10-year follow-up of laparoscopic vertical banded gastroplasty. Good results in selected patients

10-year Follow-up of Laparoscopic Vertical Banded Gastroplasty: Good Results in Selected Patients

Scozzari, Gitana MD; Toppino, Mauro MD; Famiglietti, Federico MD; Bonnet, Gisella MD; Morino, Mario MD

Author Information
From the Digestive Surgery and Center for Minimal Invasive Surgery, Department of Surgery, University of Turin, Italy.
Reprints: Mario Morino, MD, Digestive Surgery and Center for Minimal Invasive Surgery, Department of Surgery, University of Torino, C.so A.M. Dogliotti 14, 10126 Turin, Italy. E-mail: mario.morino@unito.it.

Abstract
Objective: To evaluate the long-term results of laparoscopic vertical banded gastroplasty (VBG) for morbid obesity.
Background: Laparoscopic VBG, a safe and straightforward bariatric procedure characterized by good short-term results, has been progressively replaced by other more complex procedures on the basis of a presumed high rate of long-term failure. Nevertheless, some authors have recently reported long-term efficacy in selected patients.
Methods: All patients who underwent laparoscopic VBG were included in a prospective database. Patients reaching 10-year follow-up received a complete evaluation including clinical, endoscopic, and biochemical examinations.
Results: Between January 1996 and March 1999, 266 morbidly obese patients underwent bariatric procedures. Among them, 213 were selected for laparoscopic VBG; exclusion criteria were as follows: contraindications to pneumoperitoneum, gastroesophageal reflux disease, and psychological contraindications to restrictive procedures. Mean age, preoperative weight, and body mass index were 36.9 years, 123.6 kg, and 45.4 kg/m^2, respectively. Intraoperative complication rate and conversion rate were 0.9% and 0.9%, respectively. Early postoperative complication rate was 4.2% and early reoperation rate was 0.5%. Mean hospital length of stay was 6.3 days. Mortality was nil. The 10-year follow-up rate was 70.4% (150 patients). Late postoperative complication rate was 14.7%, and 10-year revisional surgery rate was 10.0%. The excess weight loss percentages at 3, 5, and 10 years were 65.0%, 59.9%, and 59.8%, respectively. The resolution and/or improvement rate for comorbidity were 47.5% for hypertension, 55.6% for diabetes, 75% for sleep apnea, and 47.4% for arthritis. Mean Moorehead-Ardelt Quality of Life Questionnaire and BAROS values were 1.4 and 3.8, respectively.
Conclusions: The present study demonstrates that laparoscopic VBG in carefully selected patients leads to long-term results comparable with more complex and invasive procedures. Given the low postoperative morbidity for laparoscopic VBG, its present clinical role should be, in our opinion, reevaluated.

Bariatric surgery has largely demonstrated to be currently the only long-term effective therapy available for the morbidly obese population.1 It markedly lowers body weight, reverses or ameliorates comorbidities, improves quality of life, and ultimately results in a decrease in overall mortality.2
Despite the vertiginous growth of bariatric procedures performed worldwide,3 to date, none of the established procedures has definitively reached the role of “gold standard.” Reviewing the published bariatric surgery reports,3-5 it seems that different bariatric procedures are used

differently over time and among countries, supporting not only the concept that no bariatric procedure is a “gold standard” but also that as obese patients represent a heterogeneous group, there is place for many different techniques in the armamentarium of modern evidence-based bariatric surgery.

Vertical banded gastroplasty (VBG) was first described by Mason in 1982.6 In Mason's original technique, the gastric pouch was simply sutured, without transection from the gastric fundus; this led to an unacceptable rate of gastrogastric fistulas, up to 48% in some series,7 with subsequent long-term weight regain. As a result of Mason's poor long-term VBG results, MacLean et al 8 suggested a crucial technical modification in 1993, when they described VBG with a divided gastric pouch.

The laparoscopic approach to VBG was described by Hess and Hess in 1994.9 The introduction of the laparoscopic approach created a revolution in the field of bariatric surgery, showing lower postoperative complication rates, better results for postoperative pain, quicker restoration of respiratory and bowel function, shorter hospital stays and faster return to daily activities, lower abdominal complications, and better cosmetic results.10 Furthermore, in obese patients, the laparoscopic approach has demonstrably reduced postoperative mortality.11 Therefore, to date, the laparoscopic approach should be considered the preferred approach for bariatric patients. With regard to VBG, 2 randomized clinical trials 12,13 showed similar weight loss results, faster respiratory recovery, lower postoperative pain, and lower abdominal wall complication rates in laparoscopic groups.

