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Laparoscopic Adjustable Gastric Band: How to Reduce the Early Morbidity

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ABSTRACT

Background: Laparoscopic adjustable gastric band insertion is a safe weight reduction procedure, but serious complications can develop. The aim of this study was to evaluate our technique in preventing early band complications.

Methods: Patients were given the choice of procedure according to body mass index, the presence of diabetes, and preference. Weight loss data were not considered, as our aim was to evaluate the morbidity of band surgery using a specific technique. A pars flaccida approach and plication technique were used for all patients. Postoperative follow-up was provided at 1 month, 2 months, and every 3 months for the first year and then yearly for a further 2 years. Thereafter, general practitioners referred patients if late complications arose.

Results: From January 2007 to August 2011, 1149 patients (245 men [21.32%], 904 women [78.67%]) underwent laparoscopic adjustable gastric band insertion under the care of a single bariatric surgeon. Patients were hospitalized for 1 night only unless they developed early complications. The primary and secondary outcomes were major and minor band complications, respectively. Patients' age range was 18 to 64 years (mean, 44 years). Body mass index ranged from 33 to 62 kg/m^2 (mean, 42 kg/m^2). There were 2 band erosions (0.17%), 6 cases of band prolapse (0.52%), 4 port problems (0.34%), 1 band leak (0.08%), 3 tight bands (0.26%), 2 port infections (0.17%), and no deaths. Five procedures (0.43%) were abandoned and excluded from this study, and 1 (0.17%) was converted to minilaparotomy to control abdominal wall bleeding. The duration of follow-up ranged from 16 to 60 months.

Conclusions: A combined pars flaccida and plication technique is associated with a low early complication rate.

Key Words: Laparoscopic adjustable gastric band, Body mass index, pars flaccida.

INTRODUCTION

Laparoscopic adjustable gastric band (LAGB) insertion is a popular weight reduction procedure because of several factors: the overall safety of the procedure, the simple technique of insertion, lower cost, and reversibility. However, this type of surgery is not without complications, the most serious being organ injuries (gastroesophageal and vascular), band prolapse, erosion, gastric necrosis, and perforation, which could lead to death. A recent study of >28,000 patients who underwent LAGB insertion, sleeve gastrectomy, and laparoscopic gastric bypass concluded that there were fewer complications for LAGB insertion compared with the other two operations.[1]

There are 2 types of insertion techniques, perigastric and pars flaccida, which is associated with lower incidence of erosion and prolapse.[2–4]

The aim of this study was to evaluate our technique in preventing early band complications.

METHODS

Study Design

This was a prospective series of patients undergoing LAGB insertion surgery.

Setting

The study was conducted at a university hospital from January 2007 to August 2011. Data from each patient were stored electronically in a database and updated at each outpatient visit. Significant data are highlighted in **Tables 1** and **2**. Any member of the team who commu-

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Table 1.
Comorbidities

Comorbidity	n (%)
Coronary artery disease	92 (8)
Osteoarthritis	413 (35.94)
Intervertebral disk disease	66 (5.74)
Hypertension	512 (44.56)
Sleep apnea	34 (2.95)
Diabetes	98 (8.26)
Plantar fasciitis	21 (1.82)
Dyspnea on exertion/poor exercise tolerance	817 (71.10)

nicated the findings and updated the stored data saw the patients in the clinic. Data from patients who had emergency complications were added during their admissions, and subsequent outcomes and postoperative findings were updated. Data were then analyzed and reported. The outcomes of this study were compared with those of other powerful studies[5–12] **(Table 3)**. No complex statistical analysis was needed for this type of study, and therefore simple statistical methods were used.

Participants

The patient population consisted of a consecutive series of patients who underwent LAGB insertion performed by our team, which consists of 1 consultant surgeon, 2 senior specialty doctors, a senior clinical fellow, and a nurse practitioner.

Selection and Exclusion

All patients were given the choice of procedure according to body mass index (BMI), the presence of diabetes, and preference. We advised patients with high BMIs and those with diabetes to undergo gastric bypass rather than LAGB insertion. This was based on our experience with gastric bypass patients and also on the current body of evidence in the literature, which support gastric bypass for this particular group of patients. We refused LAGB insertion procedures to some patients because of their poor physiologic fitness, and this was applicable to any bariatric surgery in these patients with high American Society of Anesthesiologists scores.

