Management of Gestational Diabetes Mellitus

DAVID K. TUROK, M.D., M.P.H., University of Utah School of Medicine, Salt Lake City, Utah
STEPHEN D. RATCLIFFE, M.D., M.S.P.H., Lancaster General Hospital, Lancaster, Pennsylvania
ELIZABETH G. BAXLEY, M.D., University of South Carolina School of Medicine, Columbia, South Carolina

Gestational diabetes mellitus is a common but controversial disorder. While no large randomized controlled trials show that screening for and treating gestational diabetes affect perinatal outcomes, multiple studies have documented an increase in adverse pregnancy outcomes in patients with the disorder. Data on perinatal mortality, however, are inconsistent. In some prospective studies, treatment of gestational diabetes has resulted in a decrease in shoulder dystocia (a frequently discussed perinatal outcome), but cesarean delivery has not been shown to reduce perinatal morbidity. Patients diagnosed with gestational diabetes should monitor their blood glucose levels, exercise, and undergo nutrition counseling for the purpose of maintaining normoglycemia. The commonly accepted treatment goal is to maintain a fasting capillary blood glucose level of less than 95 to 105 mg per dL (5.3 to 5.8 mmol per L); the ambiguity (i.e., the range) is due to imperfect data. The postprandial treatment goal should be a capillary blood glucose level of less than 140 mg per dL (7.8 mmol per L) at one hour and less than 120 mg per dL (6.7 mmol per L) at two hours. Patients not meeting these goals with dietary changes alone should begin insulin therapy. In patients with well-controlled diabetes, there is no need to pursue delivery before 40 weeks of gestation. In patients who require insulin or have other comorbid conditions, it is appropriate to begin antenatal screening with nonstress tests and an amniotic fluid index at 32 weeks of gestation. (Am Fam Physician 2003;68:1767-72,1775-6. Copyright© 2003 American Academy of Family Physicians.)

A patient information handout on gestational diabetes and nutrition, written by Andrea Lindley, AFP medical editing clerkship student, Georgetown University Medical Center, Washington, D.C., is provided on page 1775.

Members of various family practice departments develop articles for "Practical Therapeutics." This article is one in a series coordinated by the University of Utah School of Medicine, Salt Lake City. Guest editor of the series is Stephen D. Ratcliffe, M.D., M.S.P.H.

See page 1692 for definitions of strength-of-evidence levels.

Screening for gestational diabetes mellitus is widely practiced despite lack of evidence that it prevents adverse perinatal outcomes. Although the disorder affects approximately 2.5 percent of pregnant women[1] and has been the subject of extensive research, its diagnosis and management continue to be debated.

As the practice of medicine moves toward an evidence-based paradigm, the debate about gestational diabetes focuses on the absence of prospective randomized controlled trials (RCTs) that assess the value of screening for and treating this disorder. Several major guidelines[2,3] do not recommend routine screening for gestational diabetes until more complete data become available. Proponents of screening argue that although available data are imperfect, there are biologically plausible explanations to account for adverse perinatal outcomes associated with gestational diabetes. In addition, much of medical practice is not based on results of RCTs.

Definition and Complications

Gestational diabetes mellitus is defined as glucose intolerance that begins, or is first recognized, during pregnancy.[4] A wide range of complications is associated with the disorder. For the mother, gestational diabetes increases the risk of preeclampsia, cesarean delivery, and future type 2 diabetes. In the fetus or neonate, the disorder is associated with higher rates of perinatal mortality, macrosomia, birth trauma, hyperbilirubinemia, and neonatal hypoglycemia.[5-8] Some studies[9-11] have found an association between gestational diabetes and increased perinatal mortality rates, but other studies[12,13] have shown no increased risk.

Diagnosis of Gestational Diabetes

Initial screening for gestational diabetes is accomplished by performing a

Patients do not have to fast before a 50-g, one-hour glucose challenge test.

