ECRONICON OPEN ACCESS

EC GYNAECOLOGY
Research Article

Bariatric Surgery and Obstetric Outcomes in a Large Middle Eastern Tertiary Obstetric Unit

Sunday Olubusola Amu*, Husam Salama, Ismail Sabry, Hilal Al Rifai, Sawsan Al-Obaidly, Mai Al Qubasi and Izudin Rahic

Women's Wellness and Research Center, Hamad Medical Corporation, Qatar

***Corresponding Author:** Sunday Olubusola Amu, Senior Obstetrician, Women's Wellness and Research Center, Hamad Medical Corporation, Qatar.

Received: September 18, 2019; **Published:** October 03, 2019

Abstract

Background: Obesity has reached epidemic levels at the global scale and is a leading cause of health-related disorders. Surgical weight reduction procedures are the last option for obese individuals but have become increasingly popular in recent years. While obesity presents specific acute and long-term risks to the pregnant woman and her offspring, the effects of bariatric surgery on pregnancy outcomes are still being evaluated.

Objective: The aim of the present study was to evaluate the impact of bariatric surgery (BS) on maternal and neonatal health in the modern and rapidly developing health care system in Qatar.

Design: In this population-based retrospective study, the data obtained as a part of the PEARL-Peristat Study (Perinatal Neonatal Registry) conducted in the state of Qatar is analyzed. The PEARL-Peristat Study is an ongoing cohort study based on the predesigned hospital data pertaining to mothers and their newborns. In its initial phase, the PEARL study was conducted from 2011 to 2013, while the phase discussed ion this work covered the 2017-2019 period.

Results: The population of interest for the present study comprised of 16,701 mothers who gave birth to 17,155 infants at > 22 weeks of gestation during a two year period in Qatar. However, only singleton deliveries (n = 16,248) were subjected to analyses. Moreover, as the study focused on obese mothers, 1,918 women that were classified as obese formed the intervention group, while the remaining 14,015 women were treated as the control group. Among the obese mothers, 315 had bariatric surgery (BS), which was on average performed at the age of 35 (59%). Majority of BS cases pertained to Qatari citizens (79%) and nulliparous women (21.6%). Compared to non-obese women, those that were classified as obese were statistically significantly more likely to deliver via caesarean section (37.5% vs 30%, p = 0.003). In the group classified as obese, DM was noted in 23% cases, while PET, PIH, and PPH were respectively reported in 2.5%, 1.9%, and 5.9% of these patients, in line with the rates obtained for the control group. BS was offered to 16 non-obese (12.9%) and 37 overweight (29.8%) women. No statistically significant differences were, however, noted between the intervention and the control group with respect to premature delivery (p = 0.12) and still birth (1.6% vs. 0.6%, p = 0.037), LBW (15% vs. 8.3%, p = 0.001), and Apgar score < 7 at fifth minute (1.3 % vs. 0.3%, p = 0.01). None of the newborns weighed above 4.5 kg. Comparison of obese women that underwent BS with those that did not revealed that the former group had a lower risk of DM (77% vs. 53%), lower GDM (19% vs. 39%) and lower overt diabetes (3.55 vs. 6.75, p = 0.001). In addition, lower BMI at delivery was noted in this group (p = 0.001), as well as lower IOL rate, a greater number of LBW newborns (p = 0.001), and lower Apgar score at 5th minute (p = 0.04). It is also noteworthy that BS was more likely to be offered to Qatari women than to non-Qatari patients (p = 0.001). On the other hand, no statistically significant differences were noted between these groups with respect to the likelihood of premature delivery, PET, PIH, or PPH.

Conclusion: Obesity remains a major health problem worldwide. However, women that have undergone bariatric surgery are still exposed to multiple health risks, including delivering low birthweight infants having babies with lower Apgar score at fifth minute, and having premature and stillborn babies. Nonetheless, BS appears to confer some desirable obstetric attributes, such as reduction in the incidence of IOL and assisted births. As bariatric surgery is a successful treatment of maternal obesity, more data is needed to determine clinical guidelines, given certain surgery-specific risks.

