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SURGICAL ENDOSCOPY
and Other Interventional Techniques

Vertical gastrectomy for morbid obesity in 216 patients: report of two-year results

Crystine M. Lee, Paul T. Cirangle, Gregg H. Jossart

Department of Surgery, California Pacific Medical Center, San Francisco, CA, USA

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Abstract
Background: The vertical gastrectomy (VG) is the restrictive part of the technically difficult biliopancreatic diversion with duodenal switch operation (DS). The VG was originally conceived of as an independent operation—the first stage of a two-stage DS that would reduce mortality and morbidity in the high-risk superobese because of a shorter operating time and no anastomoses. This article presents two-year data after VG.
Methods: Laparoscopic VG was performed in a nonrandomized fashion in obese patients that met the NIH criteria for bariatric surgery. By using 5–7 firings of 45–60-mm linear 3.5-mm GI staplers along a 32-Fr bougie, a greater-curvature gastrectomy is performed and a 60–80-ml gastric tube is created. VG was compared to adjustable Lap-Band® placement, Roux-en-Y gastric bypass (RGB), and DS.
Results: Between November 2002 and August 2005, 216 patients underwent VG. The mean age was 44.7 years (range = 16–64) and 173 (80%) were female. The mean preoperative weight and body mass index (BMI) was 302 ± 77 lbs and 49 ± 11 kg/m^2, respectively. Of the 216 patients, 5 (2.3%) had a BMI > 80 kg/m^2, 6 (2.8%) had a BMI of 70–80 kg/m^2, and 25 (11.6%) had a BMI of 60–70 kg/m^2. The mean operative time was 66 ± 11 min (range = 45–180) and the mean length of hospital stay was 1.9 ± 1.2 days. Complications occurred in 20 (6.3%) patients (vs. 7.1% after Lap-Band). Leaks occurred in 3 (1.4%) VG patients, reoperations were performed in 6 (2.8%), and no conversions to open or deaths occurred. Weight loss on par with the DS and RGB was achieved with just the VG alone.
Conclusion: The VG operation is able to achieve significant weight loss comparable to the RGB and DS operations but with the low morbidity profile similar to that of Lap-Band placement.

Key words: Bariatric surgery — Laparoscopic — Vertical gastrectomy — Sleeve gastrectomy

The vertical gastrectomy procedure (VG), also called the vertical sleeve gastrectomy, sleeve gastrectomy, greater-curvature gastrectomy, parietal gastrectomy, and even vertical gastroplasty, is a purely restrictive operation that is gaining in interest. The VG is derived from the biliopancreatic diversion with duodenal switch (DS) operation. Historical data suggest that the DS operation, as described by Hess and Hess [4], achieves superior weight loss compared to the RGB and has therefore been considered the most effective procedure for weight loss for superobese patients [1, 8]. The disadvantage of the operation is its technically demanding nature and its significant morbidity rate, which has been reported to be as high as 23% [7]. To add insult to injury, it is superobese patients, who often have multiple comorbidities and are of the highest operative risk, who need this technically challenging operation to achieve adequate weight loss, resulting in an even greater risk of complications.

The VG was therefore initially performed selectively in high-risk patients as a lower-risk, staged DS and more recently as a potentially single-stage operation for patients with lower body mass index (BMI). Michel Gagner originally conceived of performing the vertical gastrectomy as an isolated procedure, i.e., the first stage of a two-stage DS operation [G. Jossart and M. Gagner, personal communication]. Gagner theorized that performing the DS in two stages would confer the advantages of technical facility, shorter operative times, and

Abbreviations: Band; adjustable gastric band placement, BMI; body mass index, DS; Hess' biliopancreatic diversion and duodenal switch (also known as the vertical gastrectomy and duodenal switch), EBL; estimated blood loss, %EWL; percentage excess weight loss, ICU; intensive care unit, POD; postoperative day, RGB; Roux-en-Y gastric bypass, VBG; vertical banded gastroplasty, VG; vertical gastrectomy

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Correspondence to: Gregg H. Jossart

interval weight loss between stages, which would result in decreased overall morbidity. This study presents the two-year followup data after VG.

