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Original Article

Role of Bariatric Surgeries on Improving Subsequent Pregnancy Outcomes

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ABSTRACT

Background: The most successful long-term strategy for reducing maternal obesity is bariatric surgery. Following these surgeries, pregnancy is safe for both the mother and the fetus.

Aim: to evaluate the effects of bariatric surgery on the results of subsequent pregnancies (both maternal and neonatal).

Methods: A cross-sectional study design was implemented from March 2022 to April 2024, involving 3825 obese pregnant women and 579 pregnant women who had undergone bariatric surgeries before becoming pregnant. All individuals for whom full pregnancy and birth records were available were included in the current investigation. An observational plus follow-up checklist and an interview questionnaire sheet were used to achieve the study's objective. Results for moms and fetuses in the two groups were compared.

Results: Bariatric surgery patients who were pregnant experienced a decreased rate of gestational diabetes mellitus, gestational hypertension, pre-eclampsia, and cesarean sections (7.9%, 11.1%, 11.8%, and 20.4% respectively); in contrast, the obese group experienced a significantly higher rate of these conditions (18.0%, 26.9%, 19.2%, and 36.5%). In addition, a significant difference was found between the BSs group and the obese group concerning the incidence of small for gestational age (21.7% vs. 9.3%, respectively), NICU admission rates ($p = 0.004$), and low Apgar scores at 5 minutes (11.4% vs. 1.7% respectively).

Conclusions: The results of the study indicate that pregnant obese women are more likely to experience pre-eclampsia, cesarean sections, gestational hypertension, and gestational diabetes mellitus. After bariatric surgeries, there was a significant decrease in pre-eclampsia, cesarean sections, prenatal hypertension, and gestational diabetes mellitus.

Keywords: Role, Bariatric surgeries, Subsequent, Pregnancy outcomes, Kurdistan.

1 Introduction

Globally, obesity affects about 650 million adults and is a major health concern. Obesity is the most common medical disease affecting fertile women. Maternal obesity is a pre-pregnancy body mass index (BMI) of 30 kg/m^2 or greater [1]. Obesity-related issues in mothers and fetuses are exacerbated by maternal obesity. Before becoming pregnant, bariatric procedures (BSs) reduce the problems associated with maternal obesity. Obese pregnant ladies are much more likely to experience cesarean sections (CS), gestational diabetes mellitus (GDM), gestational hypertension, and pre-eclampsia (PE). Bariatric approaches extensively reduced the charges of GDM, gestational hypertension, PE, and CSs [2].

Bariatric operations are now being applied to decrease this risk for ladies who are morbidly overweight or very overweight. Studies have concentrated on determining the blessings and downsides of using it. In circumstances where in advance remedies have been useless, bariatric processes have emerged as promising. This is because they suggest a net poor power balance, which makes the next weight loss effective and long-lasting. Bariatric operations may be divided into categories primarily based on whether malabsorption or restriction is the number one weight reduction mechanism. Examples of bariatric surgical treatment encompass gastric bypass tactics, laparoscopic sleeve gastrectomy (LSG), and laparoscopic gastric banding (LGB) [3].

An amazing increase in the frequency of ladies becoming pregnant after bariatric surgical procedures has occurred in recent years, and the number of bariatric procedures has increased exponentially, with women of reproductive age undergoing about half of them [4]. Pregnancy-associated hypertensive issues, macrosomia, gestational diabetes mellitus, congenital abnormalities, and other complications are much less unusual in women who've undergone bariatric surgeries (BS) than in folks who are morbidly overweight and receive conservative care. Less regular consequences are determined when it comes to the

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frequency of untimely deliveries and C-sections. According to cutting-edge norms, one to two years must be skipped before getting pregnant after a bariatric surgical operation [5]. Thus, our study aims to determine the reason for the cross-sectional look to decide how weight problems compared to BSs affected the effects of the next pregnancies, which is considered.

