

Gestational Diabetes: Is a Higher Cesarean Section Rate Inevitable?

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OBJECTIVE — To determine the rate of and indication for cesarean section for women with gestational diabetes mellitus (GDM) compared with glucose-tolerant women.

RESEARCH DESIGN AND METHODS — From a consecutive series of women with GDM seen over a 9-year period for medical management, women who had had a cesarean section were identified and the reason for the section determined from a review of the medical record. A control group of women who had had a section were obtained from an existing database of glucose-tolerant women.

RESULTS — The section rate for women with GDM was higher at 19.8% than the 15.6% for glucose-tolerant women. However, after adjustment for age and parity, no significant differences were found. There were also no differences found for the primary indication for section.

CONCLUSIONS — In our health area of New South Wales, Australia, women with GDM do not have a higher section rate compared with glucose-tolerant women. Concerns about the diagnosis of GDM leading to an increased rate of obstetric intervention should not be generalized.

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Gestational diabetes mellitus (GDM) is any degree of glucose intolerance with onset or first recognition during pregnancy (1). Women with undiagnosed or poorly managed GDM are at increased risk of having a large for gestational age (LGA) infant. A LGA infant may be responsible for cephalo-pelvic disproportion and hence an increased risk of obstetric intervention including cesarean section.

While it is not invariable that women with GDM will have a higher section rate (2,3), it has been suggested recently that knowledge by the obstetric care providers that a woman has GDM is likely to lead to a higher rate (4–6). If this is the case, then some of the potential advantages of diagnosing GDM may be offset by the cost,

inconvenience, and complications of this higher section rate. However, if higher section rates are found only in some hospitals, then knowledge about this local practice should not be endorsed as a general disincentive to test women for GDM.

The aim of this study was to determine the cesarean section rate in a consecutive series of women with GDM and to compare the reasons for section with a control group of consecutive glucose-tolerant women.

RESEARCH DESIGN AND METHODS — The diagnosis of GDM was based on the recommendations of the Australasian Diabetes in Pregnancy Society (ADIPS) criteria (7). Unless indicated earlier

in pregnancy, all women were tested at the beginning of the 3rd trimester with a 75-g oral glucose tolerance test (GTT) administered in the morning after an overnight fast. Although the ADIPS criteria allow the option of a preliminary screening test, all women in our Health Area of New South Wales, Australia have the definitive GTT as a one-stage test. Women were diagnosed with GDM if the 2-h plasma glucose level was ≥ 8.0 mmol/l (144 mg/dl). Although the ADIPS criteria specify that GDM is also diagnosed if the fasting level is ≥ 5.5 mmol/l (99 mg/dl), 92% or more of cases of GDM are diagnosed on the result of the 2-h level (8). For local logistical reasons some women only have the 2-h test on the GTT (9).

The women with GDM who had had a section were from a consecutive series of women referred for the medical management of their GDM to a diabetologist (R.G.M.) over the period 1990–1998. All details were obtained from a comprehensive clinical database established and maintained for all women treated. All women were seen initially and reviewed as required by a dietitian and diabetes educator. All women received a carbohydrate-controlled diet and performed home glucose monitoring. The use of insulin was recommended if the fasting glucose was ≥ 5.5 mmol/l or the postprandial glucose levels were ≥ 8.0 mmol/l 1 h after a meal or ≥ 7.0 mmol/l 2 h after a meal. Obstetric care was conducted independently of the medical management and there were no combined appointments. The number of obstetric care providers primarily responsible for the deliveries varied over the period when the data was being collected but was approximately six.

For comparison, a control group of women who had had a section was obtained from a database established in 1993 of glucose-tolerant women. The primary purpose of this database was to investigate whether there was a continuum of risk for adverse pregnancy outcomes related to maternal glucose levels. The results have been reported elsewhere (10). The women in this database were consecutive patients from the prenatal clinics and obstetricians in private practice. These women were chosen for comparison because all of the relevant maternal, fetal,

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Abbreviations: ADIPS, Australasian Diabetes in Pregnancy Society; GDM, gestational diabetes mellitus; GTT, glucose tolerance test; LGA, large for gestational age.

