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Cardiopexy with Ligamentum Teres in Patients with Hiatal Hernia and Previous Sleeve Gastrectomy: An Alternative Treatment for Gastroesophageal Reflux Disease

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Abstract

Background Fifty percent of patients who have undergone sleeve gastrectomy have gastroesophageal reflux disease (GERD). Surgical reinforcement of the lower esophageal sphincter is necessary to prevent acid reflux. Here, we describe ligamentum teres cardiopexy, a surgical technique that reinforces the lower esophageal sphincter and restores its competence with a new valve, in patients with previous sleeve gastrectomy and hiatal hernia.

Methods Included in the study were 15 patients (age, 35.6 ± 15.2 years; 13 females [86.6 %]; mean pre-cardiopexy body mass index, 21.94 kg/m^2) with sleeve gastrectomy who presented with hiatal hernia and gastroesophageal reflux disease and underwent ligamentum teres cardiopexy. In this procedure, the ligamentum teres is released from its umbilical connection and the hernia reduced by manual traction, freeing the last 3–5 cm of esophagus in the abdomen. The distal ligamentum teres is fixed with one stitch to the apex of the angle of His, one at the gastroesophageal junction, and one joining the gastric fundus to the esophagus. The remainder of the ligamentum teres is fixed over itself with four to six stitches, forming a necktie cardiopexy. The procedure concludes with diaphragmatic crus closure.

Results After 6 months, 13 patients (86.6 %) achieved successful results, defined as resolution of GERD, no proton-pump inhibitor (PPI) use, and manometry measurement over 12 mmHg after surgery. Two patients (13.3 %) required continued proton-pump inhibition.

Conclusions Ligamentum teres cardiopexy combined with closure of the gastric crus is a good alternative treatment for gastroesophageal reflux disease in patients with previous sleeve gastrectomy and hiatal hernia.

Keywords Cardiopexy · Ligamentum teres · Gastroesophageal reflux disease · Sleeve gastrectomy

Introduction

To avoid gastric acid reflux, it is necessary to reinforce the lower esophageal sphincter with surgical procedures in order to restore the esophagogastric junction (EGJ) function. It is important to create an artificial valve at the EGJ, preferably behind the esophagus, lengthening the subdiaphragmatic esophagus and maintaining the sphincter mechanism in the positive pressure environment of the abdominal cavity. The hiatus narrowing is no longer considered essential, even though it may be a useful additional procedure. In patients with sleeve gastrectomy who present hiatal hernia and gastroesophageal reflux disease (GERD) only partially controlled with proton-pump inhibitors (PPIs), gastric bypass is an accepted surgical solution [1]. However, if the patient declines this procedure, there are no other surgical options. We propose a laparoscopic surgical alternative that can address postoperative GERD: cardiopexy using the ligamentum teres to achieve near-complete restoration of EGJ function and

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rehabilitation of damage caused by sleeve gastrectomy and hiatal hernia.

Materials and Methods

Conduct of the Study

The Committee for Research and Ethics approved the protocol. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee together with the 1964 Helsinki declaration and its later amendments. Before surgery, informed consent was obtained from all individual participants included in the study or their legal representatives. The study began in March 2007 and ended in June 2013. All authors had unrestricted access to the study data.

Patients

Between 2007 and 2012, laparoscopic sleeve gastrectomy (LSG) was performed in 76 patients with morbid obesity without closing the diaphragmatic pillars. Preoperatively, all patients underwent the protocol established by the Mexican College of Obesity Surgery, which included a preoperative endoscopy. One year after the gastrectomy, 40 patients (52.6 %) were taking a PPI (26 patients taking omeprazole and 14 patients with pantoprazole). A questionnaire was established for typical and atypical GERD symptoms. Thirty-seven patients presented typical symptoms including: heartburn, regurgitation and aspiration, water brash, chest pain, and dysphagia while three showed atypical symptoms (chronic nausea, asthma, cough, hoarse throat, and dental erosions). With an average of 30 months of follow-up, only 20 of 40 patients were still taking a PPI for persistent GERD. At this point (June 2013), a prospective protocol including those 20 patients was proposed to the surgical team and the ethics committee. Inclusion criteria were as follows: (1) adult patients with previous sleeve gastrectomy for morbid obesity with typical or atypical symptoms of GERD; (2) diminish esophageal-gastric junction pressure; and (3) esophageal endoscopy characterized by erosive esophagitis changes graded between A and C (Los Angeles Classification) with or without hiatal hernia, performed 2 weeks after discontinue PPI treatment. Endoscopic findings before and after LSG as well as before and after laparoscopic ligamentum teres cardiopexy (LTC) were compared. The same endoscopist performed all endoscopic studies. After providing patients with a detailed explanation of the surgical technique, 15 of the 20 patients opted to undergo the LTC procedure. Surgery consisted of drawing the esophagus down into the abdominal cavity, closing the pillars, and performing LTC. [2]

