IS POSTNATAL ORAL GLUCOSE TOLERANCE TESTING NECESSARY IN ALL WOMEN WITH GESTATIONAL DIABETES

Y Y Tan, S H Yeo, P C Y Liauw

ABSTRACT

Currently, women with gestational diabetes mellitus have a repeat oral glucose tolerance test 6 weeks after delivery to identify those with persistent glucose intolerance. In this study, 298 women with gestational diabetes had a postnatal oral glucose tolerance test and of these, 23.2% had persistent glucose intolerance after delivery.

The aim of this study was to determine if the antenatal oral glucose tolerance test results could be used to predict which patients would have persistent glucose intolerance after delivery. If only those with severely abnormal antenatal results had persistent disease, then those with only mildly abnormal antenatal results could be spared the postnatal oral glucose tolerance test.

Using receiver operator characteristic curves, this study showed that the antenatal oral glucose tolerance test results could not be used to predict reliably which patients would continue to have abnormal glucose tolerance postnatally. Hence, postnatal oral glucose tolerance testing of all patients with gestational diabetes is still necessary as the detection of persistent glucose intolerance is important for the control of the diabetic condition so as to minimise long-term complications.

Keywords: *gestational diabetes mellitus, postnatal oral glucose tolerance test*

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INTRODUCTION

Gestational diabetes mellitus has been defined as carbohydrate intolerance of variable severity with onset or first recognition during the current pregnancy, irrespective of whether or not insulin is used for treatment or if the condition persists after the pregnancy. It also does not exclude the possibility that the glucose intolerance may have antedated the pregnancy[1].

The standard protocol of our department entailed repeating oral glucose tolerance testing 6 weeks after delivery in women with gestational diabetes to identify those with persistent glucose intolerance who need further medical follow-up.

Many studies have shown that a significant proportion of women with gestational diabetes have persistent disease after delivery. Kek et al[2] found that 21.7% of women with gestational diabetes had abnormal glucose tolerance at 6 weeks postpartum in a local study. Other studies[3-6] showed that 15% to 40% of women with gestational diabetes had abnormal glucose tolerance at postnatal testing at various intervals from 4 to 10 weeks after delivery.

The aim of this study was to determine if any one of the 3 readings of the antenatal oral glucose tolerance test could be used to predict which patients would have persistent abnormal glucose tolerance after delivery. We hope to identify patients who would have normal glucose tolerance after delivery so as to spare them the postnatal oral glucose tolerance test.

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METHOD

This is a retrospective study of patients who delivered in the Department of Obstetrics & Gynaecology, Singapore General Hospital during the period from 15 December 1986 to 31 March 1993.

Antenatal patients with any one of the risk factors listed in Table I would have a 75-g load oral glucose tolerance test after an overnight fast. A Diabetic Register recorded those with abnormal oral glucose tolerance test results, as defined by the World Health Organisation in 1985[7] and they were classified into 2 groups:

1. those with frank diabetes mellitus (DM): 2-hour post-load glucose of 200 mg% (11.1 mmol/L) or more

2. those with impaired glucose tolerance (IGT): 2-hour post-load glucose of 140 mg% (7.8 mmol/L) or more but less than 200 mg% (11.1 mmol/L)

Women with gestational diabetes who were inadvertently left out of the Diabetic Register in the antenatal period due to administrative failure were identified when they were admitted

Table I - Risk factors for gestational diabetes

1. Family history of diabetes mellitus in first degree relatives
2. Past obstetric history of:
   a) gestational diabetes mellitus
   b) a big baby with a birth-weight of 4,000g or more
   c) recurrent miscarriages or unexplained perinatal death
3. Pregnancy complications such as:
   a) glycosuria
   b) macrosomia
   c) polyhydramnios
   d) recurrent urinary or genital tract infection
4. Constitutional factors such as:
   a) maternal age of 35 years or more
   b) maternal obesity - weight > 120% ideal weight
   c) use of diabetogenic drugs such as ß-sympathomimetics and corticosteroids

to the labour ward for delivery. In this way, all pregnancies complicated by abnormal glucose tolerance were captured.
A repeat oral glucose tolerance test was done 6 weeks after delivery. The patients' records were traced and the relevant information was extracted.

