Gestational Diabetes Mellitus

Is a diagnosis associated with an increase in maternal anxiety and stress in the short and intermediate term?

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OBJECTIVE — To examine anxiety levels of women diagnosed with gestational diabetes mellitus (GDM) and to compare these with glucose-tolerant (GT) women at similar stages of pregnancy.

RESEARCH DESIGN AND METHODS — Prospective longitudinal study conducted on 50 women with GDM and 50 GT women. All women completed the Mental Health Inventory (MHI-5) forms and the Speilberger State-Trait Anxiety Inventory (STAI) at the beginning of the third trimester, antepartum, and 6 weeks postpartum. Specific questions were also assessed using a Likert scale.

RESULTS — Women with GDM, compared with GT women, had a higher level of anxiety (state rather than trait) at the time of the first assessment. However, before delivery and in the postpartum period, there were no significant differences in anxiety scores between the two groups. Women in both groups were positive about being tested for GDM and wished to be tested during future pregnancies.

CONCLUSIONS — There were no sustained increased levels of anxiety for women diagnosed with GDM. Concerns expressed about causing sustained maternal anxiety by testing for GDM could not be substantiated.

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Gestational diabetes mellitus (GDM) is glucose intolerance of variable severity with onset or first recognition during the current pregnancy (1). GDM is a disorder with both immediate and long-term complications. There is an increased risk of perinatal mortality and morbidity (2), an increased risk of obesity or impaired glucose tolerance in the offspring (3), and a very high risk of the mother converting to type 2 diabetes in later life.

Despite the risks mentioned above, the diagnosis of GDM is still an area of controversy. There are procedural matters related to the various means of testing and diagnostic criteria. There is also a spectrum of opinion ranging from advice that all testing for GDM should be stopped (4) to a recommendation that all women (5), or at least women with risk factors (1), should be tested.

The putative potential harms that may be occasioned by a diagnosis of GDM ranges from a higher rate of obstetric intervention to increased levels of maternal anxiety. Although, for example, an increased rate of cesarean section can be found in some (6) but not all (7) centers, data related to maternal anxiety have been inadequately developed.

The aim of this prospective longitudinal study was to examine anxiety levels at the beginning of the third trimester, antepartum, and 6 weeks postpartum in women diagnosed with GDM and to compare these levels with those in glucose-tolerant (GT) women at similar stages of pregnancy.

RESEARCH DESIGN AND METHODS

— This study was performed in a small city in Australia with one centralized diabetes service. All pregnant women are offered a test for GDM using the Australasian Diabetes in Pregnancy Society (ADIPS) criteria. Unless otherwise indicated, women are tested in the morning at the beginning of the third trimester using a 75-g glucose tolerance test (GTT) administered after an overnight fast. No preliminary challenge test is used. A diagnosis of GDM is made if the fasting glucose level is ≥5.5 mmol/l (99 mg%) and/or the 2-h glucose level is ≥8.0 mmol/l (144 mg%) (8). For patient convenience, a modified GTT is sometimes performed when the fasting glucose level is omitted (9). The 75-g GTT, based on the World Health Organization (WHO) recommendation, is the standard used in most centers in Australia.

The population of the study area is ~280,000 people, and there are ~2,900 deliveries each year in two public hospitals and one private hospital. Currently, approximately one-quarter of the women attend private obstetric care providers, approximately one-third of the women attend prenatal clinics at the public hospitals, and the remainder of the women participate in a "shared care" program with their general practitioners. The women in the latter group only attend the prenatal clinics of the public hospitals at the beginning of the third trimester.

The Diabetes Center runs a specialized clinic for women with GDM. All women are seen by a diabetes nurse educator and a dietitian. It would be most unusual for any woman with GDM in the

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Abbreviations: GDM, gestational diabetes mellitus; GT, glucose tolerant; GTT, glucose tolerance test; MHI-5, Mental Health Inventory 5; STAI, State-Trait Anxiety Inventory.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

area not to attend the Diabetes Center. This study was performed over a 12-month period starting in November 2000. All women attending the Diabetes Center were eligible to be included in the study if they had GDM, had a singleton pregnancy, had not been previously diagnosed with GDM, were tested after 26 weeks of gestation, and had been seen in the clinic both within 1 week of diagnosis and before 32 weeks of gestation. All women had to be able to read and write English to give informed consent and had to be willing to follow the study protocol.