Keywords: *Bariatric Surgery; Maternal; Obesity; Outcome; Newborn; Women*

Abbreviations

BS: Bariatric Surgery; DM: Diabetes Mellitus; IOL: Induction of Labor; GA: Gestational Age; PET: Pre-Eclampsia Toxemia; PIH: Pregnancy-Induced Hypertension; Non-BS: Non-Bariatric Surgery

Introduction

Given that obesity has reached epidemic levels and is presently a leading cause of health-related disorders worldwide, surgical weight loss procedures are becoming more prevalent, with women accounting for the majority of these patients. As obesity causes many health issues, especially during pregnancy, large numbers of women in their childbearing years may undergo bariatric surgery (BS) to promote weight loss. However, their nutritional requirements during pregnancy or contraception effectiveness may be altered following BS. Obese women are advised to lose weight prior to conception, as obesity increases the risk of complications for mother and fetus, such as gestational diabetes, hypertension, preeclampsia, spontaneous miscarriage, large-for-gestational age offspring, and even fetal neurological and cardiovascular malformations [1-4].

Although the last resort for most overweight and obese individuals, bariatric surgery has become a cornerstone in the management of morbid obesity and is safely recommended to obese women of childbearing age [5]. The achievement of a pre-pregnancy weight reduction has been shown to increase fertility through reduction of hyperandrogenism and the incidence of polycystic ovarian syndrome. Significant weight loss also decreases obesity-related risks during the delivery, including caesarean section and instrumental delivery. Thus, the aim of the present study was to estimate the BS incidence in women aged 18 - 45 years who have accessed the obstetric services of Women's Governmental Service in Doha, Qatar.

Methods

Study design

In this population-based retrospective study, data obtained as a part of the PEARL-Peristat Study (Perinatal Neonatal Registry) conducted in the state of Qatar is analyzed. The PEARL-Peristat Study is an ongoing cohort study based on the predesigned hospital data pertaining to mothers and their newborns. In its initial phase, the PEARL study was conducted from 2011 to 2013, while this phase covered the 2017 - 2019 period. The main objective of this registry was to allow assessment of pregnancy outcomes of women that have undergone bariatric surgery for weight reduction in the state of Qatar. The PEARL study is funded by Qatar National Research Fund (Grant no. NPRP 6-238-3-059) and is sponsored by the Medical Research Centre, Hamad Medical Corporation (HMC). The study was approved by the Hamad Medical Corporation Institutional Review Board, with a waiver of consent (HMC-IRB 13064/13).

Setting and participants

The sample for the present investigation comprised of all registered births for the year 2017 in Women's Hospital-the largest government tertiary hospital in Qatar. According to the HMC annual reports for 2017 and 2018, this hospital caters for approximately 70% of all deliveries nationwide. The sample analyzed in this work was therefore generally representative of births in the country. The inclusion criteria for this study were singleton births at ≥ 22 weeks' gestation conducted in Women's Wellness and Research Center (WWRC). No other exclusion criteria were used.

Exposure variable: Bariatric surgery

While data for morbidities, such as history of hypertension and diabetes, were sourced from patient records, relevant information related to bariatric surgery was obtained in free text format from patient notes. Thus the data utilized in analyses contained free text terms such as 'roux en-y gastric bypass', 'sleeve gastrectomy', 'gastric sleeve', 'gastric bypass', etc. Several variables based on identified search terms were created to retrieve all recorded forms of bariatric surgery. The combination of all these variables resulted in a binary variable pertaining to bariatric surgery which was coded as 1 = "yes" for women that underwent this procedure and 0 = "no" otherwise.

Covariates and outcome variables

Maternal: Maternal age at delivery in years was classified under five categories, namely ≤ 24, 25 - 29, 30 - 34, 35 - 39 and ≥ 40 years. Parity was similarly classified under 'nulliparous', 1 - 4 or ≥ 5 parous experiences. Nationality was categorized into Qatari, Other Arabs, and Other Nationalities. While delivery-related data, including weight and BMI, were available for approximately 99% of the study population, data availability for pre-pregnancy BMI or BMI at early antenatal booking (< 13 weeks) was limited.

