Prevalence of Gestational Diabetes Mellitus (GDM) in Women Screened by Glucose Challenge Test (GCT) at Maharaj Nakorn Chiang Mai Hospital

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Objective : *To assess the prevalence of GDM in GCT screened women at Maharaj Nakorn Chiang Mai Hospital.*
Study design : *Retrospective descriptive study.*
Setting : *Department of Obstetric and Gynecology, Maharaj Nakorn Chiang Mai Hospital.*
Material and Method : *One thousand pregnant women who attended the antenatal care clinic and delivered at Maharaj Nakorn Chiang Mai Hospital from October 2001 to December 2002 were recruited into the study. Glucose challenge test (GCT), 50-g glucose oral load with 1-hr plasma glucose measurement, was performed in GDM high-risk pregnancies. If GCT was positive, oral glucose tolerance test (OGTT), 100-g glucose orally, was done to confirm the final diagnosis. All relevant data including demographic information, previous obstetric history, risk factors for GDM, GCT and OGTT results and pregnancy outcomes were collected for further statistical analysis.*
Main Outcome Measures : *Prevalence of GDM in GCT screened women, obstetric complications and pregnancy outcomes.*
Results : *There were totally 1,000 pregnancies enrolled into the study. Despite 451 pregnant women being eligible for GCT, only 411 cases were tested with 164 positive results. 29 cases of GDM were detected with the prevalence of 7.05%. (CI 95% = 0.048, 0.099). As a result, the sensitivity, specificity, positive predictive value, and negative predictive value of GCT were 100%, 64.66%, 17.68% and 0%, respectively. In the GDM group, the common indications for GCT screening were advanced maternal age (75.4%), familial diabetic history (22.1%) and glycosuria (6.8%). Furthermore, only 1 case of pregnancy-induced hypertension was found with cesarean section, preterm birth, LGA and SGA of 27.6%, 10.3%, 3.45% and 13.79%, respectively. There were 2 cases of pregestational diabetes mellitus (PGD; 0.2%) with 40 high-risk pregnancies (4%) without screening.*
Conclusion : *The selective GCT screening strategy was highly effective and revealed 7.05% of GDM prevalence. Its impact on obstetric complication and pregnancy outcome was inconclusive due to the small number of studied population. Careful history reviewing plays an important role in identifying GDM risk factor for GCT screening.*

Keywords : *Gestational diabetes mellitus (GDM), Prevalence of GDM, Glucose challenge test (GCT), Oral glucose tolerance test (OGTT), Selective screening strategy*

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Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance of varying degrees of severity with onset or first recognition during pregnancy. GDM is caused by the inability to overcome diabetogenic state due to insufficient pancreatic function. It carries significant and often potentially grave maternal and fetal complications including preeclampsia, polyhydramnios, fetal macrosomia, birth trauma, operative delivery, neonatal metabolic complications and perinatal death. Development of obesity and diabetes in offspring during childhood and later development of diabetes mellitus in the mother are also related with GDM. Therefore, accurate screening and early diagnosis of this condition is very important to enable timely intervention in order to ensure a satisfactory pregnancy outcome[1].

The prevalence of gestational diabetes varies worldwide and among racial and ethnic groups[2]. It also varies with the testing methods and diagnostic criteria. The increase in prevalence of GDM was recently reported to be an artifact caused by universal screening, with no evidence of benefit of this scheme to pregnancy outcome[3]. At Maharaj Nakorn Chaing Mai Hospital, glucose challenge test (GCT) screening by risk factors and confirmed by glucose challenge test (GCT) strategy has been practiced for many years without extensive evaluation. Therefore, the present study was conducted to determine the prevalence and risk factors of GDM and its impact on maternal and perinatal outcomes in the population of both screening and non-screening groups.

Material and Method

One thousand pregnant women who attended the antenatal care clinic and delivered at Maharaj Nakorn Chiang Mai Hospital from October 2001 to December 2002 were retrospectively enrolled into this study. The studied population was characterized into two groups of screening and non-screening groups. All relevant data including demographic information, familial history, obstetric history, risk factors for GDM, GCT and OGTT results, present obstetric complications, pregnancy outcomes, delivery route and birth weight were collected for further analysis.

