

DIABETIC SCREENING IN PREGNANCY

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SYNOPSIS

Diabetic Screening in pregnancy is necessary for detecting gestational diabetes and unsuspecting diabetics early in pregnancy for better antenatal care and delivery. Early control of the blood sugar levels will prevent complications in late pregnancy. This study of 497 screened pregnant women draws attention to areas where improvement can be instituted. It emphasizes the criteria for screening and highlights the factors which are responsible for abnormal glucose tolerance and diabetes in pregnancy. Positive detection for diabetes was highest among pregnant women who are Indians, above 35 years, with high parity (three or more), with family history of diabetes in first degree relatives and with glycosuria. The need to repeat a Glucose Tolerance Test to diagnose diabetes in the third trimester is shown in women who have high risk factors and are found to have a negative GTT in the first and second trimester.

INTRODUCTION

Despite the advances in diabetic care in Medicine, there is still a higher perinatal mortality and morbidity in diabetic mothers. Unless the diagnosis of diabetes is made early in pregnancy, the higher perinatal mortality and morbidity will not be reduced. The present method for the screening of all pregnant women by testing their urine for glycosuria is not adequate to detect all women with diabetes, especially if they have gestational diabetes and are seen very early in pregnancy. The glucose tolerance test is used to confirm the diagnosis of diabetes. It is more sensitive and accurate but it is obviously not practical to screen all pregnant women with an oral glucose tolerance test to exclude diabetes. The compromise solution, until a more satisfactory method is available, is to screen all potential diabetic women with an oral glucose tolerance test.

Apart from the potential diabetic, the gestational diabetic represents a special high risk pregnancy group and its identification in early pregnancy is vital in any antenatal screening programme. The screening criteria for gestational diabetes has been based on recognising the potential diabetic in pregnancy. The potential diabetic is subjected to an oral glucose tolerance test (OGTT) and the diagnosis of gestational diabetes is based on the results of this test.

In a retrospective study of diabetic pregnancies in Kandang Kerbau Hospital from 1975 to March 1978, the incidence of diabetic pregnancy was 1 in 400 deliveries. The diagnosis of diabetes was made in 164 out of 189 diabetic women during pregnancy and more than half (58.5%) were diagnosed after 33 weeks of gestation (4).

This emphasizes the need for a more effective screening method apart from the conventional test for glycosuria in all pregnant women. Since June 1978, an OGTT has been done for every woman seen at the antenatal clinic of the Department of Obstetrics & Gynaecology, University of Singapore, suspected of being a potential diabetic. This paper is a preliminary analysis of the first 497 patients so screened.

MATERIALS AND METHODS

All doctors manning the antenatal clinics of the Department of Obstetrics & Gynaecology, University of Singapore, were told to send potential diabetics in pregnancy to the Metabolic Laboratory for screening.

Pregnant women at their first antenatal visit, with the following criteria, were screened with an OGTT:

- 1) Family history of diabetes
- 2) Delivery of a previous large baby (4 kg and above) or a small baby (2 kg and below)
- 3) Any previous unexplained perinatal death (still-birth and first week death)
- 4) History of two or more previous consecutive spontaneous abortions immediately prior to the present pregnancy
- 5) Any one single episode of glycosuria in the present pregnancy
- 6) History of gestational diabetes in previous pregnancy
- 7) Acute polyhydramnios of unknown cause
- 8) Maternal obesity
- 9) Others: This may include the previous birth of a baby with gross congenital malformation, injection of drugs which are known to produce carbohydrate intolerance, eg, cortico-steroids, B-adrenergic stimulants (agonists) such as salbutamol, fenoterol, ritodrine, etc.

The Screening of Oral Glucose Tolerance Test (OGTT)

The OGTT is conducted in the Day Ward of the Metabolic Laboratory. The test is performed over two hours after an overnight fast of at least 12 hours following an unrestricted carbohydrate diet. Blood specimens are collected at:

- i) fasting
- ii) ½-hour (30 minutes)
- iii) 1-hour (60 minutes)
- iv) 1½-hour (90 minutes)
- v) 2-hour (120 minutes)

after 50 gm of oral glucose has been administered. The blood samples are collected in heparinised tubes and immediately centrifuged. The plasma is analysed for glucose by the Technicon Auto-Analyser II using the Hexokinase method (6). Internal and external quality controls are used. Our laboratory is part of the WHO inter-collaborating network of laboratories under the WHO Quality Control Scheme.

