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Bariatric Surgery in Patients With Inflammatory Bowel Disease: A Case-Control Study from the GETAID

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Background: The prevalence of obesity and the number of bariatric surgeries in both the general population and in patients with inflammatory bowel disease (IBD) have increased significantly in recent years. Due to small sample sizes and the lack of adequate controls, no definite conclusions can be drawn from the available studies on the safety and efficacy of bariatric surgery (BS) in patients with IBD. Our aim was to assess safety, weight loss, and deficiencies in patients with IBD and obesity who underwent BS and compare findings to a control group.

Methods: Patients with IBD and a history of BS were retrospectively recruited to centers belonging to the Groupe d'Etude Thérapeutique des Affections Inflammatoires du Tube Digestif (GETAID). Patients were matched 1:2 for age, sex, body mass index (BMI), hospital of surgery, and type of BS with non-IBD patients who underwent BS. Complications, rehospitalizations, weight, and deficiencies after BS were collected in cases and controls.

Results: We included 88 procedures in 85 patients (64 Crohn's disease, 20 ulcerative colitis, 1 unclassified IBD) with a mean BMI of 41.6 ± 5.9 kg/m^2. Bariatric surgery included Roux-en-Y gastric bypass (n = 3), sleeve gastrectomy (n = 73), and gastric banding (n = 12). Eight (9%) complications were reported, including 4 (5%) requiring surgery. At a mean follow-up of 34 months, mean weight was 88.6 ± 22.4 kg. No difference was observed between cases and controls for postoperative complications (P = .31), proportion of weight loss (P = .27), or postoperative deficiencies (P = .99).

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Conclusions: Bariatric surgery is a safe and effective procedure in patients with IBD and obesity; outcomes in this patient group were similar to those observed in a control population.

Key Words: bariatric surgery, complication, IBD outcome

Introduction

Obesity affects 600 million people globally.[1] Although inflammatory bowel disease (IBD), mainly Crohn's disease (CD), can be associated with dramatic weight loss and poor nutritional status, the prevalence of obesity has increased in the IBD population in recent years.[2,3] In European studies, the prevalence of obesity in IBD is about 20%; a further 20% of patients with IBD are overweight.[4,5] Obesity is also known to be associated with low-grade chronic inflammation, which may play a role in IBD[6,7] and may explain why obesity is associated with worse outcomes in patients with CD.[8] Available studies suggest that weight loss can improve the course of IBD.[9]

Bariatric surgery (BS) has dramatically changed the management of obesity by offering a means of inducing a significant decrease in body mass index (BMI) with associated improvements in cardiovascular mortality.[10] The number of bariatric procedures performed has more than tripled in the United States in the last 10 years.[11] As a result, surgical management is regularly considered in the treatment of patients with both IBD and obesity.

In patients with IBD, BS may be complicated by previous bowel resections or inflammatory involvement of the bowel wall, which is associated with a predisposition to fistulae and strictures (particularly in patients with CD); postoperative complications are often linked to concomitant medication and are associated with an increased likelihood of postoperative nutritional deficiencies.[12]

All currently available data on the feasibility and safety of BS in patients with IBD come from small case series or the administrative American series.[13–21] Importantly, no available study compares BS complications in patients with IBD vs non-IBD patients using a matched control group. Based on the currently available data, no definite conclusions can be drawn regarding outcomes in patients with IBD following BS.[9]

The primary aim of this retrospective multicenter study, conducted in Groupe d'Etude Thérapeutique des Affections Inflammatoires du Tube Digestif (GETAID) centers, was to report on the outcomes of BS in a large series of patients with IBD and to compare its feasibility and safety with a matched control group. The secondary aim of the study was to describe outcomes in patients with IBD following BS.

Methods

Patients Population

This retrospective multicenter study was conducted by GETAID. All adult patients with an established diagnosis of IBD (CD, ulcerative colitis [UC], or unclassified IBD) who underwent BS between January 1, 2008, and January 1, 2020, in the 19 participating French and Belgian GETAID centers were eligible for inclusion. Patients with a diagnosis of IBD after BS were excluded. Patients with incomplete data on the IBD course before or after surgery or with incomplete data regarding the bariatric procedure were also excluded.

