
OBSTETRICS

The Incidence of Diabetes Mellitus in Pregnant Women and its Outcomes between Pregnant Women with Diabetes Mellitus and Non-diabetes Mellitus at Maharat Nakhon Ratchasima Hospital

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ABSTRACT

Objective: To study the incidence of diabetes mellitus (DM) in pregnancy and its outcomes between DM and non-DM pregnancies at Maharat Nakhon Ratchasima Hospital.

Materials and Methods: Descriptive, retrospective study. Research duration was from May 1, 2009 – May 31, 2011. Comparison of the adverse outcomes between 340 DM with 1,023 non-DM pregnancies using statistic analysis methods: independent sample t-test, descriptive statistic analysis and logistic regression analysis at p-value < 0.05.

Results: The annual incidences of DM in pregnancies from 2009 to 2011 were 1.78, 2.50 and 2.32 percent, respectively. Cesarean section, gestational age (GA) at delivery and birth weight > 3,500 gm were statistically significant higher in non-DM group (p < 0.05). Preeclampsia, neonatal hypoglycemia, respiratory distress syndrome (RDS) and neonatal admission to neonatal intensive care unit (NICU) were significantly higher in diabetic group (p < 0.05). Pre-gestational DM, gestational diabetes mellitus A₂ (GDMA₂), gestational diabetes mellitus A₁ (GDMA₁) increased risk of mild preeclampsia (OR 2.14, 95% CI 3.67-19.77, OR 1.206, 95%CI 1.37-8.12, OR 1.12, 95%CI 1.36-7.48), superimposed preeclampsia (OR 4.77, 95%CI 14.20-968.4, OR 2.82, 95%CI 1.51-186.13, OR 3.58, 95%CI 4.15-308.1), neonatal hypoglycemia (OR 2.70, 95%CI 7.88-27.67, OR 2.22, 95%CI 5.26-16.13, OR 1.46, 95%CI 2.31-8.00) and RDS (OR 1.15, 95%CI 1.17-8.55, OR 1.36, 95%CI 1.86-8.1, OR 1.06, 95%CI 1.36-6.15).

Conclusion: The incidence of DM in pregnant women at Maharat Nakhon Ratchasima Hospital is low. Diabetic group was shown to have increased risks of preeclampsia, neonatal hypoglycemia, RDS and neonatal admission to NICU but not in cesarean section, GA at delivery and birth weight > 3,500 gm.

Keywords: incidence, diabetes mellitus in pregnancy, adverse maternal and neonatal outcomes

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Introduction

Gestational diabetes mellitus (GDM) can be divided into pre-gestational diabetes which is diagnosed before pregnancy and gestational diabetes which is first recognized during current pregnancy. The incidence of GDM varies upon the screening and diagnostic test used in those countries. In the United States of America, the incidence is about 3 to 8 percent of pregnant women and the incidence was doubled during 1994-2002 among various ethnics.⁽¹⁾ One paper indicated that the incidence of gestational diabetes was increased 68 percent, from 3.7 percent in 1991 to 6.6 percent in 1997 in every age groups and races.⁽²⁾ In Thailand, a study on the incidence of GDM at Maharat Nakorn Chiangmai Hospital using 100 gm oral glucose tolerance test (OGTT), found that the incidence was 7.05%⁽³⁾, whereas, at Srinagarind Hospital it was 5.8 percent⁽⁴⁾. GDM is a common medical condition which causes a variety of adverse maternal and neonatal outcomes. There have been many reports of increased risk of fetal macrosomia, preeclampsia and death fetus in utero in diabetic pregnancies compared with non-diabetic group⁽⁵⁾. For adverse maternal outcomes, birth canal trauma and increased cesarean section rate due to cephalopelvic disproportion (CPD) was mentioned in gestational diabetic group. In neonate, it was found out that there was increased risk of neonatal hypoglycemia, neonatal jaundice, hypocalcemia and feeding intolerance⁽⁶⁾. At Maharat Nakhon Ratchasima Hospital, the pregnant women were screened by risk-based screening method using 50 grams glucose challenge test (GCT) and confirmed diagnosis with 100 gram OGTT. The cut-off point was changed from National Diabetes Data Group (NDDG) criteria to Carpenter and Coustan criteria in May 2009. The aims of this study were to determine the incidence of GDM and pre-gestational DM and compare the adverse maternal and neonatal outcomes between diabetic and non-diabetic groups at Maharat Nakhon Ratchasima Hospital.

