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High preoperative depression, phobic anxiety, and binge eating scores and low medium-term weight loss in sleeve gastrectomy obese patients: A preliminary cohort study

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Title: **High preoperative depression, phobic anxiety, and binge eating scores and low medium-term weight loss in sleeve gastrectomy obese patients: A preliminary cohort study**

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Running title: **Psychiatric factors and weight loss in obesity surgery**

Keywords: **depression, anxiety, binge eating, bariatric surgery, sleeve gastrectomy, obesity**

ABSTRACT:

Objective: Although depression, anxiety, and binge eating are prevalent in candidates for bariatric surgery, their impact on weight loss is unknown following sleeve gastrectomy. This study assesses the associations between weight loss and preoperative depression, anxiety, and binge eating scores in patients undergoing sleeve gastrectomy for morbid obesity.

Method: This cohort study included 34 patients who underwent sleeve gastrectomy for morbid obesity between May 2006 and February 2010 in a French tertiary referral center. We assessed preoperative depression (using the Beck Depression Inventory and the SCL-90-R depression subscale), anxiety (using the Hamilton Anxiety Rating Scale and the SCL-90-R anxiety subscales), and binge eating (using the Bulimic Investigatory Test, Edinburgh). The primary outcome was the percentage of excess weight loss at 12 months (PEWL).

Results: The preoperative mean body mass index (BMI) was 55.3 kg/m^2 ± 10.2 kg/m^2 and 41.7 kg/m^2 ± 8.7 kg/m^2 at the 12-month follow-up visit. The mean PEWL was 46.8% ± 15.8%.-After adjusting for the preoperative BMI, the PEWL was negatively associated with preoperative scores for depression (β=-.357; $p<.05$), phobic anxiety (β=-.340; $p<.05$), interpersonal sensitivity (β=-.328; $p<.05$), and binge eating (β=-.315; $p=.05$). Other forms of anxiety were not correlated with the PEWL.

Conclusions: Higher preoperative depression, phobic anxiety, interpersonal sensitivity, and binge eating scores are associated with low postoperative weight loss in patients undergoing sleeve gastrectomy. Future studies should assess the preoperative prevalence of syndromal or subsyndromal atypical depression and its relationship to postoperative weight loss in bariatric surgery candidates.

INTRODUCTION

Morbid obesity, defined as having a body mass index (BMI) higher than 40 kg/m^2, is associated with increased mortality,[1] comorbidities, and decreased quality of life.[2] Psychiatric comorbidities in patients with morbid obesity include depression as well as anxiety, eating, and personality disorders,[3–6] all of which are associated with decreased quality of life.[7] Bariatric surgery for morbid obesity is an established and integral part of multidisciplinary patient management.[8] Bariatric surgery efficiently produces long-term weight loss, improves quality of life[9, 10] and reduces medical and psychiatric comorbidities.[11–14] The surgical procedures currently in use rely on either gastric restriction (e.g., adjustable gastric banding, vertical banded gastroplasty, and sleeve gastrectomy) or on gastric restriction combined with malabsorption (e.g., gastric bypass).

Although bariatric surgery is often effective in terms of weight loss,[10] 20% to 30% of patients regain weight 18 months to 2 years after surgery.[15] In a literature review, Hsu et al.[15] summarized the surgical, non-surgical, and psychological factors that have been shown to play key roles in long-term bariatric surgery results. Significant post-surgical weight loss requires behavioral changes and is largely dependent on an individual's ability to implement permanent lifestyle changes (e.g., adhering to a strict nutritional and physical activity regimen and acquiring new coping skills to decrease reliance on food to address emotional needs).[16] In this study, we hypothesized that the intensity of preoperative depression, anxiety, or binge eating might affect an individual's ability to cope with these behavioral modifications and thus affect post-surgical weight loss.

There is no clear evidence that preoperative depression, anxiety or binge eating are associated with postoperative weight loss.[17–24] Although several studies have found a link

between preoperative major depression,[18, 19, 21, 23, 24] an anxiety disorder[17, 19] or an eating disorder[18, 21, 23, 24] and lower weight loss, most have not found these relationships.[17–24]

These studies assessed psychiatric comorbidities in patients undergoing laparoscopic gastric banding, gastric bypass, or vertical banded gastroplasty using a categorical approach rather than considering psychiatric symptoms from a dimensional perspective. We hypothesized that weight loss might be related to the preoperative scores on these psychiatric dimensions rather than to the existence of a categorical psychiatric diagnosis. The mixed results of these studies might also be due to heterogeneous groups being combined with different surgical procedures. Therefore, we focused on one type of surgery, namely, sleeve gastrectomy. This restrictive procedure was recently proposed as a stand-alone bariatric approach[25] with lower operative and nutritional risks compared with mixed procedures.

