Thai Journal of Obstetrics and Gynaecology
January 2010, Vol. 18, pp. 12 - 18

OBSTETRICS

Pregnancy Outcomes Among Parturients Complicated with Diabetes Mellitus at Rajavithi Hospital

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ABSTRACT

Objective: To assess the prevalence, demographic characteristics, route of delivery, maternal and neonatal outcomes and complications of parturients complicated with diabetes mellitus (DM) at Rajavithi Hospital.

Materials and Methods: Retrospective analysis of medical records of cases diagnosed pregnancy with DM from January 1, 2005 and September 30, 2007.

Result: The prevalence of parturients complicated with DM was 1.84% of total deliveries. The most common maternal and neonatal complications were hypertensive disorders in pregnancy (25%) and macrosomia (33.6%), respectively. Occurrence of hypertensive disorder in pregnancy, macrosomia and neonatal hypoglycemia were significant difference between class A_1, A_2 and $\geq$B.

Conclusion: The prevalence of parturients complicated with DM was 1.84% of total deliveries. The most common maternal and neonatal complications were hypertensive disorders complicating pregnancy and macrosomia.

Keywords: Diabetes mellitus, Parturients, Maternal outcome, Neonatal outcome

Introduction

Diabetes mellitus (DM) is an important medical complication in the pregnant population. Accumulating evidence reveal the significant association between DM in parturients and the following outcomes: hypertensive disorders in pregnancy, macrosomia, shoulder dystocia, neonatal metabolic problems (hypoglycemia, hyperbilirubinemia, hypocalcemia and polycythemia), and perinatal mortality[1-4]. The present study was carried out to assess the prevalence of parturients with DM at Rajavithi Hospital. The demographic characteristics, route of delivery, maternal and perinatal outcomes and other complications were also evaluated.

Material and Method

After approval of the hospital's Ethic Committee, a retrospective analysis was carried out on the medical records of parturients complicated with DM who were delivered at Rajavithi Hospital from January 1, 2005 to September 30, 2007. Those with gestational age less than 28 weeks or incomplete data were excluded from the study. In the screening procedure, pregnant

women with high risk for DM at Rajavithi Hospital were screened by 1-hour (50-g) glucose screening test. The cut-off point was set at[3] 140 mg% for confirmation by 100 g oral glucose tolerance test.[5]

The cut-off levels of plasma glucose at 0, 1, 2 and 3 hour after drinking 100 g glucose were 105, 190, 165 and 145 mg%, respectively[6]. The severity of DM was classified according to the classification of diabetes complicating pregnancy recommended by the American College of Obstetricians and Gynecologists (Table1)[7].

The estimation of the sample size was using the formula[8]

$$N = \frac{Z^2 \infty /2\ p(1-p)}{d^2}$$

N = Number of appropriate sample

$Z \infty /2$ = Standard value from Table Z at confidence level = 1.96 (Type I error = 0.05)

p = Proportion of PIH incidence cases in parturients complicated DM at Rajavithi Hospital in 2004

d = Error of estimation

$$N = \frac{Z^2 \infty /2\ p(1-p)}{d^2}$$

$$N = \frac{1.96^2 x\ 0.13(1-0.13)}{0.05^2}$$

$$= 173.79 = 174 \text{ cases}$$

Twenty percent of cases were added to the calculated number because of the limitation of the retrospective study of the present study. So the total number was174 + 35 = 209 cases.

Table 1. Classification of diabetes complicating pregnancy[7]

Class	Onset	Fasting plasma glucose	2-hour postprandial glucose	Therapy
A_1	Gestational	< 105 mg/dL	< 120 mg/dL	Diet
A_2	Gestational	> 105 mg/dL	> 120 mg/dL	Insulin
Class	**Age of onset (yr)**	**Duration (yr)**	**Vascular disease**	**Therapy**
B	Over 20	< 10	None	Insulin
C	10 to 19	10 to 19	None	Insulin
D	Before 10	> 20	Benign retinopathy	Insulin
F	Any	Any	Nephropathy[a]	Insulin
R	Any	Any	Proliferative retinopathy	Insulin
H	Any	Any	Heart	Insulin

[a] When diagnosed during pregnancy: proteinuria was measured to be 500 mg or more per 24 hours before 20 weeks' gestation.

