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Selective rather than universal screening for gestational diabetes mellitus?☆

Grégoire Miailhe [a,b,c], Gilles Kayem [a,b,c], Guillaume Girard [a,b,c], Hélène Legardeur [a,b,c], Laurent Mandelbrot [a,b,c,*]

[a] Hôpital Louis Mourier, Hôpitaux Universitaires Paris-Nord Val de Seine, Assistance Publique-Hôpitaux de Paris, Department of Obstetrics and Gynecology, Colombes, France
[b] Université Paris-Diderot, Paris, France
[c] "DHU Risks in Pregnancy" University Department, Paris, France

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ABSTRACT

Objectives: To estimate the proportion of women with gestational diabetes mellitus (GDM) who would be missed by selective versus universal screening and to describe their pregnancy outcomes.
Study design: An observational cohort study in a single center performing universal screening for GDM with a 75 g oral glucose challenge test (OGTT) at 24–28 weeks gestation. We excluded women with pregestational or first trimester diabetes, those not screened and deliveries <34 weeks. Risk factors were age ≥ 35 years, BMI ≥ 25, family history of diabetes, GDM in a previous pregnancy or macrosomia in a previous pregnancy. Main outcomes were large for gestational age (LGA > 90th centile for gestational age, adjusted for gender) and small for gestational age < 10th centile.
Results: Among 2187 women screened, 309 (14%) had GDM, of whom 256 (83%) had one or more risk factors. The proportion of women who had GDM despite the absence of any risk factor was 2.4%. In multivariate analysis, LGA was significantly associated with GDM only in case of risk factors. Mean fasting blood glucose was lower in GDM without risk factors than in GDM with risk factors (87 ± 1 mg/dl versus 94 ± 14, $p < 0.001$) and fewer required insulin (6% versus 26%, respectively, $p < 0.001$).
Conclusion: Selective screening would have missed one-sixth of GDM cases, but these cases seemed milder, with normal fasting blood glucose, and thus less likely to lead to perinatal complications. Whereas an opt-in approach relies heavily on accurate patient screening, we suggest that screening tests could be avoided in low-risk women by an opt-out approach.

Introduction

Gestational diabetes mellitus (GDM) is associated with short-term and long-term morbidities for the mother and child. Most of the short-term complications are related to excessive fetal weight [1]. The risk of LGA is related to maternal blood sugar levels [2], with a continuous and linear correlation even at moderate levels of hyperglycemia [3]. Controlling blood sugar levels reduces the incidence of LGA and poor pregnancy outcomes in women with GDM, even in case of mild hyperglycemia [4–6]. The International Association of Diabetes in Pregnancy Study Groups (IADPSG) [1] issued guidelines for GDM screening, based on a universal mid-trimester 1-step 75 g oral glucose tolerance test (OGTT). These guidelines have been widely adopted worldwide. However, there is concern over the proportion of women diagnosed with GDM with these definitions, on the order of 18% [7] and even more in countries with the highest prevalence of obesity [8]. This is a burden on health-care providers [9], even if is cost/beneficial [10]. For these reasons, consensus is still lacking in the United States [11–13].

Another controversy, which has received less attention, is whether selective or universal screening should be offered [14,15]. In France, practice guidelines issued in December 2010 recommended 1-step screening with IADPSG thresholds, but restricted to women with pre-defined risk factors for GDM [16]. The objectives

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* Corresponding author at: Service de Gynecologie-Obstétrique, Hôpital Louis Mourier, HUPNVS, Université Paris-Diderot, 178 rue des Renouillers, 92700 Colombes, France. Tel.: +33 1 47 60 63 39; fax: +33 1 47 60 63 38; mobile: +33 6 85 12 76 88.
E-mail address: laurent.mandelbrot@lmr.aphp.fr (L. Mandelbrot).

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of our study were to estimate the proportion of women with GDM who would be missed by such selective versus universal screening and to analyze obstetrical outcomes for these women.

Materials and methods

We performed a retrospective cohort study in a tertiary academic perinatal center in the Paris area, including all women who delivered singletons after 24 gestational weeks from 1-04-2011 to 28-02-2012. The institutional policy was the IADPSG universal 2-h screening with a 75 g oral glucose challenge test (OGTT) at 24–28 weeks gestational age [1,17]. Many women received prenatal care outside the institution until the 3d trimester, but primary care providers were encouraged to follow this policy. First trimester screening with fasting blood sugar was optional, in case of risk factors. Women with pre-gestational diabetes or with an abnormal first trimester blood sugar test were excluded. Screening was considered positive at the IADPSG thresholds adopted by the French obstetrical and diabetes societies (4): ≥92 mg/dl (5.1 mmol/L) fasting blood glucose (FBG), ≥180 mg/dl (10 mmol/L) at 1 h or ≥153 mg/dl (8.5 mmol/L) at 2 h.

Women screening positive first received group counseling with a nutritionist and a nurse. A low carbohydrate diet was explained and women were furnished a blood glucose monitor and logbook and instructed to test for capillary blood sugar 6 times daily, before and 2 h after each meal. The objectives were FBS < 90 mg/dl and post-prandial glucose (PPG) < 120 mg/dl. Whenever these objectives were not met, women received individual counseling and in case of persistent and/or high hyperglycemia, were started on insulin. Oral hypoglycemic agents were not used at the time. Further follow-up was done weekly.

