

Laparoscopic gastric bypass as a reoperative bariatric surgery for failed open restrictive procedures

Initial experience in seven patients

J. de Csepe, R. Nahouraii, M. Gagner

Division of Laparoscopic Surgery, Mount Sinai Medical Center, One Gustave L. Levy Place, #1103, New York, NY 10029, USA

Received: 5 November 1999/Accepted in final form: 15 January 2000/Online publication: 6 February 2001

Abstract. An estimated 2% of men and 6% of women in the United States are morbidly obese. These patients have a mortality rate that is six to twelve times greater than their normal-weight peers. In these extreme cases of overweight, only surgical intervention can produce substantial and sustained weight loss. However, up to 20% of these patients will require reoperation for failure to achieve or maintain an adequate weight loss. Reoperative bariatric surgery can be challenging and has traditionally been performed as an open procedure. We present seven female patients who underwent a laparoscopic Roux-en-Y gastric bypass after failing to achieve their weight-loss goals with prior open restrictive procedures. Their average BMI before surgical revision was 42.2 kg/m². Mean operative time was 4 h 20 min, and length of hospital stay was 4.1 days. There were three complications in two patients and no deaths. Our initial experience suggests that laparoscopic gastric bypass is a safe and feasible reoperative bariatric procedure. Confirmation awaits a larger series of patients with follow-up data.

Key words: Morbid obesity — Bariatric surgery — Reoperation — Laparoscopic gastric bypass — Vertical banded gastroplasty — Roux-en-Y gastric bypass

Morbid obesity is the result of an unrelenting lifelong, accumulation of adipose tissue. This condition now afflicts an estimated 2% of men and 6% of women in the United States [14]. Individuals with morbid obesity, defined by the American Society for Bariatric Surgery (ASBS) as a body mass index (BMI) ≥ 40 kg/m², face an estimated six to 12 times greater mortality rate than their normal-weight peers [1, 16]. They must contend with serious comorbidities, such as type 2 diabetes mellitus, hypertension, joint disorders,

and obstructive sleep apnea. Attempts at medical therapy, such as diet, exercise, and behavior modification, are ineffective for most of the morbidly obese population. Of the small percentage of patients who achieve any substantial weight loss, few are capable of maintaining the loss. Some actually regain more weight than is initially lost after each attempted diet—a pattern that has been termed “yo-yo dieting” and that may have adverse health consequences of its own [3].

The poor results obtained with medical therapy resulted in the development of surgical weight loss procedures. The current procedures approved by the National Institutes of Health Consensus Conference are the vertical banded gastroplasty (VBG) and the Roux-en-Y gastric bypass (RGB) [7]. Although initial weight loss is dramatic after both procedures, RGB patients experience a more prolonged and substantial weight loss than VBG patients. After VBG, the average weight stabilizes at 60–70% above ideal body weight by the end of the 1st postoperative year. The average weight loss achieved after RGB stabilizes at 30–40% above ideal body weight by the 2nd and 3rd postoperative years. Among patients undergoing these procedures, up to 20% will fail to lose the expected amount of weight or will regain weight after an initially satisfactory weight loss [3]. Although reoperation may pose technical challenges exceeding those of the initial procedure, the predictable failure of medical management warrants surgical revision.

A number of investigators have examined reoperative bariatric surgeries, and most of them have recommended RGB as the procedure of choice [2, 5, 6, 17, 18, 20]. Although all of these prior studies were based on the performance of open procedures for revision, laparoscopic RGB as a primary bariatric surgery has been previously described [12, 15, 19]. Therefore, seven patients who had failed to achieve satisfactory results with prior open restrictive procedures were converted to laparoscopic RGB at our institution. This series is the first that we know of to utilize a laparoscopic revision. Our objective was to demonstrate the

