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Original article

Factors predictive of macrosomia in pregnancies with a positive oral glucose challenge test: Importance of fasting plasma glucose

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Abstract

Aim. – The study aimed to determine the factors associated with fetal macrosomia following a positive oral glucose challenge test (OGCT).

Methods. – In this retrospective single-centre study of 1268 pregnancies with positive 50-g OGCTs (plasma glucose ≥ 130 mg/dL, or 7.2 mmol/L), gestational diabetes mellitus (GDM) was defined as fasting plasma glucose (FPG) ≥ 95 mg/dL (5.3 mmol/L) and/or postprandial glucose (PPG) ≥ 120 mg/dL (6.7 mmol/L).

Results. – In GDM pregnancies, the odds ratios adjusted for confounders (age, BMI, ethnicity, parity and weight gain) were 2.02 for macrosomia (Z score ≥ 1.28) and 2.62 for severe macrosomia (Z score ≥ 1.88). For each 10-mg/dL increase in FPG, the mean birth–weight increase was 60 g. Macrosomia risk did not differ between GDM patients with normal FPG (< 95 mg/dL, or 5.3 mmol/L) and non-diabetics, but increased significantly in cases of FPG ≥ 95 mg/dL and regardless of the level of PPG.

Conclusion. – In our study population, birth–weight and macrosomia risk were strongly correlated with FPG, suggesting that it is a simple and efficient marker for the risk of macrosomia.

Keywords: Gestational diabetes mellitus; Macrosomia; Screening; Pregnancy

1. Introduction

Fetal macrosomia complicates 20–30% of pregnancies with gestational diabetes mellitus (GDM), leading to maternal and perinatal risks [1] as well as effects on the child's long-term health. There is a well-established correlation between the rate of macrosomia and the degree of control of blood glucose levels during pregnancy [2,3]. However, birth–weight is also related to other factors, including maternal factors such as body mass index (BMI) and weight gain during pregnancy, and genetic and placental factors [4]. Because most macrosomic infants are born to women without GDM [5], there has been ongoing controversy as to whether or not fetal macrosomia is directly related to maternal glucose levels. The Hyperglycaemia and Adverse Pregnancy Outcome (HAPO) study [6] clearly established for the first time the continuous graded relationships between increasing maternal glucose levels and birth–weight, as well as the rates of primary caesarean section delivery and neonatal hypoglycaemia independent of other risk factors. Some authors have speculated that macrosomia with normoglycaemia may in fact be macrosomia with undetected hyperglycaemia [7]. Furthermore, two randomized clinical trials demonstrated that treating moderate GDM improved perinatal and obstetric outcomes [8,9], and decreased the incidence of neonates weighing ≥ 4 kg and/or above the 90th percentile.

Taking into account these new data, guidelines have been revisited all over the world to simplify and standardize GDM screening [10], resulting in the use of a one-step 75-g 2-h oral glucose tolerance test (OGTT) and the establishment of new thresholds based on the relative risk of macrosomia. However, as these guidelines have led to a high incidence of women diagnosed with GDM, there is still some debate over who to screen and which pregnancies to consider at high-risk for macrosomia. These concerns have led to a renewed focus on the use of fasting blood glucose determinations.

The purpose of the present study, which was performed before the latest guidelines were issued, was to determine the factors

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predictive of fetal macrosomia in pregnancies with a positive 1-h 50-g oral glucose challenge test (OGCT).

2. Patients and methods

This retrospective single-centre cohort study included all pregnant women with a positive OGCT (O'Sullivan) test, defined as ≥ 130 mg/dL (7.2 mmol/L) after taking 50 g of glucose, who delivered between 1 January 2005 and 30 September 2008. Birth–weights were compared with a control group, comprising all other women who delivered during the same period. Excluded from both study groups were women with pregestational diabetes, multiple gestations, those receiving prenatal care at other institutions and those who had already delivered during the study period so that the same mother would not be included more than once. Participants' demographics, and their maternal, pregnancy and perinatal data were extracted from a computerized database (DIAMM G, Micro 6, Villers-les-Nancy, France), and data specifically relating to GDM were completed by a chart review from nutritionists' files. The study was given the approval of the Institutional Review Board (N° IRB00006477) on 6 November 2009.

