Laparoscopic Adjustable Silicone Gastric Banding (LASGB) for the Treatment of Morbid Obesity

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Morbid obesity is a serious disease that is responsible for several co-morbid conditions. Increased risks of hypertension, adult onset diabetes mellitus, dyslipidemia, pulmonary disease (Pickwickian syndrome), musculo-skeletal disorders, gallbladder disease, deep vein thrombosis, venous stasis ulcers, and increased prevalence of certain types of cancers (uterine, breast, colon carcinoma) have been reported, together with severe psychological and social disability.[1] Nonsurgical treatment options including various combinations of low-calorie or very-low-calorie diets, behavior modification, exercise, and drug therapy may achieve acceptable transient weight reduction but fail to maintain reduced body weight in most patients.[2]

Among several open surgical procedures which have been proposed since the 1960s, two operations are presently more commonly performed worldwide, on the basis of an acceptable persistent weight reduction and acceptable early and late complication rates: vertical banded gastroplasty (VBG), a gastric restrictive procedure, and gastric bypass (GB), an operation combining gastric restriction and induced malabsorption. Despite the low complication rates of VBG and GB, as compared to other procedures, open gastrointestinal surgery for morbid obesity remains technically demanding due to limited exposure, hepatomegaly from steatosis, increased mesenteric and omental fat, and shortened mesenteries. Reported complication rates for VBG and GB include operative mortality (0.3–1.6%), anastomotic leaks and peritonitis (1.6–2.3%), deep vein thrombosis (0.35%), pulmonary embolism (0.03%), subphrenic abscess (0.09%), and wound infections (5%).[3]

Gastric banding is a more recently introduced gastric restrictive procedure that was designed to be a simple, noninvasive and reversible operation in which a small pouch and stoma were created by tightening a band around the stomach, without cutting or crushing the stomach wall with staples,[4] while preserving at the same time the natural continuity of the alimentary tract. Stoma adjustable silicone gastric banding was later developed by Kuzmak to eliminate the problems of stoma size encountered with nonadjustable gastric banding.[5]

Morbidly obese patients are at higher risk for wound complications due to the large amount of fat that is present in the subcutaneous tissue. The introduction and development of laparoscopic surgery led to the clinical application of laparoscopic adjustable gastric banding for the treatment of morbid obesity,[6,7] allowing these patients to obtain particular benefit from the reduction in surgical trauma related to the limited access through the abdominal wall. Moreover, the magnified vision and enhanced exposure obtained during laparoscopic surgical gastric and esophageal procedures appear to be particularly useful in this category of patients for the

above-mentioned limited exposure in the area of the gastroesophageal junction.

The aim of this paper is to describe the details of the surgical technique for laparoscopic adjustable silicone gastric banding (LAGB, BioEnterics Co, Inamed BV, Breda, The Netherlands) and to report the authors' preliminary clinical experience.

MATERIALS AND METHODS

Patient Selection

Accurate patient selection is mandatory to optimize the results. The preoperative evaluation of the patient includes the following:

1. Gastroscopy, to exclude the presence of inflammatory conditions, such as esophagitis, gastritis, duodenitis;
2. Internist consultation, for the treatment of co-morbid conditions (hypertension, diabetes, etc.);
3. Endocrinologist consultation, to exclude thyroid or adrenal disease;
4. Psychological consultation, with the performance of Minnesota Multiphasic Personality Inventory and Rorschach Test;
5. Dietitian consultation.

From June 1995 to January 1996, 10 patients were evaluated for Laparoscopic Adjustable Gastric Banding (6 females, 4 males, mean age 32.9 years, age range 19–47 years). One of these patients had previously undergone vertical banded gastroplasty performed at another institution, which had failed due to a series of complications: the occurrence of a subphrenic abscess in the immediate postoperative period, a subsequent gastric stoma outlet stenosis, and a complete gastro-gastric fistula 5 months after the operation, which caused immediate weight regain. The patient was therefore referred to us for recurrent morbid obesity.

