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Laparoscopic Adjustable Silicone Gastric Banding: Technique and Results

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Background: Kuzmak's Adjustable Silicone Gastric Banding (ASGB) is the least invasive operation available for morbid obesity, and it is one of the more effective. Based on the know-how gained from performing more than 250 'open' procedures, we have developed an original laparoscopic technique, whose main steps are pouch measurement, limited dissection along the lesser and the greater curvature and the application of the retention sutures.

Methods: From September 1993 through October 1994, 30 morbidly obese patients underwent laparoscopic ASGB.

Results: Mean operative time was 2 h and the postoperative stay 2–3 days. Only one major perioperative complication (stomach slippage) was observed. The weight loss achieved, reported as a variation of Body Weight, Body Mass Index, per cent Ideal Body Weight and per cent Excess Weight Loss was similar to that obtained with the open procedure.

Conclusion: This new approach is a major achievement in bariatric surgery, because it combines the minimal invasiveness of laparoscopy with the reversibility and adjustability of ASGB.

Key words: Morbid obesity, gastric banding surgery, laparoscopy, weight loss, implantable device

Introduction

Gastric restrictive operations are the most commonly utilized procedures in the treatment of morbid obesity.[1] Adjustable Silicone Gastric Banding (ASGB), introduced by Kuzmak in 1986,[2] is completely reversible, yet also allows the size of gastric pouch outlet to be adjusted to a desirable size.

This gastric banding technique is the least invasive operation available for morbid obesity, and its efficacy has been proven.[3,4] However, when performing this operation, access to the subcardial area is required, and the exposure required leads to parietal injury disproportionate to the procedure itself. Moreover, for satisfactory visualization throughout the operation, sustained retraction of the costal margin is required, and recovery time can be compromised by the extent of the trauma inflicted to achieve good exposure.

With laparoscopic access, trauma is limited to the abdominal wall, and the postoperative morbidity rate and hospitalization time are thus reduced. In 1992, G.B. Cadiere first showed the feasibility of the laparoscopic positioning of ASGB.[5] The recent modification of the traditional ASGB and the availability of specific instruments have allowed the laparoscopically-guided application of ASGB on a routine basis.

Based on know-how gained in more than 250 open procedures, we have developed a laparoscopic technique which fully respects the main steps of the open procedure. We report the laparoscopic technique and the first year of experience with laparoscopic ASGB (LAP-ASGB).

Patients and Methods

Patients

From September 1993 through October 1994, 30 morbidly obese patients (28 Female, 2 Male) underwent laparoscopic application of LAP-ASGB. The

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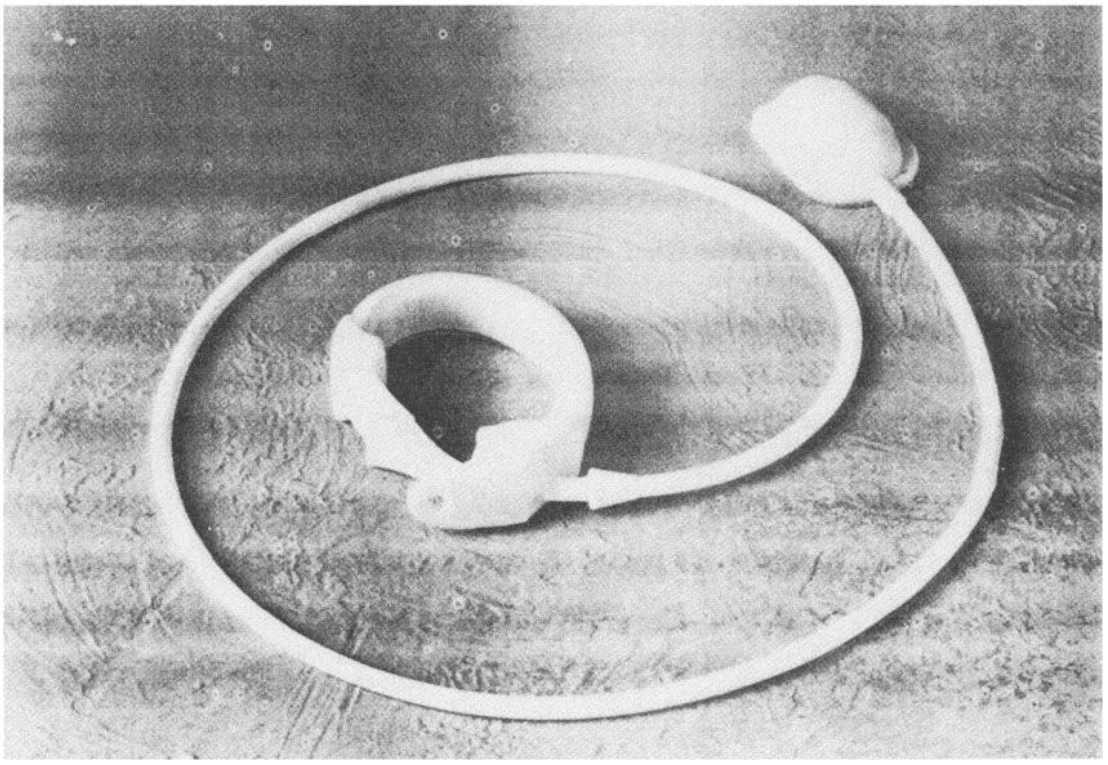

