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Pregnancy after Two Different Modalities of Bariatric Surgery. What to Expect?

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Abstract
Objective: *to assess the maternal and neonatal risks of two different bariatric surgical procedures on the following pregnancy regarding obstetric complications and perinatal outcome.*
Subject and Methods: *In this retrospective cohort study, a total of forty four pregnant women underwent bariatric surgery and were followed up for antenatal care between 2014 and 2017 included in the study. According to the type of bariatric surgery they were sub-classified into two groups. Group (A) 28 pregnant women who had undergone restrictive procedure, and group (B) 16 pregnant women who had undergone malabsorptive procedure.*
Results: *The prevalence of abortion, and preterm labor was 15.9%, 6.8%, of the total participants, and no significant differences recorded between both groups (p=0.32, 0.078; respectively). Moreover, there were no statistically significant differences in the development of hypertensive disorders or gestational diabetes mellitus between both groups. Vitamin B12 and calcium deficiencies were significantly higher in group (B) compared to group (A) (P= 0.036, 0.025; respectively). Cesarean delivery was performed in 36.3% of the total participants, and it was significantly higher in group (B) compared to group (A) (61.5% vs. 33.3%, p=0.016). The mean birth weight, and Apgar score showed statistical insignificant differences between both groups, and no neonatal mortality recorded in either group.*
Conclusion: *Bariatric surgery is the most effective treatment of obesity and related morbidities particularly at reproductive age group. Pregnancy after bariatric surgery is safe for mother and fetus but micronutrient deficiency should be managed properly before pregnancy to prevent adverse outcome.*
Keywords: *Bariatric surgery, perinatal outcome, Cesarean delivery.*

Introduction

Obesity is currently one of the most serious public health problems in women especially morbid obesity, and it is increasing in all age groups particularly reproductive age group.[(1)] In United States, obesity is considered the second cause of death next to tobacco-related diseases[(2,3)], and about 25% of women are obese and one-third of them are in the reproductive age [1], while in United Kingdom obesity rose from 24.2% in 2005 to 28.3% in 2015 among women of reproductive age.[4]

Overweight and obese women are at a high risk for delayed conception and infertility because the disturbance of the neuro-regulation of the hypothalamic-pituitary-gonadal axis is due to (i) insulin resistance and hyperandrogenemia. (ii) increased peripheral aromatization of androgens to estrogens. (iii) increased leptin levels (iv) decreased growth hormone, and sex hormone-binding globulin. These changes may explain ovulatory dysfunction and impaired reproductive health.[5] Obese or overweight women have less chance of getting pregnant, and at least 40% of women with polycystic ovaries are obese [6], and more likely to conceive after weight reduction.

However maternal obesity increases the risk of obstetric complications such as spontaneous abortions, gestational diabetes mellitus (GDM), preeclampsia as well as increased risk of stillbirth, macrosomia, shoulder dystocia, emergency cesarean section, and maternal mortality.[7] Parturient with obesity are also more likely to experience thromboembolism, wound infection and postpartum bleeding.[8]

Bariatric surgeries either restrictive, malabsorptive or both are recommended as an option in morbidly obese patients where lifestyle and/or medications have been found to be ineffective [9], and most of candidates for bariatric surgeries are women of childbearing age. Weight loss in women with obesity-related impaired fertility is associated with improved metabolic status that makes pregnancy more probable.[10,11] Therefore, it improves fertility as well as reduces the risk of obstetric complications and becomes of an enormous benefit for health of the mother and the fetus.

The most commonly used restrictive procedures are laparoscopic adjustable gastric banding (LAGB) and sleeve gastrectomy, while Roux-en-Y gastric bypass (RYGB) is a malabsorptive procedure. These procedures are associated with better results and fewer complications than other types of bariatric surgeries and complications occur in approximately 5% of cases with both procedures.[12]

Pregnancy following bariatric surgery appears to be a challenging medical condition.[13] Nutritional and microelements deficiencies are common issues in pregnancy following bariatric procedures owing to inadequate consumption or malabsorption, in addition to lower gestational weight gain, persistent vomiting and dumping syndrome. Several observational studies have reported an increased rate of intrapartum complications[14,15], but perinatal mortality rate is still controversial.[16]

Current recommendations advise delaying pregnancy for 12-18 months following bariatric surgery as rapid weight loss occurs in this period.[17] Therefore, it is believed that women after bariatric surgery who become pregnant need to be followed up by multidisciplinary team including a nutritionist, an obstetrician, an endocrinologist, and a bariatric surgeon. [18]

Surgical complications may occur during pregnancy such as band slippage, band migration in severe vomiting, band leakage in 24% of cases[19], gastric prolapse in 4% of patients[20], intestinal hernia, and intestinal obstruction.[21]

The aim of our study is to assess the maternal and neonatal risks of two different bariatric surgical procedures on the following pregnancy regarding obstetric complications and perinatal outcome.

