ORAL GLUCOSE TOLERANCE IN WOMEN DELIVERING LARGE BABIES

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INTRODUCTION

Early recognition of the diabetic state is of vital importance to the eventual control and prevention of perinatal mortality. Many workers have found that there exists a relationship between the diabetic mothers and babys' birth-weight. The diabetic woman frequently gives birth to large babies and women who have given birth to large babies may eventually become diabetic.

Wilkerson (1959) found that 14% of the women with pregnancy onset diabetes delivered babies weighing 9 lbs or more. Allen (1939) reported that approximately 60% of the babies born to diabetic mothers weigh 8 lbs or more. Kriss et al (1948) found that 7% of the women who had given birth to over-weight babies were diabetic 2 years after paturition and 77% were diabetic 26 years or more later. Fitzgerald et al (1961) followed up 61 women 13 years after delivery of a baby weighing 10 lbs or more and found that 33% showed abnormal glucose tolerance while Pederson (1961) also observed an incidence of 11% frank diabetes and 33% abnormal carbohydrate tolerance, 20 years after delivery in his study of 210 women. More recently, Shark et al (1971) in their study of a population of maternal prediabetics over a period of 5 years discovered that one of the factors related to maternal glucose tolerance was birth-weight of the baby. Mean birth-weight increased progressively with glucose levels.

However there still exists the problem of detecting the potential diabetics among such women in the immediate post partum. The present study surveys the oral glucose tolerance of 28 women who had just delivered a large baby in the University Department of Obstetrics and Gynaecology, Kandang Kerbau Maternity Hospital.

The purpose of this paper is to study the effect of large babies (over 8 lbs) (Cheng et al, 1972) on the maternal oral glucose tolerance test (OGTT) and the time interval when the OGTT was performed. An attempt was made to correlate the increase in birth-weight of the baby to the degree of distortion of the OGTT profile. Finally, a comparison was made

to study the influence of past history of large babies on the OGTT.

MATERIALS

Study Group

28 women who had just delivered a large baby weighing more than 8 lbs were selected for an oral glucose tolerance test. The women were not known diabetics and had no family history of diabetes mellitus. 13 of the women had previously delivered babies larger than 8 lbs. The OGTT was studied in 2 groups (a) within 5 days after delivery and (b) from 6-37 days after delivery in the puerperium.

Control

28 healthy women who had delivered normal weight babies were also selected as the control group. The controls had no previous history of large babies and family history of diabetes mellitus. Both groups were matched for age, weight, height, parity and race (all were Chinese). See Table I.

Method

Oral glucose tolerance tests were performed on all subjects after an overnight fast of 12 hours with a 50 gm load of glucose. Blood samples were obtained by inserting a cannula in the cubital vein under local anaesthesia, stored in heparinised tubes and centrifuged, and the plasma was frozen until they were assayed. Samples were taken at 30 minute intervals for 3 hours after 2 fasting specimens at 10 minute interval.

Plasma glucose was determined on a Technicon Autoanalyzer I by the glucose oxidase-peroxidase chromogen reaction. The method is described by D.G. Cramp (1967).

RESULTS

The Influence of large babies

Figure 1 gives the OGTT results for the women with normal weight babies (Controls) and those with overweight babies (Study Group). The Controls had higher mean fasting values for F1 and F2 of 77.0 and 74.8 mg % respectively as compared to 71.2 and 70.7 mg % for the Study Group. The difference was significant at F1 with $p < 0.05$. The Study Group had significantly higher mean glucose values at 60 and 90 minutes with p values < 0.005 and < 0.01 respectively. The mean area under the OGTT curve for the Study Group (583 units) was higher than the mean area for the Controls (528 units) although the difference was not significant statistically.