Definition

- Preterm delivery was defined as delivery at less than 37 completed weeks of gestation[9].
- Macrosomia was defined as infants whose birthweight was above the 90th percentile for their gestational age[10] using standard intrauterine growth in Thai infant[11].
- Polyhydramnios was defined as excessive amniotic fluid of more than 2,000 ml or amniotic fluid index of greater than 24 cm by sonographic examination[12].
- Hypoglycemia was defined as the infants whose blood glucose was less than 45 mg/dL[13].
- Hyperbilirubinemia was defined as the infants whose serum bilirubin was more than 12 mg%[9].
- Respiratory distress syndrome was defined as the infants who had uneven expansion of lungs or lower airway obstruction. A grunting and flaring of the nostrils were occurred. The chest x-ray shows a diffused reticulogranular infiltrate with an

air-filled tracheobronchial tree (air bronchogram). The diagnoses were documented by neonatologist[14]. Polycythemia was defined as the infants whose hematocrit was more than 65%[9].

- Perinatal death was defined as death of the fetus or neonate from 28 weeks of gestation to 7th day after birth[3].
- Hypertensive disorder complicating pregnancy (HDP)[15] was defined to be five types.
  A. Gestational hypertension
     : BP ≥ 140/90 mmHg for first time during pregnancy without proteinuria and BP returns to normal < 12 weeks postpartum and may have other signs or symptoms of preeclampsia.
  B. Preeclampsia
     : BP ≥ 140/90 mmHg after 20 weeks' gestation with proteinuria ≥ 300 mg/24 hours or ≥ 1 + dipstick.
  C. Eclampsia
     : Seizures that cannot be attributed to other causes in a woman with preeclampsia.
  D. Superimposed preeclampsia (on chronic hypertensions)
     : New-onset proteinuria ≥ 300 mg/24 hours in hypertensive women but no proteinuria before 20 weeks' gestation.
  E. Chronic hypertension (CHT)
     : BP ≥ 140/90 mmHg before pregnancy or diagnosed before 20 weeks' gestation not attributable to gestational trophoblastic disease

The data were analyzed using Chi-square test, Fisher's exact test, ANOVA, arithmetic mean, standard deviation and ranges. The level of statistical significance was set at $p < 0.05$.

Results

During the study period at Rajavithi Hospital there were 16,033 deliveries, with 295 cases (1.84%) of parturients complicated with DM. Three cases with incomplete medical records (1.02%) were excluded, resulting 292 mothers and 296 newborns (4 couples of twin) remained in the study. The cases were classified according to the ACOG's classification[7] : A_1, 149 cases (51%); A_2, 117 (40.1%); B, 19 (6.5%); C, 4 cases (1.4%); F, 1 cases (0.3%) and R, 2 cases (0.7%). Table 2 shows main obstetric characteristics of the patients classified as class A_1, A_2 and ≥ B.

The most common maternal age and gestational age at delivery were in the 20 - 34 years and 37 - 41 weeks in all classes. Cesarean section was the most common route of delivery in all classes. Table 3 shows maternal and neonatal complications among parturients complicated with DM classified by ACOG's classification. Hypertensive disorder complicating pregnancy was the most common prevalent maternal complication showing significant difference in each class, ranking as class ≥ B, class A_2, class A_1, respectively. When subgroup analysis was performed, CHT with superimposed preeclampsia was the only group found significantly different among the three classes. There was no eclampsia in the present study.

Macrosomia was the most common neonatal complication found significantly difference among groups, ranking as class ≥ B, class A_2, to class A_1, respectively. Hypoglycemia was another significant complication ranking as class ≥ B, to class A_2, class A_1, respectively.

Discussion

The prevalence of parturients complicated with DM at Rajavithi Hospital (1.84%) seemed to be much higher than those reported in the other two previous Thai studies at Ramathibodi Hospital and Lerdsin Hospital (0.3% and 0.4%, respectively)[3, 4]. However, it was slightly lower than those reported in Malta, USA, China and Iran (2.2%, 2.5%, 3.8% and 4.7%, respectively[16, 17, 9, 18]). The prevalence of parturients complicated with DM in class ≥ B decreased from 40.5% at Ramathibodi Hospital (1969-1989)[3] to 22.7% at Lerdsin Hospital (1987-1997)[4] and 8.4% at Rajavithi Hospital (present study, 2005-2007) while those in class A_2 increased from 21.8% at Lerdsin Hospital [4] to 40.6% at Rajavithi Hospital. The influence of westernized diet and the obesity in Thailand in the past decade years were postulated to be one of the reasons to explain these differences.

Table 2. The main obstetric characteristics of parturients complicated with DM classified by ACOG's classification.