Patient and disease characteristics including disease duration, location, and behavior according to the Montreal classification, history of IBD-related intestinal resection, IBD medications at the time of BS, weight, BMI, cardiovascular risk factors (eg, thromboembolic events, ischemic events, dyslipidemia, hypertension, obstructive sleep apnea), and metabolic comorbidities (eg, diabetes, nonalcoholic steatohepatitis) and deficiencies (eg, hemoglobin, ferritin, vitamin B12) were retrospectively collected. Anemia was defined as hemoglobin levels of <11.7 g/dL and <13.3 g/dL for women and men, respectively; iron deficiency as ferritin levels <5 μg/mL; and vitamin B12 deficiency as levels ≤200 ng/mL. Disease activity was determined according to the findings of the most recent morphologic exploration performed in the 2 years before BS, including endoscopy, magnetic resonance imaging (MRI), computed tomography (CT), and ultrasound. Inflammatory bowel disease was considered active if acute inflammatory lesions were visible on cross-sectional imaging and/or when ulcers were described at endoscopy (except ulcers strictly located on the anastomosis and without stricture); IBD without these disease characteristics on investigation was considered inactive. In routine clinical practice, patients with IBD attend the IBD clinic at a frequency of between once monthly and once yearly; in the current study, patients with no visit to either the gastroenterology department or the abdominal surgery department for a period of more than 1 year were considered as loss of follow-up. Data included in the analysis represent the findings at the last available follow-up.

Bariatric Procedures

Bariatric procedures included Roux-en-Y gastric bypass (RYGB), sleeve gastrectomy (SG), and laparoscopic adjustable gastric banding (LAGB). The type of adjustable gastric band used in this study has a balloon that is inflated via a port that is similar to a subcutaneous port used for chronic central venous access. The band is inflated by injecting saline via the port, located subcutaneously either on the abdominal wall or on the sternum.[22] Sleeve gastrectomy was performed by laparoscopy and consisted either of subtotal vertical gastrectomy with preservation of the pylorus, including longitudinal resection of fundus, corpus, and antrum.[22] Resection comprises approximately 80% of the stomach. In some centers, Magenstrasse and Mill (MM) gastroplasty was performed. In this technique, a long, narrow gastric tube is fashioned by a stapling along the lesser curvature (Magenstrasse), which drains into the antrum (Mill); the procedure does not require a band or stomach resection.[23] Because of the small number of cases, it was not possible to compare outcomes for the 2 procedures. To avoid bias due to the technique, patients with IBD were matched to non-IBD controls who underwent the same procedure with same surgeon.

Revisional surgeries after a first bariatric procedure were also included to give a complete picture of the bariatric procedures available to the IBD population. The indication for BS was based on the Interdisciplinary European Guidelines on Metabolic and Bariatric Surgery.[24]

Data on postoperative mortality, complications, reoperation, and rehospitalization were collected. Postoperative complications included fistulae/stricture at the surgical site, bleeding, thromboembolic events, anastomotic leak, local and systemic infections, ischemic digestive events, and any other event potentially related to the surgical procedure. Length of stay and rehospitalization within the 30 days following surgery were also recorded. Body weight, weight loss percentage, and deficiencies at last follow-up were also collected.

Control Group

Patients without IBD and undergoing BS were identified in the surgical bariatric database of each participating GETAID center. A manual matching was performed. Patients with IBD were matched 1:2 with non-IBD controls for type of bariatric procedure, sex, age, and BMI at the time of BS. Patients with IBD were also matched with non-IBD controls undergoing the same procedure in the same bariatric surgery unit to avoid bias linked to the surgical technique or the surgeon. Cardiovascular and metabolic risk factors at the time of surgery were recorded. Postoperative mortality, complications, length of stay, and reoperation rates were also collected. Body weight, weight loss percentage, and deficiencies at last follow-up were collected for statistical comparison with patients with IBD.

Postoperative IBD Course

The follow-up period started on the date of BS and ran until either February 2020 or last available date in case of loss of follow-up. During this period, we collected the following events related to the IBD course: major abdominal or perineal surgery, hospitalization, corticosteroid use, and IBD treatment modifications. Stable medication was defined as the absence of treatment modification; treatment escalation as treatment modification for active disease; and treatment de-escalation as treatment interruption or a switch from an immunosuppressant or biologic to a non-immunosuppressant drug due to clinically quiescent disease. The last morphologic exploration (imaging or endoscopy) was recorded, if available.

The main objective of this study is to report the rates of postoperative complications of BS in patients with IBD, to compare these rates with those observed in non-IBD controls, and to identify factors associated with these complications. A secondary objective is to report on the impact of BS on body weight/BMI and deficiencies in patients with IBD and to compare with non-IBD controls. Finally, we aim to describe the impact of BS on disease course (including IBD-related surgery), hospitalization, and treatment changes.

