OBSTETRIC OUTCOME OF PREGESTATIONAL DIABETIC PREGNANCIES

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ABSTRACT

This retrospective study examined the obstetric and neonatal outcome in 23 pregestational diabetic pregnancies. The incidence of congenital malformations and mortality in infants of diabetic mothers was increased compared to the control population. Late booking for antenatal care and poor glycaemia control are probably the reasons for this high incidence. There was also a significantly higher preterm delivery and Caesarean section rate in the pregnancies complicated by pregestational diabetes. The neonatal morbidity was also higher than the controls in terms of jaundice, hypoglycaemia, respiratory distress syndrome and admissions to neonatal intensive care unit.

Only with preconception counselling and tight glycaemia control in the periconception period and throughout pregnancy can we expect a drop in the complication rates in pregestational diabetic pregnancies.

Keywords: *pregestational diabetes mellitus, obstetric outcome, neonatal outcome.*

SINGAPORE MED J 1995; Vol 36: 498-500

INTRODUCTION

Over the past 30 years, despite falling perinatal mortality and morbidity in the general obstetric population, pregnancies complicated by diabetes mellitus remain a major source of perinatal mortality and morbidity[1]. Congenital malformations are a major cause of the high perinatal mortality and morbidity in this group of patients[1-5].

We embarked on this retrospective study to look at the obstetric and neonatal outcome of a group of pregestational diabetics with a view to suggest how changes in the management of this group of women might improve obstetric and neonatal outcome.

PATIENTS AND METHODS

The case records of 23 antenatal patients with pregestational diabetes mellitus who attended the Diabetic Clinic in the Department of Obstetrics and Gynaecology, National University Hospital, Singapore, between October 1, 1989 and March 31, 1993 were studied retrospectively. All patients were admitted to hospital for assessment of blood glucose profile and subsequently discharged for follow-up in the outpatient diabetic clinic. Monitoring of the diabetic condition include weekly 7-points home glucose profile, monthly glycated haemoglobin, and a 2-hour postprandial hypocount at each clinic visit. If the diabetic control is 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 poor control.

An ultrasound scan was scheduled at 12-13 weeks amenorrhoea to date the pregnancy as well as to detect gross neural tube defect and cardiovascular abnormality. At 22 weeks, a foetal abnormality scan was performed, followed by a repeat growth scan at 32 weeks. Subsequently, growth scans and nonstress test and amniotic fluid index assessment were used for foetal surveillance. For well controlled diabetics, pregnancy was terminated at 38-39 weeks amenorrhea.

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 from birth and at pre-meals for the first 3 milk feeds. The infants would be fed early so as to prevent development of hypoglycaemia. They would also be 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: macrosomia - birthweight > 4kg, 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.

The outcome of this group of pregestational diabetic pregnancies was compared with a group of 23 normal women delivered in the same period in this hospital selected at random and controlled for age, race and parity. For statistical analysis, the Z value for test of proportion was used.

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RESULTS

The mean age of this group of patients was 29.5 years (range 24-44 years). Three patients (13.3%) were diabetic for < 1 year, 13 patients (56.5%) between 1-5 years, 5 patients (21.7%) betweent 6-10 years and 1 patient (4.3%) each between 11-15 years and > 16 years.

Of the 23 pregestational pregnant diabetics studied, 8 (34.7%) were on dietary treatment prior to pregnancy, 7 (30.4%) were on oral hypoglycaemics and the remaining 8 (34.7%) were on insulin injections. The average gestational age at first antenatal visit was 11.7 weeks. Five patients (62.5%) on dietary control were seen in the first trimester, compared to 3 (42%) who were on oral hypoglycaemic and 4 (50%) who were on insulin injections. The differences were not statistically significant. During pregnancy, 19 patients (82.6%) were on insulin plus diet, while the remaining 4 (17.4%) were on dietary treatment, with no patient on oral hypoglycaemic agents. All patients (total of 8) who required insulin prior to pregnancy required progressive increased amount of insulin throughout pregnancy. All (7 patients) of those originally on hypoglycaemic required insulin. Of those on dietary control prior to pregnancy, 50% (4 of 8 patients) continued on dietary control and the rest required insulin. Table I shows the proportion of patients with average blood glucose profile > 6.6mmol/L at different gestational age. Fourteen patients (60.8%) had a HbAlc level which was high (> 6%) at booking (see Table II). Of 12 patients with high average blood glucose profile at booking, 11 (91.6%) had high HbA1c level as well. Three patients delivered babies with congenital abnormality, of which 2 had high HbA1c and mean blood glucose level at booking while one patient had normal HbA1c and mean blood glucose level at booking.