Accurate preoperative evaluation according to the above-mentioned study protocol allowed to discover conditions that at least temporarily contraindicated surgical treatment in the four male patients, who were therefore excluded from the study. The reasons for exclusion were as follows: Helicobacter ulcer in 1 case; erosive gastritis and pyloric spasm in 2 cases, 1 of the two being the patient who had previously undergone vertical gastroplasty; and emotional distress in 1 case. These patients were therefore submitted to medical (3 cases) or psychological (1 case) therapies and will be re-evaluated in the future for possible operation.

Six female patients (mean age 33.1 years, age range 23–47 years; mean body weight 113.3 kg, body weight range 92.3-135.2 kg; mean Body Mass Index, BMI, 39.7 kg/m^2, BMI range 35–46.5 kg/m^2) underwent LAGB. Obesity-related co-morbidities were present in three of these patients: adult onset diabetes mellitus, osteoarthritis, gallstones (in one patient each).

Postoperative pain was measured with a 10-point Visual Analog Scale (VAS) and by measuring the number of pain relief medications administered. Measures of outcome were Patients' Satisfaction Index and mean percentage of excess weight loss after band inflation.

Surgical Technique

The procedure begins by placing the patient in a supine position on a modified operating table with a platform for feet resting secured to the operating table, which allows the patient to be placed in steep anti-Trendelemburg position for downward displacement of intra-abdominal viscera and omentum. With the patient under general anesthesia, the stomach is decompressed with a naso-gastric tube which is then removed. The surgeon and first assistant stand on the right side of the table and the cameraman with a second assistant on the left side. The monitor is positioned on the left of the head of the operating table.

A 1-cm midline skin incision is made at the junction of the lower third with the upper two-thirds of the umbilical-xyphoid line (Fig. 1), exposing the fascia along the linea alba. This is grasped with two Kocher