Materials and methods

Patients chose to undergo VG, Band, RGB, or DS operations based on a combination of insurance coverage, personal preference, and physician recommendation. Open, hand-assisted, and revision operations were excluded, leaving 846 totally laparoscopic, primary bariatric operations. A comparative analysis of results after the four different operations performed between November 2002 and August 2005 was done.

Surgical technique

Patients were placed supine on the operating table, without splitting the legs. All patients had sequential compression devices to the calves or the feet and received 2 g of intravenous cefazolin prior to skin incision. Foley® catheters were placed for all operations except the Band. The abdomen was entered using a 12-mm Optiview® trocar (Ethicon Endo-Surgery, Inc.) in all cases and then a variable number of additional trocars were placed depending on the operation. Appendectomy and cholecystectomy were not performed routinely; cholecystectomy was performed only if preoperative ultrasonography demonstrated the presence of gallstones. Intraoperative endoscopy, postoperative nasogastric tubes, intraabdominal drains, and epidural anesthesia were not used.

Laparoscopic vertical gastrectomy

The greater-curvature vessels were taken down using the LigaSure V® (ValleyLab, Boulder, CO), then a transoral 32-Fr esophageal dilator (Cook Medical, Bloomington, IN) was positioned along the lesser curvature. The rationale for use of a 32-Fr sizing tube was based on Johnston's work with the Magenstrasse and Mill operation where he experimented with varying caliber bougies ranging from 30 to 40 Fr [6].

With the goal of preserving the antral mill mechanism, stapling is initiated at a point along the greater curvature, 6–8 cm from the pylorus. A greater-curvature gastrectomy was performed using sequential fires of linear 3.5-mm or 4.8-mm gastrointestinal staplers depending on an assessment of the thickness of the stomach wall, creating a 60–80-ml gastric tube. Bioabsorbable SEAMGUARDS® (W. L. Gore & Associates, Inc., Flagstaff, AZ) were used selectively to buttress the staple line in diabetic patients or if there was concern for staple line bleeding. A methylene blue leak test was performed to check staple line integrity, and then the stomach remnant was removed via an enlarged trocar site.

Laparoscopic adjustable gastric band placement

The Lap-Band® device (Inamed Health, Santa Barbara, CA) was secured around the proximal stomach, creating a 10–20-ml gastric pouch using the *pars flaccida* technique, which minimized perigastric dissection and kept the device out of the lesser sac [3]. The band was secured around the stomach by three or four craniocaudal gastric-to-gastric sutures. The tubing was then brought out through the abdominal wall fascia via the 12-mm trocar site. The incision was extended to accommodate the port, which was secured to the abdominal wall using permanent sutures. Patients were evaluated for a band-fill at six weeks postoperatively.

Laparoscopic Roux-en-Y gastric bypass

The RGB technique involved the creation of a hand-sewn gastrojejunostomy in the manner described by Higa and colleagues [5]. A 75-cm biliopancreatic limb and a 100-cm alimentary limb were measured and the Roux-en-Y distal anastomosis was performed using the double-stapled technique. The lesser sac was entered on a point on the lesser curvature, approximately 5–10 cm distal to the gastroesophageal junction. A roticulating 45-mm linear stapler was fired perpendicular to the long axis of the stomach to create the distal end of the gastric pouch. Placement of a transoral 32-Fr Lavacuator® tube (Mallinckrodt, Hazelwood, MO) along the lesser curvature with the tip resting on the transverse staple line facilitated the creation of a 10–20-ml tubular gastric pouch with several fires of linear staplers towards the angle of His. The Roux limb was anastomosed to the gastric pouch in an antecolic, antegastric fashion using a double-layered hand-sewn technique to create an anastomosis of 10–12 mm internal diameter. The anastomosis was then submerged and air insufflation testing was performed.