The sample was segregated into underweight (BMI ≤ 18.5 kg/m^2), normal weight (18.5 - 24.9 kg/m^2), overweight (25 - 29.9 kg/m^2), and obese (≥ 30 kg/m^2) groups [World Health Organisation]. The obese group was further classified into Obese Class I (30.0 - 34.9 kg/m^2), Obese Class II (35.0 - 39.9 kg/m^2) and Obese Class III (≥ 40.0 kg/m^2) [7].

Pregnancy outcomes were extracted from patient notes or coding summaries, whereby mode of delivery was coded as vaginal or caesarean delivery. For vaginal births, induction of labor (IOL) and assisted births (using forceps or vacuum) were coded as 1 = "yes" or 0 = "no". Diabetes status was similarly coded as "none," "overt," or "gestational diabetes." The presence or absence of maternal outcomes (coded as 1 = "yes" or 0 = "no") included pre-eclampsia (PET), pregnancy-induced hypertension (PIH) and postpartum hemorrhage (PPH). For PPH, blood loss was defined as ≥ 500 ml for vaginal births or ≥ 1,000 ml for caesarean births. For the estimation of gestational weight gain, the approach used for BMI calculation was adopted; thus, it was defined as the difference between weight measured at delivery and pre-pregnancy/early pregnancy weight.

Newborn characteristics: Based on the gestational age at delivery, the sample was separated into early (24 - 31 weeks), premature (32 - 36 weeks) and term delivery (≥ 37 weeks) groups. Moreover, birth outcome was classified as live-born or stillborn, whereas birth weight was classified as ≤ 1,499g, 1,500 - 2,499g, 2,500 - 3,999g and ≥ 4,000g. Other binary outcomes (coded as 1 = "yes" or 0 = "no") included admission to neonatal intensive care unit (NICU), macrocosmic/big baby (weight ≥ 4.5 kg), term low birth weight (< 2,500g) and low Apgar (< 7 at 5 minutes).

Comparison groups

A comparison of baseline demographic characteristics and pregnancy outcomes was made between women that underwent BS and the remaining cohort (i.e. women that had no history of BS). A sub-cohort comparison was also made between obese women that underwent BS and those that did not. No matching was performed as a part of the design.

Statistical analysis

Descriptive statistics were calculated for variable distributions, reporting numbers and percentages, or means and standard deviations, as applicable. The differences in observed proportions between the "bariatric" and "non-bariatric" groups, or between "obese bariatric" and "obese non-surgical" groups were compared using Chi-squared test or Fisher's test, as appropriate. Statistical significance was set at $p < 0.05$. All statistical analyses were performed using IBM SPSS 22 statistical software.

Results

The total number of maternal cases retrieved from the registry was 16,701, whereby those women gave birth to 17,155 infants at ≥ 22 weeks' gestation. However, only singleton (n = 16,248) cases were subjected to analysis, and in this subsample 315 mothers underwent bariatric surgery, whereas 1,918 obese mothers did not receive BS, as shown in figure 1 and 2.

