Adverse Pregnancy Outcomes in Gestational Diabetes Mellitus

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Objective: *To evaluate adverse pregnancy outcome in women diagnosed with gestational diabetes mellitus (GDM) at Siriraj hospital.*
Study design: *Cross- sectional study.*
Setting: *Department of Obstetrics and Gynecology, Faculty of Medicine Siriraj Hospital, Mahidol University.*
Material and Method: *One hundred and sixty two women who were diagnosed with GDM and who received treatment following clinical practice guideline at Siriraj hospital were enrolled. Data were abstracted from medical record regarding adverse pregnancy outcomes of both the mothers and their infants.*
Results: *The most common clinical risk for GDM was age ≥ 30 years (116 cases, 71.6%), followed by family history of diabetes mellitus (81 cases, 50%) and obesity (47 cases, 29%). Majority of the women were GDM class A1 (156 cases, 96.3%) and only six cases (3.7%) were GDM class A2. Maternal complications were found in 35 cases (21.6%) and the most common complications were postpartum hemorrhage (17 cases, 10.5%), mild preeclampsia (6 cases, 3.7%) and severe preeclampsia (3 cases, 1.9%). The most common neonatal complication was hypoglycemia (111 cases, 68.5%). This occurred in all infant of GDM class A2 mothers. Macrosomia was found in 29 cases (17.9%). No significant differences in maternal and neonatal complications were found between GDM class A1 and class A2.*
Conclusion: *Women with GDM who were diagnosed and treated following treatment guidelines demonstrated no severe maternal and neonatal complications.*

Keywords: *Pregnancy outcomes, Gestational diabetes mellitus*

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Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance of variable severity with onset of hyperglycemia during pregnancy[1]. The definition applies regardless of whether insulin is used for treatment, or the condition persists after pregnancy. It does not exclude the possibility that unrecognized glucose intolerance may have antedated the pregnancy[2]. Insulin resistance, which normally develops during pregnancy, is characterized by higher fasting plasma insulin and a higher insulin requirement in response to eating. Placental diabetogenic hormone, including chorionic somatomammotropin, human placenta lactogen, progesterone, growth hormone, and corticotrophin-releasing hormone, also increases insulin resistance in the second and third trimesters[3].

Diabetes in pregnancy is linked to several maternal and fetal complications and can result in substantial morbidity and mortality. These include fetal macrosomia, large-for-gestational age (LGA) infants, operative delivery and birth trauma, preeclampsia and hypertensive disorders, metabolic complications in the neonate (hypoglycemia, hypocalcemia, and hyperbilirubinemia), prematurity, and perinatal mortality[4-7]. Early diagnosis and treatment of GDM could avoid such adverse maternal and neonatal outcomes.

In Siriraj Hospital, a clinical practice guideline has been developed and implemented for screening, diagnosis, and management of GDM since 2000. The guideline has been monitored and revised continuously

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for better care of these women. The objective of this study was to evaluate pregnancy outcomes of pregnant women complicated with GDM as part of the continuous improvement of the guideline. In addition, factors associated with such outcomes were also evaluated.

Material and Method

This cross-sectional study consisted of 162 pregnant women diagnosed with GDM and admitted for delivery at Siriraj Hospital in 2004. Gestational diabetes was screened and diagnosed following the established guideline in our institution[8]. In brief, all at-risk pregnant women were screened using 50-gram glucose challenge test and those with abnormal results were confirmed with 100-gram oral glucose tolerance test. Screening was offered during first visit and repeated at 28-32 weeks of gestation. Exclusion criteria included those with overt diabetes mellitus, those whose gestational age at first antenatal care visit was >28 weeks of gestation, and those who received antenatal care from other hospitals and clinics.

According to our guideline, GDM class A1 were initially treated with dietary therapy and GDM class A2 were treated with insulin therapy to control maternal blood glucose level, either with or without admission to the hospital. Follow up schedules were assigned individually as appropriate, depending on gestational age, blood glucose level control, and other complications. At the time of delivery, management of these women was provided based on standard practice and guideline recommendation, under staff supervision.

Antenatal care records of these women were reviewed and data were extracted, including baseline characteristics, data on clinical risk factors, classification of GDM, treatment received, and antenatal complications. Labor and delivery records were reviewed regarding intrapartum and postpartum maternal complications as well as various neonatal complications.