Manometric Analysis

Procedure was performed using a water-perfused catheter. The pressure sensor comprises four polyvinyl catheters with 2-mm holes spaced by 5 cm (Synectics Medtronic, Stockholm, Sweden), perfused by a pneumo-hydraulic pump at a flow of 0.2 ml/min. The contraction and relaxation of the upper and lower esophageal sphincter, as well as the body of the esophagus, were recorded with 10 consecutive swallows of a 5-mL bolus of warm water. The catheters were connected to a computerized system in order to compare the results with standardized normal values (normal LES; mean 14.87, SD±5.14, median 13.8, range 25.6–5.2 mmHg). In this study, 14 mmHg pressure was considered as the standard value.

Endoscopy

This procedure helped to determine the characteristics of the esophageal mucosa. The endoscopic findings were categorized as normal, erosive esophagitis (presence of one or more isolated esophageal erosions), evaluated according to the Los Angeles classification and hiatal hernia (presence of a herniated gastric pouch in distal esophagus). When the endoscopist notes that the gastric wall is poorly distensible, the endoscopist uses retroflex to examine the cardia and gastro-esophageal junction (GEJ). The flap valve of the GEJ may be seen and assessed for its competence under air pressure.

Original Surgical Technique

Contrary to a report by Varga et al. [3], the LTC *sling* approach is not a new surgical procedure. It was described in 1964 by Narbona [4], who proposed using the ligamentum teres to perform a cardiopexy, a procedure inspired by the Pedinielli snare [5] and the technique of Rampal et al. [6], and is similar to the procedure used by Marchal et al. [7].

Laparoscopic LTC After Sleeve Gastrectomy

Following induction of general anesthesia, an orogastric tube is inserted, the patient is placed supine with the hips abducted, and monitors are positioned towards the patient head. Pneumoperitoneum is established with a Veress needle at the left costal margin, using five ports (three 5-mm ports and two 10-mm ports) and a 30 ° laparoscope. A 10-mm camera port is placed to the left of midline, 15-cm below the junction of the right and left costal margins. A 5-mm port is placed in the subxiphoid position; which is removed later and replaced by a Nathanson liver retractor, to elevate the left lateral segment of the liver, exposing the proximal stomach and esophageal hiatus. A 10-mm port in the left upper quadrant and a 5-mm port in the right upper quadrant are the surgeon's two working ports, and a 5-mm port is placed laterally in the left upper

quadrant for the assistant. After all ports are set, the surgery table is placed into reverse Trendelenburg position, the surgeon stands between the patient's legs, and the assistant is located at the patient's left side.

The procedure begins by dissecting, with a monopolar hook, of adhesions caused by the previous sleeve gastrectomy located between the edge of the left hepatic lobe and the gastric sleeve. The esophageal hiatus is identified, the gastro hepatic ligament is divided through the pars flaccida portion with an ultrasonic dissector, the right crus is exposed, and mobilized from the esophagus, and the phrenoesophageal ligament is opened. The left crus can be identified caudally where both crus join. The next step consists to create a window behind the esophagus, using a Penrose drain to facilitate its retraction. Wide exposure of the left crus is obtained by dissection of the gastrophrenic ligament and release of adhesions in the gastrophrenic peritoneum between the left crus and the GEJ. The residual fundus/neofundus adhered to the esophageal-gastric junction must be released correcting the angle of His. The hernia is reduced and the preherniario lipoma and hernial sac is removed.

The distal esophagus is dissected until a long intra-abdominal segment is obtained (the last 3–5 cm of esophagus must be free in the abdomen). The anesthesiologist then places a 36-French bougie. Interrupted nonabsorbable sutures of #0 Ethibond (Ethicon, Inc., Somerville, NJ, USA) using felt pledgets to close the crural defect. For the desinsertion of the Teres ligament by laparoscopy, the surgeon and the first assistant are placed on the left side of the patient; the camera is changed to port placed in the left upper quadrant. The surgeon works with the port placed laterally in the left upper quadrant and traction is performed through to the port placed in the right upper quadrant.