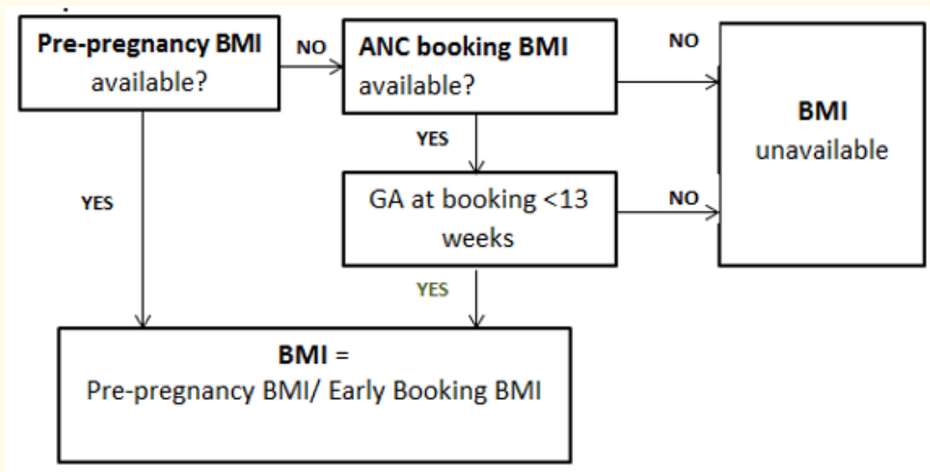

Figure 1: *Computation of BMI.*

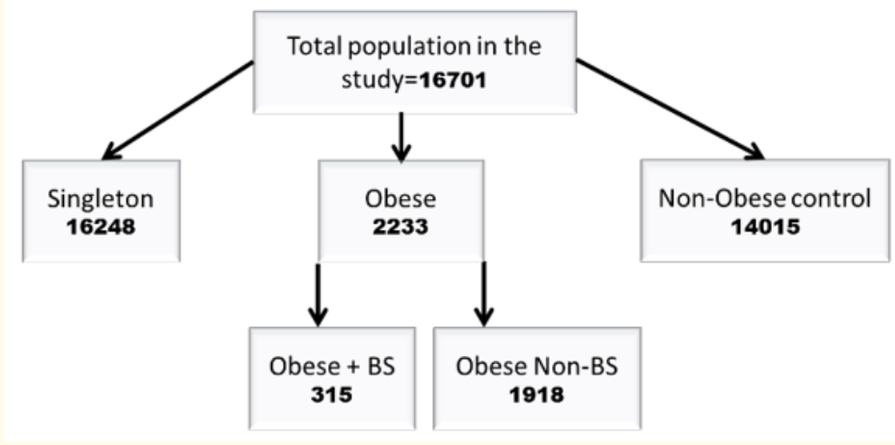

Figure 2: *Sample size distribution.*

The peak age for BS was 25-35 (59%), with the majority of BS performed on Qatari citizens (79%) and nulliparous women (21.6%). BS was offered to 16 (12.9%) non-obese and 37 (29.8%) overweight women.

Comparison of the women that underwent BS with the non-obese population (n = 14,015) revealed the same incidence of PET, PIH, and PPH, reported at 2.5%, 1.9%, and 5.9%, respectively. No statistically significant differences were, however, noted between the BS and the non-obese group with respect to premature delivery (p = 0.12) and still birth (1.6% vs. 0.6%, p = 0.037), LBW (15% vs. 8.3%, p = 0.001), and Apgar score < 7 at fifth minute (1.3 % vs. 0.3%, p = 0.01). None of the newborns weighed above 4.5 kg, as shown in table 1.

Variable	Categories	BS (n = 315)		Non-obese (n = 14,015)		P-value
		Count	%	Count	%	
Maternal Age (5 categories)	≤ 24 years	30	9.5%	3,137	19.7%	< 0.001
	25 - 29 years	85	27.0%	5,080	31.9%	
	30 - 34 years	102	32.4%	4,601	28.9%	
	35 - 39 years	68	21.6%	2,412	15.1%	
	≥ 40 years	30	9.5%	703	4.4%	
Nationality (3 categories)	Qatari	250	79.4%	4,714	29.6%	< 0.001
	Other Arabs	47	14.9%	6,346	39.8%	
	Other Nationalities	18	5.7%	4,873	30.6%	
Parity	Nulliparous	68	21.6%	4,386	27.5%	< 0.001
	Para 1 - 4	204	64.8%	10,350	65.0%	
	Para ≥ 5	43	13.7%	1,192	7.5%	
Delivery Mode	Vaginal	197	62.5%	11,186	70.2%	0.003
	Caesarean	118	37.5%	4,747	29.8%	
DM Status	No DM	244	77.5%	11,430	71.7%	0.01
	GDM	60	19.0%	4,141	26.0%	
	Overt DM	11	3.5%	362	2.3%	
PET	No PET	307	97.5%	15,556	97.6%	0.841
	PET	8	2.5%	377	2.4%	
PIH	No PIH	309	98.1%	15,604	97.9%	0.843
	PIH	6	1.9%	329	2.1%	

