Otago Diabetes

Diabetes and abnormal glucose tolerance in women with previous gestational diabetes in New Zealand

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Abstract

Gestational diabetes mellitus (GDM) is a condition in which women exhibit high blood glucose levels during pregnancy. These women are at increased risk for the future development of Type-2 diabetes and should undergo diabetes screening annually. After investigating women in the Otago region with GDM, we found that 65.6% underwent screening for Type-2 diabetes postpartum with a mean time to the first screen of 17.2 months. The prevalence of Type-2 diabetes in our study was 1.9% at 6 weeks after birth increasing to 15% by 20 months. These results indicate that future diabetes is prevalent amongst women with previous GDM and that improvements in postpartum screening are required.

Introduction

Gestational diabetes mellitus (GDM) is a risk factor for the future development of diabetes and complicates 3-8% of pregnancies although varies according to the ethnic makeup of the population [1]. After delivery, an estimated 2-14% of women with GDM have Type-2 diabetes and a further 3-35% of women have impaired fasting glucose (IFG) or impaired glucose tolerance (IGT) [2-4]. In long-term studies the cumulative incidence of diabetes is 13-20% by 9-11 years [5-6].

Internationally, there are several different criteria used for the diagnosis of gestational diabetes [7-11]. Therefore the future development of diabetes following GDM is dependant on the criteria used for establishing the diagnosis of GDM in the first place. The criteria for the diagnosis of GDM in New Zealand is different to other countries [9]. It is unknown whether women diagnosed with GDM by this criteria have the same future risk of developing diabetes as those diagnosed using other criteria.

Following GDM, continual screening for the future development of diabetes is recommended [7,9] as it assumed that the diagnosis of diabetes will reduce diabetes related morbidity. However, the rate of postpartum glucose testing is less than half in some studies [2]. There is no information on the uptake of screening for the development of diabetes in women with prior GDM in New Zealand.

The aim of this study was to determine the rate of postpartum glucose abnormalites in women with GDM diagnosed by the New Zealand GDM criteria and the adherence to postpartum screening for diabetes.

Methods

The records of all women with diagnosed gestational diabetes in the Otago region of New Zealand between the years 2005 and 2008 were obtained. The Otago region has a population

of 193,800 and an ethnic population of 79.6% European, 6.6% Maori, 4.1% Asian, 1.7% Pacific [12]. All women who are diagnosed with gestational diabetes in this region attend a single antenatal diabetes clinic, which ensures that complete ascertainment of data has been achieved. The diagnosis of gestational diabetes was according to the current criteria adopted by the New Zealand Society for the Study of Diabetes (NZSSD). The criteria consists of a fasting glucose of >5.5mmol/L and/or a 2 hour value of >9mmol/L during a 75g oral glucose tolerance test [9]. The following data was obtained on each woman: age, gestational age of baby, birth weight and mode of delivery. The following biochemical data was also collected: oral glucose tolerance test results at diagnosis, screening for diabetes at 6 weeks postpartum, further screening for diabetes in subsequent years.

All women are seen in the antenatal diabetes clinic 6 weeks postpartum after a 75g oral glucose tolerance test. Information concerning appropriate ongoing screening for diabetes is given to each woman and her primary care physician at this time. The NZSSD recommendations are that women with a prior diagnosis of GDM have annual screening for development of diabetes [9]. The diagnostic criteria for diabetes in New Zealand is a fasting glucose concentration ≥7 mmol/l and/or a 2 hour value ≥11.1 mmol/l during a 75g oral glucose tolerance test. Impaired fasting glucose (IFG) is defined as a fasting glucose level of 5.6-6.9 mmol/l and impaired glucose tolerance (IGT) as a 2 hour glucose concentration of 7.8-11.0 mmol/l during a 75g oral glucose tolerance test. For the purposes of this study dysglycaemia was defined as either diabetes, IFG or IGT.

All blood testing in the Otago region is performed by a single laboratory. The laboratory measures glucose using the glucose oxidase method.

Stata version 11.1 was used to calculate the odd ratios and 95% confidence intervals. Logistic regression models were used to calculate an adjusted odds ratio controlling for mother's age, gestational age, weight of baby, and mode of delivery.

Results

One hundred and twenty-eight women met the inclusion criteria for the study. The characteristics of the group are shown in Table 1.

