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Influence of Roux-En-Y Gastric Bypass on Obstetric and Perinatal Outcomes: A Comparative Study

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Abstract

Objective: To analyze the obstetric and neonatal outcomes in pregnancies after Roux-en-Y Gastric Bypass (RYGB) compared with matched control pregnancies.-

Methodology: A cross-sectional study of the analytical type with pregnant women matched by age and pre-pregnancy body mass index (BMI) was carried out. Group 1 (G1) comprised 60 pregnant women who did not previously undergo RYGB and Group 2 (G2) 30 pregnant women who previously underwent RYGB.

Results: In G1 mean age was 29.2 ± 4.9 and mean pre-pregnancy BMI was 26.3 ± 3.34 G2. In G2 was 30.3 ± 4.4 and 27.4 ± 3.3, respectively. In relation to gestational intercurrences, 36.7% of pregnant women in G2 showed urinary tract infection (UTI) ($p<0.001$), 76.7% anemia ($p<0.001$). Both in G1 and G2, NBs were classified as having appropriate birth weight. As regards, the gestational age at birth, 88.3% of NBs in G1 and 96.5% in G2 were considered born at term. Among the NBs in G1, a total of 81.7% was classified as AGA NBs, 10% as LGA NBs and 8.3% as SGA NBs. In G2, 72.4% were classified as AGA NBs and 24.1% as SGA NBs, ($p=0.036$).

Conclusion: No compromise of perinatal outcomes was observed. However, it was observed the significantly higher prevalence of anemia and UTI in G2 and Due to decreased the incidence of macrosomia, the chances of normal birth (NB) increases after RYGB. Neonatal outcomes and course of pregnancy improve, if conception occurs minimum 18 months after surgery.

Keywords: Adverse pregnancy outcome; Bariatric surgery; Obstetric outcomes; Perinatal outcomes; Roux-en-Y gastric bypass

Introduction

The indication for bariatric surgery has been acknowledged as an alternative to weight control that favors a significant improvement of obesity-related conditions, including infertility [1,2].

The Roux-en-Y Gastric Bypass (RYGB) is a mixed technique that promotes the restriction of the capacity of food intake with a significant reduction of the gastric reservoir leading to hypochlorhydria associated with malabsorption and conducted through the diversion of the overall duodenum and the proximal jejunum of the digestive tract [3-5].

It is expected that the weight loss resulting from surgery carries out positive actions with respect to maternal, obstetric and fetal risks associated with pre-pregnancy obesity [6-9]. On the other hand, this surgery can also cause adverse metabolic changes [10] such as induction or worsening of nutritional deficiencies of macro and micronutrients [11,12], which may compromise the obstetric outcome. The inadequacy of the nutritional and anthropometric status of the mother, both pre-gestational and gestational, favors the development of gestational intercurrences and influences the health conditions of the fetus and of the mother in the postpartum period [13]. Thus, the objective of the present study is to analyze the perinatal outcomes of pregnant women submitted previously to RYGB compared to pregnant women not submitted to this surgery.

Methodology

This is a cross-sectional analytical study comprising pregnant adult women (≥ 20 years), paired by age and pre-pregnancy BMI, selected consecutively, between March 2008 and March 2012 and divided into two groups. Group 1(G1) comprised 60 low-risk pregnant women who had not previously undergone RYGB and performed the routine prenatal care at the Maternity School of Universidade Federal do Rio de Janeiro/UFRJ (Federal University of Rio de Janeiro), and Group 2 (G2) comprised 30 pregnant women who had previously undergone this surgery and who, in addition to the above-mentioned prenatal care, were also followed up by the medical staff of a clinic specialized in obesity control where the surgery was carried out.

Pregnant women who previously underwent RYGB were followed up by a nutritionist and a general surgeon of the aforementioned clinic; in the postoperative follow-up, the women were counseled to inform the clinic's medical staff whether they became pregnant so that their monitoring would be continued during pregnancy as well. In general, pregnant women returned to the clinic in the period between the 8th and the 12th gestational week. The women should also attend the routine prenatal care conducted outside the clinic.