Vertical banded gastroplasty was the most widely used restrictive bariatric procedure before the advent of laparoscopy. Subsequently, the introduction of laparoscopic adjustable gastric banding (AGB)14 ed to an extensive use of the latter in Europe, and recently also in the United States and Canada.3 Thus, VBG has been progressively abandoned in favor of other bariatric techniques, and, to date, it seems to have gone out of fashion among the bariatric community. The main reasons for this are both a presumed high long-term failure 15-17 and a reintervention rate.18-20 The greater part of the literature data is based on several series of Mason's original technique, with its high long-term staple-line disruption rate and subsequent weight regain. To our knowledge, no series of the MacLean laparoscopic VBG with a follow-up period of at least 10 years is available in the literature. The aim of this article was to evaluate very long-term results achieved in patients who have undergone the MacLean laparoscopic VBG.

PATIENTS AND METHODS

Since January 1, 1996, patients who have undergone bariatric procedures at the Minimal Invasive Surgery Center of the University of Turin have been registered in a prospective Bariatric Surgery Register, in which all demographic, anthropometric, perioperative, and reintervention data, together with weight loss and comorbidity results registered during follow-up visits, were noted.

Patient inclusion criteria for laparoscopic VBG included the following: a history of obesity for 5 or more years, documented weight loss attempts in the past, body mass index (BMI) of either 35 kg/m^2 or more with obesity-related comorbidities or more than 40 kg/m^2, and age between 18 and 60 years. Exclusion criteria included the following: contraindications to the creation of pneumoperitoneum (eg, glaucoma), large esophageal hiatal hernias (>3 cm), symptomatic gastroesophageal reflux (GER) disease, pregnancy, drug or alcohol abuse, psychological disorders (eg, bulimia, depression), and hormonal or genetic obesity-related disease.

Patients were exhaustively evaluated to exclude “sweet” eating and “binge” eating behavior, which represents a well-known contraindication to restrictive bariatric procedures.21 Patients were classified as “sweet eaters” when more than 15% of their total caloric intake was taken in the form of sweet food such as cake, ice cream, candy, and soft drinks. Moreover, patients were evaluated by a psychiatrist to rule out “binge-eating disorder,” defined as a condition characterized by recurrent episodes of binge eating [consuming abnormally large amounts of food in a discrete period of time (eg, 2 hours)], associated with a sense of loss of control over eating.

Patients were considered eligible after evaluation of their clinical history, a thorough physical examination, blood chemistry, hormonal status, esophagogastroduodenoscopy, barium meal, esophageal manometry, 24-hour pH-metry, spirometry, and abdominal ultrasonography (if cholelithiasis was present, cholecystectomy was routinely performed at the time of bariatric surgery). Multiple preoperative interviews were conducted with the patients with the aim of creating a clear understanding of the expected benefits, risks, and long-term consequences of VBG. This included establishing a clear representation of the anticipated postoperative changes in eating habits, necessary behavior modification, and requisite prolonged follow-up with nutritional counseling and testing. A special consent form signed by the patient was also required before surgery.

To evaluate long-term laparoscopic VBG results, we analyzed all patients who had undergone laparoscopic VBG on reaching a follow-up period of 10 years. Operative and short-term data were retrospectively reviewed, analyzing the prospectively collected Bariatric Surgery Register. To evaluate long-term results, all patients were recalled and underwent a clinical visit, including Bariatric Analysis and Reporting Outcome System (BAROS) assessment with the Moorehead-Ardelt Quality of Life Questionnaire 22,23; moreover, patients underwent biochemical evaluation and, in the presence of clinical upper gastrointestinal symptoms, endoscopic evaluation.

Surgical Technique

Patients underwent laparoscopic VBG according to the Mason technique 6 modified by MacLean,8 with complete division between the gastric pouch and gastric fundus. The surgical technique has been described previously.24

Briefly, the patient is placed in lithotomy with a steep reverse Trendelenburg position; the surgeon stands between patient's legs with 1 assistant at each side; 6 ports are placed, and a 30-degree angled laparoscope is used. The lesser omentum is dissected at 6 cm from the esophagogastric junction to gain access to the lesser sac. At this level, a full-thickness transgastric window is created using a 21-mm circular stapler; the window is created over an intralumenal 12-mm calibrating tube clamped with an EndoBabcock to stabilize it perfectly to the gastric wall. After that, a 60-mm linear stapler is inserted through the gastric window and directed toward the angle of His to obtain complete gastric pouch transection. Finally, a polypropylene mesh, 1.5 cm wide, is wrapped around the distal end of the gastric pouch and sutured to itself so that a 5-cm circumference is obtained Figure 1

All patients received preoperative antibiotics and low-molecular-weight heparin and wore thromboembolic stockings.

Weight Loss Monitoring

Patient follow-up was scheduled at 1 week, 1 month, and every 3 months for the first postoperative year, with laboratory evaluation of nutritional parameters every 6 months. Thereafter, patients were followed up once a year. All patients were weighed at each visit. Eating habits were reviewed and either increased tolerance or intolerance to solids and liquids was followed with clinical examination and, if required, endoscopy and/or upper gastrointestinal radiographic series.