Laparoscopic vertical gastrectomy and duodenal switch

The biliopancreatic diversion with duodenal switch as described by Hess and Hess [4] is also known as the vertical gastrectomy with duodenal switch. It involves gastric restriction via a pylorus-preserving vertical gastrectomy and malabsorption conferred by the duodenal switch and functional shortening of the small intestine to a 100-cm common channel. The operation was performed totally laparoscopically with six trocars. The small bowel was transected 250 cm from the ileocecal valve, and the proximal transected end was anastomosed, using the double-stapled technique, to a point 100 cm from the ileocecal valve, thus creating a 100-cm common channel. The duodenum was divided 4 cm distal to the pylorus and was anastomosed to the distal 250 cm of the ileum using a retrocolic, two-layered hand-sewn, end-to-side technique. A greater-curvature vertical gastrectomy was performed by stapling along a 48-Fr esophageal dilator (Cook Surgical, Bloomington, IN) to create a 100–150-ml gastric tube. Bioabsorbable SEAMGUARDS® (W. L. Gore & Associates, Inc., Flagstaff, AZ) were used selectively to buttress the stapleline.

Postoperative care

Patients were cared for on the ward unless preexisting cardiopulmonary disease warranted ICU care. Postoperative analgesia was achieved with intravenous ketorolac every six hours and opioids delivered via a patient-controlled anesthesia (PCA) unit. Water-soluble contrast upper gastrointestinal series were performed liberally but selectively for indications including fever, unexplained tachycardia, elevated white blood cell count, or uncharacteristic pain levels (Fig. 1). Band patients were usually discharged on the first postoperative day (POD), while RGB and DS patients were typically sent home on POD 3. VG patients were usually sent home on POD 1 to 2, but some stayed longer because of issues that stemmed from their preoperative comorbidities. Band and VG patients started a liquid diet on POD 1 and RGB and DS patients on POD 2.

Calculations and statistical methods

Body mass index (BMI) in kg/m^2 was calculated from the weight in kilograms divided by the height in meters squared. Percentage excess weight loss (%EWL) was calculated from (weight lost)/(preoperative weight − ideal body weight). Data were expressed as a mean ± standard deviation for continuous variables or as a number with the percentage in parentheses for nominal variables unless indicated otherwise. Statistical significance was defined as $p \leq 0.05$. Statistical calculations were performed using the Statview 5 software program (Abacus Concepts, Berkeley, CA). Differences in variables were evaluated using the unpaired Student's t test when comparing two continuous variables and the analysis of variance (ANOVA) test when comparing more than two continuous variables. The chi-squared test was used for comparing nominal variables. When nominal variables were less than 5, Fisher's exact test was used.

Results

Between November 2002 and August 2005, 846 laparoscopic, primary bariatric operations were performed

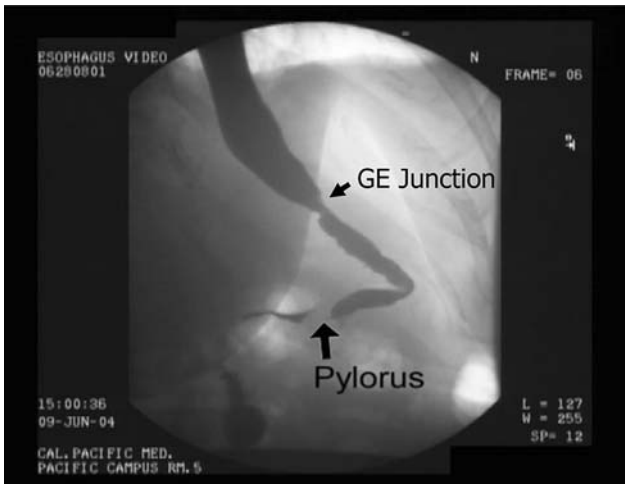


Fig. 1. Barium swallow after vertical gastrectomy. This barium swallow was obtained on the first postoperative day after laparoscopic vertical gastrectomy. The tubularized stomach can be seen between the landmarks of the gastroesophageal (GE) junction and the pylorus (in spasm). The "kink" in the tabularized stomach in fact represents the incisura of the stomach.

after open, hand-assisted, and revisional operations were excluded. Of these 846, 271 (32%) were Band, 216 (25%) were VG, 303 (36%) were RGB, and 56 (7%) were DS.