Various fasting blood glucose levels from the antenatal oral glucose tolerance test were used to predict the persistence of glucose intolerance after delivery. The sensitivity, specificity and positive predictive value at various cut-off points were determined. The 1-hour post-load glucose levels and the 2-hour post-load glucose levels from the antenatal oral glucose tolerance test were then analysed in the same way.

RESULTS

From 15 December 1986 to 31 March 1993, there were 595 women with gestational diabetes mellitus, giving an incidence of 2.3% of all deliveries. A total of 298 (50.1%) patients had a postnatal oral glucose tolerance test done. Of these, 5 patients missed the test at 6 weeks postpartum but had it done within 3 months of delivery. The other patients either did not turn up for the test or were not given an appointment for the test.

Of the 298 women who had the test done, 69 (23.2%) had persistent abnormal glucose tolerance after delivery, either impaired glucose tolerance or frank diabetes mellitus.

The percentage of patients with abnormal glucose tolerance after delivery at the various antenatal fasting, 1-hour post-load and 2-hour post-load glucose levels are shown in Fig 1, 2 and 3 respectively. For example, of the patients whose fasting glucose levels were between 5.5 to 6.0 mmol/L at the antenatal oral glucose tolerance test, 50% had abnormal glucose tolerance after delivery (Fig 1).

The cumulative frequency of patients with postnatal abnormal glucose tolerance, sensitivity, specificity and positive predictive value at the various antenatal fasting, 1-hour post-load and 2-hour post-load glucose levels are shown in Tables II, III and IV respectively. For example, 28.9% of the patients with gestational diabetes had 1-hour post-load glucose levels of less than 9.0 mmol/L and of these, 15.1% had abnormal glucose tolerance postnatally (Table III).

The receiver operator characteristic (ROC) curve was plotted for each of the 3 antenatal oral glucose tolerance test results and the 3 curves were superimposed on the same graph for comparison (Fig 4).

Fig 1 – Persistent postnatal glucose intolerance at various antenatal fasting glucose levels

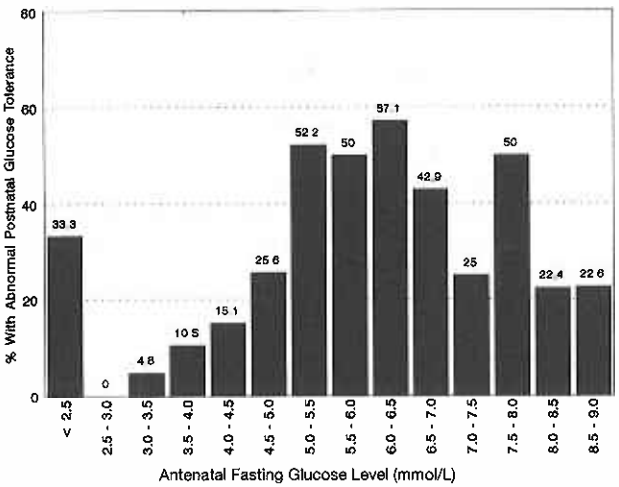


Fig 2 – Persistent postnatal glucose intolerance at various antenatal 1-hour post-load glucose levels

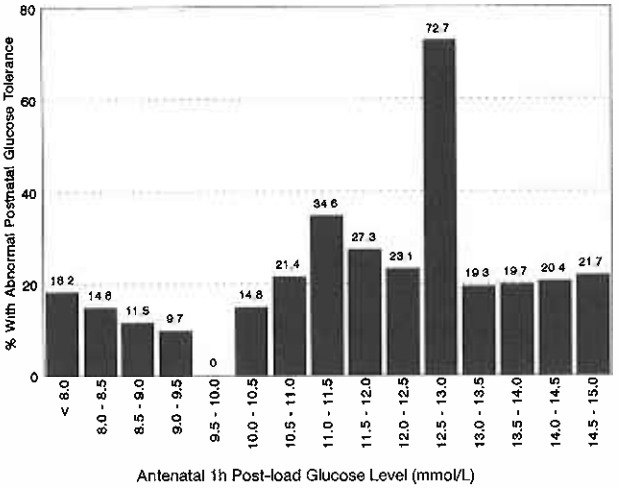


Fig 3 – Persistent postnatal glucose intolerance at various antenatal 2-hour post-load glucose levels