Figure 1. Laparoscopic Adjustable Silicone Gastric Banding.

patients were operated upon by the same surgical teams at (1) the Surgical Department of Padova University, Italy (17 patients), (2) the Surgical Department of Brussels Free University, Belgium (13 patients).

Patients' mean characteristics were: age 39 years, Body Weight (BW) 105 ± 25 kg, per cent Ideal Body Weight (%IBW) 179 ± 40, Body Mass Index (BMI) 40 ± 9. All the patients were refractory to dietary and medical regimes as well as group therapy. Follow-up consisted of a clinical surveillance and body weight measurement 2 and 4 weeks postoperatively and then every 2 months. As the aim of any treatment for obesity is loss of excess body weight, we used the per cent loss of excess body weight (%LEBW) to show postoperative weight loss together with (BW), (%IBW) and (BMI).

LAP-BAND Adjustable Gastric Banding System

The LAP-BAND Adjustable Gastric Banding System consists of: Adjustable Gastric Band, Injection Reservoir, Calibration Tube, Lap-Band Closure Tool and Gastrostenometer Electronic Sensor (INAMED, Carpinteria, CA). The LAP-ASGB (Figure 1) is a 13 mm wide band. Supplied in two standard sizes, when fastened, it forms a circular ring with an inside circumference of 10 or 9.75 cm and is connected to a 50-cm-long tube. Made of silicone elastometer, which is biocompatible and inert, the band has an inflatable inner surface. The radiopaque Kink-resistant tube is used to connect the inflatable section to the subcutaneous injection reservoir. An end plug is provided to seal the system while the band is passed round the stomach.

Equipment

The equipment used was a standard 0° and 30° laparoscopic telescope, camera, video and screen. A series of 5, 10 and 18 mm trocars, as well as a set of Roticulator Endograsp, Endograsp, Endodissect, Endoscissors, Endoclip, EndoBabcock, fan liver Retractor and cautery hook should also be available.

Operative Procedure

The main steps of the procedure developed at our institutions[6] are as follows:

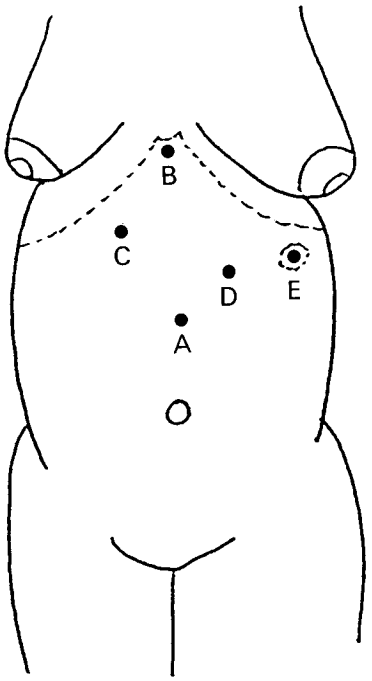

Figure 2. LAP-ASGB: Position of the ports.

