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Original article

Pregnancy outcomes and nutritional indices after 3 types of bariatric surgery performed at a single institution

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Abstract

Background: Nutritional status during pregnancy and the effects of nutritional deficiencies on pregnancy outcomes after bariatric surgery is an important issue that warrants further study. The objective of this study was to investigate pregnancy outcomes and nutritional indices after restrictive and malabsorptive procedures.

Methods: We investigated pregnancy outcomes of 113 women who gave birth to 150 children after biliopancreatic diversion (BPD), Roux-en-Y gastric bypass (RYGB), and sleeve gastrectomy (SG) between June 1994 and December 2011. Biochemical indices and pregnancy outcomes were compared among the different types of surgery and to overall 20-year hospital data, as well as to 56 presurgery pregnancies in 36 women of the same group.

Results: Anemia was observed in 24.2% and 15.6% of pregnancies after BPD and RYGB, respectively. Vitamin B_{12} levels decreased postoperatively in all groups, with no further decrease during pregnancy; however, low levels were observed not only after BPD (11.7%) and RYGB (15.6%), but also after SG (13.3%). Folic acid levels increased. Serum albumin levels decreased in all groups during pregnancy, but hypoproteinemia was seen only after BPD. Neonates after BPD had significantly lower average birth weight without a higher frequency of low birth weight defined as <2500 g. A comparison of neonatal data between babies born before surgery and siblings born after surgery (AS) showed that AS newborns had lower average birth weight with no significant differences in body length or head circumference and no cases of macrosomia.

Conclusion: Our study showed reasonably good pregnancy outcomes in this sample population after all types of bariatric surgery provided nutritional supplement guidelines are followed. Closer monitoring is required in pregnancies after malabsorptive procedures especially regarding protein nutrition. (Surg Obes Relat Dis 2014;▮:00–00.) © 2014 American Society for Metabolic and Bariatric Surgery. All rights reserved.

Keywords: Pregnancy; Bariatric surgery; Nutritional indices; Anemia; Vitamin B_{12}; Folic acid; Protein malnutrition; Neonatal outcomes; Birth weight; Gestational age; Macrosomia

In women of reproductive age, obesity is associated with anovulation and decreased fertility, primarily due to polycystic ovary syndrome [1–3]. In addition, obese pregnant women are at higher risk for obstetric complications

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including hypertension, preeclampsia, and gestational diabetes as well as early and late fetal death, congenital abnormalities, and fetal macrosomia [1,4]. Consequently, it is important for obese women to lose weight before attempting pregnancy [5]. Bariatric surgery is the most effective long-term treatment for morbid obesity, and the number of operations performed each year continues to rise. Approximately half of all bariatric surgery patients are women of reproductive age and, consequently, there will be an ever-increasing number of pregnancies after surgery [6,7].

Studies to date present encouraging data regarding reduction of obstetric complications and improved pregnancy outcomes after surgery [7–11]. However, there is a need for studies investigating the nutritional status of these women and the pregnancy outcomes, especially after malabsorptive procedures. The present study aims to further investigate pregnancy outcomes and nutritional indices after 3 types of bariatric surgery: sleeve gastrectomy (SG), a restrictive procedure, Roux-en-Y gastric bypass (RYGB), a combined restrictive-malabsorptive procedure, and our version of biliopancreatic diversion (BPD), which is a malabsorptive procedure.

Methods

This is a retrospective study investigating pregnancy outcomes of 113 women who gave birth to 150 children after BPD, RYGB, and SG in a university hospital setting between June 1994 and December 2011. All known singleton pregnancies that were recorded in our bariatric patient database during this time were included. Multiple sequential pregnancies were included, but multiple gestation pregnancies as well as pregnancies after vertical banded gastroplasty were excluded. Pregnancy outcomes were compared among different types of surgery as well as to 20-year overall birth data from our hospital database. In addition, paired comparisons of pregnancy outcomes were made in a subset of these same women who had also given birth before surgery (BS).

Surgical technique

Surgeries were performed using both open and laparoscopic techniques. The choice of procedure depended upon body mass index (BMI) consensus criteria, metabolic disorders, and eating habits. Representative of malabsorptive procedures is our version of BPD, which is the procedure of choice for patients with BMI ≥ 50 kg/m^2. This procedure includes a gastric pouch of 60 mL, a common limb of 100 cm, and an alimentary limb of $\sim$400 cm with the remainder of the small intestine as the biliopancreatic limb. Other procedures performed included RYGB and SG, and all procedures have been described in detail elsewhere [12,13].

Patient follow-up and data collection

All patients were routinely evaluated at 1, 3, 6, and 12 months after surgery (AS) and yearly thereafter with an additional evaluation at 18 months after BPD. At each follow-up complete medical, laboratory, and nutritional evaluations were performed and educational guidelines provided. Routine supplementation included a daily multivitamin-mineral tablet, containing 400 mcg of folate and 6 mcg of vitamin $B_{12,}$ as well as intramuscular injections of vitamin B_{12}, starting 6 months postop at a dosage of 1000–3000 mcg every 6–12 months depending on laboratory values [14]. Intramuscular injections were preferred at our institution as a more reliable method to achieve maximum compliance because economic issues often make compliance with every day per os supplements a problem. Additional iron (100 mg) was also prescribed after RYGB and BPD as well as additional calcium and vitamin D (1 g + 800 IU and 2 g + 1600 IU, respectively). Women of reproductive age were advised to wait 1 year after SG and RYGB, and 1½ years after BPD before becoming pregnant, and were questioned regarding existing pregnancies or intention to become pregnant. An additional vitamin supplement was recommended after RYGB and BPD during pregnancy as well as extra folic acid, 5 mg/d as prescribed by all obstetricians in Greece. Calcium supplements continued as before, iron supplementation was increased as necessary and intramuscular injections of vitamin B_{12} administered as necessary based on laboratory tests. Protein supplements were necessary only after BPD and were prescribed when daily intake was considered inadequate or if serum albumin levels fell below 3.5 g/dL. The daily protein goal after BPD was $\sim$100 g, adjusted individually, and supplements contained 20 g each of high biological value protein. Information regarding pregnancy and nutritional status was gathered during these routine postoperative visits using questionnaires with follow-up interviews and phone calls. Other pertinent information was obtained from medical records and additional laboratory examinations. The study was approved by the local Research and Ethics Committee at the University Hospital of Patras.

Maternal clinical characteristics

The following maternal characteristics were analyzed: maternal age; BMI before surgery, prepregnancy, and before delivery; weight gain during pregnancy; and the time interval between surgery and the onset of pregnancy. Data regarding pregnancies that occurred before surgery were also collected.

Laboratory evaluation

Hematology and biochemical laboratory measurements were obtained BS (I), AS but before pregnancy (II), and

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