Statistics

Descriptive statistics are expressed as means (standard deviation) for continuous variables and as numbers (percentages) for qualitative variables.

The risk for a complication or deficiency was analyzed by logistic regression; odds ratios (ORs) and 95% confidence intervals (95% CI) are provided. In case of few observations in a category, the Fisher exact association is reported as the OR with Haldane correction. The covariates were age at the time of BS, sex, weight, BMI, tobacco use, comorbidities, type of IBD, IBD medication, duration of IBD, history of surgery for IBD, Montreal classification (B, L, p), IBD activity at time of BS, type of BS, first or revisional BS, and weight loss. Weight loss was analyzed by linear regression with respect to the same risk factors as previously. Logistic and linear regressions were univariate. Multivariate analysis with stepwise selection was applied on factors that had a P-value <0.10 in univariate analyses. The McNemar test was used to compare deficiencies before and after BS. The paired Student t test was used to compare the weight before and after CB. For the case-control portion of the analysis, the conditional logit model was used to compare complications, length of stay, weight loss percentage, and deficiencies post BS (hemoglobin, ferritin, vitamin B12); $P < .05$ was considered significant. Calculations were performed using the SAS 9.4 software (SAS Institute, Cary, NC, USA).

Ethical Considerations

This retrospective multicenter study was conducted by the GETAID according to Commission Nationale de l'Informatique et des Libertés (CNIL) recommendations and French law.

Results

Patient Population

We identified 105 patients with both IBD and a history of BS in 19 GETAID centers. Twenty patients were excluded, as BS preceded the diagnosis of IBD. Eighty-eight bariatric procedures performed in 85 patients with IBD were included in the analysis. The detailed characteristics of the patients at the time of BS including IBD characteristics, comorbidities, and deficiencies are summarized in Table 1. Sixty (71%) patients were female, 64 (75%) had CD, 20 (24%) had UC, and one (1%) had unclassified IBD. A history of intestinal resection was noted in 19 (22%) patients. In CD, 45 (70%) patients had an ileal involvement (L1 or L3), 5 (8%) had an upper gastrointestinal tract location (L4), 7 (11%) had stricturing disease, and 6 (9%) had fistulizing disease. Perianal location was reported in 18 (29%) patients. Morphologic explorations were available in 58 patients, including 43 explorations showing no sign of active inflammation. Inflammatory bowel disease medications at the time of BS are indicated in Table 2.

The mean interval between IBD diagnosis and BS was 10.2 ± 6.4 years. Mean age at the time of BS was 40.1 ± 11 years. Patients had a mean body weight of 118.2 ± 19.5 kg and a BMI of 41.6 ± 5.9 kg/m^2 respectively; all had BMI >30 kg/m^2. All but 2 patients had complete follow-up: both had undergone SG, one had a loss of follow-up at 6 months postprocedure, and the other at 7 years post-procedure.

Surgical Procedures and Postoperative Complications

Sleeve gastrectomy was the most common procedure in our population (73 patients); the remaining procedures were LAGB (12 patients) and RYGB (3 patients). Four patients had a revisional surgery. Three patients who underwent 2 surgeries were included in the analysis. The mean length of hospitalization was 3.5 ± 1.7 days. There was no mortality in the entire follow-up period. Eight (9%) patients experienced complications or rehospitalization within 30 days of BS. Postoperative complications are indicated in Table 3. Four (5%) patients were reoperated for the following complications: 1 mesenteric ischemia with small bowel perforation at day 1 post-RYGB in a patient with CD, 1 sleeve stricture

Table 1. Patient and disease characteristics at the time of bariatric surgery.