50-g, one-hour glucose challenge test at 24 to 28 weeks of gestation. Patients do not have to fast for this test. To be considered normal, serum or plasma glucose values should be less than 130 mg per dL (7.2 mmol per L) or less than 140 mg per dL (7.8 mmol per L). Using a value of 130 mg per dL or higher will increase the sensitivity of the test from 80 to 90 percent and decrease its specificity, compared with using a value of 140 mg per dL or higher.[14] Thus, the lower screening level of 130 mg per dL identifies more patients with gestational diabetes at the cost of more false-positive results. Current recommendations from the American Diabetes Association (ADA)[4] and the American College of Obstetricians and Gynecologists (ACOG)[15] accept either value for defining an abnormal initial screening result. [Reference 4—Evidence level C, consensus/expert opinion; Reference 15—Evidence level C, consensus/expert opinion]

An abnormal one-hour screening test should be followed by a 100-g, three-hour venous serum or plasma glucose tolerance test. After the patient has been on an unrestricted diet for three days, venous blood samples are obtained following an overnight fast, and then one, two, and three hours after an oral 100-g glucose load. During the test period, patients should remain seated and should not smoke. Two or more abnormal values are diagnostic for gestational diabetes.

The diagnostic criteria from the National Diabetes Data Group (NDDG) have been used most often, but some centers rely on the Carpenter and Coustan criteria, which set the cutoff for normal at lower values *(Table 1)*.[16,17] Compared with the NDDG criteria, the Carpenter and Coustan criteria lead to a diagnosis of gestational diabetes in 54 percent more pregnant women, with an increased cost and no compelling evidence of improved perinatal outcomes.[18] While the ADA supports use of the stricter criteria, the most recent ACOG practice bulletin supports the use of either criteria set.[15] Whole blood glucose values are approximately 10 to 15 percent lower than serum or plasma values.

TABLE 1
Criteria for Abnormal Result on 100-g, Three-Hour Oral Glucose Tolerance Tests in Pregnant Women*

Blood sample	*National Diabetes Data Group*[16]	*Carpenter and Coustan*[17]
Fasting	105 mg per dL (5.8 mmol per L)	95 mg per dL (5.3 mmol per L)
1-hour	190 mg per dL (10.5 mmol per L)	180 mg per dL (10.0 mmol per L)
2-hour	165 mg per dL (9.2 mmol per L)	155 mg per dL (8.6 mmol per L)
3-hour	145 mg per dL (8.0 mmol per L)	140 mg per dL (7.8 mmol per L)

**—Gestational diabetes mellitus is diagnosed if two or more of the values (venous serum or plasma glucose levels) are met or exceeded.*

Information from references 16 and 17.

Management of Gestational Diabetes

BLOOD GLUCOSE MONITORING

In patients requiring insulin therapy, the ideal frequency of glucose monitoring has not been established. A common practice is to check the glucose level four times daily. A first morning glucose level can rule out fasting hyperglycemia, and additional one- or two-hour postprandial values can ensure adequate control.

Postprandial testing is preferable to preprandial testing. In one randomized study comparing postprandial and preprandial blood glucose monitoring in patients with gestational diabetes who required insulin therapy, those who measured their glucose levels after meals had larger drops in A_{1c} (−3.0 versus −0.6 percent, $P < .001$), gave birth to infants with lower birth weights (3,469 g [7 lb, 10 oz] versus 3,848 g [8 lb, 7 oz], $P = .01$), and had fewer cesarean deliveries (12 versus 42 percent, $P = .04$).[19] [Evidence level B, lower quality RCT]

There is neither objective evidence nor a clinical guideline to support a frequency for glucose monitoring in patients with diet-controlled gestational diabetes. In these patients, an acceptable practice is to use the four-times-a-day schedule on two days per week and begin more intensive treatment if two values per week exceed the limits.

DIET

A recent Cochrane review[20] found no difference in the prevalence of birth weights greater than 4,000 g (8 lb, 13 oz) or cesarean deliveries in women with gestational dia-

betes who were randomly assigned to receive primary dietary therapy or no specific treatment. The review concluded that insufficient evidence exists to recommend dietary therapy in patients with altered glucose metabolism.

The ideal diet for women with gestational diabetes remains to be defined, and current recommendations are based on expert opinion.[14] The ADA recommends nutrition counseling (with a registered dietitian, if possible) and a diet that adequately meets the needs of pregnancy but restricts carbohydrates to 35 to 40 percent of daily calories. Caloric restriction should be approached with caution, because two studies have reported a relationship between elevated maternal serum ketone levels and reduced psychomotor development and IQ at three to nine years of age in the offspring of mothers with gestational diabetes.[21,22]

For patients with a body mass index greater than 30 kg per m^2, the ADA suggests lowering daily caloric intake by 30 to 33 percent (to approximately 25 kcal per kg of actual weight per day), which avoids ketonemia. Regular exercise has been shown to improve glycemic control in women with gestational diabetes, but it has not been shown to affect perinatal outcomes.[23] (For additional dietary recommendations, see the accompanying patient information handout.)