Subjects and Methods

This retrospective cohort study was conducted at the Department of Obstetrics and Gynecology of Ibn Sina College Hospital. Women who got pregnant after bariatric surgery and were followed up during the entire course of pregnancy between 2014 and 2017 were identified from the records. This study was approved by the Hospital Research Ethics Committee and has been performed in accordance with the ethical standards as in Declaration of Helsinki (1964) and its later amendments.

Forty-seven pregnant women were identified from the records, forty-four of them met the study inclusion criteria but three cases were excluded because of incomplete documentation in two of them, and multiple births in the third woman. Pregnant women were sub-classified into two groups according to the type of bariatric surgery. Group (A) 28 pregnant women who had undergone restrictive procedure, and group (B) 16 pregnant women who had undergone malabsorptive procedure.

Data retrieved from records include demographic characteristics of pregnant women as maternal age, anthropometric measurements, time lapse from bariatric surgery till conception, type of the procedure (restrictive ,or malabsorptive), smoking, and gestational weight gain. Moreover, we collected data on obstetric profile of the patients and pregnancy outcomes as gestational age at delivery (from the first day of last menstrual period), preterm labor (before completed 37 weeks), mode of delivery, bariatric complications, maternal microelements levels, and pregnancy complications as preeclampsia, hyperemesis gravidarum, and GDM. We also retrieved data on neonatal birth weight, Apgar score, neonatal care unit admission and neonatal mortality.

Statistical Analysis

The collected data were coded, tabulated, and statistically analyzed using IBM SPSS statistics (Statistical Package for Social Sciences) software version 22.0, IBM Corp., Chicago, USA, 2013. Descriptive statistics were done for quantitative data as minimum& maximum of the range as well as mean±SD (standard deviation) for quantitative parametric data, while it was done for qualitative data as number and percentage. Inferential analyses for independent variables were done using Chi square test for differences between proportions and student t-test for continuous variables The level of significance was taken at P value <0.050 is highly statistically significant, otherwise is non-significant

Sample Size Justification

Sample size was calculated based on a previous study and by using Med Calc statistical software. Assuming area under ROC to be 0.80, an alpha of 0.05 and power of study 90.0%. A minimum sample size required was at least 40 patients will be required for this study.

Results

A total of forty four pregnant women fulfilled the inclusion criteria, 63.6% had undergone restrictive and 36.4% had undergone malabsorptive surgery. The demographic characteristics of the study participants are illustrated in table (1). There were no statistically significant differences between the two groups regarding maternal age, body mass index (BMI), smoking, and time lapse from bariatric surgery to pregnancy, while the mean gestational weight gain was significantly higher in group (A) compared to group (B) (11.2±2.03 vs. 6.2±1.92; *p*=0.0023 respectively).

According to maternal risks, there were no statistically significant differences in the development of hypertensive disorders or GDM between both groups, but hyperemesis gravidarum was significantly higher in restrictive group compared to malabsorptive group (14.3% vs. 6.3%; *p* =0.044 respectively). In respect to the course of pregnancy, the prevalence of abortion, and preterm labor was 15.9%, 6.8%, of the total participants, and no significant differences recorded between both groups (*p*=0.32, 0.078; respectively). The mode of delivery was evaluated, results showed that cesarean delivery was performed in 36.3% of the total participants, and it was significantly higher in group (B) compared to group (A) (61.5% vs. 33.3%, *p*=0.016 respectively). Table (2)

Microelements level was also assessed in our participants, deficiency of iron was in 11.4%; vitamin B12 in 22.7%; calcium in 15.9; and folic acid in 4.5% of the total patients. Furthermore, vitamin B12 and calcium deficiencies were significantly higher in group (B) compared to group (A) (*P*= 0.036, 0.025; respectively). As regard to perinatal outcome, the mean birth weight, 1 and 5 minutes Apgar score, and NICU admission showed statistical insignificant differences between both groups (*p*=0.107, 0.187,0.31,0.411 respectively), and no neonatal mortality recorded in either group. Table (2)