Perioperative variables

Perioperative variables are shown in Table 1. A greater percentage (20%) of VG patients were male compared to Band and DS patients (13% and 9%, respectively, $p < 0.05$). Male patients are usually more technically difficult because of their tendency to have more intra-abdominal fat. VG patients were also more obese than Band and RGB patients. Despite these differences, operative time for the VG operations was shorter than that for the RGB and DS operations and on par with that for the Band operation. VG patients had a shorter length of stay (LOS) (1.9 ± 1.2 days) than RGB and DS patients (2.8 ± 1.4 and 3.2 ± 2.0 days, respectively, $p < 0.01$), while Band patients had the shortest average hospitalization (1.2 ± 0.7 days, $p < 0.01$ vs. all other groups).

Postoperative weight loss variables

Postoperative variables are shown in Tables 2 and 3 and in Figures 2 and 3. Preoperatively, RGB and DS patients were of similar weight and BMI; VG patients were more obese than RGB and DS patients, and Band patients were less obese than RGB and DS patients (Table 2).

The RGB and DS patients were almost identical in their starting weight, postoperative weights, BMIs, rate of weight loss, and %EWL (Table 2, Figs. 2 and 3). They experienced approximately 110–120 lbs of weight loss and a %EWL of 75%–79% at 12 months (Table 2), and 113–125 lbs weight loss at two years (Fig. 2).

Band patients were less obese preoperatively but experienced a slower rate of weight loss (Fig. 2). At one year they lost about half the weight compared with the other groups (approximately 60 lbs vs. 120 lbs) (Fig. 3), and as a result their %EWL was only 47% at one year (Table 2).

VG patients were significantly heavier preoperatively than Band and RGB patients, with an average BMI of 49 ± 11kg/m^2. The VG patients lost 129 ± 51 lbs at one year, which was greater than that of the Band and RGB groups (58 ± 27 and 110 ± 37 lbs, respectively, $p < 0.01$) and comparable to the weight loss achieved after DS (120 ± 24 lbs). Furthermore, a weight loss plateau (< 10 lbs lost/6 months) was found in only 9 (4.2%) of VG patients.

Percentage excess weight loss (%EWL) was the greatest in the RGB and DS patients (75 ± 16% and 79 ± 12%, respectively, p = NS), least in the Band patients (47 ± 20%, $p < 0.01$ vs. RGB and DS), and somewhere in between in the VG patients (59 ± 17%, $p < 0.01$ vs. all other groups). Comparison of the groups using %EWL as the sole variable can be misleading (see Discussion).

Complications, morbidity, and mortality

Complications, morbidity, and mortality are depicted in Table 3. There were no deaths or conversions to open procedure in any groups. VG and Band patients had the fewest complications (7.4% and 6.6%, respectively, p = NS), DS had the most (48.2%, $p < 0.01$ vs. all groups), and RGB had an intermediate number of complications (22.8%, $p < 0.01$ vs. all groups). VG patients had fewer reoperations (2.8%, $p < 0.03$ vs. RGB and DS) (which included reoperations for biliary disease and hernia repairs as well as for leaks and bowel obstruction) compared to the RGB and DS groups (8.6% and 32.1%, respectively, $p < 0.01$). VG patients had fewer major complications (4.6%, $p < 0.03$ vs. RGB and DS) compared to the RGB and DS groups (10.6% and 39.3%, respectively, $p < 0.01$).

Complications in the VG group included five (2.3%) nonoperative admissions for nausea and vomiting which resolved with time, pulmonary embolism, and urosepsis. Six (2.8%) reoperations occurred of which four were for laparoscopic cholecystectomy (1.9% of VG patients) and two were for oversew of leaks and placement of drains. Ten (4.6%) major complications occurred in the VG group, including four laparoscopic cholecystectomies, three leaks (1 was managed percutaneously), one urolithiasis with urosepsis, one pulmonary embolism, and onetransfusion of 2 units of packed red blood cells.