The next steps are the same as those described by Narbona [4]: Dissection of the ligamentum teres is mobilized from falciform ligament and fat with preservation of its blood supply from the liver (umbilical fissure). The dissection begins in the most avascular part of the falciform ligament, using a harmonic dissector; it continues to the level of the anterior abdominal wall and ends at the umbilicus. Following this, the ligamentum teres is pulled from right to left behind and around the esophagus, taking care that it is not twisted. The first suture anchors the ligament to the right EGJ and the second one does it to the left. Two points of residual fundus/neofundus are applied to esophagus "anchoring" the ligament, avoiding lateral displacement. Finally, the teres ligament is fixed to itself by two or three nonabsorbable stitches that form a loop or *necktie*, described by Rampal [6]; it is required because in patients who have undergone sleeve gastrectomy, there is no anterior gastric wall (Fig. 1). The present study had an average operative time of 60 min with a range between 45 and 75 min. None of the patients required conversion to open surgery or had immediate complications.



Fig. 1 Ligamentum teres encircling the gastroesophageal junction at the angle of His, forming a *necktie*

Evaluation of Efficacy

If 6 months after surgery there was resolution of signs and symptoms of GERD, no PPI usage, and a manometric measurement over 12 mmHg, the procedure can be considered successful

Results

Clinical data, esophageal endoscopy findings, and manometric measurements of the 15 study patients are shown in Table 1. GERD symptoms were experienced by two patients pre LSG and by 15 post LSG. LTC was considered unsuccessful in two patients (13.3 %): a 62-year-old male with a manometry measurement of 13 mmHg, and a 24-year-old female with a manometry measurement of 14.9 mmHg, both required occasional PPI usage 6 months after surgery. In 13 of 15 patients (86.6 %), the procedure was successful, which was defined as resolution of signs and symptoms of GERD, no need for a PPI, and a manometry measurement over 12 mmHg 6 months after surgery.

Endoscopic Results

Before and after LSG, two patients with erosive esophagitis grade A progressed to grade B before LTC, and 13 patients continued to have grade A esophagitis. The hiatal hernia present in 15 patients prior to LSG was recorded as sliding hiatal hernia (type 1). In three patients, the size of the hernia increased after LSG. The last endoscopy study, performed 6 months after LTC, showed that two patients had mild erosive esophagitis grade A; the remaining patients presented normal esophageal mucosa. After 12 months of follow-up, two patients required occasional PPIs; however, endoscopic monitoring showed normal esophageal mucosa. Thirteen patients have remained asymptomatic.

Table 1 Clinical data ($n=15$)

Variable	LSG		LTC	
	Pre	6 months post	Pre	6 months post
Age, years	35.6±15.2 (19–62)			
Sex (female/male), n	13/2			
Follow-up period after LSG (months)	6			
BMI	44.74±4.76		21.9±2.18 (19.3–24)	
Manometry, mmHg			9.32±1.27 (7.9–11)	22.29±6.83 (13–27.3)
Esophagitis ^a grade A/B/C (NL)	13/1/1 (0)		12/2/1 (0)	2/0/0 (13)
GERD symptoms (no/yes)	13/2	1/14		13/2
Hiatal hernia, n				
3 cm	10		7	
3–4 cm	1		1	
4 cm	3		5	
5 cm	1		2	
PPI use (no/yes), n	–			13/2

Data presented as mean±standard deviation (range) unless otherwise indicated

BMI body mass index, GERD gastroesophageal reflux disease, LSG laparoscopic sleeve gastrectomy, LTC ligamentum teres cardiopexy, NL normal esophageal mucosa, PPI proton-pump inhibitor

^a Los Angeles grade esophagitis seen on esophageal endoscopy

Discussion

The ligamentum teres is a remnant of the umbilical vein that forms a fibrous strand in adults. It forms the inferior border of suprahepatic ligament, runs from the umbilicus to the liver, and receives its blood supply from a small arterial branch of the hepatic artery, which prevents long-term resorption when it is used for the procedure described. During the procedure, the ligamentum teres connects the GEJ to the left lobe of the liver, acting like a *floating anchor* that moves with ventilatory movements. This system maintains the angle of His because it pulls the GEJ forward, downward, and toward the right [8]. For the best control of reflux, crural closure should be performed.

