International Journal of Gynecology and Obstetrics 130 (2015) 127–131

Contents lists available at ScienceDirect

International Journal of Gynecology and Obstetrics

journal homepage: www.elsevier.com/locate/ijgo

www.figo.org

CLINICAL ARTICLE

Pregnancy outcomes after laparoscopic sleeve gastrectomy among obese patients

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ARTICLE INFO

Article history:
Received 14 October 2014
Received in revised form 24 February 2015
Accepted 14 April 2015

Keywords:
Bariatric surgery
Laparoscopic sleeve gastrectomy
Maternal outcomes
Neonatal outcomes
Obesity
Pregnancy

ABSTRACT

Objective: To analyze pregnancy outcomes after laparoscopic sleeve gastrectomy (LSG) according to body mass index (BMI) at conception and the interval between LSG and pregnancy. *Methods:* In a retrospective study, data were obtained for all women who became pregnant after LSG at a center in France between December 2001 and December 2011. Frequencies of perinatal events according to BMI at conception and the interval between LSG and pregnancy were compared. *Results:* A total of 63 pregnancies occurring in 54 patients were included, among which 52 (83%) occurred after the first postoperative year and 26 (41%) in women who remained obese. Compared with women who were no longer obese at conception, women who were still obese delivered neonates of significantly lower gestational age at birth ($P = 0.02$) and birth weight ($P = 0.001$). Odds of preterm delivery were also increased (odds ratio 4.37, 95% confidence interval 1.17–16.27; $P = 0.03$). Maternal and neonatal outcomes according to the interval between LSG and pregnancy did not differ significantly. *Conclusion:* Women who remain obese following LSG are at increased risk of adverse outcomes, including low gestational age at birth, low birth weight, and preterm delivery, and should be regarded as a risk group.

1. Introduction

Overweight and obesity (body mass index [BMI, calculated as weight in kilograms divided by the square of height in meters] ≥30) are a growing health problem in high-income countries. Among adult women in countries such as France, a prevalence rate of obesity up to 15% has been reported [1], which is the critical threshold that WHO defines as an epidemic requiring intervention [2]. Nevertheless, few anti-obesity strategies have proven effective; the only evidence-based intervention is bariatric surgery for morbid obesity (BMI >40) when other weight-loss measures, such as multicomponent programs including diet, exercise, and behavioral therapy, have proven unsuccessful [2,3].

Approximately 80% of patients undergoing bariatric surgery are women of reproductive age [4]. The low conception rates and the high risk of pregnancy complications linked with morbid obesity have led women of reproductive age to seek effective weight-loss interventions [3,5]. Nevertheless, each weight-loss procedure carries potential risks to subsequent pregnancies [3]. The type of procedure performed and BMI at the beginning of pregnancy seem to be the most important factors affecting maternal and neonatal outcomes [6]. Bariatric surgery procedures can be either solely restrictive (laparoscopic adjustable gastric banding [LAGB], vertical gastroplasty, and laparoscopic sleeve gastrectomy [LSG]) or combined (Roux-en-Y gastric bypass [RYGB]). There is a relative paucity of data concerning the obstetric and neonatal complications of obese women who have undergone LSG [7–11]. This surgery is a modern and effective bariatric procedure for the treatment of morbid obesity [12,13].

The impact of BMI at the beginning of pregnancy on perinatal outcomes after LSG has not been previously investigated. The aim of the present study was to analyze a cohort of women who had undergone LSG and compare pregnancy outcomes according to the interval between surgery and conception and the BMI at the beginning of the pregnancy.

2. Materials and methods

A retrospective study was conducted of all women who underwent LSG at Centre Hospitalier, Maubeuge, France, with the same surgeon (D.K.) between December 2001 and December 2011. All pregnancies in patients with a history of LSG before pregnancy were identified and included. Fetal losses before 22 weeks of gestation were excluded. The study was performed in accordance with the Declaration of Helsinki and approved by the local institutional review board and ethics committee (CEROG OBS 2014-04-01). Written informed consent was obtained from all participants.

