

# Emesis as a Risk Factor for Postoperative Hematoma in Abdominoplasty: A Retrospective Study in 189 Cases

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**Background:** Among aesthetic procedures, abdominoplasty is associated with an increased complication rate. In general, postoperative nausea and vomiting is frequently experienced. As vomiting increases the intraabdominal pressure and blood pressure, and results in an increased mechanical friction on the abdominal wall, intraoperatively ligated vessels are prone to reopen. However, previous studies have not investigated the impact of postoperative emesis on postoperative hematoma in patients undergoing abdominoplasty.

**Methods:** We performed a retrospective analysis on all patients who underwent abdominoplasty between 2017 and 2019 in our institution. Patients were divided into two groups, group 1 including patients experiencing postoperative vomiting and group two including patients without postoperative vomiting. Data extraction focused on patient characteristics, intraoperative characteristics, and postoperative complications, particularly the proportion of patients developing postoperative hematoma. Finally, statistical analysis was performed to analyze the impact of postoperative vomiting on the risk to develop a postoperative hematoma.

**Results:** We identified 189 patients fitting our inclusion criteria. Overall, the proportion of postoperative hematoma was 13.7%. Thereby, a statistically significant difference was found between both groups: 62.5% of patients in group 1 (vomiting group) and only 9.25% in group 2 (nonvomiting group) developed a postoperative hematoma [odds ratio: 16.4 (95% confidence interval, 5.3–50.9),  $P < 0.000001$ ].

**Conclusion:** In patients undergoing abdominoplasty, postoperative vomiting increases the risk to develop a postoperative hematoma. (*Plast Reconstr Surg Glob Open* 2024; 12:e5969; doi: [10.1097/GOX.0000000000005969](https://doi.org/10.1097/GOX.0000000000005969); Published online 16 July 2024.)

## INTRODUCTION

Abdominoplasty is a body-contouring procedure with the objective of functional and aesthetic improvement. Compared with other aesthetic procedures, abdominoplasty is associated with a higher complication rate.<sup>1</sup> Complications can be divided into minor and major complications. Thereby, major complications can be defined as the occurrence of venous thrombosis/pulmonary embolism, or complications such as seroma, hematoma and infections needing additional interventions such as

aspiration, evacuation, or antibiotics. Minor complications can be roughly defined as seroma and hematoma not requiring a reintervention in addition to fat or umbilical necrosis, stitch abscess, wound dehiscence, and hypertrophic scars.<sup>2</sup> The reported incidence of hematoma greatly varies among studies and ranges from 1.3% to 16%.<sup>1–3</sup> However, the severity of symptoms depends on the blood volume lost. Although minimal hematoma can stay asymptomatic, active bleeding can result in hemodynamic instability and hypovolemic shock.

Postoperative nausea and vomiting (PONV) is a common condition affecting approximately 30% of patients undergoing surgery.<sup>4</sup> The physiology of retching and vomiting is associated with an increase in intraabdominal pressure<sup>5</sup> and blood pressure<sup>6</sup> in addition to an increased mechanical friction on the abdominal wall. The incidence of postoperative cervical hematoma in patients undergoing thyroidectomy did not seem to be increased due to postoperative vomiting.<sup>7</sup>

However, in abdominoplasty, the impact of postoperative vomiting on the risk to develop a postoperative hematoma has not been investigated yet. We believe that

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Received for publication March 14, 2024; accepted May 14, 2024.

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DOI: [10.1097/GOX.0000000000005969](https://doi.org/10.1097/GOX.0000000000005969)

Disclosure statements are at the end of this article, following the correspondence information.

the distinct combination of forces, especially the mechanical friction on the abdominal wall, increases the risk to develop a postoperative hematoma in patients undergoing abdominoplasty. In this study, we aimed to analyze whether vomiting is an independent risk factor for postoperative hematoma after abdominoplasty.

## PATIENTS AND METHODS

### Data Extraction

We conducted a single center retrospective cohort study and reviewed all medical files of abdominoplasty cases treated between January 2017 and December 2019. The study was conducted in accordance with the principles outlined in the Declaration of Helsinki. All patients undergoing abdominoplasty with or without a concomitant liposuction or combination surgery were included, whereas those undergoing a DIEP-flap harvest were excluded. We retrieved patient demographic data, including age, gender, current body mass index (BMI), preoperative weight loss, and whether a previous bariatric surgery has been undergone. In addition, comorbidities, such as anticoagulation, diabetes mellitus, smoking status, and previous PONV, have been obtained. Furthermore, intraoperative data, including amount of tissue removed, type of anesthesia, and whether PTS or quilting sutures were used, were extracted. In addition, we noted whether abdominoplasty was combined with abdominal liposuction or an additional surgery like arm/thigh lift and breast procedures.

