GESTATIONAL DIABETES : OBSTETRIC AND NEONATAL OUTCOME IN 411 CASES

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ABSTRACT

Aim: To study the obstetric and neonatal outcome of women with gestational diabetes mellitus.

Methods: Four hundred and eleven (411) women with gestational diabetes mellitus were studied retrospectively. The control group was 3,391 non-diabetic women delivered in the same period.

Results: Women with gestational diabetes mellitus had a significantly higher incidence of pregnancy-induced hypertension, and more were likely to present with malpresentation in labour. They had a higher incidence of surgical induction and an increased incidence of elective and emergency Caesarean section rate compared to controls.

The neonatal outcome was excellent. The perinatal morbidity and mortality were similar to the non-diabetic controls.

Conclusion: The excellent outcome of the women with gestational diabetes mellitus in this study is attributed to tight control of blood glucose level and close attention given to this group of patients.

Keywords: gestational diabetes mellitus, obstetrics outcome neonatal outcome

SINGAPORE MEDJ 1996; Vol 37: 591-594

INTRODUCTION

Gestational diabetes mellitus affects 3%-12% of the obstetric population[1,2]. Older studies have shown that if undiagnosed or untreated, diabetes in pregnancy is associated with increased perinatal mortality and morbidity[3,4]. However, virtually all the recent series demonstrate that the perinatal mortality rate associated with gestational diabetes is not above the background risk[5,6]. This could be attributed to the manner of treatment in these recent series.

We report a retrospective study of women with gestational diabetes mellitus and compared obstetric and neonatal outcome with a group of 3,391 non-diabetic women.

METHODS

The case records of 411 women with gestational diabetes mellitus (GDM) who delivered in National University Hospital, Singapore between January 1990 and 31 March 1993, were studied retrospectively. These women had been diagnosed with gestational diabetes mellitus by a 75g oral glucose tolerance test in pregnancy (WHO, 1985)[7] and subsequently showed normal glucose tolerance test 6 weeks after delivery.

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All patients were admitted to hospital for assessment of blood glucose profile and control. Blood glucose control was achieved in the first instance by instituting a diabetic diet. In women whose blood glucose profile remained unsatisfactory, ie preprandial >5.5 mmol/L and post-prandial glucose of >6.6 mmol/L, subcutaneous insulin was prescribed (short acting insulin three times/day and medium acting insulin (Monotard) at 10 pm if necessary) so as to maintain euglycaemia. The women were subsequently discharged for follow-up in the outpatient diabetic clinic. Monitoring of the diabetic condition included monthly glycated haemoglobin and a 2-hour post-prandial blood glucose at each clinic visit. Women requiring insulin for maintenance of euglycaemia were lent a glucometer and were instructed to perform a weekly blood glucose profile at home. If the diabetic control was unsatisfactory, they were then readmitted.

For the purpose of this study, assessment of mean blood glucose level at 3 gestational periods were considered, ie <28 weeks, 28-35 weeks and >35 weeks. This was done by averaging the blood glucose levels in each period. Levels >6.6 mmol/L was considered as poor control.

At 22 weeks, a fetal abnomality scan was performed, followed by a repeat growth scan at 32 weeks. Subsequently, growth scans and nonstress tests and amniotic fluid index assessments were used for fetal surveillance as necessary. For women who were well-controlled on diet, pregnancy was terminated at 40 weeks amenorrhoea. In those who required insulin to maintain euglycaemia, pregnancy was terminated at 38 weeks amenorrhoea. Women with poor blood glucose control were delivered as and when necessary.

After birth, all infants born to these mothers, were admitted to the neonatal ward for observation and assessment by a neonatal paediatrician. Following assessment of the newborn for congenital anomalies, the capillary glucose was determined within 1 hour of birth and at pre-meals for the first 3 milk feeds. These infants were fed early to prevent development of hypoglycaemia. They were also observed for hyperbilirubinaemia, respiratory distress syndrome and transient tachypnoea of the newborn.

