Routine Screening for Gestational Diabetes Mellitus in a Family Practice Center

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In the past women were evaluated for gestational diabetes only if certain historical risk factors were present; recently, the Family Practice Department at West Virginia University began screening all pregnant women. Sixteen of 50 women tested had an abnormal screening test. Of these, 15 had oral glucose tolerance testing, which led to three having a diagnosis of gestational diabetes. The universal screening was found to be more sensitive in finding cases of gestational diabetes, while the average cost per patient for glucose testing was increased by less than $2.

Gestational diabetes refers to an abnormality of carbohydrate metabolism related to pregnancy, which will usually return to normal after delivery. The impaired glucose tolerance is due to a transient, relative insulin deficiency that appears during the second half of pregnancy because of placental production of hormones with anti-insulin effects. Gestational diabetes may be conceptualized as a type of chemical diabetes; blood glucose levels are abnormal following a meal of glucose load, but fasting blood levels are normal, and the patient is asymptomatic.

In contrast, the term *overt diabetes* may be used to refer to patients with known clinical diabetes prior to pregnancy. In addition, a small number of gestational diabetic patients may have insufficient pancreatic reserve in the face of the insulin antagonists of pregnancy. These patients may develop overt diabetes during pregnancy.

It has been customary to evaluate women for gestational diabetes mellitus when certain risk factors are present. These risk factors include weight over 200 lb, history of fetal loss or stillbirth, hydramnios, age over 35 years, glycosuria during pregnancy, and delivery of a baby weighing over 4,000 g. The obstetric hazards of gestational diabetes have been recognized for the past decade. A perinatal mortality of 6.4 percent has been noted in gestational diabetes, whereas in normal controls it is 1.5 percent.[1] This perinatal mortality rate is lower than for those with overt diabetes.

Several retrospective studies quote various rates of incidence of congenital anomalies in infants of mothers having gestational diabetes. Amankwak et al[2] conducted a prospective study of pregnant women who participated in a glucose challenge screening program. They found the incidence of congenital malformations to be 2.6 percent in the normal population and 5.1 percent in the population of mothers having gestational diabetes. The difference was independent of any effect of maternal age. The malformations encountered were the same as those common problems (eg, hypospadias, midline defects, and hemangioma) seen in nondiabetic controls. In addition, an increased incidence of fetal morbidity, such as hypoglycemia or hyperbilirubinemia, is noted in infants of mothers with gestational diabetes.[1]

Gestational diabetes mellitus may have impli-

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cations for the mother too. Ninety-eight percent of those mothers with gestational diabetes will return to normal glucose tolerance immediately after delivery.[3] However, these women are at increased risk for development of problems with glucose metabolism in later years. Mestman[4] noted a 40 percent incidence of carbohydrate intolerance eight years postpartum. O'Sullivan et al[5] noted a 16-year cumulative incidence of overt diabetes of 60 percent. Several researchers[3,4] have suggested a relationship among age, weight, and gestational diabetes. Overweight (more than 20 percent over ideal body weight) and older age (over 25 years in some studies or over 30 years in others) are associated with increased incidence of carbohydrate intolerance and abnormal oral glucose tolerance test results during pregnancy.

As part of the routine obstetrical care, some form of screening for carbohydrate intolerance during pregnancy is advocated by most experts in the field. The departments of Family Practice and Obstetrics and Gynecology of the West Virginia University School of Medicine have recently adopted the practice of routine screening of all pregnant patients for carbohydrate intolerance.

There are a variety of methods developed in different centers to screen for gestational diabetes. These methods involve different glucose loads, time intervals until blood drawing, and stage of gestation. Cost and convenience to the patient vary according to the method used. The reference standard is the 3-hour oral glucose tolerance test, which would detect all patients with impaired carbohydrate metabolism but is considered to be impractical as a screening procedure. This report deals with the performance of a quick screening test during pregnancy for the detection of glucose intolerance.