With the patients in a lithotomy position, and the operating table in a 30° reverse Trendelenburg tilt, the surgeon stands between the patient's legs, the first assistant on the patient's left side and the second on the right.

Five trocars are placed in the following sequence (Figure 2):

A – 10 mm trocar (long) for the endoscope (at the junction of the upper 2/3 with the lower 1/3 of the xypho-umbilical line);

B – 10 mm trocar for the liver retractor (sub-xyphoid);

C – 10 mm trocar for grasping forceps and Lap-Band closure tool (in right upper quadrant);

D – 5 mm trocar for cautery hook, needle holder and grasping forceps (in left upper quadrant);

E – 10 mm trocar for EndoBabcock, which later is replaced by a 18 mm trocar for band introduction and reservoir replacement (on the left anterior axillary line below the costal margin).

The five ports are utilized and positioned either in the midline or laterally to the abdominal rectus muscles in order to avoid any damage to the epigastric arteries.

The subcardiac area is exposed by lifting the left lobe of liver and by pulling down the fundus. The pouch is measured: the calibrating tube balloon is advanced into the stomach by the anesthetist, then inflated with 25 cc of air and pulled up at the gastro-esophageal junction. This allows the correct selection of the point along the lesser curvature into the phreno-gastric ligament, at which to start blunt dissection (Figure 3).

The measurement and the correct sizing of the pouch is the main step in any gastric restrictive procedure. We believe that it is of crucial importance to measure the pouch, even at laparoscopy, before starting any dissection. The calibrating tube balloon (inflated with 25 cc of air) is withdrawn upwards to the gastroesophageal junction. This allows correct selection of the location along the lesser curvature and the phreno-gastric ligament at which to perform the blunt dissection. These two sites usually correspond to the bulging caused by the greatest circumference of the balloon and are marked with the cautery hook for further reference. The balloon should be deflated and the calibrating tube removed before starting any dissection in order to avoid injury to the gastric wall.

A retrogastric tunnel is created. The balloon is deflated and the calibration tube removed. The lesser curvature is then dissected with the coagulation hook 2 – 3 cm from the cardia. The dissection along the lesser curvature should be as close as possible to the gastric wall, care being taken not to damage it; the vagus nerve should be preserved. Under direct vision the full thickness of the hepato-gastric ligament is dissected from the gastric wall so as to make a narrow opening. The posterior gastric wall should be clearly recognizable.

A very small opening into the avascular phreno-gastric ligament along the greater curvature, and close to the gastric wall is made at the previously selected site. Both along the lesser and the greater curvature the dissection has to be of the same size as the band, or even smaller, so as to avoid band and/or stomach slippage.

A retrospective tunnel is then created with the stomach held ventrally. At laparoscopy, however, the creation of the retrogastric tunnel is facilitated by the magnified image, which shows every step of the procedure, including that at the back wall of the stomach.

An Endo-Grasp Roticular is introduced into the tunnel and left in place (Figure 4). The band is introduced, the E port being replaced by an 18 mm one. The Lap-Band is introduced through the latter port and placed around the stomach at the level of dissection, utilizing the previous Endo-Grasp Roticulator. The band is then closed around the calibration tube advanced again by the Anesthetist. This step is greatly facilitated by the self-locking mechanism that the LAP-BAND is provided with (Figures 5, 6).