Classification of Results

Preoperative weight data included the following: weight, excess weight (expressed as percentage of “ideal” weight, basing the latter on the 1999 tables of the Metropolitan Life Insurance Company),25 BMI, and excess BMI calculated as BMI-25 kg/m^2, which is assumed to be the upper limit of normal).

Percentage of excess weight loss (%EWL), percentage of excess BMI loss (%EBL), and residual BMI were used to describe the postoperative weight loss results.

Weight loss and quality of life (QOL) results were classified by the use of the BAROS, incorporating the Moorehead-Ardelt Quality of Life Questionnaire.23

Obesity-related comorbidities were assessed according to BAROS.22,23 Major comorbidities were as follows: hypertension (defined as systolic pressure >140 mmHg or diastolic pressure >90 mmHg), cardiovascular disease, dyslipidemia (cholesterol level >200 mg/dL or abnormal lipid profile), type II diabetes (fasting blood glycemia level >126 mg/dL or 2-hour glycemia level >200 mg/dL on glucose tolerance test), sleep apnea syndrome (diagnosed by formal sleep study), obesity hypoventilation syndrome (pCO_2 > 45 mmHg), osteoarthritis (radiographic evaluation), and infertility. Minor conditions were lower extremity venous stasis disease and urinary stress incontinence. In assessing comorbidity results, a disorder was considered "resolved" when it was controlled without medication and "improved" when controlled by reduced doses of medication.

In addition to BAROS assessment, patients were investigated for the presence of adverse VBG-related effects. Patients were asked whether they had dysphagia, defined as subjective eating difficulties (patients were classified as follows: "not dysphagia," "solid food dysphagia," and "liquid food dysphagia"), whether they experienced postprandial vomiting (patients were classified as follows: "vomit <2 episodes per month," "vomit <2 episodes per week," and "vomit >2 episodes per week"), and finally, patients were asked whether they had GER symptoms, defined as heartburn, regurgitation, and/or chest pain (patients were classified as follows: "no GER," "medically treated GER," and "non-treated GER"). Finally, to evaluate long-term VBG perception and satisfaction of patients, they were asked whether they would repeat the procedure.

Statistical Analysis

Prospective data were collected in the Bariatric Surgery Register and managed using Microsoft Excel (Microsoft Corp, Redmond, WA). This analysis was essentially a descriptive evaluation of surgical results and no a priori power calculation was performed. Median, mean, and standard deviations were calculated for all appropriate parameters. The Student t test was used to determine the significance of the observed differences among subgroups. Statistical significance was considered to be $P < 0.05$. Data analysis was performed using SPSS, Version 16.0, for Windows (SPSS Inc, Chicago, IL). No ethical approval was required for this study.

RESULTS

Between January 1996 and March 1999, 266 patients underwent bariatric surgery in our institution. Among them, 213 (80.1%) met the study criteria and received laparoscopic VBG (Fig. 2). There were 28 men (13.1%) and 185 women (86.9%); their mean age was 36.9 years (range: 18.0–59.0). Mean preoperative weight was 123.6 ± 20.1 kg (range: 72.0–200.0); mean excess weight was 111.9 ± 28.3% (range: 30.4–190.9); mean BMI was 45.4 ± 6.3 kg/m^2 (range: 27.5–62.5).Figure 2

Thirty-five additional concomitant procedures (29 cholecystectomies, 1 umbilical hernia repair, and 5 gastric band removals) were performed in 34 patients (16.0%). Five patients with a previous gastric band underwent laparoscopic VBG conversion due to band slipping with excessive vomiting. Among this small group of patients, mean BMI was 35.5 kg/m^2 (range: 27.5–43.8).

Mean operative time was 102.4 minutes (range: 40.0–270.0) when considering all procedures; interventions in which only the VBG was performed had a mean operative time of 97.0 minutes (range: 40.0–210.0).

There were 2 (0.9%) intraoperative complications, leading to laparotomic conversion: an anterior gastric wall injury and a case of entrapment of the nasogastric tube in the linear stapled gastric transection. No other patients needed conversion during the study period. Therefore, overall conversion to open surgery was 0.9%. Mean hospital length of stay was 6.3 days (range: 2.0–20.0).

Early postoperative complications (ie, complications occurring up to the 30th postoperative day) occurred in 9 patients (4.2%). Three patients required transfusions for anemia treatment, 4 patients with respiratory distress necessitating a 48-hour admission to the intensive care unit, and 1 had wound infection; finally, 1 patient presented a gastric transection line leak on the 7th postoperative day, requiring laparotomy. The early reintervention rate was 0.5% (1/213). Mortality was nil.

Long-term results were calculated for all patients on reaching 10-year follow-up. A total of 150 patients were included (15 men, 10%, and 135 women, 90%), giving a follow-up rate of 70.4%. Mean follow-up length was 138.9 months (range: 120.0–164.0). Two patients died during the follow-up period from causes unrelated to surgery.