Basic demographic and anthropometric data were collected from all women. Preconception weight was by recall, and BMI was calculated by dividing the weight in kilograms by the height in meters squared. To measure the participant's general mental health, the Mental Health Inventory (MHI-5) was used (10). The MHI-5 assesses five dimensions (anxiety, depression, positive affect, loss of behavioral or emotional control, and psychological well-being) on a 1–6 Likert scale; the minimum score is 5 and the maximum score is 30. The MHI-5 also forms the Mental Health Scale from the Medical Outcomes Study Short Form Health Survey (SF-36) (11). MHI-5 has been shown to be a reliable and valid measure of psychological health/illness (10,12). It has been validated in diabetes populations (13) and has proven to be as accurate as other longer questionnaires in detecting diagnosable mental disorders. In addition to total scores, we used the suggested cutoff (10) of a total MHI-5 score exceeding 16 to identify "caseness" for major depression and distress to ascertain the clinical significance of our findings. To measure state and trait anxiety, the Speilberger State-Trait anxiety inventory was used (14). This is a standard valid and reliable anxiety scale that has been used in other studies of women with GDM (15). The state and trait scales both have 20 items, scored on a 1–4 scale (minimum score 20, maximum 80). The state scale asks about how the participant feels "right now - at this moment," whereas the trait scale asks the participant to respond to how they "generally feel."

Participants were also specifically asked to respond along a Likert scale line about their attitudes toward being tested for GDM with six questions: *1*) "How did you feel when you were first told you had gestational diabetes?"; *2*) "How do you feel now?"; *3*) "Are you glad you had a test for gestational diabetes?"; *4*) "Do you wish you had never had a test for gestational diabetes?"; *5*) "Do you want to be tested for gestational diabetes if you have another child?"; and *6*) "Do you think having gestational diabetes in this pregnancy might influence your decision whether or not to have more children?" GT women in the control group were not asked questions 1, 2, and 6.

Questionnaires were administered at the first clinic visit (~30 weeks of gestation, henceforth designated as "week 30"), 6 weeks later (before delivery, henceforth designated as "week 36"), and 6 weeks postpartum. Women were given the option of either completing the first questionnaire at the time of the clinic visit or taking the questionnaire home and returning it at their next visit. The two subsequent questionnaires (week 36 and postpartum) were issued at the initial visit and returned by the postpartum visit.

For comparative purposes, a group of GT women were also recruited according to the above inclusion criteria, and questionnaires were administered in a similar manner. These women were approached at the prenatal clinic and through private obstetric care providers to provide a mix of public and private patients not dissimilar to the mix of women with GDM. A total of 50 women were ultimately recruited and completed the study to match the 50 women with GDM (vide infra) who finished the study.

This study was reviewed by the combined Illawarra Area Health Service and University of Wollongong Human Research Ethics Committee. ANOVA, Student's *t* test, χ^2 test, and odds ratios were used as appropriate for the comparisons between the groups. Criterion for statistical significance was set at $P < 0.05$.

RESULTS — A total of 131 women with GDM were referred to the Diabetes Center over the 12-month study period. Of these 131 women, 38 were excluded: 24 because of previous GDM, 2 who were pregnant with twins, 1 whose diagnosis was incorrect, 7 who were from non-English speaking backgrounds, 1 with developmental delay, 1 presenting after 33 weeks of gestation, and 2 who failed to stay for the duration of the initial appointment. Of the remaining 93 women, 56 were recruited (6 later decided not to participate) and 37 declined.

Selected details of the women with GDM and the control subjects are shown in Table 1. The women with GDM were, as could be expected, slightly older and had a higher preconception BMI. There were no differences with respect to parity, gestational week of testing, marital status, living arrangements, family history of diabetes, and percentage with private insurance.