Characteristics at the Time of Bariatric Surgery, *n* = 88	Crohn's Disease, *n* = 66	Ulcerative Colitis, *n* = 22
Female gender, *n* = 88	51 (78)	10 (47)
Age (years), *n* = 88	38 ± 11	44 ± 11
Active smoking, *n* = 83	20(32)	1(5)
Previous IBD resection, *n* = 85	15(23)	4(19)
Time between IBD diagnosis and BS (years), *n* = 88	10.3 ± 6.5	9.5 ± 6.3
Weight (kg), *n* = 88	115 ± 17.4	125.6 ± 23.6
BMI (kg/m2), *n* = 84	41.2 ± 5.9	42.7 ± 5.8
Montreal classification, *n* = 88		
L1	22 (35.5)	—
L2	18 (29)	—
L3	22 (35.5)	—
L4	6 (9.4)	—
p+	20 (31.7)	—
B1	51 (79,7)	—
B2	7 (10.9)	—
B3	6 (9.4)	—
E1	—	1 (4.8)
E2	—	0 (47.6)
E3	—	8 (38.1)
Results of last exploration for IBD before BS, n = 59 (normal)	34 (72)	10 (83)
Hb (g%), *n* = 54 (normal)	44 (98)	8 (89)
Ferritin, *n* = 37 (normal)	28 (80)	2 (100)
Vitamin B12, *n* = 36 (normal)	31 (92)	2 (100)
CRP (mg/L), *n* = 47	11.2 ± 19	9.8 ± 11
Medical history		
Hypertension, *n* = 71	8 (15)	6 (32)
Obstructive sleep apnea, *n* = 70	7 (14)	5 (25)
Metabolic disorder, *n* = 88	16 (24)	6 (27)
Diabetes, *n* = 78	6 (11)	5 (23)
NASH, *n* = 78	10 (18)	1 (5)

Abbreviations: BMI, body mass index; BS, bariatric surgery; CRP, C-reactive protein; Hb, hemoglobin; IBD, inflammatory bowel disease; NASH, non-alcoholic steatohepatitis.

Table 2. IBD medications at the time of bariatric surgery.

Medications at the Time of Bariatric Surgery	Crohn's Disease, n (%; *n* = 64)	Ulcerative Colitis, n (%; *n* = 21)
No medication	13 (20)	3 (14)
5-ASA	14 (22)	6 (29)
Immunomodulator	11 (17)	3 (14)
Thiopurine	9	3
Methotrexate	2	0
Anti-TNF	21 (33)	6 (29)
Monotherapy	21	5
Anti-TNF + immunomodulator	0	1
Vedolizumab	4 (6)	1 (5)
Ustekinumab	1 (2)	0 (0)
Missing	0 (0)	2 (9)

Abbreviations: 5-ASA, 5-aminosalicylic acid; BS, bariatric surgery; IBD, inflammatory bowel disease; TNF, tumor necrosis factor.

occurring 5 months post-surgery, and 2 early gastric leaks after SG; of these patients, 1 had a second fistula (with sepsis) 2 years later and required reoperation, 1 had a wound infection requiring antibiotics and local treatments, 1 had portal veinous thromboembolism, 1 was hospitalized for kidney stones, and 1 (with ileostomy for UC) had severe dehydration

Table 3. Detailed postoperative complications in patients and controls.

Patient	Disease	Bariatric Surgery	Delay for Complications	Complications	Outcome
Male, 58 yo	UC with colectomy and ileostomy	SG Revisional surgery 26 months post LAGB	Day 21	Severe dehydration, acute renal failure, cardiogenic shock	Favorable
Male, 51 yo	UC	SG	1° Day 4	2° Months 25	1° Reoperation: initially favorable outcome but new fistula at month 25 2° Reoperation: favorable outcome
Female, 30 yo	CD (L3B1p+)	SG	Month 5	Gastric stricture	Conversion into RYGB: favorable outcome
Male, 53 yo	CD (L4B1p+)	RYGB	Day 1	Mesenteric ischemia and small bowel perforation due to sclerolipomatous mesentery with difficult mobilization during procedure	Sleeve gastrectomy after 3 months: favorable outcome
Female, 35 yo	UC	SG	Day 3	Wound infection	Wicking, stop anti-TNF: favorable outcome
Female, 59 yo	UC	SG	Day 2	Upper edge fistula of the staple line	Reoperation: favorable outcome
Female, 47 yo	CD (L3B3p-)	SG	Day 20	Kidney stones	Hospitalization: favorable outcome
Female. 59 yo	UC	SG	Day 3	Portal vein thrombosis	Anticoagulation: favorable outcome
Male, 23 yo	Control	LAGB	Month 12	Gastric erosion	Partial gastrectomy and conversion to sleeve
Male, 36 yo	Control	SG	Day 0	Hemorrhage per procedure	Hemostatic handling per procedure: favorable outcome
Female, 50 yo	Control	SG	Year 3	Gastric stricture	Conversion into RYGB: favorable outcome

Abbreviations: CD, Crohn's disease; RYGB, Roux-en-Y gastric bypass; SG, sleeve gastrectomy; TNF, tumor necrosis factor; UC, ulcerative colitis; yo, years old.

with acute renal failure (Table 3). Of note, no factors were associated with postoperative complications.

