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Research Article

MATERNAL AND NEONATAL OUTCOMES OF CESAREAN SECTION IN OBESE AND MORBID OBESE TERM PREGNANT WOMEN

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Abstract: *The study aims to compare preoperatively, intraoperatively, and postoperatively the maternal and neonatal outcomes of normal-weight, obese, and morbid obese pregnant women who delivered by cesarean section in our clinic. This study retrospectively included 151 singleton pregnancies delivered at ≥37 weeks of gestation by cesarean section. Demographic, clinical, and neonatal results of the patients were noted and compared between the groups. Among the pregnant women included in this study, the length of postoperative hospital stay and presence of chronic diseases were determined to be significantly higher in the morbid obese group compared with other groups ($p<0.05$). In the morbid obese group, the average infant birth weight and the number of infants monitored due to respiratory distress as a neonatal complication were determined to be significantly higher ($p<0.05$). The presence of pregnancy complications, particularly the presence of gestational diabetes mellitus and preeclampsia were found to be significantly higher in the morbid obese group ($p<0.05$). We determined that the incidence of maternal and neonatal complications increases as the body mass index (BMI) increases. Therefore, it is evident that monitoring the BMI and preventing obesity would be effective in avoiding complications.*

Keywords: *Cesarean section, maternal obesity, maternal complication, neonatal complication*

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1. Introduction

Overweight and obesity are defined as the abnormal or excess accumulation of fat that may disrupt health. As a norm, females have more body fat than males and it is generally accepted that women with a body fat percentage higher than 30% and males with a body fat percentage higher than 25% are obese. The World Health Organization (WHO) categorizes those with a body mass index (BMI, kg/ m2) of 18.5 or lower as underweight, those with a body mass index between 18.5 and 24.9 as normal-weight, those with a body mass index between 25 and 29.9 as overweight and those with a body mass index of 30 or higher as obese. Obesity is also characterized based on BMI as grade I (BMI 30-34.9), grade II (BMI 35-39.9), and grade III (BMI ≥40) [1].

Currently, obesity presents itself as one of the most important health concerns of recent years, with a rapidly increasing prevalence, a negative impact on public health and the future, and a resulting rise in the health expenditures of nations. Obesity, which is considered a complex and multifactorial

disorder, is currently the second most significant cause of preventable death after smoking. It is associated with a multitude of morbidities such as diabetes, cardiovascular diseases, hypertension, hyperlipidemia, cerebrovascular disease, various cancers, obstructive sleep apnea syndrome, non-alcoholic fatty liver, gastroesophageal reflux, bile duct disease, polycystic ovarian syndrome, infertility, osteoarthrosis and depression [2].

Obesity is linked to a continual increase in morbidity-mortality and a related rise in expenditures. One study has determined that the annual health expenditures increase proportionally as more patients become obese [3].

In our country, with the rapid lifestyle change, obesity has become a problem associated with a gradually increasing prevalence. In 2016, WHO reported that there were 16.092.644 obese individuals in Turkey and that Turkey presented the highest prevalence of obesity in Europe with a rate of 29.5% [4]. In the 2017 report of the Organization for Economic Cooperation and Development (OECD), the average rates of obesity and overweight in adults aged between 20 and 79 years were respectively 19.4% and 34.5% across 34 countries in 2015, while these rates were 22.3% and 33.1% in Turkey [5].

As the prevalence of obesity increases, the number of overweight and obese women of reproductive age also increases. In the United States of America, the prevalence of obesity among pregnant women varies between 18.5% and 38.3% [6].

Maternal overweight and obesity are linked to various adverse obstetric outcomes. Maternal complications include hypertension, diabetes, asthma, sleep apnea, thromboembolic disease, increased surgical site infections and more prevalent cesarean deliveries, endometritis, and anesthetic complications (primarily, intubation difficulties and epidural anesthesia). Neonatal complications include congenital malformations, large for gestational age (LGA) infants, stillbirth, shoulder dystocia, and long-term complications (obesity and diabetes) [7].

The complications of obesity, which has a prevalence that is gradually increasing worldwide and is associated with numerous adverse pregnancy outcomes, should be identified and prevented. The present study aims to compare the maternal and neonatal outcomes of normal-weight, obese and morbid obese pregnant women who delivered by cesarean section in our clinic preoperatively, intraoperatively, and postoperatively.

