Gestational Diabetes Mellitus

Simplifying the International Association of Diabetes and Pregnancy diagnostic algorithm using fasting plasma glucose

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OBJECTIVE — To determine the impact of the International Association of Diabetes and Pregnancy Study Group (IADPSG) criteria on *1*) gestational diabetes mellitus (GDM) diagnosis compared with the American Diabetes Association (ADA) criteria and *2*) the fasting plasma glucose (FPG) to predict GDM.

RESEARCH DESIGN AND METHODS — In 10,283 pregnant women undergoing a 75-g oral glucose tolerance test (OGTT) for universal screening of GDM, two FPG thresholds (of the OGTT) were used to rule in and to rule out GDM.

RESULTS — The IADPSG and ADA criteria identified GDM in 3,875 (37.7%) women and 1,328 (12.9%) women, respectively ($P < 0.0005$). FPG thresholds of ≥5.1 mmol/l ruled in GDM in 2,975 (28.9%) women with 100% specificity, while <4.4 mmol/l ruled out GDM in 2,228 (21.7%) women with 95.4% sensitivity. FPG independently could have avoided the OGTT in 5,203 (50.6%) women.

CONCLUSIONS — The IADPSG criteria increased GDM prevalence nearly threefold. By circumventing a significant number of OGTTs, an initial FPG can greatly simplify the IADPSG diagnostic algorithm.

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The scourge of gestational diabetes mellitus (GDM) is the lack of an international agreement on the screening and diagnosis among the preeminent diabetes, obstetric, and health care organizations (1). Therefore, without a globally accepted guideline, the diagnosis of GDM causes a great deal of clinical confusion (2). In March 2010, the International Association of Diabetes and Pregnancy Study Group (IADPSG) issued consensus guidelines to potentially attain a single approach for GDM diagnosis worldwide (3).

The inconsistency in GDM diagnosis is evident in the United Arab Emirates (UAE), which has the second highest prevalence of type 2 diabetes (18.7%) in the world (4). GDM in the UAE varies from 7.9 to 24.9%, depending on which of the six well-accepted criteria are used for diagnosis (2). The popular American Diabetes Association (ADA) criteria (5) demonstrates a prevalence of 10.6–14.7% (2,6–8). In this population, multiple studies have confirmed that the initial fasting plasma glucose (FPG) result of the oral glucose tolerance test (OGTT) is excellent in determining the need to continue with the OGTT (6,9–10); however, its efficiency depends on the criteria used for GDM diagnosis (6). The aim of this study was to determine, in this high-risk population, the impact of the new IADPSG criteria on *1*) the diagnosis of GDM compared with the ADA criteria and *2*) the FPG to predict GDM in order to decide whether to proceed with the OGTT.

RESEARCH DESIGN AND METHODS

— The subjects were pregnant women attending the routine antenatal clinics of two tertiary care hospitals. Due to a universal screening program, every pregnant woman underwent a 75-g OGTT scheduled at 24–28 weeks gestation. The data were collated from our four previous studies (2,6–8) between 2003 and 2008; a total of 10,283 pregnant women were available for analysis.

Plasma glucose was estimated by the glucose oxidase method (Beckman-Coulter, Brea, CA); the analytical standards for glucose were met (11). Previously, the gold standard was the ADA criteria (5) for the 75-g OGTT; the data were reanalyzed using the new IADPSG criteria (i.e., one or more plasma venous glucose values ≥0 h, 5.1 mmol/l; 1 h, 10.0 mmol/l; or 2 h, 8.5 mmol/l) (3).

The statistical analysis has been described earlier (6). A rule-in and rule-out algorithm (12) was used for the FPG to predict GDM. Briefly, this approach involves considering two FPG cutoff values. The higher threshold, with an inherently increased specificity, rules in GDM; the lower threshold, with its innate increased sensitivity, rules out GDM. Women who have FPG values in between these two thresholds are indeterminate and would need the diagnostic OGTT.