Postpartum Hemorrhage	No	297	94.3%	15,143	95.0%	0.541
	Yes	18	5.7%	790	5.0%	
*Early BMI + Obese class	Underweight	0	0.0%	144	2.4%	NA
	Normal	16	12.9%	2,026	33.5%	
	Overweight	37	29.8%	1,953	32.3%	
	Obese Class l	35	28.2%	1,223	20.2%	
	Obese Class ll	25	20.2%	492	8.1%	
	Obese Class lll	11	8.9%	203	3.4%	
Pre/ Early Pregnancy Obesity	No	53	42.7%	4,123	68.3%	< 0.001
	Yes	71	57.3%	1,918	31.7%	
** BMI at Delivery (4 categories)	< 30 kg/m^2	78	25.0%	6,933	43.9%	< 0.001
	30 - 34.99 kg/ m^2	103	33.0%	5,109	32.4%	
	35 - 39.99 kg/ m^2	74	23.7%	2,617	16.6%	
	≥ 40 kg/m^2	57	18.3%	1,129	7.2%	
GA (3 categories)	24 - 31 weeks	10	3.2%	267	1.7%	0.12
	32 - 36 weeks	24	7.6%	1,155	7.2%	
	≥ 37 weeks	281	89.2%	14,511	91.1%	
Preterm or Term Delivery	24-36 weeks	34	10.8%	1,422	8.9%	0.25
	≥ 37 weeks	281	89.2%	14,511	91.1%	
IOL	Not induced	165	83.8%	9,446	84.4%	0.792
	Induced	32	16.2%	1,740	15.6%	
Assisted Birth	No	189	95.9%	10,229	91.4%	0.025
	Yes	8	4.1%	957	8.6%	
Conception Mode	Spontaneous	297	94.9%	15,414	97.6%	0.005
	Ovulation Induced	4	1.3%	69	0.4%	
	ART	12	3.8%	303	1.9%	
Baby Status at Birth	Live-born	310	98.4%	15,832	99.4%	0.037
	Stillborn	5	1.6%	101	0.6%	
NICU admission	No	274	88.4%	14,014	88.6%	0.904
	Yes	36	11.6%	1,802	11.4%	
BWT (4 categories)	≤ 1,499g	9	2.9%	245	1.5%	<0.001
	1,500-2,499g	38	12.1%	1,085	6.8%	
	2,500-3,999g	251	79.7%	13,882	87.2%	
	≥ 4,000g	17	5.4%	713	4.5%	
Big Baby	< 4.5 kg	315	100.0%	15,853	99.5%	NA
	≥ 4.5 kg	0	0.0%	72	0.5%	
Low Apgar at 5 min	No	311	98.7%	15,892	99.7%	0.011
	Yes	4	1.3%	41	0.3%	
Term BW	Term ≥ 2,500g	293	93.0%	15,422	96.8%	<0.001
	Term < 2,500g	22	7.0%	507	3.2%	

Table 1: *Maternal outcomes of obese women that have undergone BS (n = 315) in comparison with the non-obese women that took part in the study n = 14,015).*

**Limited to 6,165 women due to paucity of pre-pregnancy/early pregnancy weight data.*

***Reported in 148 cases.*

****Conception mode reported in 149 cases. p ≤ 0.05 [Chi-sq or Fisher's test].*

Comparison of obese women that underwent BS with those that did not revealed that the former group had a lower risk of DM (77% vs. 53%), lower GDM (19% vs. 39%) and lower overt diabetes (3.55 vs. 6.75, $p = 0.001$). In addition, lower BMI at delivery was noted in this group ($p = 0.001$), as well as lower IOL rate, a greater number of LBW newborns ($p = 0.001$), and a greater number of infants with a lower Apgar score at 5th minute ($p = 0.04$). It is also noteworthy that BS was more likely to be offered to Qatari women than to non-Qatari patients ($p = 0.001$). On the other hand, no statistically significant differences were noted between these groups with respect to the likelihood of premature delivery, PET, PIH, or PPH, as reported in table 2.