Semanscin-Doerr et al.[26] are the only authors who have studied the relationship between preoperative psychiatric disorders and weight loss following sleeve gastrectomy. Their study, which focused on depression, showed that the presence of either a current or past mood disorder was associated with less medium-term weight loss. We hypothesized that other preoperative psychiatric disorders, such as anxiety or binge eating, might affect postoperative weight loss by influencing the patient's ability to cope with post-surgical behavioral changes.

The aim of this study was to assess the relationships between medium-term weight loss and preoperative depression, anxiety and binge eating scores following sleeve gastrectomy.

MATERIALS AND METHODS

Participants

This cohort study was conducted at the Nutrition Department of the University Hospital of Tours, France. We enrolled all consecutive patients undergoing laparoscopic sleeve gastrectomy for morbid obesity between May 2006 and February 2010, with patients having a follow-up period of at least 12 months.

Measures and procedure

We assessed the patients before surgery and 12 months after surgery. At the preoperative visit, we collected demographic data (i.e., duration of obesity, gender, and age) and information regarding the use of antidepressants or anxiolytics, the patients' weight and BMI, obesity comorbidities (i.e., hypertension, diabetes, dyslipidemia, and obstructive sleep-apnea syndrome), and whether the patients had a history of previous bariatric surgery. One two-surgeon team performed all the sleeve gastrectomies for all of our patients by resecting a standard amount of stomach. All sleeve gastrectomies were performed as a standalone procedure for morbid obesity. Then, 12 months later, we recorded patient weight, BMI, the incidence of surgical reoperation, and the rate of postoperative gastric fistula. The primary outcome of our study was the percentage of excess weight loss at 12 months (PEWL). The PEWL was calculated as follows: weight loss * 100 / (preoperative weight – weight if BMI was 25 kg/m^2).

According to Buchwald et al.,[27] the PEWL is the standard measure to assess weight loss in the bariatric surgery nomenclature. The PEWL can be interpreted as the way toward a healthy BMI (e.g., a 100% PEWL means that the patient has lost enough weight to reach a healthy BMI of 25 kg/m^2). Unlike weight loss, which is strongly related to height and initial excess weight, the PEWL enables bariatric surgery comparisons between individuals.

Depression and binge eating were assessed during a preoperative psychiatric consultation with self-administered questionnaires, whereas anxiety was assessed using self-administered questionnaires and a semi-structured instrument administered by a trained psychiatrist.

Depression

We assessed depression using the Beck Depression Inventory (BDI) and the depression subscale of the Symptom Checklist-90-Revised (SCL-90-R).

BDI

Beck and Beamesderfer[28] developed the 13-item, self-rated BDI to assess the severity of depressive symptoms. Each item is scored from 0 to 3, producing a global score ranging from 0 to 39. The BDI has been validated across cultures and in bariatric surgery populations.[29–31]

SCL-90-R depression subscale

Derogatis designed the 90-item, self-rated SCL-90-R to measure psychiatric illness symptoms. Each item is scored from 0 to 4, producing a global score ranging from 0 to 360. Furthermore, there are subscores for nine dimensions: depression (from 0 to 52), anxiety (from 0 to 40), obsessive-compulsive (from 0 to 40), phobic anxiety (from 0 to 28), interpersonal sensitivity (from 0 to 36), somatization (from 0 to 40), paranoid ideation (from 0 to 24), psychoticism (from 0 to 40), and hostility (from 0 to 24). According to Ransom et al.,[32] this instrument demonstrates good internal consistency and preliminary validity data for bariatric surgery patients compared with the Millon Behavioral Medicine Diagnostic. The

authors also concluded that the SCL-90-R could be used as a psychiatric screening measure for bariatric surgery patients.[32]

Anxiety

We assessed anxiety using the Hamilton Anxiety Rating Scale and four SCL-90-R subscales: anxiety, obsessive-compulsive, phobic anxiety, and interpersonal sensitivity. Hamilton[33] designed the Hamilton Anxiety Rating Scale as a semi-structured instrument to be administered by a trained clinician to assess anxiety severity. All 14 items are scored from 0 to 4, producing a global score ranging from 0 to 56, including a "somatic" anxiety score that ranges from 0 to 28, and a "psychic" anxiety score that ranges from 0 to 28. According to Maier et al.,[34] the reliability and concurrent validity of this scale are sufficient in patients with anxiety disorders.

