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Original article

Hypoglycemia during oral glucose tolerance test among post-bariatric surgery pregnant patients: incidence and perinatal significance

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Abstract

Background: While hypoglycemia during an oral glucose tolerance test (OGTT) has been shown to occur in a considerable portion of nonpregnant post-bariatric surgery (BS) patients, its incidence among pregnant post-BS patients evaluated for gestational diabetes has only been sparsely studied.

Objectives: We investigated OGTT results and pregnancy outcomes in pregnant women who underwent 3 types of bariatric procedures before pregnancy.

Setting: A university hospital.

Methods: From medical records, data were collected on glucose measurements during a 100-g, 3-hour OGTT, as well as maternal and fetal outcomes.

Results: Of 119 post-BS pregnant patients included in the study, 55 underwent laparoscopic sleeve gastrectomy, 34 laparoscopic adjustable gastric banding, and 30 laparoscopic Roux-en-Y gastric bypass surgery. Hypoglycemia (<55 mg/dL) was encountered in 59 (49.6%) patients during the OGTT. Among them, the nadir plasma glucose levels occurred 2 hours after glucose ingestion in 25 (42.4%) and after 3 hours in 34 (57.6%), with a median value of 47 (44–52) mg/dL. The risk of hypoglycemia was higher among women with prior laparoscopic Roux-en-Y gastric bypass surgery (83.3%) than among those with prior laparoscopic sleeve gastrectomy (54.5%; $P = .009$) or laparoscopic adjustable gastric banding (11.8%; $P < .0001$). Time from surgery to conception was significantly shorter among women with evidence of hypoglycemia during OGTT (median 711 versus 1246 days, $P = .002$). Compared with patients without evidence of hypoglycemia, patients who experienced hypoglycemia had lower rates of gestational diabetes ($P = .03$) but higher proportions of low birth weight ($P = .01$) and small for gestational age infants ($P = .03$).

Conclusions: Because hypoglycemia is common during OGTT among post-BS parturients, other diagnostic methods should be considered in this setting. The association found between hypoglycemia and poor fetal growth warrants investigation as to whether interventions to prevent hypoglycemia will improve fetal outcome. (Surg Obes Relat Dis 2017;■:00–00.) © 2017 American Society for Metabolic and Bariatric Surgery. All rights reserved.

Keywords:

Bariatric surgery; Pregnancy; Oral glucose tolerance test; OGTT; Hypoglycemia

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Obesity is recognized as a global epidemic. Its worldwide prevalence has more than doubled in the last 2 decades, including 35% of the U.S. population [1]. Bariatric surgery

(BS) has become the mainstay of treatment for morbid obesity due to its demonstrated efficacy in achieving significant weight loss and in improving obesity-related co-morbidities [2]. Despite the dramatic increase in the utilization of BS in the management of obesity, post-operative complications are not uncommon and were reported to occur in up to one third of patients [3]. In recent years, the occurrence of post-BS postprandial hyperinsulinemic hypoglycemia has become a concern [4]. Although the mechanisms implicated in this phenomenon are largely unclear, its clinical consequences may be hazardous, as recurrent hypoglycemia is known to cause dementia, reduce quality of life, and increase all-cause mortality [5].

Of patients who undergo BS, 80% are women of child-bearing age [6]. Due to this situation, coupled with the dramatic increase in the utilization of BS in the management of obesity, obstetricians are likely to encounter women who have undergone BS in their routine practice [7]. Pregnancy after BS has been related to risk reduction in various outcomes, including rates of gestational diabetes (GD) [8–10]. Nevertheless, among the studies that evaluated the occurrence of GD after BS, only a few mentioned the diagnostic criteria used [8]. Moreover, specific guidelines have not been established for screening and diagnosing GD in women who have had BS.

The oral glucose tolerance testing (OGTT) is considered the gold standard for diagnosing GD [11]. However, as OGTT is a liquid meal, it passes quickly into the small intestine and may elicit a hyperinsulinemic hypoglycemic response [4]. While hypoglycemia during an OGTT has been shown to occur in a considerable portion of non-pregnant post-BS patients [12–15], its occurrence among pregnant post-BS patients evaluated for GDM has only been sparsely studied with a reported incidence of 55% to 58% [16,17]. Moreover, recognizing hypoglycemia in the OGTT is important because associations have been reported between the occurrence of hypoglycemia during an OGTT and pregnancy outcomes [18–20].

In light of the paucity of data, we aimed to evaluate the incidence of hypoglycemia during an OGTT and its perinatal significance, and to compare results among 3 types of bariatric procedures.

Methods

Patients

This cohort study included all singleton pregnancies among women with prior BS who underwent a 100-g, 3-hour OGTT at 24 to 28 weeks of gestation and who were referred to our medical center during 2006 to 2016. The electronic medical record database of the maternal-fetal unit of the 2 university hospitals included in our center were

reviewed between January and April 2017. The following data were extracted: patient characteristics (demographic characteristics, gravity, parity), type of prior BS, preoperative data, early-pregnancy body mass index, pregnancy-associated hypertensive disorders, GD, OGTT results, gestational age (GA) at delivery, mode of delivery, gestational weight gain, birth weight, and Apgar scores at 1 and 5 minutes. Hypoglycemia was defined as plasma glucose levels <55 mg/dL, according to the Endocrine Society definition [21,22]. Early-pregnancy body mass index was calculated according to height and weight measurements reported at the first prenatal visit in the first trimester of pregnancy. GA was based on ultrasonography performed during the first trimester of pregnancy. Preterm delivery was defined as GA <37 completed weeks. Small for gestational age was defined as <10th percentile and large for gestational age as >90th percentile, using birth weight z-scores calculated with formulas published in regard to a similar population in Israel, after adjustment for GA and the offspring's sex [23]. Low birth weight was defined as <2500 g and macrosomia as >4000 g. Institutional review board approval waiving informed consent was obtained for this retrospective study from the Hadassah Medical Center Helsinki Committee.

OGTT

The test was performed after overnight fasting of at least 8 hours. After withdrawal of a fasting venous plasma sample, a solution of 100-g anhydrous glucose was mixed in 300 mL of water and swallowed in 10 minutes. Plasma glucose measurements were then taken at 1, 2, and 3 hours. Patients who could not swallow the solution or who vomited afterward were not included in this study. We used the diagnostic thresholds established by Carpenter and Coustan (fasting value, 95 mg/dL; 1-hour value, 180 mg/dL; 2-hour value, 155 mg/dL; 3-hour value, 140 mg/dL), by which the diagnosis of GD is established when at least 2 threshold values are met or exceeded [24].

Statistical analysis

Patient characteristics are described as proportions for categorical variables and as medians and interquartile ranges for continuous variables without a normal distribution. Significance between groups was assessed by the χ^2 test and Fisher's exact test for categorical variables and by the Mann-Whitney *U* test for continuous variables. A multivariable logistic regression analysis (reported as odds ratios and 95% confidence intervals) was performed to assess factors independently associated with the development of hypoglycemia during an OGTT, using stepwise methods. A 2-sided *P* value < .05 indicated statistical significance.

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