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RESEARCH ARTICLE

Maternal Obesity and Postpartum Hemorrhage in Women Undergoing Cesarean Delivery: A Retrospective Cohort Study

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ABSTRACT

Objective: Postpartum hemorrhage (PPH) is one of the most common causes of maternal death. Our objective was to determine whether an association exists between maternal obesity and increased risk of PPH.

Materials and Methods: Women who underwent cesarean delivery between July 2022 and June 2023 were evaluated retrospectively. The patients were divided into two groups according to their body mass index (BMI): Group 1 had a BMI ≥30 kg/m² (n=82), and Group 2 had a BMI <30 kg/m² (n=109). Demographic features, duration and mode of placental separation, and amount of PPH were recorded. To measure blood loss, the weight of surgical gauze sponges used during the procedure and the volume of blood aspirated via surgical suction were recorded.

Results: Postpartum blood loss was compared between the groups, but the difference was not statistically significant. Obesity is often considered a risk factor for PPH. Our study did not provide supporting data regarding the increased risk of obesity. Risk assessment scores for PPH have been proposed, but many women who experience severe hemorrhage have scores indicating a low risk.

Conclusion: Obesity is a risk factor for many obstetric complications; therefore, clinicians should be more alert. Nevertheless, obstetricians should be prepared for PPH regardless of the BMI of the pregnant individual.

Keywords: Cesarean delivery, obesity, postpartum hemorrhage, pregnancy

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INTRODUCTION

Approximately 3–5% of all deliveries are complicated by postpartum hemorrhage (PPH).[1,2] Approximately 15% of maternal deaths worldwide are due to obstetric hemorrhage.[3] Recently, the incidence of PPH has increased in developed countries.[2] Kramer et al.[4] partly explained this increase by the induction and augmentation of labor and cesarean section. Multiple pregnancies, chorioamnionitis, and operative delivery are known risk factors for PPH.[5] Previous studies have suggested that maternal obesity is a risk factor. According to a population-based cohort study in Sweden, maternal obesity is associated with a slightly increased risk of PPH.[6] Another study from the United Kingdom also suggested that the increased risk of PPH can be attributed to maternal obesity.[7]

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Studies have suggested that more than half of pregnant women in the United States are overweight or obese.[8] Obesity is associated with adverse pregnancy outcomes. Maternal death, gestational diabetes, preeclampsia, and an increased rate of cesarean sections are among them.[9] Because the incidence of PPH is increasing, researchers have hypothesized an association between obesity and an increased risk of PPH. Population-based studies from Sweden and the United Kingdom have confirmed the existence of an association.[6,7] However, one study suggested that maternal obesity decreases the risk of PPH and has a protective effect.[10] Other studies have reported no association between maternal obesity and PPH.[11] An inconsistency in this subject is apparent.

The risk of PPH is not the same for each delivery mode.[2] Surgical morbidity and tissue injury are more probable in obese women than in those with a lower body mass index (BMI).[12] Therefore, it would not be wrong to expect a greater risk for PPH in obese women undergoing cesarean section than in women with similar BMI undergoing vaginal delivery. This finding alone does not indicate an increased risk of PPH in obese women. An association exists between obesity and increased rates of cesarean section, preeclampsia, and magnesium sulfate use.[13] This association may explain the increased risk of hemorrhage in obese women. Obesity is a known risk factor for thrombosis.[14] A BMI greater than 30 kg/m² was associated with higher serum concentrations of fibrinogen,[15] and Charbit et al.[16] found that fibrinogen levels can be used to differentiate between severe and non-severe PPH. Paglia et al.[10] argued that the increased fibrinogen level and accompanying hypercoagulability might modify the risk of severe PPH.

PPH is a potentially life-threatening complication; therefore, it is important to establish the risk factors with precautions. To investigate obesity as a potential risk factor for PPH, we aimed to compare postpartum blood loss in obese and non-obese women who underwent term delivery with cesarean section.

MATERIALS and METHODS

This retrospective cohort study was conducted at a tertiary referral hospital in Istanbul, Türkiye. The study was approved by the institution's ethics committee (No: 4070/29.08.2023), and patients had signed informed consent forms at admission, permitting the use of their data for research provided their identity was concealed. Informed consent was part of the standard admission procedure because the institution was a teaching hospital. This study was conducted in accordance with the principles of the Declaration of Helsinki.