Statistics were used to describe various baseline characteristics, using mean, standard deviation, number, and percentage. Incidences of maternal and fetal complications were estimated. Comparisons of various adverse outcomes were made between GDM class A1 and A2. Student's t test and Chi-square test were used as appropriate. Statistical significance was considered if p value < 0.05.

This study has been reviewed and approved by Ethics Committee, Faculty of Medicine Siriraj Hospital, Mahidol University.

Results

One hundred and sixty two GDM women who received treatment following clinical practice guideline at Siriraj hospital from 1 January 2004 to 31 December 2004 were recruited. Table 1 shows baseline characteristics of these women. Mean maternal age was 32.0 ± 4.9

Table 1. Baseline characteristics of pregnant women in this study

Characteristics	N (%)
Mean maternal age $\pm$ SD (year)	32.0 ± 4.9
Mean GA at diagnosis $\pm$ SD (week)	24.1 ± 9.5
Mean BMI $\pm$ SD (kg/m^2)	24.0 ± 4.4
Parity	
0	70 (43.2%)
1	58 (35.8%)
≥ 2	34 (21.0%)
Risk for GDM	
Family history of DM	81 (50%)
Maternal age ≥ 30 years	116 (71.6%)
Previous history of fetal macrosomia	4 (2.5%)
Previous history of congenital fetal anomaly	1 (0.6%)
Previous history of unexplained intrauterine fetal death	4 (2.5%)
Previous hypertension	4 (2.5%)
Previous history of GDM during previous pregnancy	1 (0.6%)
Obesity	47 (29%)
GDM class	
GDM A1	156 (96.3%)
GDM A2	6 (3.7%)

years and mean GA at diagnosis was 24.1 ± 9.5 weeks of gestation. Approximately 43% were nulliparous. The most common clinical risk for GDM were age ≥ 30 years (116 cases, 71.6%), followed by family history of diabetes mellitus (81 cases, 50%) and obesity (47 cases, 29%). Majority of the women were GDM class A1 (156 cases, 96.3%) and only 6 cases (3.7%) were in class A2.

Labor and delivery data are shown in Table 2. Mean gestational age at delivery was 38.3 ± 1.4 weeks and 12 cases (7.4%) were preterm delivery. Majority had normal vaginal delivery (59.9%) and 35.8% delivered by cesarean section. Mean birth weight of the infant was 3190.1 ± 565.0 grams.

The most common maternal complications was postpartum hemorrhage (17 cases, 10.5%). Among these, 15 cases were from uterine atony and the two others were from birth canal laceration. Other complications included mild pre-eclampsia (6 cases, 3.7%) and severe pre-eclampsia (3 cases, 1.9%). This is shown in Table 3

Data on neonatal complications are shown in Table 4. Large-for-gestational age (LGA) infants were found in 29 cases (17.9%) while SGA infants were found in only five cases (3.1%). The most common neonatal complication was hypoglycemia (111 cases, 68.5%), followed by jaundice (33 cases, 20.4%) and respiratory distress syndrome (8 cases, 4.9%). Birth asphyxia was found in only two cases (1.2%) and there was only one case of shoulder dystocia and stillbirth (0.6%).

Table 5 shows comparison of maternal and neonatal complications between GDM class A1 and A2. There were no significant differences in any maternal and neonatal complications. Interestingly, it should be noted that all infants of GDM A2 mothers experienced hypoglycemia and 50% had neonatal jaundice while 67.3% and 19.2% of infants of GDM A1 mothers experienced such conditions. However, no significant difference has been observed.

Table 2. Data on labor and delivery

Characteristics	N (%)
Mean GA at birth ± SD (weeks)	38.3 ±1.4
GA at birth	
Preterm	12 (7.4%)
Term	150 (92.6)
Mode of delivery	
Normal labor	97 (59.9%)
Forceps and Vacuum extraction	7 (4.3%)
Cesarean section	58 (35.8%)
Mean birth weight ± SD (g)	3190.1 ± 565.0

Table 3. Maternal complications

Complication	N (%)
Mild pregnancy-induced hypertension (PIH)	6 (3.7%)
Severe pregnancy-induced hypertension (PIH)	3 (1.9%)
Postpartum hemorrhage (PPH)	17 (10.5%)

Table 4. Neonatal complications

Complication	N (%)
Shoulder dystocia	1 (0.6%)
RDS	8 (4.9%)
Hypoglycemia	111 (68.5%)
Jaundice	33 (20.4%)
Stillbirth	1 (0.6%)
Size	
Appropriate for gestational age	128 (79%)
Small for gestational age	5 (3.1%)
Large for gestational age	29 (17.9%)
Apgar score at 5 minute	
≥ 7	160 (98.8%)
< 7	2 (1.2%)

Discussion

Gestational diabetes is one of the most common pregnancy complications that affects as many as 5% of all pregnancy women[9]. Early diagnosis and appropriate treatment could improve the prognosis and prevent associated morbidity and mortality of these pregnant women and their newborn infants.

