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Long-term weight loss outcomes after bariatric surgery: a propensity score study among patients with psychiatric disorders

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Abstract

Introduction To analyze the safety and long-term result of bariatric surgery in patients with psychiatric disorders.

Material and methods From January 2009 to December 2018, $n=961$ patients underwent bariatric surgery in a tertiary center. Among them, two groups of patients were created: a group of patients with psychiatric disorders (PG) and a group without psychiatric disorders (CG), using a propensity score matched (PSM). Primary endpoint was long-term outcomes and secondary endpoints were the postoperative morbidity 90 days after surgery, late morbidity, occurrence of psychiatric adverse events, and resolution of obesity-related comorbidities.

Results Analysis with PSM permitted to compare 136 patients in each group, with a ratio 1:1. TWL% at 2 years in the PG was 32.7% versus 36.6% in the CG ($p=0.002$). Overall surgical morbidity was higher in the PG than the CG (28% vs 17%, $p=0.01$). Severe surgical complications were not statistically significant (4% vs 3%, $p=0.44$). Psychiatric adverse events were significantly more frequent in the PG than in the CG. The resolution of obesity comorbidities was equivalent for both groups at 2 years.

Conclusion Substantial weigh loss was reported among patients with psychiatric disorders receiving bariatric surgery at the cost of more non-severe surgical complications. Further, a psychiatric postoperative follow-up visit may be warranted for patients with preoperative psychiatric disorders, given the incidence of psychiatric adverse events.

Keywords Bariatric surgery · Long-term outcomes · Psychiatric disorders

The prevalence of obesity has been on the rise in the past three decades, with increasing social and economic burden across the world [1–3]. Bariatric surgery has been shown to be efficacious on both weight loss, and obesity-related comorbidities including type 2 diabetes, arterial hypertension, lipidemic disorders, sleep apnea, and extend their life expectancy [4, 5], and has thus been increasingly used in recent years. For example, the number of bariatric procedures has increased 20-fold in the last 20 years in France, with Roux-en-Y gastric bypass (RYGB) and sleeve gastrectomy (SG) which are the two most widely performed operations [6].

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Obesity and psychiatric disorders have a bidirectional relationship, with the prevalence of obesity being more than twice greater among patients with mental disorders compared to patients having none [7], and patients with obesity being more likely to meet diagnostic for a psychiatric disorder [8] or to experience more severe form of illness [9, 10]. This high prevalence is partially explained by the use of psychotropic medications known to favor weight gain, such as anti-depressants, mood stabilizers, or anti psychotics [11–13]. On the other hand, obesity is a known risk factor of several mental disorders, particularly for depression [14]. Accordingly, the candidates for bariatric surgeries frequently have psychiatric disorders as comorbidities [8], 23% of mood disorders, 9% of suicidal ideations, and 1% of psychosis. Although scientific organizations recommend psychiatric evaluation before bariatric surgery, the adoption and application of these guidelines and the modalities of the follow-up vary greatly [15, 16]. Severe mental disorders are still being considered as contraindications to those surgeries [17, 18]. Those "severe mental disorders" are not clearly defined by the French Haute Autorité de Santé (HAS), but the International Federation for the Surgery of Obesity (IFSO) quotes as potential contraindications schizophrenia, schizoaffective disorder, substance abuse, psychosis, bipolar disorder, eating disorders, neurocognitive disorder, or personality disorders.

Although the association between psychiatric disorders and obesity has been consistently reported, few studies have examined the impact of having psychiatric disorders on the outcome of bariatric surgery. In particular, studies examining the impact of psychiatric disorders on weight loss and postoperative outcomes after bariatric surgery have yielded mixed results, possibly due heterogeneity of samples and methodology. We made a review of those studies and summarized in Annexe 1 [19–35]. This review confirms divergent results, with various assessments of the weight loss outcomes, making comparison with others studies uneasy. Nevertheless, the two more recent comparative studies showed a significant difference of weight loss between patients with Axis I disorders and patient without [31, 35]. Finally, data on long-term results of bariatric surgery in patients with psychiatric disorders are scarce.

The present study thus aims to (a) evaluate the effectiveness of surgical weight loss within two years in patients with and without psychiatric disorders; and (b) assess the impact of psychiatric disorders on the following: (i) the early ($\leq$ 90-day) and late morbidity and mortality rates, (ii) the rate of postoperative psychiatric adverse events, and (iii) the resolution of obesity-related comorbidities within 2 years.