Gestational diabetes is diagnosed when a patient has two or more abnormal values on a fasting 100-g, three-hour glucose tolerance test.

INSULIN

Most,[24-26] but not all,[27,28] prospective trials involving insulin therapy in women with gestational diabetes have shown a reduction in the incidence of neonatal macrosomia. Therefore, insulin therapy traditionally has been started when capillary blood glucose levels exceed 105 mg per dL (5.8 mmol per L) in the fasting state and 120 mg per dL (6.7 mmol per L) two hours after meals. These cutoff values are derived from guidelines for managing insulin in pregnant women who have type 1 diabetes. A more aggressive goal of a fasting capillary blood glucose level below 95 mg per dL (5.3 mmol per L) is supported by a prospective study of 471 women with gestational diabetes that showed a decrease in large-for-gestational-age neonates, from 28.6 to 10.3 percent (relative risk, 5.99; 95 percent confidence interval, 1.37 to 8.88), in the women with fasting blood glucose levels of 95 to 105 mg per dL who were treated, respectively, with diet or insulin; the study reported no data on additional birth outcomes.[29] [Evidence level B, nonrandomized observational study] This more conservative goal is recommended in the most recent ACOG practice bulletin on gestational diabetes.[15] Because of variable and imperfect data on this point, it is acceptable to use either cutoff value for fasting glucose testing.

One prospective nonrandomized study of 445 patients has shown a reduction in operative deliveries and birth trauma in women with gestational diabetes who are treated with insulin.[30] However, the findings of this study remain to be demonstrated in an adequately powered RCT.

There are no specific studies declaring one type of insulin or a certain regimen as superior in affecting any perinatal outcome. A common initial dosage is 0.7 units per kg per day, with one dose consisting of two thirds of the total amount given in the morning and one dose consisting of one third of the total amount given in the evening. One third of each dose is given as regular insulin, and the remaining two thirds as NPH insulin. A recent study of 42 women with gestational diabetes supports the safety of very-short-acting insulin lispro, which can be used with once-daily extended insulin ultralente.[31] The simplest regimen that will control blood glucose levels is the best.

Physicians should expect to increase the insulin dosage as the pregnancy progresses and insulin resistance increases. No published guidelines are available to help family physicians treat patients with gestational diabetes who require insulin. When necessary, collaborative care with an obstetrician or perinatologist is advisable.

ORAL HYPOGLYCEMIC MEDICATIONS

Use of oral hypoglycemic agents to treat gestational diabetes has not been recommended because of concerns about potential teratogenicity and transport of glucose across the placenta (causing prolonged neonatal hypoglycemia).[32] Although first-generation hypoglycemic agents (chlorpropamide [Diabinese], tolbutamide [Orinase]) have been shown to cross the placenta, recent in vitro and in vivo evidence has determined that glyburide (Micronase) does not enter the fetal circulation.[33,34]

A recent RCT comparing the use of glyburide and insulin in women with gestational diabetes demonstrated that glyburide therapy resulted in comparable maternal outcomes (e.g., glycemic control, cesarean deliveries) and

Women with gestational diabetes should be screened for diabetes six weeks postpartum and annually thereafter.

neonatal outcomes (e.g., macrosomia, hypoglycemia, intensive care unit admissions). Glyburide therapy was not started before 11 weeks of gestation and was not detected in any of the neonatal cord blood samples. Preliminary evidence from this trial suggests that glyburide may be a safe, effective alternative to insulin in the management of gestational diabetes.

The ACOG[15] and the ADA[20] agree that glyburide should not be prescribed for the treatment of gestational diabetes until additional RCTs support its safety and effectiveness. Despite these recommendations, many physicians are using glyburide in this setting because of its ease of use compared with insulin. In a recent prospective cohort study of patients with polycystic ovary syndrome,[33] metformin therapy has been shown to decrease the subsequent incidence of gestational diabetes, reduce first-trimester miscarriage rates, and result in no apparent increase in congenital anomalies.[35] RCTs are needed to demonstrate the safety and effectiveness of metformin (Glucophage) in pregnancy before use of this medication is warranted for the treatment of gestational diabetes.