Data were obtained from the institution's patient database. A total of 191 patients were included in the study. Patients who underwent cesarean delivery between July 2022 and June 2023 were included. Exclusion criteria were previous diagnosis of placental invasion anomalies and placenta previa. The demographic features, duration and mode of placental separation, amount of PPH, and complications were recorded. To measure blood loss during PPH, the quantity and weight (in grams) of surgical gauze sponges that were used, and the volume of blood aspirated with surgical suction were recorded. Patients with incomplete records in the database were excluded from the study.

Patients were divided into two groups. Group 1 consisted of women with a BMI ≥30 kg/m² (n=82), and Group 2 included women with a BMI <30 kg/m² (n=109). The BMI of the patient was calculated according to anthropometric measurements made at the time of pregnancy diagnosis, which was no later than the eighth week of gestation.

A power analysis was conducted using G*Power version 3.1.9.7,[17] and a minimum sample size of n=185 was calculated (α=0.05 and Power=0.80). Age, gestational age at delivery, gravidity, parity, abortion, preoperative hematocrit level, duration of surgery, change in hematocrit after surgery, volume of blood aspirated with surgical suction, weight of gauze sponges, and duration of placental separation were recorded and compared for each group.

Statistical Analysis

Data analysis was performed with SPSS (Version 20.0; SPSS Inc., Chicago, IL, USA). The Kolmogorov–Smirnov normality test was used to assess the distribution. Normally distributed parameters were compared using the independent samples t-test, whereas non-normally distributed parameters were compared using the Mann–Whitney U test. The mode of placental separation was expressed as percentages for spontaneous and manual separation; the comparison of the groups was performed using the χ^2 test. A value of $p<0.05$ was considered statistically significant.

We used ChatGPT-4 (OpenAI, USA) for language revision and grammatical editing to improve the clarity and readability of the manuscript.

RESULTS

The clinical characteristics and BMIs of the patients were examined. The gestational age at delivery, gravidity, parity, abortion, and preoperative hematocrit levels were similar. The mean age of the higher BMI group was significantly higher than that of the other group (p=0.04). The parameters are listed in Table 1.

Table 1. Comparison of clinical characteristics and BMI

Maternal measures	Group 1 BMI ≥30 (n=82)	Group 2 BMI <30 (n=109)	p
Age (mean±SD)	30.3±5.4	28.6±5.9	0.040^
Gestational age at delivery (mean±SD)	37.7±1.9	37.7±2.4	0.170^^
Gravidity (mean±SD)	3.1±1.6	2.9±1.5	0.305^^
Parity (mean±SD)	1.7±1.3	1.6±1.2	0.685^^
Abortions (mean±SD)	0.4±0.7	0.3±0.5	0.299^^
Preoperative hematocrit value (percent) (mean±SD)	34.1±3.0	33.9±3.5	0.769^

^: Independent samples t test; ^^: Mann Whitney U test; p<0.05. BMI: Body mass index; SD: Standard deviation

Table 2. Comparison of delivery measures and BMI

Delivery measures	Group 1 BMI ≥30 (n=82)	Group 2 BMI <30 (n=109)	p
Duration of surgery (mean±SD)	37.8±12.2	36.5±12.9	0.375
Change in hematocrit value (mean±SD)	4.0±2.5	4.1±2.7	0.635
Volume of blood aspirated with surgical suction (mL) (mean±SD)	118.8±106.9	101.4±76.8	0.623
Weight of blood in gauze sponges (grams) (mean±SD)	776.7±402.6	770.2±343.1	0.795
Duration of placental separation (seconds) (mean±SD)	17.2±6.8	19.0±8.0	0.187

Mann Whitney U test; p<0.05. BMI: Body mass index; SD: Standard deviation

The duration of surgery (37.8±12.2 vs. 36.5±12.9, p=0.375), change in hematocrit (postoperative sample taken 4 hours after surgery) (4.0±2.5 vs. 4.1±2.7, p=0.635), aspirated blood volume (mL) with surgical suction (118.8±106.9 vs. 101.4±76.8, p=0.623), weight (g) of gauze sponges used in surgery (776.7±402.6 vs. 770.2±343.1, p=0.795), and duration (s) of placental separation (17.2±6.8 vs. 19.0±8.0, p=0.187) were compared. No statistically significant differences in these parameters were found between the groups (Table 2).

Finally, we assessed the potential effect of obesity on placental separation. In the high BMI group, placental separation was spontaneous in 39% of the patients, whereas manual intervention was required in 69% of the patients. In the other group, the percentages were 37.6% for spontaneous and 62.4% for manual. These differences were not statistically significant (Table 3).