Materials and methods

Patients and methods

Study design

This study made use of de-identified clinical data, were maintained in a database repository of morbidly obese patients undergoing laparoscopic bariatric surgery from January 2009 to December 2018 at the University Hospital of Caen, a French tertiary bariatric center. Patients with preoperative psychiatric diseases were defined as cases (psychiatric group: PG), patients without preoperative psychiatric diseases as controls (control group: CG). Inclusion of the patients to the psychiatric group was done retrospectively after the review of the medical chart, and reports of medical, surgical, and psychiatric consultations before the surgery. Hence, diagnoses of depression, bipolar disorder, schizoaffective disorder, or schizophrenia, current or lifetime, were included in the PG. Binge eating disorders, anxiety, and personality disorder were not included in the PG. Patient without the results of weight loss at 24 months were excluded from the primary endpoint analysis. DSM IV and DSM-5 have been used by the reviewer (non-psychiatrist) to define the psychiatric disorders aforementioned. This retrospective study has been approved by the institutional ethics committee (OBTENTION EN COURS). All indications for bariatric surgeries were assessed using the International Federation for the Surgery of Obesity criteria [17] and endorsed in an interdisciplinary consensus meeting. All procedures were standardized to be administered in the same way by all the surgeons of our center. Details of surgical techniques have been published previously [36, 37]. During the studied period, all patients underwent the same surgical technique by an experienced surgeon. Only postoperative drainage disappears since 2014 and our department is referenced as Early Rehabilitation After Surgery (ERAS) department since we performed Thorell's ERAS guidelines from 2017 [38]. Only patients with a follow-up longer than 24 months after bariatric surgery were considered for the analysis.

Data collection

The relevant data for each patient were prospectively collected. Patient characteristics (sex, age), biometrics values (i.e., weight, height, body mass index BMI, percentage of excess body weight), comorbidities (diabetes, hypertension, sleep apnea, dyslipidemia…), the ASA physical status classification system (American Society of Anesthesiologists), surgical past history, medications, and

habitus were retrieved. The postoperative data recorded included postoperative complications occurring within 90 days postoperatively. We considered surgery-related morbidity to be any complication resulting from the surgical procedure, such as leakage, bleeding events, infectious complications and reoperation, or any other event directly caused by the surgery. All the complications were stratified according to the Clavien–Dindo scale [39], with a score of three points or higher being considered as a severe complication.

Outcomes in weight control were evaluated with BMI, percentage of total weight loss (TWL%) percentage of excess body weight loss (%EWL) and percentage of excess BMI loss (EBMIL) [40]. Outcomes in weight control were evaluated with the percentage of total weight loss (%TWL) as follows:

$$\left[\frac{(\text{Preoperative weight} - \text{Weight during follow-up})}{\text{Preoperative weight}}\right] \times 100.$$

Excess of body mass index (EBMIL) was calculated from the initial BMI (global EBMIL). Postoperative comorbidities of obesity (type 2 diabetes, arterial hypertension, and sleep apnea) were assessed as persisting (the same medications as before surgery) or resolved (no medications needed) by the surgeons during the follow-up.

Psychiatric adverse events were collected declaratively by the surgeons during the clinical follow-up and were divided into major depressive events, bipolar symptoms, and suicide attempts or self-harm.

Endpoints

The primary endpoint was the total weight loss at 24 months of follow-up after the surgery, expressed in percentage of total weight loss (TWL%). The secondary endpoints were as follows: (i) weight loss after 6–12–18 months of follow-up (TWL%, excess weight loss %EWL and excess BMI Loss EBMI%); (ii) overall morbidity and surgical complications (i.e., leakage, bleeding, reoperation) at 90 days postoperatively, according to the Clavien–Dindo classification; (iii) late postoperative morbidity (> 90 days postoperatively) including psychiatric adverse events; and (iv) resolution of comorbidities related to obesity. Long-term mortality rate was collected from the patient's medical records and INSEE French national death database.

Follow-up

All patients were assessed as part of a routine follow-up program in the outpatient clinic and were seen on a regular schedule 3, 6, 9, 12, 18, and 24 months postoperatively. Thereafter, patients were supposed to be seen annually. Patients lost to follow-up were contacted several times by e-mail or phone.

Statistical analysis method

Characteristics of patients were described by preoperative psychiatric diseases group (PG vs CG) used as count (percentage) and mean (standard deviation) or median (interquartile range) for qualitative and quantitative variables, respectively.

First, the primary outcome was compared between both groups using Student's *t* test. The secondary effectiveness outcomes were analyzed in the same way. The secondary safety outcomes were analyzed using χ^2 or Fisher's exact test.

Second, baseline differences between PG and CG may differ because the two groups were not randomized; therefore, we analyzed our data using propensity score method. We used the propensity score matching (PSM) to address the potential channelling bias on the endpoints. We modeled the probability of having a preoperative psychiatric disease using a nonparsimonious logistic regression including the following variables: age, sex, nonsteroidal anti-inflammatory drug use (NSAID), antiplatelet agents, anticoagulants, pulmonary history, gastric ring history, chronic obstructive pulmonary disease (COPD), heart disease, abdominal surgery, gastritis, corticosteroids, diabetes, duration of the operation, Barrett's esophagus (EBO), hiatal hernia, high blood pressure (HBP), type of surgery, non-alcoholic fatty liver disease (NAFLD), liver biopsies, preoperative weight, parietal reparation, gastroesophageal reflux disease (GERD), sleep apnea syndrome (SAS), hepatic ultrasound steatosis, smoking, and deep vein thrombosis. We performed a one-to-one procedure (PROC PSMATCH) to match preoperative psychiatric diseases groups based on their propensity scores. Then, we analyzed this paired population using paired Student's *t* test for primary outcome and effectiveness secondary outcomes (at 6, 12, 18, and 24 months). For safety secondary outcomes, we compared this paired population using conditional logistic regression. The resolution of comorbidities was assessed in populations with baseline comorbidities by preoperative psychiatric diseases groups using Cochran's *Q* test.