Methods

The departments of Obstetrics and Gynecology and Family Practice at West Virginia University have adopted the glucose challenge screening method of O'Sullivan et al.[5] A 50 g glucose drink (Glucola, Miles Laboratories) is given at 24 to 28 weeks to a nonfasting patient. One hour later, a serum glucose determination is performed. If the level is greater than 130 mg/dL, a full 3-hour oral glucose tolerance test is performed. The normal values used in this paper are displayed in Table 1 (recent modifications of the standards for the oral glucose tolerance test are noted in the Appendix). If any points are higher than the normal values, the tolerance test is considered abnormal. O'Sullivan found this regimen to be 79 percent sensitive and 88 percent specific. It would identify 79 percent of women who actually have gestational diabetes as being such, while identifying 88 percent of normal patients as normal. He found clinical historical factors to be only 62 percent sensitive in making a diagnosis of gestational diabetes.

Table 1. Normal Glucose Tolerance Test in Pregnancy

Time (h)	Plasma Glucose (mg/dL)
0 (fasting)	≤ 100
1	≤ 200
2	≤ 150
3	≤ 130

Other researchers[4,6,7] have used 100 g or 75 g glucose-loading doses or have waited two hours to draw blood, claiming better sensitivity and specificity. The method noted above represents a compromise; it avoids high doses of glucose to minimize nausea, it does not require prior fasting, the glucose can be administered on arrival in the clinic, and the blood sugar can be drawn one hour later to avoid a long waiting time in the office. It should be noted that although the patient need not fast to be screened, there may be fewer false-positive results in patients who do come to the office in a fasting state.

At the Family Practice Center, between September 1, 1981, and August 30, 1982, 60 pregnancies were followed to delivery by family practice residents or staff. One woman was a known diabetic patient. Of the remaining 59 patients, eight did not undergo tests for carbohydrate intolerance. One patient had a history of hydramnios, and a glucose tolerance test was performed without a screening test.

Results

Of the 50 remaining patients who underwent testing with Glucola between 24 and 28 weeks' gestation, there were 16 abnormal results (greater than 130 mg/dL). Of these, 15 had oral glucose tolerance tests; three were abnormal (Table 2). Thus 31 percent of all pregnant patients had abnormal glucose levels on screening and required

Table 2. Results of Glucola Screening for Gestational Diabetes

Patient Classifications	Number
Total patients screened	50
Abnormal Glucola screening*	16
Oral glucose tolerance tests performed	15
Gestational diabetics	3

*One patient was lost to follow-up

an oral glucose tolerance test. Overall, 6 percent of this obstetrical population was found to have gestational diabetes. The cost of this screening (25 bottles of Glucola at $2 each and 50 serum glucose determinations at $4 each) plus 15 glucose tolerance tests at $18 each was $520, for an average of $10 per patient or $173 to make a diagnosis of gestational diabetes.

In this patient population of 50 women, there were 24 with at least one historical risk factor present. It is not possible to compare the case finding yield of historical factors, since glucose tolerance tests were not done on all these patients. The cost of screening these 24 women with 3-hour glucose tolerance tests would be $430. Moreover, one of the patients with gestational diabetes discovered by glucose challenge testing had no positive historical risk factors and would have been entirely overlooked in the past.

Discussion

As noted above, patients with abnormal glucose tolerance tests, using the norms in Table 1, are considered to have gestational diabetes. They will require some increased surveillance during pregnancy, but typically are able to deliver spontaneously at term.

Overt diabetics, on the other hand, require intensive prenatal surveillance. Insulin therapy is tightly regulated, often with hospitalization. Special procedures and interventions may be necessary at or before delivery.

At West Virginia University, any patient with a gestational diabetes diagnosis is followed according to the following protocol: Those having a diagnosis of gestational diabetes are seen every two weeks until 28 weeks; then they are followed weekly. An American Diabetic Association diet is prescribed to provide about 300 kcal above basal requirements. Hemoglobin A_{1c} (glycosylated hemoglobin) determinations are performed monthly, and fasting and 2-hour postprandial blood sugars are performed every two weeks. Weekly non-stress tests are performed starting at 32 weeks. Urine dip stick for nitrite is performed at each weekly visit, and urine for culture is recommended on a monthly basis. If the patient has uncomplicated gestational diabetes, spontaneous vaginal delivery at term is allowed. Any gestational diabetic patient with stillborn infants on previous deliveries, hypertension, hydramnios, or a fetus suspected to be either macrosomic or small for gestational age is followed as an overt diabetic. Patients with elevated fasting blood sugars or who require insulin are also followed as overt diabetics.