Postoperative data of complications, primarily hematoma and secondarily seroma, infection, and wound healing problems, during the time of hospitalization was retrieved. Postoperative nursing reports were thoroughly screened to detect documented postoperative nausea and vomiting.

### Surgical Technique

A standard abdominoplasty under general anesthesia according to the Pitanguy technique was performed in all patients. All patients received muscle relaxants. After the area has been washed and covered in a sterile manner, the lower abdomen was incised transversely. Then the adipocutaneous flap was undermined starting at the incision line and extending cranially to the xyphoid-costal arch. After excessive tissue was excised, the umbilicus was repositioned. If necessary, we placed plication sutures for rectus muscle diastasis along the midline, reaching from the xiphoid to the pubis. According to the surgeon's preference, progressive tension sutures (PTS) or quilting sutures were used. The abdominoplasty was combined with contouring liposuction or other procedures, including upper thigh or arm lift and breast surgery (eg, mastopexy) according to patient's wishes.

### Perioperative Management

Preoperative PONV risk stratification was done according to Apfel risk score. Thereby, patients are stratified into three risk categories, "low," "medium," and "high," corresponding to the number of risk factors, 0–1, 2, and 3–4, respectively<sup>8</sup> (Table 1).

### Takeaways

**Question:** Is the risk to develop a postoperative hematoma after abdominoplasty increased in patients who experience postoperative vomiting?

**Findings:** We found that patients who experienced postoperative vomiting after abdominoplasty had a statistically significantly higher risk to develop a postoperative hematoma.

**Meaning:** Postoperative vomiting is an independent risk factor to develop a postoperative hematoma after abdominoplasty.

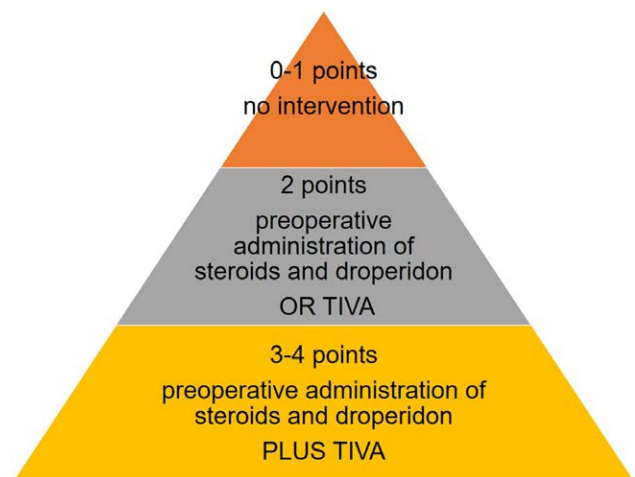
In our institution, patients with two or more risk factors are administered steroids and droperidol perioperatively, or anesthesia is changed to total intravenous anesthesia (TIVA) to prevent PONV. If three or more points are present, TIVA is performed as a standard anesthesia in addition to the administration of steroids and droperidol (Fig. 1).

Postoperatively, patients were advocated to strict bed rest and were placed in a modified Fowler's position for the first 24 hours after surgery. In addition, patients were required to wear an abdominal binder and avoid

**Table 1. Preoperative PONV Risk Stratification According to the Apfel Risk Score<sup>8</sup>**

Risk Factors	Points
Female gender	1
Nonsmoker	1
History of PONV or motions sickness	1
Postoperative opioids	1
Sum	0–4

Table 1 was reused with permission of the American Society for Enhanced Recovery and Perioperative Medicine.<sup>15</sup>



**Fig. 1.** This figure represents the postoperative nausea and vomiting prophylaxis algorithm in our institution according the Apfel risk stratification. Additional independent recommendations are (1) use local instead of general anesthesia, (2) limit the use of propofol for anesthesia induction and maintenance, (3) limit the use of volatile anesthesia, (4) limit the use of opioids, (5) provide optimal liquid supply whenever possible.