Baseline characteristics were compared between groups before and after the matching procedure using the standardized mean differences.

A *p*-value less than 0.05 was considered significant; all *p* values were two-tailed. No adjustment was performed. Statistical analyses were performed on complete cases, using SAS statistical software, version 9.4 (SAS Institute Inc, Cary, NC, USA) and R software, version 3.6.2 (The R Foundation for Statistical Computing).

Results

Population

Nine hundred and sixty-one patients (138 patients in PG and 823 patients in CG) underwent either primary laparoscopic bariatric surgery (RYGB or SG) or revisional bariatric surgery (from SG to RYGB). In PG, depression ($n=126$) and bipolar disorder ($n=12$) were the most frequent psychiatric disorders. One hundred and thirty-six patients in PG (mean age 47 ± 11 years) were 1:1 matched to 136 patients in CG (mean age 48 ± 11 years). Characteristics of both unadjusted and PSM populations are summarized in Table 1. After matching, no significant differences were observed between both groups regarding ASA score, biometrics values (preoperative and maximum body mass index BMI), comorbidities (diabetes mellitus, OSAS), and bariatric surgical procedures (i.e., LSG, LRYGB, and revisional bariatric surgery). The flow chart of the study is visible in Fig. 1.

Primary endpoint weight loss at 24 months

Effective body weight reduction was observed in each group with an increased efficacy observed until 2 years, regardless of the population analyzed (unadjusted and PSM, respectively).

Unadjusted model

The risk of TWL% at 24 months was significantly higher in CG patients than in PG patients (3.3, 95% CI [1.6–5.0], $p<0.001$) (Table 2).

Both TWL% and %EWL were significantly more pronounced at 6, 12, 18, and 24 months in CG as compared to PG in unadjusted population (Table 2). EBMI% was significantly more pronounced only from the 12 months in CG as compared to PG.

PSM model

Every adjusted TWL%, %EWL, and EBMI% were significantly more pronounced at 24 months in CG as compared to PG (Table 2). The risk of TWL% at 24 months was significantly higher in CG patients than in PG patients (3.9, 95% CI [1.5–6.2], $p=0.002$). The values at 24 months of %EWL (8.7, 95% CI [2.2–15.2], $p=0.009$) and EBMI% (7.8, 95% CI [0.3–15.4], $p=0.043$) were also significantly higher in CG as compared with PG, respectively (Table 2). This difference seems to appear at 12 months on the diagram of Fig. 2 and then increases at 18 months.

Table 1 Baseline patient characteristics and SMD before and after matching

	Before matching			After matching		
	PSY ($n=138$)	No PSY ($n=823$)	SMD	PSY ($n=136$)	No PSY ($n=136$)	SMD
Age (years), mean ± std	47 ± 11	43 ± 11	0.36	47 ± 11	48 ± 11	−0.08
Female, *n* (%)	120 (87)	634 (77)	−0.26	118 (87)	115 (85)	−0.06
Preoperative weight, mean ± std	115.6 ± 23.1	118.3 ± 21.8	−0.12	115.6 ± 23.1	117.1 ± 19.6	−0.07
Preoperative body mass index, mean ± std	42.4 ± 6.9	42.7 ± 6.4	0.04	42.4 ± 6.9	43.4 ± 6.8	0.14
Max body mass index, mean ± std	46.4 ± 7.3	46.6 ± 7.5	0.03	46.4 ± 7.3	47.6 ± 8.3	0.16
Overweight, mean ± std	50.8 ± 19.7	52.1 ± 18.4	0.06	50.8 ± 19.8	52.7 ± 17.8	0.10
ASA, *n* (%)						
0 or 1	4 (3)	17 (2)	0.10	4 (3)	4 (3)	0.11
2	93 (67)	583 (71)		93 (68)	86 (63)	
3	41 (30)	221 (27)		39 (29)	46 (34)	
Diabetes, *n* (%)	45 (33)	211 (26)	0.15	43 (32)	46 (34)	−0.05
Hypertension, *n* (%)	57 (41)	293 (36)	0.11	56 (41)	55 (40)	0.02
SAS, *n* (%)	61 (44)	322 (39)	0.10	60 (44)	64 (47)	−0.06
Alcohol, *n* (%)	1 (1)	14 (2)	0.10	1 (1)	3 (2)	0.12
Smokers, *n* (%)	24 (17)	103 (13)	0.14	23 (17)	29 (21)	−0.12
Type of surgery, *n* (%)						
Gastric bypass	94 (68)	578 (70)	0.09	92 (68)	86 (63)	0.10
Sleeve gastrectomy	38 (28)	223 (27)		38 (28)	44 (32)	
Sleeve gastrectomy + GBP	6 (4)	22 (3)		6 (4)	6 (4)	
Propensity score, mean ± std	0.21 ± 0.13	0.13 ± 0.08	0.71	0.20 ± 0.12	0.20 ± 0.11	0.02

