# Do Low-Risk Prenatal Patients Really Need a Screening Glucose Challenge Test?

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**BACKGROUND.** It is common practice to routinely screen pregnant women for gestational diabetes. The screening technique typically used is the 1-hour 50-g oral glucose tolerance test (OGTT), with a subsequent 3-hour 100-g OGTT for women whose 1-hour test was positive. This process can be both time-consuming and inconvenient for patients. Additionally, its sensitivity and specificity are estimated to be 70% and 87% respectively, and data about the effect of screening and treatment on low-risk pregnancy outcomes are limited. The objective of this study was to reassess the value of routine screening of all pregnant patients with a 1-hour glucose challenge test.

**METHODS.** At a university-based family practice center with a predominantly low-risk population, a retrospective analysis was performed of all patients (n=595) who received prenatal care and gave birth between January 1988 and December 1993. Among women in whom gestational diabetes was diagnosed on the basis of glucose tolerance testing, we identified those with risk factors for the disease, and examined whether a selective screening program based on risk factors alone would have resulted in correct diagnoses of gestational diabetes.

**RESULTS.** Of the 595 patients, 544 (91.4%) were screened with a 1-hour 50-g OGTT. This initial screening test was positive in 76 women (12.8%). Of these, 58 (76.3%) then had a 3-hour 100-g OGTT, and 13 received a diagnosis of gestational diabetes. Nine of these 13 women had risk factors for gestational diabetes. We determined that less than 1% of prenatal patients without risk factors for gestational diabetes were ultimately found to have gestational diabetes.

**CONCLUSIONS.** Screening with a 1-hour 50-g OGTT only those women who have identifiable risk factors for gestational diabetes is a reasonable approach to identifying the disease in a low-risk population. All pregnant women should have a thorough history taken to determine whether they have risk factors for gestational diabetes.

**KEY WORDS.** Diabetes, gestational; prenatal diagnosis; risk factors; pregnancy outcome. *(J Fam Pract 1997; 44:556-561)*

Gestational diabetes, the most common medical problem of pregnancy, is reported to occur in 3% to 5% of all pregnancies.[1] Factors that place a woman at higher risk for developing gestational diabetes include obesity, greater maternal age, a family history of diabetes mellitus, and previous unfavorable pregnancy outcomes, such as macrosomic infant, stillbirth, neonatal death, congenital abnormality, multiple spontaneous abortions, polyhydramnios, preeclampsia, prematurity, and previous gestational diabetes.[2] Some have concluded that relying on commonly accepted historical factors is an inadequate method of identifying women at risk for gestational diabetes, and thus have recommended routine screening of all pregnant women with an oral glucose tolerance test (OGTT).[3,4] Some studies of low-risk populations, however, suggest that selective screening of only those women with risk factors is a safe alternative that does not increase the likelihood of

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adverse outcomes.[5]

Screening for diabetes in pregnancy is a controversial subject, and there is little agreement on screening recommendations. The Third International Workshop on Gestational Diabetes recommended that all pregnant women have a 50-g OGTT between 24 and 28 weeks' gestation, and that a 1-hour plasma glucose value greater than 140 mg/dL be the cutoff for performing a 3-hour 100-g OGTT.[6] The Committee on Technical Bulletins of the American College of Obstetricians and Gynecologists (ACOG) acknowledges that there are no data to support the benefit of universal screening.[7] The United States Preventive Services Task Force (USPSTF) concluded that there is insufficient evidence at present to recommend for or against routine screening for gestational diabetes.[8] In their review of the literature, Hunter and Keirse[9] concluded that routine glucose tolerance testing in pregnant women should be discontinued.

Ideally, the strongest study to examine the controversy about universal screening for gestational diabetes is a randomized controlled trial. Since such a trial is unlikely, cohort studies can be helpful. We have conducted a 5-year retrospective analysis to determine (1) the percentage of patients in a low-risk population of a family practice center who had a positive 1-hour 50-g glucose tolerance screening test, (2) how many of these tests were true positives, and (3) whether these women with true positive tests could have been selected for screening on the basis of historical risk factors such as obesity, family history, or previous adverse pregnancy outcome.

## METHODS

Subjects eligible for this study were all women who enrolled at the family practice center of a large southern academic medical center for prenatal care prior to 26 weeks' gestation, carried the pregnancy until at least 28 weeks' gestation, gave birth between January 1, 1988, and December 31, 1993, and had no personal history of diabetes. They were considered low-risk patients because of the absence of significant disease, particularly the absence of diabetes mellitus. Five hundred ninety-five women met these eligibility criteria.

