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The Impact of Prior Obesity Surgery on Bleeding after Abdominal Body Contouring Surgery

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Background: Body contouring surgery removes excess skin and fat, often after massive weight loss. Some reports suggest that patients who have previously undergone obesity (bariatric) surgery are at excess risk of subsequent bleeding, possibly due to complex nutritional and metabolic sequelae of massive weight loss.
Methods: A retrospective cohort study of intraoperative blood loss and postoperative bleeding indicators were examined for patients who had undergone abdominoplasty. Participants were categorized based on their history of previous obesity surgery, and outcome variables were compared using odds ratio, followed by subgroup comparison between a history of restrictive versus malabsorptive obesity surgery,
Results: The study included 472 patients, of which 171 (36.2 %) had a history of obesity surgery. Mean age was 40.4 years, and 402 (85.1%) participant were women. Fifty-five (11.6%) patients were smokers whereas 65 (13.7%) were hypertensive. Mean body mass index before surgery was 30.2 kg per m^2, and average time between obesity and body contouring surgery (if applicable) was 35.8 months. Patients with a history of obesity surgery exhibited greater intraoperative blood loss (162.2 mL versus 132.1 mL; $P = 0.001$), drainage volume at 24 h (155 mL versus 135 mL; $P = 0.001$), and total drainage volume (300ml versus 220 mL; $P = 0.001$). Postoperative hematoma requiring surgical re-exploration was almost three times higher following a history of obesity surgery (4.7% versus 1.7 %; $P = 0.05$).
Conclusions: History of obesity surgery increases intraoperative blood loss, postoperative serosanguinous drainage volumes, and the risk of postoperative hematoma requiring surgical evacuation after abdominal body contouring procedures.
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INTRODUCTION

The obesity pandemic has fueled the development of, and demand for, bariatric surgery. Options are numerous and may be categorized as purely restrictive (gastric banding, sleeve gastrectomy), purely malabsorptive (jejunal bypass), more restrictive than malabsorptive (Roux-en-Y bypass), more malabsorptive than restrictive (biliopancreatic diversion) and appetite suppressive (implantable gastric stimulation).[1] Although the consequences of massive weight gain are well documented, the complex legacy of massive weight loss following obesity surgery is relatively neglected. One troublesome feature of massive weight loss is redundant skin. This has fueled the development of another specialty interest, collectively known as body contouring surgery. Procedures described for the removal of redundant skin and residual fat following massive weight loss (by natural or surgical means), changes in body habitus with age and following pregnancy include abdominoplasty, belt lipectomy, brachioplasty, and thigh lift.

Obesity is strongly linked to hypercoagulability, mainly due to associated inflammation and impairment of fibrinolysis.[2] In contrast, obesity surgery induces an antithrombotic shift.[3] This shift has been explained by several mechanisms, including decreased circulating inflammatory (and thrombogenic) adipokines due to fat mass reduction,[4] lower liver-derived proteins essential for factor

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VIII activity (FVIII),[3] decreased synthesis of plasminogen activator inhibitor 1 (PAI-1)[5] and lower plasma levels of endothelial-derived Von Willebrand factor.[6] Moreover, excess adipose tissue deposition drives the formation of a vascular tree to accommodate the associated perfusion requirements, and these vessels (more numerous and of larger caliber) persist even after loss of volume of adipose tissue. It has therefore been postulated that patients who have previously undergone bariatric surgery may have an increased risk of bleeding and hematoma formation following subsequent surgery, including body contouring surgery. The aim of this study was to evaluate the impact of prior obesity surgery on risk of bleeding during and after abdominal body contouring surgery.

Takeaways

Question: How does a history of obesity surgery affect risk of bleeding after body contouring surgery?

Findings: History of obesity surgery increases intraoperative blood loss, postoperative drainage volumes, and the risk of postoperative hematoma requiring surgical evacuation after abdominal body contouring procedures.

Meaning: Patients with a history of obesity surgery require special attention and education about their increased risk of bleeding during body contouring procedures.