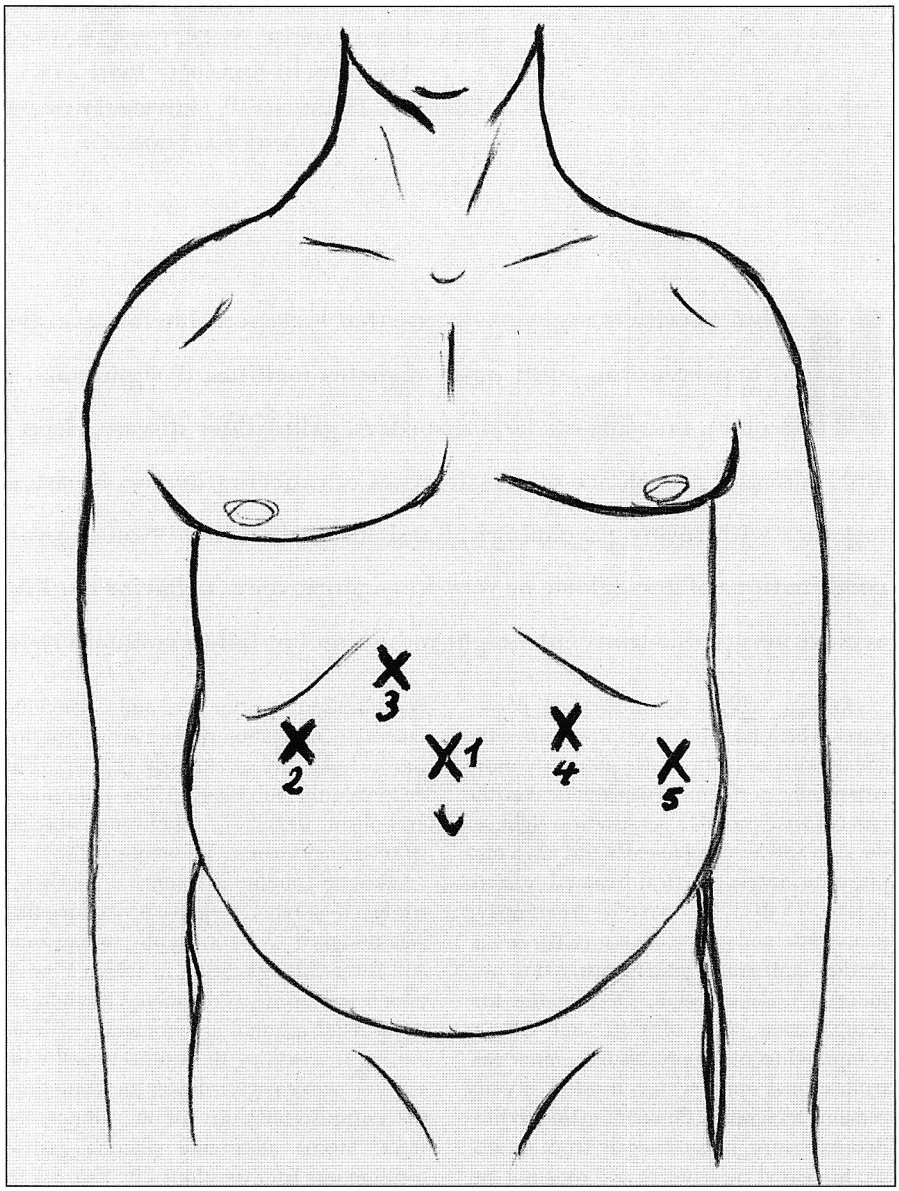

Figure 1. Trocar site positions for LASGB.

clamps which are raised to provide countertraction so as to allow safe introduction of the Veress needle into the peritoneal cavity. Pneumoperitoneum is created with carbon dioxide gas inflation at an intra-abdominal pressure of 12–14 mmHg. Trocar No. 1, a 10- to 12-mm trocar (Tri-Star 512 S, Ethicon Endo-Surgery, Cincinnati, Ohio, USA), is then introduced inside the peritoneal cavity through this incision and is used to gain access with a 45° forward oblique view optic. Under laparoscopic vision, four more 10- to 12-mm trocars (Tri-Star 512 S, Ethicon Endo-Surgery, Cincinnati, Ohio, USA) are positioned as shown in Figure 1. Trocar No. 2 is placed in the right hypochondrium below the apex of the right costal arch, trocar No. 3 also in the right hypochondrium in a right paramedian position, trocar No. 4 in the left hypochondrium along the left pararectal line, and trocar No. 5 in the left flank region along the anterior axillary line. During the procedure, trocars No. 3 and 4 are the operative ports employed for tissue dissection while trocars Nos. 2 and 5 are used for instruments that allow to obtain exposure of the gastroesophageal junction and of the gastric fundus. The laparoscope may occasionally be moved to trocar No. 4 to gain a better vision of the fundic region. At the beginning of our experience, trocar No. 2, which was employed for liver retraction, was located in the subxyphoid region, but was subsequently moved to a right and lateral position to reproduce the same trocar positions that we usually employ for laparoscopic hiatal hernia repair.

With a five-digit liver retractor (Endo Retract, code No. 176613, U.S. Surgical Corporation, Norwalk, Conn., USA) introduced from trocar No. 2, the round ligament and left lobe of the liver are retracted anteriorly to expose the gastroesophageal junction, and an automatic Babcock grasper (AB 10, Ethicon Endo-Surgery, Cincinnati, Ohio, USA) is introduced from trocar No. 5 to further displace the fatty omentum distally. The calibration tube with gastric pouch sizer is then introduced through the patient's mouth by the anesthesiologist and is advanced to the stomach, where the balloon of the gastric pouch sizer is inflated with 25 mL of air, and is then withdrawn upwards against the gastroesophageal junction. This allows the surgeon to measure accurately the distance from the gastroesophageal junction where the LAP-BAND will be placed and to select two points, one along the lesser curvature and one along the greater curvature of the stomach proximal to the first short gastric vessel, where to begin the dissection of the hepatogastric and phrenogastric ligaments. These two opposite points are chosen at the inferior margin of the bulging caused by the gastric pouch sizer when this is inflated inside the stomach. After scoring the two gastric ligaments at the selected points with electrocautery, the sizing balloon is deflated and the calibration tube is withdrawn into the esophagus.