Table 3. Comparison of the mode of placental separation between the study groups

	Mode of placental separation (Spontaneous)		Mode of placental separation (Manual)		p
	n	%	n	%	
Group 1					0.843
BMI ≥30	32	39	50	61	
Group 2					
BMI <30	41	37.6	68	62.4	

χ^2 test; p<0.05. BMI: Body mass index

DISCUSSION

Obesity is one of the most common public health concerns worldwide. The frequency of obesity is increasing; therefore, its associated diseases are becoming more common. From an obstetrician's perspective, obesity raises concerns owing to its association with various pregnancy complications, such as preeclampsia and gestational diabetes.[18] However, there isn't a consensus on whether obesity is a risk factor for PPH. Although some studies have reported an association,[6] in this study, we did not observe any significant differences in terms of blood loss between the high and low BMI groups.

There are conflicting findings in the literature regarding the association between obesity and PPH. Our study design aimed at testing this association, and we expected greater blood loss and longer duration of surgery in the high BMI group than in the lower BMI group. However, our findings suggested otherwise. Our data were in parallel with those studies that did not attribute a higher risk of PPH to obese patients.[10] The volume of blood aspirated with surgical suction and the weight of

gauze sponges were used to assess blood loss during surgery, and the differences between groups were not statistically significant, although a minimal increase was seen in both parameters in the high BMI group. This finding supports the idea that obesity alone is not a risk factor for PPH when delivery mode is controlled.[10] According to a review by Holly et al.,[19] obesity alone showed no association with atonic PPH, and they argued that underlying conditions, such as hypertension and diabetes mellitus, constitute the real risk. Additionally, although statistically insignificant, the change in hematocrit was lower in the high BMI group. This may be due to hypercoagulability in obese patients, as suggested by Paglia et al.[10]

Conner et al.[20] investigated the effect of obesity on the "incision-to-delivery" interval and demonstrated an association between increased BMI and increased skin incision-to-delivery time. In our study, the duration of surgery was slightly longer in the high BMI group; however, the difference was not statistically significant. Furthermore, the duration of placental separation was also assessed in our study. However, again the difference was insignificant between the high and low BMI groups.

Placental adherence abnormalities and invasion of the villous tissue into the myometrium prevent spontaneous separation of the placenta from the uterine wall at delivery. When not diagnosed during prenatal examinations, manual removal of the placenta can cause heavy hemorrhage from the uteroplacental vascular structures during delivery.[21] Vieira et al.[22] studied the placenta accreta spectrum (PAS) regarding its potential association with maternal obesity, and a database study reported that obesity was neither an independent risk factor for PAS nor associated with the severity of PAS. Apart from the duration of placental separation, we did not report a significant difference between the groups due to the mode of placental separation (spontaneous or manual).

Our study has several limitations. First, the patients were operated on by different surgical teams because the institution is one of the largest teaching hospitals in the region. Therefore, surgical teams with different levels of experience may have affected our findings. For example, lean patients may be perceived as technically easier to operate on, potentially leading to the inclusion of a relatively inexperienced obstetric resident in the surgical team. This may have lengthened the duration of surgery and therefore affected the blood loss parameters in the low BMI group. Although each surgical team was required to include at least one specialist and experienced attending surgeon, we could not completely rule out this confounding factor.

Second, the retrospective nature and sample size of the study also pose limitations. However, since this was a single-center study, all recorded data for each patient, including the surgical reports on surgical gauze weight and aspirated fluid, were standardized, which allowed a healthy comparison. Additionally, only a limited number of studies have investigated the effect of maternal obesity on the risk of PPH while accounting for the mode of delivery. Our study specifically focused on cesarean deliveries, which is one of its strengths.

The findings of this study may make obesity seem innocent regarding pregnancy-related complications. However, this is certainly not the case. Obesity can complicate pregnancy and delivery in multiple ways. Opøien et al.[23] found that BMI >30 kg/m^2 was an independent risk factor for post-cesarean surgical site infections. The risks of gestational diabetes and preeclampsia are also associated with obesity.[18] The risk of stillbirth, which is one of the most serious complications of pregnancy, has also been reported to be associated with maternal obesity.[24]

CONCLUSION

In conclusion, the lack of an association between obesity and PPH should not lead obstetricians to undermine obesity as a risk factor in prenatal care. Our results contribute to the literature by reinforcing the notion that obesity alone is not an independent risk factor for PPH. However, extra care should still be given to obese patients both prenatally and during delivery.

Disclosures

Ethics Committee Approval: The study was approved by the University of Health Sciences, İstanbul Şişli Hamidiye Etfal Training and Research Hospital Clinical Research Ethics Committee (No: 4070, Date: 29/08/2023).

Informed Consent: Informed consent was part of the standard admission procedure because the institution was a teaching hospital.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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