Patients' care was performed as follows. First-trimester screening for fasting plasma glucose (FPG) was prescribed to women with risk factors for type 2 diabetes, defined as BMI > 30 kg/m^2, personal or family history of diabetes, previous neonatal birth–weight > 4000 g and/or unexplained fetal death. In cases of FPG > 126 mg/dL, the women were considered to have preexisting diabetes and so were excluded from the study. Second-trimester screening was systematically prescribed for all women except in cases of preexisting diabetes (including first-trimester diagnoses), using a two-stage procedure (Fig. 1). A classical 50-g OGCT was performed between 24 and 28 weeks of gestation. In cases with results ≥ 130 mg/dL (7.2 mmol/L), the women were called in for counselling by a nutritionist. A simplified procedure without a 100-g OGTT was used, as adopted decades ago by our institution to improve the acceptability and uptake of testing. FPG and postprandial glucose (PPG) tests 2 h after a standard breakfast were performed 10 days after nutritional counselling. This procedure was based on the fact that most guidelines recommend dietary and/or medical therapy based on FPG and PPG levels rather than on screening tests *per se* [11,12]. All women with FPG ≥ 95 mg/dL (5.3 mmol/L) and/or PPG ≥ 120 mg/dL (6.7 mmol/L) who thus required active management were considered to have GDM and were prescribed a diet based on 2000 kcal/day, comprising 50% carbohydrates in three meals and one snack. FPG and PPG measurements were repeated and if levels were still above the objectives, then glucose capillary testing six times a day was started and the patient was treated by insulin if necessary.

Macrosomia was defined as a birth–weight ≥ 4000 g and large-for-gestational age (LGA) as a standardized birth–weight Z score ≥ 1.28 (corresponding to the 90th percentile), using reference values for a Paris area population adjusted for fetal gender and gestational age [13]. Severe LGA was defined as a Z score ≥ 1.88, which corresponded to the 97th percentile.

2.1. Statistical analysis

Crude odds ratios (ORc) were calculated to study any associations between LGA and the risk factors under study. *P* values were estimated from logistic (unadjusted) models.

To investigate the relationship between the probability of LGA and blood sugar concentrations, semiparametric

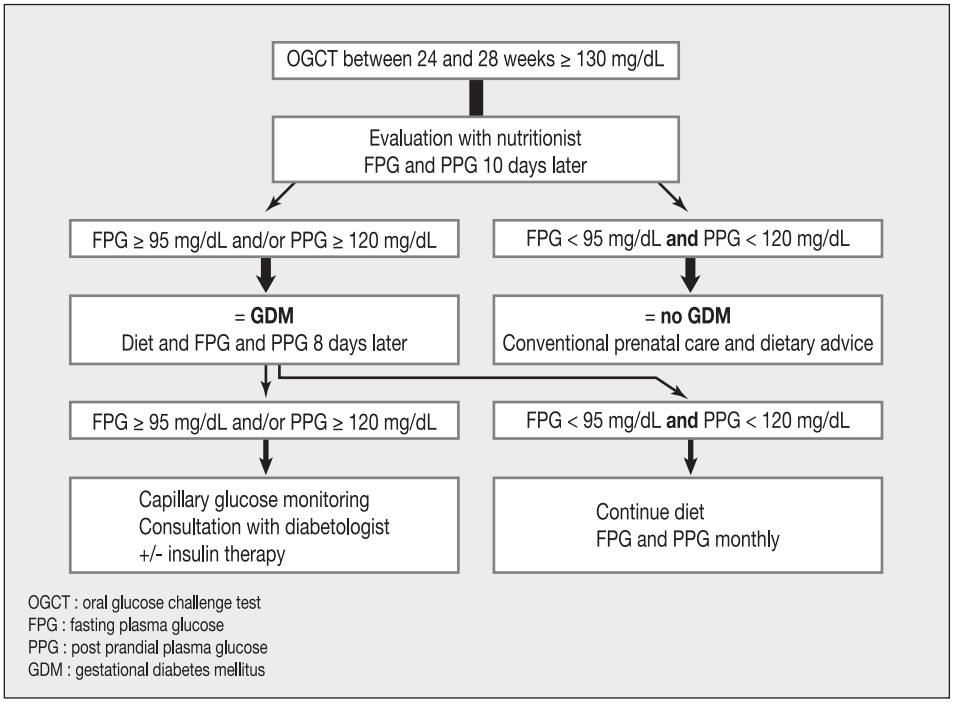

Fig. 1. Algorithm used for gestational diabetes mellitus screening and management.