Prevalence of Gestational Diabetes and Macrosomic Newborns in a Mexican Population

Gerardo Forsbach, MD
Jesús J. Contreras-Soto, MD
Gerardo Fong, MD
Guillermo Flores, MD
Obdulia Moreno, PhD

Prevalence of gestational diabetes was investigated in 693 pregnant patients between the 24th and 28th wk of gestation. A glucose screening test (GST) was performed with a 50-g glucose load, followed by a blood sample 1 h later. Patients with glucose levels >140 mg/dl 1 h after the GST were scheduled for a full oral glucose tolerance test (OGTT). One hundred seven patients had an abnormal GST, and 30 patients (4.3%) were diagnosed as having gestational diabetes mellitus (GDM). The percentage of GDM increased significantly when glucose levels were >180 mg/dl to a maximum of 84.61% when glucose levels were >200 mg/dl. Also, patient age was directly related to GDM, which increased in incidence to 20% when patients >26 yr had an abnormal GST. After delivery, newborn weights were compared between those born to mothers with GDM (*n* = 30) and those born to mothers with an abnormal GST (*n* = 77). Patients with an abnormal GST and normal OGTT had 12 (15.58%) macrosomic and 2 premature newborns. However, patients with GDM had 5 (16.66%) macrosomic and no premature newborns. Patients with a normal GST had 7.33% of the macrosomic newborns. There was no perinatal mortality in newborns of GDM mothers; only 1 of the 5 macrosomic newborns presented transient hypoglycemia. Evaluation of 26 GDM patients was possible after delivery, disclosing 3 (11.53%) with non-insulin-dependent diabetes mellitus and 5 (19.23%) with impaired glucose tolerance. These results showed 4.3% undetected GDM in our population and no differences in the proportion of macrosomic newborns between those born to mothers with GDM and those born to mothers with an abnormal GST.
***Diabetes Care* 11:235–38, 1988**

From the Department of Endocrinology, Hospital de Gineco-Obstetricia "Dr. I. Morones," Instituto Mexicano del Seguro Social, Monterrey, Nuevo Leon, Mexico.

Address correspondence and reprint requests to G. Forsbach, MD, Hospital de Gineco-Obstetricia "Dr. I. Morones," Apartado Postal 71, C.P. 64000 Monterrey, Nuevo Leon, Mexico.

Fetal macrosomia affects the outcome of newborns, predisposing them to birth trauma and asphyxia at delivery (1). Maternal diabetes mellitus is a well-known cause of newborn macrosomia, and strict glucose control in patients with insulin-dependent diabetes mellitus decreases the prevalence of macrosomia in newborns (2,3). Gestational diabetes mellitus (GDM), defined as carbohydrate intolerance of variable severity with onset or first recognition during pregnancy, complicates 1–12% of all pregnancies and is associated with fetal macrosomia (1). Patients with GDM are at significant risk for fetal macrosomia, and prophylactic insulin treatment has been proposed to reduce its prevalence (4). This study surveyed the prevalence of GDM in a Mexican population and compared the prevalence of macrosomia between groups of patients with an abnormal 1-h postglucose blood glucose level but a normal oral glucose tolerance test (OGTT) and patients with GDM.

PATIENTS AND METHODS

Routine screening for GDM as recommended by the American Diabetes Association was begun at Hospital de Gineco-Obstetricia "Dr. I. Morones" (Instituto Mexicano del Seguro Social) in March 1986. This study comprised a 6-mo period at the antenatal clinic of the hospital and involved performing a glucose screening test (GST) of a blood sample 1 h after the ingestion of a 50-g glucose load in all pregnant patients between the 24th and 28th wk of gestation except those known to have diabetes. Patients whose glycemia was >140 mg/dl 1 h after the GST were scheduled for a full OGTT, preceded by a minimum of 3 days on a high-carbohydrate diet. The OGTT was done with a 100-g glucose