Of those women with gestational diabetes 104 (81%) underwent screening for diabetes with an oral glucose tolerance test at 6 weeks postpartum. Of these women 24 (23.07%) had dysglycaemia (impaired fasting glucose (5.77%), impaired glucose tolerance (8.65%), both (6.73%) or diabetes (1.92%)) (Table 2).

Table 1 - Characteristics of women in study

Characteristic	No. of Participants n=128
Age (years)	
Younger than 25	10 (7.8)
25-29	18 (14.0)
30-35	45 (35.2)
Older than 35	55 (43.0)
Gestational Age (weeks)	
<37	73 (57.0)
≥37	55 (43.0)
Type of delivery	
Vaginal	59 (46.8)
Caesarean	67 (53.2)
Birthweight (gram)	
<4000	104 (81.3)
≥4000	24 (18.7)

Data are n (%)

Of the 128 women, 84 (65.6%) underwent some form of follow-up screening for Type 2 diabetes (Table 3). Therefore 34.4% of women never had any form of postpartum screening for diabetes. In addition only 25.8% had their first screening test at the recommended time of 12 months postpartum.

Table 2 – Results of 6/52 OGTT

	No. of women n=104	Prevalence (%)
Normal	80	76.9
IFG	6	5.77
IGT	9	8.65
IGF & IGT	7	6.73
Diabetes	2	1.92

Table 3 – Postpartum screening

	No. of women n=128	Prevalence (%)
Screening		
Yes	84	65.6
No	44	34.4
Undergo **12month*** screening	33	25.8 ± 7.6

*10-14 months considered as annual screening

The mean time to screening was 17.8 (±2.62) months postpartum (Table 4). For women with a normal 6 week postpartum glucose tolerance test, the mean time to further screening was 17.6 (±3.12) months. For women with either IFG or IGT the mean time was 13.5 (±5.73) months. Those women who did not undergo a 6 week test had a mean time to follow up screening of 24.8 (±7.28) months. Of the 84 women who underwent some form of future

screening for diabetes, 13 (15.5%) progressed to Type 2 diabetes. The mean time to diabetes being diagnosed by screening test was 20.7 (±4.51) months postpartum. Seventeen (20.2%) developed IFG and/or IGT during postpartum screening. Of those with a normal 6 week OGTT, three (5.7%) progressed to diabetes whereas of those with an abnormal OGTT at 6 weeks, five (31.3%) progressed. Of those who did not undergo 6 week testing, five (33.3%) progressed to diabetes.

Table 4 – Results of last postpartum screening test based on 6/52 week OGTT status.

Outcome of last screening test	Total n=84	Normal 6/52 n=53	Abnormal 6/52 n=16	No 6/52 n=15
Normal	64.3	77.4	50	40.0
IFG/IGT	20.2	17.0	18.8	13.3
Diabetes	15.5	5.7	31.3	33.3
Average time to first screen	17.8 ± 2.62 months	17.6 ± 3.12 months	13.5 ± 5.73 months	24.8 ± 7.28 months

Data are % ± 95% C.I.

There were a total of 125 screening tests undertaken during the follow-up period by the 84 women who underwent some form of screening (Table 5). Of these tests 72% were fasting glucose levels and 28% were 75g oral glucose tolerance tests. Of those individuals who underwent fasting glucose screening 22.2% developed dysglycaemia compared to 54.3% who had an oral glucose tolerance test. The oral glucose tolerance test is 3.62 (1.55-8.37) as likely to detect dysglycaemia compared to a fasting test alone.

Those women with a fasting glucose ≥5mmol/l at the time of diagnosis of gestational diabetes were 1.55 (1.07-2.22) times as likely to progress to dysglycaemia compared to women with a fasting level <5mmol/l (Table 6).

Table 5 – Dysglycaemia diagnosis based on screening tool

	Prevalence (%)	Adjusted OR*
OGTT (n=35)	54.3	3.62 (1.55-8.37)**
Fasting (n=90)	22.2	

OR, odds ratio (95% C.I.)
*Adjusted for maternal age, gestational age, birth weight, mode of delivery.
**P=0.003

Table 6 – Prevalence of dysglycaemia based upon fasting levels at diagnosis of gestational diabetes

Fasting glucose (mmol/L)	Prevalence (%)	Adjusted OR*
<5.0	21.4	
≥5.0	42.5	1.55 (1.07-2.22)**

OR, odds ratio (95% C.I.)
**Adjusted for maternal age, gestational age, birth weight, mode of delivery.
*P=0.02

The likelihood of future screening did not correlate with differences in maternal age, gestation at delivery, birth weight or mode of delivery.