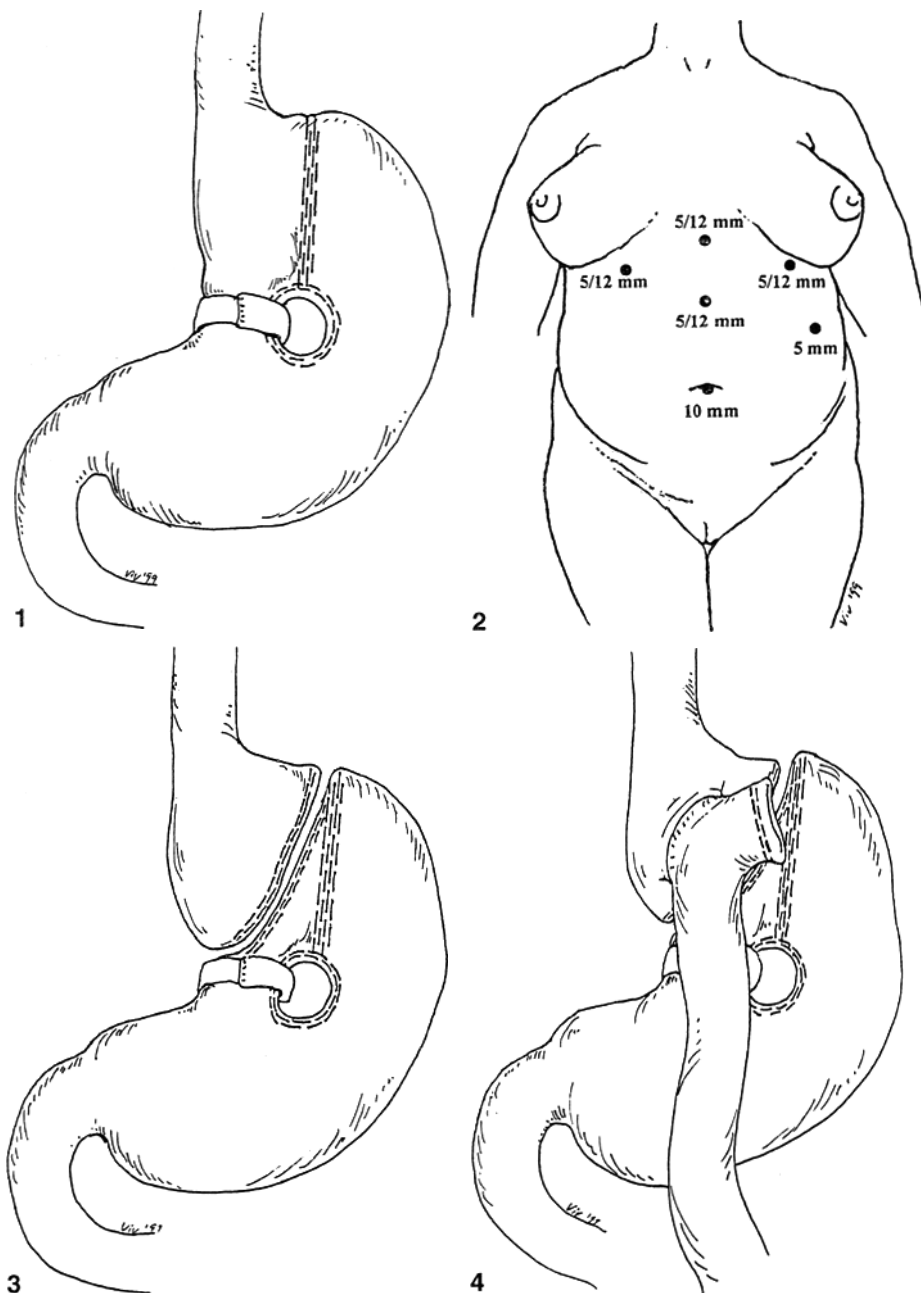


Fig. 1. Vertical banded gastroplasty.

Fig. 2. Position and size of trocars.