**Table 2. Summary of Patient Demographics and Clinical Characteristics with Concomitant Descriptive Analysis**

	Total	Group 1 (N = 16) (Postoperative Vomiting)	Group 2 (N = 173) (No Postoperative Vomiting)	P
<b>Age (y)</b>	<b>N = 189</b>	<b>N = 16</b>	<b>N = 173</b>	<b>0.03*</b>
Mean	41.38	34.98	41.97	
Range	17–80	17–56	21–80	
<b>Gender</b>	<b>N = 189</b>	<b>N = 16</b>	<b>N = 173</b>	<b>1.0</b>
Male	38	3	35	
Female	151	13	138	
<b>BMI</b>	<b>N = 188</b>	<b>N = 16</b>	<b>N = 172</b>	<b>0.95</b>
Mean	26.37	26.32	26.38	
Range	18.4–42.3	21.1–36.3	18.4–42.3	
<b>Weight Loss (kg)</b>	<b>N = 144</b>	<b>N = 13</b>	<b>N = 131</b>	<b>0.56</b>
Mean	49.07	52.23	48.76	
Range	7–110	30–85	7–110	
Diabetes	12	3	9	0.68
Anticoagulation	6	0	6	1.0
Smoking	61	5	56	1.0
Bariatric surgery	72	4	68	0.30
Known PONV	9	0	9	0.6

\*Statistically significant differences between group 1 (patients experiencing postoperative vomiting) and group 2 (patients without postoperative vomiting) are marked.

strenuous activities and heavy lifting for 6 weeks postoperatively. During the hospital stay, all patients were administered low-molecular-weight heparin as a thrombosis prophylaxis. The cutoff for drain removal was defined as an output below 30 mL per 24 hours. Usually, patients were discharged one day after drain removal.

All patients were divided into two groups regarding their postoperative vomiting status. If patients experienced vomiting during their postoperative hospital stay, they were accounted to group 1 (vomiting group). Group 2 (nonvomiting group) served as a control group and included all patients who did not vomit during the postoperative period.

### Statistical Analysis

Data were checked for consistency and normality. Fisher exact test or Pearson chi-square test was used to analyze crosstabulations tables, and corresponding odds ratios with 95% confidence intervals (CIs) were computed. Independent *t* tests or generalized linear models with log-normal distribution were used for continuous variables, if applicable. Whisker plots were used to illustrate means and 95% CIs for means. All reported tests were two-sided, and *P* values less than 0.05 were considered statistically significant. All statistical analyses in this report were performed using STATISTICA 13 (Hill, T. & Lewicki, P. Statistics: Methods and Applications. StatSoft, Tulsa, Okla.).

## RESULTS

### Patient Demographics and Clinical Characteristics

A total of 189 cases of abdominoplasty were included in this study. Mean age of patients was 41.3 years with a mean body mass index of 26.4. The ratio of women to men was 4:1, respectively. Patient demographics were comparable between the two groups, including preoperative weight

loss. An overview of patient demographics and clinical characteristics is given in [Table 2](#).

Although we found a significant difference in age between both groups with group 2 being approximately 7 years older, there was no significant difference in the prevalence of comorbidities ([Table 2](#)), including diabetes, smoking history, and prior bariatric surgery.

### Operative Characteristics

Operative characteristics of the two study groups with corresponding *P* values are summarized in [Table 3](#).

The average amount of tissue removed during abdominoplasty was 1430.6 g. Thirty-six (19.0%) patients received a simultaneous abdominal liposuction. Plication of rectus muscle due to rectus diastasis or repair of a present hernia was performed in 56 (29.6%) patients. In total, 103 (54.5%) patients underwent additional procedures at the time of abdominoplasty [eg, hernia repair; liposuction; breast surgery, including liposuction, lipofilling, change of implants, and mastopexy; thigh lift; body lift; blepharoplasty; and others (upper extremity scar correction and drainage of known seroma)]. Patients stayed in hospital for an average of 7.53 days.

Among the two groups (vomiting versus nonvomiting), no significance regarding all but one operative characteristic was noted. We saw that PTS or quilting sutures were only performed in the nonvomiting group. Although not statistically significant, a trend for a longer hospitalization in the vomiting group, with 8.25 versus 7.47 days, respectively, was observed.