To compare the rates of complications, patients with IBD were matched 1:2 with non-IBD controls. Thirty-three procedures were not matched because they were performed in another hospital with no possible access to a surgical database or because the matching criteria were not met. Eleven patients were matched 1:1, as all the specific criteria for the matching were only met with 1 control. Fifty-five patients with IBD and 99 non-IBD controls were included for the case-control portion of the analysis. No difference was observed between patients with IBD and non-IBD controls for risk of complications (P = .31), rehospitalization within 30 days (P = .31), or complications requiring surgery (P = .57).

Patients with IBD had similar length of hospital stay vs non-IBD controls (3.5 ± 1.8 days vs 3.7 ± 7 days, P = .60). There were no mortality events during hospitalization or follow-up in either patients with IBD or non-IBD controls. The rates of specific complications in patients with IBD vs non-IBD controls are indicated in Table 4.

Outcomes After Bariatric Surgery

Weight evolution

After a mean follow-up of 34 months, the mean weight of patients with IBD was 88.6 ± 22.4 kg. Patients lost 29.3 ± 16.0 kg (P < .0001) and 24.9% ± 12.7% (P < .0001) of their weight before BS. Weight loss (and weight loss percentage) according to the type of BS and disease (UC vs CD) are indicated in Figure 1. Factors associated with higher weight loss were the behavior of CD (B3 vs B1, P = .008), type of BS (P = .036; RYGB and SG vs LAGB), BMI at the time of BS (P = .01), and initial BMI (P = .009). Factors associated with weight loss percentage were the behavior of CD (B3 vs B1, P = .013) and the type of BS (P = .011). Weight loss was significantly lower in older patients (P = .043). In the non-IBD control group, weight loss percentage was 30.8 ± 14.7%. No significant difference was observed between IBD and non-IBD control patients (P = .27; Table 4).

IBD evolution

Regarding IBD events during the follow-up period, 1 patient required salvage colectomy 4 months after BS for acute severe UC, 2 patients had new anoperianal lesions after a mean duration of 24 months post-BS, and 5 other patients were hospitalized for IBD flare without surgery. Corticosteroid treatment was administrated in 6 patients during follow-up (2 requiring intravenous corticosteroid treatment).

Overall, 64 (75%) patients had no modification of their IBD medication, 15 (18%) required treatment escalation for loss of response (including 1 salvage colectomy), and 3 (3.5%) had treatment de-escalation; 3 patients had missing data. Detailed treatment modifications are indicated in Table 5. Considering the BS procedure, patients undergoing a LAGB had a higher risk of severe complications (P = .011) or hospitalization for IBD flare (P = .046) vs RYGB and SG.

Deficiencies

Anemia, iron, and vitamin B12 deficiencies were observed in 11.5%, 9.5%, and 30%, respectively, of patients for whom data was available at last follow-up. When comparing the

evolution of deficiencies pre- and post-BS in the same patient, no statistical differences were observed for hemoglobin (P = .56), ferritin (P = .32), or vitamin B12 (P = .18). No risk factors were identified for anemia or iron deficiency. Vitamin B12 deficiency was statistically higher in CD patients with ileal location (L1 or L3 vs L2, P = .019; OR = 13.4). Statistical comparison of post-BS deficiencies in patients with IBD vs non-IBD controls demonstrated no significant difference for hemoglobin (P = 0.58), ferritin (P = .99), or vitamin B12 (P = 0.99) between the 2 groups (Table 4)

Discussion

We report the largest series of patients with IBD and obesity who underwent a bariatric procedure. This is also the first study that compares complications and outcomes following BS that employs a case-control design. Interestingly, our results show no increased risk of perioperative complications in patients with IBD vs non-IBD controls and no clear worsening of the disease after the BS.