The 43 women with GDM who did not participate in the study (37 who declined and 6 who withdrew) were younger (29.0 ± 5.3 years; $P = 0.02$) and had a higher 2-h glucose level on the GTT (9.1 ± 1.2 mmol/l; $P = 0.05$) but did not differ in other details from the women with GDM who did participate.

Impact of GDM on mental health and anxiety

As shown in Table 2, there were few differences in mental health and anxiety measures between patient groups. At the first visit, women with GDM reported significantly greater psychological distress on the MHI-5 and state anxiety scores. These scores had become similar to those of the control subjects by week 36 and remained so in the postpartum period. There were no differences at any stage between the groups on trait anxiety scores.

Using the recommended cutoff of 16 to detect "caseness" for major depression on the MHI-5, women with GDM (n = 15, 30%) were more depressed than the control subjects (n = 6, 12%; $P = 0.03$). Therefore, at the time of diagnosis of GDM, there is a threefold increased risk of developing significant depressive feelings (odds ratio 3.14, CI 1.1–8.94). However, by week 36 and in the postpartum period, the level of stress and anxiety for women with GDM was the same as the baseline levels of the control pregnant women on all measures.

At week 36, seven of the women with GDM were receiving insulin therapy. There were no significant differences in state anxiety ($P = 0.87$) or mental health scores ($P = 0.06$) between these women and those being treated with diet alone.

There was a significant difference in the demographic variable of country of birth between groups. To assess whether this contributed to the differences in anxiety and depression found between groups, we compared the country of origin with mental health and anxiety scores at 30 weeks. There were no differences

Table 1—*Selected demographic and clinical details for women with GDM and control subjects*

	Women with GDM (n = 50)	Control subjects (n = 50)	t or χ^2	P
Age (years)	31.4 ± 5.0	29.0 ± 4.8	−2.45	0.02*
Parity	0.9 ± 1.1	0.7 ± 1.2	−0.88	0.38
Weight (kg)	71.3 ± 20.2	70.0 ± 12.3	−1.30	0.20
Height (m)	1.61 ± 0.07	1.66 ± 0.08	3.25	0.002*
BMI (kg/m^2)	27.4 ± 7.2	24.6 ± 3.8	−2.34	0.02*
Weeks at GTT	28.4 ± 1.8	28.2 ± 0.6	−1.06	0.29
0-h fasting glucose level (mmol/l)	4.7 (0.5)	4.4 (0.3)	−1.33	0.20
(mg%)	84.6 (9.0)	79.2 (5.4)		
2-h fasting glucose level (mmol/l)	8.7 (1.0)	5.5 (1.1)	−14.77	0.000*
(mg%)	156.6 (18.0)	99.0 (19.8)		
Privately insured (%)	46	32	2.06	0.15
Family history of diabetes (%)	30	16	2.59	0.11
Married (%)	86	76	1.62	0.20
Living with partner (%)	96	90	1.38	0.24
Australian born (%)	66	86	5.48	0.02*

Data are means ± SD. *$P < 0.05$

either in mental health ($P = 0.45$) or state anxiety scores ($P = 0.64$) with respect to country of origin. There was a difference between groups with respect to age, but analyzing this with respect to mental health and anxiety scores did not reveal any significant differences.

Attitudes toward being tested for GDM

A summary of the patients' attitudes toward testing for GDM is shown in Table 3. Using ANOVA, no significant differences were detected between women with GDM and control subjects at week 30, week 36, and in the postpartum period. Both groups of women were strongly positive about being tested for GDM in the current pregnancy and in future pregnancies.