### Complications

Prevalence of complications with corresponding *P* values are summarized in [Table 4](#). Concerning our primary outcome, postoperative vomiting was observed in 16 patients. While 9.25% of patients in the nonvomiting group developed a postoperative hematoma, the

**Table 3. Summary of Operative Characteristics of Study Groups**

	Total	Group 1 (N = 16) (Postoperative Vomiting)	Group 2 (N = 173) (No Postoperative Vomiting)	P
<b>Resection Weight (g)</b>	N = 155	N = 15	N = 140	0.69
Mean	1431	1321	1442	
Range	140–7262	180–4354	140–7262	
Abdominal liposuction	36	4	32	0.51
Additional body-contouring procedures (double count possible, due to multiple combined procedures per one patient)	103	9	94	1.0
N = 1	90	8	82	
N = 2	11	1	10	
N = 3	2	0	2	
Mean	1.15	1.1	1.15	
Additional hernia repair/rectus plication suture	56	4	52	
Liposuction	34	3	31	
Breast procedures	23	1	22	
Thigh lift	7	2	5	
Body lift	1	0	1	
Blepharoplasty	2	0	2	
Others	2	0	2	
PTS/quilting sutures	49	0	49	0.13
<b>Length of Hospital Stay (d)</b>	N = 173	N = 16	N = 173	0.32
Mean	7.53	8.25	7.47	
Range	2–31	4–12	2–31	

N indicates absolute no. patients.

**Table 4. Summary of the Postoperative Number of Complications as an Absolute Number with Percentages in Parentheses (%)**

	Total	Group 1 (N = 16)	Group 2 (N = 173)	P
Postoperative vomiting	16 (8.47%)	16 (100%)	0 (0%)	<0.00001*
Hematoma	26 (13.76%)	10 (62.5%)	16 (9.25%)	<0.000001*
Seroma	32 (16.93%)	3 (18.75%)	29 (16.76%)	0.74
Delayed wound healing	20 (10.58%)	3 (18.75%)	17 (9.82%)	0.39
Dog ear	26 (13.76%)	3 (18.75%)	23 (13.29%)	0.47
Infection	4 (2.11%)	0 (0%)	4 (2.3%)	1.0
Surgical reintervention	22 (11.64%)	7 (43.75%)	15 (8.67%)	0.0007*

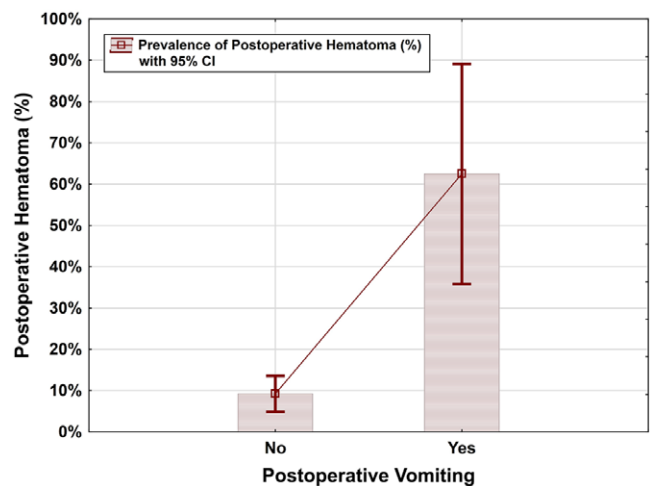
\*Statistically significant differences between group 1 (patients experiencing postoperative vomiting) and group 2 (patients without postoperative vomiting).

percentage of patients developing a postoperative hematoma in the vomiting group was 62.5%, corresponding to a 6.8-fold increase (Fig. 2). Therefore, vomiting proved to be an independent factor statistically significantly influencing the risk of developing a hematoma with an odds ratio of 16.4 (95% CI, 5.3–50.9).

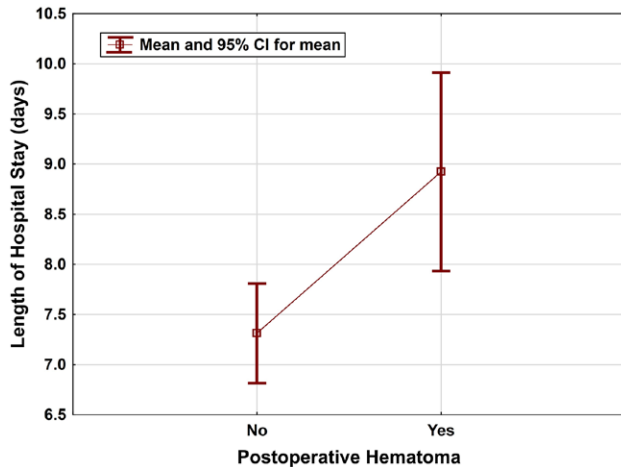
Furthermore, we detected a statistically significant difference regarding the surgical reintervention rate between both groups. With an odds ratio of 8.1 (95% CI, 2.65–25.0), the need for a surgical reintervention was statistically significantly higher in the vomiting group.

