Laparoscopic circular stapled longitudinal extramucosal pyloroplasty: an alternative technique for pyloric disruption

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OBJECTIVES: Oesophagectomy with gastric pull-up is the most common surgical procedure for oesophageal cancer. Pyloroplasty may be performed to facilitate stomach emptying, but its role is still controversial. When laparoscopic mobilization of the stomach is performed, conventional extramucosal pyloroplasty may be difficult to carry out; therefore, we describe a new technique for mechanical pyloric disruption.

METHODS: We conceived the laparoscopic longitudinal extramucosal partial section of the anterior pyloric wall using a circular stapler. We performed it in 6 patients undergoing oesophagectomy for cancer, with the laparoscopic abdominal step before thoracotomy.

RESULTS: The procedure was easy and safe and without intraoperative complications in all patients. Postoperative video-oesophagogram showed regular anastomosis and graft emptying.

CONCLUSIONS: Our preliminary experience has led us to conclude that circular stapler longitudinal extramucosal pyloroplasty is an easy, safe and quick procedure that can be performed in laparoscopic surgery. Moreover, it seems to ensure a regular emptying of the graft as standard pyloroplasty does.

Keywords: Pyloroplasty • Circular stapler • Laparoscopy • Oesophagectomy • Oesophageal cancer

INTRODUCTION

The therapy for early-stage oesophageal cancer or end-stage benign oesophageal disease is oesophagectomy and the most common reconstruction is by means of a gastric pull-up. The usefulness of pyloroplasty for stomach emptying after its pull-up is still controversial and depends on whether the whole stomach or a tubularized graft is used to re-establish the intestinal transit [1-3]. Pyloroplasty seems to reduce the incidence of early postoperative delayed gastric emptying, aspiration events and long-term symptoms after meals, when the whole stomach is used [1, 4]. The benefit of pyloroplasty is less clear when a thin tubularized gastric graft is used [1, 5]. Otherwise, the pyloroplasty may shorten the graft, increase the risk of leakage and facilitate the dumping syndrome and longer term bile reflux [1-3].

According to Ivor and Lewis, oesophageal cancer located in the lower third of the oesophagus or in the gastric cardia (Siewert I) must be treated with the resection of the mid and lower third of the oesophagus and with a superior polar resection of the stomach [6, 7]. Laparoscopic mobilization and preparation of the stomach for the pull-up is a feasible, safe and an increasingly performed procedure as the abdominal step before thoracotomy, thus ensuring a better postoperative outcome [6]. Otherwise, Heineke-Mikulicz or extramucosal pyloroplasty may be difficult to perform when a minimally invasive approach is used.

We developed a novel technique to disrupt the pylorus with a circular stapler that allows for a quick and simple procedure in laparoscopic surgery.

MATERIALS AND METHODS

In our hospital, oesophagectomy is preferentially performed according to the Ivor Lewis technique and the reconstruction of the alimentary tract is routinely carried out with the whole stomach with pyloroplasty. The abdominal step is performed in laparoscopy before the thoracotomic step.

Since 2011, we have performed six oesophagectomies for cancers of the lower third of the oesophagus or of the gastric cardia, using this new technique. Firstly, the stomach was laparoscopically mobilized, preserving the gastroepiploic vessels along the greater curvature. The distal oesophagus was mobilized through the abdominal hiatus and the superior pole of the stomach was resected with a linear stapler, from the lesser curvature to the
fundus. Lymphadenectomy of paracardial and coeliac stations was then performed. The graft was not tubularized in all cases.

Pyloroplasty was performed according to the following technique in all cases. One 2-0 suture was placed longitudinally through the muscular layer of the pyloric anterior wall in order to pull it up (Fig. 1A). Then, a 28-mm circular stapler was introduced through the trocar incision in the left hypochondrium. The circular stapler was closed while pulling up the anterior pyloric wall into it, and this was achieved by pulling up the running suture or tying it surrounding the stapler (Fig. 1B). Firing the stapler excised a bite of the pyloric muscular wall, thus performing a longitudinal partial section ($\approx \frac{1}{4}$) of the pylorus (Fig. 1C). To carry out a safer procedure with an extramucosal pyloric disruption, we preferred endoscopic control during the procedures. Oesophagectomy was then carried out with a right thoracotomy and an end-to-side oesophago-gastric anastomosis was performed with the circular stapler. The intraoperative images of the technique are shown in Fig. 2.