Screening GDM test was performed in pregnancies with risk factors including diabetic familial history, maternal age of 30 years old or greater, previous GDM or pregnancy induced hypertension (PIH), fetal anomaly, intrauterine fetal death, macrosomia, polyhydramnios, glycosuria, polydypsia, excessive weight gain, marked obesity or (body mass index; BMI > 30 kg/m^2) and larger fundal height compared to gestational age. GCT using 50-g glucose oral load with plasma glucose measurement after 1 hour was done at the first booking, 24 and 28 weeks or 30 and 32 weeks of gestation. The positive result was defined as plasma glucose of 140 mg/dL or greater. Subsequently, OGTT with 100-g glucose ingestion was performed for GDM diagnosis using the plasma glucose cutoff values of 105, 190, 165, and 145 mg/dL at the fasting period, 1, 2 and 3 hour, orderly[4]. The OGTT was considered positive when any two of the non-fasting plasma glucose values were equal or greater than the normal criteria. In cases of fasting glucose value being 105 mg/dL or greater, the patients would be defined as $GDMA_2$ while $GDMA_1$ was classified as normal value.

Obstetric complications such as premature rupture of membranes (PROM), pregnancy induced hypertension (PIH), and gestational hypertension were observed in the present study. Pregnancy outcomes including preterm labor, route of delivery and birth weight were also described. Small-for-gestational-age (SGA) was defined as birth weight below the 10^{th} percentile of expected weight for gestational age while large-for-gestational-age (LGA) was defined as birth weight greater than the 90^{th} percentile of expected weight for gestational age according to Maharaj Nakorn Chiang Mai Hospital birth weight distribution curve[5].

Primary outcome measure was the prevalence of GDM in the screening group. Pregnancy complications and outcomes in both the screening and non-screening groups were also evaluated. Finally, the efficacy of GCT for GDM detection was determined. Pearson chi-square test and Fisher's exact test were applied as appropriate by using STATA 5 program. The results were considered statistically significant at $p < 0.05$ with 95% of confidence interval (CI).

Results

During the period, there were totally 1,000 pregnancies who attended the ANC clinic and delivered at Maharaj Nakorn Chiang Mai Hospital. The average maternal age and BMI of the population were 27.1 ± 5.9 years old and 21.6 ± 3.5 kg/m^2, respectively. Obviously, BMI and maternal age in the pregestational diabetes mellitus (PGD) group (25 kg/m^2, 38 ± 7.1 years old) and the GDM group (24.5 kg/m^2, 34.1 ± 4.6 years old) were the two greatest among the total population. Two thirds of the pregnant women were nulliparous (Table 1). According to the inclusion criteria, there

Table 1. Demographic data in the studied population (N = 1,000)

Characteristics	Non-screening group (N=589)			Screening group (N=411)		Total N=1,000
	No risk N=547	Risk N=40	PGD* N=2	Non GDM N=382	GDM** N=29	
Mean age ± SD (yr)	23.6 ± 3.4	28.5 ± 4.7	38.0 ± 7.1	31.3 ± 5.5	34.1 ± 4.6	27.1 ± 5.9
ParityNullipara (%)	416 (76.1)	19 (47.5)	0 (0)	164 (42.9)	9 (31)	608 (60.8)
Multipara (%)	131 (23.9)	21 (52.5)	2 (100)	218 (57.1)	20 (69)	392 (39.2)
BMI ± SD (kg/m^2)	20.8 ± 2.9	22.0 ± 3.0	25.0 ± 1.4	22.4 ± 3.7	24.5 ± 4.3	21.6 ± 3.5