SMD standardized mean differences

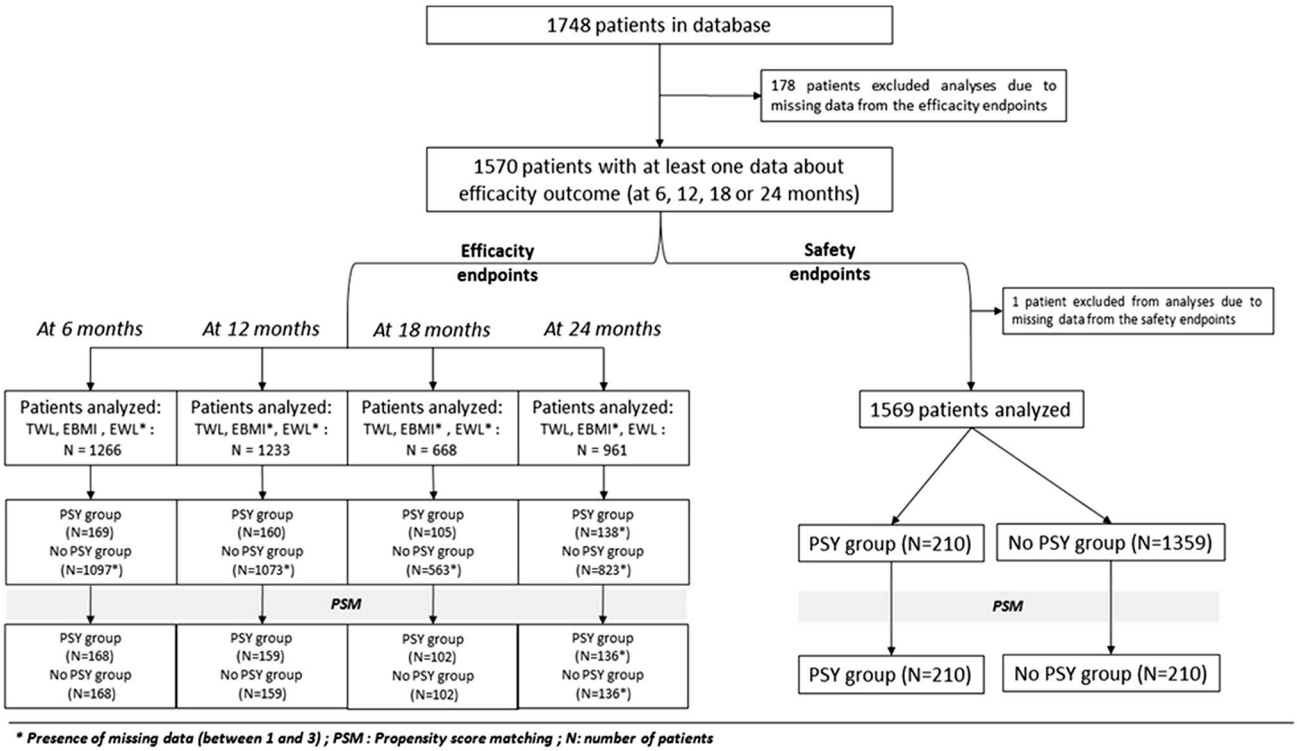

Fig. 1 Flowchart of the study. Presence of missing data (between 1 and 3). *PSM* propensity score matching, *N* number of patients

Surgical outcomes There was no surgical mortality in either group. All procedures were performed laparoscopically without conversion, except seven procedures (0.4%) mostly in the group conversion SG to RYGB. The prevalence of postoperative complications within 90 days between PG and CG is reported in Table 3.

Unadjusted model

The overall morbidity at 90 days was significantly more frequent in PG compared with CG (28% vs 18%, $p < 0.001$). Nevertheless, severe postoperative complications according to Dindo-Clavien classification was not significantly different between both groups, including leakage, hemorrhage, and reoperation (Table 3). With a mean follow-up of 6.2 years, both postoperative mortality and morbidity rates weren't significant between both groups.

PSM model

The overall morbidity at 90 days was significantly increased in the PG compared to the CG (28% vs 17%, $p = 0.01$) (Table 3). Although not significant, severe postoperative complications (4% vs 3%, $p = 0.45$) (Fig. 3) and reoperation (4% vs 2%, $p = 0.41$) were more frequent in PG compared to the CG, in the PSM population. With a mean follow-up of 6.2 years, the prevalence of long-term morbidity (39% vs 32%, $p = 0.17$) and mortality (2% vs 1%, $p = 0.71$) was increased in the PG compared to the CG (Table 3).

Psychiatric adverse events In the psychiatric cohort, 11 patients (5.2%) declared during the follow-up major depressive disorders. Two bipolar patients had postoperative recurrences of their bipolar symptoms, and two depressive patients were secondarily diagnosed of bipolar disorders. Three suicide attempts or self-harms were noticed (1.4%), and no completed suicide to our knowledge.

The overall psychiatric adverse events rate in the PG is 10.5%.

In the control group, 19 patients (1.4%) have declared postoperatively major depressive symptoms, and a patient (0.1%) developed bipolar disorders. Two suicide attempts (0.2%) were signaled, without known completed suicide in this cohort neither.

The overall psychiatric adverse events rate in the CG was 1.7%.