The outcome of the pregnancies was assessed by type of labour, mode of delivery, neonatal outcome in terms of congenital malformation, birthweight, presence of hyperbilirubinaemia, neonatal hypoglycaemia and respiratory distress syndrome. The criteria for diagnosis of neonatal morbidities are as follows: hyperbilirubinaemia - serum bilirubin >220 mmol/L at < 72 hours

after birth, hypoglycaemia - <1.1 mmol/L at <34 weeks and <2.2 mmol/L at >34 weeks, respiratory distress syndrome - when baby required assisted ventilation for >24 hours. Statistical analyses were performed using the student's t-test.

RESULTS

A 75g glucose tolerance test was performed when there were high risk factor such as first degree relatives who are diabetic, previous history of gestational diabetes mellitus, persistent glycosuria, positive glucose challenge test [1 hour blood glucose level >7.8 mmol/L [7]], fetal macrosomia or polyhydramnios [8]. More than three-quarters of the women had an oral glucose tolerance test performed because of diabetes mellitus in first degree relatives (44%) or because glycosuria (32.3%) was detected at a routine antenatal clinic visit (Table I).

Table I – Indications for OGTT

Indications for OGTT	N=411	Percentage (%)
1. Glycosuria	133	32.3
2. H/O 1st degree relatives with DM	181	44.0
3. Previous pregnancy had GDM	42	10.2
4. High maternal weight	3	0.7
5. High maternal weight gain	7	1.7
6. Glucose challege test positive	33	8.0
7. Bad obstetric history	7	1.7
8. Polyhydramnios	8	1.9
9. Macrosomia	32	7.8
10. Elderly mothers	3	0.7
11. Recurrent vaginal moniliasis	2	0.05
12. Triplets on salbultamol	1	0.02
13. Indications not stated	24	5.8

Diabetic control (Table II)

The diabetic control in these patients with gestational diabetes was good. The proportion of blood glucose (BGL) levels and HbA1c level that were abnormal (ie BGL >6.6 mmol/L and HbA1c > 6%) in the 3 gestational periods were less than 7% and 3% respectively. The majority of patients were on dietary control while 5.4% (22/411) required insulin as well.

Table II – Diabetic control in pregnancy

	<27 wks	28-35 wks	>35 wks
HbA1c > 6%	5/138 (3.6%)	4/188 (2.1%)	4/58 (6.8%)
BGL > 6.6 mmol/L	2/170 (1.2%)	6/317 (1.9%)	6/275 (2.2%)

Obstetric complications (Table III)

The obstetric complications among GDMs were compared to 3,391 patients who delivered in 1992 and whose pregnancies were not complicated by diabetes mellitus (control group). Women with gestational diabetes were significantly more likely to have hypertension and present with malpresentation (other than breech) at the onset of labour. However, the incidence of anaemia was significantly less in women with gestational diabetes compared with controls. There was no significant difference in incidence of multiple pregnancies, cervical incompetence, thyrotoxicosis and breech presentation.

Women with gestational diabetes mellitus had a significantly higher rate of surgical inductions and both elective and emergency Caesarean section compared to the control group (Table IV).

Table III – Associated obstetric complications in GDM patients

Obstetric complications	GDM n = 411 (%)	Control n = 3391 (%)	P value
Hypertension	23 (5.6)	124 (3.7)	*
Small for dates (<2500g)	36 (8.8)	340 (10.0)	ns
Anaemia	7 (1.7)	132 (3.9)	*
Antepartum haemorrhage	10 (2.4)	62 (1.9)	ns
Multiple pregnancy	5 (1.2)	34 (1.0)	ns
Malpresentation (Other than breech)	3 (0.7)	4 (0.1)	**
Cervical incompetence	2 (0.5)	6 (0.2)	ns
Thyrotoxicosis	2 (0.5)	20 (0.6)	ns
Breech presentation	18 (4.3)	122 (3.6)	ns