In the context of rising rates of obesity, the question of feasibility and safety of BS in patients with IBD is crucial. Obesity by itself may increase postoperative complications.[25,26] In IBD, obesity is associated with a higher risk of postoperative complications (in particular, wound infection), longer length of hospital stay, and increased perioperative mortality.[27] Patients with IBD are at risk of requiring future surgery or may have previously undergone a procedure that may make malabsorptive procedures more challenging.[28] Combining these conditions could theoretically lead to a high risk of postoperative complications. Soon-to-be available data from small case series that do not include a non-IBD control suggest that BS is safe in IBD populations. In our large cohort, consisting of 88 procedures in 85 patients, BS was demonstrated to be safe in patients with IBD and obesity. A recent meta-analysis including 10 studies has demonstrated a pooled rate of early and late adverse events of 15.9% and 16.9%, respectively.[29] This lower rate of complications is likely explained by the small number of RYGB in our study (n = 3). When compared with other studies,[11] the high number of SG procedures in our series suggests that other procedures, including RYGB and LAGB, are being progressively abandoned in IBD populations. One possible explanation is that RYGB is known to be associated with higher rates of complications (compared with SG) in IBD populations. A study comparing RYGB and SG in 54 patients with IBD demonstrated a higher rate of surgical complications following RYGB vs SG (26% vs 3%).[16] In a meta-analysis, patients with IBD who underwent RYGB experienced nearly twice the rate of overall adverse events compared with those who underwent SG (45.6% vs 21.6%).[29] In our cohort, we could not compare the risk of complications in patients with RYGB vs SG, as the number of RYGB procedures was low (n = 3). Of note, 1 of the 3 RYGB procedures undertaken was complicated by early small bowel perforation favored by difficulties to move a sclero-lipomatosis mesentery in a patient with CD.

Importantly, this is the first study that compares complication rates in patients with IBD with those in non-IBD controls. No difference was observed between patients with IBD and non-IBD controls matched for age at the time of BS, type of BS, sex, BMI, and surgeon performing the surgery; this suggests that BS is as safe in patients with IBD as it is in the general population. An Nationwide Inpatient Sample in the United States compared 790 patients with IBD with a group including all patients who underwent BS without secondary diagnosis codes of IBD.[17] The overall rate of adverse events was similar in both groups, except for a higher risk of perioperative small bowel obstruction in patients with IBD. Limitations of this study were that it compared 2 heterogenous groups and that it utilized a database limited to in-hospital stays that was not able to capture complications occurring after discharge.[17]

To our knowledge, no study outside of our own has tried to identify risk factors for complications of BS in patients with IBD. In our cohort, no strong risk factors were identified for postoperative complications or rehospitalization, including the type of IBD, a history of previous IBD resection, and IBD medications. As in the meta-analysis of Garg et al,[29] more adverse events were observed in patients with UC vs CD (although this difference did not reach statistical significance).

Our study demonstrates that BS is an effective procedure that can reduce body weight in patients with IBD without increasing the risk of denutrition or severe deficiencies. Weight loss percentage was similar when compared with other series.[13] Similarly, no significant difference was observed between UC and CD. We confirmed that the highest weight loss was achieved with RYGB and the lowest weight loss with LAGB.[13,14,18] In our cohort, weight loss percentage was similar in patients with IBD vs matched non-IBD controls, suggesting an absence of risk of poor general nutritional status after BS in IBD populations. To our knowledge, no study outside of our own has looked at post-BS deficiencies in patients with IBD. In the general population, the incidence of iron deficiency and anemia, respectively, can reach 24.5% and 16.7%

Table 4. Outcomes in patients with IBD and non-IBD controls post-bariatric surgery.

	Controls, n (%; n = 98)	IBD, n (%; n = 55)	P
Postoperative complications	2 (2)	3 (5.5)	0.37
Complications/ rehospitalization within 30 days post-BS	3 (3.1)	4 (7.3)	0.31
Complications requiring surgery	2 (2)	4 (7.3)	.57
Weight loss percentage (mean SD)	30.8 ± 14.7	27.8 ± 15.1	0.27
Length of hospitalization (days + SD)	3.5 ± 1.8	3.7 ± 1.7	0.6
Anemia, n = 50/38	4 (8)	4 (10.5)	0.8
Ferritin deficiency, n = 43/28	4 (9.3)	0 (0)	0.99
Vitamin B12 deficiency, n = 37/27	2 (5.4)	7 (25.9)	0.99

Abbreviations: BS, bariatric surgery; IBD, inflammatory bowel disease; SD, standard deviation.