Apart from the OGTT after the first antenatal visit, a repeat OGTT is done for any patient who showed a "borderline" plasma glucose value two hours after the

glucose load if the screening OGTT was done before the third trimester. This "borderline" value is 120 mgm% - 139 mgm% (6.6 mmol/l - 7.7 mmol/l). This repeat OGTT is done any time between 28 weeks and 30 weeks of gestation.

Diagnosis of Diabetes is made from the two-hour plasma glucose level of the OGTT. The patient is diagnosed as having diabetes in pregnancy if the two-hour plasma glucose is 140 mgm% (7.8 mmol/l) or more.

The "borderline" group as defined above is also treated as a diabetic in pregnancy if any one of the following values on the OGTT curve is exceeded:

- i) fasting - 110 mgm% (6.1 mmol/l)
- ii) peak or one hour - 200 mgm% (11.1 mmol/l)

The patient who is diagnosed as being a diabetic is recalled for admission into hospital for stabilization and treatment of her diabetes.

RESULTS

Four hundred and ninety-seven patients were screened after their first antenatal visit. The racial distribution is as follows: 77.1% Chinese, 12.7% Indians, 9.1% Malays and 1.2% others, viz, Eurasians, Europeans. The racial composition reflects that of Singapore's multi-racial society except the Indian group is slightly more than their distribution in Singapore's population. (Table I). 89.3 per cent of the women were between the ages of 20 and 35 years. The highest number fell in the 25 to 30 years group at 39.4%. (Table II)

More than half of the women were primigravida (53.3%) and 27.2% Gravida Two, 12.5% Gravida Three and only 5.6% had more than three pregnancies. (Table III).

**Table I
RACIAL DISTRIBUTION**

	% (N = 497)
Chinese	77.1
Indian	12.7
Malay	9.1
Others	1.1 (Eurasian = 0.8)
Total	100.0

The OGTT was done mainly at 12 (28%), 30 (20.7%) and 34 (38.6%) weeks of gestation. The high number of OGTT done in the third trimester is a reflection of the time when the patients are referred to our hospital for antenatal booking. Most of our patients are first seen when they are pregnant in our Maternal and Child Health Clinics and they are referred to us only after the third trimester unless complications develop early in pregnancy. (Table IV)

The most common indication for OGTT screening is glycosuria, followed by family history of diabetes, previous undesirable fetal outcome, previous birth of a large or a very small baby, acute polyhydramnios of

Table II
AGE DISTRIBUTION

	% (N = 497)
Less than 20	2.0
20 -	24.1)
25 -	39.4) 89.3%
30 -	25.8)
35 -	6.8
40 and above	1.8
Total	100.0*

* Sum is not exactly 100.0 because values brought to one decimal place

Table III
PARITY DISTRIBUTION

Para	% (N = 497)
0	53.3
1	27.2
2	12.5
3 and above	5.6
Unknown	1.4
Total	100.0

Table IV
TIMING OF GTT SCREENING - FIRST GTT

Weeks	% (N = 497)
12	3.8
12 -	28.0
28 -	6.6
30 -	20.7
34 -	38.6
1st week PP	0.2
Unknown	1.1
Total	100.0

unknown cause, a history of two or more consecutive abortions prior to the present pregnancy and maternal obesity. Other indications include suspected large baby in the present pregnancy, uterine size bigger than gestational dates, previous gestational diabetes, recurrent moniliasis and vaginal discharge. (Table V).

Using our criteria for "borderline" and abnormal values of the OGTT, there was 24.5% (122) in the "borderline" group and 16.9% (84) in the abnormal group making a positive detection rate of 41.4% (206) of all the patients screened. (Table VI)

An attempt is made to analyse the borderline and

abnormal OGTT by race, age, parity, the period of gestation, family history of diabetes and the presence of glycosuria.