Characteristics	Parturients with DM				p-value
	N = 149 Class A_1 N (%)	N = 117 Class A_2 N (%)	N = 26 Class ≥ B N (%)	N = 292 Total N (%)	
1. Maternal age (years)					
: ≤ 19	4	2	0	6	
: 20 - 34	69	68	15	152	N.A.
: ≥ 35	76	47	11	134	
(Mean ± SD)(years)	33.4 ± 5.8	32.44 ± 5.5	33.0 ± 6.8	32.9 ± 5.8	0.40
2. Prepregnancy BMI (Mean ± SD) (kg/m^2)	30.17 ± 4.49	32.89 ± 6.08	32.04 ± 7.62	31.42 ± 5.63	< 0.05*
3. GA. At delivery (weeks)					
: ≤ 36	19	14	10	43	
: 37 - 41	129	103	16	248	N.A.
: ≥ 42	1	0	0	1	
(Mean ± SD)(weeks)	37.9 ± 2.0	37.8 ± 1.8	36.8 ± 2.1	37.8 ± 1.9	0.03*
4. Birth weight (Mean ± SD)(grams)	3,094.91 ± 618.54	3,291.70 ± 647.91	3,116.8 ± 778.192	3,175.7 ± 650.39	0.04*
5. Mode of delivery					
5.1 Spontaneous vaginal delivery	56(37.6)	38(32.5)	3(11.5)	97(33.1)	0.034
5.2 Operative vaginal delivery					
- Forceps extraction	5(3.4)	2(1.7)	1(3.8)	8(2.7)	0.67
- Vacuum extraction	3(2.0)	3(2.6)	0(0)	6(2.1)	0.71
5.3 Cesarean section	85(57.0)	74(63.2)	22(84.6)	181(62)	0.026*
- Primary	60(40.3)	49(41.9)	17(65.4)	126(43.2)	0.054
- Repeated	25(16.8)	25(21.4)	5(19.2)	55(18.8)	0.636
6. Treatment of DM					
6.1 Diet control	145(97.3)	24(20.5)	1(3.8)	170(58.2)	< 0.001*
6.2 Insulin	4(2.7)	93(79.5)	25(96.2)	122(41.8)	< 0.001*

* p – value < 0.05 was statistically significant.

Table 3. Maternal and neonatal complications among parturients complicated with DM classified by ACOG's classification

Complications	Parturients / or neonates born to parturients with DM				p-value
	N = 149 Class A_1 N (%)	N = 117 Class A_2 N (%)	N = 26 Class ≥ B N (%)	N = 292 Total N (%)	
Maternal Complications					
• Hypertensive disorder complicating pregnancy	26(17.4)	33(28.2)	14(53.8)	73(25.0)	0.011*
- Gestational hypertension	3(2.0)	2(1.7)	1(3.8)	6(2.1)	0.785
- Preeclampsia	12(8.1)	13(11.1)	5(19.2)	30(10.3)	0.207
- Chronic hypertension	6(4.0)	13(11.1)	3(11.5)	22(7.5)	0.068
- Superimposed preeclampsia (on chronic hypertension)	5(3.4)	5(4.3)	5(19.2)	15(5.0)	0.003*
• Premature labor	19(12.8)	16(13.7)	6(23.1)	43(14.6)	0.372
• Polyhydramnios	5(3.4)	1(0.9)	0(0)	6(2.0)	0.268
• Postpartum hemorrhage	4(2.7)	6(5.1)	2(7.7)	12(4.1)	0.382
Neonatal Complications					
• Macrosomia	36(24.2)	49(41.9)	13(50)	98(33.6)	0.002*
• Birth injury	0(0)	1(0.9)	0(0)	1(0.3)	0.472
• Respiratory distress syndrome	2(1.3)	2(1.7)	1(3.8)	5(1.6)	0.662
• Congenital anomalies	2(1.3)	3(2.6)	0(0)	5(1.6)	0.583
• Perinatal death	2(1.3)	2(1.7)	0(0)	4(1.3)	0.794
• Hypoglycemia	5(3.4)	7(6.0)	5(19.2)	20(6.6)	0.006*
• Hyperbilirubinemia	7(4.7)	2(1.7)	0(0)	9(3.1)	0.238
• Polycythemia	1(0.7)	0(0)	0(0)	1(0.3)	0.618
• Intrauterine growth restriction	4(2.7)	0(0)	1(3.8)	5(1.6)	0.167

One case may had more than one complications, * p – value < 0.05 was statistically significant.