Discussion

The highly efficacious DS operation has been touted for the superobese patient; however, performing this operation, which carries a significant morbidity rate, in high-risk patients can result in greater cumulative risk. Performing just the restrictive component of the DS, an isolated VG, is a lower-risk option for this group of patients. In the United States and Germany, this pro-

Table 1. Preoperative variables for patients undergoing laparoscopic vertical gastrectomy (VG), adjustable gastric band placement (Band), Roux-en-Y gastric bypass (RGB), and vertical gastrectomy with duodenal switch (DS)

	VG (n = 216)	Band (n = 271)	RGB (n = 303)	DS (n = 56)	p value
Age (yr)	43 ± 11	42 ± 12	43 ± 19	42 ± 8	NS
Male (%)	43 (20%)†	34 (13%)	46 (14%)	7 (9%)	< 0.05 vs Band, DS†
Preop weight (lbs)	302 ± 77†	257 ± 42*	281 ± 47	288 ± 49	< 0.01 vs Band, RGB†; < 0.01 vs RGB, DS*
Preop BMI (kg/m^2)	49 ± 11†	42 ± 5*	46 ± 6	47 ± 6	< 0.01 vs Band, RGB†; < 0.01 vs RGB, DS*
OR time (min)	90 ± 30†	89 ± 25*	140 ± 37	226 ± 45	< 0.01 vs RGB, DS†; < 0.01 vs RGB, DS*
EBL (ml)	35 ± 19†	29 ± 18†	53 ± 44†	89 ± 47†	< 0.01 vs all other groups†
Length of stay (days)	1.9 ± 1.2†	1.2 ± 0.7*	2.8 ± 1.4	3.2 ± 2.0	< 0.01 vs all†; < 0.01 vs RGB, DS*

The symbols refer to the p value comparison between procedures in that column
NS = not significant

Table 2. Postoperative weight variables for patients undergoing laparoscopic vertical gastrectomy (VG), adjustable gastric band placement (Band), Roux-en-Y gastric bypass (RGB), and vertical gastrectomy with duodenal switch (DS)

	VG (n = 216)	Band (n = 271)	RGB (n = 303)	DS (n = 56)	p value
Preop weight (lbs)	302 ± 77†	257 ± 42*	281 ± 47	288 ± 49	< 0.01 vs Band, RGB†; < 0.01 vs RGB, DS*
1 yr weight (lbs)	242 ± 64†	194 ± 33*	174 ± 36	165 ± 29	< 0.0 vs all†; < 0.01 vs RGB, DS*
Preop BMI (kg/m^2)	49 ± 11†	42 ± 5*	46 ± 6	47 ± 6	< 0.01 vs Band, RGB†; < 0.01 vs RGB, DS*
1 yr BMI (kg/m^2)	37 ± 9†	32 ± 5*	28 ± 5	27 ± 4	< 0.01 vs all†; < 0.01 vs RGB, DS*
1 yr %EWL (%)	59 ± 17†	47 ± 20*	75 ± 16	79 ± 12	< 0.05 vs all†; < 0.01 vs RGB, DS*
1 yr weight lost (lbs)	129 ± 51†	58 ± 27*	110 ± 37	120 ± 24	< 0.01 vs Band, RGB†; < 0.01 vs RGB, DS*

The symbols refer to the p value comparison between procedures in that column

Table 3. Complications in patients undergoing laparoscopic vertical gastrectomy (VG), adjustable gastric band placement (Band), Roux-en-Y gastric bypass (RGB), and vertical gastrectomy with duodenal switch (DS

	VG (n = 216)	Band (n = 271)	RGB (n = 303)	DS (n = 56)	p value
Nonoperative readmissions (%)	5 (2.3%)	4 (1.5%)†	12 (4.0%)	4 (7.1%)	< 0.05 vs DS†
Reoperations (%)	6 (2.8%)†	13 (4.8%)‡	26 (8.6%)	18 (32.1%)*	< 0.03 vs RGB, DS†; < 0.01vs all*
Deaths (%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	NS
Major complications (%)	10 (4.6%)†	13 (4.8%)‡	32 (10.6%)	22 (39.3%)*	< 0.03 vs RGB, DS†; < 0.03 vs RGB, DS‡; < 0.01vs all*
Total complications (%)	16 (7.4%)	18 (6.6%)‡	69 (22.8%)	27 (48.2%)*	< 0.03 vs RGB, DS†; < 0.03 vs RGB, DS‡; < 0.01vs all*