Pregnant women in G2 were following a prior pregnancy supplementation protocol due to the RYGB conduction, through a multivitamin, comprising 8.0mg of iron and 240μg of folic acid. Such

supplementation was adjusted after confirmation of pregnancy through the inclusion of a multivitamin specific to the gestational period totalizing 90mg of iron and 6mg of folic acid [14]. During prenatal care, pregnant women in G1 received iron supplementation (40mg) and folic acid (400µg) from the 20th gestational week onwards, following the Ministry of Health – Brazil recommendation [15].

To assess adherence to the proposed supplementation, containers of the prescribed supplements were requested in all consultations, a moment in which the importance of their daily use was emphasized and educational materials contemplating their benefits were delivered to the participants.

G1 inclusion criteria

Adult pregnant women, single fetus gestation, in addition to being followed up by the routine prenatal care of the health unit aforementioned.

G1 exclusion criteria

The presence of diabetes mellitus, prior restrictive diets, prior malabsorptive and restrictive surgeries, intestinal malabsorption syndromes, neoplasia and no liver and/or renal diseases.

G2 inclusion criteria

Adult pregnant women with single fetus gestation submitted to RYGB before pregnancy, who are followed up by the routine prenatal care and by the clinic specialized in controlling the obesity in question.

G2 exclusion criteria

Malabsorptive and restrictive surgeries prior to RYGB, intestinal malabsorption syndromes, neoplasia and liver and/or kidney diseases.

Both for participants in G1 and G2, an exclusion criterion was the fact of not having adequately fulfilled the supplementation described (use of less than 80% of the number of pills prescribed in the evaluated period).

All procedures used in the anthropometric assessment of pregnant women and newborns (NB) were standardized for G1 and G2.

For the anthropometric assessment of women, we used the pre-pregnancy Body Mass Index (BMI) in accordance with the cut-off points established by WHO [16]. The total gestational weight gain (TGWG) was calculated by subtracting the pre-pregnancy weight measured up to the 13th gestational week and the pre-partum weight. Adequacy of the gestational weight gain was classified into appropriate and inappropriate, as proposed by the Institute of Medicine (IOM) [17-19].

For the anthropometric assessment of NBs, information on weight and gestational age (GA) were collected at birth from medical records. For birth weight classification, the WHO criteria were adopted: low birth weight (NB weighing less than 2,500 g), insufficient weight (NB weighing between 2,500 g to 2,999 g), appropriate weight (NB weighing between 3,000 g to 3,999 g) and overweight or macrosomia (NB weighing 4,000 g or more) [20].

As for GA at birth, NBs with GA <37 weeks were considered born pre-term, those between 37 and 42 weeks born full-term, and those born with GA >42 weeks born post-term, in accordance with the last menstrual period – LMP [21]. On the basis of information on weight and GA at birth, we assessed the correlation between weight/gestational age at birth, in accordance with the growth curve proposed by Pedreira et al. [22], and newborns (NBs) were classified into small for gestational age (SGA <P10), appropriate for gestational age, P10-P90 (AGA) and large for gestational age (LGA >P90). APGAR indexes were obtained in the first and fifth minutes to assess the newborn vitality [23].

Information on maternal intercurrences developed during the gestational period was collected through consultations on medical records, maternity cards, and through interpretation of laboratory tests performed during pregnancy. The gestational intercurrences considered were the presence of pregnancy-induced hypertension syndromes (PIHSs), anemia and urinary tract infection (UTI) [24-26]. The neonatal intercurrences considered were birth weight, thus the NBs were classified into low birth weight, appropriate weight or macrosomic, and GA at birth, thus the NBs were classified into born preterm, full-term, or post-term.

Other obstetric information data were collected: a number of births, inter-gestational interval, the interval between surgery and the LMP, and the number of abortions after surgery.

The tool used to collect data was pre-tested, comprising a form filled by a single interviewer with data from an interview and from access to the prenatal medical records, and it was complemented by data from consultations with the nutritionist.