Impact of diagnosis of GDM

Regarding how the women with GDM recalled feeling immediately after being told about the diagnosis, responses were diverse, ranging from "not being worried at all" (10% of respondents) to "as worried as I have ever felt" (42% of respondents). On a 0–100 Likert scale, the mean response was 63.5 (SD 27.4, range 0–100) at the time of diagnosis. However, after both the first medical consultation and the first visit to the Diabetes Center, the score at week 30 had decreased significantly ($P = 0.000$) to 44.7 (25.6, 0–86). By week 36, the score had decreased to 25.0 (19.9, 0–85), and by the postpartum period, the score was 13.2 (15.9, 0–72). Having GDM in the current pregnancy did not seem to be an impediment to consideration about future pregnancies. When subjects were asked the question "Do you think having gestational diabetes in this pregnancy might influence your decision whether or not to have more children?" at week 30, the mean (SD) response was 14.2 (22.0); at week 36, the response was 9.1 (18.2), and in the postpartum period, the response was 8.9 (15.3).

CONCLUSIONS — When maternal welfare is considered, the potential for increased psychological stress caused by an additional complicating diagnosis in pregnancy must be a consideration. The possibility that testing for and diagnosing GDM could cause anxiety sufficient to negate the benefits of diagnosis and treatment has been raised. However, there is little objective information on this subject.

In practical terms, in the study area, all pregnant women are tested for GDM and attend the Diabetes Center if results are positive. The women in this study were derived from consecutive women with GDM seen over a 12-month period. Some exclusion criteria were applied. Women in whom GDM had been diagnosed during a previous pregnancy were not included in the study because it was considered possible that their previous experiences with GDM may have altered their responses. Also, the few women with multiple pregnancy were not consid-

Table 2—*Mental health and anxiety status scores for women with GDM and control subjects*

	Women with GDM (n = 50)	Control subjects (n = 50)	F	P
Mental health (MHI-5)				
Week 30	13.9 ± 4.8	11.4 ± 3.8	8.53	0.004*
Week 36	10.9 ± 3.8	11.7 ± 4.0	1.06	0.31
Postpartum	11.5 ± 4.5	11.7 ± 4.0	0.07	0.79
State anxiety (STAI)				
Week 30	40.6 ± 13.3	34.2 ± 9.9	7.55	0.007*
Week 36	33.7 ± 10.9	35.3 ± 9.1	0.63	0.43
Postpartum	31.7 ± 10.6	34.1 ± 10.9	1.19	0.28
Trait anxiety (STAI)				
Week 30	39.5 ± 10.3	38.3 ± 10.2	0.31	0.58
Week 36	36.0 ± 9.0	37.8 ± 10.4	0.88	0.35
Postpartum	34.4 ± 10.5	36.7 ± 9.5	1.37	0.24

Data are means ± SD. *$P < 0.05$.

Table 3—*Responses on a 0–100 Likert scale to feelings about GDM testing for women with GDM and control subjects*

	Women with GDM (n = 50)	Control subjects (n = 50)	F	P
Are you glad you had a test for GDM? (0 = no, 100 = yes)				
Week 30	91.7 ± 17.4	88.4 ± 14.8	1.03	0.31
Week 36	88.1 ± 24.8	93.3 ± 10.3	1.85	0.18
Postpartum	92.8 ± 19.7	93.3 ± 11.8	0.02	0.88
Do you wish you never had a test for GDM? (0 = no, 100 = yes)				
Week 30	9.4 ± 23.7	4.6 ± 9.6	1.78	0.18
Week 36	10.2 ± 24.2	4.0 ± 7.5	2.91	0.09
Postpartum	9.8 ± 22.8	4.2 ± 5.8	2.86	0.09
Do you want to be tested for GDM if you have another pregnancy? (0 = no, 100 = yes)				
Week 30	96.9 ± 9.9	92.4 ± 15.6	2.96	0.09
Week 36	93.0 ± 20.6	94.1 ± 10.1	0.11	0.74
Postpartum	94.8 ± 15.7	95.9 ± 7.9	0.19	0.66

Data are means ± SD.

ered because existing anxiety levels may have confounded the results. It was also decided to restrict the study to women who were diagnosed before a certain week of gestation to ensure time to conduct a second prepartum test. Women who were not able to give informed consent (e.g., women from a non–English-speaking background) were also excluded. It is possible that these few women may comprise a special group for whom anxiety concerns are a real factor.