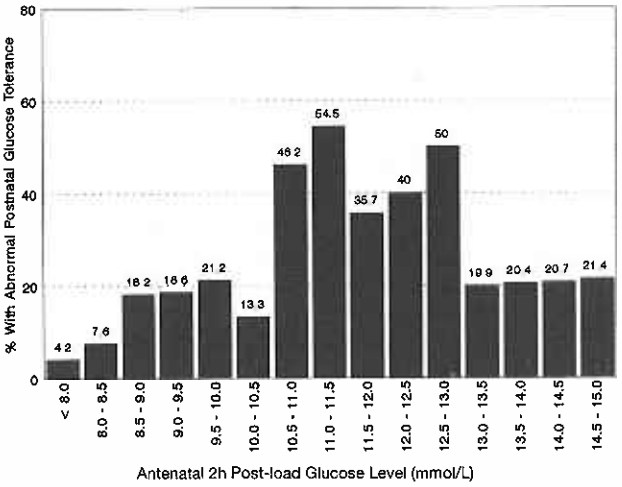


Fig 4 – ROC curves for the prediction of postnatal glucose intolerance using antenatal OGTT

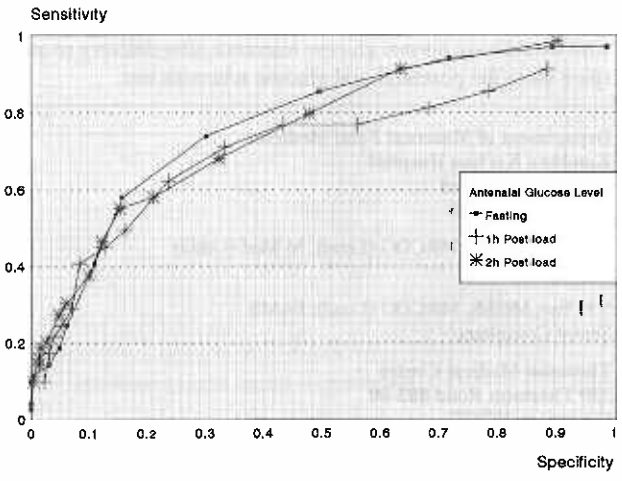


Table II - Cumulative frequency of patients with postnatal abnormal glucose tolerance, sensitivity, specificity and positive predictive value at various fasting glucose levels from the antenatal oral glucose tolerance test

Fasting glucose (mmol/L)	Total (n)	CF (%)	Postnatal glucose intolerance (n)	(%)	Sensitivity (%)	Specificity (%)	PPV (%)
<2.5	6	2.0	2	33.3	97.1	1.7	22.9
<3.0	27	9.1	2	7.4	97.1	10.9	24.7
<3.5	69	23.2	4	5.8	94.2	28.4	28.4
<4.0	126	42.3	10	7.9	85.5	50.7	34.3
<4.5	179	60.1	18	10.1	73.9	70.3	42.9
<5.0	222	74.5	29	13.1	58.0	84.3	52.6
<5.5	245	82.2	41	16.7	40.6	89.1	52.8
<6.0	267	89.6	52	19.5	24.6	93.9	54.8
<6.5	274	91.9	56	20.4	18.8	95.2	54.2
<7.0	281	94.3	59	21.0	14.5	96.9	58.8
<7.5	289	97.0	61	21.1	11.6	99.6	88.9
<8.0	291	97.7	62	21.3	10.1	100.0	100.0
<8.5	295	99.0	66	22.4	4.3	100.0	100.0
<9.0	296	99.3	67	22.6	2.9	100.0	100.0

CF = cumulative frequency; PPV =positive predictive value

Table III - Cumulative frequency of patients with postnatal abnormal glucose tolerance, sensitivity, specificity and positive predictive value at various 1-hour post-load glucose levels from the antenatal oral glucose tolerance test