Within this cohort receiving universal screening, we studied: (1) how many women would not have been screened if testing had been selective, (2) how many GDM cases would have been missed, (3) differences between the low-risk and high-risk populations, and (4) obstetrical and neonatal outcomes. Risk factors were those recommended by the IADPSG [1] and French [16] guidelines: maternal age > 35 years, pre-gestational BMI > 25, family history of diabetes, GDM in a previous pregnancy and/or macrosomia (birthweight >4500 g) in a previous child. Ethnic origin is not considered as a risk factor for GDM in these guidelines [16].

We analyzed the following maternal characteristics: age, geographic origin, parity, GDM in a previous pregnancy, macrosomia in a previous child, family history of diabetes, pre-gestational BMI, weight gain during the pregnancy, previous cesarean section. The elements regarding GDM were the blood glucose values at the screening test, insulin treatment and weight gain during pregnancy. Obstetrical outcomes were hypertension/preeclampsia, mode of delivery and shoulder dystocia. In accordance with French practice guidelines [16] we did not perform cesarean sections solely because of diabetes, except in case of estimated fetal weight above 4500 g. Neonatal outcome measures were gestational age at birth, birthweight, birthweight *z*-score, cord blood arterial pH, Apgar score at 5 min. LGA was defined as >90th centile and small for gestational age (SGA) was defined as <10th centile.

Data were collected prospectively in the department's computerized database (DiammG, Micro6, Vandoeuvre-les-Nancy, France), which is used for routine patient follow-up. The database is approved by the French Computer Watchdog Commission (CNIL). The study was approved by the Institutional Review Board – IRB 00006477 (Study N° 13-044, October 15, 2013). Continuous variables were analyzed by ANOVA, and categorical variables were compared with chi-square or Fisher's exact test. The independent effect of GDM with or without risk factors on small for gestational age (SGA) or LGA was tested and quantified with a multivariable logistic regression. We adjusted for covariables previously described as risk factors of LGA and SGA and for variables found to be potential confounders in bivariate analyses. The variables included in the model, in addition to GDM status, were maternal age, parity, geographical origin, BMI and hypertension/preeclampsia. Another model was performed including in addition to the above confounders, weight gain during the pregnancy. It must be underlined that BMI and age, which are risk factors for LGA, are also risk factors for GDM. Stata 11.0 software was used for the statistical analysis.

The birthweight *z*-score was calculated with the formulas published by Salomon et al. [18] on a similar population in France, adjusting for gestational age and the infant's sex.

Results

We included 2187 women, of a total of 2555 singleton deliveries beyond 24 gestational weeks over the study period, after excluding 17 women who had type 1 or type 2 diabetes known before the pregnancy, 84 with GDM diagnosed early in pregnancy, and 303 (12%) who did not receive GDM screening. The test was positive in 309/2187 women tested (14%).

Among these 309 women with GDM, 256 (83%) had one or more risk factors and 53 (17%) had none.

In the overall study population, 1310 women (60.7%) had one or more GDM risk factor. Of these, 256 (19.2%) had GDM. There were 851 women with no risk factor for GDM (38.9%), and of these, 55 (6.2%) had GDM.

Among the 345 women who were not offered screening, the proportions were similar: 208 (60.5%) had one or more risk factors.

Women with GDM without risk factors were younger, leaner, more often nulliparous and more often Caucasian (Table 1).

GDM was independently associated with maternal age ≥ 35 years, BMI ≥ 25, family history of diabetes, history of macrosomia and most strongly with a history of GDM (adjusted odds ratio, aOR 5.58 95% CI 3.62; 8.59) (Table 2).

Fasting blood glucose (FBG) was significantly lower in GDM without risk factors than in GDM with risk factors (87 mg/dl versus 94 mg/dl, $p < 0.001$) (Table 3), but higher than in the no-GDM group (87 mg/dl versus 79 mg/dl, $p < 0.001$). OGTT values did not differ between the GDM groups with or without risk factors, but were much higher than in the no-GDM group at 1 and 2 h. Insulin was required more frequently in GDM with risk factors than in GDM without risk factors (26% versus 6%, respectively, $p = 0.005$).

There were no significant differences in gestational age at birth, modes of delivery or mean birthweights between the GDM and no-GDM groups (Table 4). In univariate analysis, LGA (>90th centile) incidence was higher in GDM with risk factors than in GDM

Table 1
Maternal characteristics. Characteristics were compared between GDM groups with and without risk factors and the no-GDM (reference) group.

	GDM without risk factor $n = 53$	GDM with risk factor(s) $n = 256$	No GDM $n = 1878$
Nulliparous, *n* (%)	34 (64)*	98 (38)§	780 (42)
Maternal age > 35 years, *n* (%)	0*	86 (34)*,§	298 (16)
BMI pre-pregnancy > 25, *n* (%)	0*	172 (70)*,§	632 (36)
Geographic origin, *n* (%)		*,§	
Europe	25 (47)	73 (29)	668 (36)
North Africa	14 (26)	126 (49)	720 (38)
Sub-Sahara Africa	6 (11)	30 (12)	283 (15)
Others	5 (9)	16 (6)	129 (7)
Previous cesarean section, *n* (%)	4 (8)	38 (16)*	191 (11)

* Statistically significant difference ($p < 0.05$) with no GDM group.
§ Statistically significant difference ($p < 0.05$) with GDM without risk factor group.