In this study the most common clinical risk for GDM was maternal age of ≥ 30 years. This was similar to a previous report from Siriraj Hospital[8]. Another study of 2,139 Asian women revealed that previous GDM was the most significant clinical risk factor for screening GDM (odds ratio 14.5)[10]. A study of GDM in adolescence revealed that BMI is an important risk factor for the development of GDM in adolescence gravidas[11]. Previous report from Siriraj Hospital demonstrated that the significant risk factors were family history of DM, age ≥ 30 years, history of unexplained fetal death, and obesity[8]. The differences might be due to the differences in patient's characteristics and conditions in each population, criteria for screening GDM and criteria for diagnosis of GDM.

Our study revealed that maternal complications occurred in about 21.6% (35 cases) and the most

Table 5. Comparison of maternal and neonatal complications between GDM A1 and A2

Complicatons	GDM A1 N (%)	GDM A2 N (%)	p-value
Maternal complications			
Mild PIH	6 (3.8%)	0 (0%)	1.0
Severe PIH	3 (1.9%)	0 (0%)	1.0
PPH	15 (9.6%)	2 (33.3%)	0.12
C/S	54 (34.6%)	4 (66.7%)	0.19
Neonatal complications			
LGA	28 (17.9%)	1 (16.7%)	0.15
Birth asphyxia	9 (5.8%)	0 (0%)	1.0
Hypoglycemia	105 (67.3%)	6 (100%)	0.18
Jaundice	30 (19.2%)	3 (50%)	0.1
Stillbirth	1 (0.6%)	0 (0%)	1.0

common complication was postpartum hemorrhage (10.5%), followed by mild and severe pre-eclampsia respectively. The prospective cohort study performed in 1,310 women in Iran showed the most common maternal complication was gestational hypertension (9.7%)[12]. Another study of 972 GDM mothers in Saudi Arabia showed that common complications were perineal tear (18%) that may cause postpartum hemorrhage, followed by pre-eclampsia (2%)[13].

The most common neonatal complication found in our study was hypoglycemia (68.5%). This occurred in all infants of GDM class A2 mothers. Previous studies reported that neonatal hypoglycemia occurred from 5.5% to 25%[14-16], depending on fasting blood sugar of mother, criteria for diagnosis GDM, and timing for testing fetal blood sugar after birth. However, this condition should be anticipated in the majority of the cases, especially infants of GDM A2 mothers. Most studies showed fetal macrosomia occurred in about 10%-20% of infant of GDM mothers[17]. Our study demonstrated that 17.9% of infants of GDM mothers were LGA (17.9% in GDM A1 and 16.7% in GDM A2). However, some information related to infant's size was limited due to the nature of retrospective data such as glycemic control, dietary control, etc.

When GDM of different classes were compared, rate of maternal and neonatal complications such as birth asphyxia, RDS, jaundice, pregnancy induced hypertension were not statistically different. However, the samples were too small, especially in GDM A2 group, so that a definite conclusion could not be reached. In addition, our study lacked information on glycemic control that might affect both maternal and neonatal outcomes. A prospective study with more appropriate and accurate data collection should be conducted to answer these problems and provide more information with this regard in the future.

In addition, our study enrolled only pregnant women who received screening and diagnosis before 28 weeks of gestation. At-risk pregnant women who started antenatal care later might not be diagnosed with GDM until their third trimester. This group of women with undiagnosed GDM could possibly experience worse maternal and neonatal outcomes than those enrolled in our study. Therefore, early screening and diagnosis of GDM in high-risk women is still crucial for early treatment to prevent such adverse outcomes.

Although treatment guideline for GDM has been implemented for many years, some maternal and neonatal complications still existed. However, these complications were not severe and did not cause any mortality in our study. Nevertheless, these results provided more information to our institution to improve our guideline and further minimize both maternal and neonatal morbidities in the future.