Binge eating

We assessed binge eating symptoms using the Bulimic Investigatory Test, Edinburgh, a 33-item self-report measure developed by Henderson and Freeman.[35] According to the authors of the scale, the BITE has satisfactory reliability and validity in patients who binge eat Furthermore, it provides three scores: an overall score (from 0 to 69), a symptom score (from 0 to 30) and a severity score (from 0 to 39). The symptom score measures the degree of binge eating symptoms present, whereas the severity score measures the frequency of both bingeing and purging behaviors. The BITE is used in European countries and has been validated and translated in Italian,[36] Hungarian,[37] and French.[38] The BITE can be used as a reliable screening method for a binge eating disorder in obese patients.[36] Moreover, it was found to be a valid alternative to the Binge Eating Scale as a screening method for binge eating disorder in this population.[39]

Statistical analyses

Analyses were performed using the Systat 12 statistical package (SYSTAT Software, Inc., San Jose, CA). The factors associated with the PEWL were tested in univariate analyses using Pearson's correlation test, Spearman's correlation test, Student's t-test or the Wilcoxon rank-sum test, depending on the type of variables involved (means or proportions) and the normality of the distribution. The factors associated with the PEWL were also tested after adjusting for the preoperative BMI using a multiple linear regression because preoperative BMI was the variable most strongly associated with PEWL. The distribution normality was tested for each continuous variable using the Shapiro-Wilk test. All analyses were two-tailed; a p-value of .05 or less was considered statistically significant.

Ethics

Informed consent was obtained from each patient in accordance with the Declaration of Helsinki guidelines. This study did not require institutional review board approval because it was not considered biomedical research under French law.

RESULTS

Participants

Thirty-seven patients had laparoscopic sleeve gastrectomy over the study period and participated in the planned follow-up. Thirty-four patients (92%) returned fully usable questionnaires at the preoperative and 12-month postoperative visits. Our analyses are based on these 34 patients.

Descriptive statistics

Table 1 shows the patients demographics. The mean preoperative BMI was 55.3 kg/m^2 ± 10.2 kg/m^2, and the mean 12-month follow-up BMI was 41.7 kg/m^2 ± 8.7 kg/m^2. The mean PEWL was 46.8% ± 15.8%. Table 2 shows the descriptive statistics for the depression, anxiety, and binge eating scores.

The sociodemographic characteristics associated with weight loss

The PEWL was not associated with obesity duration (p=.30), gender (p=.60), use of antidepressants (p=.81) or anxiolytics (p=.82); however, it was negatively correlated with age (r=-.397; p=.02). A higher PEWL was observed for patients with less preoperative BMI (ρ_s=-.409; p=.02), which was the variable most strongly associated with the PEWL. The PEWL was lower in patients who had a preoperative sleep apnea syndrome (t=2.39; p=.03), but was not associated with the presence of hypertension (p=.93), diabetes (p=.10), or dyslipidemia (p=.59). The PEWL was not associated with prior bariatric surgery (p=.73) or with the incidence of postoperative complications, such as postoperative gastric fistulas (p=.38) or reoperations (p=.30), at 12 months**.**

Associations between psychiatric scores and preoperative BMI

The preoperative BMI was not associated with any preoperative depression scores as assessed by the Beck Depression Inventory (p=.44) and the SCL-90-R subscale (p=.31). The preoperative BMI was not associated with anxiety, as assessed by the Hamilton Anxiety Rating Scale (p=.20), the SCL-90-R subscales for anxiety (p=.52), obsessive-compulsive (p=.95), phobic anxiety (p=.63), or interpersonal sensitivity (p=.98). Finally, it was not associated with binge eating (p=.69).

Psychiatric scores associated with weight loss after adjusting for preoperative BMI (Table 2)

After adjusting for the preoperative BMI, the PEWL was negatively associated with depression as assessed by the Beck Depression Inventory (i.e., patients with higher depression scores had lower PEWLs) but not as assessed by the SCL-90-R subscale.

The PEWL was negatively associated with phobic anxiety and the interpersonal sensitivity SCL-90 subscales, but not with the other forms of anxiety assessed by the Hamilton Anxiety Rating Scale or the SCL-90-R anxiety, and obsessive-compulsive subscales.

The PEWL was negatively associated with the overall and symptom scores of the BITE but not with the severity score.

DISCUSSION

In this study, we showed that patients with higher preoperative scores for depression, phobic anxiety, interpersonal sensitivity, and binge eating had less medium-term weight loss. We also found that medium-term weight loss was not associated with other forms of anxiety.

