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Original article

Pregnancy adverse outcomes related to pregravid body mass index and gestational weight gain, according to the presence or not of gestational diabetes mellitus: A retrospective observational study

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Abstract

Aim. – This study retrospectively evaluated the complications associated with prepregnancy overweight (OW) or obesity (OB) and gestational weight gain (GWG) in women with or without universally screened and treated gestational diabetes mellitus (GDM).

Methods. – A total of 15,551 non-Asian women without pregravid diabetes or hypertension who delivered singleton babies (2002–2010) were classified according to GDM (13.5%), pregestational body mass index (BMI; normal range: 18.5–24.9 kg/m^2), OW (26.2%), OB (13.9%; BMI ≥ 30 kg/m^2) and GWG (< 7 kg: 32%; 7–11.5 kg: 37%; 11.6–16 kg: 23%; > 16 kg: 8%). Main outcome measures were large/small for gestational age (LGA/SGA), caesarean section, preeclampsia, preterm delivery and shoulder dystocia.

Results. – GDM was associated with more LGA babies [Odds Ratio (OR): 2.12, 95% confidence interval (CI): 1.85–2.43], caesarean section (OR: 1.49, 95% CI: 1.34–1.65) and preeclampsia (OR: 1.59, 95% CI: 1.21–2.09). OW/OB and GWG were associated with LGA infants whatever the GDM status, and with SGA babies only in women without GDM. LGA status was independently associated with GWG in women with GDM (11.6–16 kg: OR: 1.74, 95% CI: 1.49–2.03 and > 16 kg OR: 3.42, 95% CI: 2.83–4.13 vs 7–11.5 kg) and in women without GDM (OR: 2.14, 95% CI: 1.54–2.97 or OR: 2.65, 95% CI: 1.68–4.17, respectively), and with BMI only in women without GDM (OR: 1.12, 95% CI: 1.00–1.24, per 10 kg/m^2). SGA status was independently associated with OW (OR: 0.86, 95% CI: 0.77–0.98), OB (OR: 0.84, 95% CI: 0.72–0.98) and GWG < 7 kg (1.14, 95% CI: 1.01–1.29) only in women without GDM.

Conclusion. – In our European cohort and considering the triumvirate of GDM, BMI and GWG, GDM was the main contributor to caesarean section and preeclampsia. OW/OB and GWG contributed to LGA and SGA infants mainly in women without GDM.

Keywords: Gestational diabetes mellitus; Gestational weight gain; Obesity; Pregnancy; Prognosis

1. Introduction

Gestational diabetes mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy, and is associated with adverse outcomes during pregnancy [1]. Obesity has a growing prevalence in women of childbearing age [2] and is a confounding factor. First, it is a risk factor for GDM [2,3]. Second, it shares complications with GDM, such as large-for-gestational-age (LGA) infants

Abbreviations: GWG, Gestational weight gain; IOM, Institute of Medicine; HAPO, Hyperglycaemia and Adverse Pregnancy Outcomes; IADPSG, International Association of Diabetes and Pregnancy Study Groups; LGA, large for gestational age; SGA, small for gestational age.

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[4–11], caesarean section [4,5,7,8,11,12], hypertensive disorders [4,5,7,8] and, in certain studies, shoulder dystocia [5]. Also, gestational weight gain (GWG) appears to be crucial [5,8–10,13,14].

To date, only five recent studies, four from the United States [5,10,15,16] and only one from Europe [9], have explored the impact of GDM, obesity and GWG together. Some limitations may affect these observational studies. First, the prevalence of GDM is sometimes very low [9,16] with screening which might not have been universal [5,10,15,16]. Second, women with pregravid diabetes and hypertension were not excluded [5,9,10,15,16], whereas these conditions are often associated with overweight and obesity. Therefore, considering women with 'isolated obesity' might better evaluate the role of obesity *per se* [12]. Regarding body mass index (BMI), underweight women are not always considered separately [5,16] nor is the lower BMI cutoff point in Asian women [17] taken into account to define overweight and obesity [5,9]. Finally, excessive GWG [9,10], determined according to pregravid BMI status as proposed by the Institute of Medicine (IOM) [18] rather than GWG *per se*, has often been considered and is an additional confounding factor.