Table (1): Demographic characteristics of patients in group (A), and (B)

Variables	Restrictive Group(A) (n=28)	Malabsorptive Group (B) (n=16)	P
Age (Year) **Mean ± S.D**	30.6±5.21	32.7±4.91	0.342
Time lapse from procedure to conception (Months) **Mean ± S.D**	19.8±3.98	23.4±4.02	0.189
BMI (kg/m^2) **Mean ± S.D**	32.8±2.96	29.8±2.75	0.412
Gestational weight gain(kg) **Mean ± S.D**	11.2±2.03	6.2±1.92	0.0023*
Smoking	4 (14.2%)	2 (12.5%)	0.425

Data presented as mean± SD; or numbers (%); *Significant (P < 0.05); BMI: body mass index.

Table (2): Obstetric risks and perinatal outcome in group (A), and (B).

Variables	Restrictive Group(A) (n=28)	Malabsorptive Group(B) (n=16)	P
Gestational age at delivery **Mean ± S.D**	38.3±0.98	37.9±1.08	0.412
Iron <48ug/ml B12 < 200pg/ml Calcium <8.4 mg/dl Folic acid <3.1 ng/mL	2 (7.1%) 3 (10.7%) 2 (7.1%) 0 (0.0%)	3 (18.8%) 7 (43.8%) 5 (31.3%) 2 (12.5%)	0.12 0.036* 0.025* 0.11
Abortion	4(14.3%)	3(18.8%)	0.32
Hyperemesis gravidarum	4 (14.3%)	1(6.3%)	0.044*
Pre-eclampsia	3(10.7%)	1(6.3%)	0.365
Gestational diabetes Mellitus	1(3.6%)	0(0.0%)	0.85
Preterm Delivery	1(3.6%)	2(12.5%)	0.078
Mode of delivery **Cesarean delivery** **Vaginal delivery**	8(33.3%) 16(66.7%)	8 (61.5%) 5 (38.5%)	0.016*
Bariatric Complications	0 (0.0%)	1 (6.3%)	-
Low birth weight	1(3.6%)	2(12.5%)	0.078
APGAR Score (1min) **Mean ± S.D**	7.1±0.82	6.9±0.86	0.187
APGAR Score (5min) **Mean ± S.D**	8.1±0.45	7.8±0.71	0.31
Birth weight **Mean ±SD**	2450-3500 3050±108.6	2400-3200 2960±122.3	0.107
NICU admission	3 (10.7%)	2(12.5%)	0.411
Neonatal mortality	0 (0.0%)	0(0.0%)	-

Data presented as mean± SD; or numbers (%); *Significant (P < 0.05).

Discussion

As the prevalence of obesity has increased rapidly particularly in women over the last few decades, women resort to bariatric surgery to achieve adequate weight loss with better life style. The majority of women having bariatric surgery are at reproductive-age owing to the beneficial effect of weight loss on restoring hormonal imbalance and increase fertility. This retrospective study includes forty four pregnant women that underwent bariatric surgery and were cared for antenatal care by our team, where 28 cases (63.3%) underwent restrictive surgery (Group A), while 16 cases

(36.7%) underwent malabsorptive surgery (Group B).

Recommendations advice patients to wait for at least two years after such surgery before conception, which is explained by rapid weight loss and nutritional deficiency develop during this period.(22-24) In our study, the mean time interval (months) between bariatric surgery and pregnancy was 19.8±3.98 in restrictive group compared to 23.4±4.02 in malabsorptive group (p=0.189). This is consistent with most publications as the time lapse between bariatric surgery and pregnancy ranges from 21 to 57 months and the mean interval is more than 18 months.(23-26) Recently several studies reported that pregnancy following bariatric surgery earlier than 18 months have the same impact on maternal and perinatal outcomes.(21,22,27,28)

The pre-gestational BMI has a negative impact on obstetric outcome, the mean BMI of the participants at the beginning of pregnancy was 32.8±2.96 vs.29.8±2.75 in group (A) and (B) respectively (P= 0.412) which is in agreement with several studies reported that pre-gestational BMI was between 30 and 34 kg/m2.(16,23-25,29) The risk of abortion increases proportionately to BMI (30,31),and decreases following proper surgical or conservative weight loss (32-34) Our data showed 15.9% abortion rate, while it ranges between 15.3 % and 38.9% in general publications.(26,29,34-36)