METHODS

Study Design and Participants

A retrospective cohort study was designed to examine the independent impact of prior obesity surgery on risk of bleeding during and after abdominal body contouring surgery (dermo lipectomy and lower body lift), by comparing intraoperative blood loss volume as well as postoperative drain output and quality, hemoglobin drop, the need for transfusion, hospital stay, and risk of re-exploration surgery for evacuation of hematoma. This was done at a single hospital by multiple surgeons using similar surgical techniques and perioperative management protocols. Each patient was identified and marked in the preoperative areas, with a large ellipse skin pattern encompassing the abdominal pannus, just superior to the umbilicus. The upper incision was made, and an abdominoplasty flap was raised. The inferior incision was made just inferior to the pannicular crease. Then, the pannus was resected and lifted from the abdominal wall, leaving a small amount of fat and areolar tissue attached to the fascia. Liga-clips and electrocautery were used for hemostasis of the abdominal perforators. Rectus diastasis was corrected using O-Vicryl figure-of-eight sutures and O-PDS looped running sutures. Average abdominal flaps weight removed was 2300 g (range 1200–3500) g. The average time of surgery was 125 minutes (range 95–160 min). The intraoperative blood loss was evaluated by the surgeons and the anesthesiologist based on the visual estimation method by measuring blood loss in the suction canisters and approximation of blood loss amount in surgical sponges and drapes. Although the estimation method represents the most commonly used technique, it tends to underestimate intraoperative blood loss when compared with the more accurate formula estimation method.[7]

Inclusion Criteria

Both male and female patients aged between 20 and 60 years old were included. As obesity causes a pro-inflammatory state[8] and the association between inflammation and hemostasis is well established,[9] patients were included when weight was stable for at least 6 months before the procedure. A minimum of 2 years was required between bariatric surgery and body contouring procedure to ensure equilibrium of the physiologic baseline.

Exclusion Criteria

Patients were excluded if weight was unstable in the 6 months before surgery. Patients diagnosed with a bleeding disorder and patients taking antiplatelet and/or anticoagulant medication were excluded. The study excluded other malabsorptive conditions and an underweight population (defined as BMI below 18 kg/m^2). Patients who underwent surgical procedures other than abdominoplasty or belt lipectomy, including additional procedures at the same time, were also excluded. Patients with a history of bariatric surgery less than 2 years were excluded as well. None of the patients received tranexamic acid during their hospital stay.

Data Collection

Demographic data collected on each patient included age at surgery; gender; smoking status; premorbid health, including coagulopathy and hypertension; medication history; body mass index (BMI) before and after obesity surgery; time between obesity and body contouring surgery (if applicable); type of obesity (restrictive versus malabsorptive); and type of body contouring surgery (abdominoplasty or belt lipectomy). Further data sets collected included pre- and postoperative complete blood count, the average number of units given for those who required intra- and postoperative blood and blood products (fresh frozen plasma or platelets), drain output, length of hospital stay, and take back to the operative room or readmission for hematoma evacuation.

Statistical Methods

Data were presented as proportions, medians (range), or mean (±SD) as appropriate. Differences in categorical variables were analyzed using the chi-square test, as appropriate. Yates' corrected chi-square was used for categorical variables if the expected cell frequencies were below 5. Continuous variables were compared using Student *t* test for parametric data, and Mann–Whitney U test was used for nonparametric data, where applicable. Multivariate logistic regression analysis was performed for the predictors after adjusting for the most relevant covariates such as age, gender, smoking, re-exploration surgery, blood loss intraoperatively, drain output first during 24 hours, and total drain output. Subanalyses

were performed on the method of bariatric surgery performed and were divided into "restrictive" and "malabsorptive." Gastric banding and Roux-en-Y bypass procedures were classed as mainly restrictive, whereas biliopancreatic diversion and jejunal bypass were classed as mainly malabsorptive. Data were presented as adjusted odds ratio along with 95% confidence interval for these two models. A two-tailed *P* value of less than 0.05 was considered statistically significant. Data analysis was carried out using the Statistical Package for Social Sciences version 22 (SPSS Inc., Chicago, Ill.).