After exclusions based on defined criteria, more than half of the remaining women participated in and completed the study. Apart from some minor points, there were no major differences between the women who participated in the study and those who declined or subsequently changed their minds. Statistical analysis did not reveal any biases in our results from this variation between groups.

In 1989, Spirito et al. (16) found no difference in anxiety or depression scores for women with GDM compared with GT control subjects some weeks after diagnosis. They opined that if there had been a negative effect at the time of diagnosis, then this was not operative some weeks later. Contrary to their expectations, use of insulin was not found to have an adverse effect on emotional status. Four years later, Likert scales were used to assess women's attitudes about screening and diagnosis of GDM (17). Women were positive about the advantages of testing during pregnancy and indicated their willingness to be tested during any subsequent pregnancy—an attitude that was incidentally substantiated in a subsequent study (18).

In 1994, Langer and Langer (19) reported a prospective study of women with GDM who were compared with a group of women at high risk for GDM but who were GT. Reviews were performed at ~37–38 weeks of gestation. Not only did treatment of these women cause no increase in anxiety or depression scores, but the achievement of glycemic goals contributed to patient reassurance. No adverse effects were associated with use of insulin.

In 1997, Kerbel et al. (15) found that the perception of health was lower in women who had a false-positive result of glucose challenge test than in women who were not tested or whose test results were negative. A comparison was not made with women in whom GDM had been diagnosed. Considering the study methodology and the <50% response rate, it is possible that women with concerns may have been more likely to respond. Omitting the screening test and proceeding straight to the definitive test can easily circumvent any potential anxieties about a false-positive result of screening. One year later, a retrospective review of some of the women involved in the Toronto Tri-Hospital Gestational Diabetes Screening Study found a reduction in self-perceived health status some years after diagnosis (20). Given that these women are at increased risk for diabetes, this cannot be considered an unreasonable or unexpected finding.

In the present study, women in whom GDM had been diagnosed recalled having a high level of worry at the time of diagnosis. This had reduced significantly by the time of the first visit to the Diabetes Center and continued to decrease significantly at week 36 and in the postpartum period. Both women with GDM and control subjects remained very positive about having been tested for GDM and about the need for testing in future pregnancies.

At week 30, women with GDM, compared with control subjects, had an increase in state anxiety scores rather than trait anxiety scores. This indicated that their anxiety was reactive rather than intrinsic. By week 36 and in the postpartum period, there were no significant differences in any of the scores. Therefore, women with GDM were worried and anxious at the time of diagnosis, an understandable phenomenon, but were no different than control subjects by week 36 and in the postpartum period. It was very likely that receiving medical advice and a treatment plan quickly dissipated any anxiety and distress. Similar to previous reports (16,19), albeit with smaller numbers, we were unable to demonstrate any increased level of anxiety among women requiring insulin therapy.

There may be certain differences in diagnosis and treatment of GDM in the study area that might contribute to this lack of anxiety. All women, rather than women with selected risk factors, are offered a test for GDM. Therefore, anxiety about being "classified" as being in a high-risk group or about being excluded from being tested and wondering about whether a diagnosis has been missed is avoided. The GTT used is relatively simple, with no preliminary challenge test (to potentially cause anxiety about false-positive results) and only a 75-g glucose load and a 2-h test duration. In addition, women are seen within 1 week of diagnosis by a specialized medical, nursing, and dietetic team with considerable expertise in this condition. Women are followed at approximately 2-week intervals during pregnancy and are informed about what will happen in the postpartum period.

To our knowledge, this is the first prospective longitudinal study of anxiety in women with GDM with assessments at diagnosis as well as before and after delivery. Some women with GDM had reactive anxiety at the time of diagnosis that quickly settled. Some weeks after diagnosis (week 36) and in the postpartum period, no differences could be demonstrated between women diagnosed and treated with GDM and control subjects. In the study area, women with GDM do not have any sustained increase in anxiety, and concerns about causing anxiety should not be an impediment to testing for GDM.

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