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

Table 1—Selected demographic and clinical details of women with GDM and glucose-tolerant women who have had a cesarean section

| | Women | |
|------------------------------|----------------------|----------------------|
| | GDM | Glucose-tolerant |
| n | 216 | 216 |
| Age (years) | 31.3 ± 5.1 (16–42) | 28.1 ± 5.1* (16–42) |
| Parity | 1.0 ± 1.0 (0–4) | 0.8 ± 1.0† (0–6) |
| BMI (kg/m ²) | 27.4 ± 6.3 (16–44) | 24.3 ± 4.3* (16–40) |
| Gestational week of test | 28.5 ± 3.3 (9–38) | 29.0 ± 1.8 (22–36) |
| 2-h GTT (mmol/l) | 9.0 ± 1.1 (8.0–14.6) | 5.8 ± 1.0* (3.3–7.9) |
| Birth weight (kg) | 3.3 ± 0.6 (1.3–5.2) | 3.4 ± 0.6 (0.9–4.7) |
| Gestational week of delivery | 38.5 ± 1.7 (32–42) | 38.9 ± 1.7 (31–42) |

Data are means ± SD. *P < 0.0001, †P < 0.05.

and pregnancy outcome data were already available. A number of glucose-tolerant women who had had a section equal to the number of women with GDM who had had a section was taken from the database in a sequential manner after the database had been sorted by medical record number. A medical record number was applied by the hospital to all patients (obstetric and nonobstetric) independently of the reason for presentation.

The primary reason for the section was entered into the medical record by the obstetric medical officer responsible at the time of the delivery. The medical records of all patients were subsequently reviewed by a registered nurse and the primary reason for the section extracted and categorized into 10 groups as shown in RESULTS.

BMI was determined by dividing the prepregnancy weight (in kilograms) by recall by the height (in meters) squared. Only women with singleton pregnancies were considered. The gestational age of testing and delivery was determined by the obstetric care providers using a combination of patients' dates, clinical assessment, and ultrasound examination. All pregnancy outcome data were determined from the New South Wales Midwives Data Collection Form. It is a statutory requirement in New South Wales that this form be completed for every pregnancy.

Unless otherwise stated, all results have been expressed as means ± 1 SD. Statistical methods used included the χ^2 test, t test, and logistic regression analysis.

RESULTS — The prevalence of GDM in our Health Area is 7.2% and there are just over 3,000 births each year (11). Over the 9-year period 1,092 women with GDM were seen, of whom 216 (19.8%) had had

a section. A total of 1,421 records of glucose-tolerant women were examined to find 216 sections (15.6%). This difference was significant (P < 0.01) but did not remain so after adjustment for age and parity. Selected demographic and clinical details of these patients are shown in Table 1.

A logistic regression on the combined data for all of the women with GDM (n = 1,092) and all the glucose-tolerant women (n = 1,421) was carried out to see whether the variables age, parity, weight, height, BMI, week of test, the glucose level of the GTT at 2 h, fetal birth weight, and gestational age of delivery had any influence on whether or not the mother had had a section. Only age, parity, and gestational week of delivery were significant (P < 0.002) after correction for all other variables. In addition, a logistic regression was performed to test the effect of GDM on cesarean section after correction for age, parity, and gestational week of delivery. The

analysis could only use the results for 2,478 women because a small number of women had missing values for at least one of the variables to be used in the analysis. The effect of GDM was not significant (P = 0.06) after correction for the other three variables.

The GDM women who had not had a section (n = 876) were younger at 29.6 ± 5.2 years (P < 0.0001), had a lower BMI at 25.7 ± 5.5 kg/m² (P < 0.01), and were delivered later at 39.1 ± 1.5 weeks (P < 0.0001) compared with GDM women who had had a section. There were no significant differences with respect to parity, the gestational week of the GTT, fetal birth weight, and the 2-h glucose result of the GTT.

The glucose-tolerant women who had not had a section (n = 1,205) were younger at 27.1 ± 4.9 years (P < 0.01), had a lower 2-h glucose result of the GTT at 5.6 ± 1.0 mmol/l (P < 0.01), and were delivered later at 39.7 ± 1.4 weeks (P < 0.0001) compared with glucose-tolerant women who had had a section. There were no significant differences with respect to parity, the gestational week of the GTT, and fetal birth weight.

An elective section was carried out in a significantly (P < 0.05) higher proportion of the women with GDM (126 of 216, 58.3%) compared with the glucose-tolerant women (106 of 216, 49.1%).

For the women with GDM, the section rate did not differ significantly for any of the 9 years. For women with GDM, the percentage requiring insulin treatment was similar for those who had a section (38 of 216, 17.6%) and for those who did not (145 of 876, 16.6%).