1h post-load glucose (mmol/L)	Total (n)	CF (%)	Postnatal glucose intolerance (n)	(%)	Sensitivity (%)	Specificity (%)	PPV (%)
<8.0	33	11.1	6	18.2	91.3	11.8	23.8
<8.5	60	20.1	10	16.7	85.5	21.8	24.8
<9.0	86	28.9	13	15.1	81.2	31.9	26.4
<9.5	117	39.3	16	13.7	76.8	44.1	29.3
<10.0	146	49.0	16	11.0	76.8	56.8	34.9
<10.5	173	58.1	20	11.6	71.0	66.8	39.2
<11.0	201	67.4	26	12.9	62.3	76.4	44.3
<11.5	227	76.2	35	15.4	49.3	83.8	47.9
<12.0	238	79.9	38	16.0	44.9	87.3	51.7
<12.5	251	84.2	41	16.3	40.6	91.7	59.6
<13.0	262	87.9	49	18.7	29.0	93.0	55.6
<13.5	269	90.3	52	19.3	24.6	94.8	58.6
<14.0	274	91.9	54	19.7	21.7	96.1	62.5
<14.5	279	93.6	57	20.4	17.4	96.9	63.2
<15.0	286	96.0	62	21.7	10.1	97.8	58.3

CF = cumulative frequency; PPV =positive predictive value

Fig 5 shows the cumulative frequencies of patients with various fasting glucose levels on the antenatal oral glucose tolerance test and those with postnatal abnormal glucose tolerance, either IGT or DM. Fig 6 shows the same information for the various antenatal 2-hour post-load glucose levels.

DISCUSSION

It is important to identify patients with persistent abnormal glucose tolerance after delivery because diabetes mellitus is associated with multi-organ involvement in the long-term. Early detection of the condition will allow early control of the disease and minimise its long-term complications such as arteriosclerosis, nephropathy and retinopathy.

It was our clinical impression that patients with lower fasting glucose levels and lower 2-hour post-load glucose levels. with the antenatal oral glucose tolerance test had milder disease and therefore were less likely to have persistent glucose intolerance postnatally than those with higher glucose levels. Kjos et al[4] and Catalano et al[5] had also identified elevated fasting glucose level as a predictor of postnatal glucose intolerance in their studies.

Hence, the purpose of this study was to identify a reasonable cut-off point, using the antenatal oral glucose tolerance test results, to decide which patients did not require postnatal oral glucose tolerance testing.

From the ROC curve for the antenatal fasting glucose level, the 2 suggested cut-off points are 4.5 mmol/L and 5.0 mmol/L. If patients with a fasting glucose level of 4.5 mmol/L on the antenatal oral glucose tolerance test were excluded from postnatal testing, then 26% of patients with persistent abnormal glucose tolerance after delivery, either IGT or DM, would have been missed (Fig 5). If only those with diabetes mellitus on postnatal testing were considered, then 17% would have been missed. If a fasting glucose level of 5.0 mmol/L were used as the cut-off

Table IV – Cumulative frequency of patients with postnatal abnormal glucose tolerance, sensitivity, specificity and positive predictive value at various 2-hour post-load glucose levels from the antenatal oral glucose tolerance test

2h post-load glucose (mmol/L)	Total (n)	CF (%)	Postnatal glucose intolerance (n)	(%)	Sensitivity (%)	Specificity (%)	PPV (%)
<8.0	24	8.1	1	4.2	98.6	10.0	24.8
<8.5	90	30.2	6	6.7	91.3	36.7	30.3
<9.0	134	45.0	14	10.4	79.7	52.4	33.5
<9.5	177	59.4	22	12.4	68.1	67.7	38.8
<10.0	210	70.5	29	13.8	58.0	79.0	45.5
<10.5	225	75.5	31	13.8	55.1	84.7	52.1
<11.0	238	79.9	37	15.5	46.4	87.8	53.3
<11.5	249	83.6	43	17.3	37.7	90.0	53.1
<12.0	263	88.3	48	18.3	30.4	93.9	60.0
<12.5	268	89.9	50	18.7	27.5	95.2	63.3
<13.0	278	93.3	55	19.8	20.3	97.4	70.0
<13.5	281	94.3	56	19.9	18.8	98.3	76.5
<14.0	284	95.3	58	20.4	15.9	98.7	78.6
<14.5	285	95.6	59	20.7	14.5	98.7	76.9
<15.0	290	97.3	62	21.4	10.1	99.6	87.5