ns - not significant
*P<0.05
**p=0.001-0.01

Table IV – Obstetric complications

	GDM n=411 (%)	Control n=3391 (%)	P value
Surgical Inductions	71 (17.3)	266 (7.8)	**
Instrumental vaginal deliveries	32 (7.8)	232 (6.9)	ns
Elective Caesarean Indications	30 (7.3)	125 (3.6)	**
Breeches	7 (23.3)		
Other malpresentation	2 (6.7)		
Macrosomia	15 (50.0)		
IUGR	3 (10.0)		
Placenta praevia	3 (10.0)		
Emergency Caesarean Indications	55 (13.4)	343 (10.2)	*
Failed induction	15 (27.2)		
No progress	28 (50.9)		
Fetal distress	9 (16.4)		
Breech in labour	1 (1.8)		
Face presentation	1 (1.8)		
Cord presentation	1 (1.8)		
Total Caesarean	85 (20.7)	468 (13.8)	***

ns - not significant
* p=0.01-0.05
** P=0.001-0.01
***P<0.001

Neonatal complications

The neonatal outcome of the 411 infants of diabetic mothers were excellent. 1.8% (9 babies) were admitted to the neonatal intensive care unit compared to the average admission in the control group of 11.5%. The indications for admission into intensive care unit were hypoglycaemia (0.7%), prematurity (1.2%), transient tachypnoea of newborn and meconium aspiration syndrome (0.4%). The neonatal problems faced by infants of diabetic mothers were neonatal jaundice 3.1% (13), hypoglycaemia 0.7% (3) and tachypnoea of the newborn 0.2% (1), prematurity 1.2% (3), small for dates 1.2% (5), meconium

aspiration syndrome 0.2 (1), twins 0.8% (4 sets), birth asphyxia 0.2% (1), and hypothyroidism 0.4% (2) (Table V).

Two infants of diabetic mothers had congenital malformation. The 34-year-old mother of the Malay infant with complex malformation of the heart and cleft lip and palate was diagnosed to be gestational diabetes mellitus at 36 weeks amenorrhoea and was well-controlled on diet. She was induced at 40 weeks and had emergency Caesarean section performed for failed induction. The baby's birthweight was 3.4 kg. The mother of the second (Indian) baby was diagnosed to be gestational diabetes mellitus at 23 weeks amenorrhoea and was well-controlled on diet. The pregnancy was complicated by intrauterine growth retardation and ended in elective Caesarean section. At birth, the infant weighed 2.3 kg and Apgar score at 5 minutes was 2. The infant required intubation and was admitted to neonatal intensive care unit. He had congenital pneumonia and was floppy at birth. Later, he developed spastic cerebral palsy.

There was significantly more babies between 3000-3490 gm among infants of diabetic mothers and less infants between 2500-2900 gm compared to control group. Although more infants had birthweight greater than 4 kg, the difference did not reach statistical significance (Table VI)

Table V – Neonatal complications in 41 of 411 GDM patients (415 babies)

Neonatal Complications	No (%)
NICU admission	9 (1.8)
Neonatal jaundice	13 (3.1)
Hypoglycaemia	3 (0.7)
Prematurity	3 (1.2)
Small for dates	5 (1.2)
Transient tachypnoea of newborn	1 (0.02)
Meconium aspiration syndrome	2 (0.04)
Hypothyroidism	2 (0.04)
Birth hypoxia	1 (0.02)
Gastric problem	1 (0.02)
Pneumomediastinum	1 (0.02)

Table VI – Birthweights of infant of diabetic mothers

Birthweights	GDM n=411 (%)	Control n=3391 (%)	P value
<2500 g	36 (8.8)	340 (10.0)	ns
2500-2900 g	87 (21.2)	971 (28.6)	**
3000-3490 g	191 (46.5)	1421 (41.9)	*
3500-3990 g	80 (19.5)	559 (16.5)	ns
>4000 g	17 (4.1)	100 (2.9)	ns

ns - not significant
* p=0.01-0.05
**p=0.001-0.01

Crude perinatal mortality rate was 0.4/1000 births due to death of 1 set of twins from extreme prematurity. The corrected perinatal mortality is zero.

DISCUSSION

The majority of women with GDM managed in this centre between January 1990 and March 1993 were screened by classical historical risk factors for the oral glucose tolerance test. Eight percent of women with GDMs were identified using a 50g 1-hour glucose challenge test. We do not routinely perform glucose challenge test in all patients, but the cohort of patients referred from government outpatient clinics have routine glucose challenge test performed between 24-28 weeks.

