Foetal Outcome and Postpartum Maternal Metabolic Status in South Indian Women in Relation to the Antepartum Glycaemic Status*

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ABSTRACT

The effect of gestational glycaemia on foetal and maternal outcome was studied in 126 women who reported for postpartum check up within a year of delivery. The classification of the maternal glucose tolerance in the postpartum period was made according to the WHO criteria, based on an oral glucose tolerance test (OGTT) with 75 gms of glucose.

Subjects were divided into four groups according to gestational plasma glucose values (GPG) (mg/dl), namely FPG < 105 and 2-h PG < 140 (group I), FPG ≥ 105 and 2-h PG ≥ 140 (group II), FPG ≥ 140 and/or 2-h PG ≥ 200. The overall occurrence of foetal abnormalities increased with higher GPG values (x^2 = 8.2, p = 0.04). The prevalence of abnormalities was higher in the other groups compared to group I (x^2 = 4.9, p< 0.05), but the groups II, III and IV had similar occurrence of foetal complications.

The occurrence of postpartum IGT was not different in the various groups whereas the development of postpartum diabetes in the mothers increased with higher GPG values (x^2 = 36.2, p < 0.001). Significant difference was noted between the groups I and II (x^2 = 16.9. p < 0.001) with respect to the prevalence of diabetes. The highest percentage of diabetes was found in the group with FPG ≥ 140 mg/dl and 2-h PG ≥ 200 mg/dl during gestation. However, the differences in the development of diabetes in the groups II,III and IV were not statistically different from each other. The 2-h GPG values were higher in women (p < 0.001) who developed postpartum hyperglycaemia compared to those who had normal plasma glucose values after the delivery. Parameters such as the age, body mass index and the presence of family history of diabetes did not vary between the two groups.

The study shows that even mild degree of gestational hyperglycaemia causes considerable foetal and maternal complications and that the occurrence of postpartum diabetes is high in South Indian women with gestational diabetes mellitus (GDM). It is also likely that a few women have had undetected hyperglycaemia even before conception.

INTRODUCTION

Several European studies have evaluated the glycaemic cut off points in relation to the foetal and maternal outcome of gestational diabetes mellitus (GDM) [1-10]. There is some disagreement on the diagnostic criteria for G.D.M., the main uncertainty is whether to adopt the W.H.O. recommendations [11] eg. venous plasma glucose of ≥ 200 mg/dl (11 mmol/l) 2-h after 75 g glucose for diagnosis or to continue to use the recommendations of the National Diabetes Data Group (NDDG) [12] eg. venous plasma glucose of ≥ 165 mg/dl (9.5 mmol/l) 2-h after 100 g glucose. There is also considerable evidence to show that there are ethnic differences in the pathological significance of different levels of hyperglycaemia during gestation depending on the prevalence of diabetes, the birth rate and perinatal mortality in the populations [13]. For example there have been differences in the foetal outcome in hyperglycaemic Pima women compared to the other ethnic groups within the U.S. itself [13].

A recent study by Samanta et al compared the maternal and foetal outcome in white and Asian women with GDM in the U.K. (8). Among the whites the outcome did not correlate with the 2-h blood glucose, but among the Asians, a significant linear correlation was noted with increasing plasma glucose. This stresses the need for data from different ethnic groups.

In this study, it was found that cut-off values lower than even 165 mg/dl at 2-h during an oral glucose tolerance test (OGTT) (similar to the N.D.D.G. criteria) during pregnancy were associated with high foetal risk.

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There was also a high occurrence of postpartum diabetes among the South Indian women who had carbohydrate intolerance during gestation.

MATERIALS AND METHODS

One hundred and forty eight pregnant women referred to the Diabetes Research Centre, Madras, for assessment of the glycaemic status during the period of March 1988 to June 1989, were included in this study. In all of them, hyperglycaemia was detected for the first time during pregnancy. The reasons for the referral were first degree family history of diabetes (n = 52), glycaemia detected on routine examination (n =36), raised blood glucose on routine examination (n = 32), bad obstetric history (n = 25) and history of hyerglycaemia during previous pregnancy (n =3).

Height , weight , family history of diabetes and the details of previous obstetric history were recorded and all subjects underwent a 2-h OGTT with 100 g glucose. The treatment with a single dose of intermediate acting insulin was started in all women with either an FPG of ≥ 105 or 2-h P.G. of ≥ 145 mg/dl. The remaining were observed for one week with diet along and purified porcine intermediate acting insulin was started if post-prandial plasma glucose was ≥ 150 mg/dl. Eighty women required insulin. The average calorie intake of the study subjects was calculated by a dietitian and ranged from 1800 –2200 Kcals.