RESULTS

Study and Patient Characteristics

A total of 472 patients were included in this study of which 171 (36.2 %) had a history of obesity surgery. Patient characteristics are shown in (Table 1). The mean age for patients who underwent obesity surgery was 36.9 compared with a mean age of 42.4 for patients who have not had any bariatric surgery ($P = 0.001$). One hundred twenty-six obesity surgery patients (73.7%) were women compared with 276 female patients (91.7%) in the other group ($P = 0.001$). Thirty-three obesity surgery patients were smokers (20.5%) compared with 22 (8%) nonobesity surgery patients who were smokers ($P = 0.001$). There were no significant differences in mean BMI before body contouring surgery, or prevalence of hypertension.

Bleeding-related Outcomes

Patients with a history of obesity surgery (restrictive or malabsorptive) exhibited greater intraoperative blood loss (162.2 mL versus 132.1 mL; $P = 0.001$) and greater drainage volumes at 24 hours (155 mL versus 135 mL; $P = 0.001$), and in total (300ml versus 220 mL; $P = 0.001$) as well as almost three times the incidence of perioperative hematoma requiring surgical re-exploration (4.7% versus 1.7%; $P = 0.05$). No statistically significant differences were noted in hemoglobin drop (at postoperative day 1 and at discharge), transfusion requirements (blood units or fresh frozen plasma), time of drain output conversion to serosanguinous, length of stay, or readmission rate between the groups (Table 2).

Restrictive versus Malabsorptive Obesity Surgery

Among patients with a history of obesity surgery, 155 (90.6%) underwent a restrictive procedure (most commonly sleeve gastrectomy) and 16 (9.4%) underwent a malabsorptive procedure (gastric bypass surgery). Average time between restrictive and body contouring surgery was 34.9 months and 44.6 months in the case of malabsorptive surgery. When comparing the collected bleeding outcomes, there was no statistical difference between the two groups in terms of intraoperative blood loss, hemoglobin drop, drain output, transfusion requirements, surgical re-exploration, and length of stay. The obesity surgery patient cohorts are summarized in Table 3.

Table 1. Characteristics of Participants

Patient Characteristics	Patients with a History of Obesity Surgery (n = 171)	Patients without a History of Obesity Surgery (n = 301)	*P*
Age, y (mean ± SD)	36.9±9.9	42.4±9.2	0.001
Male gender	45 (26.3%)	25 (8.3%)	0.001
Female gender	126 (73.7%)	276 (91.7%)	
Smoking	33 (20.5%)	22 (8.0%)	0.001
BMI before body contouring surgery (mean ± SD)	30.3±5.1	30.2±4.4	0.84
Hypertension	20 (11.7%)	45 (15.0%)	0.32
Time between obesity surgery and body contouring surgery (mean ± SD)	35.8±20.9	—	—

Table 2. Comparison between Patients with or without History of Obesity Surgery

	Patients with History of Obesity Surgery (n = 171)	Patients without History of Obesity Surgery (n = 301)	*P*
Blood loss intraoperatively in mL (mean ± SD)	162.2±81.5	132.1±57.6	0.001
Drain output first 24 h (mL) (median, range)	155 (10–2250)	135 (15–1150)	0.001
Total drain output (mL) (median, range)	300 (20–3700)	220 (4–2000)	0.001
Re-exploration surgery for hematoma	8 (4.7%)	5 (1.7%)	0.05
Hemoglobin drop at postoperative day 1 (mean ± SD)	1.79±1.42	1.52±1.20	0.08
Hemoglobin drop at discharge (mean ± SD)	1.99±1.42	1.66±1.20	0.09
Units of blood transfusion (mean ± SD)	2.3±1.0	1.9±0.4	0.25
Fresh frozen plasma units (mean ± SD)	3.6±1.7	3.0±1.1	0.56
Days of bloody drain (median, range)	1 (1–9)	1 (1–12)	0.61
Length of stay (median, range)	4 (1–17)	4 (1–16)	0.50
Readmission rate due to bleeding complications	0 (0.0%)	1 (0.3%)	0.45