The symbols refer to the p value comparison between procedures in that column
NS = not significant

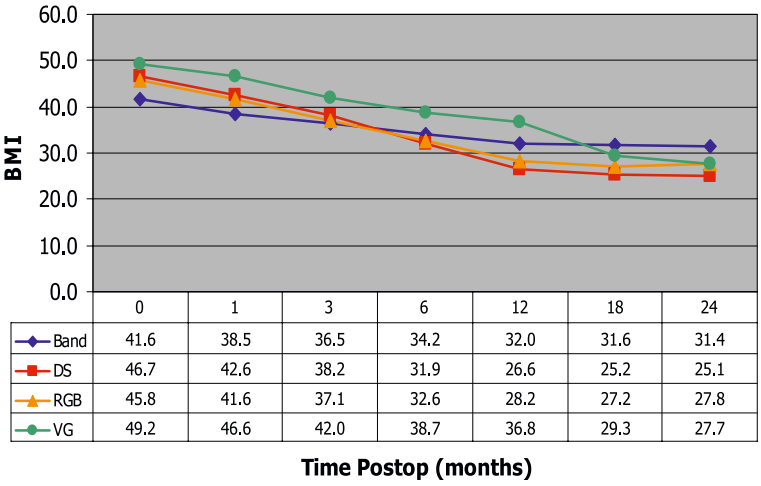
cedure was first performed laparoscopically in very-high-BMI patients to try to reduce the overall risk of weight loss surgery by "staging" the bariatric operations. In particular, when the patient's BMI is above 60 kg/m^2, it is difficult to perform safely a RGB or a DS laparoscopically. In addition, it is a reasonable option for patients who have a contraindication to intestinal bypass (e.g., ulcer history, Crohn's disease, renal failure).

The VG is a reasonable solution to this problem. It can usually be done laparoscopically, even in patients weighing over 500 lbs. The gastric restriction can cause these patients to lose more than 200 lbs, allowing significant improvement in health and resolution of associated medical problems such as diabetes and sleep apnea; it therefore effectively downstages a patient to a lower-risk group. The patients can then return to the operating room for the second stage of the procedure, which can be either the DS, RGB, or even laparoscopic adjustable band placement.

In this study VG patients had the highest preoperative weight and BMI but experienced a similar rate of weight loss in absolute terms compared to the RGB and DS groups. %EWL was misleadingly lower in the VG group because, for a given weight loss, more obese patients will have a lower %EWL than a less obese patient. This is because the calculation of %EWL [= (weight lost)/(preoperative weight – ideal body weight)] includes preoperative weight is in the denominator and therefore %EWL is a dependent, not independent, variable of preoperative weight. VG achieved this weight loss in patients with a complication profile that was comparable to that of the Band operation and superior to that of the RGB and DS operations.

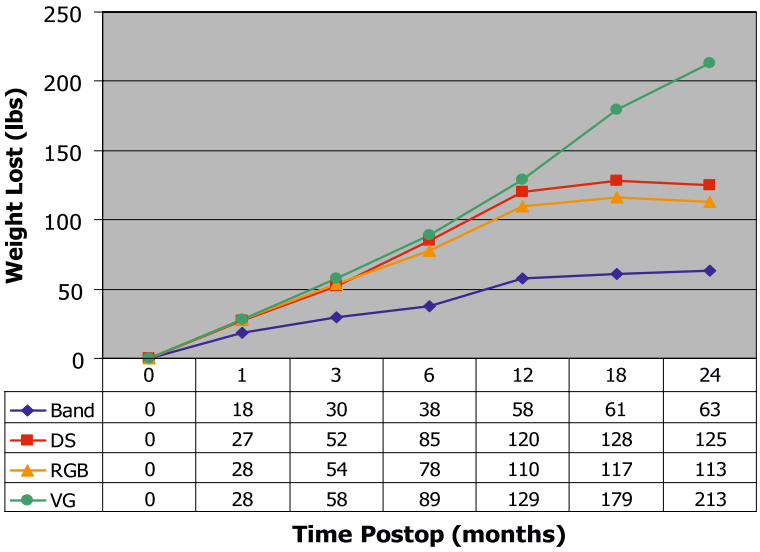
A new kind of restrictive operation?