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ผลเสียต่อการตั้งครรภ์ในสตรีที่มีภาวะเบาหวานขณะตั้งครรภ์

ดิฐกานต์ บริบูรณ์หิรัญสาร, ภัทรวลัย ตลึงจิตร, ประเสริฐ ศันสนีย์วิทยกุล, ราตรี ศิริสมบูรณ์

วัตถุประสงค์: *เพื่อศึกษาผลเสียของการตั้งครรภ์ในสตรีที่เป็นเบาหวานขณะตั้งครรภ์*
รูปแบบการวิจัย: *การวิจัยชนิดตัดขวาง*
สถานที่ทำการศึกษา: *ภาควิชาสูติศาสตร์-นรีเวชวิทยา คณะแพทยศาสตร์ศิริราชพยาบาล*
วัสดุและวิธีการ: *กลุ่มศึกษาคือสตรีตั้งครรภ์ที่เป็นเบาหวานขณะตั้งครรภ์ ซึ่งฝากครรภ์และคลอดในโรงพยาบาลศิริราชจำนวน 162 ราย ในปี พ.ศ. 2547 โดยสตรีทั้งหมดได้รับการตรวจคัดกรองภาวะเบาหวานขณะตั้งครรภ์และได้รับการดูแลรักษาตามแนวทางการดูแลรักษาที่ใช้ในโรงพยาบาลศิริราช ทำการทบทวนเวชระเบียนและเก็บข้อมูลต่างๆ ของกลุ่มตัวอย่าง ได้แก่ ข้อมูลพื้นฐาน ข้อมูลเกี่ยวกับการฝากครรภ์ ข้อมูลเกี่ยวกับปัจจัยเสี่ยงของภาวะเบาหวานขณะตั้งครรภ์ ผลของการตรวจคัดกรอง การวินิจฉัยสุดท้าย และภาวะแทรกซ้อนของมารดาและทารก หลังจากนั้นจะทำการรวบรวมข้อมูลต่าง ๆ และบันทึกข้อมูลในแบบบันทึกข้อมูลที่จัดทำขึ้น*
ผลการศึกษา: *ปัจจัยเสี่ยงที่พบบ่อยที่สุดในหญิงที่เป็นเบาหวานขณะตั้งครรภ์คืออายุตั้งแต่ 30 ปีขึ้นไป 71.6%, ประวัติโรคเบาหวานในครอบครัว 50% และภาวะอ้วน 29% ตามลำดับ โดยพบว่าส่วนใหญ่ (96.3%) เป็นเบาหวานชนิด A1 และพบชนิด A2 เพียง 3.7% พบภาวะแทรกซ้อนในมารดา 35 ราย (21.6%) และภาวะแทรกซ้อนที่พบบ่อยที่สุดคือการตกเลือดหลังคลอด (10.5%) ภาวะความดันโลหิตสูงขณะตั้งครรภ์ชนิดไม่รุนแรง (3.7%) และภาวะความดันโลหิตสูงขณะตั้งครรภ์ชนิดรุนแรง (1.9%) ตามลำดับ ส่วนภาวะแทรกซ้อนในทารกแรกเกิดพบว่าภาวะน้ำตาลในเลือดต่ำเป็นภาวะแทรกซ้อนที่พบบ่อยที่สุด 68.5% และพบในทารกทุกคนที่เกิดจากมารดาที่เป็นเบาหวานขณะตั้งครรภ์ชนิด A2 นอกจากนี้ยังพบทารกที่มีน้ำหนักตัวเกิน 4,000 กรัมจำนวน 29 คน (17.9%) ภาวะแทรกซ้อนระหว่างการตั้งครรภ์ทั้งในมารดาและทารกไม่มีความแตกต่างอย่างมีนัยสำคัญทางสถิติระหว่างสตรีที่เป็นเบาหวานชนิด A1 และ A2*
สรุป: *หญิงตั้งครรภ์ที่ได้รับการวินิจฉัยว่าเป็นเบาหวานขณะตั้งครรภ์และได้รับการดูแลรักษาตามแนวทางการดูแลรักษาสตรีตั้งครรภ์ที่เป็นภาวะเบาหวานขณะตั้งครรภ์ของโรงพยาบาลศิริราชไม่พบว่ามีภาวะแทรกซ้อนที่รุนแรงทั้งในมารดาและทารก*