Late complications occurred in 22 of 150 patients (14.7%). Fifteen patients (10.0%) underwent revisional surgery: 3 underwent VBG takedown due to severe dysphagia (n = 2 cases) and to an outlet stricture unresponsive to endoscopic dilation (n = 1 case); 11 patients underwent Roux-en-Y gastric bypass (RYGB) conversion due to weight regain (n = 7 cases), severe GER (n = 3 cases), and large gastrogastric fistula leading to overfeeding with weight gain (n = 1 case); finally, 1 patient underwent conversion to biliopancreatic diversion due to weight regain in severe hyperphagia underestimated at preoperative work-up. All revisional procedures were performed successfully by laparoscopic approach. The rate of revisional surgery increased during the follow-up period: from 3.3% at 5 years to 10.0% at 10 years (Fig. 3). Patients who underwent revisional surgery during the study period were excluded from further analysis.Figure 3

Late complications that did not require a surgical reintervention were as follows: a gastric ulcer, medically treated; 2 outlet strictures successfully treated by endoscopic dilations; and 2 alimentary bolus obstructions successfully treated by endoscopic removal; finally, 2 patients underwent trocar hernia repair.

Weight Loss Results

Weight loss results were analyzed in patients with persistent VBG anatomy at 10-year follow-up (ie, 133 patients). Results for weight loss at 3-, 5-, and 10-year follow-up are presented in Table 1. Ten-year EWL results as per BAROS are presented in Figure 4. With regard to residual BMI, at 10-year follow-up, 32 of 133 patients (24.1%) presented a BMI of 35 kg/m^2 or more whereas 101 patients (75.9%) had a BMI of less than 35 kg/m^2. The median BMI during the study period is shown in Figure 5.

Comorbidity Resolution and QOL Assessment

With regard to major obesity-related comorbidities, the improvement and/or resolution rate was 47.5% for hypertension, 100% for cardiovascular disease, 50% for dyslipidemia, 55.6% for type II diabetes, 75% for sleep apnea syndrome, 100% for obesity hypoventilation syndrome, 47.4% for osteoarthritis, and 100% for infertility. With regard to minor comorbidities, the improvement/resolution rate was 20% for lower extremity venous stasis disease and 100% for urinary stress incontinence.

Quality of life was assessed using the Moorehead-Ardelt Quality of Life Questionnaire 23; the mean overall score was 1.4 ± 1.0 (range: -2 to 3). Classification of QOL-specific domain answers is shown in Table 2.

To incorporate these results into the BAROS scoring system, patients were divided into those with and those without comorbidities. The overall mean BAROS score was 3.8 ± 1.8 (range: -1.0 to 7.3). Results as per BAROS classification are shown in Figure 6. Globally, 72 patients (54.1%) were classified as very good or excellent (Fig. 6).

Apart from the QOL questionnaire, we specifically analyzed the presence of gastric symptoms, asking patients whether they experienced dysphagia, vomiting, or GER symptoms. With regard to dysphagia, 106 patients (79.7%) had no eating difficulties whereas 27 patients (20.3%) had solid food dysphagia (typically for red meat, bread, and pasta); none had liquid food dysphagia. Vomiting was classified according to the number of emesis events: 77 patients (57.9%) reported fewer than 2 episodes per month; 7 patients (5.3%) reported fewer than 2 episodes per week, and 49 patients (36.8%) more than 2 episodes per week. One hundred eight patients (81.2%) had no GER

symptoms, 21 patients (15.8%) received long-term administration of protonic pump inhibitors, and 4 patients (3.0%) had GER symptoms with no medical therapy.
Finally, to assess the long-term perception of VBG of patients, we asked them whether they would repeat the same procedure: 114 patients (85.7%) answered yes, 15 (11.3%) no, and 4 (3.0%) were uncertain.