Fig. 3. The distal gastric pouch is excluded following application of a linear cutting stapler.

Fig. 4. A jejunal Roux limb is anastomosed to the new gastric pouch.

safety and feasibility of laparoscopic RGB as a reoperative bariatric surgery.

Materials and methods

Seven patients who had undergone previous open bariatric procedures presented for surgical revision after unsatisfactory weight loss and/or failure to maintain an initially satisfactory loss. Five of them had undergone VBG (Fig. 1), one had open adjustable gastric banding, and one had VBG with a subsequent open gastric bypass. All patients were revised laparoscopically with conversion to a Roux-en-Y gastric bypass (Figs. 2, 3, and 4).

A thorough preoperative workup was undertaken, and a medical clearance was obtained from an internist. Then, an upper endoscopy and upper

GI series were completed. A full bowel preparation was done the night before surgery. All patients were informed of the risks inherent in any reoperative procedure, as well as the potential benefits and alternatives.

Technique

The patient was placed in a supine split-leg position. Video monitors were positioned over the left and right shoulders. The arms were protected with arm boards, and the legs were placed in pneumatic compression boots. A urinary catheter was inserted and the abdomen was prepped and draped. A 10-mm trocar was placed intraumbilically using the open technique, and pneumoperitoneum was established to a pressure of 15 mmHg. After inspection of the abdominal cavity with a camera (Storz, Culver City, CA, USA) attached to a 10-mm 30° laparoscope, the remaining trocars were

Table 1. Patient data

Characteristic	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7	Median	Mean
Age (yr)	29	52	36	37	25	47	32	36	36.9
Initial weight (kg)	136	107	99.8	181	144	129	159	136	137
Height (m)	1.60	1.52	1.55	1.65	1.70	1.65	1.73	1.625	1.63
Initial BMI (kg/m ²)	53.1	46.1	41.6	66.5	49.8	47.4	53.2	49.8	51.1
Lowest BMI postop (kg/m ²)	39.0	37.1	31.5	41.2	43.4	26.6	41.8	39.0	37.2
BMI prior to reop (kg/m ²)	45.2	46.1	37.8	41.2	43.4	37.4	44.1	41.2	42.2
Weight loss (%)	-15	0	-9.1	-38	-13	-21.1	-17.1	-15	-16.2
Operating time (min)	190	480	180	180	312	252	240	246	262
Roux limb (cm)	65	65	60	60	65	50	100		
Length of stay (days)	2	5	5	9	4	2	2	4.5	4.1

placed under direct vision. These included a 5-mm trocar in the left anterior axillary line for liver retraction and 5–12-mm Versaport trocars (US Surgical Corp., Norwalk, CT, USA) in the left upper quadrant, right upper quadrant, superior midline epigastrium, and inferior midline epigastrium for dissecting, suturing, and stapling.

Diffuse abdominal adhesions were commonly encountered. The stomach was often adherent to the anterior abdominal wall, liver, and/or diaphragm, requiring a meticulous sharp lysis. A window was created posterior to the stomach, extending from the mid-lesser curvature to the angle of His. When we needed to revise a VBG, multiple applications of a 3.5-mm/45-mm linear cutting stapler (EndoGIA II; US Surgical Corp.) were used to partition the stomach proximal to the VBG staple line and prosthetic band, thus creating a new gastric pouch. Care was taken not to cross the prior VBG staple line, which might inadvertently create a closed gastric remnant. When we needed to revise an adjustable gastric banding procedure, the band was divided with ultrasonically activated coagulating shears (Ultracision; Ethicon Endosurgery, Cincinnati, OH, USA) and then removed. The new gastric pouch was then created with the linear cutting stapler.