Microelements and vitamins requirements are increased during pregnancy particularly following bariatric surgery, and their deficiencies can be prevented before and during pregnancy by adequate supplementations and monitoring. In the present study, iron, vitamin B12, calcium and folic acid deficiencies were 11.4%, 22.7%, 15.9%, 4.5% respectively, and the prevalence of hyperemesis gravidarum was 11.3%. Moreover, vitamin B12 and calcium deficiencies were significantly higher in malabsorptive group compared to restrictive group (P= 0.036, 0.025; respectively). González et al, in a recent publication reported 60.7% iron deficiency, 40.5% 25-OH-D3 deficiency, 22.6% B12 deficiency, 6.6%, calcium deficiency, and 5.4% folic acid deficiency.(23)

Another study published by Bebber et al. on 39 pregnant women who had undergone bariatric surgery reported a rate of 53.4% vitamin B12 deficiency, and 16.1%, folic acid deficiency.(36) Microelements deficiency could be explained by emesis gravidarum, decreased gastric acid production, malabsorption, or decreased intake of some food due to intolerance and consequently appropriate maternal nutrition and supplementation is fundamental. Recent studies on pregnant women after bariatric surgery with micronutrient deficiencies have proved no adverse perinatal outcomes. (36-38)

In respect to obstetric risks, the remarkable fetomaternal benefits after bariatric surgery is the reduction of GDM and hypertension.(39) In our study the prevalence of preeclampsia, and GDM was 9%, 2.2% respectively. Several studies have reported a reduction in GDM after bariatric surgery (0%–8.9%), but there were insignificant differences in the prevalence of GDM when compared to women with similar BMI. (16,21,23-27)

Beenet et al. reported 2.5% pregnancy-associated hypertensive disorders (PAHD), and 3% preeclampsia (40), while Aricha-Tamir et al. published that the incidence of PAHD was 16.5%. (26) Moreover, Cafaro et al. reported significant lower incidence of gestational hypertension 8.2% and preeclampsia 2.7%.(29) On the contrary, Kjaer et al. (24) in a cohort study and Patel et al. (21) in another study published no differences were found in the rate of preeclampsia and PAHD among women who had undergone bariatric surgery and those who had not. In a recent meta-analysis, the risk of preeclampsia is reduced by about approximately half in women who underwent bariatric surgery.(41)

Gestational weight gain (GWG) is influenced by the time lapse from surgery and conception and at the same time it has a direct impact on birth weight. GWG was significantly higher in restrictive group compared to malabsorptive group (11.2±2.03 vs. 6.2±1.92; P=0.0023 respectively).

Likewise Sheiner et al.[25] reported higher weight gain during pregnancy in the LAGB group as compared with RYGB(P < 0.001). On the other side, Guelinckx et al. [19] showed no differences in GWG after malabsorptive or restrictive surgery.

Obesity is a major risk factor for cesarean delivery particularly with higher BMI. In the present study cesarean delivery was performed in 36.3% of total pregnancies, and it was statistically higher in group (B) compared to group (A) (61.5% vs. 33.3%; *p*=.016 respectively). However, rates of cesarean delivery have been variable in the literatures 18.3% -100%.[22,24,35,,42] Some studies suggested that the risk of cesarean section is owing to narrow diameters of the birth canal because of maternal pelvic soft tissues, dystocia, and cephalopelvic disproportion.[43] Only one woman in malabsorptive group had cholecystitis, which necessitated laparoscopic cholycystectomy. Our study showed very good perinatal outcome in terms of average birth weight (3050 vs. 2960 gm in group A & B respectively), and average Apgar score. The incidence of Low birth weight infants was 6.8% which is consistent with the published rates (5.2%–27.8%), and no neonatal mortality.[16,23,26,34,42]

Conclusion

Bariatric surgery is the most effective treatment of obesity and related morbidities particularly at reproductive age group, but the optimal interval between surgery and conception is still controversial. Pregnancy after bariatric surgery is safe for mother and fetus but micronutrient deficiency should be managed properly before pregnancy to prevent adverse outcome. This mandates a multidisciplinary team for strict medical monitoring of pregnancy following bariatric surgery. Women in need of body contouring surgery following bariatric surgery should wait until complete their families. Further studies are needed to determine which surgical procedure to select for women desiring conception and its long term effects.

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