As is usual in this medical center, physicians followed the common screening practice of a 1-hour 50-g OGTT at 24 to 28 weeks' gestation. The women were nonfasting and remained sedentary in the waiting room of the family practice center during the 1 hour between drinking the 50 g of liquid glucose and having the blood sample drawn. Patients with a plasma glucose value greater than 140 mg/dL 1 hour after the glucose challenge were considered to have a positive result, according to ACOG guidelines,[3] and were given the 3-hour 100-g OGTT. They were in a fasting state at the outset of the testing and were inactive in the waiting room of the family practice center during the 3 hours of testing. The criteria of the National Diabetes Data Group[10] were used to assess the results of the 3-hour OGTT. These criteria define an abnormal result as two or more of the following plasma glucose values: fasting, >105 mg/dL; 1 hour, >190 mg/dL; 2 hours, >165 mg/dL; and 3 hours, >145 mg/dL. Women with abnormal 3-hour OGTT results were classified as having gestational diabetes. All testing was performed in the family practice center laboratory, and the plasma glucose values were determined using the hexokinase enzymatic method.

### Data Collection

Laboratory results were obtained through a retrospective chart review of the patients' medical records and laboratory files. All patient charts were reviewed for recognized historical (pre-pregnancy) risk factors for gestational diabetes, including obesity, family history of diabetes mellitus, age greater than 35 years, previous gestational diabetes, previous macrosomic baby, and poor pregnancy outcome. Information on the medical record was confirmed and augmented by data collected from the university hospital's perinatal database. This database maintains extensive prenatal and delivery data on all births at the university hospital, where all patients from the family practice center give birth.

Since it has been reported that 8% of women who weigh >250 lb had gestational diabetes compared with less than 1% of those weighing <200 lb,[11] we defined maternal obesity in this study as weight >200 lb. Patient weight was taken from the family practice center medical record and/or the prenatal record. The weight at the time of conception, estimated by the weight at any visit during the year preceding the pregnancy or the weight recorded during the first 10 weeks of gestation, was used as the patient's baseline weight.

### Analysis

Epi Info[12] was used for data entry and analysis. Descriptive statistics were calculated to summarize the demographic characteristics of the study population and to determine the prevalence of gestational diabetes and other risk factors.

## RESULTS

Of the 595 women who met the criteria for our study, 60% were non-Hispanic white, 35% were black, and 5% of other races. The median age was 27 years, with a range of 15 to 46 years. Most patients (70%) were multiparous. The study practice serves a university community with a diverse socioeconomic population. The insurance status of the prenatal population is approximately 40% Medicaid and 60% private insurance or managed care. Of the 595 women in the study, 406 had no risk factors for gestational diabetes and 189 had one or more risk factors.

The screening results of 76 patients (12.8%) were positive for gestational diabetes; 51 patients (8.6%) either were not screened or had no record of a screening result. Of the 76 patients with a positive 1-hour glucose screening test, 58 (76.3%) subsequently underwent a 3-hour 100-g OGTT. Of these, 45 (77.6%) women had negative results; 13 (22.4%) had a positive test result and were thus classified as having gestational diabetes. These findings are summarized in the Figure.

Of the 13 women with gestational diabetes as determined by a positive 3-hour 100-g OGTT, 4 had no risk factors for gestational diabetes, and 9 had one or more of the following risk factors: obesity, family history of diabetes, previous poor pregnancy outcome, and previous macrosomic baby. Although age greater than 35 years and previous occurrence of gestational diabetes were also studied as risk factors, none of the 13 women in the group with gestational diabetes had these.

Of the infants born to the women in the study group, 83 had a birthweight of more than 4000 g. Eighty-one of these women had been screened with the 1-hour 50-g OGTT, and of these, 69 had a negative result and 12 had a positive result. Of the 12 women with a positive 1-hour screening result who eventually gave birth to infants weighing over 4000 g, 7 had normal results from the 3-hour 100-g OGTT, 2 had abnormal results, and 3 were not tested further.