Variables	Categories	Obese-BS (*n* = 315)		Obese non-BS (*n* = 1,918)		P-value
		Count	%	Count	%	
Maternal Age (5 categories)	≤ 24 years	30	9.5%	186	9.7%	0.996
	25 - 29 years	85	27.0%	502	26.2%	
	30 - 34 years	102	32.4%	621	32.4%	
	35 - 39 years	68	21.6%	430	22.4%	
	≥ 40 years	30	9.5%	179	9.3%	
Nationality (3 categories)	Qatari	250	79.4%	626	32.6%	<0.001
	Other Arabs	47	14.9%	893	46.6%	
	Other Nationalities	18	5.7%	399	20.8%	
Parity	Nulliparous	68	21.6%	321	16.7%	0.065
	Para 1 - 4	204	64.8%	1,360	70.9%	
	Para ≥ 5	43	13.7%	237	12.4%	
Delivery Mode	Vaginal	197	62.5%	1,126	58.7%	
	Caesarean	118	37.5%	792	41.3%	0.199
Maternal Age at BS (2 categories)	< 35 years	217	68.9%	1,309	68.2%	0.821
	≥ 35 years	98	31.1%	609	31.8%	
DM Status	No DM	244	77.5%	1,030	53.7%	<0.001
	GDM	60	19.0%	759	39.6%	
	Overt DM	11	3.5%	129	6.7%	
BMI at Delivery (4 categories)	< 30 kg/m^2	78	25.0%	26	1.4%	<0.001
	30-34.99 kg/m^2	103	33.0%	563	29.5%	
	35-39.99 kg/m^2	74	23.7%	853	44.7%	
	≥ 40 kg/m^2	57	18.3%	467	24.5%	
PET	No PET	307	97.5%	1,857	96.8%	0.543
	PET	8	2.5%	61	3.2%	
PIH	No PIH	309	98.1%	1,865	97.2%	
	PIH	6	1.9%	53	2.8%	0.379
Postpartum Hemorrhage	No	297	94.3%	1,832	95.5%	
	Yes	18	5.7%	86	4.5%	0.337
GA (3 categories)	24 - 31 weeks	10	3.2%	39	2.0%	0.338
	32 - 36 weeks	24	7.6%	172	9.0%	
	≥ 37 weeks	281	89.2%	1,707	89.0%	
Preterm or Term Delivery	24 - 36 weeks	34	10.8%	211	11.0%	0.913
	≥ 37 weeks	281	89.2%	1,707	89.0%	
IOL	Not Induced	165	83.8%	859	76.3%	0.021
	Induced	32	16.2%	267	23.7%	
Assisted Birth	No	189	95.9%	1,049	93.2%	0.142
	Yes	8	4.1%	77	6.8%	

Conception Mode	Spontaneous	297	94.9%	1,824	95.9%	0.289
	Ovulation Induced	4	1.3%	10	0.5%	
	ART	12	3.8%	68	3.6%	
Baby Status at Birth	Live-born	310	98.4%	1,903	99.2%	0.16
	Stillborn	5	1.6%	15	0.8%	
NICU Admission	No	274	88.4%	1,646	86.6%	0.384
	Yes	36	11.6%	255	13.4%	
BW (4 categories)	≤ 1,499g	9	2.9%	37	1.9%	0.001
	1,500-2,499g	38	12.1%	116	6.1%	
	2,500-3,999g	251	79.7%	1,650	86.2%	
	≥ 4,000g	17	5.4%	112	5.8%	
Big Baby	< 4.5 kg	315	100.0%	1,903	99.4%	NA
	≥ 4.5 kg	0	0.0%	12	0.6%	
Low Apgar at 5 min	No	311	98.7%	1,912	99.7%	0.041
	Yes	4	1.3%	6	0.3%	
Term BW	Term ≥ 2,500g	293	93.0%	1,870	97.6%	<0.001
	Term < 2,500g	22	7.0%	46	2.4%	

Table 2: *Maternal outcomes of obese women that have undergone BS (n = 315) in comparison with obese women that did not have BS (n = 1,918).*

Statistical significance set at p < 0.05.