Materials and Methods

This research was a retrospective cohort study. The Institutional Review Board, Maharat Nakhon

Ratchasima Hospital had approved this study. Data were collected from medical records of 1,363 pregnant women, who delivered and/or attended the antenatal care clinic at Maharat Nakorn Ratchasima Hospital from May 1, 2009 – May 31, 2011. Three hundred and forty pregnant women with diabetes mellitus (DM) and 1,023 pregnant women without DM were selected randomly. Multifetal gestations, hydrops fetalis and congenital anomalies were excluded. Data were divided into two groups of diabetic pregnancies and non-diabetic groups. In diabetic group composed of pre-gestational DM and GDM. Gestational diabetes was diagnosed by two-step approach using 50 gm GCT with cut-off point at 140 mg/dl, confirmed by 100 gm OGTT using Carpenter and Coustan criteria. Patients with two or more abnormal values were admitted for diet control and serial capillary blood glucose for 3 days. Expected fasting and 2 hour postprandial capillary blood glucose were less than 95 mg% and 120 mg%, respectively. Endocrinologist and nutritionist were consulted for multidisciplinary management.

Obstetric and neonatal outcomes including preeclampsia, postpartum hemorrhage, primary cesarean section due to CPD, shoulder dystocia, birth canal trauma, neonatal hypoglycemia, preterm delivery, postterm, meconium aspiration syndrome, birth asphyxia, neonatal jaundice, respiratory distress syndrome (RDS), neonatal admission to neonatal intensive care unit (NICU) were recorded and analyzed between both groups.

Gestational age (GA) was recorded according to the last menstrual period or confirmed by early ultrasound. Postpartum hemorrhage was defined as blood loss more than 500 ml in vagina delivery and more than 1,000 ml in cesarean section. Macrosomia was defined as the birth weight of more than 4,000 grams⁽⁷⁻⁹⁾. All analyses were performed using statistical program. Data were presented as counts, range and frequencies (%). The logistic regression analysis was used to assess the relative risks of adverse maternal and neonatal outcomes in the form of Odds ratio. One sample t-test was used to assess the means of one population. Independent sample t-test was used to

calculate the mean and standard deviation of 2 population groups. Differences in the frequencies of events between patient-groups were analyzed by Chi-square test. P-value of less than 0.05 is statistically significant.

Results

For the duration between 2009 to 2011, the incidence of diabetes mellitus (DM) in pregnancy was 1.78, 2.50 and 2.32 percent, respectively. The patient's baseline characteristic composed of maternal age at delivery, pre-pregnancy body mass index (BMI), total weight gain and primigravida. The data is described in (Table 1).

Table 1. Demographic comparisons of pregnancy with diabetes mellitus and without diabetes mellitus (control group).

	Control (n=1,023)	DM (n=340)	P
Mean ± SD of maternal age at delivery	28.02 ± 7.23	33.25 ± 6.19	<0.05
Mean ± SD of pre-pregnancy BMI (kg/m ²)	22.85 ± 9.30	28.34 ± 5.25	<0.05
Mean ± SD of total weight gain (kg)	12.28 ± 5.94	9.23 ± 4.52	<0.05
Primigravida	357 (34.90%)	64 (18.82%)	<0.05

DM: Diabetes Mellitus, BMI: body mass index

For maternal outcomes in this study composed of cesarean section, gestational age (GA) at delivery, preeclampsia, shoulder dystocia, birth canal trauma and postpartum hemorrhage. For neonatal outcomes includes birth weight >3,500 gm, birth weight < 2,500

gm, neonatal hypoglycemia, birth asphyxia, RDS and neonatal admission to NICU. The differences in maternal and neonatal outcomes between pregnant women with diabetes and non-diabetes mellitus are described in (Table 2).