Dietary advice and drugs are generally provided only to women with GDM, as GWG [5,8–10,13,14], treatment modalities and glycaemic levels achieved can modify the outcomes [19]. Only the Hyperglycaemia and Adverse Pregnancy Outcomes (HAPO) study reported obesity-related adverse events independently of glycaemic status and its treatment [4,7]. However, in that study, BMI was measured at the time of oral glucose tolerance tests at between 24 and 32 weeks of gestation, and not before pregnancy. Therefore, GWG could not be assessed.

Given this context, a large multiethnic European cohort of non-Asian women who delivered singleton babies and were without pregravid diabetes or hypertension was selected for our present retrospective observational study. In this cohort, the adverse outcomes related to 'isolated' overweight, obesity and GWG were investigated in women with and without universally screened and treated GDM.

2. Methods

2.1. Participants, GDM screening and care

A total of 20,653 women delivered at our hospital between January 2002 and December 2010. Data are routinely entered at birth for all women (no exceptions) giving birth at our university hospital by the midwife assisting at the delivery, then checked and collected during the maternity stay by a midwife qualified in data management and storage (I.P.), with no interactions with the women themselves. The authors did not have access to identification of patients' information prior to anonymization. The purposes of the database are to assess the overall quality of obstetric care and to regularly update medical management protocols. The data are retrospective and observational, with no need for either approval by an ethics committee/institutional review board or patients' written informed consent. The patients' records/information are anonymous, and the database is declared to the French data protection authority (*Commission nationale de l'informatique et des libertés* [CNIL]).

In the present study, women with known diabetes ($n = 204$), previous hypertensive disorders ($n = 448$) and multiple pregnancies ($n = 378$) were not included. Furthermore, women whose prepregnancy BMI ($n = 1669$) and GWG ($n = 2$) were unknown were also not included. Finally, those also excluded were women from Asia ($n = 628$) or India/Pakistan/Sri Lanka ($n = 1076$), and those with a BMI < 18.5 kg/m^2 ($n = 687$).

Thus, 15,551 pregnancies were analyzed. Definitions of our parameters did not change over the 9 years of the study. BMI was calculated from self-reported pregravid weight and measured height during pregnancy, using the following formula: weight (in kg) divided by the height (in m) squared. Women were classified as normal weight, overweight and obese when their BMI was 18.5–24.9 kg/m^2, 25.0–29.9 kg/m^2 and ≥ 30 kg/m^2, respectively [17]. GWG categories (< 7 kg, 7.0–11.5 kg, 11.6–16 kg and > 16 kg) were defined according to the usual thresholds proposed by IOM guidelines for overweight women (optimal GWG: 7–11.5 kg) and normal-weight women (optimal GWG: 11.6–16 kg) [18].

GDM was assessed using a one-step screening and diagnostic test, which always comprised a 75-g oral glucose tolerance test [2,20,21]. GDM was defined as a fasting plasma glucose value ≥ 5.3 mmol/L (the same fasting plasma glucose target as in previous French recommendations) and/or a 2-h blood glucose value ≥ 7.8 mmol/L (World Health Organization criteria) [2,20,21]. One-step screening was chosen to limit the number of participants lost to follow-up, as our study population was characterized by widespread geographical origins [21]. Screening was specifically prescribed during the hospital routine follow-up visit and then performed out of hospital. As is usual for epidemiological studies, the women without screening were considered to be without GDM [2,9,10,15].

Women who were overweight or obese had no specific follow-up unless they were diagnosed with GDM. All women with such a diagnosis were referred to a multidisciplinary team, which included a diabetologist, obstetrician, midwife, dietitian and nurse educator. These women received individualized dietary advice, were instructed on how to perform self-monitoring of blood glucose levels six times a day, and visited the diabetologist every two to four weeks. Insulin therapy was started if fasting and 2-h postprandial glucose levels were > 5.3 mmol/L and > 6.8 mmol/L, respectively. Antenatal visits were scheduled for every two to four weeks up to 34 weeks, and weekly thereafter, with cardiotocography and assessment of amniotic fluid volume [2,21].

2.2. Prognosis

The following outcomes were considered: LGA or SGA (birth weight > 90th percentile or < 10th percentile, respectively, of the general French population) [22]; caesarean section; preeclampsia (blood pressure ≥ 140/90 mmHg on two measurements taken 4 h apart and proteinuria ≥ 300 mg/24 h or 3+ or more on dipstick testing of a random urine sample); preterm delivery (before 37 full weeks); and shoulder dystocia, defined