Historically, restrictive bariatric operations such as the original horizontal gastroplasty introduced by Printen



	0	1	3	6	12	18	24
Band	41.6	38.5	36.5	34.2	32.0	31.6	31.4
DS	46.7	42.6	38.2	31.9	26.6	25.2	25.1
RGB	45.8	41.6	37.1	32.6	28.2	27.2	27.8
VG	49.2	46.6	42.0	38.7	36.8	29.3	27.7

Fig. 2. Body mass index in patients after undergoing laparoscopic vertical gastrectomy (VG), adjustable gastric band placement (Band), Roux-en-Y gastric bypass (RGB), and vertical gastrectomy with duodenal switch (DS). VG patients were more obese than both RGB and DS patients but lost weight at a similar rate (slope). Band patients were less obese and lost weight at approximately half the rate of VG, RGB and DS patients.



	0	1	3	6	12	18	24
Band	0	18	30	38	58	61	63
DS	0	27	52	85	120	128	125
RGB	0	28	54	78	110	117	113
VG	0	28	58	89	129	179	213

Fig. 3. Postoperative weight loss in patients after undergoing laparoscopic vertical gastrectomy (VG), adjustable gastric band placement (BAND), Roux-en-Y gastric bypass (RGB), and vertical gastrectomy with duodenal switch (DS). VG patients lost weight as effectively as RGB and DS patients. Band patients lost approximately half as much weight as the other RGB and DS patients.

and Mason in 1973 [12], the vertical gastroplasty described Mason [9], and its variant, the silastic-ring vertical banded gastroplasty, have met with mixed success. Unfortunately, the sizable pouches had a tendency to stretch, the stomas enlarged, or the nondivided staple lines recanalized resulting in arrested weight loss and often weight regain.

These gastroplasty procedures all had promising 1–2-year weight loss profiles with percentage of excess weight loss (%EWL of 60%–70%) but disappointing long-term weight loss (%EWL of 30%–40% at 5 years) [10, 11]. In addition, these procedures also had complications specifically related to the restrictive mesh or ring and have nearly been abandoned. These procedures did yield a reasonable long-term weight loss for those individuals with lower BMIs, suggesting that a purely restrictive procedure may be adequate for the lower-BMI group.

A recent development in restrictive bariatric surgery is laparoscopic adjustable gastric band placement, wherein an inflatable band is secured at the cardia, creating a 15–20-ml gastric pouch. Infusion of saline via a port narrows the internal diameter of the band and can increase the degree of restriction. Weight loss occurs gradually over a 2–3-year period with %EWL that was 47% at one year in this series. While recanalization is not a problem in this operation, the presence of the prosthesis introduces a host of its own problems with slippage, erosions, infection, and port-related complications [2].

Of all the existing purely restrictive operations, the Magenstrasse and Mill (MM) operation most closely resembles the vertical gastrectomy and confers the advantage of lack of a foreign body. It was designed to be a more physiologic restrictive operation than the VBG because it preserves the antral "mill." The MM operation also uses a bougie placed along the lesser curvature to size and guide the creation of a vertical gastric tube [6]. A EEA stapler is then used to create a circular defect in the antrum, approximately 6 cm from the pylorus, which then allows linear staplers to be fired from the antrum up to the angle of His, creating the "Magenstrasse" or "street of the stomach" while preserving the antral "mill." The key difference between the MM and the VG is that the greater curvature of the stomach is entirely transected and removed in the VG,