Table I - Proportion of patients who had mean blood glucose level > 6.6mmol/L at different gestational age.

Gestational Age (weeks)	No. of patients (n)	No. of patients with glucose level > 6.6mmol/L (%)
< 28	21	4 (19)
28-35	22	2 (9)
> 35	17	2 (11.7)

Maternal Complications and Obstetric Outcome

Three patients (13.3%) had diabetic complications; two patients had diabetic nephropathy and had diabetes for 3-4 years and another had retinopathy and nephropathy. This patient had diabetes for 10 years.

During pregnancy, 4 patients (17.3%) had obstetric complications. Two had asymmetrical macrosomia (head / abdominal circumference ≤ 5%), with one patient delivering spontaneously at 37 weeks a baby of birthweight 3.2kg, while the second patient had breech presentation and had elective Caesarean section resulting in a baby of birthweight 4.2kg. The third patient had intrauterine growth retardation of the foetus and hypertension (this patient had diabetic retinopathy and nephropathy discussed previously) and had elective Caesarean section. The baby was found to have congenital heart disease (pulmonary atresia with intact interventricular septum). One patient had significant proteinuria without hypertension (as discussed previously) and antenatal ultrasound scans revealed foetal congenital heart disease (transposition of great vessels). This patient was treated for preterm labour three times and at 34 weeks was in established labour but unfortunately did not progress beyond 5 cm dilatation after 17 hours, hence resulting in emergency Caesarean section. The baby, of birth weight 3 kg,

Table II - Profile of patients' mean blood glucose level, HbA1c at different gestational ages.

Case No.	At booking			HbA1c (%)		
	Gestation (weeks)	Mean BSL mmol/L	HbA1c (%)	< 28 weeks	28-35 weeks	> 35 weeks
1.	7	6.2	4.9	4.8, 4.2 5.1, 5.6		
2.	7	4.6	5.7	5.4		
3.	25	14.7	11.6			
4.	9	8.1	9.9	6.8		6.4
5.	4	11.4	11.0	8.3, 5.7	6.9	
6.	7	5.6	5.3	4.8	5.4	
7.*	7	12.4	10.3	7.8, 6.6, 6.6		
8.	24	6.0	4.9	5.2		
9.	7	5.6	5.6	6.5, 5.1		
10.	13	5.0	5.3		5.7	
11.	14	6.6	5.3	5.5		
12.	8	5.4	5.7	4.7, 5.1	6.1	
13.	18	8.5	6.2		5.3, 5.4	5.6
14.	9	7.5	6.8	6.3		
15.	7	10.6	9.5	7.6, 6.0		7.2
16.	10	6.3	6.3	5.7	8.1	
17.	13	6.9	6.9			
18.*	7	11.4	9.1	9.1, 5.9	6.3	6.7
19.*	12	10.5	6.3	6.3	5.6	6.2
20.	28	5.1	5.4		5.4	
21.	14	3.9	6.2	5.8	5.2	
22.	6	13.3	9.4	7.4, 7.1	7.9	
23.	14	5.8	7.7	6.8	8.3	

*congenital heart disease

died on day 10 immediately after an arterial switch operation.

The comparison of obstetric outcome of the pregestational diabetics and the paired controls is shown in Table III. The pregestational diabetics had significantly higher Caesarean section rate. The surgical inductions and instrumental vaginal deliveries rates of the 2 groups were similar. There were 9 preterm deliveries (39.1%) in the group of pregestational diabetics compared to 3 (13.0%) preterm deliveries in the control group. Fifty-six percent (5 of 9 patients) of the preterm deliveries in pregestational diabetics were iatrogenic. Birthweights in the 2 groups were not significantly different in spite of the significantly higher preterm deliveries in the pregestational diabetic group.

Three (13%) of the infants in the pregestational diabetics group had severe congenital heart disease as compared with 4.3% in the normal control group. Two deaths were recorded among these 3 infants at Day 11 and 1.5 years respectively, both in the postoperation period after corrective surgery. The third infant had complex heart disease with univentricle heart and coartation of aorta and had undergone surgery. His mother had diabetes for 6 years.