Each of those events was significantly more frequent in the PG ($p < 0.05$).

Table 2 Efficacy outcomes

Linear regression	Unadjusted						Matched					
	PSY		No PSY		Difference [95% CI]	p*	PSY		No PSY		Difference [95% CI]	p**
	N		*N*				*N*		*N*			
Primary outcome												
Total weight loss (TWL) at 24 months (%), mean ± SD	138	32.9 ± 9.8	823	36.2 ± 9.2	3.3 [1.6; 5.0]	**< 0.001**	136	32.7 ± 9.7	136	36.6 ± 9.1	3.9 [1.5; 6.2]	**0.002**
Secondary outcomes												
TWL at 6 months (%), mean ± SD	169	29.4 ± 8.0	1097	30.8 ± 6.9	1.4 [0.1; 2.6]	**0.036**	168	29.4 ± 8.0	168	29.2 ± 6.5	−0.2 [−1.9; 1.4]	0.767
TWL at 12 months (%), mean ± SD	160	33.4 ± 9.0	1073	36.1 ± 8.3	2.7 [1.2; 4.2]	**< 0.001**	159	33.3 ± 9.0	159	35.0 ± 8.0	1.7 [−0.3; 3.7]	0.100
TWL at 18 months (%), mean ± SD	105	33.2 ± 9.5	563	36.5 ± 9.4	3.3 [1.4; 5.3]	**< 0.001**	102	33.2 ± 9.6	102	36.5 ± 9.4	3.3 [0.6; 6.0]	**0.020**
Excess BMI Loss (EBMI) at 6 months (%), mean ± SD	169	60.7 ± 25.6	1097	64.2 ± 21.6	3.5 [− 0.6; 7.6]	0.091	168	60.5 ± 25.5	168	60.8 ± 19.6	0.3 [−4.6; 5.2]	0.910
EBMI at 12 months (%), mean ± SD	160	69.9 ± 29.7	1070	78.1 ± 26.2	8.1 [3.3; 13.0]	**0.002**	159	69.8 ± 29.8	159	77.6 ± 26.0	7.8 [1.6; 14.0]	**0.014**
EBMI at 18 months (%), mean ± SD	105	69.8 ± 27.2	561	77.0 ± 29.3	7.2 [1.2; 13.2]	**0.020**	102	69.4 ± 27.3	102	78.1 ± 27.1	8.6 [0.8; 16.4]	**0.031**
EBMI at 24 months (%), mean ± SD	137	68.2 ± 31.3	822	78.0 ± 28.6	9.8 [4.5; 15.0]	**< 0.001**	135	67.6 ± 31.1	135	75.5 ± 29.4	7.8 [0.3; 15.4]	**0.043**
Excess weight loss (EWL) at 6 months (%), mean ± SD	169	55.7 ± 23.9	1096	59.8 ± 19.4	4.1 [0.2; 7.9]	**0.038**	168	55.6 ± 23.9	168	60.7 ± 18.8	5.2 [0.4; 9.9]	**0.033**
EWL at 12 months (%), mean ± SD	160	65.1 ± 27.1	1071	72.7 ± 23.6	7.6 [3.2; 12.1]	**0.001**	159	64.9 ± 27.1	159	70.8 ± 24.4	5.8 [−0.1; 11.8]	0.056
EWL at 18 months (%), mean ± SD	105	64.4 ± 24.7	561	72.0 ± 26.5	7.6 [2.1; 13.1]	**0.007**	102	64.1 ± 24.9	102	72.8 ± 24.9	8.7 [1.6; 15.8]	**0.018**
EWL at 24 months (%), mean ± SD	138	62.8 ± 29.0	823	72.5 ± 26.2	9.7 [4.9; 14.5]	**< 0.001**	136	62.3 ± 28.9	136	71.0 ± 24.0	8.7 [2.2; 15.2]	**0.009**