Table 2. Comparisons of maternal and neonatal outcomes between pregnant women with diabetes mellitus and without diabetes mellitus (control group).

	Control (Number/percent)	DM (Number/percent)	P
Cesarean section	453 (33.2)	229 (16.8)	<0.05
Mean ± SD of GA at delivery	37.84 ± 2.13	37.31 ± 2.13	<0.05
Birth weight > 3,500 gm	174 (12.8)	97(7.1)	<0.05
Birth weight < 2,500 gm	121(8.9)	51(3.7)	NS
Preeclampsia (mild, severe)	35 (2.6)	52 (3.8)	<0.05
Shoulder dystocia	2 (0.1)	3 (0.2)	NS
Birth canal trauma	6 (0.4)	4 (0.3)	NS
Postpartum hemorrhage	22 (1.6)	10 (0.7)	NS
Neonatal hypoglycemia	30 (2.2)	65 (4.8)	<0.05
Birth asphyxia	35 (2.6)	14 (1.0)	NS
Respiratory distress syndrome	25 (1.8)	26 (1.9)	<0.05
Neonatal admission to NICU	2 (0.1)	7 (0.5)	<0.05

DM: diabetes mellitus, GA: gestational age, NICU: neonatal intensive care unit, NS: not significant

For a thorough analysis, classification of DM in pregnant women including gestational diabetes A₁ (GDMA₁), gestational diabetes A₂ (GDMA₂) and pre-gestational DM were analyzed for relative risks in the development of gestational hypertension, mild

preeclampsia, severe preeclampsia, superimposed on chronic hypertension, neonatal hypoglycemia, preterm delivery, RDS and neonatal admission to NICU and compared with non-diabetic group. The data is described in (Table 3).

Table 3. Relative risks of maternal and neonatal outcomes between types of diabetes mellitus during pregnancy and without diabetes mellitus (control group).

Adverse outcomes	GDMA ₁ OR (95%CI)	GDMA ₂ OR (95%CI)	Pre-gestational DM OR (95%CI)
Gestational HT	1.17 (2.15-12.97)	-	-
Mild Preeclampsia	1.12 (1.36-7.48)	1.21 (1.37-8.12)	2.14 (3.67-19.77)
Severe Preeclampsia	-	1.72 (2.7-11.61)	2.31 (4.66-21.8)
Superimposed on CHT	3.58 (4.15-308.1)	2.82 (1.51-186.13)	4.77 (14.20-968.4)
Neonatal hypoglycemia	1.46 (2.31-8.00)	2.22 (5.26-16.13)	2.69 (7.88-27.76)
Preterm delivery	-	-	0.98 (1.45-4.74)
RDS	1.06 (1.36-6.15)	1.36 (1.86-8.1)	1.15 (1.17- 8.55)
Neonatal admission to NICU	1.95 (0.98-50.02)	2.83 (3.08-93.89)	2.03 (0.68-85.10)

GDMA₁: gestational diabetes mellitus A₁, GDMA₂: gestational diabetes mellitus A₂, PPH: postpartum hemorrhage, HT: hypertension, CHT: chronic hypertension, RDS: respiratory distress syndrome, NICU: neonatal intensive care unit

Discussion

The incidence of DM in pregnancy at Maharat Nakhon Ratchasima Hospital was increased from the year 2009 to 2010 and remained somewhat stable from the year 2010 to 2011. The increase in incidence of DM in pregnancy may be due to the change in cut-point criteria, from NDDG to Carpenter and Coustan criteria, which is the lower cut-off point, attributable to increase in sensitivity in detection of diabetes in pregnancy. Even though, the incidence was less when compared to the other studies in Thailand^(3,4). The possible reasons were this study identified pregnancies who attended antenatal care from difference places, so some might have missed screening for high risk patients. These patients may develop GDM or some of them were treated in general hospital and had not been referred for appropriate treatment.

In the United States of America, incidence was about 3 to 8 percent of pregnant women and the incidence was doubled during 1994-2002 among various ethnics⁽²⁾, which were higher than this study.