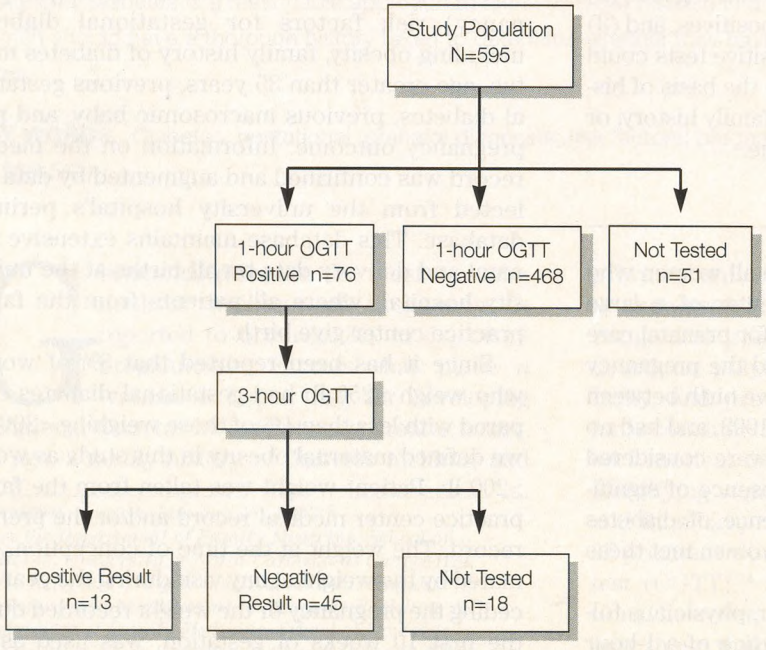
The 13 women in whom gestational diabetes was diagnosed after they had followed the entire screening protocol gave birth to 13 healthy infants. All these women had received dietary counseling, and only 2 of the newborns weighed more than 4000 g.

In the total group of 595 women, there were two stillbirths. Both were unexplained intrauterine deaths, one at 29 weeks' gestation and the other at 41 weeks' gestation. Both mothers had had negative 1-hour glucose screening tests earlier in the prenatal course.

Sixty-nine women (11.6%) did

**FIGURE**

**Summary of 1-hour and 3-hour OGTT screening program in study of testing for gestational diabetes in a low-risk population.**



not adhere to the screening protocol: 51 were not initially tested with a 1-hour glucose challenge, and 18 were not subsequently tested with a 3-hour glucose challenge after having a positive initial screening test. If the women who did not adhere to the screening protocol are omitted, the prevalence of gestational diabetes for the study population is 2.5% (13/526). The prevalence for women with no risk factors for the disease is 1.1% (4/353). The prevalence for women with one or more risk factors is 5.2% (9/173). The positive predictive value for the 1-hour 50-g OGTT was 22.4% (13/58).

Of the 51 patients who either were not screened with the 1-hour test or had no record of being screened, 12 (23.5%) had a risk factor for gestational diabetes. All 51 of these women had live-born infants, only two of which weighed more than 4000 g (4050 and 4480 g); neither of the two mothers had risk factors for gestational diabetes. Of the 18 women who were initially screened with the 1-hour 50-g OGTT and had a positive result (glucose concentration greater than 140 mg/dL) but were not tested further with the 3-hour 100-g OGTT, four had a risk factor for gestational diabetes. All 18 of these women had live births, and three of the infants weighed over 4000 g (4050, 4570, and 4610 g). Only one of the three mothers had a risk factor for gestational diabetes, ie, a positive family history.

## DISCUSSION

We found a low prevalence of gestational diabetes in this clinical setting. Universal screening of all women in this population of prenatal patients yielded only a 2.5% prevalence of gestational diabetes. Only 1% of women with no risk factors subsequently received a diagnosis of gestational diabetes.

The 2.5% prevalence rate cited includes only those women who followed the protocol for screening. Sixty-nine women (11.6%) did not adhere to the screening protocol. Reasons for nonadherence included patient refusal, personal practices of some of the physicians, and dietary counseling and management after a positive initial 1-hour screening test result without verification by the 3-hour OGTT. The lack of screening of these women might falsely lower the prevalence of gestational diabetes.

Central to controversy surrounding universal screening is that there is no evidence that detection will lower perinatal mortality because perinatal mortality is not excessive in these women.[13] Although gestational diabetes is reported to be associated with perinatal complications due to macrosomia, such as birth trauma, instrumented vaginal delivery, and cesarean section,[14] and some estimate that up to 30% of infants born to mothers with gestational diabetes have a birthweight >4000 g,[15] others have found that less than 4.4% of women with untreated gestational diabetes give birth to infants weighing 4500 g or more.[16] One study[17] suggested that up to 10,000 women would need to be screened to prevent 50 cases of macrosomia, 6 cases of shoulder dystocia, and 1 case of shoulder girdle injury. Furthermore, few of these cases result in lasting problems.