In preparation for the gastrojejunostomy, the anvil of a 25-mm circular anastomosing stapler (CEEAA; US Surgical Corp.) was placed into the end of an orogastric tube and sutured in place with a 2-0 Prolene suture. The tube was inserted orally, anvil side last. The gastric pouch was opened with scissors, and the tube was drawn through the pouch until the anvil centered itself within the gastric pouch opening. The tube and its attached suture were dissected from the anvil with ultrasonically activated coagulating shears and removed from the abdomen.

Next, the ligament of Treitz was identified and a portion of jejunum ~20–50 cm distal to the ligament was divided with a 3.5-mm/45-mm linear cutting stapler. Then, ~5 cm of mesentery was divided to facilitate a tension-free anastomosis. An enterotomy was made in the Roux limb. The 25-mm circular anastomosing stapler was prepared by taping a tubular plastic bag around its shaft to protect the wound from contamination. After the left upper quadrant port site incision was enlarged, the functional end of the stapler was inserted through the incision and placed into the Roux limb. The jejunum was brought up to the gastric pouch in an antecolic orientation. The stapler pin was rotated through the jejunum at a point that allowed the anastomosis to be formed without tension. After the pin was removed, the stapler was attached to the anvil and an end-to-side gastrojejunostomy was created. The Roux limb enterotomy was resected using a 3.5-mm/45-mm linear cutting stapler, and the remnant was removed in a retrieval bag. After the tape was loosened from the shaft of the circular anastomosing stapler, the stapler was removed while the wound remained protected by the bag.

The jejunojunal anastomosis was constructed 50–100 cm from the gastrojejunostomy, depending on the patient's BMI. It was created in a side-to-side fashion using a 3.5-mm/30-mm linear cutting stapler and two running intracorporeal 2-0 silk sutures (Softsilk with ESK tapered needle; US Surgical Corp.) to close the remaining enterotomy. A methylene blue test of the gastrojejunostomy and gastric staple lines was performed. Two drains were placed, one near the gastrojejunal anastomosis and the other near the jejunojunal anastomosis. The fascia of the trocar sites was closed with a suture passer, and the skin was closed with absorbable sutures.

Case reports

For each of the seven patients, the age, sex, height, weight prior to the initial bariatric surgery, lowest attained weight following the initial sur-

gery, weight prior to the reoperative surgery, and results of the preoperative tests were recorded, as well as the operative time, length of Roux limb, hospital course, and complications (Table 1).

Case 1

A 29-year-old woman who had had an open VBG in 1995 presented with inadequate weight loss. Her initial BMI of 53.1 kg/m² decreased to 39.0 kg/m² postoperatively, but it eventually rose to 45.2 kg/m² (15% decrease). A preoperative upper GI series revealed a fistula from the gastric pouch to the gastric remnant. She underwent an uncomplicated laparoscopic RGB. An upper GI series on the 1st postoperative day was normal, revealing a patent anastomosis without a staple line or anastomotic leak. She was started on a regular diet. On the 2nd postoperative day, the drains were removed and the patient was discharged home.

Case 2

A 52-year-old woman who had had an open VBG in 1997 presented with unsatisfactory weight loss. Her initial BMI of 46.1 kg/m² decreased to 37.1 kg/m² postoperatively, but it eventually returned to 46.1 kg/m² (0% decrease). A preoperative upper GI series revealed a fistula from the gastric pouch to the gastric remnant. She underwent a laparoscopic RGB. The fundus of the stomach was firmly adherent to the left diaphragm, and during dissection a pleural injury occurred. Although intraoperative chest radiographs revealed no pneumothorax, a prophylactic thoracostomy tube was placed. The procedure was further complicated by the inclusion of the esophageal temperature probe in the gastric staple line. Removal of the probe and revision of the gastric pouch were performed. Operative time was substantially longer for this patient than for the others. An upper GI series and a chest radiograph on the 1st postoperative day were normal. The thoracostomy tube was removed on the 3rd postoperative day, and the patient was advanced to a regular diet. The drains were removed on the 4th postoperative day, and the patient was discharged home the following day.