The Authors

DAVID K. TUROK, M.D., M.P.H., is assistant professor in the Department of Obstetrics and Gynecology and the Department of Family and Preventive Medicine at the University of Utah School of Medicine, Salt Lake City. Dr. Turok received his medical and master of public health degrees from Tufts University, Boston.

STEPHEN D. RATCLIFFE, M.D., M.S.P.H., is program director for the family practice residency program at Lancaster (Pa.) General Hospital and adjunct professor in the Department of Family and Preventive Medicine at the University of Utah School of Medicine. Dr. Ratcliffe received his medical degree from Washington University School of Medicine, St. Louis, and a master of public health degree from the University of Utah.

ELIZABETH G. BAXLEY, M.D., is professor and chair of the Department of Family and Preventive Medicine at the University of South Carolina School of Medicine, Columbia, where she earned her medical degree. Dr. Baxley completed a family practice residency in Anderson, S.C., and a faculty development fellowship at the University of North Carolina at Chapel Hill.

Address correspondence to David K. Turok, M.D., M.P.H., University of Utah School of Medicine, Department of Obstetrics and Gynecology, Room 2B200, 30 North 1900 East, Salt Lake City, UT 84132-2209 (e-mail: david.turok@hsc.utah.edu). Reprints are not available from the authors.

ANTEPARTUM FETAL ASSESSMENT

Data on gestational diabetes and an increased risk of fetal demise are conflicting. The 2001 ACOG practice bulletin[15] concludes that evidence is insufficient to determine the optimal antepartum testing regimen in women with gestational diabetes who have relatively normal glucose levels on diet therapy and no other perinatal risk factors. Acceptable practice patterns for monitoring pregnancies complicated by gestational diabetes range from testing all women beginning at 32 weeks of gestation to no testing until 40 weeks of gestation.

The ACOG[15] recommends antenatal testing for patients whose blood glucose levels are not well controlled, who require insulin therapy, or who have concomitant hypertension. The antenatal testing can be initiated at 32 weeks of gestation. In this situation, no method of antenatal testing has proved superior to others. Community preference may dictate use of the nonstress test, the modified biophysical profile (i.e., nonstress test and amniotic fluid index), or a full biophysical profile.

TIMING AND ROUTE OF DELIVERY

In gestational diabetes, shoulder dystocia is the complication most anticipated at the time of delivery. In one study,[36] this complication occurred in 31 percent of neonates weighing more than 4,000 g who were delivered vaginally to unclassified mothers with diabetes. No prospective data support the use of cesarean delivery to avoid birth trauma in women who have gestational diabetes. One remaining limiting factor is the 13 percent error rate (± 2 SD) in estimating fetal weight by ultrasonography.[37]

A decision analysis[38] that evaluated the cost and efficacy of a policy of elective cesarean delivery for an estimated fetal weight of 4,500 g (9 lb, 15 oz) in mothers with diabetes found that 443 cesarean deliveries would need to be performed to prevent one case of brachial plexus injury, at a cost of $930,000. A reasonable approach is to offer elective cesarean delivery to the patient with gestational diabetes and an estimated fetal weight of 4,500 g or more, based on the patient's history and pelvimetry, and the patient and physician's discussion about the risks and benefits. There are no indications to pursue delivery before 40 weeks of gestation in patients with good glycemic control unless other maternal or fetal indications are present.

INTRAPARTUM MANAGEMENT

The goal of intrapartum management is to maintain normoglycemia in an effort to prevent neonatal hypoglycemia. Patients with diet-controlled diabetes will not require intrapartum insulin and simply may need to have their glucose level checked on admission for labor and delivery. While patients with insulin-requiring diabetes are in active labor, capillary blood glucose levels should be monitored hourly. Target values are 80 to 110 mg per dL (4.4 to 6.1 mmol per L).[39]

POSTPARTUM MANAGEMENT

Women with gestational diabetes rarely require insulin in the postpartum period. As insulin resistance quickly resolves, so does the need for insulin. Patients with diet-controlled diabetes do not need to have their glucose levels checked after delivery. In patients who required insulin therapy during pregnancy, it is reasonable to check fasting and two-hour postprandial glucose levels before hospital discharge.