Once the band has been brought into the locked

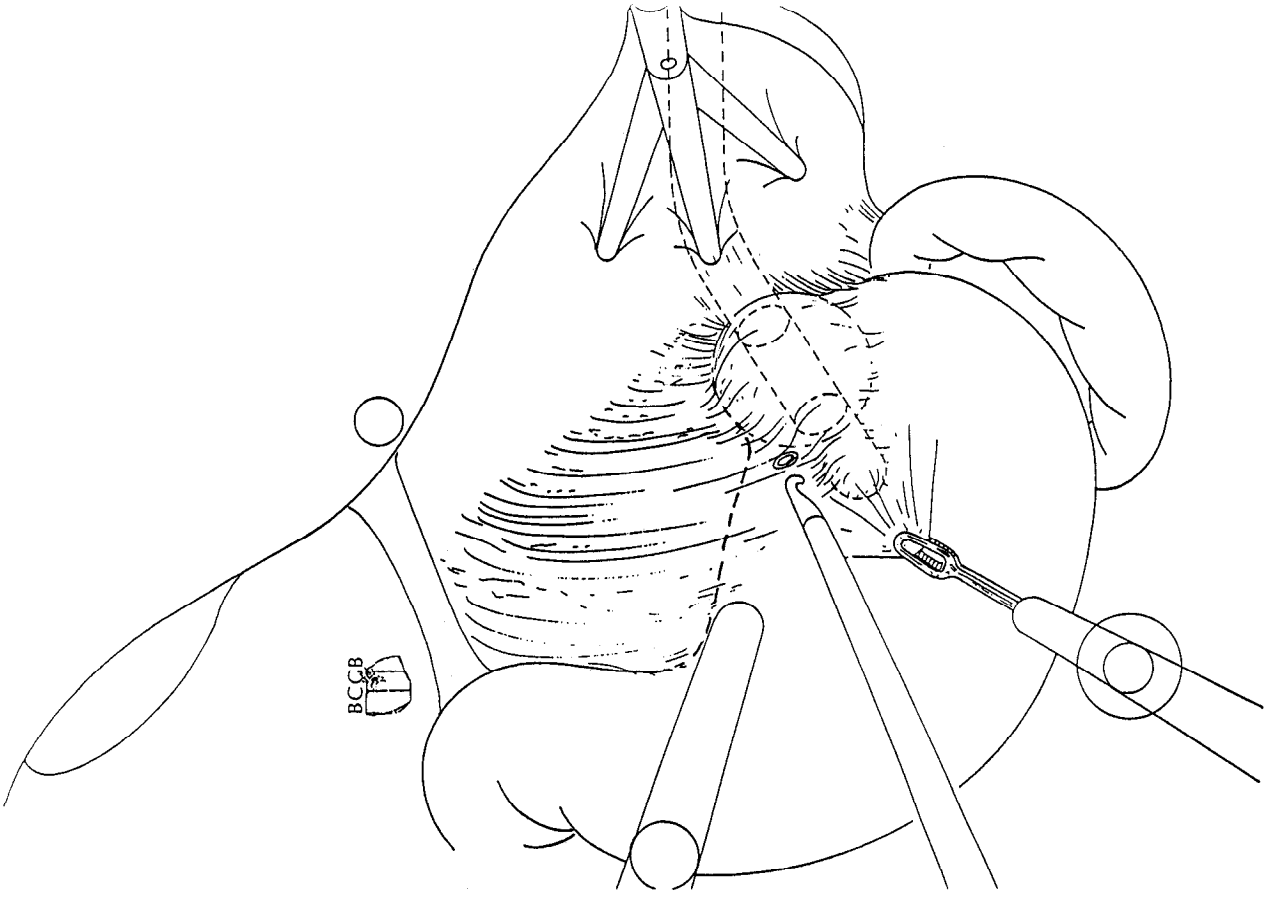

Figure 3. LAP-ASGB: Measurement of the pouch.

Table 1. LAP-ASGB: results

Months	0	3	6	9	12
%EWL	–	22.7 ± 10	41.9 ± 15	51.4 ± 17	70.6 ± 40
%IBW	180 ± 40	166 ± 23	142.6 ± 15	135.5 ± 15	124.2 ± 33
BMI	40.6 ± 9	37 ± 5	32.2 ± 8	30.6 ± 4	27.1 ± 7
BW (kg)	106 ± 23	97.5 ± 16	81.5 ± 8	77.4 ± 8	74.5 ± 19
No. patients	30	21	6	6	4

position, stoma calibration is carried out by injecting saline solution into the band. Calibration tube introduction displaces the sequential lights on the Gastrostenometer Electronic Sensor to the right. Inflation is continued until the fourth light is illuminated; this corresponds to a 12 mm stoma.