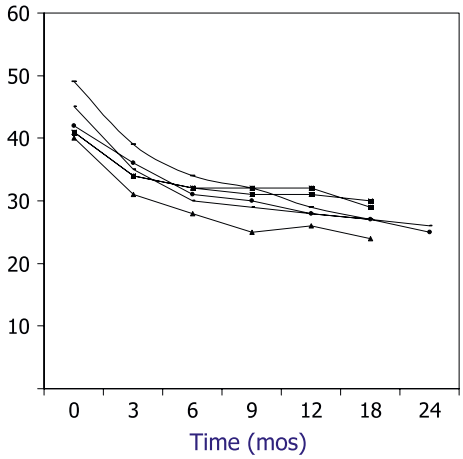


Fig. 4. Individual patient weights after laparoscopic vertical gastrectomy alone in patients of BMI 50 kg/m^2 or less. Patients all achieved BMIs of less than 35 kg/m^2 within six months after surgery.

whereas with the MM, the greater curvature, while separated from the lesser curvature along much of its length, is still attached to the rest of the stomach at the antrum.

The MM operation has enjoyed superior results to that of the other gastroplasties. Johnston's first 100 patients, with an average preoperative BMI of 46.3 kg/m^2, saw a mean weight loss of 84 $\pm$ 31 lbs and a %EWL of 58% at one year [6]. Now with over 230 postoperative MM patients, Johnston has achieved a durable five-year %EWL of 61%, with a stable weight generally being achieved at one year postoperatively. This has been achieved with a 0% mortality rate and 4% major complication rate in the hands of its creator, David Johnston. Given the similarity between the MM operation and the VG operation, it is reasonable to conclude that the VG operation may also have durable five-year weight loss, in contrast to the earlier restrictive operations.

Potential role of the vertical gastrectomy operation in bariatric surgery

The vertical gastrectomy operation may be a viable first-stage operation in staged operations for the supermorbidly obese. It is relatively simple technically and yet can achieve significant interval weight loss before a second-stage procedure and has the flexibility of being converted to either a RGB or a DS.

The operation may also prove to be the only operation required for patients of BMI $<$ 50 kg/m^2. Review of individual patient data demonstrates that these patients rapidly achieve a BMI $<$ 35 kg/m^2 at six months (Fig. 4). Not only is the weight loss superior to that achieved by the Band, the safety profile is similar with a complication rate of approximately 6%–7% in this study.

The VG operation may also potentially benefit the following groups of patients:

1. Patients concerned about the potential long-term side effects of an intestinal bypass such as intestinal obstruction, ulcers, anemia, osteoporosis, protein deficiency, and vitamin deficiency.
2. Patients who are considering a Band but are concerned about an implanted prosthesis, or those who may not be compliant with frequent physician visits and adjustments.
3. High-risk patients who have other medical problems that prevent them from having weight loss surgery such as anemia, Crohn's disease, extensive prior surgery, severe asthma requiring frequent steroid use, organ transplant candidates or recipients, and other complex medical conditions.
4. Patients who need to take anti-inflammatory medications may also consider the VG because, unlike the gastric bypass where these medications are associated with a high incidence of ulcers, the VG does not seem to have the same issues.
5. Patients who are on critical medications (e.g., cardiac and transplant medications) because the VG's purely restrictive nature will make delivery and absorption of medications more predictable.

Limitations of the study

The obvious limitations of this study include the fact that it is a nonrandomized, retrospective study with a short duration of followup of only one year. It would be difficult to randomize patients to the various operations given the nature of the operations, insurance, and patient choice. Because laparoscopic vertical gastrectomy for bariatric surgery has been done for only a short period, this is to be expected. The alternatives are to withhold the data and not present it until longer-term, e.g., five-year, data or more operations have been performed. We feel, however, that there is benefit to sharing our findings, despite their shortcomings, with the scientific community to further our collective knowledge about these operations.

Conclusions

While the long-term efficacy of the VG is unclear, the data thus far seem promising. The short-term data in this study suggest that the vertical gastrectomy achieves significant weight loss on par with that of the RGB and DS operations, while with fewer complications. Further study will be needed to determine the long-term results with this operation and to identify its role in the armamentarium of the bariatric surgeon.

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