the different outcomes between 2 groups.

The weakness of this study was the retrospective study. Therefore, many confounding factors including blood sugar level before and after insulin therapy, HbA1C level, the uniform regularity of fetal scan and surveillance, could not be controlled.

Conclusion

In conclusion, the methods of diagnostic test for GDM by 50-g GCT and screening test by 50-g GCT, 140-199 mg/dl, following with confirmatory diagnostic test OGTT using Carpenter and Coustan criteria had no significant different of adverse outcomes of both mothers and neonates. However, the benefit of the diagnostic test for GDM by using 50-g GCT is the early diagnosis of GDM, less cost and prompt treatment of pregnant women with GDM when compares to the screening test by 50-g GCT, 140-199 mg/dl, following with confirmatory diagnostic test 100-g OGTT using Carpenter and Coustan criteria.

Acknowledgements

Miss Nattacha Palawat is acknowledged for assistance with the data collection.

Potential conflicts of interest

The authors declare no conflicts of interest.

References

1. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Diabetes Care

1997;20:1183-97.
2. Classification and Diagnosis of Diabetes. Diabetes Care 2017;40(Supplement 1):S11-S24.
3. Gestational Diabetes Mellitus. Diabetes Care 2003;26(suppl 1):s103-s5.
4. The HAPO Study Cooperative Research Group. Hyperglycemia and Adverse Pregnancy Outcomes. N Engl J Med 2008;358:1991-2002.
5. ACOG Practice Bulletin No. 190: Gestational Diabetes Mellitus. Obstet Gynecol 2018;131:e49-e64.
6. Yogev Y, Xenakis EMJ, Langer O. The association between preeclampsia and the severity of gestational diabetes: The impact of glycemic control. Am J Obstet Gynecol 2004;191:1655-60.
7. Ehrenberg HM, Durnwald CP, Catalano P, Mercer BM. The influence of obesity and diabetes on the risk of cesarean delivery. Am J Obstet Gynecol 2004;191:969-74.
8. Cunningham FG, Leveno KJ, Bloom SL, Dashe JS, Hoffman BL, Casey BM, Spong CY, et al. Diabetes Mellitus. Williams Obstetrics. 25th ed. New York: McGraw-Hill 2018;1097-117.
9. Farrar D, Simmonds M, Bryant M, Sheldon TA, Tuffnell D, Golder S, et al. Hyperglycaemia and risk of adverse perinatal outcomes: systematic review and meta-analysis. BMJ 2016;354:i4694.
10. Srichumchit S, Luewan S, Tongsong T. Outcomes of pregnancy with gestational diabetes mellitus. Int J Gynaecol Obstet 2015;131:251-4.
11. Vandorsten JP, Dodson WC, Espeland MA, Grobman WA, Guise JM, Mercer BM, et al. NIH consensus development conference: diagnosing gestational diabetes mellitus. NIH Consens State Sci Statements 2013;29:1-31.
12. Carpenter MW, Coustan DR. Criteria for screening tests for gestational diabetes. Am J Obstet Gynecol 1982;144:768-73.
13. Melamed N, Hiersch L, Hod M, Chen R, Wiznitzer A, Yogev Y. Is abnormal 50-g glucose-challenge testing an independent predictor of adverse pregnancy outcome? J Matern Fetal Neonatal Med 2012;25:2583-7.
14. Yee LM, Cheng YW, Liddell J, Block-Kurbisch I, Caughey AB. 50-Gram glucose challenge test: is it indicative of outcomes in women without gestational diabetes mellitus? J Matern Fetal Neonatal Med 2011;24:1102-6.
15. Ankumah NA, Tita AT, Biggio JR, Harper LM. Pregnancy Outcomes in Women with 1-Hour Glucose Challenge Test >/= 200 mg/dL. Am J Perinatol 2016;33:490-4.
16. Wong VW, Garden F, Jalaludin B. Hyperglycaemia following glucose challenge test during pregnancy: when can a screening test become diagnostic? Diabetes Res Clin Pract 2009;83:394-6.
17. Boriboonhirunsarn D, Lertbunnaphong T, Khanmali P. Cut-off value of 50 g glucose challenge test for the diagnosis of gestational diabetes mellitus. Diabetes Metab Res Rev 2012;28:90-.
18. Cheng YW, Esakoff TF, Block-Kurbisch I, Ustinov A, Shafer S, Caughey AB. Screening or diagnostic: markedly elevated glucose loading test and perinatal outcomes. J Matern Fetal Neonatal Med 2006;19:729-34.