A cardiopexy procedure using a sling around the GEJ was initially proposed by Pedinielli [5], who called it *technique du collet* (collar technique). A strip of skin was cut from the abdominal wall, slung around the distal esophagus, sutured over itself, and then attached to the anterior abdominal wall. Pedinielli had satisfactory results with this technique, but the absence of blood supply to the cutaneous strip caused it to become necrotic. For this reason, the use of other tissue, such as the ligamentum teres, to perform cardiopexy was proposed by Rampal [6] in France in 1964 and by Narbona [4] in Spain in 1972. LTC alone is not sufficient for reflux prevention; therefore, closure of the hiatus must be performed concomitantly. Marchal et al. adopted Rampal's technique,

incorporating the restoration of the angle of His with a suture between the distal esophagus and the gastric fundus [6]. If the patient has undergone a previous sleeve gastrectomy, the problem is greater (in our patients, only two had GERD symptoms before, and 40 of 76 after, sleeve gastrectomy) because PPI usually provide only partial control. The goal of LTC is reduction of the hernia and prevention of reflux. This is done by creating an artificial valve restoring the angle of His. Securing the EGJ via LTC provides mobility with hepatic movements, which occur with breathing and diaphragmatic displacement. If the hiatus is enlarged, increases in intra-abdominal pressure associated with contraction of the diaphragm increase the likelihood of acid reflux, but the LTC procedure allows the ligament to pull in a downward direction, reproducing the physiological work of gastroesophageal sphincter. Sleeve gastrectomy in patients with morbid obesity results in GERD in 50 % of cases. In the present study, LTC restored esophageal sphincter function in 86.6 % of cases. This was demonstrated by manometric measurements and the absence of symptoms and signs of GERD, evidenced by non-requirement of PPIs and healing of erosive esophagitis corroborated by endoscopy.

In the context of surgical treatment with which the EGJ can be bolstered, preoperative manometric assessment is a poor predictor of outcome. The best predictor of response to either antisecretory therapy or surgery is the severity of the esophagitis at index endoscopy.

The present study shows a small sample; nevertheless, it may support that this procedure can be performed in patients undergoing bariatric surgery [9] together with sleeve gastrectomy [10] in order to prevent GERD [11]. Further studies with a longer period of follow-up are needed to address the clinical efficacy and safety of this procedure.

Conclusions

The study shows the benefits of the LTC procedure to heal GERD-related esophagitis, confirmed by endoscopy, and adequate function of the lower esophageal sphincter, as demonstrated by manometry measurements. The surgical technique described in this study might be feasible to solve the reflux in postoperative patients with sleeve gastrectomy. Further studies with a longer period of follow-up are needed to address the clinical efficacy and safety of this procedure.

Conflict of Interest The authors declare that they have no conflict of interest.

References

1. Delattre JF, Palot JP, Ducasse A, et al. The crura of the diaphragm and diaphragmatic passage. Applications to gastroesophageal reflux, its investigation and treatment. *Anal Clin*. 1985;7:271–83.
2. Kahrilas PJ, Shaheen NJ, Vaezi MF, et al. American gastroenterological association medical position statement on the management of gastroesophageal reflux disease. *Gastroenterology*. 2008;135:1383–91.
3. Varga G, Cseke L, Kalmar K, et al. Laparoscopic repair of large hiatal hernia with teres ligament: midterm follow-up: a new surgical procedure. *Surg Endosc*. 2008;22:881–4.
4. Narbona B, Olavarrieta L, Lloris JM, et al. Le traitement du reflux gastro-oesophagien par pexie avec le ligament rond. A propos de 100 opérés suivis entre 16 et 23 années. *Chirurgie*. 1990;116:201–10.
5. Pedinielli L. Traitement chirurgical de la hernie hiatale par la “technique du collet”. *Ann Chir*. 1964;18:1461–74.
6. Rampal M, Perillat P, Rougaut R. Notes préliminaires sur une nouvelle technique de cure chirurgicale des hernies hiatales: la cardiopexie par le ligament rond. *Marseille Chir*. 1964;16:488–90.
7. Marchal G, Balmes M, Bousquet M, et al. Traitement des hernies hiatales par la technique de Rampal. *Montpellier Chir*. 1967;479–482.
8. Nathanson LK, Shimi S, Cuschieri A. Laparoscopic ligamentum teres (round ligament) cardiopexy. *Br J Surg*. 1991;78:947–51.
9. Cottam D, Qureshi FG, Mattar SG, et al. Laparoscopic sleeve gastrectomy as an initial weight-loss procedure for high-risk patients with morbid obesity. *Surg Endosc*. 2006;20:859–63.
10. Friedenberg FK, Xanthopoulos M, Foster GD, et al. The association between gastroesophageal reflux disease and obesity. *Am J Gastroenterol*. 2008;103:2111–22.
11. El-Serag H. The association between obesity and GERD: a review of the epidemiological evidence. *Dig Dis Sci*. 2008;53:2307–12.