These may be due to differences in the tests used to screen and the patient's baseline socio-demographic characteristics. Lastly, when compared the frequency of GDM based on International Association of Diabetes in Pregnancy Study Groups (IADPSG) Consensus Panel-recommended criteria, the incidence of GDM was 17.8%⁽¹⁰⁾. This report was conducted among 15 centers that participated in the Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study. The incidence of GDM was very high in that study, and cannot be compared to this study due to different patient's selection and testing criteria's.

For this study patient's demographic, mean maternal age at delivery and pre-pregnancy BMI were significantly higher in diabetic group compared to control group, which were comparable with the previous study⁽¹¹⁾. They mentioned that risk factors for GDM among Asian women were advanced age and more pre-pregnancy BMI. But total weight gain in diabetic group was significantly lesser than control group in this study. This may brought about to the lower cesarean

section rate and birth weight less than 3,500 gm in diabetic group than in control group.

The study had found an increased in the incidence of preeclampsia in diabetic group compared to non-diabetic group. This result was similar to previous studies⁽¹²⁾ indicating that diabetic pregnancies were at increased risks of preeclampsia, abnormal presentation and higher in cesarean section rate, neonatal hypoglycemia, RDS, preterm and small-for-gestational age⁽¹²⁾. Also, comparable to HAPO study: preeclampsia, saying that rate of preeclampsia increased with higher level of fasting, 1-, and 2-hour plasma glucose⁽¹³⁾. Consequently, these results remind clinicians to beware of the concomitant preeclampsia during antepartum, intrapartum and postpartum period.

The previous study⁽¹⁴⁾ showed that pre-gestational DM increased risk for cesarean section rate, shoulder dystocia and preeclampsia. Neonates of pre-gestational diabetes group increased risks for admission to NICU, large-for-gestational age and preterm birth⁽¹⁴⁾. Interestingly, shoulder dystocia and postpartum hemorrhage were not significantly higher in diabetic pregnancies group in this study. The prevalence of GDM and its outcome in western Rajasthan found that prevalence percentage of shoulder dystocia and postpartum hemorrhage was higher in GDM than in non-GDM group, but it did not reach statistical significant⁽¹⁵⁾.

At Maharat Nakhon Ratchasima Hospital, as stated in the methods, the clinicians admitted every pregnant women with at least 2 of 4 abnormal values of 100 gm OGTT for diabetic control, keep capillary blood sugar in acceptable range of fasting and 2 hour postprandial of < 95 mg% and 120 mg%, respectively. The clinicians gave general information about benefit of treatment of diabetes during pregnancy and educated them about self-monitoring blood glucose at home. Endocrinologist consultation for close follow up and its complication were provided. These may attribute to reduced risk of neonatal birth weight more than 3,500 gm, shoulder dystocia and postpartum hemorrhage.

For adverse neonatal outcomes, when comparing diabetic and non-diabetic pregnancies, the diabetic group had statistically significant increased risks of

neonatal hypoglycemia, RDS and neonate admission to NICU. These results were comparable to the previous study⁽¹⁶⁾ which mentioned that neonates born to diabetic pregnancies had increased risk of neonatal hypoglycemia, hypocalcemia, hyperbilirubinemia and RDS⁽¹⁶⁾. Also, as stated in Neonatal Short-Term Outcomes of Gestational Diabetes Mellitus in Saudi Mothers: A Retrospective Cohort Study, concluded that the number of infants needed NICU admission was significantly higher for infants born to GDM mothers compared to infants born to normal mothers. Hypoglycemia was the main cause of NICU admission for newborns of GDM mothers. But the rate of RDS was not increased in the offspring of GDM mothers, in one study⁽¹⁷⁾.

In this study, the mean GA at delivery was significantly lower in diabetes group. This implied that neonates born with RDS might be the same group of population that was born at lower GA. Therefore, in diabetic pregnancies, even at term, neonatal hypoglycemia, RDS and neonatal admission to NICU are still conditions to be concerned.

For clinical application, the incidence of pregnancy with DM in this study is low but various adverse maternal and neonatal outcomes were detected, comparable to other previous studies. Women with moderate to high risks of GDM should not be missed for screening. Risk based-screening method is still valuable in early detection of GDM. Adverse maternal and neonatal outcomes are conditions to be aware, predicted and prevented in pregnant women with DM.