2. Materials and Methods

This study retrospectively evaluated a total of 151 normal-weight, obese and morbid obese pregnant women who were admitted to the Gynecology and Obstetrics Clinic of Dicle University between January 1, 2019 - December 31, 2019, and delivered singleton babies at ≥37 weeks of gestation by cesarean section. This study was granted approval by Dicle University Faculty of Medicine Ethics Committee (Date: 07.05.2020, Number: 154).

Pregnant women with vaginal delivery, preterm delivery, multiple pregnancies, placental position and invasion anomalies, coagulation disorder, and intrauterine fetal death were excluded from this study.

Patients' demographic data, gestational age at delivery, presence of maternal chronic diseases, history of prior maternal operations, presence of pregnancy complications, indications for cesarean section, type of anesthesia in cesarean delivery, type of skin and uterine incision, presence of intraoperative and postoperative complications, length of postoperative hospital stay (days), 1-minute and 5-minute APGAR scores, infant birth weight, presence of neonatal complications were obtained from patient files and surgical notes by scanning the hospital information management system archives.

The heights and weights of the pregnant women included in the study were measured by nurses at the clinic using an electronic scale of the brand TESS. BMI values of the patients computed in the first trimester or before pregnancy were noted. As accepted by the U.S. Institute of Nutrition and Food [8], the 151 cases included in the study were evaluated within three separate groups based on the BMI

values that were determined using the data obtained via the weight and height assessment. Accordingly, pregnant women with a BMI between 18.5–24,9 kg/ m2 were considered normal-weight, pregnant women with a BMI between 30–39,9 kg/ m2 were considered obese and pregnant women with a BMI > 40 kg/ m2 morbid obese. The three groups included in the evaluation were assessed based on preoperative, intraoperative, and postoperative maternal and neonatal outcomes.

As antepartum complications, the patients were evaluated with regard to preeclampsia-eclampsia, gestational hypertension, gestational diabetes mellitus (GDM), post-term pregnancy, intrauterine growth retardation, and deep vein thrombosis.

The patients were evaluated with regard to intestinal injury, bladder injury, uterine atony as intraoperative complications; and with regard to surgical site infections, thromboembolism, fever, whether a relaparotomy was performed and the length of postoperative hospital stay as postoperative complications.

Pregnant women included in the evaluations were also compared with respect to the type of anesthesia, type of skin and uterine incision, hypogastric-uterine artery ligation, balloon tamponade use, whether a drain was placed, and the indication for cesarean section.

Infants were evaluated by neonatologists accompanying the cesarean delivery. The three groups were compared with regard to neonatal birth weight, 1-minute and 5-minute APGAR scores, respiratory distress syndrome, early neonatal sepsis, neonatal respiratory distress, and the number of neonates admitted to the service to be monitored.

Statistical analysis was performed using the SPSS 21 statistics program package. Whether the variables conformed to a normal distribution was analyzed using histogram graphs and the Kolmogorov Smirnov test. Descriptive analyses were presented using mean, standard deviation, median values. Categorical variables were compared using the Pearson Chi-Square Test. In the comparison of variables with a non-normal distribution (nonparametric variables) across BMI groups, the Kruskal Wallis test was used. In the comparison of the changes in the preoperative-postoperative values between the BMI groups, repeated measures analysis was used. Cases associated with a p-value lower than 0.05 were evaluated as statistically significant results.

3. Results

This study included a total of 151 pregnant women, of whom 41 were normal-weight, 71 were obese and 39 were morbid obese. Mean BMI (33,79± 7,83), mean age (31,50± 5,9), and other demographic data for all pregnant women are presented in Table-1.

Table 1. Demographic characteristics of the patients

	X̄± SD	**Median**
Body mass index	33.79± 7.83	33.70
Age	31.50± 5.91	32.00
Gravidity	4.58± 2.45	4.00
Parity	2.95± 2.17	3.00
Number of living children	2.77± 2.03	3.00
Gestational age	38.02± 2.20	38.10
Number of abortions	0.64± 0.92	0.00

When the antepartum data of the pregnant women included in the study were compared between the three groups; we determined the presence of gestational complications to be significantly higher in the morbid obese group compared with the normal-weight and obese groups. It was also found to be significantly higher in the obese group compared with the normal-weight group ($p<0.05$). GDM and the number of preeclamptic pregnant women were found to be higher in the morbid obese group compared with the other groups. The presence of chronic diseases was significantly higher in the morbid obese

group compared with the other groups ($p<0.05$). The chronic disease that was detected the most frequently in the morbid obese group was heart disease. The three groups were not significantly different with regard to prior operations and indications for cesarean section ($p>0.05$) (Table 2).