Blunt dissection along the lesser curvature begins at the previously selected site with a 5-mm grasper (DSG 22, Ethicon Endo-Surgery, Cincinnati, Ohio, USA) holding the hepatogastric ligament while it is being opened with a 5-mm curved dissector (DCD 32, Ethicon Endo-Surgery, Cincinnati, Ohio, USA) along the lesser curvature of the stomach. As during laparoscopic hiatal hernia repairs, care is taken to preserve the hepatic branch of the vagus nerve. The size of the hepatogastric ligament opening should not be larger than 10 to 12 mm. Should a gastric vessel be encountered at this site along the lesser curvature, it is electrocauterized and divided. Blunt dissection proceeds staying close to the posterior gastric wall to create a retrogastric tunnelization in the direction of the previously selected point along the greater curvature. Exposure of the gastric fundus and of the greater curvature is enhanced by grasping the gastric fundus with an automatic Babcock grasper entering from trocar No. 5 and displacing it anteriorly and medially, with a rotation towards the right of the gastric fundus around its longitudinal axis. Creation of the retrogastric tunnel is facilitated by blunt dissection of the phrenogastric ligament posteriorly to the greater curvature of the stomach. Two automatic Babcock graspers introduced from trocars Nos. 3 and 4 may be helpful for blunt tissue dissection following the posterior gastric wall. Next, a roticulating grasper (Endo Grasp Roticulator, U.S. Surgical Corporation, Norwalk, Conn., USA) is introduced through the opening made in the hepatogastric ligament and it is curved while being directed towards the opening on the phrenogastric ligament, bluntly dissecting the retrogastric tissues to complete the creation of the retrogastric tunnel. If necessary, moving the forward oblique view laparoscope from trocar No. 1 to trocar No. 4 may help to obtain a better vision of the retrogastric space until the tip of the roticulating instrument is seen completing the dissection and exiting to the left of the gastroesophageal junction, proximally to the first short gastric vessel. Particular care is taken during the phase of retrogastric tunnel creation to avoid entering or damaging the gastric wall. The Endo Grasp Roticulator is then held in place by grasping the diaphragmatic peritoneal layer.

To introduce the Laparoscopic Adjustable Gastric Banding (LAGB, BioEnterics) System inside the peritoneal cavity, trocar No. 5 is substituted with an 18-mm trocar (TEC 18, Ethicon Endo-Surgery, Cincinnati, Ohio, USA) which allows the passage of the straightened LAP-BAND mounted on a grasper. Prior to its introduction, the LAGB System is flushed with sterile saline to remove air bubbles and is connected to the band tubing end plug. Once the LAGB System is inside the peritoneal cavity, the band tubing end plug is grasped with the Endo Grasp Roticulator, which is then retracted inside the retrogastric tunnel pulling the tubing and the LAP-BAND around the stomach. The band tubing end plug is inserted into the buckle and brought outside the abdomen through trocar No. 5. Before locking the LAP-BAND, the calibration tube is reintroduced inside the stomach and the stoma pouch sizer is again inflated with 25 mL of air, making sure the sensor tip of the calibration tube is inside the gastric stoma. The calibration tube is then connected to the Gastrostenometer Electronic Sensor, which is adjusted until the first light on the display is on. Next, the LAP-BAND closure tool is introduced through trocar No. 2 and is empoyed to lock the LAP-BAND. Measurement of the amount of sterile saline required to reach an internal gastric stoma diameter of 12 mm is immediately performed by inflating the LAP-BAND through the tubing outside the abdomen with sterile saline, until the fourth light on the Gastrostenometer display is on (less than 4 mL of saline are required). The amount of saline required is noted and will be percutaneously administered in the postoperative period through the access port for stoma adjustment. The tubing is then closed again and placed back inside the peritoneal cavity. Three or four nonabsorbable retention sutures are applied on the seromuscular anterior gastric wall immediately above and below the LAP-BAND, beginning from the greater curvature, so as to secure the gastric banding in place and prevent its dislodgment. Again, the LAP-BAND tubing is brought outside the abdomen through the 18-mm trocar, the trocars are removed while checking for hemostasis at the trocar sites, and the

