Comparison of Hemoglobin A_{1c} With Fasting Plasma Glucose and 2-h Postchallenge Glucose for Risk Stratification Among Women With Recent Gestational Diabetes Mellitus

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OBJECTIVE—Postpartum testing with a 75-g 2-h oral glucose tolerance test or fasting plasma glucose (FPG) alone is often not performed among women with histories of gestational diabetes mellitus (GDM). Use of hemoglobin A_{1c} (A1C) might increase testing. The association between A1C and glucose has not been examined in women with histories of GDM.

RESEARCH DESIGN AND METHODS—We assessed the association of A1C ≥5.7% with FPG ≥100 mg/dL and 2-h glucose ≥140 mg/dL among 54 women with histories of GDM between 6 weeks and 36 months postpartum.

RESULTS—A1C ≥5.7% had 65% sensitivity and 68% specificity for identifying elevated FPG or 2-h glucose and 75% sensitivity and 62% specificity for elevated FPG alone. The area under the receiver operating characteristic curve for A1C was 0.76 for elevated FPG or 2-h glucose and 0.77 for elevated FPG alone.

CONCLUSIONS—The agreement between A1C and glucose levels is fair for detection of abnormal glucose tolerance among women with histories of GDM.

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Postpartum testing is recommended for women with histories of gestational diabetes mellitus (GDM) to diagnose diabetes and to stratify women for risk of future diabetes (1–3). Several groups have recommended postpartum testing with fasting plasma glucose (FPG) alone (1), others have recommended 2-h 75-g oral glucose tolerance tests (OGTTs) (2), and others have recommended hemoglobin A_{1c} (A1C) (4). Agreement between A1C and glucose has not yet been reported in this population. Our objective was to examine the agreement between A1C, FPG, and 2-h glucose among women with recent GDM.

RESEARCH DESIGN AND METHODS

The study population consisted of 54 women with GDM who underwent an OGTT between 6 weeks and 36 months postpartum to enroll in a trial of lifestyle modification (5). Women were recruited from a university health system, a managed care plan, and several private practices in southeastern Michigan. Inclusion criteria were physician-confirmed GDM diagnosis within the past 3 years, no preexisting diabetes diagnosis, enrollment at ≥6 weeks after delivery, age ≥18 years, <150 min of self-reported physical activity per week and no contraindications to walking, fluency in English, working e-mail address, and lack of current pregnancy, confirmed by a study urine pregnancy test. The study was approved by the University of Michigan Institutional Review Board.

Women were instructed by study staff to eat an unrestricted diet in the days prior to the test and to fast overnight. The Michigan Diabetes Research and Training Center Chemistry Laboratory performed all assays. Glucose was measured by the Roche Cobas Mira Chemistry Analyzer (intra-assay variation 2% at 84 and 283 mg/dL, interassay variation 2.9% at 82 mg/dL and 2.6% at 278 mg/dL). A1C was measured in whole blood using the NGSP-approved Pointe Scientific immunoassay (interassay variation 4% at 5.0% A1C and 6% at 10.7% A1C).

Of 54 women, 5 (9.3%) had diabetes (i.e., FPG ≥126 mg/dL and/or 2-h glucose ≥200 mg/dL). We classified FPG ≥100 mg/dL as consistent with impaired fasting glucose (IFG) or diabetes, 2-h values ≥140 mg/dL as consistent with impaired glucose tolerance (IGT) or diabetes, and A1C ≥5.7% as consistent with increased risk of diabetes (5). We examined Spearman's correlations between glucose levels and A1C, compared the sensitivity and specificity of A1C ≥5.7% for detecting any glucose intolerance, and created receiver operating characteristic (ROC) curves of A1C for any glucose intolerance. STATA 11.0 (College Station, TX) was used for analyses.

RESULTS

—Participants were 36 years of age (± 4 years) with a BMI of 30.6 kg/m^2 (± 7.0 kg/m^2). They were non-Hispanic white (73%), Asian (11%), or African American (11%). Eighteen months (±12 months) had elapsed since their GDM delivery. By glucose levels, 37 of 54 (68.5%)

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women were glucose-intolerant. Twelve had FPG ≥100 mg/dL, 18 had 2-h glucose ≥140 mg/dL, 7 had both IFG and IGT, and 23 had IFG or IGT. Twenty-five of 54 (46.3%) had A1C ≥5.7.