All operations were led by the same surgeon. Pars flaccida and a plication technique were used in all but 8 patients, who were excluded because their procedures involved the perigastric technique. The Allergan (Irvine, CA) AP system (small or large) was inserted for all patients.

Follow-Up

The first band adjustment was conducted 6 weeks after insertion. Postoperative follow-up was provided at 1 month, 2 months, and every 3 months for the first year and then yearly for a further 2 years. The period of follow-up by our team ranged from 6 to 36 months, but general practitioners (GPs) were involved, and they referred any patients with complications. Therefore, the period of study and complete results were accumulated from 16 months to 6 years.

Variables

Our aim was to assess early outcomes after LAGB insertion, and therefore early morbidities such as organ injury, death, bleeding, gastric prolapse, erosions, technical errors and dysphagia were examined, but to compare our results with those of other studies, only 4 items were used: prolapse, erosions, port complications, and mortality.

Data Sources and Measurement

The incidence of prolapse, erosions, mortality, and port complications was recorded for each patient. Then these were compared with the same outcomes as reported in a selection of large and powerful studies.

Bias

We included a consecutive series of patients during a specific period of time using a single type of band and insertion technique, different BMI values, and a single-surgeon series, so selection bias was largely eliminated. Eight patients in whom the perigastric technique was used were excluded from this study, but no major complications were recorded for this technique, although the literature reports higher prolapse rates compared with the pars flaccida approach.

The assessment of complications after band surgery was conducted by our team, not by independent assessors, which may suggest some (perhaps) minor degree of bias, especially for minor complications. Major band complications such as prolapse, erosions, mortality, and so on, were reported and were not amenable to any bias.

Table 2.
Morbidity

No. of Patients	Diagnosis	Treatment
1	Acute gastric prolapse	Band repositioned.
2	Dysphagia 24 h after surgery	Band repositioned
3	Dysphagia 4 wk after surgery for tight band	The band was changed to AP large
1	Patient presented 1 y after surgery with a tight band	Reoperation, and the band was changed to AP large
2	Band erosions	Both removed
5	Chronic prolapse	One repositioned, 1 converted to bypass; 2 were removed, and 1 patient did not want any intervention
5	Inflation port problem	Revision of the port site
1	Dislocation of the port	Repositioning
2	Port infections	One port was removed, and another port was reinserted later, after resolution of the infection
1	Abdominal pain	Results of laparoscopy were negative

Table 3.
Outcomes of Large Studies Reporting on LAGB Insertion

Study	Year	No. of Subjects	Follow-Up (y)	Prolapse (%)	Erosion (%)	Port Complications (%)	Mortality Related to Surgery (%)
Carelli et al[5]	2010	2965	7	4.5	0.2	3.3	0.06
Angrisani et al[7]	2003	1893	6	4.8	1.00	4.0	0.53
Chevallier et al[8]	2004	1000	7	16.9	0.3	2.1	—
Dargent et al[9]	2004	1180	8	8.8	1.86	—	—
Singhal et al[6]	2008	1140	4	0.26	0.08	0.87	0
Favretti et al[11]	2007	1791	12	3.9	0.9	11.2	—
Watkins et al[10]	2008	2411	5	5.10	0.12	2.3	0.04
Kohn et al[16]	2012	2097	10	—	2.53	—	—
Mittermair et al[12]	2009	0785	10	6.7	6.5	10.96	—
Total/mean		15,262	8.7	5.6	1.49	3.8	0.07
This study		1149	5	0.52	0.17	0.6	0

LAGB, laparoscopic adjustable gastric band.

Study Size

The power of the study arrived to after exploring the literature and assessing the size of each of the other powerful studies.

Quantitative Variables

The 4 main complications after LAGB insertion were compared with those reported in 10 powerful studies.

Statistical Analysis

Simple statistical methods were used. No specific method was used for any subgroup. Missing data for 1-year follow-up in nearly 30% of the patients were not included in the analysis.