The outcomes of the three pregnant women with gestational diabetes discovered by screening are summarized as follows. One patient had mild pre-eclampsia prior to term. One had a baby that weighed at least 4,000 g. While one patient had some late decelerations of the fetal heart rate during delivery, all three were delivered of babies with Apgar scores of 8 and 9. In the nursery, one baby had hyperbilirubinemia and required two extra days of hospital care with phototherapy. One baby had early hypoglycemia and was treated with oral glucose solution.

The interval since delivery at the time of this study was between 6 and 18 months for all these women. No systematic follow-up by the delivery physician had occurred. One patient was seen for dysuria, and a urinalysis was performed, which was negative for glucose. Another presented complaining of dizziness; her fasting blood sugar was 92 mg/dL.

At this time there are no specific recommendations for the follow-up of carbohydrate intolerance in the nonpregnant patient. For the purpose of this study, free blood sugar determinations were offered to the three women with gestational diabetes. Two women underwent random blood glucose determinations, and both had blood sugar levels of less than 100 mg/dL.

The justification for routine screening of all pregnant patients has been outlined. At the West Virginia University Family Practice Center, in one year three gestational diabetic patients were found by doing routine post-Glucola serum determinations on all patients between 24 and 28 weeks'

gestation. Of these three, only two had positive traditional historical risk factors. One would have been overlooked completely by relying on the absence of risk factors.

The cost of screening all patients and performing follow-up glucose tolerance testing as needed was $520. This compares with $430 to perform oral glucose tolerance tests on all patients with risk factors by history. The universal screening is slightly more expensive, but not prohibitively so.

Conclusions

Routine testing for carbohydrate intolerance in pregnancy is recommended for all patients because of the increased fetal morbidity and mortality in women with gestational diabetes and the increased risk of subsequent development of overt diabetes in these women. Universal screening is considered to be more sensitive than reliance on historical risk factors. This increased sensitivity was demonstrated by the screening program at the West Virginia University Family Practice Center, although the number of patients seen was quite small.

There is a slight increase in cost per patient in universal screening, but this cost increase is less than $2 per patient compared with the prior recommendations regarding testing for carbohydrate intolerance in pregnancy. The benefits in terms of prevention of fetal loss, malformations, or morbidity justify this expense, especially if an overt diabetic is discovered by Glucola screening, as these patients have a much higher rate of fetal morbidity and mortality and will need very careful obstetrical management to avert or reduce such complications.

In the future it may be possible to narrow the focus of carbohydrate intolerance screening in pregnancy. There seems to be a relationship between overweight and increasing age and the development of gestational diabetes. The extra weight can be mild to moderate and need not be manifest as gross obesity. The age limits are not clearly defined at this time, but refinements may be expected in the future.

The significant incidence of continued carbohydrate intolerance and eventual diabetes in patients with a history of gestational diabetes would suggest that these patients should have routine follow-up over the long term after delivery. This follow-up is well suited to family practice, as the patient may be expected to return for ongoing care unrelated to pregnancy. Currently there are no definite guidelines for the follow-up of patients with gestational diabetes mellitus.

References

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Appendix

The values used in the 3-hour glucose tolerance test at West Virginia University are based on Mestman's research[4] and the recommendations of the American College of Obstetrics and Gynecology. In the past year the National Diabetes Data Group has come out with new standards for defining gestational diabetes mellitus by a 3-hour oral glucose tolerance test. The norms follow.

Time (h)	*Glucose (mg/dL)*
0	105
1	190
2	165
3	145

These levels are based on glucose determinations performed by an autoanalyzer.
In determining glucose levels, it should be noted that venous whole blood glucose values are 15 mg/dL less than serum values and that capillary blood glucose values are 10 mg/dL more than venous values.