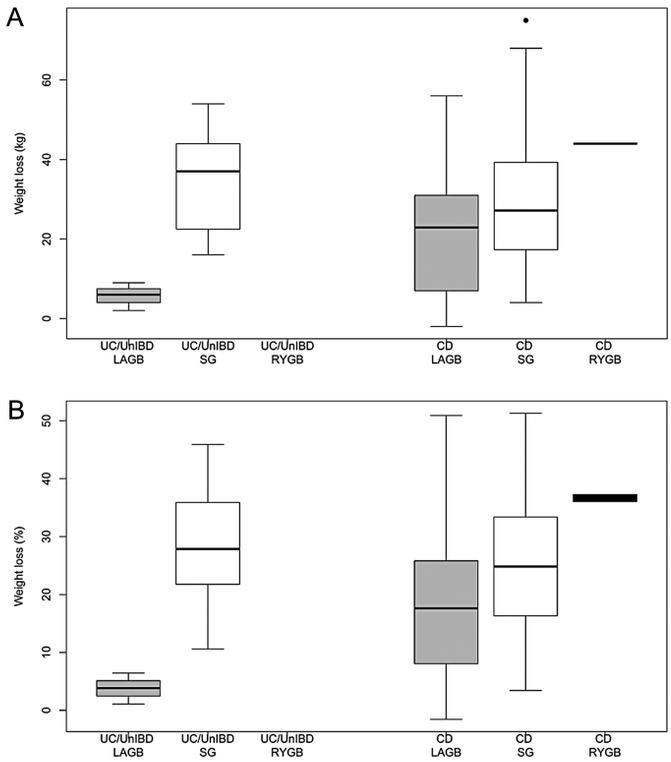

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Figure 1. Weight loss (A) and weight loss percentage (B) according to the surgical procedure and disease type. Mean weight loss and weight loss percentage was 28.4 ± 13 kg and 23.3 ± 1 in UC and 27 ± 16 kg and 23.4 ± 12% in CD. The difference was not significant between UC and CD for weight loss ($P = .68$) or weight loss percentage ($P = .82$). Sleeve gastrectomy and RYGB were associated with higher weight loss and higher weight loss percentage vs LAGB ($P = .036$ and $P = .011$ for SG and RYGB, respectively). Abbreviations: CD, Crohn's disease; LAGB, laparoscopic adjustable gastric banding; RYGB, Roux-en-Y gastric bypass; SG, sleeve gastrectomy; UnIBD, unclassified IBD.

Table 5. Treatment modifications after bariatric surgery.

Treatment modifications after BS	Crohn's disease, *n* = 64	Ulcerative colitis, *n* = 21
No treatment modification	48 (75)	16 (76)
No medication	11	2
5-ASA	10	4
Immunomodulator (thiopurine or methotrexate)	9	3
Biologic	18	7
Treatment de-escalation	3 (5)	0 (0)
Stop thiopurine => no medication	1	—
Stop anti-TNF => no medication	1	—
Stop anti-TNF => start thiopurine	1	—
Treatment escalation	11 (17)	3 (14)
Start thiopurine	0	1
Start biologic	7	2
Switch biologic	4	0
Anti-TNF => anti-TNF + immunomodulator	1	0
Proctocolectomy	NA	1
Missing data	2	1

Abbreviations: 5-ASA, 5-aminosalicylic acid; BS, bariatric surgery; IBD, inflammatory bowel disease; NA, not available.
The percentage of patients with stable medication or treatment escalation was similar in CD and in UC. No patient stopped treatment with an immunomodulator or anti-TNF in the UC group compared with 3 patients in the CD group. In the treatment escalation group, patients who started thiopurine had no medication or were on 5-ASA before BS, and patients who started a biologic had no medications or were on thiopurine before BS. Patients who switched for a different biologic were either on anti-TNF or vedolizumab and started either anti-TNF, vedolizumab, or ustekinumab.

post-RYGB and 12.4% and 1.6% post-SG.[30] We found no difference according to the surgical procedure, but the number of RYGB procedures in in our study population was low. We observed lower rates of iron deficiency (9.5%) but higher rates of anemia (11.5%) compared with data post-SG.

In patients with IBD, anemia is common and multifactorial.[31] In the IBSEN cohort, the incidence of anemia was 13% and 7.5% in CD and UC, respectively.[32] This suggests that BS is not the only mechanism causing anemia in our cohort, and the rate of deficiency was similar in patients before and after BS.

In the present study, patients with IBD were not at higher risk of deficiencies vs non-IBD controls, and previous IBD resection was not associated with an increased risk. This is likely explained by the rigorous postoperative follow-up and the use of supplemental iron and vitamins to prevent long-term alterations of nutritional parameters in these patients.[33]

Obesity is associated with more complex management of IBD, mainly due to a higher risk of extraintestinal manifestations,[34] longer duration of hospitalization,[35] higher costs,[36] and higher morbidity of IBD-related surgeries in CD[29] and UC.[33]