Anti-slippage sutures should be applied in order to avoid band and/or stomach slippage. Three or four stitches are placed between the sero-muscolar layer of the stomach just proximal and distal to the band. These retention sutures start as close as possible to the greater curvature and then are sequentially placed towards the lesser curvature (Figure 7). A running suture could be utilized in the same way.

The injection reservoir, with the convex side up, is sunk into the abdominal wall by exercising a moderate pressure, just above the distal part of the left rib-cage, usually without enlarging the 18 mm trocar opening. In the open procedure, the reservoir is placed in the right rectus abdominis muscle, mainly in order to protect it from wound infection and from further abdominoplasty surgery. With the laparoscopic technique the risk of wound infection is negligible and with the reservoir positioned above the left

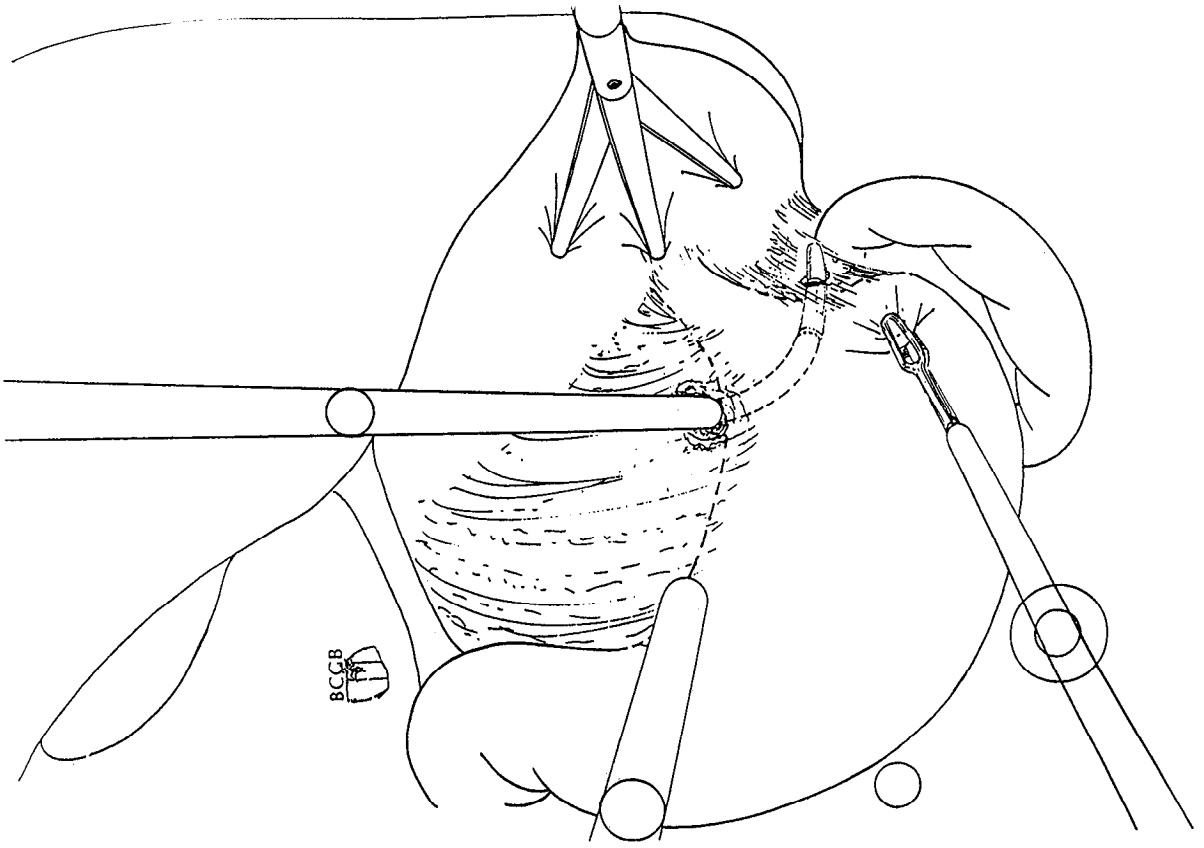

Figure 4. LAP-ASGB: Creation of the retrogastric tunnel and introduction of an Endo-Grasp Roticulator.