HDP was still the most common maternal complication in the present study (25%), similar to those found in the two previous Thai studies (27.5% and 26.7%)[3,4]. Hollander et al[1] suggested that age and BMI could be one of the predisposing factors for GDM as well as hypertension. Van Assche et al[19] proposed that increased thromboxane generation could relate to the occurrence of preeclampsia. HDP was also found to be significantly different among classes, ranking as class ≥ B, class A_2 to class A_1. When subgroups of HDP were considered, CHT with superimposed preeclampsia was the only complication significantly difference among classes, with highest incidence in class ≥ B when compared to class A_1 and A_2.

Polyhydramnios in the present study (2%) was similar to those at Ramathibodi Hospital (2.5%)[3] but much lower than those at Lerdsin Hospital (7.9%)[4]. There were only a few previous foreigner's papers reported the prevalence of polyhydramnios, the incidence varied from 2.7 to 32%[20,21]. Polyhydramnios could be caused by excessive fetal urine production

secondary to hyperglycemia[22]. Current data demonstrated that polyhydramnios is still a maternal complication in GDM patients[12, 22].

Similar to previous studies[5, 23], macrosomia was the most common neonatal complication in the present study, even though it was classified by many criteria. The incidence of macrosomia in the present study (33.6%) was higher than those in previous foreign studies (16-29%)[24, 25] but lower than those in previous Thai studies (43.6% and 44.5%)[3,4]. A remarkably lower number of parturients with DM class ≥ B (8.9%) in the present study compared with that in the previous Thai studies (40.5% and 32.7%)[3, 4] was postulated to be one of the causes of lower incidence of macrosomia in the present study.

Hypoglycemia was significantly higher in the neonates of mothers in class ≥ B (19.2%) than those in classes A_1 and A_2 (3.4% and 6.0%, respectively), but there was no significant difference in neonatal hypoglycemia between diet control and insulin treatment groups in the present study. Fan et al[9] reported the similar non-significant difference prevalence of hypoglycemia between diet control and insulin treatment group. They also reported similar result in prevalence of hypoglycemia between poorly and well controlled glycemia groups[9].

In conclusion, the prevalence of parturients complicated with DM at Rajavithi Hospital during 2005-2007 was 1.84% of total deliveries. The most common maternal and neonatal complications were hypertensive disorders complicating pregnancy and macrosomia (25% and 33.6%, respectively).

Acknowledgement

The authors wish to thank Rajavithi Hospital for the research grant to support this study, and are grateful to Dr.Rina Patramanon from Faculty of Science, Khon Kaen University in language correction.

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ผลของการตั้งครรภ์ของผู้คลอดโรคเบาหวานที่โรงพยาบาลราชวิถี

เอกชัย โควาวิสารัช, สุธารัตน์ ศรีเมือง

วัตถุประสงค์ *: เพื่อประเมินความชุก ลักษณะทางประชากรศาสตร์ วิธีการคลอด ผลลัพธ์ของมารดาและทารกแรกเกิด และภาวะแทรกซ้อนของผู้คลอดโรคเบาหวานที่โรงพยาบาลราชวิถี*

วัสดุและวิธีการ *: ศึกษาย้อนหลังจากเวชระเบียนของผู้คลอดโรคเบาหวานที่โรงพยาบาลราชวิถีตั้งแต่วันที่ 1 มกราคม 2548 ถึงวันที่ 30 กันยายน 2550*

ผลการศึกษา *: ความชุกของผู้คลอดโรคเบาหวานที่โรงพยาบาลราชวิถีเท่ากับ ร้อยละ1.84 ของการคลอดทั้งหมด ภาวะแทรกซ้อนของมารดาและทารกแรกเกิด ที่พบได้บ่อยที่สุด ภาวะความดันโลหิตสูงในระหว่างตั้งครรภ์ (ร้อยละ 25) และภาวะทารกตัวโต (ร้อยละ 33.6) พบว่าภาวะความดันโลหิตสูงในระหว่างตั้งครรภ์ ภาวะทารกตัวโต และภาวะทารกมีน้ำตาลในเลือดต่ำ มีความแตกต่างกันอย่างมีนัยสำคัญระหว่างมารดาที่เป็นโรคเบาหวานขั้น A_1, A_2 และ $\geq B$*

สรุป *: ความชุกของผู้คลอดที่มีโรคเบาหวานแทรกซ้อนที่คลอดที่โรงพยาบาลราชวิถีเท่ากับร้อยละ 1.84 ของการคลอดทั้งหมด ภาวะแทรกซ้อนของมารดาและทารกที่พบได้บ่อยที่สุดคือ ความดันโลหิตสูงในระหว่างตั้งครรภ์และภาวะทารกตัวโต*