Discussion

According to the recent Qatar Biobank report, 70% of the population residing in the state of Qatar is suffering from morbid obesity [8]. Moreover, almost 16% of Qatar Biobank visitors were diagnosed with diabetes, and 86% were Vitamin D deficient. Furthermore, data provided by the Qatar National Health indicate that 71% of Qatar's population (inclusive of expatriates) are considered to be overweight while 32% are classified as morbidly obese. This trend is likely to escalate in the future, given that 50% of the Qatari population does not engage in a regular physical activity [9].

Salama., *et al.* recently reported that 14% of infants born to either overweight or obese mothers were admitted to NICU, compared to 11% in normal non-obese population. Similarly, significantly greater incidences of birth weight above 4,000 g were noted for infants born to mothers with BMI ≥ 30 [10]. The incidences of hypertension, cholestasis, diabetes, postpartum hemorrhage and caesarian section were also the highest in the obese group. Salama and colleagues further argued that an increase in maternal BMI before conception adversely influences intrauterine growth, infant weight at delivery, and delivery outcomes. In this particular study, premature delivery was more frequent in overweight and obese women (8 - 11%) compared to women of normal weight (5.8%). On the other hand, the delivery room death and stillbirth rates were comparable across all BMI groups. Being overweight or obese is a recognized risk factor for carrying an excessively large baby and preterm delivery, while being obese alone is a major risk factor for NICU admission. Pregnant women with high BMI were also found by Salama., *et al.* to be at a significant risk of cesarean section, GDM, and hypertension, but not postpartum hemorrhage [10].

Although bariatric surgery is an aggressive weight loss measure, it has become a successful treatment for severely obese women, despite certain surgery-specific risks. Thus, more empirical data is required to determine clinical guidelines, given that the long-term effects of BS on pregnancy outcomes are presently unclear [11]. In governmental hospitals in the state of Qatar, since 2017, approximately 1,000 bariatric surgeries have been performed annually, and 70% of these cases pertained to women aged 30 - 40 years as a means of promoting weight loss [12-14].

In the present study, compared to the non-obese mothers included in the analyses (n = 14,015), the women that underwent BS (n = 315) were at a greater risk of delivering by cesarean section (p = 0.003), having overt diabetes (p = 0.01), delivering a stillborn infant (p = 0.025), and having LBW newborn (p = 0.001), or a baby with an Apgar score < 7 (p = 0.01).

Newborns delivered to mothers that underwent BS were more prone to have LBW than infants born to obese mothers that did not undergo BS. However, no statistically significant differences were noted between the obese-BS and obese-non BS groups with respect to mode of delivery, maternal age at delivery, presence of PET, PIH, PPH, premature labor, assisted birth, conception mode, Apgar score at birth, or need for NICU admission. On the other hand, mothers in the BS group were at a lower risk of overt DM ($p < 0.001$) during the early stages of pregnancy and at delivery ($p < 0.001$), while also having lower overall DM rate.

In the developed world, obesity continues to be a major health problem. According to the 2015 World Health Organization report, approximately 2.3 billion adults were classified as overweight and more than 700 million were considered obese [15]. This global obesity epidemic is reflected in the dramatic increase in the morbid obesity incidence in women of childbearing age. Obesity in pregnancy is extremely dangerous, not only because of the adverse effects on maternal health and pregnancy outcomes, but also due to the disturbed nutritional balance *in utero*, which may have deleterious effects on the developing child. Thus, it is highly recommended that obese women of reproductive age lose weight before conceiving [16]. In many such cases, however, behavioral and medical interventions do not yield satisfactory results, due to which bariatric surgery may be the only alternative, despite the associated risks. In general, BS is safely recommended to obese women of childbearing age.