peritoneal cavity is deflated. The procedure is completed by securing the access port of the LAGB System to the musculoaponeurotic fascia in a subcutaneous pocket created in the proximity of trocar No. 5 port site, and connecting it to the LAP-BAND tubing after this has been cut to the appropriate length. Only trocar No. 5 port site fascia is closed with sutures before closing the skin with subcuticular absorbable sutures and Steri-Strip Skin Closures (Medical-Surgical Division/3M, St. Paul, Minn., USA).

In this preliminary series, the patients' postoperative in-hospital stay has been purposely prolonged for safety reasons. At the time of discharge the patients were given an 800 Kcal diet regimen and were advised to increase their physical activity.

Close multidisciplinary follow-up of morbidly obese patients is of the uppermost importance. The patients are regularly seen in the office by the dietitian and by the internist, if co-morbid conditions are present. A weekly telephone contact between the patient and members of the surgical team is agreed upon and is regularly kept. Psychological support is offered to the patients if they show an inability to comply with the treatment plan.

Approximately 1 month after the operation, the patients undergo inflation of the LAP-BAND with the amount of saline measured intraoperatively (approximately 3 mL) that is capable of reducing the internal diameter of the gastric stoma to 12 mm. This amount of saline is subdivided in two to three doses, each dose being administered at 1-week intervals from each other.

RESULTS

No intraoperative complications were observed and no conversions to open surgery occurred. Mean operative time for LAGB was 108.6 minutes (range 90–120 min). Laparoscopic cholecystectomy with routine intraoperative cholangiography was associated in one patient, requiring one more subxyphoid trocar and adding 55 more minutes to the operative procedure.

All patients had an uneventful postoperative course except one who developed postoperative vomiting due to the inability to comply with a change in eating habits. Liquid diet and ambulation were resumed in all cases in less than 24 hours. Postoperative VAS scores were equal to or less than 2 in all cases. Mean hospital stay was 5 days (range 4–6 days). At a mean follow-up of 11.3 weeks (range 3–29 weeks), mean percentage of excess weight loss was 28.6% (range 11.7–69.3%). Patients' Satisfaction Index was 100%. All patients were enthusiastic with the immediate postoperative results of the procedure and with their initial weight loss. Having personally experienced the operation, when the patients were questioned if they would have this procedure again to reduce their body weight, all patients answered affirmatively.

DISCUSSION

Stoma adjustable silicone gastric banding does not permanently modify the anatomy of the stomach and maintains the natural continuity of the alimentary tract, while at the same time being effective in determining permanent weight loss in morbidly obese patients.[8] The fact that it can be applied laparoscopically adds significant advantages to this group of high-risk patients, with less pain, faster recovery, more rapid return to normal activities, and better cosmetic results. In this initial experience, the hospital stay was deliberately prolonged because the procedure was relatively new for us and also because most patients were from areas distant from the hospital. As a matter of fact, all patients had passed flatus and were able to tolerate a semisolid diet within 48 hours of the procedure. Therefore our belief is that most patients can be discharged within this time period.

As with all surgical operations for morbid obesity, accurate multidisciplinary patient selection is mandatory. In the small series of patients whom we evaluated for possible operation, 40% of the cases were temporarily excluded from surgical treatment as a result of this accurate patient selection.

When adequate laparoscopic surgical experience is present, LAGB is a feasible, safe, and simple procedure with excellent immediate postoperative results. After LAP-BAND inflation, which is performed approximately 1 month after surgery, all patients experience a feeling of early satiety with meals, which causes them to modify their eating habits. This effect, associated with a dietary regimen, increased physical exercise, psychological support, and close follow-up yielded satisfactory results in terms of weight loss. A larger number of patients and a longer period of follow-up are required before drawing conclusions regarding its long-term efficacy upon weight loss and co-morbidities. **SII**

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