2 Material and Methods

2.1 Study design

Following the Helsinki Declaration's informed consent guidelines and the approval of the Medical Research Standing Committee, this cross-sectional study was carried out from March 2022 to April 2024.

2.2 Study setting

This study was carried out in several antenatal clinics for pregnant women who attended follow-up on their current pregnancy. These antenatal clinics were selected because it is the teaching clinics and have a high flow rate of pregnant women attending.

2.3 Participants

In this study, data on 11,252 expectant mothers were gathered; 33.9% (3825/11,252) of the mothers were obese, and 5.1% (578/11,252) of the mothers had previously experienced BSs before the current pregnancy. Women who received bariatric surgery before the current pregnancy (case group) and obese pregnant women with pre-pregnancy BMIs ≥ 30 kg/m^2 (control group) were prospectively tracked from the beginning of pregnancy until four to six weeks after giving birth. Women with singleton pregnancies in the age range of 20 to 40 were among them. The study excluded women with spontaneous abortion, twins or triplets, incomplete medical records (delivery and/or prenatal), inflammatory bowel illnesses, gastric reflux, hiatal hernia, and pre-existing medical conditions.

2.4 Pilot study

A pilot study was carried out on 10 percent of the overall sample size to check the tools for clarification, applicability, and viability, and then the required adjustments were made.

2.5 Study tools

2.5.1 Interview questionnaire sheet

2.5.1.1 Socio-demographic characteristics

These included the participants' height, weight, and socioeconomic status to determine their pre-pregnancy BMI (kg/m^2). They also included the mother's age, education, and occupation. The World Health Organization classified people into five categories: normal weight (≤ 24.9 kg/m^2), overweight (≤ 25.0–29.9 kg/m2), obese (30–34.9 kg/m2), obese (35.0–39.9), and obese (≥ 40 kg/m^2) [6].

2.5.1.2 Obstetric history

a. Obstetric history of current pregnancy: - Data about parity, mode of conception (spontaneous, ovulation induction, or assisted reproductive technology), and length of pregnancy (days) were all included.

b. Obstetric history of previous pregnancy before bariatric surgery: Data included the occurrence of gestational diabetes, pre-eclampsia, and cesarean section. Also, this history included the presence of stillbirth, small for gestational age, and admission to the NICU.

2.5.1.3 Bariatric surgery history

The type of bariatric surgeries and the gap between bariatric surgery and conception were among the data collected. The two types of bariatric procedures that lower stomach capacity is malabsorptive (such as the Roux-en-Y gastric bypass) and restrictive (such as laparoscopic gastric banding (LGB) and LSG) [7].

2.5.2 Observational plus follow-up checklist

a. Gestational hypertension, preterm birth, cesarean sections (CSs) or vaginal deliveries, pregnancy-related disorders (e.g., gestational diabetes mellitus, or GDM), and pre-eclampsia (PE) were among the maternal health issues that were documented.

b. Data on fetal outcomes were collected, such as low Apgar score (< 7) at 5 minutes, stillbirth, and admission to the neonatal intensive care unit (NICU). Additionally, details were collected regarding gestational age at delivery (i.e., full-term (> 37–40 weeks) or preterm delivery (PTD < 37 weeks) and fetal birth weight (normal, small for gestational age (SGA), or LGA).

2.6 Data collected from the control group

After informing the participants of the study's goal and gaining their signed consent, data from obese pregnant women were collected and analyzed to identify outcomes for both the mother and the fetus.

2.7 Statistical analysis

SPSS version 20.0 statistics software was used for all statistical calculations. The normality of the distribution of the continuous variable, age, was examined before any statistical computations were done. The age distribution was normal, and the mean standard deviation was used to express it. There were two formats for categorical variables: numbers and percentages. The ages of the patients and controls were compared using an independent sample. Categorical variables were compared using the Chi-square test.