In this study, birthweight was used as the most reliable outcome measurement because reliable data regarding instrumental deliveries, dystocia, or birth trauma were not available. There were 83 infants weighing more than 4000 g born to the 595 mothers in the study. Sixty-nine of these women had a negative 1-hour 50-g glucose screening test, 12 had a positive test, and 2 were not screened at all. Of the 12 whose initial tests were positive, 7 were found to have normal glucose concentrations on the 3-hour 100-g OGTT, 2 were found to have abnormal readings on the 3-hour test, and 3 were not tested further. If dietary counseling does make a difference, the incidence of newborns weighing over 4000 g might have been reduced if all the women had been screened, as some would have been found to have gestational diabetes and therefore would have received dietary counseling.

Similarly, of the 18 women who had a positive 1-hour 50-g OGTT result but were not tested with the 3-hour OGTT, 3 gave birth to infants weighing more than 4000 g. Early identification of gestational diabetes and dietary management might have been effective in reducing the likelihood of these cases of macrosomia.

Since the purpose of screening is to detect and treat a disorder that carries an adverse prognosis,[4] early identification of gestational diabetes may lead to appropriate management of glucose intolerance and, therefore, to better outcomes for the mother and infant.[14,18,19] Two retrospective studies, however, found no significant difference in macrosomia or birth trauma among the infants of women screened for gestational diabetes compared with those of the unscreened control population.[20,21] Lucas et al[22] have

argued that universal screening is unjustified because the criteria for a screening program (ie, an important targeted disease, an acceptable screening test, a discriminating diagnostic test, and effective intervention for diseased individuals) are not met by available screening tests for gestational diabetes.

Even if treatment of gestational glucose intolerance reduces the incidence of macrosomia, such treatment is not likely to have much impact on the overall rate, since gestational diabetes is implicated as a cause of macrosomia in only 5% of all infants weighing 4500 g or more at birth.[23] Most macrosomic infants are born to women without gestational diabetes.[24] As described earlier, of the 83 infants in our study weighing more than 4000 g, 69 (83%) of their mothers had a negative screening test for gestational diabetes. Maternal obesity, gestational weight gain, and maternal age may be more important than gestational diabetes as determinants of macrosomia and adverse outcomes.[25] Thus, although fetal macrosomia is linked to gestational diabetes, maternal obesity is a prominent and inseparable cofactor.

Concern has been raised over the effects of manipulating fetal growth by strict diets or by insulin treatment in women with abnormal OGTT findings, the majority of whom will give birth to infants of normal weight.[5] One analysis found that women who maintained tight glucose control had a higher incidence of small-for-gestational-age newborns.[26]

Women with gestational diabetes are thought to be at higher risk for developing diabetes mellitus later in life.[27] Concerns that a selective screening program may miss these women, however, may be unfounded because it is likely that these women have risk factors that would put them in the group to be screened while pregnant.

We found that in this study population, selective screening of only those women with historical risk factors would have identified about 70% of the women with gestational diabetes. The remaining 30% who were diagnosed with gestational diabetes had no identifiable risk factors. This 30%, however, represents only 4 women of the 526 who fully adhered to the screening protocol, or less than 1%. Given that data on treatment of gestational diabetes in low-risk pregnancy are limited, it is unclear whether it is important to identify these four cases.

## CONCLUSIONS

There is no agreement regarding universal screening of all pregnant women for gestational diabetes, and there are some who question whether such screening should be done at all. We believe that identification of women with gestational diabetes may be important, but in the low-risk population of this study, the prevalence of gestational diabetes in women with no recognized risk factors was low. We therefore conclude that in low-risk populations, selectively administering the 1-hour OGTT only to women with risk factors for gestational diabetes is a preferable alternative to universal screening.