This study shows that high preoperative depression scores are associated with less medium-term weight loss following sleeve gastrectomy after adjusting for the preoperative BMI. These results are in line with previous findings following sleeve gastrectomy,[26] gastric banding and gastric bypass[21]; specifically, preoperative major depression is associated with low medium-term weight loss. Our study also shows that weight loss is associated with depressive symptoms severity. Although our results support the hypothesis that depressive symptoms have an adverse effect on weight loss, the nature of the relationship between

preoperative depression level and low weight loss should be evaluated further. A persistent depressed mood, markedly diminished interest or pleasure, feelings of worthlessness, disturbed sleep, and appetite characterize depression.[40] These symptoms might adversely affect patient's adherence to their postoperative behavioral regimen, which includes dietetary constraints, thus affecting weight loss. Because depression is also associated with a systematic cognitive bias in information processing that leads to focusing on negative aspects of experiences,[41] depressive symptoms might be associated with negative cognitive interpretations of the behavioral changes that follow surgery. Subsequently, this effect might also reduce the patient's ability to acquire the new coping skills needed to decrease reliance on food and address emotional needs. These hypotheses should be tested in future studies.

Original findings of this study include a significant link between low medium-term weight loss and high preoperative phobic anxiety and interpersonal sensitivity scores after adjusting for the preoperative BMI. We also found that other forms of anxiety were not associated with weight loss. Phobic anxiety is defined as a persistent, irrational fear response to a specific person, place, object or situation that is disproportionate to the stimulus and that leads to avoidance or escape behavior.[42] This dimension encompasses social anxiety and agoraphobic symptoms. Following surgery, patients usually report increases in social contacts, social activities, and occupational opportunities.[12, 14] For patients with high preoperative phobic anxiety and interpersonal sensitivity scores, increases in social contacts might generate anxiety that could subsequently affect eating behavior and weight loss. According to Bocchieri et al.,[14] some patients might have difficulty adjusting to the demands of increased social acceptance or to the dramatic changes in social acceptance following bariatric surgery. These patients might need additional therapeutic interventions for social anxiety and agoraphobic symptoms to cope with the psychosocial consequences of weight loss.

Another original finding is the significant relationship between the preoperative level of binge eating and weight loss following sleeve gastrectomy. Herpertz et al.'s[18] literature review showed that eating to reduce stress (as opposed to controlled enjoyable eating behavior) following gastric banding and gastric bypass might be a negative predictor of postoperative weight loss. Among candidates for bariatric surgery, binge eating disorder is one of the most common eating disorders, with a prevalence rates ranging from 7.3% to 49%.[18] Previous studies have found that preoperative binge eating did not predict postoperative weight loss, whereas postoperative binge eating did (for reviews see ref.[24, 43]). Although preoperative binge eating does not systematically lead to poor weight loss, we can assume that the patients who binge ate before the surgery in our sample developed postoperative binge eating that favored weight regain. The lack of association between the BITE severity score and the PEWL could be related to the fact that this severity score subscale assesses both bingeing and purging behaviors (which were low in our study population, as expected), whereas the symptom score assesses only binge eating.[35] Although the BITE has been validated in obese patients,[36, 39] our results suggest that the symptom score is more relevant to our purposes compared with the severity score in this population.

Finally, it is intriguing that the PEWL is associated with depression, binge eating, and interpersonal sensitivity scores. Because atypical depression is a subtype of major depressive disorder with atypical features characterized by mood reactivity, significant weight gain, increases in appetite, hypersomnia, leaden paralysis, and a long-standing pattern of interpersonal rejection sensitivity,[40] we might hypothesize that the existence of a preoperative syndromal or subsyndromal atypical depression is associated with poorer PEWL. Future studies should assess the prevalence of atypical depression and its relationship to postoperative weight loss in candidates for bariatric surgery.

Our results have important practical implications. Because preoperative phobic anxiety and interpersonal sensitivity are rarely assessed during preoperative visits,[16] these factors, in addition to depression and binge eating, should be systematically screened from a dimensional perspective during the preoperative evaluation to identify patients at risk of low weight loss. Improved screening for these dimensions could lead to the implementation of psychotherapeutic or psychopharmacological interventions. Although we can hypothesize that any intervention targeting patients with a syndromal or subsyndromal diagnosis of depression, social anxiety, or binge eating disorder might help improve post-surgical weight loss,[15] this hypothesis should be tested in future studies. Among the possible therapeutic interventions, cognitive-behavioral therapy is an interesting option because it efficiently treats depression, binge eating and social anxiety disorder.[44–47]