In relation to the statistical analysis, for quantitative variables we calculated the measures of the central tendency and dispersion (mean and standard deviation), and for the comparison of the means of the groups we applied the Student's T test. For testing the homogeneity of the proportions between the categorical variables we applied the Chi-square test, and for verifying the relative risk we calculated the *odds ratio*. In the overall analyses, a significance level of 5% was considered. Analyses were conducted using the SPSS for Windows version 17 statistical package.

The study participants read and signed an informed consent in accordance with Resolution nº 196 of 10/10/1996 of the National Health Council. The study was approved by the Research Ethics Committee of the Maternity School of UFRJ (Protocol nº 75/02) and by the Research Ethics Committee of Hospital Universitário Clementino Fraga Filho (Protocol nº 011/06).

Results

In Table 1 are shown the means and the standard deviations of perinatal characteristics.

In G2, a woman had a spontaneous abortion in the second trimester of pregnancy, and another woman had two pregnancies during the study period, of which only the first was taken into consideration. Thus, G2 final sample comprised 30 women and 29 newborns. Mean preoperative weight for this group was 116.11 ± 19.77kg, mean BMI was 43.67 ± 5.76 kg/m^2 and percentage of excess weight loss was 83.22 ± 14.08, considering the mean interval between surgery and the LMP.

The interval between surgery and LMP was 17.70 ± 9.1 months, and 70.0% of the pregnant women became pregnant in an interval less than or equal to 18 months after surgery, and 30.0% showed an interval that exceeded 18 months.

	G1 (n=60)		G2 (n=30)		
Characteristics	Mean	SD	Mean	SD	p-value
Age (years)	29.22	4.92	30.33	4.38	0.673
Pre-pregnancy weight (kg)	66.07	11.6	72.74	9.85	**0.005***
Height (m)	1.58	0.07	1.62	0.07	**0.006***
Pre-pregnancy BMI (kg/m^2)	26.32	3.34	27.36	3.26	0.166
Total weight gain during pregnancy (kg)	12.05	6.08	7.68	3.73	**0.001***
Gestational age at delivery	39.12	1.56	39.35	0.59	0.529
Birth weight (g)	3335.1	521.27	3128.79	271.48	**0.049***

Table 1: Perinatal characteristics of pregnant women who underwent RYGB and pregnant women who did not undergo this surgery
T-Student Test (ind) * p<.05
BMI – Body Mass Index
LMP – Last Menstrual Period
RYGB – Roux-en-Y Gastric Bypass

In relation to the assessment of pregnancy outcomes, 36.7% of pregnant women in G2 had UTI ($p<0.001$), 76.7% had anemia ($p<0.001$) and 3.3% had PIHS ($p=0.190$), against 1.67%, 30.0%, 11.7% of pregnant women in G1.

Pregnant women in G2 were 7.7 times more likely to develop anemia when compared to pregnant women in G1 (IC=2.8–21.0), and 34.1 to develop UTI (CI= 4.1–282.1).

A total of 50.0% of pregnant women in G1 had weight gain above the recommended by IOM [21], while 50.0% of pregnant women in G2 were below the recommended weight gain ($p=0.003$).

The mean of the NBs birth weight was 3,335.1g ± 521.3 and 3,128.8g ± 271.5 in G1 and G2, respectively ($p=0.049$). Despite having shown a significant difference in the comparison of the mean birth weight, a larger percentage of NBs in G1 (91.7%) and G2 (96.5%) was classified as having appropriate birth weight.

In relation to GA at birth, were considered full-term births a total of 88.3% in G1 and 96.5% in G2.

Among the NBs in G1, a total of 81.7% was classified as AGA NBs, 10% as LGA NBs and 8.3% as SGA NBs. In G2, 72.4% were classified as AGA NBs and 24.1% as SGA NBs, showing a statistically significant difference in the comparison between the groups ($p=0.036$).