For the state of New South Wales, Australia, with ~86,000 births each year over

Table 2—Primary indication for cesarean section for women with GDM and glucose-tolerant women

| | Women | |
|--------------------------------|-----------|------------------|
| | GDM | Glucose-tolerant |
| n | 216 | 216 |
| Antepartum hemorrhage | 2.3 (5) | 1.9 (4) |
| Breech presentation | 14.8 (32) | 19.4 (42) |
| Cephalo-pelvic disproportion | 3.7 (8) | 3.7 (8) |
| Failure to progress | 15.7 (34) | 19.9 (43) |
| Failed induction | 2.3 (5) | 1.9 (4) |
| Fetal distress | 11.6 (25) | 13.9 (30) |
| Pregnancy-induced hypertension | 4.6 (10) | 4.2 (9) |
| Placenta previa | 1.4 (3) | 1.9 (4) |
| Previous section | 31.9 (69) | 27.3 (59) |
| Other | 11.6 (25) | 6.0 (13) |

Data are % (n).

the period considered, the section rate has ranged from 17.1% in 1993 to 18.2% in 1997 (the last year for which data are available). In 1997, for example, the section rate within different health areas of the state have ranged from 14.0 to 23.8% (12). However, in our Area the section rate has remained very constant, 15.4, 15.7, 15.8, 15.8, 15.4, and 15.6% for the years 1992 through 1997.

The primary indications for the cesarean section are shown in Table 2. With a χ^2 analysis of the contingency table, using either each individual indication or various groupings of reasons, there was no significant association between the indication for the section and whether the woman had GDM.

CONCLUSIONS — The rate of and reason for cesarean section in women with GDM has been mentioned incidentally in many papers but specifically examined in only a few. For women who have had their GDM intensively treated, and who have a reduced rate of macrosomia, the section rate is only slightly above that found in a glucose-tolerant population (2,3). Where a higher section rate for women with GDM compared with glucose-tolerant women has been reported, it has been ascribed either to a need for repeat sections (13) or as an obstetric care provider-linked decision (4-6).

Goldman et al. (4) found that the section rate for women with GDM was 35.3% compared with 22.0% for glucose-tolerant women. After consideration of variables, it was thought that the increased rate was "probably related to patterns of physician decision-making." Buchanan et al. (5) found that in an insulin-treated GDM group the section rate of 43% was twice that of a diet-treated group despite a reduction in the rate of macrosomia. They felt that the indications for section were more rigorously applied for women treated with diet and there was a lower tolerance for women treated with insulin.

Naylor et al. (6) from the Tri-Toronto Hospital Gestational Diabetes Project found that the macrosomia rate was 14% for glucose-tolerant women, 29% for untreated women with GDM, and 10% for treated women with GDM. However the section rates were 22, 30, and 34%, respectively. Thus, women with treated GDM had about a third the rate of macrosomia but a similar section rate to women with lesser degrees of glucose intolerance

whose obstetric care providers were blinded to the result. It was felt that "recognition of GDM may lead to a lower threshold for surgical delivery that mitigates the potential benefits of treatment."

The above findings, if representative, could be a serious cause for concern. However, contrary results have also been reported. Langer et al. (2) found a rate of 21.5% for conventionally treated women with GDM and for intensively treated women with GDM a rate of 15.0%, which was not dissimilar to the 13.7% for the overall obstetric population. Hod et al. (3) have reported that development of and adherence to a management protocol for women with GDM has reduced the section rate over time.

In the series reported here the section rate for women with GDM at 19.8% was slightly higher than the rate of 15.6% for glucose-tolerant women but this increased rate was explained by the increased age and parity of the women with GDM. The mean fetal birth weights for glucose-tolerant and GDM women were not significantly different. When the specific primary indication for the sections was examined, there were no significant differences between glucose-tolerant and GDM women.

There is a marked international variation in the cesarean section rate (14). There has also been a generalized increase over time and some changes in the primary indications (15). In Australia, the section rate has gradually increased over the years with differences between states, between urban and rural areas, and even between hospitals in the same city (16). These differences are presumably results of the clinical mix and the development of local obstetric practices. However it is also likely that non-medical factors such as socioeconomic class, insurance status, patients' expectations, obstetric convenience, and concerns over malpractice litigation are likely to influence the rate.

In the Illawarra Area the overall section rate occupied an intermediate position compared with the rates in other health areas within the state. The indications for and rates of cesarean section for glucose-tolerant and GDM women were similar and there was nothing to suggest that the diagnosis of GDM per se led to any increase in the rate of cesarean section. Thus, the genuine concerns by some that the advantages of a diagnosis of GDM may be discounted by an increased rate of cesarean section should not be generalized.

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