Our study has several limitations. First, our results are limited to the 12-month postoperative period, and future studies should assess the long-term relationship between preoperative psychopathology and weight outcome. In addition, our statistical analyses accounted for only one covariate: the preoperative BMI. We could not account for other covariate, because of overfitting problems due to the limited size of our study[48] and the potential loss of statistical power. A larger sample size would have enabled us to analyze the effect of other important covariates, such as the existence of previous bariatric surgery procedure or preoperative obesity comorbidities. Because our sample size was small, our results need to be replicated in larger datasets and at various recruiting centers. Although our sample size was small, the sex ratio, mean age and rates of preoperative obesity comorbiditie (excluding sleep apnea syndrome) were comparable to those observed in Buchwald's meta-analysis of 135,246 bariatric surgery candidates across 621 studies.[27] Because success following bariatric surgery is defined as a reduction in medical and psychiatric comorbidities as well as improved quality of life,[21] future studies should investigate which preoperative

psychiatric dimensions are associated with both weight loss and quality of life evolution. Future studies should also assess both preoperative and postoperative depression, anxiety, and binge eating to test the hypothesis that, when untreated, these disorders are associated with poor postoperative weight loss.

In conclusion, our study shows that preoperative depression, phobic anxiety, interpersonal sensitivity and binge eating scores are associated with low medium-term weight loss in obese patients undergoing sleeve gastrectomy. Our results suggest that these dimensions should be assessed preoperatively, and patients should receive appropriate psychotherapeutic and psychopharmacological care. Our results also suggest to assess further the prevalence of syndromal and subsyndromal atypical depression and its relationship to weight loss in candidates for bariatric surgery. Additional studies are needed to assess the association between these dimensions and postoperative weight loss.

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TABLES

Table 1. Characteristics of study population (*n*=34)

Age at baseline (years)	38.5 ± 11.0
Obesity duration (years)	23.8 ± 10.2
Gender	
Male	7 (20.6%)
Psychotropic use	
Antidepressants	5 (14.7%)
Anxiolytics	3 (8.8%)
Preoperative weight (kg)	152.1 ± 34.2
Weight at 12-month follow-up (kg)	114.9 ± 29.5
Preoperative BMI[1] (kg/m^2)	55.3 ± 10.2
BMI[1] at 12-month follow-up (kg/m^2)	41.7 ± 8.7
Preoperative obesity comorbidities	
Hypertension	10 (29.4%)
Diabetes	5 (14.7%)
Dyslipidemia	16 (47.1%)
Obstructive sleep-apnea syndrome	13 (38.2%)
Previous bariatric surgery history	6 (17.6%)
Postoperative gastric fistula rate at 12-month follow-up	2 (5.9%)
Incidence of surgical reoperation at 12-month follow-up	4 (11.8%)

Data are presented as means ± standard deviation (SD) or number (%).

[1]BMI: Body Mass Index

Table 2. Psychiatric dimensions associated with the percentage of excess weight loss (PEWL) after adjusting for the preoperative BMI (*n=34)*

	Score	β	95% CI (β)	B	*p*-value
Depression					
Beck Depression Inventory-13	6.5 ± 4.8	**-.357**	-.672, -.042	**-1.19**	**.028**
SCL-90-R[4] depression subscale	7.8 ± 7.0	-.302	-.627, .023	-.68	.068
Anxiety					
Hamilton Anxiety Rating Scale	3.7 ± 3.9	-.192	-.531, .148	-.78	.26
SCL-90-R[4] anxiety subscale	3.2 ± 4.0	-.244	-.571, .084	-.97	.14
SCL-90-R[4] obsessive-compulsive subscale	3.9 ± 3.6	-.181	-.513, .150	-.80	.27
SCL-90-R[4] phobic anxiety subscale	2.0 ± 2.6	**-.340**	-.655, -.024	**-2.09**	**.036**
SCL-90-R[4] interpersonal sensitivity subscale	7.0 ± 6.4	**-.328**	-.644, -.012	**-.82**	**.042**
Binge eating					
BITE[5] overall score	11.6 ± 6.6	**-.315**	-.634, .003	**-.75**	**.05**
BITE[5] symptom score	9.6 ± 5.0	**-.369**	-.679, -.060	**-1.17**	**.021**
BITE[5] severity score	2.0 ± 2.4	-.100	-.439, .240	-.67	.55

[1]β: Multiple linear regression model standardized slope coefficient

[2]CI: Confidence Interval

[3]B: Multiple linear regression model unstandardized slope coefficient; for example, the B between the PEWL and the Beck Depression Inventory score is -1.19, which means that there

was a mean decrease in the PEWL of 1.19% for each one point increase in depression after adjusting for preoperative BMI

[4]SCL-90-R: Symptom Checklist 90 Items Revised

[5]BITE: Bulimic Investigatory Test, Edinburgh