It has been shown that lowering blood glucose level to near normoglycaemic profile in women with gestational diabetes mellitus will prevent diabetic complications[8-10]. More common complications in infant of diabetic mothers include spontaneous abortion, stillbirth, macrosomia, metabolic complications and neonatal and maternal trauma due to shoulder dystocia in large for gestational age infant. Higher mean blood glucose level is reported to result in a 12-fold higher relative risk of developing macrosomia compared with those with lower blood glucose levels [11]. In our GDM patients, we defined normal mean blood glucose level as ≤ 6.6 mmol/L. In this population, blood glucose control was generally good as only 5.3% of the blood glucose level and 12.5% of HbA1c were abnormal (Table II). The increasing trend of abnormal blood glucose level with gestational age is most probably due to increase of insulin resistance which occurs as pregnancy advances.

In the few earlier studies in which gestational diabetes was either undiagnosed or untreated, the perinatal mortality rates were directly proportional to the degree of glucose intolerance [3,4]. Current studies do not confirm such a perinatal risk, as all involved some sort of intervention or intensive surveillance and thus do not represent gestational diabetes in its undiagnosed state. Obstetric outcome was excellent in the group of women with gestational diabetes mellitus when compared with the control group except for an increased incidence of hypertension and malpresentation.

The policy of surgical induction at 38 weeks for insulin-dependent diabetes and at 40 weeks for GDMs on diet, has resulted in a significantly higher surgical induction rate compared to the control group. This is the case in other studies as well and has been a matter for concern recently[9]. The rationale for early induction in diabetic mothers is to prevent the odd case of sudden unexplained intrauterine deaths. However, the incidence of intrauterine deaths is low in well-controlled diabetics. Furthermore, data on which early induction is based is controversial; the question has been raised as to whether it is necessary for surgical induction, especially in the presence of poor cervical score [14] in mild gestational diabetes mellitus with good control of diet. Failed surgical induction and failure to progress in labour had led to higher rates in emergency Caesarean section. In this group of women, 27.2% (15/55) of all emergency Caesarean sections performed were for failed induction and 50.9% (28/55) were for poor progress in labour. The significantly higher rate in elective Caesarean section may be attributed to a high rate of elective section for malpresentation (including breech presentation) (30%) and to clinically diagnosed macrosomia (50%).

The incidence of macrosomia (birthweight ≥ 4 kg) was 2.9% in infants of non-diabetic women compared to 4.1% in infants of diabetic mothers (IDM). The large size of a macrosomic infant is the result of greater visceral size of more numerous and larger cells from hyperinsulinaemia [10,11]. Tight maternal serum glucose control has been shown to decrease the incidence of fetal macrosomia [12]. Indeed, it has been shown that prophylactic insulin in pregnancy reduced the incidence of macrosomia [10] in infant of diabetic mother. The low incidence of macrosomic babies (4%) among our IDM may be attributed to good glycaemic control maintained till delivery. Insulin was prescribed in our population of gestational diabetes mellitus only if a 3-day trial of diabetic diet failed to bring the blood glucose profile to euglycaemic levels.

Hypoglycaemia has been reported to occur in 47% of

macrosomic and 20% of nonmacrosomic IDM[13]. The incidence of hypoglycaemia in this group of IDMs is only 0.7% which could be attributed to the low incidence of macrosomia and good glycaemic control in the peripartum period. The rates of hyperbilirubinaemia and tachypnoea of the newborn in this group of IDM were low.

The malformation rate in this study was 0.2% involving the heart, cleft lip and palate in one infant. As expected, this rate is not higher than the control group as gestational diabetes is usually mild and manifested in later part of pregnancy beyond the period of fetal organogenesis.

In conclusion, this study on infants of gestational diabetes mothers enjoyed a low perinatal morbidity and zero corrected perinatal mortality. The excellent outcome, which is comparable to other studies, is attributed to tight control of blood glucose level and close attention given to this group of patients.

We have shown in a population of women with GDM, that tight blood glucose control and closer antenatal supervision resulted in obstetrics outcome and perinatal morbidity and mortality to be similar to the general obstetrics population.

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