load, and blood samples were collected at 0, 1, 2, and 3 h. The OGTT was interpreted according to criteria proposed by the Second International Workshop-Conference on Gestational Diabetes Mellitus (5). Plasma glucose was measured with an automated hexokinase method. Obesity, defined as a prepregnancy weight >20% of ideal body weight (1983 Metropolitan Life Insurance Company tables), was recorded. Patients diagnosed with GDM were treated as high-risk pregnancies, and dietary therapy was prescribed to keep fasting blood glucose levels <100 mg/dl and 2-h postprandial blood glucose levels <120 mg/dl. If necessary, insulin therapy was instituted. An ultrasonographic evaluation of the fetus was obtained, and fetal heart rate was monitored weekly until delivery. Patients with a macrosomic fetus were submitted to elective cesarean section, and newborns were monitored during the first 2 days of life.

After delivery, newborn weights were compared between the GDM patients and patients with an abnormal GST but a normal OGTT. Macrosomia was defined as a newborn weight ≥4000 g. Patients with GDM were submitted to a standard OGTT performed and interpreted according to the National Diabetes Data Group (6) 3–6 mo after delivery. A test for linear trend in proportions (7) was used for analysis of the relation of the 1-h glucose level and GDM; χ^2-analysis was used to compare the prevalence of GDM for groups by age and to compare the incidence of macrosomia in the newborns.

RESULTS

A total of 765 pregnant women were screened between March and September 1986; patients who exceeded the 140 mg/dl glucose threshold were scheduled for a full OGTT. A total of 179 patients exceeded the glucose threshold limit, but 72 patients failed to keep their appointment for the OGTT and were excluded from the analysis. The total number of pregnant patients was reduced to 693, and 107 patients were submitted to an OGTT within 2 wk. One hundred twelve (16.66%) of the 693 patients and 24 (22.42%) of the 107 patients with an abnormal GST were obese. Thirty (28%) patients, 6 (20%) of them obese, who had an abnormal glucose level had an OGTT diagnostic of GDM and represented 4.3% of the total population. The relation between the results of the GST and a positive OGTT are shown in Table 1. The percentage of GDM increased significantly when glucose levels were >180 mg/dl up to a maximum of 84.61% when glucose levels were >200 mg/dl ($P < .02$). Table 2 shows the relation between patient age and GDM in these groups; the highest percentages of GDM occurred in patients 26–30 and 31–35 yr old, and there was a significant difference ($P < .02$) between patients <26 and >26 yr old. Twenty-one patients with GDM maintained fasting blood glucose levels <100 mg/dl and blood glucose levels 2 h after breakfast <120 mg/dl, without glucosuria or ketonuria, measured weekly until term. Glycosylated hemoglobin measured at the moment of diagnosis and at term was within normal limits. Three of these 21 women had macrosomic newborns. Nine patients with GDM required diet and insulin therapy to keep fasting blood glucose levels <100 mg/dl and blood glucose levels 2 h after breakfast <120 mg/dl without glucosuria or ketonuria. Insulin therapy was adjusted once or twice a week until term. Glycosylated hemoglobin measured at the moment of diagnosis and at term was within normal limits. Two of these 9 patients treated with diet and insulin had macrosomic newborns.

Toxemia appeared in 4 (13.33%) patients with GDM and in 7 (9.1%) patients in the group with abnormal GST but normal OGTT. Maternal obesity was associated with fetal macrosomia in 16.66% of the patients whose GST was normal, in 22.42% of the patients with an abnormal GST but a normal OGTT, and in 20% of the patients with GDM.

There were 43 (7.33%) macrosomic newborns in 586 women with a normal GST and 17 (15.88%) macrosomic newborns in 107 women with an abnormal GST; the difference between these groups was significant ($P < .02$). Women with an abnormal GST but a normal OGTT ($n = 77$) had 12 (15.86%) macrosomic new-

TABLE 1
Relationship between glucose levels 1 h after 50-g glucose load and diagnosis of gestational diabetes mellitus (GDM)

Plasma glucose (mg/dl)	Total patients (*n*)	GDM patients (*n*)	GDM (%)
140–149	41	3	7.31
150–159	21	5	23.80
160–169	13	2	15.38
170–179	6	1	16.66
180–189	7	3	42.85*
190–199	6	5	83.33*
≥200	13	11	84.61*
Total	107	30	

*$P < .02$ by test for linear trend in proportions (7).