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**REFERENCES**

1. Magee MS, Walden DE, Benedetti TJ, et al. Influence of diagnostic criteria on the incidence of gestational diabetes and perinatal morbidity. JAMA 1993; 269:609-15.
2. Maresh M, Beard RW, Bray CS, et al. Factors predisposing to and outcome of gestational diabetes. Obstet Gynecol 1989; 74:342-6.
3. O'Sullivan JB, Mahan CM, Charles D, Dandrow RV. Screening criteria for high-risk gestational diabetic patients. Am J Obstet Gynecol 1973; 116:895-900.
4. Lavin JP, Barden RP, Miodovnik M. Clinical experience with a screening program for gestational diabetes. Am J Obstet Gynecol 1981; 141:491-4.
5. Dietrich ML, Dolnicek TF, Rayburn WF. Gestational diabetes screening in a private, midwestern American population. Am J Obstet Gynecol 1987; 156:1403-8.
6. Metzger BE. Summary and recommendations of the Third International Workshop Conference on Gestational Diabetes Mellitus. Diabetes 1991; 40(suppl 2):197-201.
7. American College of Obstetricians and Gynecologists. Diabetes and pregnancy. ACOG Tech Bull No. 200, 1994:1-8.
8. US Preventive Services Task Force. Guide to clinical preventive services. 2nd ed. Baltimore, Md: Williams & Wilkins, 1996:93-208.
9. Hunter DJS, Keirse MJNC. Gestational diabetes. In: Chalmers I, Enkin M, Keirse MJNC, eds. Effective care during pregnancy and childbirth. Oxford, England: Oxford University Press, 1989:403-10.
10. National Diabetes Data Group. Classification and diagnosis of diabetes mellitus and other categories of glucose intolerance. Diabetes 1979; 28:1039-57.
11. Johnson SR, Kolberg BH, Vance MW, Railsback LD. Maternal obesity and pregnancy. Surg Gynecol Obstet 1987; 164:431.
12. Dean AG, Dean JA, Barton AH, Dicker RC. Epi Info, Version 5: a word processing, database, and statistics program for epidemiology on microcomputers. Stone Mountain, Ga: USD Inc, 1990.
13. Ales KL, Santini DL. Should all pregnant women be screened for gestational glucose intolerance? Lancet 1989; 1:1187-91.
14. Coustan DR, Imarah J. Prophylactic insulin treatment of gestational diabetes reduces the incidence of macrosomia, oper-

ative delivery, and birth trauma. Am J Obstet Gynecol 1984; 150:836-42.

15. Coustan DR, Widness JA, Carpenter MW, Rotondo L, Pratt DC, Oh W. Should the fifty-gram, one-hour plasma glucose screening test for gestational diabetes be administered in the fasting or fed state? Am J Obstet Gynecol 1986; 154:1031-5.
16. Wilkerson HLC, Remein OR. Studies of abnormal carbohydrate metabolism in pregnancy: the significance of impaired glucose tolerance. Diabetes 1957; 6:324-9.
17. Blank A, Metzger BE, Grave GD. Effects of gestational diabetes on perinatal morbidity reassessed. Diabetes Care 1995; 18:127-9.
18. O'Sullivan JB, Charles D, Mahan CM, Dandrow RV. Gestational diabetes and perinatal mortality rate. Am J Obstet Gynecol 1973; 116:901-4.
19. O'Sullivan JB, Mahan CM, Charles D, Dandrow RV. Medical treatment of the gestational diabetic. Obstet Gynecol 1974; 150:836-42.
20. Gabbe SG, Mestman JH, Freeman RK, et al. Management and outcome of class A diabetes mellitus. Am J Obstet Gynecol 1977; 127:465-9.
21. Santini DL, Ales KL. The impact or universal screening for gestational glucose intolerance on outcome of pregnancy. Surg Gynecol Obstet 1990; 170:427-36.
22. Lucas MJ, Lowe TW, Bowe L, McIntire DD. Class A1 gestational diabetes: a meaningful diagnosis? Obstet Gynecol 1993; 82:260-5.
23. Spellacy WN, Miller S, Winegar A, Peterson PQ. Macrosomia—maternal characteristics and infant complications. Obstet Gynecol 1985; 66:158-61.
24. Braveman P, Showstack J, Browner W, et al. Evaluating outcomes of pregnancy in diabetic women: epidemiologic considerations and recommended indicators. Diabetes Care 1988; 11:281-7.
25. Johnson JW, Longmate JA, Frentzen B. Excessive maternal weight and pregnancy outcome. Am J Obstet Gynecol 1992; 167:353-70.
26. Langer O, Levy J, Brustman L, et al. Glycemic control in gestational diabetes mellitus—how tight is tight enough: small for gestational age versus large for gestational age? Am J Obstet Gynecol 1989; 161:646-53.
27. Harris MI. Gestational diabetes may represent discovery of preexisting glucose intolerance. Diabetes Care 1988; 11:402-11.