*PGD = pregestational diabetes mellitus **GDM = gestational diabetes mellitus

were 451 pregnant women eligible for GCT screening. However, only 411 cases were tested with 164 positive GCT results and needed OGTT. There were only 29 cases of GDM representing for 7.05% among the screening group or 2.9% in the total population. The sensitivity, specificity, positive predictive value, negative predictive value of GCT for GDM detection were 100%, 64.66%, 17.68% and 0%, respectively (Table 2). Regarding the non-screening group, there were 40 high-risk pregnancies (4%) missed for GCT screening. Two cases of PGD were also observed in this group (0.2%). In the screening group, the common indications for GCT screening were advanced maternal age (75.4%) followed by familial diabetic history (22.1%) and glycosuria (6.8%). The risk factors were similar to those of the 40 missed-cases (Table 3). Premature rupture of the membranes (PROM) was apparently the most common obstetric complication (7.6%) particularly observed in the low risk (8.04%) and the negative GCT (7.85%) groups. PIH was the second most common complication found (2.8%) especially in the negative GCT group (Table 4). Vaginal delivery was the most common route of birth (84.8%) followed by cesarean section (15.2%). LGA, SGA, fetal distress and fetal anomaly were observed in 10.5%, 10% 1.4% and 0.4%, respectively. There was no statistical significance in pregnancy outcomes of preterm birth, LGA, SGA and fetal anomaly among all the groups (risk, without risk, PGD, GDM and non-GDM). However, fetal distress and cesarean section rate were significantly different with the highest in GDM group (Table 5).

Table 2. The efficacy of GCT for GDM detection by using OGTT as the diagnostic test

Result	GDM	Non-GDM	Total
Positive	29	135	164
Negative	0	247	247
Total	29	382	411

Remark: sensitivity, specificity, positive and negative predictive value of GCT = 100%, 64.66%, 17.68%, 0% respectively

Table 3. Indications for GDM screening (N = 451)

Indications	Non-screening group N=40 (%)	Screening group N=411 (%)	Total N=451 (%)
Age ≥ 30 years	21 (52.5)	310 (75.4)	331 (73.4)
Family history of DM	17 (42.5)	91 (22.1)	108 (24.0)
Urine sugar positive	0	28 (6.8)	28 (6.2)
Obvious obesity (BMI >30 kg/m^2)	0	9 (2.2)	9 (2.0)
Weight gain > 2 kg/4wksor > 1 kg/2wks	0	8 (1.9)	8 (1.8)
Previous child > 4000 gm	0	6 (1.5)	6 (1.3)
Uterine size > gestational age	0	5 (1.2)	5 (1.1)
History of death fetus in utero	1 (2.5)	3 (0.7)	4 (0.9)
Polyuria or polydipsia	0	2 (0.5)	2 (0.4)
History of fetal anomaly	2 (5.0)	0	2 (0.4)
Polyhydramnios	0	1 (0.2)	1 (0.2)
Pregnancy induced hypertension	0	1 (0.2)	1 (0.2)
History of GDM in previous gestation	0	1 (0.2)	1 (0.2)

Table 4. Obstetric complications in the studied population (N = 1,000)

Complications	Non-screening group N = 589			Screening group N = 411		Total N = 1,000 (%)
	No risk N = 547 (%)	Risk N = 40 (%)	PGD N = 2 (%)	Non GDM N = 382 (%)	GDM N = 29 (%)	
PROM	44 (8.04)	2 (5)	0	30 (7.85)	0	76 (7.6)
PIH	7 (1.28)	0	0	20 (5.24)	1 (3.45)	28 (2.8)
Gestational HT	4 (0.73)	0	0	4 (1.05)	0	8 (0.8)
Chronic HT	2 (0.37)	0	0	4 (1.05)	0	6 (0.6)
Twin	4 (0.73)	0	0	2 (0.52)	0	6 (0.6)
PPH	1 (.018)	0	0	3 (0.79)	0	4 (0.4)
Chorioamnionitis	1 (0.18)	0	0	0	0	1 (0.1)
Polyhydramnios	0	0	0	1 (0.26)	0	1 (0.1)
Total	63	2	0	64	1	130

Table 5. Pregnancy outcomes in the studied population (N=1,000)