2.8 Results

The data in (Table 1) represent the characteristics of pregnant women with obesity (control group) and those with BSs before the current pregnancy (case group). The case group's age mean ± SD was 27.5 ± 4.6, while the control group's was 27.9 ± 4.9. The obese group's pre-pregnancy BMI was significantly higher (32.9 ±3.5 vs. 25.8 ±3.1 kg/m^2, respectively; p = 0.0001) than that of the BSs group. Furthermore, the 34.7% of women in the control group and the 55.2% of women in the case group did not significantly differ in their levels of university education. The high socioeconomic level of the case group was 52.7%, but it was only 12.5% in the control group (p=0.004).

Table 1: Characteristics of obese pregnant women versus the BS-pregnant group.

Variables	BS-pregnant (n=578) case group		Obese pregnant women (n= 3825) Control group		Chi-Square	
	N	%	n	%	X^2	P
Age (Years)					1.180	0.758
< 25	160	27.7	263	6.9		
25 – 30	208	35.9	1063	27.8		
30 – 35	176	30.4	1327	34.7		
> 35	34	6.0	1172	30.6		
Mean ±SD	27.5 ± 4.6		27.9 ± 4.9		0.502	0.617
Pre-pregnancy BMI [kg/m^2]	25.8 ± 3.1		32.9 ± 3.5		0.611	0.0001*
Education					1.114	0.573
Primary education	98	16.9	1648	43.1		
Secondary education	161	27.9	849	22.2		
University education	319	55.2	1328	34.7		
Occupation					2.044	0.153
Employee	360	62.3	1009	26.4		
Housewife	218	37.7	2816	73.6		
Socio-economic status					1.833	0.004*
Low level	120	20.8	2176	56.9		
Intermediate level	153	26.5	1170	30.6		
High level	305	52.7	479	12.5		

Table 2: Obstetric data and information about bariatric surgeries between the case and control groups.

Variables	**BS-pregnant (n=578) case group**		**Obese pregnant women (n= 3825) control group**		**Chi-Square**	
	N	**%**	**n**	**%**	**X^2**	**P**
Parity						
Nulliparous	157	27.2	804	21.0	1.032	0.002
Para 1-4	376	65.1	2410	63.0		
Para ≥ 5	45	7.7	611	16.		
Pregnancy duration (days)	(266-280)		(255-269)		1.112	0.001
Type of BS surgeries						
LSG	463	80.1	-	-		
Gastric bypass	71	12.3	-	-		
LGB	44	7.6	-	-		
Bariatric surgeries and to conception interval						
Less than 12 months	176	30.4	-	-		
From 12 to 24 months	277	47.9	-	-		
More than 24 months	125	21.7	-	-		
Conception mode						
Spontaneous	537	92.9	3633	95.0	2.043	0.71
Ovulation induction	12	2.1	20	0.5		
ART	29	5.0	174	4.5		

LSG: Laparoscopic sleeve gastrectomy. **LGB:** Laparoscopic gastric banding. **ART:** Assisted reproductive technology.

(Table 2) summarize the data in which the group of women with BSs, 7.6% had LGB surgery, 12.3% had gastric bypass surgery, and the majority (80.1%) had LSG. 31.4% of the women in the BSs group who were studied had a BS to conception interval of less than 12 months, 21.7% had a BS to conception interval of more than 24 months, and 47.9% of the women had a BS to conception interval of 12–24 months**.** Additionally, the spontaneous conception rate in the case and control groups is shown in this table (92.9% vs. 95.0% respectively).

Table 3: Maternal outcomes between obese pregnant women and the BS-pregnant group.