Weight reduction after surgery improves fertility, and results in a significantly lower incidence of severe pregnancy-related complications like hypertension, large-for-gestational-age infants, gestational diabetes, instrumental delivery and caesarean section [4,17,18]. Nevertheless, increased incidences of miscarriage, growth restriction and prematurity have been reported. Moreover, several authors have noted that BS may lead to nutritional deficiency and related maternal and fetal complications, especially after the malabsorptive surgery types [4,19-22].

Conclusion

Bariatric surgery has become a successful treatment of maternal obesity, despite the associated risks, such as greater incidences of still birth, LBW and CS. The clinical and economic impacts of these outcomes thus require further evaluation.

Bibliography

1. Bar-Zohar D., *et al*. "Pregnancy after laparoscopic adjustable gastric banding: Perinatal outcome is favorable also for women with relatively high gestational weight gain". *Surgical Endoscopy* 20.10 (2006): 1580-1583.
2. Dixon JB., *et al*. "Birth outcomes in obese women after laparoscopic adjustable gastric banding". *Obstetrics and Gynecology* 106 (2005): 965-972.
3. Ducarme G., *et al*. "Obstetric outcome following laparoscopic adjustable gastric banding". *International Journal of Gynecology and Obstetrics* 98.3 (2007): 244-247.
4. Jasaitis Y., *et al*. "Management of pregnancies after adjustable gastric banding". *Journal de Gynécologie Obstétrique et Biologie de la Reproduction* 36.8 (2007): 764-769.
5. DeMaria EJ. "Bariatric surgery for morbid obesity". *New England Journal of Medicine* 356.21 (2007): 2176-2183.
6. Feig., *et al*. "The steps are as shown in Figure 1. Evidence for definition" (2015).
7. Global Health Observatory (GHO) data. "Mean Body Mass Index (BMI)".
8. Qatar Biobank annual report (2016).
9. http://nhsq.info/app/media/4787
10. Husam Salama., *et al*. "Pre-gestation Body Mass Index characteristics of mothers with singleton pregnancies in the state of Qatar: A population epidemiological study". *CJPD* 25.1 (2019).
11. Al-Nimr RI., *et al*. "Effects of Bariatric Surgery on Maternal and Infant Outcomes of Pregnancy-An Evidence Analysis Center Systematic Review". *Journal of the Academy of Nutrition and Dietetics* (2019).
12. HMC conducts about 1,000 bariatric surgeries annually.

13. Obesity - assessment and primary care.

14. Ministry of Public Health. State of Qatar. Obesity - assessment and primary care. Medicine > General medicine > Obesity in adults (2017).

15. World Health Organization, Fact sheet N°311 (2006).

16. American College of Obstetricians and Gynecologists. "ACOG Committee Opinion Number 315, September 2005, Obesity in Pregnancy". *Obstetrics and Gynecology* 106.3 (2005): 671-675.

17. Marceau P., *et al*. "Outcome of pregnancies after biliopancreatic diversion". *Obesity Surgery* 14.3 (2004): 318-324.

18. Martin LF., *et al*. "Pregnancy after adjustable gastric banding". *Obstetrics and Gynecology* 95.6 (2000): 927-930.

19. Huerta S., *et al*. "Vitamin A deficiency in a newborn resulting from maternal hypovitaminosis A after biliopancreatic diversion for the treatment of morbid obesity". *American Journal of Clinical Nutrition* 76.2 (2002): 426-429.

20. Cools M., *et al*. "Adverse neonatal outcome after maternal biliopancreatic diversion operation: Report of 9 cases". *European Journal of Pediatrics* 165.3 (2006): 199-202.

21. Van Schoubroeck D., *et al*. "Fetal cerebral hemorrhage caused by vitamin K deficiency after complicated bariatric surgery". *Obstetrics and Gynecology* 112.2 (2008): 434-436.

22. Eerdekens A., *et al*. "Maternal bariatric surgery: Adverse outcomes in neonates". *European Journal of Pediatrics* 169 (2010): 191.

Volume 8 Issue 11 November 2019