RESULTS

— The current ADA criteria identified 1,328 (12.9%) women with GDM; however, by the new IADPSG criteria (applied to the same OGTT), 3,875 (37.7%) women would have GDM ($P < 0.0005$) (i.e., a 2.9-fold increase). The mean maternal age was (means ± SD) 28.3 ± 6.1 years. The mean gestational age (at time of OGTT) was 25.6 ± 6.3 weeks. The women with GDM (with either the ADA or IADPSG criteria) were older with higher fasting, 1-h, and 2-h plasma glucose values ($P <$ 0.0005). There were two main ethnic groups: 8,233 (80.1%) Arab women and 1,592 (15.5%) South-Asian women

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Table 1—*GDM diagnosis by IADPSG criteria* (n = *10,283*)

FPG at or above the threshold	4.2 mmol/l	4.4 mmol/l	4.7 mmol/l	5.0 mmol/l	5.1 mmol/l
No. of women at or above the threshold [*n* (%)]	9,478 (92.2)	8,055 (78.3)	6,000 (58.3)	3,701 (36.0)	2,975 (28.9)
False-negative rate (%)	1.7	4.6	11.1	19.5	23.2
Sensitivity (%)	98.3	95.4	88.9	80.5	76.8
PPV (%)	40.2	45.9	57.4	84.2	100.0
LR+	1.11	1.40	2.23	8.84	*
No. of women below the threshold [*n* (%)]	805 (7.8)	2,228 (21.7)	4,283 (41.7)	6,582 (64.0)	7,308 (71.1)
False-positive rate (%)	88.4	68.0	39.9	9.1	0.0
Specificity (%)	11.6	32.0	60.1	90.9	100.0
NPV (%)	92.0	91.9	90.0	88.5	87.7
LR−	0.14	0.15	0.18	0.21	0.23

Selected threshold values of the FPG with associated test sensitivity, specificity, positive (PPV) and negative (NPV) predictive values, likelihood ratios of positive (LR+) and negative (LR−) test result; false-positive rate (1 − specificity) and false-negative rate (1 − sensitivity). *Not calculable.

(i.e., nationals of India, Pakistan, Bangladesh, and Sri Lanka). There was no significant difference in GDM diagnosis between Arabs and South Asians with IADPSG criteria ($P = 0.3$); nevertheless, with the ADA criteria the difference was significant ($P < 0.0005$).

The IADPSG criteria identified all women with GDM by the ADA criteria but categorized an additional 2,547 (24.8%) women as having GDM. The κ statistic for the agreement of GDM diagnosis (between IADPSG and ADA) was fair (39.4%). The area under the receiver-operating characteristic curve (AUC) for FPG using the IADPSG and ADA criteria was 0.907 (95% CI 0.899–0.914) and 0.871 (0.859–0.882), respectively. Table 1 lists selected threshold values for FPG with the associated test characteristics.

CONCLUSIONS — The IADPSG recommendation that every pregnant woman should undergo the OGTT is very demanding; it would severely overload the laboratory. An urgent, initial FPG result can assist in deciding if the pregnant woman should continue with her OGTT (6). In this study, using the two-cutoff approach, a higher FPG threshold of ≥5.1 mmol/l ruled in GDM in 2,975 (28.9%) women with 100% specificity (Table 1). A lower FPG threshold of <4.4 mmol/l ruled out GDM in 2,228 (21.7%) women at an acceptable sensitivity of 95.4%; only 180 (4.6%) women with GDM were misclassified as healthy. In the Hyperglycemia and Adverse Pregnancy Outcome Study, risks of adverse outcomes were low when the FPG was ≤4.4 mmol/l (3). Thus, the initial FPG could circumvent the cumbersome OGTT in over half the pregnant women without compromising health care.

The IADPSG criteria increased GDM prevalence almost threefold compared with the ADA criteria; this would further add to the health expenditure due to the additional antenatal visits, further laboratory work up, and medications, if needed. However, using these more liberal criteria does have many advantages. In the short term, as confirmed by the recent trials, attaining glucose targets by diet, exercise, or drugs would decrease adverse outcome in index pregnancy. In the long term, a significantly greater number of women would be identified to be at risk for type 2 diabetes; this fact is most evident in Australia (13), because the Australasian criteria are the most inclusive among the six major criteria for GDM diagnosis (2). Thus, these new criteria could be of real benefit; targeting the "extra" women with GDM after delivery may help to forestall the ongoing epidemic of type 2 diabetes.

The current guidelines for GDM have numerous shortcomings: they have often been developed from tenuous data, frequently the result of expert opinion, sometimes economically driven, and at times convenience oriented (1). Finally, the long-awaited, single-guideline—based on sound scientific data—is available. In many other areas of medicine, standardization has been attained with fruitful results (14); such consistency is crucial for GDM. Despite the constraints, this unique opportunity for one global approach to GDM should not be missed.

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