Operative Technique

The technique of pars flaccida is the gold-standard approach for gastric band insertion, but in addition to that,

we have introduced specific modifications, which are highlighted throughout the different steps accordingly.

The operative field was prepared by chlorhexidine and povidone-iodine. Under general anesthesia, using a supine and split leg position with 30° head-up tilt, induction of pneumoperitoneum using a Veress needle is created, achieving 16 mm Hg pressure.

A 5-port technique is used. Insertion of the first 5-mm port is to the left of the midline into the left rectus abdominus muscle, about 10 cm below the left costosternal angle. The 15-mm port is inserted just inferior to the middle left costal margin. The other 3 5-mm ports are inserted in the midline above the umbilicus, under the middle part of the right costal margin and in the right flank for the flexible liver retractor.

Procedure

General laparoscopy is performed, and a liver retractor is then inserted and adjusted to retract the left lobe of the liver away from the gastroesophageal junction, thus providing an adequate view.

Initial dissection is conducted to display the angle of His, and the fundus of the stomach and the gastroesophageal fat pad are retracted. The peritoneum, which is reflected from the diaphragm on the left pillar of the crus, is opened by hook diathermy to display the left pillar of the crus, which is dissected and followed down through its entire length (it is very important to dissect the lower part of the left pillar of the crus down to the left suprarenal gland). We achieve this by inserting a grasper into this space and opening the jaws repeatedly and slowly between the left crus and the gastric wall. Occasionally, an extra left flank port is used to retract the omentum using a grasper throughout the whole operation.

When there is a <5-cm hiatal hernia, we dissect the left and right crura anteriorly to provide adequate and satisfactory anterior closure of the hiatal defect.

After this step, the pars flaccida is opened by incising the gastrohepatic omentum using hook diathermy. Retracting the fat pad between the gastroesophageal junction and the right pillar of the crus can identify the right pillar of the crus of the diaphragm.

The anteroinferior border of the right pillar of the crus is exposed and the peritoneum incised for 1 to 1.5 cm anterior to its lowermost border. We have found that a small vessel that usually crosses transversely on the right pillar of the crus or a small lymph node when present at that area is a useful landmark.

After the incision is made, the grasper is passed gently through this hole behind the gastroesophageal junction, targeting the angle of His on the left side, taking care not to injure the esophagus, stomach, spleen, diaphragm, or upper abdominal vessels.

A common problem at this stage is that the grasper does not pass easily because the peritoneal incision anterior to the right crus is too high. This can be solved by enlarging the incision at the anterior border of the right rectus using 2 graspers to dissect the pathway behind the gastroesophageal junction. Dissection using 2 graspers will widen the tract through which the band will pass. The grasper should never be forced, as a blindly forced grasper behind the gastroesophageal junction may result in esophageal injury and even major vascular injury. By passing the grasper behind the gastroesophageal junction gently, it can easily be tunneled to appear at the left crus near the angle of His, where the initial dissection was performed. If there is any resistance, this step should be taken under any circumstance.

The grasper is left in situ. The surgeon changes his or her gloves and primes the band system with normal saline. An appropriately sized gastric band is introduced into the peritoneal cavity through the 15-mm port. The band is probed behind the gastroesophageal junction. Before pulling the band completely through the retroesophageal tunnel, a dissection of the fat pad on the gastroesophageal junction is performed starting from the left pillar of the crus to the right to expose the upper part of the stomach just inferior to the gastroesophageal junction. This will help ensure that the gastrogastric stitches are in the stomach wall, not in the fat pad (a common technical fault that can result in false security by stitching the fat rather than the gastric wall). We believe this step is very important for the insertion of subsequent gastrogastric stitching. The other advantage of this step is that it enables us to place the band in the uppermost part of the stomach, just under the gastroesophageal junction. The band is locked before placing the gastrogastric stitches.

We use Ethibond 2/0 (Ethicon Endo-Surgery, Blue Ash, OH) to perform interrupted gastrogastric stitching. The first stitch is placed at the upper part of the fundus, as near as possible to the left crus, taking a deep bite into the fundus and to the stomach above the band just to approximate both sides of the stomach without undue tension. Although it is difficult to prove, we feel that encircling the band tightly may predispose to future erosion.