Variables	**BS-pregnant (n=578) case group**		**Obese pregnant women (n= 3825) control group**		**Chi-Square**	
	n	**%**	**n**	**%**	**X^2**	**P**
Gestational diabetes						
Positive	46	7.9	689	18.0	0.623	0.0003*
Negative	532	92.1	3136	82.0		
Gestational hypertension					1.124	0.001*
Positive	64	11.1	1028	26.9		

Negative	514	88.9	2797	73.1		
Pre-eclampsia					1.041	0.0005*
Positive	68	11.8	737	19.2		
Negative	510	88.2	6091	80.8		
Cesarean section					2.012	0.03*
Positive	118	20.4	1396	36.5		
Negative	460	79.6	2429	63.5		
Preterm deliveries					1.214	0.02*
Positive	53	9.2	795	20.8		
Negative	525	90.8	3030	79.2		

The data in the (Table 3), display comparison to the BSs group (7.9%, 11.1%, 11.8%, and 20.4%, respectively), pre-eclampsia, gestational hypertension, cesarean sections, and gestational diabetes mellitus were significantly more common in the obese group (18.0%, 26.9%, 19.2%, and 36.5%, respectively) (p = 0.0003, 0.001, 0.0005, and 0.03, respectively). Moreover, with a p-value of less than 0.02, there was a significantly higher prevalence of preterm births in the obese group (20.8%) compared to the BS group (9.2%).

Table 4: Fetal outcomes between obese pregnant women and the BS-pregnant group**.**

Variables	**BS-pregnant (n=578) case group**		**Obese pregnant women (n= 3825) control group**		**Chi-Square**	
	n	**%**	**n**	**%**	**X^2**	**P**
Small for gestational					0.623	0.001*
Positive	54	9.3	831	21.7		
Negative	524	90.7	2994	78.3		
IUGR					1.124	0.321
Positive	47	8.1	433	11.3		
Negative	531	91.9	3392	88.7		
Low Apgar score at 5 min.					1.041	0.004*
Yes	10	1.7	437	11.4		
No	568	98.3	3388	88.6		
NICU admission					2.012	0.005
Yes	15	2.6	498	13.0		
No	563	97.4	3327	87.0		
Stillbirth					3.214	0.172
Yes	86	14.8	726	18.9		
No	492	85.2	3099	81.1		

NICU: Neonatal intensive care unit. **IUGR:** Intrauterine growth retardation.

The data between BSs group and the obese group summarized in (Table 4), showed that there was no statistically significant difference in the incidence of either intrauterine growth retardation (11.3% vs. 8.1%) or stillbirth (18.9% vs. 14.8%, respectively) (p = 0.321). The incidence of small for gestational age (21.7% vs. 9.3%, respectively), NICU hospitalization (13.0% vs. 2.6%, respectively), and low Apgar score at 5 minutes (11.4% vs. 1.7%, respectively) distinguished the obese group from the BSs group statistically significantly.

Table 5: The odd ratio and relative risks of adverse maternal and fetal outcomes for pregnant women before and after performing bariatric surgery**.**

Variables	Before BS		After BS		p-value
	OR	RR	OR	RR	
Maternal outcomes					
Gestational diabetes	1.9	1.79	1.7	1.6	0.08*
Pre-eclampsia	1.3	1.25	1.06	1.09	
Cesarean section	1.7	1.6	1.2	1.10	
Fetal outcomes					
Small for gestational age	1.28	1.25	0.08	1.01	0.001*
Stillbirth	0.46	0.48	0.33	0.28	
NICU admission	1.08	1.07	0.07	0.08	

The data presented in (Table 5) summarized that the pregnant women before bariatric surgery had significantly higher odd, and relative risks of gestational diabetes, pre-eclampsia, and incidence of cesarean section (p-value equal 0.08). Also, in this table, fetal outcomes after bariatric surgery reported low odd, and relative risks of small for gestational age, stillbirth, and admission to NICU (p-value equal 0.001).