This study was designed as a retrospectively study. It is probable that a minority of the data has been recorded incorrectly or misplaced, while some useful information was not fully available, such as abnormal value of 100 g OGTT, GA at the time of testing and post-treatment glucose level. In the future or subsequent study, it is recommended that there should be a prospective study comparing the risk-based screening with Carpenter and Coustan criteria, compare with universal 75 gm OGTT test, which is still be controversies in the cost-effectiveness.

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อุบัติการณ์ของเบาหวานในสตรีตั้งครรภ์และเปรียบเทียบภาวะแทรกซ้อนในกลุ่มที่เป็นเบาหวาน และไม่เป็นเบาหวานในสตรีตั้งครรภ์ที่โรงพยาบาลมหาราชนครราชสีมา

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วัตถุประสงค์: ศึกษาอุบัติการณ์ของเบาหวานในสตรีตั้งครรภ์และเปรียบเทียบภาวะแทรกซ้อนในกลุ่มเบาหวาน และไม่เป็นเบาหวานขณะตั้งครรภ์ที่โรงพยาบาลมหาราชนครราชสีมา

วัสดุและวิธีการ: การศึกษาแบบพรรณนาย้อนหลังในสตรีตั้งครรภ์ที่เป็นเบาหวาน 340 คน และไม่เป็นเบาหวาน 1,023 คน ที่โรงพยาบาลมหาราชนครราชสีมา ระหว่าง 1 พฤษภาคม 2552 – 31 พฤษภาคม 2554 เปรียบเทียบภาวะแทรกซ้อนโดยใช้สถิติ independent sample t-test, descriptive statistic analysis และ logistic regression analysis โดย $p < 0.05$

ผลการศึกษา: อุบัติการณ์ของเบาหวานในสตรีตั้งครรภ์ปี 2552- 2554 คือ 1.78, 2.50 และ 2.32 เปอร์เซ็นต์ ตามลำดับ กลุ่มที่ไม่เป็นเบาหวานมีอัตราการผ่าคลอด อายุครรภ์ที่คลอด และน้ำหนักแรกเกิด $>3,500$ กรัม มากกว่า ($p < 0.05$) กลุ่มที่เป็นเบาหวานเพิ่มความเสี่ยงต่อ preeclampsia, neonatal hypoglycemia, respiratory distress syndrome (RDS) และ neonatal admission to neonatal intensive care unit (NICU) อย่างมีนัยสำคัญ ($p < 0.05$). Pre-gestational diabetes mellitus, gestational diabetes mellitus A₂ (GDMA₂), gestational diabetes mellitus A₁ (GDMA₁) เพิ่มความเสี่ยงต่อ mild preeclampsia (OR 2.14, 95% CI 3.67-19.77, OR 1.21, 95% CI 1.37-8.12, OR 1.12, 95% CI 1.36-7.48), superimposed preeclampsia (OR 4.77, 95% CI 14.20-968.4, OR 2.82, 95% CI 1.51-186.13, OR 3.58, 95% CI 4.15-308.1), neonatal hypoglycemia (OR 2.70, 95% CI 7.88-27.67, OR 2.22, 95% CI 5.26-16.13, OR 1.46, 95% CI 2.31-8.00) และ RDS (OR 1.15, 95% CI 1.17-8.55, OR 1.36, 95% CI 1.86-8.1, OR 1.06, 95% CI 1.36-6.15)

สรุป: อุบัติการณ์ของเบาหวานในสตรีตั้งครรภ์ที่โรงพยาบาลมหาราชนครราชสีมาค่อนข้างต่ำ เบาหวานในสตรีตั้งครรภ์เพิ่มความเสี่ยงต่อภาวะ preeclampsia, neonatal hypoglycemia, RDS และ neonatal admission to NICU แต่ไม่เพิ่มการผ่าคลอดทางหน้าท้อง อายุครรภ์ที่คลอด และน้ำหนักแรกเกิดที่มากกว่า 3,500 กรัม