Case 3

A 36-year-old woman underwent an open VBG in 1992, followed by an open revision for a lax stoma in 1994. The latter procedure was complicated by the development of an incarcerated internal hernia, which required a small bowel resection on postoperative day 10. Her chief complaints postoperatively were regurgitation, dysphagia, and unsatisfactory weight loss. Her initial BMI of 41.6 kg/m² decreased to 31.5 kg/m² postoperatively, but it eventually rose to 37.8 kg/m² (9% decrease). She underwent an uncomplicated laparoscopic RGB. An upper GI series performed on the 1st postoperative day was normal. After resolution of a postoperative ileus, the drains were removed and the patient was discharged on the 5th postoperative day.

Case 4

A 37-year-old woman who had undergone an open VBG in 1992 presented with regurgitation, dysphagia, and unsatisfactory weight loss. Her initial

BMI of 66.5 kg/m² decreased to 41.2 kg/m² with no further drop (38% decrease). She underwent an uncomplicated laparoscopic RGB. An upper GI series performed on the 1st, postoperative day was normal. Her initial recovery was uneventful. On postoperative day 4, she was tachycardic to 104 beats/min, distended, and tympanitic over the epigastrium. Methylene blue administered orally was not seen in her drains. A CT scan revealed a marked gastric remnant dilation, which resolved rapidly after the placement of a percutaneous gastrostomy tube under CT guidance. The patient did well and, after removal of the drains on postoperative day 7, was discharged home with the gastrostomy tube on postoperative day 9.

Case 5

A 25-year-old woman who had undergone an open VBG in 1997 presented with unsatisfactory weight loss. Her initial BMI of 49.8 kg/m² decreased to 43.4 kg/m² postoperatively (13% decrease). She underwent an uncomplicated laparoscopic RGB. A postoperative upper GI series was normal, and the drains were removed on postoperative day 2. She was discharged on postoperative day 4.

Case 6

A 47-year-old woman who had had an open VBG in 1987 and an open RGB in 1990 presented with inadequate weight loss. Her initial BMI of 47.4 kg/m² prior to her first procedure decreased to 26.6 kg/m² after the second procedure, but it eventually returned to 37.4 kg/m² (21% decrease). A preoperative upper GI series revealed a large gastric pouch. She underwent a laparoscopic reduction of the gastric pouch by excision of a 2-cm section of stomach containing the old staple line and the gastrojejunostomy. The excised segment included a fistula between the pouch and the stomach remnant. A jejunal Roux limb was anastomosed to the new gastric pouch. An upper GI study performed on the 1st postoperative day was normal. On the 2nd postoperative day, the drains were removed and the patient was discharged home.

Case 7

A 32-year-old woman who underwent an open adjustable gastric banding procedure in 1994 presented with unsatisfactory weight loss. Her initial BMI of 53.2 kg/m² decreased to 41.8 kg/m² postoperatively, but it eventually returned to 44.1 kg/m² (17% decrease). A preoperative upper GI series revealed that the band had migrated distally. She underwent an uncomplicated laparoscopic RGB. An upper GI series on the 1st postoperative day was normal. On the 2nd postoperative day, the drains were removed and the patient was discharged home.

Discussion

As more and more morbidly obese individuals undergo bariatric procedures, the number of patients requiring revision can be expected to increase. In this series, despite some complaints of severe regurgitation and dysphagia, all patients failed to achieve or maintain an adequate weight loss. Preoperative studies demonstrated fistula formation between the gastric pouch and remnant, an enlarged pouch, or migration of the adjustable gastric band. Other investigators have reported that inadequate weight loss was the most common indication for reoperative bariatric procedures [2, 5, 18]. Initially, staple line disruption secondary to persistent overeating, with subsequent vomiting, accounted for most bariatric surgery failures. In one series where routine endoscopic examinations were performed after VBG, 48% of the patients incurred such a staple line disruption [13]. The problem of staple line disruption can be addressed by placing a four-row staple line or using a cutting stapler to

separate the stomach completely [2, 5, 18]. These techniques, however, do not prevent gastric pouch and stoma dilation, which can lead to subsequent weight gain [5].