Table 2. Comparison of antepartum data

		BMI						
		Normal-weight		Obese		Morbid obese		p
		n	%	n	%	n	%	
Chronic disease	None	36	87.80	54	76.06	21	53.85	0.002**
	Hypertension	0	.00	5	7.04	0	.00	
	Diabetes mellitus	0	.00	0	.00	2	5.13	
	Heart disease	3	7.32	4	5.63	5	12.82	
	Asthma	0	.00	1	1.41	4	10.26	
	Thyroid disease	0	.00	6	8.45	3	7.69	
	Other	2	4.88	1	1.41	4	10.26	
Prior operations	None	10	24.39	18	25.35	10	25.64	0.666
	Cesarean	29	70.73	50	70.42	28	71.79	
	Appendectomy	2	4.88	2	2.82	0	.00	
	Uterine surgery	0	.00	1	1.41	0	.00	
	Other	0	.00	0	.00	1	2.56	
Prior operations	No	10	24.39	18	25.35	10	25.64	0.991
	Yes	31	75.61	53	74.65	29	74.36	
Pregnancy complication	GDM[a]	3	7.32	8	11.27	7	17.95	
	Preeclampsia	1	2.44	3	4.23	7	17.95	
	IUGR[b]	2	4.88	2	2.82	1	2.56	
	Postterm pregnancy	0	.00	0	.00	0	.00	
	Eclampsia	0	.00	0	.00	0	.00	
	DVT[c]	0	.00	0	.00	0	.00	
Pregnancy complication	No	35	85.37	58	81.69	24	61.54	0.020*
	Yes	6	14.63	13	18.31	15	38.46	
Indications for cesarean section	Repeat cesarean	29	70.73	50	70.42	27	69.23	0.586
	Fetal distress	2	4.88	1	1.41	2	5.13	
	Malpresentation	4	9.76	8	11.27	3	7.69	
	Cephalopelvic disproportion	2	4.88	5	7.04	1	2.56	
	Severe preeclampsia	1	2.44	1	1.41	3	7.69	
	Fetal anomaly	2	4.88	3	4.23	0	.00	
	Elective	0	.00	2	2.82	3	7.69	
	Failure to progress	1	2.44	1	1.41	0	.00	

Chi-square Test;* $p<0.05$; **$p<0.01$ [a]Gestational diabetes mellitus; [b]Intrauterine growth retardation; [c]Deep vein thrombosis

When the intraoperative and postoperative data were compared across the three groups, it was found that patients in the morbid obese group had a significantly longer postoperative hospital stay than the other two groups. It was also found to be significantly longer in the obese group compared with the normal-weight group ($p<0.05$). The groups were not significantly different with regard to other data (Table 3).