TABLE 2
Prevalence of gestational diabetes mellitus (GDM) by age in women with abnormal glucose screening test*

Age (yr)	Total positive screens (*n*)	GDM patients (*n*)	GDM (%)
15–20	1	0	0
21–25	25	1	4.0
26–30	41	11	26.82†
31–35	37	10	27.02†
36–40	24	6	25.0†
41	9	2	22.2†

*Abnormal glucose screening test defined as serum glucose ≥140 mg/dl 1 h after oral ingestion of 50-g glucose load.
†$P < .02$ by test for linear trend in proportions (7).

borns, and women with an abnormal GST and GDM (n = 30) had 5 (16.66%) macrosomic newborns; the difference between these groups was not significant. Macrosomic newborns born to women with GDM were delivered by cesarean section. There was no perinatal mortality, and only 1 of the 5 newborns had transitory hypoglycemia, but there were no other complications or congenital abnormalities. Macrosomic newborns from women with abnormal GST but normal OGTT were also delivered by cesarean section, and there were no perinatal mortalities, complications, or congenital abnormalities.

After delivery, 26 of the 30 patients with GDM were submitted to a standard OGTT, 3 patients refused further testing, and 1 patient moved out of town. Eighteen (69.23%) patients had a normal OGTT after delivery, 5 (19.23%) patients showed impaired glucose tolerance, and 3 (11.53%) patients had non-insulin-dependent diabetes mellitus (NIDDM). Insulin requirement during pregnancy was not related to the final classification of these patients. Also, macrosomic newborns occurred in each of these groups.

DISCUSSION

GDM has been reported to complicate 1–12% of all pregnancies (1); in the United States, an incidence of 2–3% has been mentioned (8). However, some ethnic groups have an elevated prevalence of diabetes (9), and it has been suggested that the Mexican population (10) and the Mexican-American population with Spanish ancestry are at increased risk for NIDDM (11). Our study disclosed a 4.3% incidence of GDM, which is within the range reported for the general population but is increased when compared with the 2–3% mentioned by Gabbe (8). Screening by the 50-g glucose-load test selected 107 (15.44%) patients from the total population, and we found 30 (28%) patients with GDM in this selected population, which is close to the proportions of 30.8% with GDM obtained by Carpenter and Coustan (12) and 26.2% with GDM obtained by McFarland and Case (2) in populations selected by the GST. The relation between the 1-h glucose level and GDM in Table 1 showed that a progressive increase of positivity for the OGTT was associated with the highest 2-h glucose level ($P < .02$). Moreover, in the range of 140–149 mg/dl, 3 patients had GDM, supporting the need for performing systematic OGTT when the 1-h glucose level is >140 mg/dl. Maternal age has been proposed as an important factor directly related to GDM (2). In Table 2, maternal age was compared to the prevalence of GDM. Patients >26 yr old with an abnormal GST had >20% possibility of having GDM; the percentages of GDM between 26 and 42 yr ranged 22.2–27.02% and were significantly different from patients <26 yr old ($P < .02$).

Glycosylated hemoglobin has not been a sensitive indicator for GDM (5) or for detection of NIDDM in mothers of macrosomic newborns (13). Until now, the 50-g oral glucose test given without regard to time of last meal or time of day seemed to be the most sensitive test to select pregnant women for a complete OGTT (5).

Macrosomia in the newborn may be related to GDM or maternal obesity. However, when we compared the group of patients who had an abnormal GST with normal OGTT versus the group of patients with GDM, we found no significant difference between the percentages of macrosomic newborns (15.58 vs. 16.66%). Pregnant women with a normal GST had 7.3% macrosomic newborns. Interestingly, both figures are consistent with previous studies on the percentage of macrosomic newborns born to GDM mothers (14) but are also consistent with the overall incidence of macrosomic newborns (14.05%) in nondiabetic women with low-level hyperglycemia (15). Only one macrosomic newborn from the group of GDM patients had transitory hypoglycemia, and there were no other complications or congenital abnormalities in this group. After delivery, 26 of the 30 patients with GDM were evaluated, and an abnormal OGTT was found in 8 (30.76%) patients; the rest (69.23%) had a normal OGTT. It seems that in our population, a woman with an abnormal 1-h glucose level had the same risk for a macrosomic newborn as a woman with GDM, and a more stringent criterion may be necessary to evaluate pregnant patients.