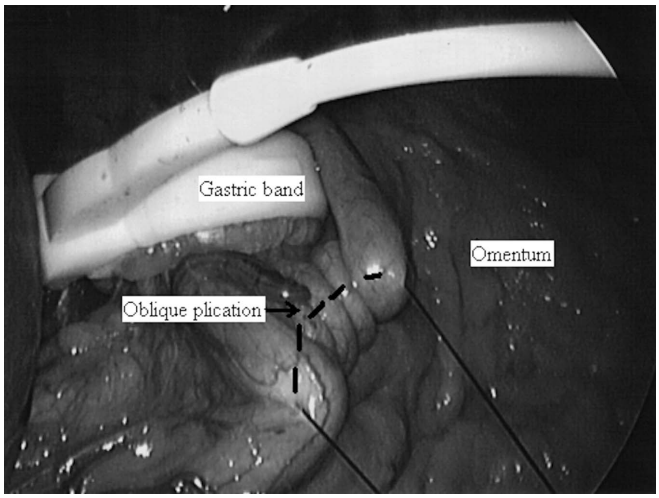

Figure 1. Oblique plication.

The gastrogastric stitches are deeply stitched into the wall of the stomach, with good bites taken above and below the band before the knot is tied. Occasionally, bleeding from the site of the needle may occur, but this can be easily controlled by tying the knot.

When there is excessive tissue within the band, the band is unlocked and dissection of fat is performed medial to the gastroesophageal junction to decrease the total volume of tissue within the band.

It is important to make sure that the band is not tight, which is done by assessment of the space between the band and the gastric tissue. It is equally important to ensure that if the band is rotated, it rotates easily.

In our initial series, after finishing the gastrogastric stitching, a combination of 2 different plication stitching techniques was used. However, for the last 500 cases, we adopted oblique plication, whereby we use a Prolene 2/0 (Ethicon Endo-Surgery) stitch running from the greater curvature to the lesser curvature parallel to the lower border of the gastric band **(Figure 1)**. This suture is tied with an extracorporeal knot. It is seromuscular stitching running for 5 to 10 cm to plicate or purse-string the anterior gastric wall. We believe this has helped decrease the incidence of postoperative prolapse.

The inflation port is fixed in the epigastric area after exposure of the rectus sheath, and 4 Ethibond stitches are inserted with good bites into the sheath before fixation of the port.

The inflation port is connected with the tube, which is pushed back into the abdominal cavity under direct vision and checked through the wound aspect and intraperitoneal aspect using the laparoscope. This is an essential step to make sure that the port is not looped within the abdominal cavity. All wounds are closed with subcuticular stitching after instilling local anesthetic.

RESULTS

Participants

From January 2007 to August 2011, LAGB insertion was conducted in 1157 patients.

Descriptive Data

The pars flaccida technique was used in 1149 patients (99.30%), and the 8 (0.70%) patients in whom the perigastric approach was used were excluded from this study. The cohort included 245 men (21.32%) and 904 women (78.67%). The age and BMI of patients ranged from 18 to 64 years (mean, 44 years) and 33 to 62 kg/m^2 (mean, 42 kg/m^2) respectively. Patients were hospitalized for 1 night only, unless they developed complications. Hospital stays for patients who developed complications ranged from 4 to 10 days (mean, 7 days). The mean follow-up period was 36 months (range, 16–60 months).

Outcome Data and Main Results

Comorbidities are listed in Table 1. Morbidity (Table 2) included 1 conversion to minilaparotomy to control abdominal wall muscular bleeding. Five procedures were abandoned: 2 because of large hiatal hernias, 1 because of bleeding from a left liver lobe hemangioma, and 2 because of large, fatty, rigid livers. Five patients stayed for >1 night. One patient was admitted postoperatively to the intensive therapy unit for 2 nights for management of sleep apnea.

All patients were seen in the first and second months (100%). A total of 1045 patients (91%) completed follow-up at 6 months, while 792 patients (69.14%) were seen at 1-year follow-up. Patients were informed to contact the unit in case of complications, and each patient's GP was involved in the follow-up procedure. GPs were asked to refer patients with any suspicion of complications.