The nasogastric tube was placed during the surgical procedure and removed after 24–48 h. The patients were not given any food until a postoperative contrast study was performed on the 7th or

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Figure 1: Diagrammatic representation of the technique. (A) A suture is longitudinally run through the muscular layer of the pyloric anterior wall. (B) The circular stapler is closed, while pulling up the anterior pyloric wall into it (by the running suture), performing a longitudinal partial section ($\approx \frac{1}{4}$) of the pylorus. (C) The mechanical extramucosal longitudinal suture of the pylorus.

Figure 2: Intraoperative images of the technique. (A) The 2-0 suture is run through the muscular layer of the pyloric anterior wall. (B) A 28-mm circular stapler is closed while pulling up the anterior pyloric wall into it (the running suture is tied surrounding the stapler) to perform a partial section of the pylorus. (C) Mechanical extramucosal longitudinal suture of the pylorus.
8th postoperative day in order to assess the integrity of the anastomosis and graft emptying. Afterwards, they were progressively fed with a diet for oesophagectomized patients. Moreover, patients were invited to modify their eating habits: eat multiple small meals (at least 5 meals/24 h), avoid drinking more fluid immediately after a meal, avoid eating monosaccharides (sugar, sweets and cookies) and replace them with polysaccharides (pasta, fruits and potatoes) and increase the intake of fats and proteins.

RESULTS

Laparoscopic circular stapled longitudinal pyloroplasty was easily, safely and quickly performed in all the 6 patients, without any intraoperative complications. The examination of the specimens of the excised pyloric wall revealed that the stapler line was just extramucosal in all cases.

The postoperative course was uneventful in 4 patients. One patient presented anaemia due to haemothorax that required blood transfusion, and another patient developed pulmonary infection, which was treated with antibiotics.

The postoperative contrast studies performed on the 7th/8th postoperative day did not show any leakage either of the oesophago-gastric anastomosis or of the pyloric suture (Fig. 3). The graft emptying was regular in all cases; no patient needed postoperative endoscopic dilatation either of the esophago-gastric anastomosis or of the pylorus. Patients were made to fast after the video-oesophagogram. Nobody presented with long-term bile reflux or dumping syndrome. The median follow-up was 17 months.

DISCUSSION

The stomach is the first choice substitution of the oesophagus after oesophagectomy for most surgeons. When compared with the normal stomach, the elevation of the stomach into the thorax causes many anatomical and physiological changes which result in a series of clinical manifestations: the right gastroepiploic artery remains the only blood supplier of the free thoracic stomach, the vagus nerve is removed and the stomach innervation depends on the autonomic myenteric plexus (which affects the regular relaxation function of the pylorus), the elevated stomach is subjected to the negative thoracic pressure (which can impede emptying), the angle of His disappears during the gastric mobilization and pulling up, and the spring action of the diaphragm on the lower oesophagus is lost (thus causing the loss of the antireflux mechanism) [8]. Moreover, the resection of the fundus and the reshaping of the stomach pulled up as a neo-oesophagus (full stomach, subtotal stomach and narrow gastric tube) affect the receptive expansion, motility and secretions (which affect the opening and closure of the pylorus) [8]. The clinical presentations are delayed emptying, dumping syndrome and reflux.

Delayed gastric emptying is the most common problem in patients with motility dysfunction of the thoracic stomach, with an incidence rate of 50% after oesophagectomy [2, 8]. The basis of the gastric emptying is that the pylorus opens when the pressure in the stomach exceeds the pyloric pressure. Reduced stomach volume, weakened receptive expansion and vagotomy cause dysfunction of the pylorus, which leads to delayed emptying that manifests as early satiety or vomiting.

The role of pyloroplasty after oesophagectomy with gastric pull-up reconstruction is still controversial. Some authors have shown that pyloroplasty reduces the incidence of early postoperative delayed gastric emptying and consequently the aspiration events and the prolongation of the hospital stay [1, 3, 4]. Moreover, pyloroplasty is associated with fewer long-term symptoms after meals, when the whole stomach is used. The advantage of pyloroplasty is less clear when a tubularized stomach is used [3].
Other authors argue that a standard pyloroplasty may shorten the graft, increase the risk of leakage, lengthen the operative time and cause dumping syndrome and longer term bile reflux [5, 8]. Moreover, a standard pyloroplasty is challenging when performed during laparoscopic surgery.