Several studies have demonstrated that BS does not worsen the course of the disease. Aelfers et al[13] reported that only 7% of patients with IBD flared after BS during follow-up. In some series, a small proportion of patients with IBD were able to reduce their medication.[14] One study compared outcomes after BS in 25 patients with IBD vs IBD controls (matched for age, sex, IBD subtype, phenotype, and location) who did not undergo BS.[9] Although not significant, corticosteroid use and IBD-related surgeries were numerically less common in cases vs controls.[9]

In our cohort, the number of IBD complications and hospitalizations was low, confirming the lack of negative impact of BS on the IBD course. Only 1 patient had IBD-related surgery, and 2 had new perianal lesions after a mean follow-up of 34 months; 5 hospitalizations for IBD flare were reported. Regarding medications, 75% of the patients did not modify their IBD medication, and 5% were able to stop their immunosuppressive treatment, suggesting disease stabilization and possible improvement in these patients. In addition to the potential positive effect of weight loss, patients undergoing BS in our series had stable IBD, with 75% of normal explorations before BS. This rate could be higher if we assume that the proportion of patients who had no recent exploration before BS (n = 31) were those with presumably nonactive disease.

The main strength of our study is the large number of patients enrolled when compared with the series reported in the available literature. The current study is one of just 2 available European case series, the first being the study by Aelfers et al.[13] This is valuable as European countries have numerically fewer obese people compared with the United States, and the European experience in treating obesity is more recent compared with the United States. Another strength is the fact that it is first case control-matched study. Also, a large amount of data could be collected thanks to the GETAID network, including data related to IBD outcomes and medications during post-BS follow-up. Finally, to our knowledge, this is the only study looking at risk factors for complications, weight loss, and deficiencies.

Our study has some limitations, mainly due to its retrospective nature. Notably, no objective biomarkers or morphologic explorations were systematically used to assess outcomes post-BS. Because of the small number of RYGB procedures, we could not compare the different surgical procedures; as SG was the most common procedure, the data generated here mainly represent the outcome post-SG. Another limitation is the absence of data on gastroesophageal reflux disease (GERD) during follow-up. Severe refractory GERD following SG is an indication of a requirement for conversion to RYGB. No patients in our series required conversion of SG to RYGB for refractory GERD, suggesting no severe GERD in our population.

In conclusion, this large cohort demonstrates that BS, particularly SG, can be safe and effective in patients with IBD. The risk of complications and deficiencies was not higher vs non-IBD controls. Disease stabilization or improvement was observed in some patients included in this study, and overall, findings are reassuring and demonstrate that BS should not be contraindicated in patients with IBD.

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Conflicts of Interest

R.A. declares counseling, boards, transports or fees from Abbvie, Biogen, Ferring, Janssen, MSD, Pfizer, Takeda, and Tillots. M.S. declares travel fees from Abbvie, mylan, Takeda. X.R. declares consulting, boards, transports or fees from MSD, Abbvie, Amgen, Biogen, Takeda, Janssen, Pfizer, Theradiag, Tillots, and Ferring. M.N. declares fees from Abbvie, Adacyte, Amgen, Arena, Biogen, CTMA, Ferring, Janssen, Mayoli-Spindler, MSD, Pfizer, and Takeda. D.L. declares counseling, boards, transports or fees from Abbvie, Biogaran, Biogen, Ferring, HAC-pharma, Janssen, MSD, Novartis, Pfizer, Prometheus, Roche, Takeda, Theradiag, and Tillots. S.N. reports lecture or advisory board fees from AbbVie, MSD, Vifor Pharma, Pfizer, Janssen, Takeda, and Ferring. L.P.B. declares fees from Abbvie, Takeda, and Janssen. L.P.B. reports consulting fees from Merck, Abbott, Janssen, Genentech, Mitsubishi, Ferring, Norgine, Tillots, Vifor, Shire, Therakos, Pharmacosmos, Pilège, BMS, UCB-pharma, Hospira, Celltrion, Takeda, Boerhinger-Ingelheim, Lilly, and Pfizer; lecture fees from Merck, Abbott, Janssen, Ferring, Norgine, Tillots, Vifor, Therakos, and HAC-pharma. X.R. reports consulting and lecture fees from MSD, Abbvie, Hospira, Janssen, Pfizer, Takeda, Norgine, Ferring, HAC Pharma, and Theradiag. G.B. received lecture fees from Abbvie, Ferring, MSD, Takeda, and Pfizer and consultant fees from Takeda and Janssen. R.G., C.R., E.L., S.R., G.P., A.A., F.C., C.S., C.G., L.K., C.T.P., S.M., S.V., M.S., Ph.S, B.C., and C.B.T. have no conflict of interest regarding this work.

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