Bold values indicate statistically significant values

Difference = No PSY − PSY, *95% CI* 95% confidence interval

*p-value obtained by Student's t test

**p-value obtained by paired Student's t test

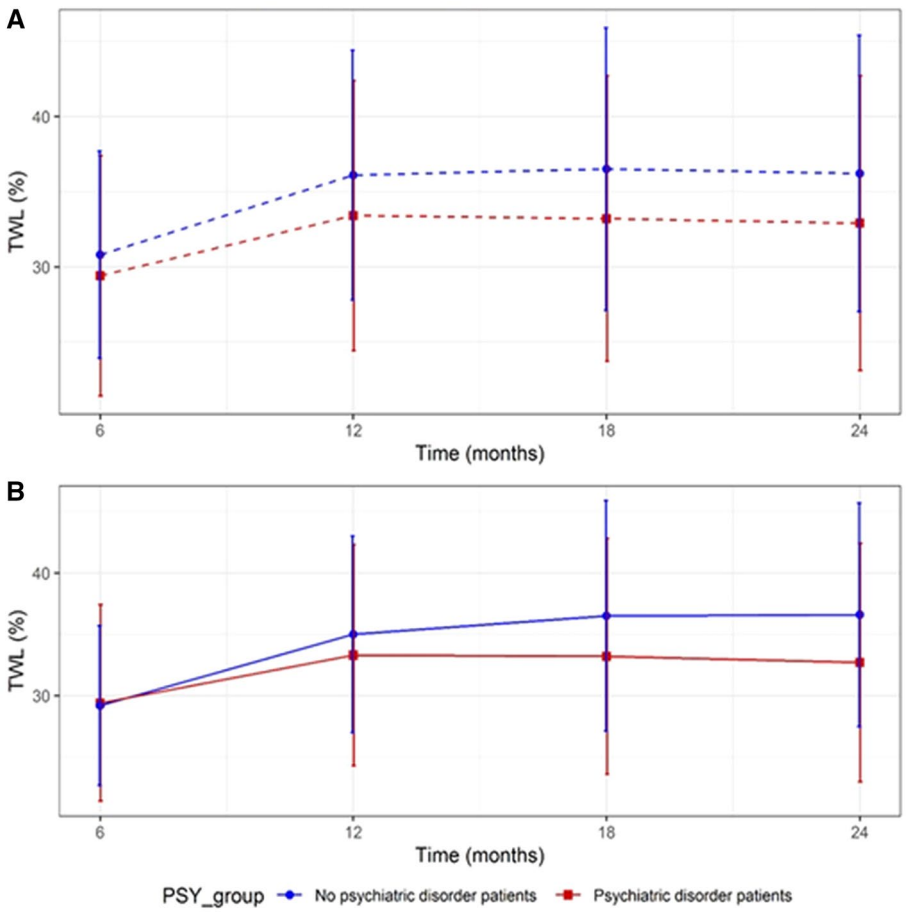

Fig. 2 Evolution of total weight loss (TWL) according to presence of psychiatric disorder in unadjusted model (**A**) and PSM model (**B**)

Table 3 Safety outcomes

	Unadjusted			Matched		
	PSY ($n=210$)	No PSY ($n=1359$)	p*	PSY ($n=210$)	No PSY ($n=210$)	p**
Serious complications up to 90 days, *n* (%)	9 (4)	47 (3)	0.548	9 (4)	6 (3)	0.442
Overall morbidity within 90 days, *n* (%)	59 (28)	244 (18)	**< 0.001**	59 (28)	36 (17)	**0.010**
According to Clavien–Dindo classification, *n* (%)						
Minor < 3	50 (24)	197 (15)		50 (24)	30 (14)	
Major ≥ 3	9 (4)	47 (3)		9 (4)	6 (3)	
Surgical complications until 90 days						
Leakage, *n* (%) (FISTULE_J30 + FISTULE_J90)	5 (2)	28 (2)	0.795	5 (2)	5 (2)	1.000
Reoperation, *n* (%)	8 (4)	44 (3)	0.667	8 (4)	5 (2)	0.410
Infectious complications, *n* (%)	11 (5)	49 (4)	0.251	11 (5)	10 (5)	0.828
Hemorrhage, *n* (%)	4 (2)	47 (3)	0.299	4 (2)	6 (3)	0.530
Late complications, *n* (%)	81 (39)	435 (32)	0.060	81 (39)	67 (32)	0.172
Death, *n* (%)	4 (2)	17 (1)	0.513	4 (2)	3 (1)	0.707

Bold values indicate statistically significant values

*p-value of χ^2 or Fisher's exact test

**p-value of conditional logistic regression

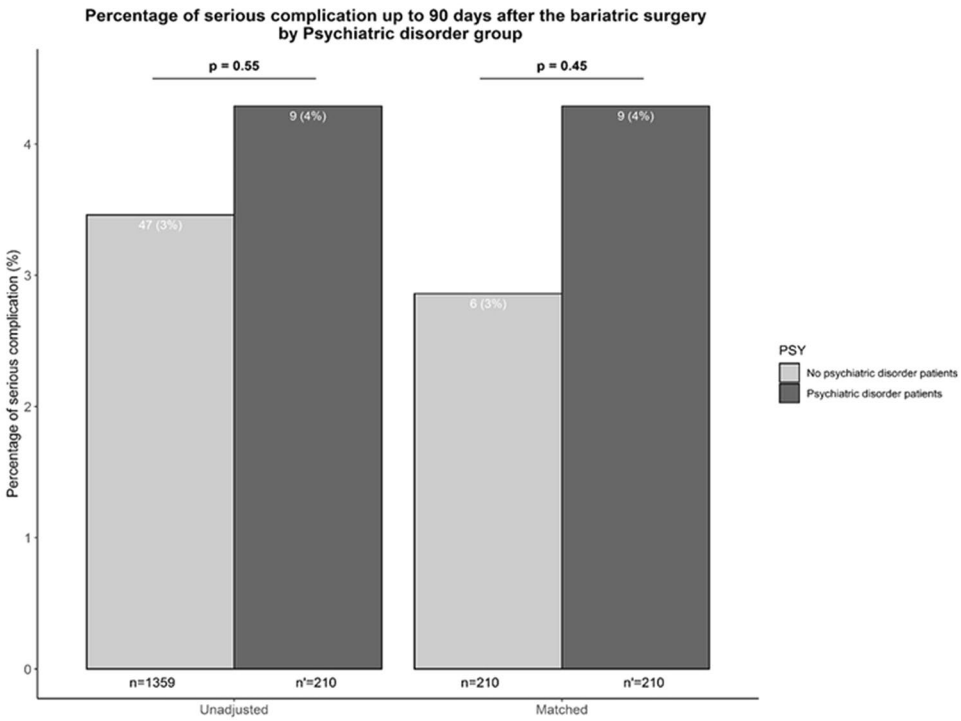

Fig. 3 Repartition of serious complications until 90 days between psychiatric disorder groups. Percentage of serious complication up to 90 days after the bariatric surgery by psychiatric disorder group