The absolute number of patients who developed a postoperative hematoma was 26 (13.8%). The impact of postoperative hematoma on length of hospital stay was calculated and is depicted in Figure 3. The results show that patients experiencing postoperative hematoma statistically significantly ( $P = 0.009$ ) had to stay longer in the hospital; on average 1.61 days longer (95% CI, 0.53–2.71) with a mean hospital stay of 8.92 days versus 7.31 days, respectively.

After we realized that PTS or quilting sutures were only used in the nonvomiting group, an additional statistical analysis was performed to investigate the impact of PTS/quilting sutures on the risk to develop



**Fig. 2.** Prevalence of postoperative hematoma after abdominoplasty in patients experiencing postoperative vomiting vs patients not experiencing postoperative vomiting with 95% CIs. The rate of postoperative hematoma is given in percentage. The figure illustrates significantly different postoperative hematoma rates of 62.5% vs 9.25% in the vomiting vs nonvomiting group, with an odds ratio of 16.4 (95% CI, 5.3–50.9).



**Fig. 3.** This figure illustrates the impact of postoperative hematoma on length of hospital stay. Patients experiencing postoperative hematoma had to stay statistically significantly longer ( $P = 0.009$ ) in hospital with a plus of 1.61 days compared with patients without postoperative hematoma.

**Table 5. Summary of the Proportion of Postoperative Hematomata in Patients Receiving PTS/Quilting Sutures versus Not Receiving PTS/Quilting Sutures**

	Total (N = 189)	PTS/Quilting Sutures (N = 49)	No PTS/Quilting Sutures (N = 140)	P
Postoperative hematoma	26 (13.76%)	7 (14.3%)	19 (13.6%)	1.0

Data are depicted as an absolute number with percentages in parentheses (%). Summary of the statistical analysis: Fisher exact test,  $P = 1.0$ , two-sided, odds ratio 1.06 (95% CI, 0.42–2.70).

a postoperative hematoma. Thereby, a two-sided Fisher exact test was used. No significant difference in the prevalence of postoperative hematoma was found between patients receiving PTS/quilting sutures versus not receiving PTS/quilting sutures with an odds ratio of 1.06 (95% CI, 0.42–2.70; Table 5).

## DISCUSSION

Knowledge about potential risks factors is essential to reduce the complication rate after abdominoplasty. Furthermore, understanding potential causes for hematoma development is key to establish preventative measures and adapt current technical standards.

Winocour et al evaluated approximately 25,500 abdominoplasties and found an overall complication rate of 4.0%, with hematoma being the most frequent major complication. They found male sex, age, and high BMI to be independent risk factors significantly increasing the complication rate.<sup>1</sup> However, there are publications showing an even higher complication rate after abdominoplasty surpassing 50%.<sup>2</sup>

Potential complications after abdominoplasty were first reported in 1977.<sup>9</sup> Since then, many approaches have been introduced aiming to reduce postoperative complications including hematoma, bleeding, and seroma. For example,

the use of drains has been established, however, without a uniform consent on their real benefit.<sup>10</sup> Further, various suture techniques have been introduced to minimize the risk to develop a postoperative hematoma and decrease the need for drains. For example, quilting sutures, introduced by Le Louan and Pascal,<sup>11</sup> or PTS can be applied. PTS was firstly described by Pollock and Pollock in 2000.<sup>12</sup> With interrupted sutures kept under progressive tension, a tensionless skin closure should be obtained, aiming to obliterate dead space without the need for drains.<sup>13</sup> With that, not only the incidence of seroma but also that of hematoma was reduced.<sup>14</sup> However, whether their use is truly superior stays controversial. Our data suggest that PTS and quilting sutures do not have a statistically significant influence on the risk to develop a postoperative hematoma. While in patients with PTS or quilting sutures, 14.29% (7 of 49) developed a postoperative hematoma, 13.48% (19 of 141) of patients without PTS or quilting sutures did so (Table 5).