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Results

The average duration of the operation was 2 h (range 40–240 min). Table 1 shows Weight Loss reported as a variation of BW, %LEBW, BMI and %IBW.

One major perioperative complication occurred: 2 weeks after surgery one patient had slippage of the distal stomach above the banding and underwent a second open procedure. At laparotomy the herniated stomach was reduced, the banding was left in the original position and further anti-slippage sutures were applied. No other complications were observed.

The duration of the postoperative hospital stay was 2–3 days. Oral intake was permitted on the first postoperative day. After radiological control with peroral contrast medium, patients were allowed to ingest liquid as of the first postoperative day.

Discussion

Gastric restrictive operations play a major role in the treatment of morbid obesity.[1] In 1986, Kuzmak introduced his SASGB technique,[2] which is gaining a wide acceptance for its limited invasiveness and total reversibility. In fact, in a single step a meal sizing pouch is created, without any stapling or crushing of the gastric wall. Furthermore, the diameter of the outlet can be adapted to the patient's needs. The preservation of the integrity of the stomach and an adjustable outlet diameter certainly have advantages over other gastric restrictive procedures, which cause irreversible lesions.

In 1992 a member of our team (G.B.C.) first showed the feasibility of the laparoscopic approach utilizing the regular inflatable band in five patients.[5] Although results were quite satisfactory, it was immediately evident, that, if the laparoscopic approach was to become a standard treatment, a few modifications of the regular inflatable band had to be introduced and that some specific instruments were required. In fact, the laparoscopic band, recently devised by the Manu-

Figure 5. LAP-ASGB: Introduction and placement of the band.