Because women with gestational diabetes are at high risk for developing type 2 diabetes in the future, they should be tested for diabetes six weeks after delivery via fasting blood glucose measurements on two occasions or a two-hour oral 75-g glucose tolerance test. Normal values for a two-hour glucose tolerance test are less than 140 mg per dL. Values between 140 and 200 mg per dL (11.1 mmol per L) represent impaired glucose tolerance, and greater than 200 mg per dL are diagnostic of diabetes. Screening for diabetes should be repeated annually thereafter, especially in patients who had elevated fasting blood glucose levels during pregnancy.[40]

Breastfeeding improves glycemic control and should be encouraged in women who had gestational diabetes.[41]

Contraception should be discussed, because women who have diabetes during one pregnancy are likely to have the same condition in a subsequent pregnancy. There are no limits on the use of hormonal contraception in patients with a history of gestational diabetes. As previously noted, these women also are at increased risk of developing type 2 diabetes in the future.

Patients should be counseled about diet and exercise. By losing weight and exercising, women can significantly decrease their risk of developing diabetes.

The authors indicate that they do not have any conflicts of interest. Sources of funding: none reported.

REFERENCES

1. Xiong X, Saunders LD, Wang FL, Demianczuk NN. Gestational diabetes mellitus: prevalence, risk factors, maternal and infant outcomes. Int J Gynaecol Obstet 2001;75:221-8.
2. Periodic health examination, 1992 update: 1. Screening for gestational diabetes mellitus. CMAJ 1992;147:435-43.
3. Screening for gestational diabetes mellitus: recommendation and rationale. Am Fam Physician 2003;68:331-5.
4. Report of the expert committee on the diagnosis and classification of diabetes mellitus. Diabetes Care 2003;26(suppl 1):S5-20.
5. Sermer M, Naylor CD, Gare DJ, Kenshole AB, Ritchie JW, Farine D, et al. Impact of increasing carbohydrate intolerance on maternal-fetal outcomes in 3637 women without gestational diabetes. The Toronto Tri-Hospital Gestational Diabetes Project. Am J Obstet Gynecol 1995;173:146-56.
6. Casey BM, Lucas MJ, Mcintire DD, Leveno KJ. Pregnancy outcomes in women with gestational diabetes compared with the general obstetric population. Obstet Gynecol 1997;90:869-73.
7. Dang K, Homko C, Reece EA. Factors associated with fetal macrosomia in offspring of gestational diabetic women. J Matern Fetal Med 2000;9:114-7.
8. Langer O, Levy J, Brustman L, Anyaegbunam A, Merkatz R, Divon M. 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.
9. O'Sullivan JB, Charles D, Mahan CM, Dandrow RV. Gestational diabetes and perinatal mortality rate. Am J Obstet Gynecol 1973; 116:901-4.
10. Beischer NA, Wein P, Sheedy MT, Steffen B. Identification and treatment of women with hyperglycaemia diagnosed during pregnancy can significantly reduce perinatal mortality rates. Aust N Z J Obstet Gynaecol 1996;36:239-47.
11. Wood SL, Sauve R, Ross S, Brant R, Love EJ. Prediabetes and perinatal mortality. Diabetes Care 2000;23:1752-4.
12. Gabbe SG, Mestman JG, Freeman RK, Anderson GV, Lowensohn RI. Management and outcome of class A diabetes mellitus. Am J Obstet Gynecol 1977;127:465-9.
13. Cundy T, Gamble G, Townend K, Henley PG, MacPherson P, Roberts AB. Perinatal mortality in Type 2 diabetes mellitus. Diabet Med 2000;17:33-9.
14. Gestational diabetes mellitus. Diabetes Care 2003;26(suppl 1): S103-5.
15. ACOG Practice Bulletin. Gestational diabetes. Number 30, September 2001 (replaces Technical Bulletin Number 200, December 1994). Obstet Gynecol 2001;98:525-38.
16. Classification and diagnosis of diabetes mellitus and other categories of glucose intolerance. Diabetes 1979;28:1039-57.
17. Carpenter MW, Coustan DR. Criteria for screening tests for gestational diabetes. Am J Obstet Gynecol 1982;144:768-73.
18. Schwartz ML, Ray WN, Lubarsky SL. The diagnosis and classification of gestational diabetes mellitus: is it time to change our tune? Am J Obstet Gynecol 1999;180(6 pt 1):1560-71.
19. De Veciana M, Major CA, Morgan MA, Asrat T, Toohey JS, Lien JM, et al. Postprandial versus preprandial blood glucose monitoring in women with gestational diabetes mellitus requiring insulin therapy. N Engl J Med 1995;333:1237-41.
20. Walkinshaw SA. Dietary regulation for "gestational diabetes." Cochrane Database Syst Rev 2003;(2):CD000070.
21. Rizzo T, Metzger BE, Burns WJ, Burns K. Correlations between antepartum maternal metabolism and child intelligence. N Engl J Med 1991;325:911-6.