Table 3. Comparison of intraoperative and postoperative data

		BMI						
		Normal-weight		Obese		Morbid obese		p
		n	%	n	%	n	%	
Anesthesia type	Spinal	39	95.12	66	92.96	34	87.18	0.392
	General	2	4.88	5	7.04	5	12.82	
Skin incision type	Pfannenstiel	41	100.00	71	100.00	39	100.00	
	UM[d]	0	.00	0	.00	0	.00	
	UM + LM[e]	0	.00	0	.00	0	.00	
Uterine incision type	LST[f]	41	100.00	71	100.00	39	100.00	
	Classic	0	.00	0	.00	0	.00	
Hypogastric artery ligation	No	41	100.00	71	100.00	39	100.00	
	Yes	0	.00	0	.00	0	.00	
Uterine artery ligation	No	41	100.00	71	100.00	37	94.87	0.054
	Yes	0	.00	0	.00	2	5.13	
Balloon tamponade	No	41	100.00	71	100.00	39	100.00	
	Yes	0	.00	0	.00	0	.00	
Abdominal drain	No	40	97.56	71	100.00	37	94.87	0.177
	Yes	1	2.44	0	.00	2	5.13	
Percutaneous drain	No	41	100.00	71	100.00	38	97.44	0.236
	Yes	0	.00	0	.00	1	2.56	
Intraoperative complications	None	41	100.00	71	100.00	37	94.87	0.054
	Intestinal injury	0	0.00	0	.00	0	0.00	
	Bladder injury	0	0.00	0	.00	0	0.00	
	Uterine atony	0	0.00	0	.00	2	5.13	
Postoperative complications	None	41	100.00	68	95.77	35	89.74	0.192
	Surgical site infection	0	.00	3	4.23	3	7.69	
	Fever	0	.00	0	.00	1	2.56	
	Relaparotomy	0	.00	0	.00	0	.00	
	Thromboembolism	0	.00	0	.00	0	.00	
		X̄± SD	**Median**	**X̄± SD**	**Median**	**X̄± SD**	**Median**	
	Postoperative hospital stay (days)	1.88±0.46	2.00	1.99±0.60	2.00	2.38±1.02	2.00	0.014*

Chi-square Test, Kruskal Wallis Test; *p<0.05
[d]Upper midline; [e]Upper midline and Lower midline;[f] Lower segment transverse

When the neonatal data were compared, infant birth weight was determined to be significantly higher in the morbid obese group compared with the normal-weight and obese groups. It was also found to be significantly higher in the obese group compared with the normal-weight group (p<0.05). As neonatal complications, the number of neonates monitored due to respiratory distress was determined to be significantly higher in the morbid obese group (p<0.05). The three groups were not significantly different with regard to 1-minute and 5-minute APGAR scores (p>0.05) (Table 4).

Table 4. Comparison of neonatal data

		BMI						
		Normal-weight		Obese		Morbid obese		p
		n	%	n	%	n	%	
Neonatal complications	None	30	73.17	56	78.87	28	71.79	0.022*
	Respiratory distress-monitoring	10	24.39	4	5.63	10	25.64	
	arly-onset neonatal sepsis	0	.00	3	4.23	1	2.56	
	Respiratory distress syndrome	0	.00	4	5.63	0	.00	

	Normal-weight		Obese		Morbid obese		
	X̄± SD	Median	X̄± SD	Median	X̄± SD	Median	
1-minute APGAR	5.83±1.34	6.00	5,52±.98	6.00	5.59±1.07	6.00	0.189
5-minute APGAR	8.37±.66	8.00	8,15±.75	8.00	8.08±.74	8.00	0.283
Infant birth weight	3069.88±349.06	3075.00	3300.99±418.87	3300.00	3363.41±476.07	3300.00	0.002**

Chi-square Test; Kruskall Wallis Test; *p<0.05;** p<0.01

4. Discussion

Obesity is a significant health problem worldwide and it has been stressed that maternal obesity has a negative impact on pregnancy outcomes, constituting a risk factor for complications such as GDM, infectious morbidity, postpartum hemorrhage, large for gestational age infants, and even stillbirth [9]. Thus, complications associated with obesity need to be identified and prevented. Therefore, the present study aimed to compare the maternal and neonatal outcomes of normal-weight, obese and morbid obese pregnant women who delivered by cesarean section in our clinic preoperatively, intraoperatively, and postoperatively and to discuss our findings in light of current literature data.

In a study conducted by Melchor et al. that compared normal-weight and obese patients, obese patients were determined to have a higher risk of preeclampsia, while there was no difference with regard to GDM. The two groups were not different in terms of preterm delivery, stillbirth, and neonatal mortality. Their study found that the presence of chronic hypertension was significantly higher in the obese group [10]. In a prospective study performed by Tasdemir et al., obese and non-obese patients were compared. Obese patients were determined to have a significantly higher prevalence of GDM and hypertension [11]. In a study conducted in China on 9516 normotensive patients, the risk of preeclampsia was 1.81 times higher in obese pregnant women compared with those that were non-obese. Meanwhile, the risk of preeclampsia was found to be 2.28 times higher in those with excessive gestational weight gain. Moreover, the authors stressed that there was a synergistic relationship between preeclampsia, weight gain during pregnancy, and obesity [12]. Our study also determined the presence of gestational complications to be significantly higher in the morbid obese group when compared with the normal-weight and obese groups. Particularly, we determined the number of GDM and preeclamptic patients to be higher in the morbid obese group. At the same time, the presence of chronic diseases was also found to be significantly higher in the morbid obese group compared with the other groups. The difference of our study from these previous studies is that morbid obese patients were included as well. In line with the literature, we found that gestational complications and the presence of chronic diseases among the patients increased as weight gain increased. With regard to this situation that constitutes a significant risk for maternal and neonatal mortality, we can say that patients should conceive after reaching a normal BMI in the pre-pregnancy period or that their pregnancy should be monitored in consideration of these complications and risks after they conceive.