Race: The Indians have the highest incidence of borderline patients followed by the Chinese, others and the Malays. When we look at the abnormal patients, the Malays are the most numerous followed by Indians and Chinese. If the positive results, ie, borderline and abnormal patients, are added together, then the Indians (50.8%) have the highest incidence followed by the Chinese (40.7%) and the Malays (37.8%). (Table VII)

Age: The highest incidence of borderline and abnormal results are in women 35 years and above (48.8%) followed by 30 to 35 (48.4%), 25 to 30 years (41.3%) and below 25 years (32.3%). (Table VIII)

Parity: The incidence of abnormal and borderline results is similar to the age distribution, ie, 50% in Para 3 and more, 46.8% in Para 2, 37.8% in Para 1, and only 41.5% in Primigravida. (Table IX)

Table V
INDICATIONS FOR SCREENING
(N = 497)

Glycosuria	35.6%
Family History	30.0%
Previous undesirable fetal outcome	9.8%
Previous large or small baby (> 4 kg, or < 2 kg)	9.4%
Acute polyhydramnios	7.0%
Obesity	6.4%
Two or more consecutive abortions	6.2%
Others	16.9%

N.B. Some patients have more than one indication.

Table VI
RESULTS OF FIRST GTT

	% (N = 497)
Normal	58.6
Borderline*	24.5)
Abnormal**	16.9) 41.4%
Total	100.0

* 2-hr values = 120-139 mg% (6.6-7.7 m.mol/l)

** a) 2-hr values = 140 mg% (7.8 m.mol/l) and above

b) Borderline 2-hr values with fasting values = 110 mg% (6.1 m.mol/l) and above

or c) Borderline 2-hr values with 1-hr peak = 200 mg% (11.1 m.mol/l) and above

Table VII
RESULTS OF FIRST GTT BY RACE

	% Chinese (N = 383)	% Indian (N = 63)	% Malay (N = 45)	% Others (N = 6)
Normal	59.3	49.2	62.2	83.3
Borderline	25.1	31.7	11.1	16.7
Abnormal	15.6	19.1	26.7	0.0
Total	100.0	100.0	100.0	100.0

Table VIII
RESULTS OF FIRST GTT BY AGE

	% Below 25 yr (N = 130)	% 25 yr (N = 196)	% 30 yr (N = 128)	% 35 yr + Above (N = 43)
Normal	67.7	58.7	51.6	51.2
Borderline	20.8	25.5	28.1	20.9
Abnormal	11.5	15.8	20.3	27.9
Total	100.0	100.0	100.0	100.0

Table IX
RESULTS OF FIRST GTT BY PARITY

	Para 0 % (N = 265)	1 % (N = 135)	2 % (N = 62)	3 + above % (N = 28)	Unknown % (N = 7)
Normal	58.5	62.2	53.2	50.0	71.4
Borderline	25.7	23.0	21.0	28.6	28.6
Abnormal	15.8	14.8	25.8	21.4	00.0
Total	100.0	100.0	100.0	100.0	100.0

Period of Gestation: The peak incidence of borderline and abnormal results is at 28 to 30 weeks (48.4%). It is also high at 12 to 28 weeks (46.8%), below 12 weeks (42.1%) and 30 to 34 weeks (41.8%). (Table X)

Family History of Diabetes (first degree relatives, ie, parents and siblings): 52.3 per cent of women with first degree family history of diabetes had either a borderline or abnormal OGTT of which 20.1% were abnormal and 32.2% were borderline. This compares with 36.8% without a family history (21.3% borderline and 15.5% abnormal). (Table XI)

Table X
RESULTS OF FIRST GTT BY TIMING OF FIRST GTT

	% NA/UNK (N = 10)	% <12WK (N = 19)	% 12WK- (N = 139)	% 28WK- (N = 33)	% 30WK- (N = 103)	% 34WK (N = 192)	% 1ST WK PP (N = 1)
Normal	70.0	57.9	53.2	51.6	58.2	63.0	100.0
Abnormal (+ Borderline)	30.0	42.1	46.8	48.4	41.8	37.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

A further 7.6% of women were found to have an abnormal or borderline OGTT when it was repeated after the third trimester in those women whose first OGTT showed borderline results. 2.6 per cent of the borderline OGTT deteriorated to abnormal in the second OGTT taken after the third trimester.