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http://dx.doi.org/10.1016/j.ijgo.2015.03.022
0020-7292/

Women were regularly followed up after surgery and offered nutritional counseling. Iron and vitamin supplementation were given routinely during pregnancy, as is standard practice after bariatric surgery in France. Women were screened for nutrient deficiencies at the 6-month prenatal visit.

For the present study, information was obtained from the prospectively maintained database. The prenatal variables assessed were age, ethnic origin, parity, weight before surgery, BMI before surgery, weight loss before pregnancy, BMI at the beginning of pregnancy, and previous cesarean delivery. BMI was calculated using the pre-pregnancy weight and height, which were reported by each woman at the first prenatal visit. In accordance with the National Institutes of Health and WHO definitions, women with a BMI of at least 30 were considered obese.

Pregnancy variables examined were maternal weight gain (defined as the maternal pre-delivery weight minus the maternal weight at the beginning of pregnancy), bariatric complications, the need for iron and vitamin supplementation, spontaneous or induced preterm delivery (<37 weeks of pregnancy), hypertensive disorders (pre-eclampsia or gestational hypertension), gestational diabetes mellitus (GDM; glucose intolerance first recognized in the current pregnancy), intrauterine growth restriction (estimated weight <10th percentile for gestational age on Hadlock curves [14]), labor and its complications (mode of delivery and induction of labor), and postpartum hemorrhage (blood loss >500 mL after vaginal delivery or >1000 mL after cesarean delivery, during the first 24 hours). All patients had been screened for GDM according to a 75-g oral glucose tolerance test.

The neonatal outcomes evaluated were sex, birth weight, 5-minute Apgar score, umbilical arterial blood gas analysis, and the need for admission to the neonatal intensive care. Additionally, frequencies of large-for-gestational-age (LGA) neonates (birth weight >95th percentile for gestational age on Hadlock curves [14]), macrosomia (birth weight ≥4000 g), low birth weight (<2500 g), and small-for-gestational-age (SGA) neonates (birth weight <10th percentile for gestational age on Hadlock curves [14]) were recorded.

Pre-pregnancy, pregnancy, delivery, and neonatal outcomes were analyzed and compared according to BMI at the beginning of pregnancy and the interval between LSG and pregnancy. After name coding, all data were transferred into a computerized database and analyzed using Excel 2000 (Microsoft Inc, Redmond, WA, USA) and SPSS version 17.0 for Windows (SPSS Inc, Chicago, IL, USA). For univariate analysis, frequencies of adverse maternal or neonatal events by BMI group at the beginning of pregnancy and according to the interval between surgery and conception were computed and compared with χ^2 tests. For parametric continuous data, *t* tests or analysis of variance were used; non-parametric distributions were compared with the Wilcoxon or Kruskal-Wallis tests. $P < 0.05$ was considered statistically significant.

3. Results

A total of 432 women underwent LSG during the study period, 219 (51%) of whom were of reproductive age (20–39 years). Overall, data on 63 pregnancies in 54 women following LSG were obtained (nine women had two pregnancies in the study period). They were all singleton pregnancies, except for one twin pregnancy. The maternal characteristics and pregnancy outcomes are shown in Table 1. No fetal malformations were detected. Of the 54 women, 46 (85%) were of European origin, 3 (6%) were from North Africa, and 5 (9%) were from Sub-Saharan Africa. No bariatric complications during pregnancy were recorded.

Eleven (18%) deliveries occurred in women who conceived within 12 months after LSG and 52 (83%) in women who conceived after 12 months. Maternal weight gain during pregnancy was significantly higher in women who conceived more than 12 months after surgery ($P = 0.08$) (Table 2). Compared with women who became pregnant more than 12 months after LSG, women who conceived within 12 months had a higher weight at conception and higher BMI at conception, although the differences were not significant ($P = 0.06$ and $P = 0.07$, respectively) (Table 2). No significant differences were observed regarding pregnancy and neonatal outcomes according to the interval between LSG and pregnancy.