Apart from adapting the surgical technique on its own, postoperative modifications can be made. For example, Schwaiger et al found that prolonged immobilization (45h) during the immediate postoperative time positively influenced the revisional surgery rate, by means of reducing the occurrence rate of hematoma and bleeding from 14% to 5% in the control versus study group, respectively.<sup>3</sup>

As a new approach, we investigated whether postoperative vomiting is a potential risk factor to increase the incidence of postoperative hematoma after abdominoplasty. Our data suggest that emesis after abdominoplasty significantly increases the risk of developing a postoperative hematoma. In the vomiting group, 63% of patients developed a hematoma, which is a 6.8-fold increase in comparison with the nonvomiting group. To the best of our knowledge, postoperative vomiting has not yet been identified as an independent risk factor for hematoma after abdominoplasty.

It is known that anesthesia incites PONV. Thereby, preoperative evaluation takes place to filter PONV-sensitive patients. Known risk factors according the Apfel risk score<sup>8</sup> are female gender, nonsmoker status, history of PONV, or motion sickness and postoperative opioids. The more factors apply, the higher the risk for PONV. However, oftentimes PONV preventative measurements fail, or patients are not medicated appropriately, and therefore, PONV still occurs. In our study, we found an overall postoperative emesis rate of 8.47%. In our institution, we follow the treatment algorithm presented in Figure 1 to prevent PONV. The algorithm was lastly updated in 2017. Recent international guidelines on the management of PONV were published in 2020.<sup>15</sup> The recommendations expanded, and Gan et al now recommend the use of two antiemetics in case of one to two risk factors and three to four antiemetic treatments in case three or more risk factors are present. In addition, they added two additional risk factors, namely surgery type and opioid analgesia. For further details on the guidelines, we kindly refer to the original article by Gan et al.<sup>15</sup> Our research highlighted the need for an update on our PONV guidelines.

It is known that the process of retching and vomiting increases intraabdominal pressure. However, what should not be forgotten is that vomiting also increases blood pressure. There is evidence that the gag reflex leads to an increased mean arterial blood pressure.<sup>6</sup> This is of importance, as high blood pressure is associated with intensified bleeding. The idea that postoperative vomiting complicates the postoperative period has already been investigated in patients undergoing thyroidectomy. Bononi et al put attention on the question whether postoperative vomiting is a risk factor for the development of cervical hematoma. In their study, postoperative vomiting did not increase the incidence of postoperative hematoma. Accordingly, they suggested that the most important factor to prevent cervical hematoma is careful hemostasis.<sup>7</sup> We agree that thorough hemostasis is key to prevent postoperative bleeding. Therefore, as a standard procedure, we have the blood pressure increased during intraoperative hemostasis. However, we believe that the crucial differentiating factor is the site of operation. The increased abdominal muscle tension increased mechanical friction in combination with an increased intraabdominal pressure, and increased blood pressure puts more force on ligated or coagulated vessels in the abdominal wall than on ligated vessels placed somewhere else. This is of concern as the rather large wound area in abdominoplasty predisposes active bleeding to stay silent for a long time, resulting in great blood loss. We show that hematoma leads to statistically significantly longer hospital stays.

Therefore, we think it is of utmost importance that not only anesthesiologists but also surgeons are aware of the risks and intervene as early as possible. We want to open the discussion whether every patient undergoing abdominoplasty should receive PONV-prophylaxis. Further, it could be beneficial to extend the duration when PONV-prophylaxis is administered from the immediate perioperative period to the first 1 or 2 postoperative days. With that, a more reliable antiemetic therapy during the delicate postoperative period could be provided.

Finally, we appreciate the limitations of our study. Particularly, it involved a relatively small sample size. Although the study includes 189 patients, which is a relatively large size, only 16 cases of emesis were documented. Despite the small sample size, our study demonstrated an important indication.

In addition, the retrospective study design was prone to differences between the study groups. In our study, there was a statistical significance in only little characteristics between groups: firstly, age and secondly, the use of intraoperative PTS/quilting sutures. In light of the fact that studies found higher age rather than younger age to be a predicting factor for postoperative complication, we doubt that the younger age in the vomiting group resulted in the significantly higher proportion of patients developing a postoperative hematoma.

Furthermore, to minimize bias due to the difference in use of PTS/quilting sutures between groups, we tried to filter their impact on the development of a postoperative hematoma through an independent calculation. With that, we found their influence on the risk of developing a postoperative hematoma to be nonsignificant.

## CONCLUSION

Vomiting during the first postoperative days after abdominoplasty is shown to be a modifiable risk factor increasing the risk of developing a postoperative hematoma.

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## DISCLOSURE

*The authors have no financial interest to declare in relation to the content of this article.*

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