Based on these findings, we concluded that the prevalence of GDM in our population was 4.3%. The 50-g GST selected a population that yielded a 28% incidence of GDM by the OGTT. Maternal age >26 yr with an abnormal GST was related to a possibility of >20% chance of having GDM. The prevalence of macrosomic newborns born to patients with GDM and to patients with an abnormal GST but a normal OGTT was not different. Evaluation of the patients with GDM after delivery disclosed 3 patients with NIDDM and 5 patients with impaired glucose tolerance.

ACKNOWLEDGMENTS

We acknowledge the helpful assistance of Drs. G. Joffre and E. Vargas from the Hospital de Gineco-Obstetricia "Dr. I. Morones" (Instituto Mexicano del Seguro Social).

REFERENCES

1. O'Sullivan JB, Charles D, Mahan CM, Dandrow RV: Gestational diabetes and perinatal mortality rate. *Am J Obstet Gynecol* 116:901–904, 1973
2. McFarland KF, Case CA: The relationship of maternal age on gestational diabetes. *Diabetes Care* 8:598–600, 1985
3. Gabbe SG: Management of diabetes mellitus in pregnancy. *Am J Obstet Gynecol* 153:824–28, 1985
4. Coustan DR, Imoralh J: Prophylactic insulin treatment of

gestational diabetes reduces the incidence of macrosomia, operative delivery, and birth trauma. *Am J Obstet Gynecol* 150:836–42, 1984
5. Summary and Recommendations of the Second International Workshop-Conference on Gestational Diabetes Mellitus. *Diabetes* 34 (Suppl. 2):123–26, 1985
6. National Diabetes Data Group: Classification and diagnosis of diabetes mellitus and other categories of glucose intolerance. *Diabetes* 28:1039–57, 1979
7. Snedecor GW, Cochran WG: *Statistical Methods*. 6th ed. Ames, Iowa State Univ. Press, 1976, p. 246–48
8. Gabbe SG: Gestational diabetes mellitus. *N Engl J Med* 315:1025–26, 1985
9. Knowler WC, Pettit DJ, Savage PJ, Bennett PH: Diabetic incidence in Pima Indians: contributions of obesity and parental diabetes. *Am J Epidemiol* 113:144–56, 1981
10. Alva RA, Ordoñez RB: Programa de detección y control de la diabetes sacarina en el Instituto Mexicano del Seguro Social. *Salud Publica Mex* 12:317–20, 1970
11. Hanis CL, Ferrell RE, Barton SA, Aquilar L, Garza A, Tulloch BR, Garcia CA, Schull WJ: Diabetes among Mexican-Americans in Starr County Texas. *Am J Epidemiol* 118:659–72, 1983
12. Carpenter MW, Coustan DR: Criteria for screening tests for gestational diabetes. *Am J Obstet Gynecol* 144:768–73, 1982
13. Contreras J, Mata-Cárdenas B, Avila A, González-Quiroga G, Forsbach G: Hemoglobina glucosilada y curva de tolerancia a la glucosa en madres de recién nacidos macrosómicos. *Rev Med Inst Mex Seguro Soc* 24:397–400, 1986
14. Landon MB, Gabbe SG: Antepartum fetal surveillance in gestational diabetes mellitus. *Diabetes* 34 (Suppl. 2):50–54, 1985
15. Tallarigo L, Giampietro O, Penno G, Miccoli R, Gregori G, Navalesi R: Relation of glucose tolerance to complications of pregnancy in nondiabetic women. *N Engl J Med* 315:989–92, 1986