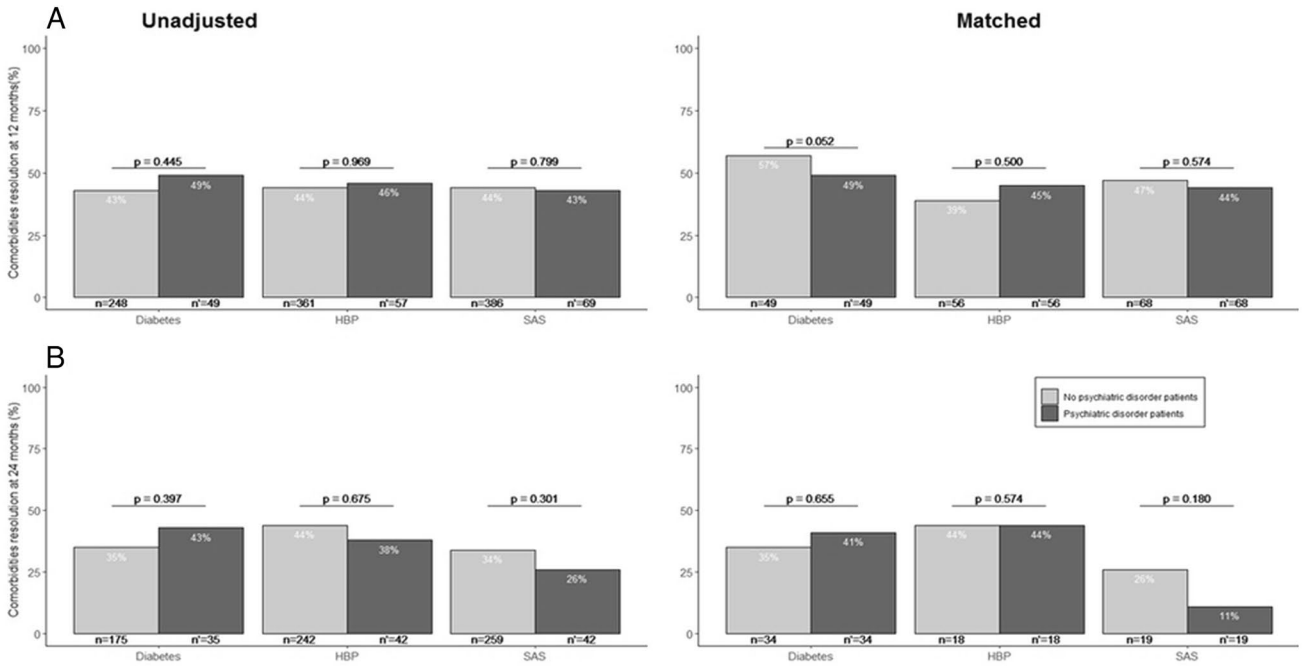

Fig. 4 Resolution of obesity comorbidities

Comorbidities solving (Fig. 4)

The resolution rates of the various obesity-associated comorbidities are detailed in Fig. 4. 1 and 2 years after bariatric surgery, the resolution of diabetes, hyperblood pressure, and obstructive sleep apnea were not significantly different between both groups in both unadjusted and PSM models. Although not significant, the odds of obstructive sleep apnea resolution were 2.3 times higher in the CG compared to the PG (26% vs 11%, $p = 0.18$) in the PSM population.

Discussion

The present study, with a propensity-matched score, shows that bariatric surgery is less effective for patients with psychiatric comorbidities at 24 months, than patients without, in terms of TWL%, EWL% and EBMIL%. Moreover, those patients are more likely to have postoperative overall morbidity at 90 days. However, the increased postoperative morbidity does not concern the severe complications, as leakage, hemorrhage, or infectious complications, leading to a reoperation. The resolution of the comorbidities of obesity was not statistically different between the groups.

About the weight loss outcome, the results of this study are consistent with those of previous retrospective studies [31, 35]. Vermeer et al. showed in a similar-sized cohort a significant difference of TWL% at 12 months between patients Axis I of DSM IV (mood disorders, psychotic disorders, or anxious disorders) and patients without any psychiatric history. That difference was sustained at 4 years after the surgery. In a study with shorter follow-up but with a larger population, Legatto et al. found a significant difference of TWL% at 12 months, comparing the psychiatric status. Those results were still significant in the adjusted models. On the contrary, Fisher's team presented in 2016 a large retrospective cohort study showing no difference of TWL% between groups at 24 months [27]. Our study does not present the larger population, but it is the first using a pairing with propensity score, to increase the homogeneity of the two groups before comparison and understate the selection bias.