Among the pregnant women who gave birth to SGA NBs, approximately 71% became pregnant at an interval less than 18 months from the day of surgery. An association was verified between the presence of anemia and the occurrence of SGA NBs in both groups, but no statistical significance was found.

A total of 80.0% of NBs in G1 and 90.0% of NBs in G2 showed APGAR greater than or equal to eight in the first minute, and 98.0% of the NBs in G1 and almost 100.0% in G2 showed APGAR scores greater than or equal to eight in the 5th minute. There was also no association between the APGAR scores and the maternal complications evaluated in this study.

Discussion

In this study, the average time between RYGB and pregnancy was around 17 months, with about ¼ of the sample displaying an interval less than or equal to 12 months. A smaller interval than most studies reported in the literature which shows 24-35 month intervals [27,28]. Considering the increasing nutritional demands imposed by pregnancy and the limitations on food intake and absorption of nutrients resulting from the bariatric surgery, some studies recommend that, although no significant difference was found, pregnancy should occur in a 12-18 month interval from surgery since, throughout the first year after surgery, the patient undergoes a rapid weight loss that can represent theoretical risks for both the maternal and the fetal health, especially for fetal health since there is a possibility of occurring long-term intercurrences [29-31].

As regards the total gestational weight gain, G1 showed a mean significantly higher than G2 in which 50% of pregnant women showed weight gain above the IOM recommendations [19], while 50% of pregnant women in G2 showed an insufficient gain. These results are in line with other studies in the literature which attest that most women, previously submitted to bariatric surgery and who were overweight in the pre-gestational period, have weight gain above the recommended levels they should maintain until the end of pregnancy [32-34].

This can be justified in part since women in this study started pregnancy while they were still in a period of intense weight loss. In addition, they were part of a group whose routine prenatal follow-up was conducted by professionals from the surgical clinic where prenatal nutritional assistance was offered throughout the gestational period. This type of monitoring has not been reported by other studies [9,33].

It is worth mentioning that the mean of the pre-pregnancy BMI of both groups was characterized as overweight, which is a very relevant fact since the increased risk of maternal and fetal outcomes is associated with maternal obesity [10], such as polycystic ovary syndrome, infertility, gestational diabetes, preeclampsia, pregnancy-related hypertension, sleep apnea, cesarean delivery, infection, embolism, abortion, preterm labor, postpartum weight retention, fetal macrosomia, risk of brachial plexus trauma, prematurity, late fetal death and juvenile obesity [5-8].

As regards the gestational complications evaluated, there was no significant difference between the groups with regard to pregnancy-related hypertension, probably because the pre-pregnancy nutritional status category of highest risk for this complication is obesity [33] and, as previously reported, pre-pregnancy BMI of both groups was classified as overweight.

However, pregnant women in G2 presented a frequency and *odds ratio* of UTI and iron deficiency anemia significantly higher when compared to pregnant women in G1.

Anatomical and physiological changes that occur in the urinary tract due to pregnancy, such as increased urine output and the expansion of the collector system that is caused by compression of the uterus, hypertrophy of the musculature of the ureter and reduction of peristaltic activity resulting from the action of progesterone promote urinary stasis and, thus, the occurrence of UTI [35].

The association between the occurrence of UTI and a worse gestational prognosis has been reported in the literature. Some complications that may occur are premature labor and delivery, premature rupture of membranes, intrauterine growth restriction, NBs with low birth weight and perinatal death, besides an association with the greater occurrence of hypertension, preeclampsia, and anemia. However, it is not yet clarified whether UTI keeps a relationship of the cause or/and effect with these complications [36].

Some studies report that anemia is a common complication after RYGB, and iron deficiency is its main etiology [37]. About 80% of pregnant women in G2 presented this condition that is a percentage lower than the one found by Nomura and collaborators, who found [38] that 86.7% of the post-RYGB pregnant women of their sample had anemia. A study conducted by Belogolovkin and collaborators [39] found that pregnant women previously submitted to bariatric surgery were 4.3 times more likely to develop anemia during pregnancy when compared to pregnant women without surgery, but in the present study, we found a probability that was 7.7 times greater.