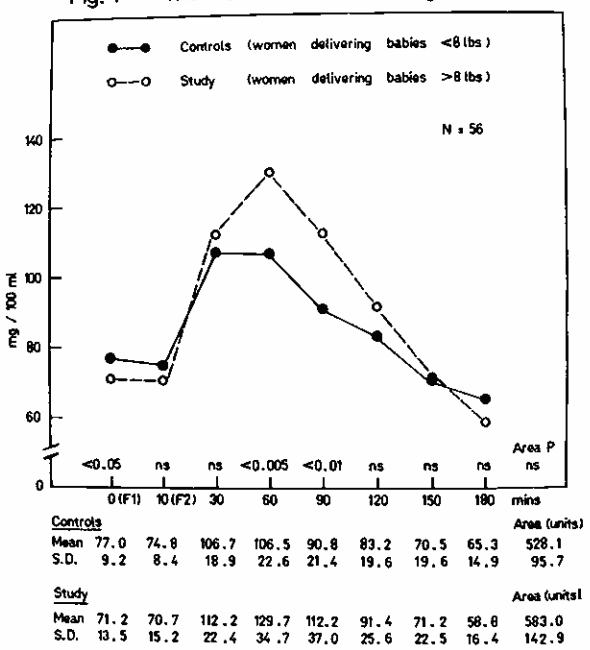
Table 1

General Data

Parameters	Controls	Study Group	P
Age	28.96 ± 4.34	28.96 ± 4.99	NS
Parity	2.64 ± 1.65	2.64 ± 1.98	NS
Height	153.4 ± 4.4	153.1 ± 4.7	NS
Weight	55.2 ± 6.5	56.9 ± 7.1	NS

OGTT

Fig. 1 The Influence of Large Babies



The Influence of Timing of OGTT

Figure 2 gives the OGTT results of the Study Group divided into 2 sub-groups:- (a) Group 1 whose OGTT was done 1-5 days after delivery and (b) Group 2 whose OGTT was done from 6-37 days after delivery. The numbers of subjects in Group 1 was 20 and in Group 2, 8.

Group 2 had higher mean glucose values from F1 to 30 minutes and subsequently lower mean values from 60 minutes onwards. However, the differences at all levels between the 2 sub-groups were not significant. The mean area for Group 1 was 590.4 units compared to 562.6 units for Group 2.

The Influence of Birthweight of the Baby

Figure 3 shows the OGTT of the Study Group divided into 2 sub-groups according to the birth-weight of the babies:— (a) Group 3 includes women who had delivered babies 8-9 lbs and (b) Group 4 includes women who had delivered babies

over 9 lbs. The numbers of subjects in Group 3 and 4 are 10 and 18 respectively. Group 4 had higher mean glucose area but the difference was not significant.

The Influence of Past Obstetric History of Large Babies

Figure 4 shows the OGTT of the Study Group with the history of large babies considered as a factor. Group 5 are women who had delivered over-weight babies but had no previous history of large babies. Group 6 are those who had delivered large babies prior to this present pregnancy. Group 6 had higher mean glucose values at all levels, the differences being significant at all levels except for 90, 120 and 180 minutes levels. Group 6 also had a higher mean glucose area under the OGTT curve of 637.3 units. compared to 528.6 units for Group 5. The difference in mean areas was significant at $p<0.05$.

Abnormal OGTT

Based on our criteria, the abnormality is more than 2 SD. of the controls.

The Effect of Large Babies

Table 2 shows the percentage of abnormal OGTTs between the Controls and the Study Group. There is an increase in the percentage of abnormal OGTTs for F2 and 120 minutes in the Study Group. There are 2 abnormal OGTTs using mean area under the OGTT curve as an index in the Study Group but none in the Controls.

The Effect of Time

Table 3 is a comparison between the 2 sub-groups of the Study Group divided according to timing of OGTT. Group 1 are those women whose OGTTs were done within 5 days after delivery and Group 2 are those whose OGTTs were done after 5 days till 37 days of the puerperium. Abnormalities were detected in F1, F2, 120 and 180 minutes and area under the OGTT curve in Group 1 but none in Group 2.