Of the 54 women, 21 (39%) were still obese at the start of pregnancy (women with two pregnancies assessed at the start of their first pregnancy). Among the 63 pregnancies, 26 (41%) began when the mother was still obese. The interval between LSG and pregnancy was significantly longer among pregnancies that began when the mother was still obese than among those that began when the mother was no longer obese ($P = 0.001$) (Table 3). Maternal weight gain during pregnancy was significantly lower among pregnancies in obese women ($P = 0.01$) (Table 3). Further, pregnancies among obese women lead to a significantly lower gestational age at birth ($P = 0.02$) and a significantly higher rate of preterm delivery (odds ratio 4.37, 95% confidence interval 1.17–16.27; $P = 0.03$). Mean birth weight was significantly lower for pregnancies among obese women ($P = 0.001$) (Table 3). Additionally, there was a trend toward a higher rate of neonatal intensive care unit transfers, although the difference between groups was not significant ($P = 0.08$). No other significant differences were observed regarding maternal and neonatal outcomes according to BMI at the beginning of pregnancy.

Table 1
Maternal characteristics and pregnancy outcomes.[a]

Characteristics/outcomes	Pregnancies (n = 63)
Maternal characteristics	
Maternal age, y	29.4 ± 5.8 (20–49)
Maternal weight before LSG, kg	118.0 ± 16.0 (80.0–166.0)
BMI before LSG	44.0 ± 5.3 (29.4–61.0)
History of hypertension before pregnancy	2 (3)
History of diabetes before pregnancy	1 (2)
Interval between LSG and pregnancy, mo	30.8 ± 20.0 (4–96)
Maternal weight loss before pregnancy, kg	43.1 ± 11.5 (12.0–65.0)
Maternal weight at conception, kg	75.3 ± 16.1
BMI at conception	28.1 ± 4.9 (20.3–45.9)
BMI ≥30	26 (41)
Gravidity	2.4 ± 1.1
Parity	1.1 ± 1.0
Nulliparity	18 (29)
Pregnancy outcomes	
Maternal weight gain during pregnancy, kg	9.0 ± 7.7
Gestational diabetes mellitus	8 (13)
Gestational hypertension	3 (5)
Pre-eclampsia	1 (2)
Intrauterine growth restriction[b]	9 (14)
Iron supplementation	26 (41)
Vitamin supplementation	19 (30)
Labor induction	10 (16)
Gestational age at birth, wk	38.0 ± 2.8
Preterm delivery (<37 wk)	13 (20)
Spontaneous preterm birth	9 (69)
Induced preterm birth	4 (31)
Spontaneous vaginal delivery	43 (68)
Operative vaginal delivery	0
Cesarean delivery	20 (32)
Planned cesarean delivery	9 (45)
Cesarean delivery during labor	11 (55)
Postpartum hemorrhage	4 (6)
Birth weight, g	2940 ± 525
Large for gestational age [c]	2 (3)
Low birth weight [d]	10 (16)
Small for gestational age [e]	9 (14)
Birth weight ≥4000 g	2 (3)
Female neonate	31 (49)
Apgar score <7 at 5 min	0
Umbilical arterial blood pH <7.0	1 (2)
Transfer to neonatal intensive care unit	6 (10)

Abbreviations: LSG, laparoscopic sleeve gastrectomy; BMI, body mass index (calculated as weight in kilograms divided by the square of height in meters).
[a] Values are given as mean ± SD (range), number (percentage), or mean ± SD.
[b] Estimated weight <10th percentile for gestational age on Hadlock curves [14].
[c] Birth weight >95th percentile for gestational age on Hadlock curves [14].
[d] <2500 g.
[e] Birth weight <10th percentile for gestational age on Hadlock curves [14].