CF = cumulative frequency; PPV =positive predictive value

Fig 5 – Cumulative frequency curves for the antenatal fasting glucose level

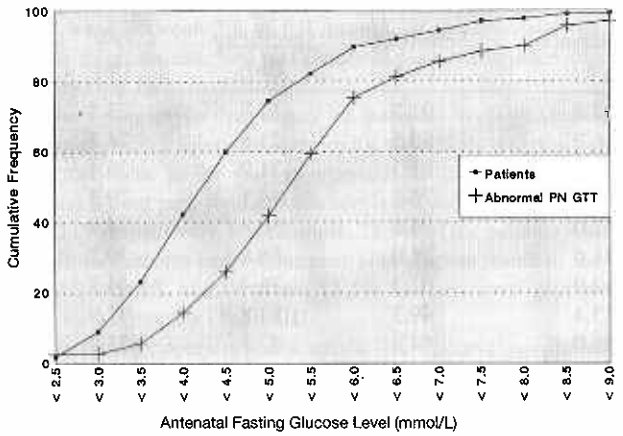
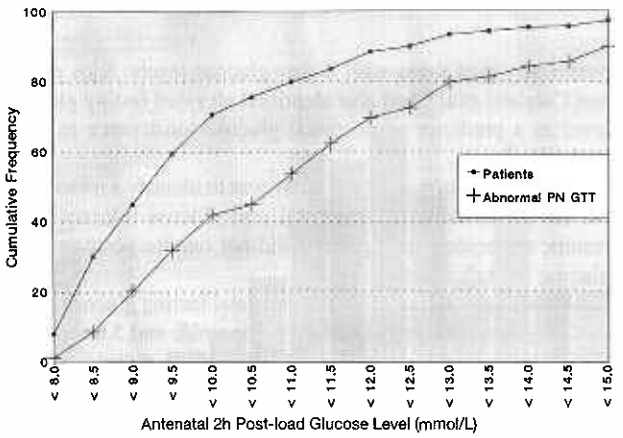


Fig 6 - Cumulative frequency curves for the antenatal 2-hour post-load glucose level



point, we would miss 42% of those with persistent abnormal glucose tolerance (Fig 5) and 21% of those with diabetes mellitus.

The ROC curve for the 2-hour post-load glucose level suggested that 10.5 mmol/L would be the best cut-off point to use. However, using this cut-off point would miss 45% of patients with persistent abnormal glucose tolerance (Fig 6) and 21% of those with diabetes mellitus.

Hence, all the 3 readings from the antenatal oral glucose tolerance test are not good enough for predicting postnatal abnormal glucose tolerance as their sensitivities and specificities were not high enough.

We also have to bear in mind the results of studies which have shown that women with gestational diabetes have higher risks of developing diabetes mellitus in later life even if their 6-week postnatal glucose tolerance test results were normal. Farrell et al[8] found that the cumulative prevalence of abnormal glucose tolerance 12 months after delivery was 33.3%. Grant et al[9] found that 19% of women with gestational diabetes had abnormal glucose tolerance when retested at intervals of 1 to 12 years following delivery. O'Sullivan[10], using cumulative life table analysis found that 73% of women with gestational diabetes followed-up for 24 years or more had developed diabetes mellitus.

CONCLUSION

This study proves that the results of the antenatal oral glucose tolerance test cannot be used to predict reliably which patients will have persistent abnormal glucose tolerance after delivery. Hence, all patients with gestational diabetes will still need a postnatal oral glucose tolerance test. This is important as diabetes mellitus is associated with multi-organ damage in the long run and early detection and control will minimise its long-term complications.

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