The Effect of Weight

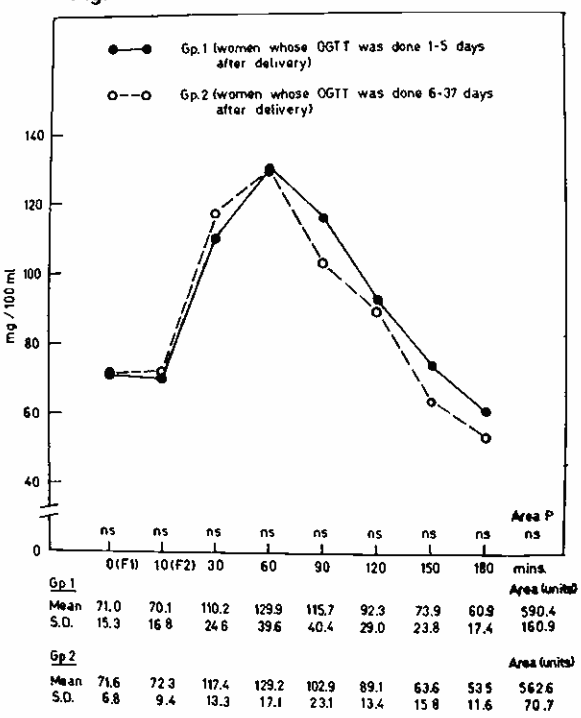
The Study Group was again divided into 2 sub-groups in Table 4. Group 3 are women with babies between 8-9 lbs and Group 4 are women with babies larger than 9 lbs. It was noted that they were abnormals in the F1, F2, 180 minutes and area under the curve in the women with more than 9 lbs babies but not in the women with babies 8-9 lbs. In the 120 minutes sample both groups had abnormals but the percentage is higher in the women with heavier babies.

The Effect of Past Obstetric History of Large Babies

Table 5 is an analysis of the abnormals in the 2 sub-groups 5 & 6 of the Study Group. Group 5 are those women with no previous history of large babies and Group 6 are those with previous history of large babies. The F1, F2, 120 and 180 minutes

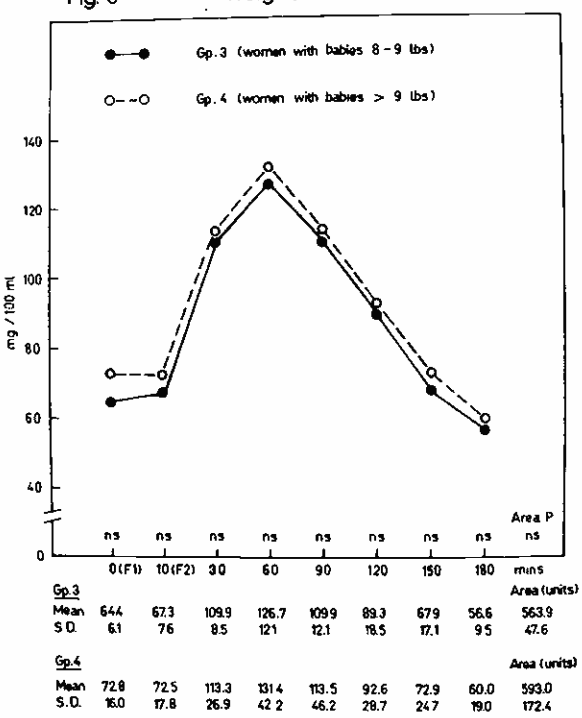
OGTT

Fig. 2 Time Factor



OGTT

Fig. 3 Weight Factor



OGTT

Fig. 4 Past Obstetric History of Large Babies

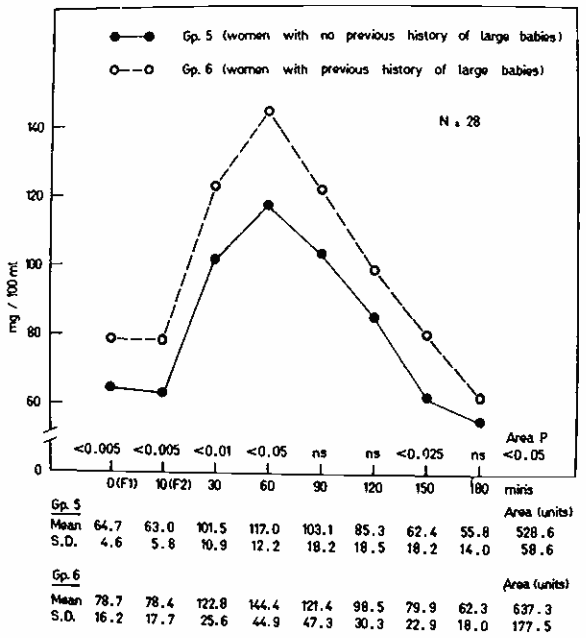


Table 4

Analysis of Abnormal OGTTs

Weight Factor

Parameters	Group 3 (Women with babies 8-9 lbs)	Group 4 (Women with babies 9 lbs)
F1	0% (0/10)	11.1% (2/18)
F2	0% (0/10)	11.1% (2/18)
120 mins	10.0% (1/10)	11.1% (2/18)
180 mins	0% (0/10)	5.6% (1/18)
Area	0% (0/10)	11.1% (2/18)