Concerning the safety of the bariatric surgery in the psychiatric population, most of the studies reviewed did not present results about the postoperative surgical complications. Only Gorin et al. presented their rate of postoperative complications, which was not different between patients with and without mood disorders [41]. The lack of surgical complications data in those studies is probably because they were mainly led by psychiatrists' research teams. In their works, emphases were placed on psychiatric postoperative morbidity, such as recurrence of depression, modification of medications, emergency attending, suicide attempts, or psychiatric hospitalization. On the opposite of this attitude, we worked on a database of morbidly obese patients undergoing surgery, prospectively maintained by the surgeons of our obesity specialized center. This explains the few psychiatric postoperative data in our study, with probable understatement of those events.

The psychiatric postoperative outcomes have been well studied, particularly by two authors [29, 42], observing a diminution of the prevalence of depressive symptoms psychiatric disorders 3 years after surgery. However, they did not observe psychiatric medication decrease. This improvement on depressive symptoms and the lower rate of postoperative depression were confirmed by the meta-analysis of Dawes. More recently, another meta-analysis was made upon the suicide and self-harm attempts after bariatric surgery [43]. They were both augmented after bariatric surgery compared to BMI and age-matched population without surgery. Moreover, this raise seemed linked with the psychiatric preoperative status and the intake of psychotropic medication. A review of 2022 confirms those statements [44]. Our own results on suicide attempts seem consistent whit them too. Smaller studies about bipolar disorders and schizophrenia have been published. Shelby described multiples disturbances in the postoperative management of 18 bipolar and schizophrenic patients, with symptoms exacerbations, treatment substitutions, decompensations, or psychiatric hospitalization [26]. On the contrary, Archid presented a small cohort of eight schizophrenic patients, having no exacerbation of symptoms and with a stable psychiatric status after surgery [30]. Those divergent findings illustrate the heterogeneity of those patients, and the difficulty to select safely psychiatric patients among bariatric surgery candidates. A recent article explaining the advent of a "bariatric psychiatry" describe a first phase of improvement of psychiatrics symptoms lasting usually two years after the surgery, often followed by a slow worsening of the mental wellbeing [45]. The implementation of ERAS protocol since 2017 in our center may have beneficial effects on the surgical and psychological outcomes of bariatric surgery for high-risk populations such as patient with psychiatric conditions. Giving to those patients a closer framing shall improve the postoperative outcomes. Similarly, a systematic postoperative psychiatric consultation could be added to the usual clinical pathway to screen postoperative psychiatric adverse events and to treat them properly.

We sought pathophysiological explanations to clinical perturbations and found potential evidence. Modifications induced by the SG or the RYGB on the organism are not fully understood: volume of distribution reduced, fatty mass decreased, gastric acidity/volume/mobility decreased, malabsorption, molecular protein linking, endocrinological modulations, bile secretion, and even gut–brain mechanism modifications are all potentially responsible of those disturbances [46, 47]. Hence, several studies looked after the postoperative pharmacokinetics changes, especially for psychiatric medications. Whether the RYGB [48, 49] or the SG [50], a lessen absorption seems to occur, requiring vigilance about postoperative psychiatric symptoms. This statement is even more true with the use of narrow band medication, as lithium, which can lead to very dangerous situations [51]. Even if more pharmacokinetic data are available for the bypass, and that it seems more hazardous in terms of postoperative medications management because of the greater malabsorption compared to the sleeve gastrectomy,

there is no study allowing to state on the risk of a surgery over another.

This study has several limitations. Firstly, the retrospective design of this study is its main limitation. Secondly, no objective psychiatric diagnostic scale has been used to preoperatively assessed the psychiatric status of the patients. As described in the Introduction, the psychiatric preoperative evaluation is not a diagnostic interview, but rather a general meeting to assess the personality of the candidate and potentials dangerous behaviors or comorbidities. Thirdly, we only studied patients who succeed in the bariatric surgery pathway, the operated patients. This might constitute a considerable bias of selection, as the severe mentally ill patients are certainly refused before this crucial step. This also explained the absence of schizophrenic patients in our analysis. Fourthly, it is important to mention the high rate of patients lost to follow-up in our cohort at 2 years, approaching nearly half of the population and creating a potential bias of attrition in the study.

Conclusion

Bariatric surgery on mentally ill patients allows a lesser but substantial weight loss, with an equivalent correction of comorbidities related to obesity at 2 years. However, there are more non-severe surgical adverse events. Therefore, it seems appropriate to propose bariatric surgery to patients with psychiatric diseases, on condition of preparing them with great care, together with psychiatric team. The systematic preoperative screening of psychotrauma would be reasonable, and the creation in our hospital of a Psychotrauma Center goes in this direction. The key point of the success of the bariatric surgery in this population should rely on attentive and sustained postoperative psychiatric care.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00464-023-10343-z.

Declarations

Disclosures Ludovic Dupont, Benjamin Menahem, Jean-Jacques Parienti, Arnaud Alves, Eric Bui, Adrien Lee Bion, Hugo Meunier, and Anaïs Briant have no conflicts of interest or financial ties to disclose.

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