

Esophagogastric Reconstruction in Cobra-Head Shape with Toupet-Like Partial Anti-Reflux Technique for Resection of Proximal Gastric Tumors. Experience with Three Cases from a Non-Asian Population

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Abstract

Background: Proximal gastrectomy is a rarely performed procedure but a feasible option in benign tumors and malignant neoplasms in the proximal third of the stomach since novel options of reconstructions are available nowadays with fewer long-term sequels. **Methods:** Report of three cases of proximal gastric gastrointestinal stromal tumors (GIST), with a description of its presentation, histological characteristics, and follow-up after being treated with proximal gastrectomy with cobra head reconstruction. **Results: Case 1:** A 62-year-old woman with epigastric pain of four months with endoscopic evidence of a cardia GIST. The surgery was performed without complications. The histopathological report confirmed a fusiform GIST of 3.2 × 3 × 2.5 cm, stage IA. No adjuvant treatment was considered. An esophagogram showed no evidence of reflux and no stenosis, and no disease recurrence after 40-months follow-up. **Case 2:** A 66-year-old woman with dyspepsia and a palpable tumor in the epigastrium. The surgery was performed without complications. The pathology report confirmed a proximal gastric GIST of 13 × 8 × 7 cm, staged II. She received adjuvant treatment with imatinib for 36 months without recurrence and no reflux or stenosis. **Case 3:** A 55-year-old woman with intermittent hematemesis and right subscapular pain. The surgery was performed without complications. The histopathological report concluded that a

GIST tumor of the cardia, 1.4 × 1.2 cm, staged IA. She was left in observation. At a 6-month follow-up, she does not report dysphagia, reflux, or stenosis, and no locoregional recurrence. **Conclusions:** Open and laparoscopic proximal gastrectomy is a safe therapeutic option for GIST. Furthermore, the reconstruction of the esophagus-gastro anastomosis in the cobra head after proximal gastrectomy is feasible and secure in our population, with good functional results in a short follow-up.

Keywords

GIST, Gastric Cancer, Laparoscopy, Proximal Gastrectomy, Cobra Head Reconstruction

1. Introduction

The stomach has several regions where different tumors can grow, from adenocarcinoma, the most frequent (95%), to lymphomas or gastrointestinal stromal tumors (GIST) [1] [2]. Tumors in the esophagogastric junction, cardia, and fundus are considered proximal [3]. The increase in obesity rates worldwide predisposes to more significant reflux disease associated with an increased incidence of proximal gastric adenocarcinoma [4]. When tumors present at an early stage, conservative surgery is an option to preserve as much of the stomach as possible without neglecting the oncological principles (respecting surgical margins and a correct lymph node dissection) [5]. It also adds the benefit of improving the quality of life since these patients maintain the digestive and endocrine function of the stomach; however, this type of early-stage patient is rare in our environment, and gastric preservation is not indicated [6] [7]. Despite this, other less frequent tumors with more favorable tumor biology are ideal candidates to try to preserve the most significant amount of gastric tissue, for example, GIST or leiomyomas [8] [9].

Proximal gastrectomy is a frequent procedure in Japan and Korea due to the high incidence of early gastric cancer. There are several reconstruction techniques to reduce pathological acid or bile reflux since several physiological anti-reflux mechanisms are eliminated after a proximal gastrectomy [10] [11]. However, they are complex techniques, such as the “Kamikawa” reconstruction, that increase the surgical time and the risk of late stenosis [12] [13]. That is the reason a Japanese group, in 2016, described a minimally invasive technique to create a gastric tube 3 cm wide by 20 cm long with a cobra head termination to fix the esophagus to the gastric tube as a partial anti-reflux procedure. As a result, from their 13 patients with early proximal gastric cancer (T1N0M0) without esophageal invasion, there was no leak or stenosis of the anastomosis and no intra-abdominal collections. Furthermore, at 1-year follow-up, only three patients presented reflux esophagitis (Los Angeles Classification grade B and C) with adequate pharmacological control [14].

This novel technique has good preliminary results (in open and minimally invasive approaches) since creating a thin gastric tube reduces the area to produce acid. Also, adding a partial anti-reflux procedure such as a Toupet-Type, minimizes the risk of reflux, the main complication in patients undergoing proximal gastrectomy. In addition, linear anastomosis decreases the stenosis rate in short- and long-term follow-up [15] [16]. Another important matter nowadays is evaluating the quality of life after oncological procedures since life expectancy has increased with the improvement of surgical and systemic treatments [17]. Some studies have reported less post-gastrectomy syndrome with proximal gastrectomy, resulting in enhancing wellbeing [18].