Glycosuria: Of the patients screened with OGTT who had one episode of glycosuria in the present pregnancy, 23.2% had borderline result and 21.5% had abnormal result. The detection rate for abnormal and borderline was 44.7%. (Table XII)

Table XI
**RESULTS OF FIRST GTT
BY FAMILY HISTORY OF DIABETES**

	% No family history (N = 348)	% Positive Family history (N = 149)
Normal	63.2	47.7
Borderline	21.3	32.2
Abnormal	15.5	20.1
Total	100.0	100.0

Table XII
GLYCOSURIA

	% Glycosuria (N = 177)
Normal	55.3
Borderline	23.2
Abnormal	21.5

DISCUSSION

O'Sullivan (5) demonstrated that clinical history, based on a previous abnormal pregnancy history, birth of a large baby, maternal obesity and family history of diabetes, was an insensitive screening factor. He proposed an one-hour screening blood sugar test following oral ingestion of 50 gm of glucose and OGTT on those patients with levels exceeding 130 mgm%/ (7.2 mmol/l). He showed that the number of gestational diabetic patients in the population correctly identified by the screening blood sugar test is 79%

(sensitivity rate) of the total to be detected while 87% of persons without this condition (specificity rate) were correctly excluded by the same test.

There is no perfect way of screening for gestational diabetes except to perform OGTT on all pregnant women. This is obviously not feasible and very expensive for most centres. The glucose tolerance test itself remains a crude method of diagnosis for diabetes especially in pregnancy. There is much doubt about its reproducibility and controversy over the amount and route of administration of glucose and the interpretation of the results (3). The British Diabetic Association's (2) criteria for diagnosis of diabetes for a 50 gm oral glucose load is a venous blood glucose peak of more than 180 mgm% (10.6 m.mol/l) and a two-hour of more than 110 mgm% (6.1 m.mol/l). WHO (7) recommended for a 50 gm glucose load and a venous blood glucose level at two hours of more than 130 mgm% (7.2 m.mol/l). Our Diabetic Team's criterion for diagnosis is based on a single two-hour venous plasma glucose level after a 50 gm load of 140 mgm% (7.8 m.mol/l) and above. In view of the numerous criteria available, it is better to adopt a single system and keep to it.

The incidence of diabetes in the female population in Singapore is 1.64% (1). The incidence of diabetic pregnancies in the Kandang Kerbau Hospital in the years 1975 to 1978 was 0.25% (4). The University Department of Obstetrics & Gynaecology had 7,878 deliveries in 1978 and 84 abnormal OGTT (= Diabetics) were discovered in this screening exercise giving an incidence of 1.07% which is more than four times the hospital incidence. This increase confirms our suspicion that we were under-diagnosing our diabetics especially the gestational diabetics. It is our objective that an awareness of the problem of the potential diabetics and especially, the gestational diabetics, who are a "high-risk" group of pregnant women, will reduce the perinatal mortality and morbidity in our diabetic pregnancies (overall perinatal mortality rate 3%).

The racial distribution from this study confirms an earlier study (1) that the Indian women in our community have a higher tendency to diabetes than the Chinese or Malays.

The type of diabetes in our female population is mostly of the maturity-onset type. The highest incidence of abnormal OGTT was in the women aged 30 years or more and consequently they are of higher parity too.

The main factors which give rise to a high positive detection rate in this study of screening for diabetes

are glycosuria and first degree family history of diabetes (44.7% and 52.3% respectively).

Unfortunately, most of our pregnant women present late in pregnancy at booking in our hospital. Even so, the results of the screening show a higher rate of borderline and abnormal results in the third trimester. It is interesting to note that a further 2.6% of women with a borderline OGTT result showed deterioration to an abnormal OGTT in a second OGTT performed in the third trimester.

CONCLUSION

The objective of this screening of potential diabetic women in pregnancy is to detect gestational diabetics early in order to control the blood sugar and prevent complications. Ideally, it should commence before 28 to 30 weeks. This study focuses our attention to areas where improvement can be instituted such as early antenatal booking, the need for OGTT screening of potential diabetics and the higher incidence of diabetes among the Indians.

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