22. Rizzo TA, Dooley SL, Metzger BE, Cho NH, Ogata ES, Silverman BL. Prenatal and perinatal influences on long-term psychomotor development in offspring of diabetic mothers. Am J Obstet Gynecol 1995;173:1753-8.
23. Avery MD, Leon AS, Kopher RA. Effects of a partially home-based exercise program for women with gestational diabetes. Obstet Gynecol 1997;89:10-5.
24. O'Sullivan JB, Gellis SS, Dandrow RV, Tenney BO. The potential diabetic and her treatment in pregnancy. Obstet Gynecol 1966; 27:683-9.
25. Coustan DR, Lewis SB. Insulin therapy for gestational diabetes. Obstet Gynecol 1978;51:306-10.
26. Thompson DJ, Porter KB, Gunnells DJ, Wagner PC, Spinnato JA. Prophylactic insulin in the management of gestational diabetes. Obstet Gynecol 1990;75:960-4.
27. Persson B, Stangenberg M, Hansson U, Nordlander E. Gestational diabetes mellitus (GDM). Comparative evaluation of two treatment regimens, diet versus insulin and diet. Diabetes 1985; 34(suppl 2):101-5.
28. Garner P, Okun N, Keely E, Wells G, Perkins S, Sylvain J, et al. A randomized controlled trial of strict glycemic control and tertiary level obstetric care versus routine obstetric care in the management of gestational diabetes: a pilot study. Am J Obstet Gynecol 1997;177:190-5.
29. Langer O, Berkus M, Brustman L, Anyaegbunam A, Mazze R. Rationale for insulin management in gestational diabetes mellitus. Diabetes 1991;40(suppl 2):186-90.
30. Coustan DR, Imarah J. Prophylactic insulin treatment of gestational diabetes reduces the incidence of macrosomia, operative delivery, and birth trauma. Am J Obstet Gynecol 1984;150:836-42.
31. Jovanovic L, Ilic S, Pettitt DJ, Hugo K, Gutierrez M, Bowsher RR, et al. Metabolic and immunologic effects of insulin lispro in gestational diabetes. Diabetes Care 1999;22:1422-7.
32. Ziegler MH, Grafton TF, Hansen DK. The effect of tolbutamide on rat embryonic development in vitro. Teratology 1993;48:45-51.
33. Elliott BD, Schenker S, Langer O, Johnson R, Prihoda T. Comparative placental transport of oral hypoglycemic agents in humans: a model of human placental drug transfer. Am J Obstet Gynecol 1994;171:653-60.
34. Langer O, Conway DL, Berkus MD, Xenakis EM, Gonzales O. A comparison of glyburide and insulin in women with gestational diabetes mellitus. N Engl J Med 2000;343:1134-8.
35. Glueck CJ, Wang P, Goldenberg N, Sieve-Smith L. Pregnancy outcomes among women with polycystic ovarian syndrome treated with metformin. Hum Reprod 2002;17:2858-64.
36. Acker DB, Sachs BP, Friedman EA. Risk factors for shoulder dystocia. Obstet Gynecol 1985;66:762-8.
37. Nahum GG, Stanislaw H. Ultrasonographic prediction of term birth weight: how accurate is it? Am J Obstet Gynecol 2003; 188:566-74.
38. Rouse DJ, Owen J, Goldenberg RL, Cliver SP. The effectiveness and costs of elective cesarean delivery for fetal macrosomia diagnosed by ultrasound. JAMA 1996;276:1480-6.
39. Caplan RH, Pagliara AS, Beguin EA, Smiley CA, Bina-Frymark M, Goettl KA, et al. Constant intravenous insulin infusion during labor and delivery in diabetes mellitus. Diabetes Care 1982;5:6-10.
40. Kim C, Newton KM, Knopp RH. Gestational diabetes and the incidence of type 2 diabetes: a systematic review. Diabetes Care 2002;25:1862-8.
41. Kjos SL, Henry O, Lee RM, Buchanan TA, Mishell DR Jr. The effect of lactation on glucose and lipid metabolism in women with recent gestational diabetes. Obstet Gynecol 1993;82:451-5.