In this article, we used this type of reconstruction in 3 patients with proximal GIST tumors who underwent proximal gastrectomy by combined open and laparoscopic approach.

2. Surgical Technique

Proximal gastrectomy follows the oncological principles of the Japanese school to treat proximal gastric tumors. The stomach is released at the greater curvature by cutting the greater omentum 3 to 4 cm below the right gastroepiploic artery, which is preserved, but the left gastroepiploic artery is cut. In the lesser curvature, we preserve the right gastric artery, and the posterior gastric surface is dissected from the pylorus to the esophagus, including the section of the posterior gastric, left gastric, and short gastric vessels. The phreno-esophageal membrane is opened to release the esophagus at least 5 cm, and the vagus nerves must be sectioned for a better release. Measuring two to three centimeters of the distal esophagus proximal margin, it is cut with a 60 mm linear stapler.

The distal cut of the stomach is performed by designing a thin gastric tube 3 centimeters wide with a length of 20 centimeters on the greater curvature and 5 cm on the lesser curvature from the pylorus using a linear stapler to intermediate tissue thickness of 45 or 60 mm and the proximal part of the gastric tube should have a 6 centimeters wide base that will simulate the cobra head. In minimally invasive surgery, we perform the gastric tube by extracorporeal approach (**Figure 1**). Subsequently, for the esophagogastric anastomosis, an enterotomy will be performed in the middle third on the staple line of the esophagus, another on the anterior gastric face in the 6 cm area closer to the greater curvature to introduce 45 mm linear stapler, performing the anastomosis between the posterior surface of the esophagus with the anterior surface of the stomach. The closure of the enterotomy will be with a continuous surge using a barbed suture (3-0 monofilament) from the left staple line to the right staple line. Finally, individual stitches will be placed with a 3-0 monofilament suture to invaginate or fix the esophagus with the anterior surface of the stomach, simulating a Toupet-type partial fundoplication (**Figure 2**). This reconstruction is possible by minimally invasive surgery where we performed the reconstruction tube using a 5 cm subxiphoid incision and finally intracorporeal lineal anastomosis plus Toupet-type partial fundoplication (**Figure 3**).

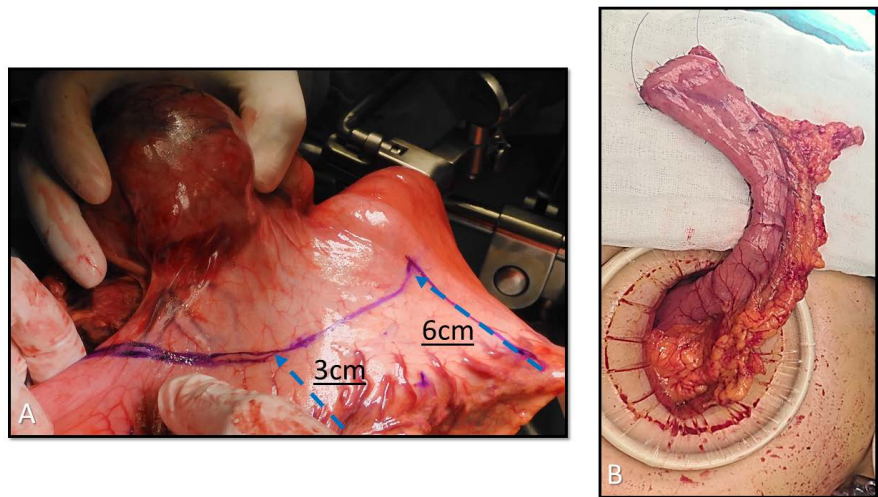


Figure 1. Performing gastric tube cobra-head. (A) Showing the 6 and 3 cm width of the gastric tube (B) Extracorporeal approach in minimally invasive surgery.