The postpartum follow-up period ranged from 3 to 11 months. Out of the 148 women, 85% (126) could be retested after childbirth. These women were reclassified after an OGTT with 75 g oral glucose based on the WHO criteria for non-pregnant adults [11].

Plasma glucose was estimated by the glucose oxidase procedure using Boehringer Mannheim (Germany) reagents.

For the purpose of analysis, study subjects were divided into 4 groups based on fasting (FPG) and 2-h post-glucose (PG) plasma glucose values during the GTT in pregnancy (GPG)

Group I FPG < 105 mg/dl or 2 hr PG < 140 mg/dl
Group II FPG ≥ 105 mg/dl and 2 hr PG ≥ 140 mg/dl
Group III FPG ≥ 115 mg/dl an d2 hr PG ≥ 165 mg/dl (similar to the NDDG criteria)
Group IV FPG ≥ 140 mg/dl an /or 2 hr PG ≥ 200 mg/dl (similar to the WHOcriteria)

Statistical analysis was done by chi square test, Fischer's exact probability test and Wilcoxon rank sum test wherever relevant. Values in Table I are the mean ± SD.

RESULTS

The foetal complications and postpartum diabetes were significantly higher in all other groups compared to group l as shown in Table 1.

Table 1
Foetal and maternal complications in relation to the cut-of values of gestational plasma glucose (mg/dl)

Group	I FPG < 105 or PG < 140 n=55	II FPG ≥ 105 and PG≥140 n=80	III FPG≥115 and PG≥ 165 n=53	IV FPG≥ 140 and/or PG≥200 n=37
Foetal complications				
Abortions Perinatal death	2(4)	9(11)	9(17)	7(19)
Premature baby	2(4)	7(9)	4(5)	5(6)
Total	4(7)	16*(20)	13(25)	12**(32)
Congenital Abnormality	0	1(1)	2(4)	2(5)
Maternal				
Caesarean section	32(58)	38(48)	26(49)	16(43)
Postpartum Follow-up				
IGT	6(11)	10(13)	7(13)	3(8)
Diabetes	10(18)	44#(55)	35(66)	27***(73)

Numbers in brackets denote percentages

FPG= Fasting plasma glucose; PG = 2-h Post-Glucose plasma glucose

* (Groups I & II) $X^2 = 4.9$, $P < 0.005$
** (Groups I to IV) $X^2 = 8.2$, $P = 0.04$; ***$x^2 = 36.2$, $P < 0.001$
# (Groups I&II) $X^2 = 16.9$, P □ 0.001

There was no significant difference in the rates of foetal complications (abortions, perinatal deaths and prematurity) between groups II , III and IV. While there was no occurrence of congenital abnormalities in group I, there was increasing occurrence in the other groups. The causes of perinatal death were stillbirth (n = 2) , respiratory distress syndrome (n = 4) and neonatal hypoglycaemia (n = 1). The two congenital abnormalities were ventricular septal defect and transposition of great vessels. There was no

significant difference in the mean birth weight of the babies. The occurrence of postpartum IGT was not different in the various groups whereas the development of postpartum diabetes in the mothers increased with higher GPG values (X^2 = 36.2, $p < 0.001$). Significant difference was noted between the groups I and II (X^2 = 16.9, $p< 0.001$) with respect to the occurrence of diabetes. The highest percentage of diabetes was found in group IV. However, the differences in the prevalence of diabetes between the groups II, III and IV were not statistically different from each other.

During the postpartum check up of the 126 women, 56 (44%) developed diabetes and 9(7%) showed IGT. Another 7(6%) had one abnormal value in GTT. The mean age (29 ± 5 vs 28 ± 5 yrs), mean body mass index (BMI) (27.5 ± 4.2 vs 26.8 ± 5.1 kg/m^2) and the percentage with positive family history of diabetes (80 vs 87%) were similar in women who developed postpartum glucose intolerance (NIDDM + IGT + abnormal GT) and those who had normal glycaemia. There was also no difference in the parity between the groups (median 2 for both). The GPG values were higher in women who developed postpartum glucose intolerance compared to those who did not (FPG mg/dl 139 ± 60 vs 107 ± 29 and 2-h PG mg/dl 253 ± 63 vs 196 ± 39, $p < 0.001$). There was no statistically significant difference in the percentage of subjects in whom hyperglycaemia was detected in the three trimesters between two groups. In 9 out of the 25 cases, in whom abnormal glucose tolerance was detected in the I trimester, the HbA_1 values were higher than 8% (Normal 5 – 8 %).