Morbidly Obese Patients Versus Superobese Patients

Among the 213 patients who underwent laparoscopic VBG, 166 (77.9%) were morbidly obese (preoperative BMI <= 50) and 47 (22.1%) were superobese (preoperative BMI > 50). In the morbidly obese group, mean weight, excess weight, and BMI were 117.5 ± 15.1 kg (range: 72.0–160.0), 100.6% ± 19.5% (range: 30.4–139), and 42.8 ± 4.2 kg/m^2 (range: 27.5–50.0), respectively. In the superobese group, preoperative weight, excess weight, and BMI were 145.3 ± 20.8 kg (range: 113.0–200.0), 151.6% ± 16.0% (range: 127.1–190.9), and 54.6 ± 3.2 kg/m^2 (range: 50.1–62.5), respectively.
There were no statistically significant differences between morbidly obese and superobese patients in terms of operative time (100.8 ± 34.3 vs 108.3 ± 35.8, P = 0.191), hospital length of stay (6.2 ± 1.8 vs 6.7 ± 2.6, P = 0.132), early complication rate (3.0% vs 8.5%, P = 0.213), and reintervention rate (0% vs 2.1%, P = 0.512).
The weight loss results were better for the morbidly obese at 3- and 5-year follow-up. EWL% was significantly higher in the morbidly obese group (66.9% ± 17.2% vs 59.0% ± 16.3%, P = 0.018, at 3 years; 61.5% ± 21.4% vs 55.1% ± 20.6%, P = 0.114, at 5 years).
At long-term follow-up, there were 112 morbidly obese (74.7%) and 38 superobese (25.3%) patients. The morbidly obese group presented a lower complication rate (13/112, 11.6% vs 9/38, 23.7%, P = 0.120) and a lower redo-surgery rate (9/112, 8.0% vs 6/38, 15.8%, P = 0.283).
At 10-year follow-up, 101 morbidly obese and 32 superobese patients had intact VBG anatomy. An EWL of 50% or more was achieved in 65.3% of patients in the morbidly obese group versus 68.8% in the superobese group (P = 0.881). Nevertheless, with regard to residual BMI, in the morbidly obese group, 17 patients (16.8%) presented a BMI of 35 kg/m^2 or more and 84 patients (83.2%) a BMI of less than 35 kg/m^2; in the superobese group, 15 patients (46.9%, P = 0.001) had a BMI of 35 kg/m^2 or more and 17 patients (53.1%, P = 0.001) a BMI of less than 35 kg/m^2. A comparison between the morbidly obese and superobese patients in terms of EWL and residual BMI is shown in Figure 7.

DISCUSSION

In the last few decades, a broad spectrum of bariatric procedures has been used to achieve the goals of long-term weight reduction and comorbidity improvement in the obese population. More complex procedures, such as malabsorptive (biliopancreatic diversion and duodenal switch) and restrictive/malabsorptive (RYGB), although leading to better early weight loss results, are characterized by a considerable rate of postoperative complications due to the presence of multiple gastrointestinal anastomosis, with a mortality rate significantly higher than simpler restrictive procedures.11,26 Furthermore, these procedures present a lifelong risk for developing nutritional deficiencies (biliopancreatic diversion and duodenal switch)27,28 and a consistent rate of long-term weight regain (RYGB).29,30 On the other hand, restrictive procedures (laparoscopic VBG and laparoscopic AGB) seem to be characterized by limited weight loss and high reoperation and revisional surgery rates.15-20
Vertical banded gastroplasty was largely applied during the prelaparoscopic era, accounting for 51% of all bariatric procedures in 1987–1989; subsequently, its use has been progressively reduced, representing only 3% of procedures in 2002–2004,4mostly as a consequence of the widespread use of laparoscopic AGB. Nevertheless, laparoscopic VBG, in our experience, has been shown to be a simple and safe procedure.

In a previously reported randomized clinical trial comparing laparoscopic VBG and laparoscopic AGB,31,32 short-term results were similar between the 2 groups whereas laparoscopic VBG was superior to laparoscopic AGB in terms of long-term weight loss, complications, and reintervention rate.

The main criticisms reported against restrictive procedures are insufficient long-term weight loss, high reintervention rates, and poor postoperative QOL.

With regard to weight loss results, laparoscopic VBG has proved to achieve EWL ranging between 50% and 70% at 5-year follow-up.17,19,20,33,34 Available long-term studies concern essentially the Mason technique without gastric pouch transection, leading to a high rate of gastric staple-line fistula and subsequent weight regain,7,35,36 with 10-year EWL of 40% to 50%.20,33,37 The present study shows that the transection of the gastric pouch has improved long-term results, leading to a 10-year EWL of 60% and a success rate of 66%. These results compare favorably with the few available long-term data on other bariatric procedures. In the review by O'Brien,38 which addressed published studies with more than 100 patients, mean EWL was 59% at 8 years after laparoscopic AGB and 52% at 10 years after RYGB.

The literature on VBG reports a high rate of revisional surgery,39 up to 56% of patients.18 The main causes of revisional surgery are weight regain and severe GER. In our experience, the gastric pouch transection led to a minimal rate of long-term technical complications (0.7% for gastrogastric fistula and 2.0% for gastric outlet stricture) whereas careful patient selection reduced the rate of GER and weight regain related to poor patient compliance. The overall reintervention rate of 10% at 10-year follow-up compares favorably with long-term results of other bariatric procedures: 6% to 52% after laparoscopic AGB 40-42 and 4% to 17% after RYGB.43,44

With regard to comorbidity resolution rates, there is no doubt that restrictive procedures are less effective than malabsorptive ones, at least with regard to metabolic syndrome components.45,46 In the present study, diabetes, dyslipidemia, and arterial hypertension improved or resolved only in half of the patients. Therefore, at present, our policy is to consider as a relative contraindication to laparoscopic VBG the presence of diabetes and severe dyslipidemia.