Discussion

Our results show that the majority of women with gestational diabetes in our population undergo screening at 6 weeks postpartum. Some studies have shown similar findings [13], however others have reported much lower rates of approximately 30% [14-15]. One study showed that of those that subsequently developed diabetes only 30% had undergone a 6 week postpartum screen for diabetes [16]. The routine recall of women for a follow-up visit with the diabetes specialist following an OGTT in our unit may be responsible for the high rate of postpartum screening. Specialist follow-up has been associated with a higher rate of screening [15]. Other factors associated with increased postpartum screening rates include older maternal age, higher education, earlier GDM diagnosis, use of diabetes medications during pregnancy, and more provider contacts after delivery [17]. Our study showed that there was no statistically significant correlation between maternal age, gestation at delivery, birth weight or mode of delivery and the likelihood of future screening The follow up by a specialist is an important opportunity to detect glucose abnormalities as shown in our results where 24% had some form of dysglycaemia, similar to other studies [14].

Gestational diabetes is diagnosed by different diagnostic criteria in different countries [7-11]. However, despite different criteria the National Diabetes Data Group and the American Diabetes Association similarly predict the likelihood of developing postpartum dysglycaemia at approximately 25% [18]. The criteria for the diagnosis of GDM in New Zealand has been different to other countries by adopting a 2 hour value of 9mmol/l during a 75g OGTT [9]. The results of our study show that with these criteria the future development of diabetes is similar to when GDM is diagnosed with other criteria.

Rates of screening for diabetes after the initial 6 week screen fell significantly in our study with only 65% of women undergoing some form of screening with a mean time to screening of 17.8 months. In addition, those women who failed to undergo a 6 week screen were also less likely to have on-going screening. These rates are higher than those reported by others, even with a organised follow-up screening programme [13]. Although primary care physicians are aware of the risk that GDM poses in terms of future diabetes risk they often do not assess and screen women for its development [19].

A systematic review showed that the cumulative incidence of diabetes ranged from 2.6% to over 70% in studies that examined women 6 weeks postpartum to 28 years postpartum with the most rapid rise in cumulative incidence occurring in the first 5 years with a plateau after 10 years [20]. The prevalence of Type-2 diabetes in our study was only 1.9% in those having a 6 week postpartum screen increasing to 15% by 20 months postpartum. This rate of progression is lower than in another report from New Zealand that found a 19% risk of progression; however that cohort had a significantly higher percentage of Maori individuals than our population [16]. We found that progression to diabetes was more common in those women with an abnormal 6 week postpartum OGTT or those who did not undergo the 6 week test at all.

The majority of women had screening for diabetes by fasting plasma glucose rather than by oral glucose tolerance test. Different criteria and recommendations are used for the screening and diagnosis of diabetes by different expert groups [21-22]. Our study shows that the OGTT is superior to fasting glucose at detecting dysglycaemia. This is to be expected since the OGTT includes a fasting plasma glucose concentration. However, it appears from our data that the 2 hour value after glucose ingestion does detect a significant proportion of women with abnormal glucose tolerance or diabetes that would have been missed by a fasting glucose level alone. One possible explanation for this finding is that the OGTT may have

been utilised in especially high risk individuals who were more likely to demonstrate abnormalities.

An interesting finding from this study is that those women with a fasting glucose level ≥5mmol/l at the time of the diagnosis of GDM were at a significantly higher risk of developing postpartum dysglycaemia. This finding has been reported by other groups [23-24]. This could be used to identify an especially high risk group for the future development of diabetes that should have more aggressive follow-up screening and lifestyle intervention.

This study has several limitations. The total number of women in this study was relatively small and the findings need to be verified by larger cohorts. In addition the participants in this study mainly consisted of women of European descent and different results have been reported in a population with a higher percentage of at risk ethnic groups. However this study has the strength that it comprises all women diagnosed with GDM in a confined geographic location who have all had their care through a single antenatal diabetes service and all glucose measurements performed by one laboratory improving completeness of data capture.

In conclusion this study shows that the future development of dysglycaemia in women with prior GDM as diagnosed by the New Zealand criteria is similar to that of other criteria. Whilst screening at 6 weeks postpartum is commonly performed, testing beyond this stage is reduced. Improved follow-up of women with prior gestational diabetes should be encouraged so that preventive measures can be instituted and the diagnosis of diabetes can be established at an earlier stage.

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