Pregnancy outcomes	Non-screening group N=589			Screening group N=411		Total N=1,000 (%)	p value *
	No risk N=547 (%)	Risk N=40 (%)	PGD N=2 (%)	Non GDM N=382 (%)	GDM N=29 (%)		
Preterm delivery	48 (8.8)	2 (5)	0	39 (10.2)	3 (10.35)	92 (9.2)	0.795
Birth weight [5]							
> 90 percentile	51(9.32)	3 (7.5)	1 (50)	49 (10.21)	1 (3.45)	105 (10.5)	
< 10 percentile	55 (10.05)	3 (7.5)	0	38 (9.95)	4 (13.79)	100 (10)	0.343
Apgar score (<7 at 5 min)	5 (0.91)	0	1 (50)	7 (1.83)	1 (3.45)	14 (1.4)	0.000*
Fetal anomalies	1(0.18)	0	0	3 (0.79)	0	4 (0.4)	0.670
Route of delivery							
• Vaginal route	483 (88.3)	35 (87.5)	0	309 (80.9)	21 (72.4)	848 (84.8)	
• Cesarean Section	64 (11.7)	5 (12.5)	2 (100)	73 (19.1)	8 (27.6)	152 (15.2)	0.000*

* $p < 0.05$ = statistical significant (Pearson chi-square)

Discussion

GDM prevalence has been reported variably from 1.4 to 14 percent worldwide and differently among racial and ethnic groups[6-9]. Prevalence rates are higher in Black, Latino, Native American, and Asian women than White women[2]. By comparison, the presented GDM prevalence of 7.06 percent was greater than that of Serirat et al (2.02%) in a Thai population[10]. However, the number of samples was greater in the previous study (N = 25,997) and the population characteristics were also different. Regarding the 40 high-risk pregnancies missed for GCT screening, they were treated as low-risk pregnancies without further investigation and proper management. Fortunately, there was no difference in pregnancy outcome between this group and the other. The unscreened high-risk cases in the present study may originate from the inadequate history reviewing and the variation of clinical competency from different levels of health care providers including student nurses, medical students, residents and senior staffs. To improve the result, vigilant history taking to identify GDM risk should be routinely performed in every pregnant woman. Concerning GDM group, PIH was the only obstetric complication observed while pregnancy outcomes were comparable to the other. However, the impact of GDM on obstetric complications and pregnancy outcome was inconclusive due to the small number of studied population. Nevertheless, early diagnosis and proper antenatal management may improve the result more or less. According to the present finding, GCT screening has proved to be highly sensitive but rather low in specificity[11]. In the future, a larger scale of research should be conducted in a prospective manner to clarify the statistical difference in pregnancy complication and outcome. The present study, however, showed the effectiveness of the GDM selective screening scheme

and reflected how important the history reviewing was to identify GDM high-risk pregnancy.

Conclusion

The selective GCT screening strategy was highly effective and revealed 7.05% of GDM prevalence. Its impact on obstetric complications and pregnancy outcome was inconclusive due to the small number of studied population. Careful history reviewing plays an important role in identifying GDM risk factor for GCT screening.

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ความชุกของโรคเบาหวานขณะตั้งครรภ์ในสตรีที่ถูกตรวจคัดกรองด้วยวิธี glucose challenge test ในโรงพยาบาลมหาราชนครเชียงใหม่

พฤหัส จันทร์ประภาพ, ฉัตรดาว สุจริต

วัตถุประสงค์ *: เพื่อหาความชุกของโรคเบาหวานในขณะตั้งครรภ์ของสตรีตั้งครรภ์ที่ได้รับการตรวจคัดกรองเบาหวานด้วยวิธี GCT ในโรงพยาบาลมหาราชนครเชียงใหม่*

ชนิดของการวิจัย *: การวิจัยเชิงพรรณนาโดยการเก็บข้อมูลย้อนหลัง*

สถานที่ทำการวิจัย *: ภาควิชาสูติศาสตร์และนรีเวชวิทยา โรงพยาบาลมหาราชนครเชียงใหม่ คณะแพทยศาสตร์ มหาวิยาลัยเชียงใหม่*

กลุ่มตัวอย่าง *: สตรีที่มาฝากครรภ์และคลอดที่โรงพยาบาลมหาราชนครเชียงใหม่ในช่วงเดือนตุลาคม 2544 ถึงเดือนธันวาคม 2545 จำนวน 1,000 ราย*