Correlations were 0.31 ($P < 0.05$) for A1C versus FPG and 0.44 ($P < 0.05$) for A1C versus 2-h glucose. Among women from 6 weeks to 1 year after delivery (n = 17), r = 0.15 for A1C versus FPG (P = 0.56) and 0.24 for A1C versus 2-h glucose (P = 0.36). Among women 1–1.9 years after delivery (n = 20), r = 0.61 for A1C versus FPG (P = 0.004) and 0.72 for A1C versus 2-h glucose (P = 0.004). Among women ≥2 years after delivery (n = 17), r = 0.44 for A1C versus FPG (P = 0.07) and 0.36 for A1C versus 2-h glucose (P = 0.15).

A1C had 65% sensitivity (15 of 23) and 68% specificity (21 of 31) for any glucose intolerance. A1C had 75% sensitivity (9 of 12) and 62% specificity (26 of 42) for IFG alone. Five women with diabetes by glucose all had A1C ≥5.7%, and 2 women had A1C levels ≥6.5%. The area under the ROC curve for any glucose intolerance was 0.76 (Fig. 1), 0.77 for FPG ≥100 mg/dL, and 0.63 for 2-h glucose ≥140 mg/dL. For any glucose intolerance, A1C ≥6.0 had 39% sensitivity and 81% specificity, and A1C ≥5.0% had 96% sensitivity and 16% specificity.

CONCLUSIONS—In this small cohort of women with recent GDM, we found a similar prevalence of glucose intolerance as observed in larger studies of women with GDM (6). A1C had fair correlation with single measures of glucose, as has been found in other studies of nonpregnant women (7–9). Correlations were low within the year after delivery and improved after the 1st year.

A1C does not require fasting or ingestion of a glucose load, so use of A1Ccould improve postpartum testing rates for women with recent GDM (6). A1C is already used for preconception risk stratification in diabetic women (10). On the other hand, several issues specific to GDM women could affect the choice of test. Use of glucose would presumably lead to more diabetes diagnoses (11). Women with GDM who develop diabetes face longer periods of glucose intolerance than other glucose-intolerant adults (12), and earlier diagnosis and treatment might be advantageous. Earlier identification of prediabetes might also lead to earlier prevention efforts. A1C might be affected by factors such as iron deficiency and acute blood loss, which are common in postpartum women (13), as suggested by the low correlations between glucose and A1C in the year after delivery. Finally, the A1C-glucose relationship may vary by race/ethnicity as a result of the influence of hemoglobin variants upon the performance of specific assays (3) as well as racial-ethnic differences in hemoglobin glycation (14). Outcome data to determine the optimal test are currently lacking.

The strengths of our study include its examination of postpartum GDM women, a heretofore unexamined group, and performance of both OGTTs and A1C. However, the number of women with diabetes was small and tested only once, and repeated tests could improve correlation (7).

We conclude that for recognition of abnormal glucose tolerance in postpartum women, the agreement between the A1C cut point ≥5.7% and plasma glucose levels is at best fair. To determine the optimal test, outcome-based studies are needed to examine adherence to testing recommendations, test performance, and the impact of diagnosis and failure to diagnose glucose intolerance on clinical outcomes.

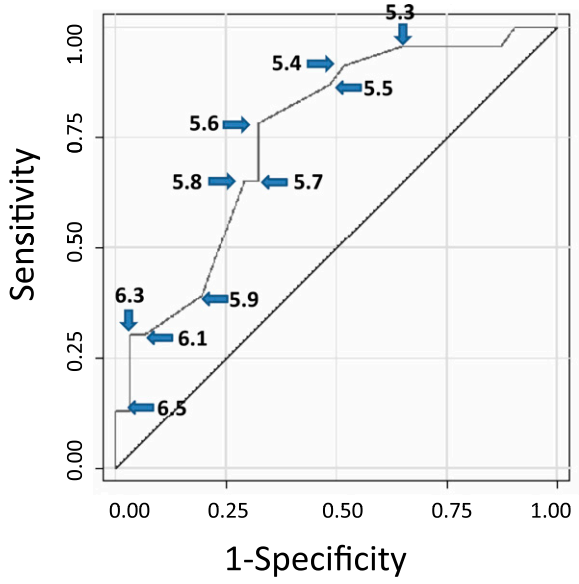

Figure 1—*ROC curve for A1C used for detection of any glucose intolerance by glucose levels from an OGTT performed the same day. Numbers in boldface type indicate A1C cut points and corresponding sensitivity and specificity. (A high-quality color representation of this figure is available in the online issue.)*

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