In a study by Vegel et al. in which obese and non-obese patients who were delivered by cesarean section were compared, obesity was reported to be an independent risk factor for surgical site infections.

No difference was determined between the two groups in terms of the length of stay at the hospital [13]. In a Finnish study, it was reported that obese women had a higher relaparotomy risk compared to women with a BMI of 20-30 kg/ m2, with no difference in terms of intraoperative injuries (organ injuries and lacerations) or bleeding [14]. In our study, only women who delivered by cesarean section were examined. There were first pregnancies as well as repeat pregnancies among those examined. It was found that, as the primary method that is also preferred in the literature, the Pfannenstiel incision was the preferred cesarean section incision method. When the complication rates are considered, the overall number of surgical site infections among all patients was only six (3.97%). There was no significant difference between normal-weight and obese or morbid obese groups in terms of intraoperative complications. Although our study did not observe a difference between the groups with regard to intraoperative complications and the cesarean procedure, the length of postoperative hospital stay in days was significantly higher in the morbid obese group. We think this stems from the fact that we provide adequate postoperative care in our clinic to minimize the occurrence of postoperative complications.

In a study performed by Baser et al., it was found that in obese patients the infant birth weights were higher, the number of macrosomic fetuses was higher and the pH value was lower in neonates. No difference was reported in 1-minute and 5-minute APGAR scores [15]. In the study by Melchor et al., neonatal outcomes; fetal macrosomia, rate of admission to neonatal intensive care unit, and low pH values were determined to be significantly higher in the obese group. However, it was reported that no difference was found in terms of neonatal mortality [10]. In agreement with the studies in the literature, our study determined that infant birth weights and the number of infants monitored for respiratory distress were significantly higher in the morbid obese group and that there was no difference in terms of 1-minute and 5-minute APGAR scores. As understood from these results, in addition to its adverse maternal effects, obesity also has adverse neonatal effects, and thus, we must be attentive to the newborn infants of obese and morbid obese patients as well.

Our study is superior to others in that it was performed at a tertiary hospital and that we differentiated the patients as normal-weight, obese, and morbid obese, comparing them in three groups. The limitation of our study is that we accessed our data via the hospital records system and the amount of weight gain during pregnancy could not be obtained. Another limitation of our study is that only patients who were delivered by cesarean section were included and cesarean section is performed by different specialists in our clinic.

5. Conclusion

Maternal obesity is closely associated with complications that have an adverse impact on maternal and neonatal health during pregnancy. For protection against the negative effects of maternal obesity on maternal and neonatal health, it is needed to regulate maternal diet during pregnancy and ensure weight gain at a recommended level. For protection against pregnancy complications, obese women should be recommended to lose weight before pregnancy in a planned manner and conceive after they reach the ideal weight limits. For this purpose, we would like to stress the importance of informing obese women with respect to an adequate, balanced diet and weight control starting from pre-pregnancy, screening them for complications that may occur during pregnancy, and providing close and stringent follow-up.

Ethical Statements: This study was granted approval by Dicle University Faculty of Medicine Ethics Committee (Date: 07.05.2020, Number: 154).

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Authors' Contributions:

A.A: Conceptualization, Methodology, Formal analysis, Writing - Original draft preparation (%40)

R.G: Conceptualization, Writing - Original draft preparation, Investigation (%15)
F.M.F: Conceptualization, Methodology, Formal analysis (%10)
R.B: Conceptualization, Investigation (%10)
S.Y.T: Conceptualization, Methodology, Investigation (%15)
T.G: Conceptualization, Investigation (%10).
All authors read and approved the final manuscript.

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