2.9 Discussion

To determine the effect of bariatric surgery on the mothers and babies, a cross-sectional study collected data on 11,252 pregnant women, of whom 5.1% (578/11252) had undergone bariatric surgery before the current pregnancy, and 33.9% (3825/11252) were obese. Bariatric procedures (BS) mitigate several pregnancy problems associated with obesity. Pregnant obese women are more likely to get GDM, PE, CSs, and gestational hypertension. The incidences of GDM, PE, CSs, and gestational hypertension were all considerably lower after bariatric surgery.

Comparing the overweight group (18.0%, 26.9%, 19.2%, and 36.5%, respectively) to the BSs institution (7.9%, 11.1%, 11.8%, and 20.4%, respectively), the quotes of cesarean transport, GDM, PE, and gestational hypertension had been extensively higher (p = 0.0003, zero.001, zero.0005, and 0.03, respectively). Furthermore, with a p-value of less than zero.02, the incidence of preterm births became considerably better within the obese institution (20.8%) as compared to the BS institution (9.2%). Additionally, a prospective examination determined that the obese cohort had a substantially better prevalence of pregnancy-triggered high blood pressure (19%) and GDM (19%) than the manipulated group (10% and 6.3%, respectively) [8]. An observational study also located the prevalence of GDM, and high blood pressure becomes considerably less after LGB [9].

The prevalence of CSs was found to be significantly higher in the obese group (36.5%) compared to the BSs group (20.4%) in the study, with a p-value of less than 0.03. Furthermore, when comparing the odds and dangers of CSs to the BSs group, the obese group showed considerably greater odds. the observational descriptive study discovered that maternal obesity increases the likelihood of CSs, which is compatible with this [10], in addition to a historical investigation which discovered that obese women were more likely than controls to have CSs [11]. Obese women had a significantly higher rate of emergency cesarean sections than controls, in line with a retrospective evaluation of 287,213 singleton pregnancies [12]. In a meta-analysis that the fees of CSs after LGS and BSs decreased [13&14].

In this examination, there has been a significant distinction (p = 0.004) between the overweight organization and the BSc institution within the incidence of bad Apgar ratings at five minutes (11.4% vs. 1.7%, respectively), NICU hospitalizations (13.0% vs. 2.6%, respectively), and small gestational age (21.7% vs. 9.3%, respectively). Studies from Denmark and America, which discovered multiplied dangers of SGA and IUGR, respectively, after malabsorptive bone grafting (BSs), assist this [15&16]. There may be a poor correlation between the weight loss of the lady after giving birth and the child's delivery weight (the greater the decrease in fetal birth weight, the larger the maternal weight loss after Birth) [3]. The result explains why women who are delivered after a malabsorptive bypass have a lower birth weight than those who are delivered after an LGB or LGS.

Finally, conditions that obese pregnant women are more likely to face include GDM, PE, CSs, gestational hypertension, and others. With the BSs, a much-reduced incidence of gestational hypertension, PE, GDM, and CSs was noted. It was not discovered that having BSs or being fat enhanced the likelihood of neonatal issues such as IUGR, stillbirth, and NICU hospital stays. The study's flaws included the inability to ascertain the causes of NICU hospitalizations, the outcomes for neonates after NICU admissions, and the women's refusal to participate.

This study showed that pregnant women before bariatric surgery had significantly higher odds and relative risks of gestational diabetes, pre-eclampsia, and the incidence of cesarean section. Also, fetal outcomes after bariatric surgery reported low odd, and relative risks of small for gestational age, stillbirth, and admission to NICU. This study was the first cross-sectional study conducted in Iraq to evaluate the effects of bariatric surgery on the results of subsequent pregnancies (both maternal and neonatal).

Conclusion

The risks of gestational hypertension, GDM, PE, and CS are higher in obese pregnant women. Significantly lower rates of GDM, PE, CSs, and gestational hypertension were observed following bariatric surgery. In addition, after bariatric procedures, fetal outcomes improved.

Declaration of Conflicting Interests

About the research, writing, and/or publication of this work, the author disclosed no potential conflicts of interest.

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