With regard to postoperative QOL, in this study, we applied the BAROS system,22,23 a well-established and easy-to-use instrument for the evaluation of bariatric surgery. In interpreting these results, it is important to bear in mind that follow-up at 10 years means that patients are 10 years older and this may worsen some domain results, such as sexual pleasure. Nevertheless, 82% of patients defined their self-esteem as better or much better than before surgery and 86% of them would still choose to undergo the same operation.

Because laparoscopic VBG does not involve bowel limb construction, blind segment obstruction cannot occur, and mesenteric defects are not created, reducing the incidence of internal hernias. Moreover, the upper gastrointestinal tract is still easily accessible for endoscopy and radiographic evaluation. In our experience, 2 patients underwent endoscopic common bile duct stone removal during the follow-up period.

Finally, the simple anatomy of laparoscopic VBG allows for easily manageable revisional surgery. Laparoscopic VBG is reversible simply by creating an anastomosis between the gastric pouch and the gastric fundus; with regard to laparoscopic VBG conversion to RYGB, the most frequently reported option after failed laparoscopic VBG,47–49 it must be underlined that the MacLean VBG represents essentially the first step of an RYGB.

Patient selection is, in our experience, crucial to obtaining good long-term results after laparoscopic VBG. It is of vital importance to study exhaustively the eating behavior of the patient before surgery, because it has been well established that binge eaters and sweet eaters are not good candidate for laparoscopic VBG.21,34,50 Goergen,50 differentiating preoperatively sweet eaters and nonsweet eaters, orientating the former to RYGB and the latter to VBG, obtained a similar 2-year EWL in the 2 groups (82.4% in RYGB vs 79.6% in VBG).

In the preoperative selection of patients, patient weight and BMI must also be taken into account. Although operative time, hospital length of stay, and early and late complication rates were not

significantly different between morbidly obese and superobese patients in our series, the latter showed significantly lower long-term weight loss. Furthermore, at 10-year follow-up, 83% of the morbidly obese had a BMI of less than 35 kg/m^2 whereas this percentage was only 53% in the superobese (P = 0.001). Currently, our policy is to exclude patients with a preoperative BMI of more than 50 kg/m^2 from laparoscopic VBG.

In conclusion, this study demonstrates the crucial role of long-term follow-up in bariatric surgery. The long-term results for different bariatric techniques tend to become comparable in terms of weight loss, revisional surgery, and long-term weight regain with a 30% to 50% rate of imperfect results. Our long-term results demonstrate that laparoscopic VBG, modified in accordance with MacLean, represents a simple and safe procedure, which can lead to results on weight loss, comorbidities, and QOL comparable with other more complex bariatric procedures. On this premise, we believe that in strictly selected patients, with a preoperative BMI of less than 50 kg/m^2 and in the absence of binge-eating disorders or sweet-eating behavioral patterns, laparoscopic VBG still has a place in the bariatric surgery armamentarium, and its role should be reevaluated.

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FIGURE 1 . The MacLean VBG technique.