วิธีดำเนินการ *: คัดเลือกสตรีตั้งครรภ์ตามเกณฑ์ที่กำหนดไว้ในช่วงเดือนตุลาคม 2544 ถึงเดือนธันวาคม 2545 แล้วทำการเก็บข้อมูลพื้นฐานของสตรีตั้งครรภ์แต่ละคน ได้แก่ ข้อมูลทางด้านประชากรศาสตร์, สูติศาสตร์ทั่วไป, ปัจจัยเสี่ยงต่อการเป็นเบาหวาน, ผลการตรวจ GCT และ OGTT ตลอดจนผลลัพธ์ของการตั้งครรภ์ แล้วนำข้อมูลที่ได้มาวิเคราะห์ทางสถิติต่อไป*

ตัววัดที่สำคัญ *: ค่าความชุกของโรคเบาหวานในขณะตั้งครรภ์ของสตรีตั้งครรภ์ซึ่งมีปัจจัยเสี่ยงที่เป็นข้อบ่งชี้ และได้รับการตรวจคัดกรองเบาหวานในโรงพยาบาลมหาราชนครเชียงใหม่ ด้วยวิธี Glucose challenge test (GCT)*

ผลการวิจัย *: จากกลุ่มตัวอย่างศึกษาทั้งหมด 1,000 รายมีข้อบ่งชี้ 451 ราย แต่ได้รับการตรวจคัดกรองเพียง 411 ราย ผล GCT ผิดปกติ 164 ราย ตรวจพบเป็นเบาหวานในระหว่างตั้งครรภ์ 29 ราย คิดเป็นค่าความชุกของโรคเบาหวานร้อยละ 7.05 (ช่วงความเชื่อมั่น 95% เท่ากับ 0.048, 0.099) สำหรับค่าความไว ความจำเพาะ ค่าทำนายผลบวกและค่าทำนายผลลบของการตรวจ GCT ในการวินิจฉัย GDM โดยใช้ OGTT เป็นวิธีมาตรฐานมีค่าร้อยละ 100, 64.66, 17.68 และ 0 ตามลำดับ ข้อบ่งชี้ของการตรวจ GCT ในกลุ่มที่เป็นเบาหวานในระหว่างตั้งครรภ์ได้แก่ อายุมารดาร้อยละ 75.4 มีประวัติเบาหวานในครอบครัวร้อยละ 22.1 มีน้ำตาลในปัสสาวะร้อยละ 6.8 พบภาวะแทรกซ้อนจากความดันโลหิตสูงในระหว่างตั้งครรภ์ 1 ราย มีการผ่าตัดคลอดร้อยละ 27.6 คลอดก่อนกำหนดร้อยละ 10.3 ทารกตัวโตร้อยละ 3.45 และทารกโตช้าในครรภ์ร้อยละ 13.79 ในการศึกษานี้พบสตรีที่เป็นเบาหวานก่อนการตั้งครรภ์ 2 รายคิดเป็นร้อยละ 0.2 และมีสตรี 40 รายที่มีข้อบ่งชี้ในการตรวจ GCT แต่ไม่ได้รับการตรวจคิดเป็นร้อยละ 4*

สรุป *: ความชุกของโรคเบาหวานในขณะตั้งครรภ์ของสตรีตั้งครรภ์ที่ได้รับการตรวจคัดกรองเบาหวานด้วยการตรวจ GCT ในโรงพยาบาลมหาราชนครเชียงใหม่มีค่าร้อยละ 7.05 สำหรับภาวะแทรกซ้อนและผลลัพธ์ของการตั้งครรภ์ที่เกิดขึ้นในสตรีที่เป็นเบาหวานในระหว่างตั้งครรภ์นั้นยังไม่สามารถวิเคราะห์ได้อย่างชัดเจน เนื่องจากกลุ่มตัวอย่างยังมีจำนวนน้อยเกินไป การซักประวัติปัจจัยเสี่ยงต่อการเป็นเบาหวานมีความสำคัญในการคัดกรองผู้ป่วยเพื่อรับการตรวจคัดกรอง GCT*