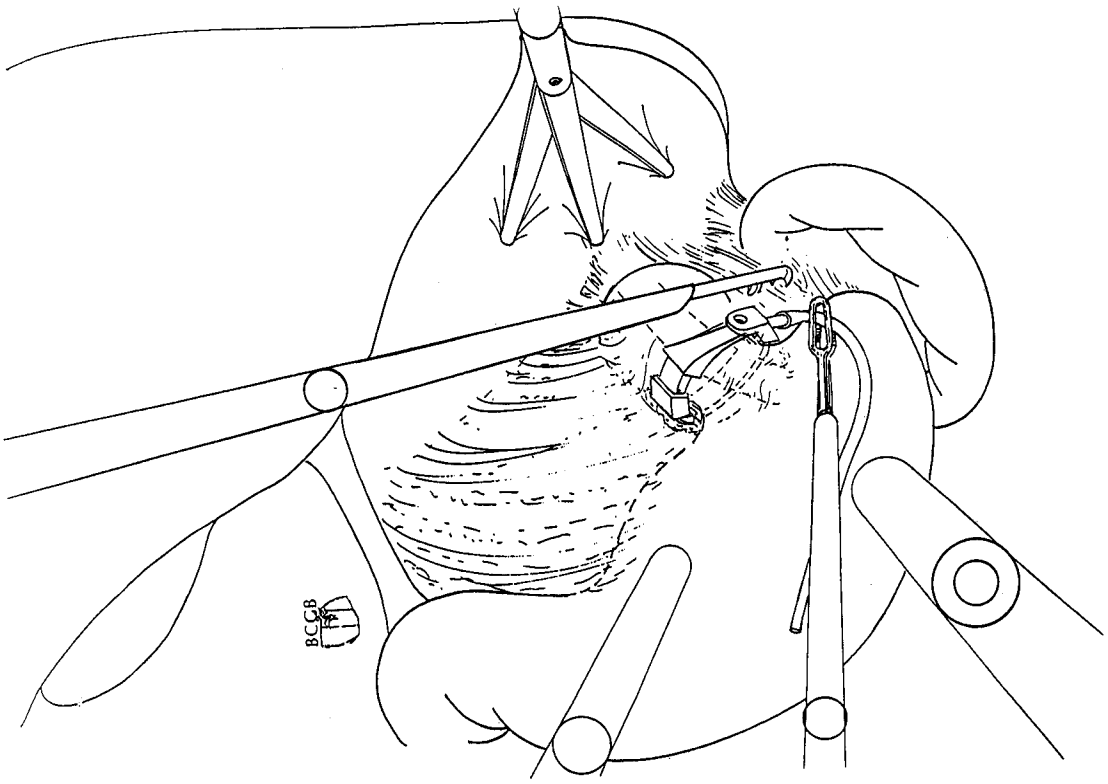

Figure 6. LAP-ASGB: Closure of the band around the calibration tube.

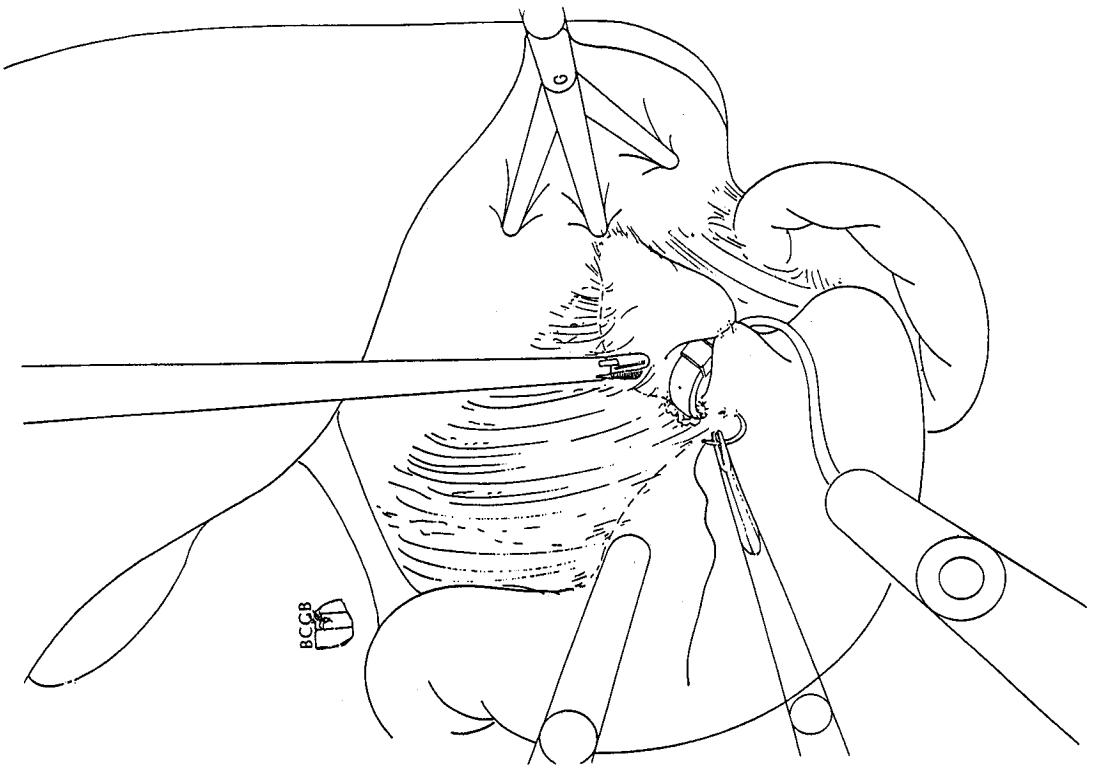

Figure 7. LAP-ASGB: Anti-slippage sutures.

facturer (INAMED, Carpinteria, CA), has a self-locking mechanism, two standard sizes and a 360° inflatable portion which facilitate its application and calibration. At the same time, Roticulator Instruments (AUTOSUTURE) and Lap-Band Closure Tool (INAMED) have appeared on the laparoscopic instruments market. These technical innovations have not only made laparoscopic positioning of the banding possible, but they have made it easier and safer than ever.