There was one (4.3%) case each of stillbirth and neonatal death in the control group compared to 2 (8.6%) postnatal deaths in infants of pregestational diabetics (see Table III). The total mortality in both groups were not significantly different. All 3 deaths were due to congenital heart disease.

Table III - Comparison of obstetrics outcome between pregestational diabetics and controls.

	Pregestational diabetics N=23 (%)	Normal control control N=23 (%)	P value
Spontaneous vaginal delivery	11 (47.8)	19 (82.6)	$p < 0.05$
Instrumental vaginal delivery	2 (8.6)	1 (4.3)	n.s.
Caesarean sections	10 (43.4)	3 (13.0)	$p < 0.05$
Surgical induction	5 (21.7)	2 (8.6)	n.s.
Birthweights			
< 2500g	5 (21.7)	4 (17.3)	n.s.
2500-4000g	14 (61.0)	17 (73.9)	n.s.
>4000g	4 (17.4)	2 (8.6)	n.s.
Prematurity < 37 weeks	9 (39.1)	3 (13.0)	$p < 0.05$
Livebirths	23 (100)	22 (95.6)	n.s.
Stillbirths	0	1 (4.3)	n.s.
Neonatal and infant deaths	2 (8.6)	1 (4.3)	n.s.
Congenital heart disease	3 (13.0)	1 (4.3)	n.s.
Admission to NICU > 1 week	7 (30.34)	1 (4.3)	$p < 0.05$
Neonatal jaundice	12 (52.1)	1 (4.3)	$p < 0.01$
Hypoglycaemia	3 (13.0)	0	n.s.
Respiratory distress syndrome	3 (13.0)	0	n.s.

n.s. : not significant

Not surprisingly, the neonatal morbidities were significantly different in the 2 groups in terms of admission to neonatal intensive care unit for more than 1 week and neonatal jaundice. There were no statistically significant difference in terms of neonatal hypoglycaemia and respiratory distress syndrome.

DISCUSSION

Mortality in infants of this group of pregestational diabetics was exclusively due to congenital malformation. Our results concur with those of other series [1] in that excluding death due to major congenital malformations, the perinatal mortality rate in diabetic women receiving optimal care approaches that observed in normal gestation. The understanding that maternal hyperglycaemia may be responsible not only for perinatal death but also for significant infant morbidity [6] has focused our efforts on the regulation of maternal glycaemia both before conception and throughout gestation.

Despite being established diabetics, 9 patients (39.1%) were seen by the obstetric team only after the first trimester. In addition, average blood glucose level at booking was high (> 6.6 mmol/L) in 11 patients (47.8%), and 13 patients (56.5%) had high HbA1c (> 6%) at booking. In humans , it has been reported by Miller[3] that the anomalies seen in diabetic pregnancies occur by the 9th week of amenorrhoea. This could explain the high rate (13%) of congenital abnormalities in the group of pregestational diabetics.

Pregestational diabetics experienced poorer obstetric outcome in terms of increased Caesarean section rate and preterm deliveries compared to controls. Despite significantly higher preterm deliveries in pregestational diabetics, there was no difference in birthweight in the 2 groups which imply that the preterm babies of diabetic mothers were heavier.

In the present era, survival is no longer the sole benchmark for successful pregnancy. Diabetes in pregnancy has been associated with foetal and neonatal morbidity eg foetal and neonatal macrosomia, traumatic and operative delivery, and neonatal metabolic derangements such as hypoglycaemia, erythrocytosis, jaundice and hypocalcaemia[7]. In this study, infants of diabetic mothers were admitted to the neonatal intensive care unit more frequently and experienced significantly higher incidence of hyperbilirubinaemia. These infants also had 3 times greater incidence of hypoglycaemia and respiratory distress syndrome.

In conclusion, pregestational diabetics are high risk obstetric patients with increase in the rates of operative deliveries, preterm deliveries, congenital malformation, and neonatal mortality and morbidity in terms of NICU admissions, jaundice, hypoglycaemia and respiratory distress. Increased efforts must be made to reach out to established diabetic women to come forward for preconception counselling and to adhere to strict glycaemia control especially before conception and the first trimester to prevent teratogenesis. To prevent neonatal morbidity, strict euglycaemia should be sustained throughout pregnancy.

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