DISCUSSION

The recommendations by the WHO expert committee to raise the criteria for the diagnosis of GDM has produced nonuniformity in the diagnostic criteria for GDM [11]. The NDDG is currently following the criteria based on the original recommendations of O'Sullivan and Mahan [12]. The end point and the deciding factors are mostly dependent on the foetal outcome. In this study, we found that glycaemic levels with cut off values even lower than the 2-h value, similar to the NDDG criteria, had high foetal risk in pregnant women in the South Indian population. On follow-up , it was seen that there was also a high occurrence of postpartum diabetes in theses women.

The foetal complications , on the whole, increased with increasing GPG values. It was of interest that the foetal and maternal complications were quite high in women in group II (FPG of ≥ 105 mg/dl and 2-h PG ≥ 140 mg/dl) as well as in group III (FPG of ≥ 115 mg/dl and 2-h PG of ≥ 165 mg/dl). Groups III and IV did not show statistically significant difference in the prevalence rates of complications. This observation suggests that importance should be given to lower levels of gestational hyperglycaemia in order to avoid risk to the foetus and the mother.

These observations agree with those of Tallarigo et al in Italian women [1] and Nasrat et al from Saudi Arabi [2] which have shown that foetal complications and postpartum maternal hyperglycaemia occur even in women with mildly abnormal glucose values during gestation, though to a considerably lesser extent in women with higher plasma glucose values. Raising the criteria for diagnosis of diabetes in pregnancy would ignore a large number of women with hyperglycaemia having risk of foetal and maternal complications. One of the limitations of our study is that we did not perform a 3-h GTT as recommended by the NDDG, but we have performed only a 2-h GTT. However, this allowed a better comparison with the WHO recommendations.

The occurrence of diabetes within a year was 55% , 65% and 73%, in women who had a combination of GPG values (mg/dl) FPG ≥ 105 with 2-h PG ≥ 140, FPG ≥ 115 and 2-h PG ≥ 165 and FPG ≥ 140 and 2-h PG ≥ 200 respectively thereby showing a high occurrence of overt diabetes after GDM in our population. This may be a reflection of the high susceptibility to NIDDM among Indians. Our diabetes survey in a township in South India recorded a prevalence of 5% [14] and a recently completed diabetes survey in the city has shown a prevalence of 8.2% [15] among the urban South Indians.

Secondly, the high occurrence of postpartum diabetes could be a reflection of the possibility of number of young women with glucose intolerance undetected before conception. In majority of the women, hyperglycaemia was detected in II and III trimesters. However, in 25 women , the GTT showed hyperglycaemia in I trimester and in them, 9 had HbA_1 > 8% suggesting the probability of preexisting hyperglycaemia. This phenomenon has been described from other populations [16]. However, the clinical implication of this follow-up study is that women, in whom hyperglycaemia is detected for the first time during pregnancy, have

high risk of having postpartum NIDDM and hence the need for follow-up.

The degree of gestational hyperglycaemia was an important determinant for postpartum diabetes. Some other short and long term follow up studies have corroborated this finding [5,7,9,10]. The mean BMI, age and the presence of positive family history of diabetes however did not influence the postpartum metabolic outcome of GDM. This is significant in the light of our earlier reports showing a high degree of familial aggregation of diabetes in South India [17]. Cocilovo el al [6] also did not find that the age or family history of diabetes influenced the development of postpartum IGT. However, they found that higher BMI on follow-up was associated with development of diabetes. The findings of Freinkel et al [10] did not corroborate this observation. Oats et al showed that 45% of those who developed postpartum diabetes had BMI > 29 during gestation which was significantly higher than women who later had IGT or normal glucose tolerance [4]. They also noted an increased prevalence of first degree family history of diabetes among those who developed postpartum diabetes compared to those who became normal.

This paper gives data regarding foetal risk and the occurrence of postpartum diabetes for different levels of gestational hyperglycaemia in women from yet another ethnic group and supports the observation that gestational hyperglycaemia even lower to the present diagnostic values is associated with considerable risk as far as foetal outcome and postpartum diabetes are concerned. Raising the criteria further for diagnosis of GDM, as recommended by the WHO Expert Committee may result in underdiagnosis and an unacceptable degree of foetal loss.

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