Based on our experience gained in more than 250 ASGB open procedures, we developed the above laparoscopic technique, while following the main steps of the 'open' procedure. The 30 patients who from September 1993 through October 1994 underwent laparoscopic-Band application tolerated the procedure very well. Despite the presence of a pneumoperitoneum of 16 mm Hg and the 30° reverse Trendelenburg tilt, no ill effects were recorded and optimal ventilation of patients was maintained throughout the procedure. Laparoscopy allowed a good exposure of the subcardial area and of the GE junction, which is usually poor at laparotomy, irrespective of the incision made.

It should, however, be borne in mind that steatosis of the liver and/or left lobe hypertrophy are relative contraindications, because in such cases retraction of the liver is difficult and exposure of the GE junction is poor.

In the early postoperative period, 1/30 patients developed increasing and protracted vomiting. Gastroscopy and upper G.I. series revealed that the upper pouch was enlarged and had slipped through the band. At reoperation, performed 2 weeks after the laparoscopic procedure, it was clear that as the stomach had been dragged up through the band, emptying was impossible. This kind of 'stomach herniation' was reduced by pulling the gastric walls through the banding, which was in a correct position. The band was secured on the anterior surface with more interrupted sutures between the serosa of the stomach just proximal and distal to the band, in order to avoid further slippage. The patient did well afterwards and is asymptomatic.

Postoperative pain was minimal because surgical trauma to the abdominal wall and retraction of the costal margin are greatly reduced compared with the open procedure, and on the day of operation all patients were out of bed and walking. Early ambulation facilitates pulmonary function.[7] Patients were

discharged on postoperative day 2 or 3, whereas with the open procedure postoperative hospital stay is usually 5–6 days.

The mean operative time, which was 2 h, will be further reduced by improvements in surgical technique. With the development of skills, it should be possible to extend this method to most prospective initial banding candidates. We believe, however, that the success of the laparoscopic technique will depend on its following the main steps of the open procedure. It is therefore important to measure the pouch, to limit the dissection along the lesser and greater curvature, and to apply retention sutures.

LAP-ASGB appears to be a promising technique because it reduces the perioperative morbidity rate and hospital stay, while the short-term results seem to equal those of the open procedure.[3] This is not unexpected, as the approach is different, but not the procedure itself. This new approach is not only justified, but it also represents a major achievement in bariatric surgery, as it combines the minimal invasiveness of the laparoscopic approach with the reversibility and adjustability of ASGB.

References

1. Renquist K, NBSR Data Contributors. Surgical Treatment of Obesity in America. Data According to the National Bariatric Surgery Registry. *Prob Gen Surg*, 1992; **9**: 231–8.
2. Kuzmak L. Gastric Banding. In: Deitel M. ed. *Surg Morbidly Obese Patient*. Philadelphia: Lea & Febinger 1989: 225–59.
3. Favretti F, Enzi G, Segato G, *et al.* Stoma Adjustable Silicone Gastric Banding: A 4-year Experience. *Acta Chir Aust*, 1994; **107(S)**: 15.
4. Kuzmak L. A review of 7-Year Experience with Silicone Gastric Banding. *Obesity Surg* 1991; **1**: 403–8.
5. Cadiere GB, Bruyns J, Himpens J, *et al.* Laparoscopic gastroplasty for Morbid Obesity. *Br J Surg* 1994; **81**: 1524–7.
6. Cadiere GB, Favretti F, Bruyns J, *et al.* Gastroplastie par Coelio-Videoscopie: Technique. *Le Journal de Coelio-Chirurgie* 1994; **10**: 27–41.
7. Shanta TR, Harden J. Laparoscopic Cholecystectomy: Anesthesia Related Complications and Guidelines. *Surg Laparosc Endosc* 1991; **3**: 173–8.

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