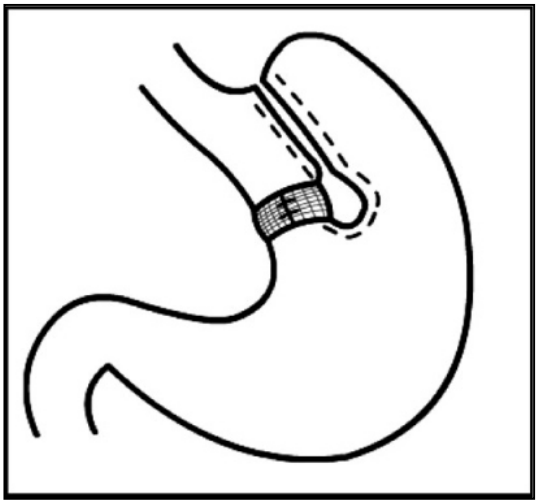


FIGURE 2 . Study design

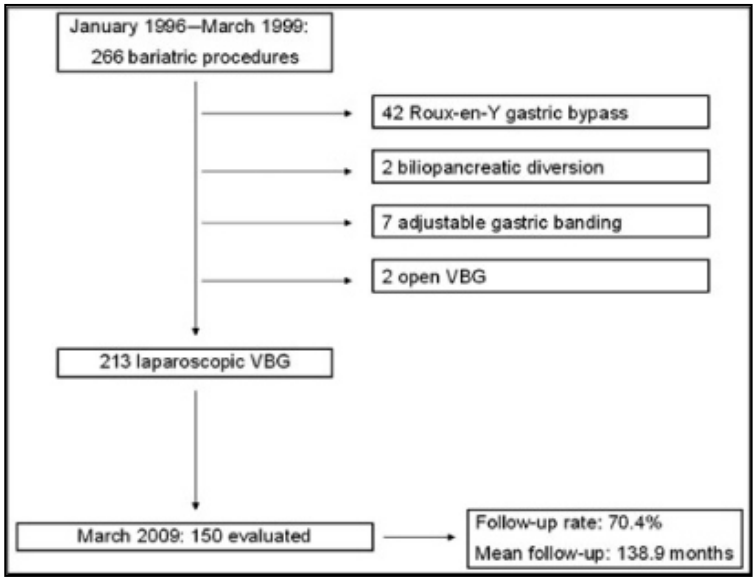
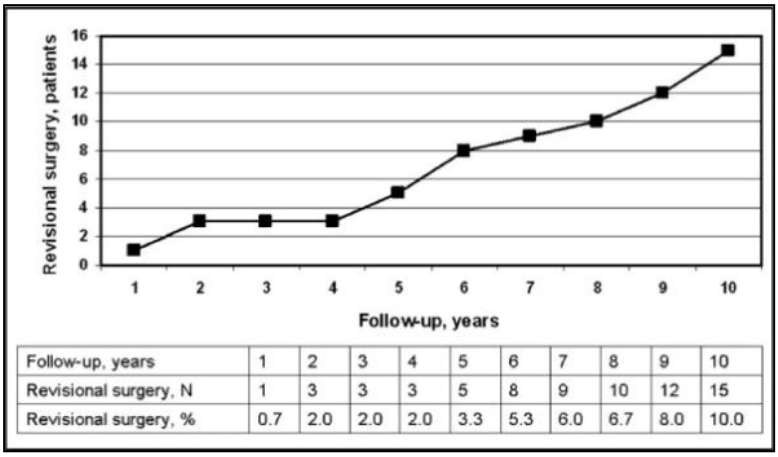
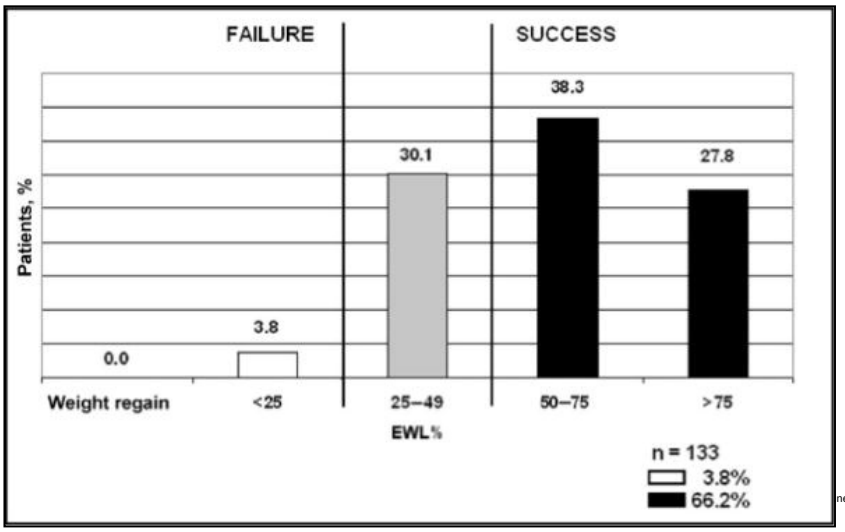


FIGURE 3 . Revisional surgery rate during the follow-up period.



Follow-up, years	1	2	3	4	5	6	7	8	9	10
Revisional surgery, N	1	3	3	3	5	8	9	10	12	15
Revisional surgery, %	0.7	2.0	2.0	2.0	3.3	5.3	6.0	6.7	8.0	10.0

FIGURE 4 . Weight loss as per the BAROS system in the 133 patients with more than 10-year follow-up and a persistent VBG anatomy. A weight loss of 50% or more EWL was considered a successful result; a weight loss of less than 25% was considered a procedure failure.



nes indicate maximum and minimum values

FIGURE 5 . Box-plot diagram of BMI during the study period. Thicker lines indicate median values; upper and lower box lines indicate third and first quartiles; and vertical lines indicate maximum and minimum values