This greater propensity to develop anemia may be related to the lower interval between surgery and pregnancy shown by the current study when this finding is confronted to findings in literature [27,28] in which approximately 80.0% of the women who became pregnant in an interval less than or equal to 18 months of the date of the surgery developed anemia.

We highlight the metabolic changes caused by RYGB leading to hypochlorhydria which, associated with enteric diversion, contribute to the installation of anemia and various hypovitaminosis. In addition, this scenario can be aggravated when there are shorter intervals between gestation and the surgery, due to the larger food restriction featuring this period, such as intake restrictions of some foods that are sources of iron of animal origin and have a higher bioavailability of this nutrient [40].

Although pregnant women from both groups followed to satisfaction the supplementation protocol recommended, micronutrient deficiency often occurs associated with other vitamin and mineral deficiencies resulting from close association between dietary sources, metabolic pathways, and physiological functions so that multiple deficiencies can be masked by the greatest need of a single micronutrient [41].

With regard to the NBs in G1, a total of 91.7% showed appropriate weight at birth, 88.3% were born full-term, 80.0% showed APGAR greater than or equal to eight in the first minute and 98.0% in the fifth minute. In G2, 96.5% showed adequate weight at birth, 96.5% were born at term, approximately 90.0% showed APGAR greater than or equal to eight in the first minute and 69.0% in the fifth minute. These variables showed no significant difference when the comparison was performed between the groups. When the weight-gestational age correlation of Pedreira and collaborators [22] was performed, the highest percentage in G1 (81.7%) was classified as AGA and 75.9% in G2.

The mean of SGA occurrence in NBs in G1 was 8.3%, which is in line with other studies in the literature [42,43]. In G2 this percentage was 24.1%, and the overall cases were with women who became pregnant in an interval less than or equal to 18 months of the date of the surgery. This percentage is close to the one found by Nomura and collaborators [38], who observed 23.3% of SGA in NBs in their sample. However, other studies showed a lower frequency as the study of Patel and collaborators [27], who found 11.5% of SGA in pregnancies after RYGB. Kjær and collaborators [44] also pointed out in their study a smaller percentage of SGA (7.7%), however, they found that pregnant women after RYGB were 2.3 times more likely to generate SGA NBs when compared to those who had not been submitted to this surgery.

A possible justification for the higher percentage of SGA found in the present study may relate to the fact that women in G2 became pregnant also in a period of a massive weight loss highlighted in several studies [45]. This fact may have contributed to a greater aggravation on nutrient absorption, and consequently fetal malnutrition.

Meas [46] suggests that SGA NBs present a greater risk of developing diabetes and metabolic syndrome in adult life. However, as the long-term effects of perinatal outcomes of pregnancies that occur after bariatric surgery are still little studied, these correlations can be even more complex.

Conclusion

The results of the current study showed that despite the metabolic changes resulting from RYGB, in addition to the increased nutritional demands throughout gestation no changes occurred comprehensively in the perinatal outcomes, except the higher prevalence of anemia and UTI in G2. It also showed that the supplementation conducted did not provide the desired impact, regardless of the group evaluated.

Due to decreased incidence of macrosomia, the chances of normal birth (NB) increases after RYGB. Neonatal outcomes and course of pregnancy improve if conception occurs minimum 18 months after surgery. Although the results did not show negative impact for most perinatal variables evaluated by our study, there is no guarantee that there will be no adverse events in postnatal life.

There are many gaps to be filled regarding an improved nutritional approach so that pregnancy after RYGB may bring about minor risks, both for the mother and the fetus. In this sense, we recommend an interdisciplinary monitoring during pregnancy after bariatric surgery, as well as a nutritional follow-up to the overall pregnant women along with their prenatal routine consultations.

Conflict Of Interest

Authors have no conflict of interest.

Statement of Human and Animal Rights

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Statement of Informed Consent

Informed consent was obtained from all individual participants included in the study.

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