Weight loss following RGB as a primary procedure has been found to be generally superior to that following VBG [3]. RGB not only results in a greater weight loss, it is also associated with a lower incidence of revision. Using a Kaplan-Meier analysis to correct for the length of follow-up, van Gemert et al. noted a 56% incidence of revision after primary VBG over a 12-year period, as compared with a 12% incidence of revision after RGB [18].

Other studies have verified the superiority of RGB over VBG in the reoperative setting. In a series from the Mayo Clinic, Behrns et al. prospectively observed 61 consecutive patients after reoperative bariatric surgery, the majority of whom (61%) presented with inadequate weight loss. The mean percentage of excess body weight lost (EBWL) was greater with reoperative RGB than with VBG (54% vs 24%) [2]. Buckwalter et al. followed 23 reoperative patients for a mean of > 2 years. The average percentage of EBWL was greater with reoperative RGB than with other bariatric surgeries (77.3% vs 33.8%) [5]. Furthermore, van Gemert et al. found that 46% of their patients who underwent a reoperative VBG required additional revisional surgery, whereas none of their reoperative RGB patients required revision [18].

All of the patients in our series were women. Their average age was 37 years. Prior to their initial bariatric surgery, their average BMI was 51.1 kg/m². The lowest mean BMI achieved postoperatively was 37.2 kg/m², but it increased to an average of 42.2 kg/m² prior to their current revisional surgery. Five of the seven patients had a BMI > 40 kg/m², and none of them had a BMI < 35 kg/m². A comparison of the initial average BMI to the average BMI recorded prior to the current revisional surgery indicates that their mean weight loss was only 16%.

The reoperative surgery time averaged 4 h 22 min (range, 3–8h). The wide variation was probably due not only to the weight of the patients but also to the presence of adhesions, the lysis of which sometimes consumed a majority of the procedure. The average postoperative length of stay in hospital was 4.1 days. These data compare favorably with our experience in completing > 100 primary RGB. These procedures were associated with an average operative time of 2 h 25 min and an average length of stay of 3.1 days [9].

The overall morbidity and mortality rates for reoperative bariatric procedures are generally considered to be higher than those for the initial surgery. In the series reported by van Gemert et al., the overall morbidity rate was 33% for revision with both VBG and RGB, and there were no mortalities [18]. Other investigators have reported lower morbidity rates. Behrns et al., for example, experienced one fatality, (due to a pulmonary embolus), and an 11% morbidity rate in their reoperative series [2]. Morbidity and mortality data from the literature range between 12% and 41% and 0% and 2%, respectively [4, 6, 10, 11, 17, 20].

In our series, two patients suffered complications. One patient sustained an intraoperative diaphragmatic injury that required the placement of a thoracostomy tube as well as a revision of the gastric pouch after an esophageal temperature probe was inadvertently left in place prior to creating

the gastric staple line. Another patient experienced gastric remnant dilation, which required postoperative placement of a percutaneous gastrostomy tube. The presence of clots at the jejunojunostomy, leading to a biliopancreatic limb obstruction, was thought to be the cause. This patient remained in the hospital for 9 days, significantly increasing the average length of stay in this series to 4.1 days.

It is obvious that all of the potential complications of open RGB, such as anastomotic breakdown, intraabdominal hemorrhage, and gastric remnant dilation, may occur following laparoscopic RGB. Postoperatively, however, morbidly obese patients can expect to lose substantial excess weight as well as benefit from a more rapid recovery of pulmonary function, decreased pain, a quicker return to productivity, and a decreased incidence of the wound complications associated with laparoscopic surgery. Because the complications encountered in this small series were easily addressed, we believe that laparoscopic RGB will prove to be a safe and feasible reoperative bariatric procedure with further experience. The surgery, however, is technically challenging. For that reason, we support the 1993 ASBS recommendation that "laparoscopic obesity operations should be undertaken only by surgeons who are experienced both in video-laparoscopic technique and in the complexities of open bariatric operations and the field of morbid obesity" [8].