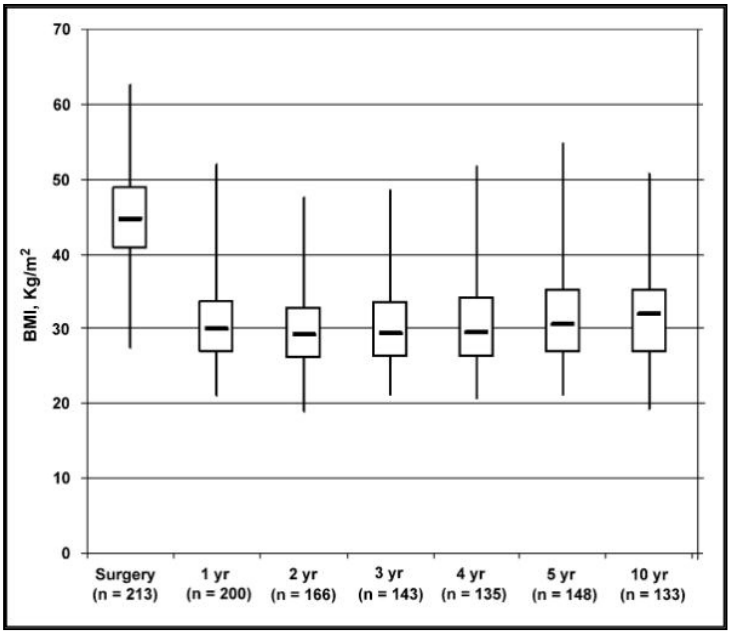


FIGURE 6 . Classification of long-term results as per the BAROS system

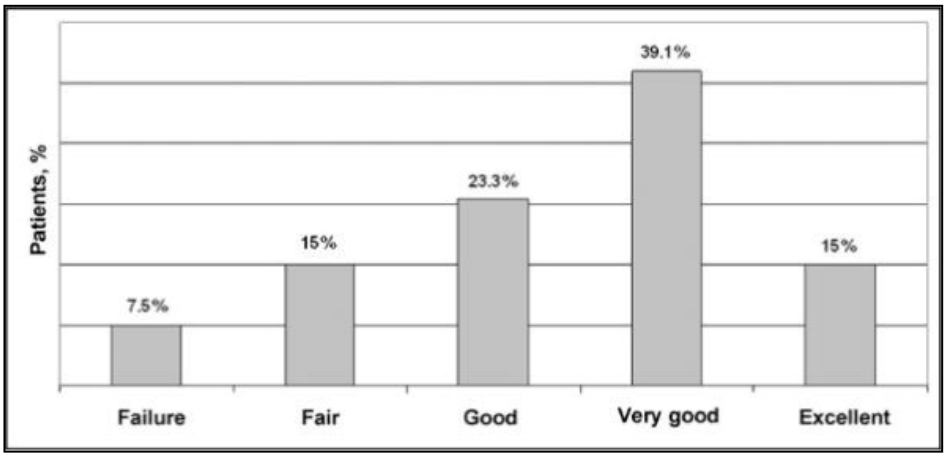


FIGURE 7 . Weight loss in morbidly obese and superobese patients. MO indicates morbidly obese; SO, superobese.

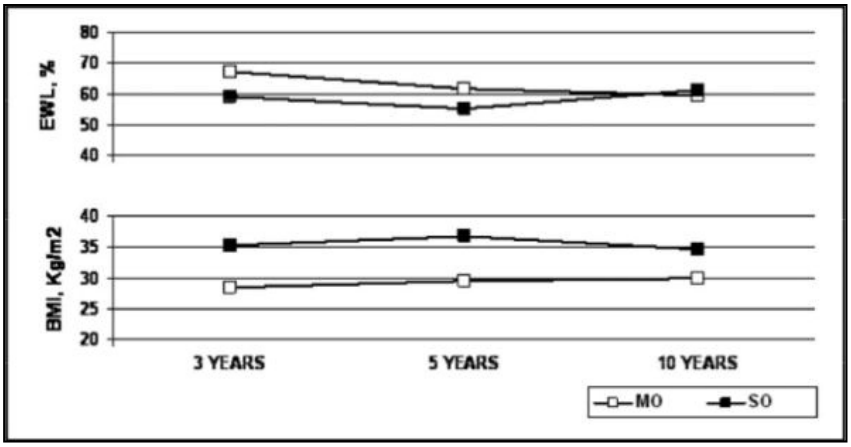


TABLE 1 . Weight Loss Results

TABLE 1. Weight Loss Results

	Preoperative	3 yr	5 yr	10 yr
Weight, kg	123.6 ± 20.1	81.7 ± 15.2	84.3 ± 16.5	84.2 ± 16.9
BMI, kg/m^2	45.4 ± 6.3	30.2 ± 5.5	31.3 ± 6.1	31.2 ± 5.8
EWL, %	—	65.0 ± 17.3	59.9 ± 21.3	59.8 ± 20.8
EBL, %	—	77.8 ± 22.1	71.6 ± 26.4	71.5 ± 25.3

Data are expressed as mean ± standard deviation.

TABLE 2 . Moorehead-Ardelt Quality of Life Questionnaire Results

TABLE 2. Moorehead-Ardelt Quality of Life Questionnaire Results

	Self-esteem	Physical Activity	Social Life	Ability to Work	Sexual Life
Much worse	1.6	1.6	0	0.8	2.4
Worse	6.3	3.1	2.3	5.5	7.1
Same	10.2	19.7	32.3	34.6	37.0
Better	38.6	39.4	39.4	38.6	37.8
Much better	43.3	36.2	26.0	20.5	15.7

Data are expressed as percentages.