Table 3. Comparison between Restrictive and Malabsorptive Obesity Surgery

	Restrictive Obesity Surgery (n = 155)	Malabsorptive Obesity Surgery (n = 16)	*P*
Age, y (mean ± SD)	36.6±9.9	39.8±8.6	0.22
Gender			
Male	41 (26.5%)	4 (25.0%)	0.90
Female	114 (73.5%)	12 (75.0%)	
BMI before body contouring surgery (mean ± SD)	30.2±5.1	30.7±4.9	0.71
Smoking	31 (21.2%)	2 (13.3%)	0.47
Hypertension	14 (9.0%)	6 (37.5%)	0.001
Time b/w bariatric and plastic (mean ± SD)	34.9±20.3	44.6±25.4	0.09
Blood loss intraoperatively (mL) (mean ± SD)	163.0±83.7	154.7±57.9	0.69
Drain output first 24 h (mL) (median, range)	155 (10–2250)	200 (60–500)	0.21
Total drain output (mL) (median, range)	300 (20–3700)	600 (100–2300)	0.09
Days of bloody drain (median, range)	1 (1–9)	1 (1–2)	0.81
First day hemoglobin drop (mean ± SD)	1.73±1.41	2.29±1.44	0.20
Hemoglobin drop at discharge (mean ± SD)	1.99±1.47	2.05±1.12	0.90
Units of blood transfusion (mean ± SD)	1.7±1.0	1.7±0.6	0.17
Fresh frozen plasma units (mean ± SD)	3.7±1.8	3.0±1.4	0.62
Length of stay (median, range)	4 (1–17)	5 (3–11)	0.12
Re-exploration surgery for hematoma	8 (5.2%)	0 (0.0%)	0.35

DISCUSSION

Patients who underwent obesity surgery before body contouring procedures represent a unique population with a distinctive metabolic and physiological profile.[10] This study, comprising 472 patients who had undergone abdominoplasty or belt lipectomy following massive weight loss, found that when the cause of the weight loss was bariatric surgery (rather than diet and exercise), patients experienced a significantly higher risk of intraoperative blood loss, significantly higher serosanguinous surgical drain outputs, and a significantly greater incidence of perioperative hematoma requiring surgical evacuation.

The existing literature is divided on the subject, with Sadeghi et al[11]and Hasanbegovic et al[12] reporting that a history of obesity surgery was associated with a higher risk of complications (up to 60% higher risk) after subsequent body contouring surgery, especially in relation to seroma formation and bleeding, whereas Souto et al,[13] in a small series of 20 patients, found no difference between the two groups. A systematic review and metaanalysis by Marouf and Mortada[14] found that history of obesity surgery was associated with 37% increased risk of complication in those with a BMI of 30 kg per m^2 or more before body contouring surgery, and this was correlated with the amount of resected tissue; however, it has been shown that the resulting bleeding complications were only intraoperatively and that no other complications were noted postoperatively.

This study provides robust and comprehensive evidence on the impact of prior obesity surgery on bleeding risk during and after abdominal body contouring procedures. Our retrospective cohort study relied on eleven measures of both intraoperative and postoperative bleeding-related outcomes. This includes blood loss intraoperatively, drain output amount and quality (bloody versus serosanguinous), postoperative hemoglobin changes, transfusion requirements (blood or blood products), length of stay, and re-exploration/readmission due to hematoma. Although most related studies relied on one or two outcomes and focused mainly on life-threatening measures like need for re-operation or need for blood transfusion.[15] This study also provides valuable data regarding a demographic that is under-represented in the literature.

It seems that history of massive weight loss by surgical means (both restrictive and malabsorptive) results in an antithrombotic physiological state that can last for years after obesity surgery. The observed difference in intraoperative blood loss might not be clinically significant enough to result in a hemoglobin level drop after surgery. However, this finding, along with the other observations of higher drain output and risk of exploration for hematoma evacuation, has important implications for the consent process and informs surgeons of the need to observe meticulous hemostasis and consideration of the use of tranexamic acid intraoperatively, as has been shown to be helpful in other surgical areas.[16,17] The mechanism behind this increased risk is still unclear, but could be physiologic or simply anatomic variance, as these patients have larger blood vessel diameter correspondent to their BMI status before obesity surgery. This article bears some limitations, being a retrospective study with potential missing information. Future prospective studies will focus on understanding the root causes of this observed phenomenon.

CONCLUSIONS

Patients undergoing abdominal body contouring procedures with a history of obesity surgery require special consideration because they exhibit greater intraoperative blood loss, higher serosanguinous drain outputs, and higher rates of postoperative hematoma requiring surgical evacuation.

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DISCLOSURES

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