We set out to use a circular stapler to achieve a longitudinal disruption of the pylorus during oesophagectomy with a minimally invasive abdominal approach. We thought that taking a bite out of the anterior musculature of the pylorus would disrupt its function by interrupting the pyloric sphincter. The staple line would be extramucosal to reduce the risk of leakage. To facilitate the bite by the stapler, we ran a single longitudinal suture through the pylorus and, afterwards, we closed the stapler by pulling the tissue into it. We chose the circular stapler because we believe that it better allows the slippage of the pyloric wall into it (by pulling up the running suture) and therefore the extramucosal partial bite. We performed the procedures under endoscopic control, in order to ensure an extramucosal pyloric disruption. We maintain that endoscopic control is not mandatory, but it can be useful for a safer procedure, especially at the beginning, in order to determine a complete muscular disruption and to avoid a full-thickness bite of the pyloric wall.

This preliminary experience showed that the circular stapler longitudinal extramucosal pyloroplasty is a safe, easy and quick procedure that can be performed in laparoscopic surgery. It seems to ensure a regular emptying of the graft as conventional pyloroplasty does, as shown by the postoperative video-oesophagram.

Oezcelik reported a similar technique for pyloroplasty: the subserosal disruption of the pyloric wall from the internal lumen by the circular stapler passed through a gastrotomy in the lesser curvature, performed before the tubularization of the stomach [5]. He showed that this technique was easy to perform, safe and equally efficacious compared with the standard pyloroplasty, ensuring optimal gastric emptying. We believe that our technique may ensure the same advantages; furthermore, it is easier and quicker because it can be performed externally, without requiring a gastrotomy.

Since patients with oesophageal cancer have a poor prognosis because of the high recurrence rate even after an apparent radical resection, except those with an early-stage disease, the surgical procedure should therefore be carried out with low morbidity and minimal postoperative symptoms in order to ensure a satisfactory quality of life. The circular stapler longitudinal extramucosal pyloroplasty follows this direction: it is a procedure that can be easily performed in laparoscopy.

Even though our experience seems promising, it is limited by the small number of cases so far. Therefore, a prospective study is necessary to determine the true role of this technique compared with conventional pyloric myotomy and with gastric pull-up reconstruction without pyloroplasty. Yet, since the usefulness of pyloroplasty during oesophagectomy and gastric pull-up is still controversial, a randomized study is needed to definitively assess it.

Conflict of interest: none declared.

REFERENCES


eComment. Alternative approaches to pyloric disruption after oesophagectomy: Stapled pyloroplasty versus dilatation and botulinum injection

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We read with great interest the article by Bugiantella et al. on laparoscopic circular stapled longitudinal extramucosal pyloroplasty for patients undergoing gastric pull-up for oesophageal cancer [1]. It is a novel, elegant, fast and apparently safe technique for pyloric disruption and compares favourably to both classical pyloroplasty and pyloromyotomy which are generally safe, but can rarely lead to life-threatening complications [2–4]. However, there is no definitive data to support one technique of pyloric drainage over another or in fact whether it is indicated at all [2–4]. Furthermore, the available randomized trials were published more than 10 years ago and, crucially, have been conducted before the widespread use of a tubularized stomach as a conduit and a high anastomosis to reduce leak rate. As surgeons are moving away from pyloric disruption because of the possibility of local complications, bile reflux and increased dumping, the combination of endoscopic balloon dilatation and botulinum toxin seems a safe alternative that provides the benefits of less pulmonary complications as well as improved gastric emptying in the immediate postoperative period, whilst only transiently disrupting the pylorus [2]. The authors’ technique would provide the same benefits, but with a presumably permanent effect on the pylorus. It is interesting that the authors reported normal gastric emptying, with no need for dilatation in all patients, but also no long-term bile reflux or dumping syndrome with a median follow-up of 17 months [1]. Further study of this technique is necessary to better evaluate its short- and long-term functional effects. Thus, after this feasibility study, it would be interesting for the authors to compare their stapled pyloroplasty technique to endoscopic balloon dilatation and botulinum toxin injection in a randomized manner, to determine the technique that would provide the best functional result, while minimizing complications in this complex patient population.

Conflict of interest: none declared.

References