Table 5

Past Obstetric History of Large Babies

Parameters	Group 5 (Women with no previous history of large babies)	Group 6 (Women with previous history of large babies)
F1	0% (0/15)	15.4% (2/13)
F2	0% (0/15)	15.4% (2/13)
120 mins	6.7% (1/15)	15.4% (2/13)
180 mins	0% (0/15)	7.7% (1/13)
Area	0% (0/15)	15.4% (2/13)

Table 2

Analysis of Abnormal OGTTs

Parameters	Control	Study Group
F1	7.1% (2/28)	7.1% (2/28)
F2	3.6% (1/28)	7.1% (2/28)
120 mins.	3.6% (1/28)	10.7% (3/28)
180 mins	3.6% (1/28)	3.6% (1/28)
Area	0% (0/28)	7.1% (2/28)

Table 3

Analysis of Abnormal OGTTs

Time Factor

Parameters	Group 1 (OGTT 1-5 days after delivery)	Group 2 (OGTT 6-37 days after delivery)
F1	10.0% (2/20)	0% (0/8)
F2	10.0% (2/20)	0% (0/8)
120 mins.	15.0% (3/20)	0% (0/8)
180 mins	5.0% (1/20)	0% (0/8)
Area	10.0% (2/20)	0% (0/8)

and area under the curve all showed abnormals in Group 6 but not in Group 5 except for the 120 minutes sample. Even here, the percentage of abnormals was higher in Group 6 compared to Group 5.

DISCUSSION

Our results show that there is a decrease in glucose tolerance for women who had just delivered large babies over 8 lbs as compared to women who had just delivered normal weight babies although the difference in mean area under the OGTT curve was not significant at $p < 0.10$. Except for F1, 60 and 90 minutes levels the other glucose levels were not significantly higher. The minimal differences may be attributed to the small number of subjects (28) being studied. Moreover it had been reported by many workers that women who had delivered large babies do not develop diabetes mellitus until some years later (Wilkerson, 1959; Allen, 1939; Skipper, 1933; Jackson, 1952; Moss et al, 1951; Miller, 1945; Hagbard, 1958; Pederson, 1961). Similarly the incidence of large babies may precede the onset of diabetes by many years. (Allen, 1939; Wilkerson, 1959; Allen, 1939; Kriss et al, 1948; Fitzgerald et al, 1961; Pederson, 1961; Miller, 1945; Hagbard, 1958).

It has also been shown that the standard OGTT is not sufficient to reveal the abnormalities of the potential diabetic years before the development of the disease. A more sensitive process for detecting the potential diabetics is the cortisone

glucose tolerance test. Fajans et al (1954, 1959) found an increased percentage of abnormal glucose tolerance in potential diabetics when the subjects were administered with cortisone before the test. Other methods have also been used. These included the intravenous glucose tolerance (Hamilton & Stein, 1942), intravenous tolbutamide (Unger & Madison, 1958) and high glucose infusion studies of Cerusi and Luft (1963).

Where timing of the OGTT is considered, our results showed that the earlier in the puerperium the test is being done, the more likely the glucose intolerance will be detected in mothers who have delivered large babies (Refer to Table 3).

The birthweight of the baby also affects the glucose tolerance of the mothers. The heavier the baby, the more likely will the glucose tolerance of the mother be affected as shown in our results in Table 4. Kriss et al (1948) predicted that the heavier the birth-weight of the baby the greater the chances of the mother developing diabetes.

We also note that the past obstetric history of large babies is a factor in detecting abnormal OGTT in women delivering large babies. Table 5 of our results confirms this observation.

CONCLUSION

In summary our study of the glucose tolerance in women delivering large babies show that the following factors are taken into account as they have a bearing on the OGTT.

(i) The timing of the OGTT should be done as soon as possible after delivery (within 5 days).

(ii) The heavier the baby the more likely an abnormal OGTT will be found and in our experience mothers delivering babies weighing more than 9 lbs should be investigated for their glucose tolerance and finally

(iii) The past obstetric history of large babies does influence the glucose tolerance.

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