References

- Balsiger BM, Luque-De Leon E, Sarr MG (1997) Surgical treatment of obesity: who is an appropriate candidate? *Mayo Clin Proc* 72: 551–558
- Behrns KE, Smith CD, Kelly KA, Sarr MG (1993) Reoperative bariatric surgery: lessons learned to improve patient selection and results. *Ann Surg* 218: 646–653
- Benotti PN, Forse RA (1995) The role of gastric surgery in the multidisciplinary management of severe obesity. *Am J Surg* 169: 361–367
- Benotti PN, Forse RA (1996) Safety and long-term efficacy of revisional surgery in severe obesity. *Am J Surg* 172: 232–235
- Buckwalter JA, Herbst CA, Khouri RK (1985) Morbid obesity: second gastric operations for poor weight loss. *Am Surg* 51: 208–211
- Cates JA, Drenick EJ, Abedin MZ (1990) Reoperative surgery for the morbidly obese: a university experience. *Arch Surg* 125: 1400–1403
- Consensus Development Conference Panel Gastrointestinal surgery for severe obesity. *Ann Int Med* 115: 956–961
- Deitel M (1997) Laparoscopic bariatric surgery [Letter]. *Surg Endosc* 11: 965 DOI: 10.1007/s004649900499
- Gagner M (1999) Laparoscopic gastric bypass [Presentation]. Annual meeting of the Society of American Gastrointestinal Endoscopic Surgeons (SAGES) 23 March 1999, San Antonio, TX, USA
- Kfoury E, Vanguri A (1993) Distal Roux-en-Y gastric bypass conversion operation for failed vertical banded gastroplasty. *Obes Surg* 3: 41–43
- Linner JH, Drew RL (1992) Reoperative surgery: indications, efficacy, and long-term follow-up. *Am J Clin Nutr* 55: S606–S610
- Lönroth H, Dalenbäck J, Haglund E, Lundell L (1996) Laparoscopic gastric bypass: another option in bariatric surgery. *Surg Endosc* 10: 636–638 DOI: 10.1007/s004649900117
- MacLean LD, Rhode BM, Forse RA (1990) Late results of vertical banded gastroplasty for morbid obesity and super obesity. *Surgery* 107: 20–27
- Martin LF, Hunter SM, Lauve RM, O'Leary JP (1995) Severe obesity: expensive to society, frustrating to treat, but important to confront. *South Med J* 88: 895–902
- Potvin M, Gagner M, Pomp A (1997) Laparoscopic Roux-en-Y gastric bypass for morbid obesity: a feasibility study in pigs. *Surg Laparosc Endosc* 7: 294–297
- Standards Committee, American Society for Bariatric Surgery [ASBS] Guidelines for reporting results in bariatric surgery. *Obes Surg* 7: 521–522
- Sugerman HJ, Wolper JL (1984) Failed gastroplasty for morbid obesity: revised gastroplasty versus Roux-en-Y gastric bypass. *Am J Surg* 148: 331–336
- van Gemert WG, van Wersch MM, Greve JWM, Soeters PB (1998) Revisional surgery after failed vertical banded gastroplasty: restoration of vertical banded gastroplasty or conversion to gastric bypass. *Obes Surg* 8: 21–28
- Wittgrove AC, Clark GW (1996) Laparoscopic gastric bypass, Roux-en-Y: experience of 27 cases, with 3–18 months follow-up. *Obes Surg* 6: 54–57
- Yale CE (1989) Conversion surgery for morbid obesity: complications and long-term weight control. *Surgery* 106: 474–480