DISCUSSION

The 2 gastric band insertion techniques are perigastric and pars flaccida. The perigastric approach is associated with

frequent complications, notably prolapse. The pars flaccida approach is not a new technique, but it is more popular and is used by most surgeons. Yet there is no standardization of technique with regard to the site and size of retroesophageal or gastric access, dissection of the gastric fat pad, gastrogastric stitching, inflation port locations, and port fixation. Consequently, surgeons report different rates of complications. One important influencing factor for these complications could be how the pars flaccida technique is actually performed. This may explain why the morbidity of LAGB insertion varies from center to center. The aim of our study was to evaluate our technique, which is associated with minimal complications compared with those of other large and powerful studies (Table 3). However, complications do occur.

Prolapse

Prolapse can be a life-threatening complication. Reported rates differ among various studies, but an average rate of 4.5% was reported in 1 recent and large study of about 3000 patients.[5] The "Birmingham stitch" study[6] reported a very small slippage rate of 0.2%, which coincides with our initial study.[13] The slippage rate of 0.52% in the present study is among the lowest in the literature, taking into consideration the period of follow-up.

Dysphagia

Dysphagia occurred in 3 patients because the bands were too tight and the patients were not able to tolerate food. Early replacement with larger bands resolved the problem. In 2 other patients, the bands were too high, and early repositioning cured the dysphagia. Only 1 patient opted to continue with a fluid diet for 1 year before replacement with a larger band. Dysphagia after gastric band insertion should be investigated by gastroscopy, upper gastrointestinal series, or computed tomography. Early band-related complication should be diagnosed and treated accordingly, while late dysphagia in LAGB patients could reveal unrelated serious pathology, such as cancer.[14,15]

Erosions

Two band erosions (0.17%) occurred in female patients who had achieved excellent weight loss, both of whom had small bands. A recent study of 2097 patients from Australia reported a 2.5% rate of erosion,[16] while an overall rate of 1.47% was reported in a review of >15,000 patients.[17] We have concluded that the triad of risk factors for erosions includes tight, small bands in female patients. This is possibly due to fat distribution, as surgeons are more inclined to place small bands than large ones in female patients. Small band size as a risk factor for complication has been reported by Matlach et al[18] from Germany. Because of our use of only 1 type of band, we were unable to assess whether band type was a contributing risk factor. However, Cherian et al[19] found less erosion with the use of Allergan bands (5.6% vs 0.9%).

Access Port and Tube Complications

Eleven complications (0.9%) were reported (Table 2). Port and tube problems are most common complication after LAGB insertion. Tog et al[20] reported a 8.7% rate of such complications. Mittermair et al[12] reported a higher rate with longer follow-up of 4 years (11% port and 6.45% tube complications).

Limitations of Our Study

Only 70% of our patients were available for follow-up at 1 year. Midterm complications may have occurred in the remaining 30% of patients, and they may have received medical care for their morbidities at other institutions. Nevertheless, we are not aware of any complications in this group of patients, and we did not receive any evidence of complications from concerned GPs or other clinicians.

We also acknowledge that longer follow-up of LAGB patients may uncover additional morbidities, such as erosion and prolapse. Therefore, we have decided to report long-term outcomes in a future study. The lag period since the first case will then be extended to 5 years, with mean follow-up by our team of 3 years. GPs will refer patients who develop complications after that period. Because ours are the only centers in a catchment area of 300,000, we see all our patients unless they have moved or developed complications while overseas or elsewhere.

Our results compare favorably with the available data from a meta-analysis and a systematic review,[2,17] and this may be due at least partly to the standardized technique we use and also to the relatively short-term mean follow-up period of 3 years. It is well known that the longer the follow-up, the higher the complication rate, and our patients are not an exception.

We believe that the technique we use is safe and effective, is associated with lower rates of minor and major complications, and has no mortality. This technique can be adopted at any bariatric unit to produce similar results.

CONCLUSIONS

A combined technique of pars flaccida and plication is associated with negligible morbidity and no mortality. Short-term complications are lower than in reported large series, reflecting the high safety profile of this approach.

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