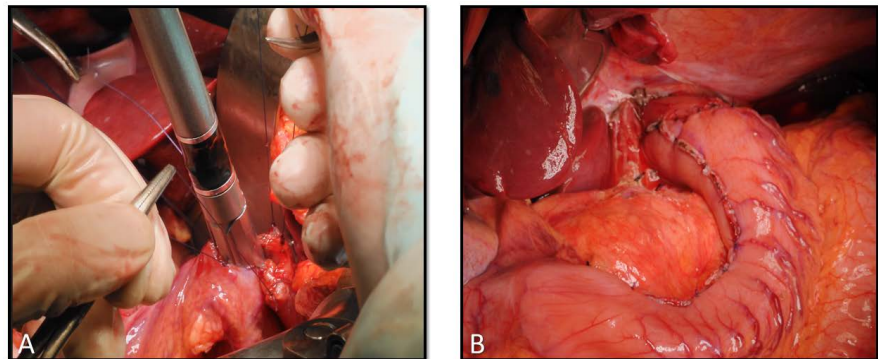


Figure 2. (A) Lineal anastomosis between posterior esophageal surface against anterior gastric surface. (B) Final view of the esophagogastric reconstruction in cobra-head shape.

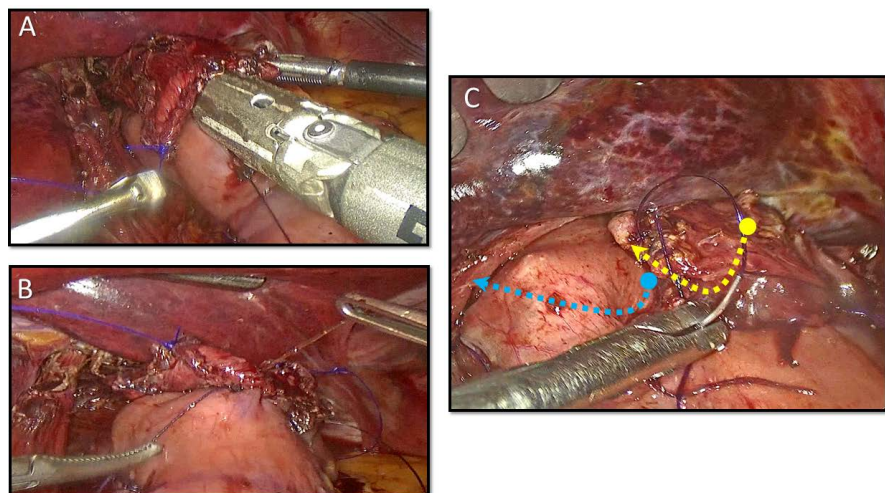


Figure 3. Minimally invasive reconstruction. (A) Intracorporeal lineal anastomosis. (B) The closure of the enterotomy with a continuous barbed suture. (C) Showing the Toupet-type partial fundoplication using individual stitches where invaginate the esophagus with the anterior surface of the stomach.

3. Case Presentation

3.1. Case 1

A 62-year-old woman with a history of laparoscopic cholecystectomy eight years ago began with abdominal distension and epigastric pain over four months of evolution. The endoscopy showed a submucous gastric lesion. The endoscopic ultrasound (EUS) showed a 3 cm calcified lesion in the upper third of the lesser gastric curvature dependent on the muscularis propria layer. A fine needle aspiration biopsy was performed, reporting a GIST (**Figure 4**). Contrast-enhanced tomography of the chest/abdomen ruled out regional and distant metastatic disease. A proximal gastrectomy was performed by laparoscopic approach with conversion to open surgery to achieve the esophageal-gastro anastomosis reconstruction in the cobra head with a partial anti-reflux procedure. There were no postoperative complications, and she was discharged on the tenth postoperative day. The histopathology report confirmed fusiform GIST of $3.2 \times 3 \times 2.5$ cm, with one mitosis/50 fields and 19 negative nodes, negative margins, and the staging was pT2 pN0 M0. The patient was placed in a low-risk group and was left under surveillance. An esophagogram showed no evidence of reflux and no stenosis. The disease-free period (PLE) was 40 months, and she only reported mild symptoms of reflux controlled with medical treatment (omeprazole) and nutritional changes for the first six months.

3.2. Case 2

A 66-year-old woman presented with dyspepsia after three years of evolution. She had a previous history of a low-grade papillary urothelial carcinoma of the bladder diagnosed a year earlier and treated by transurethral bladder resection (TURB) and intravesical BCG application. In the last three months, she increased

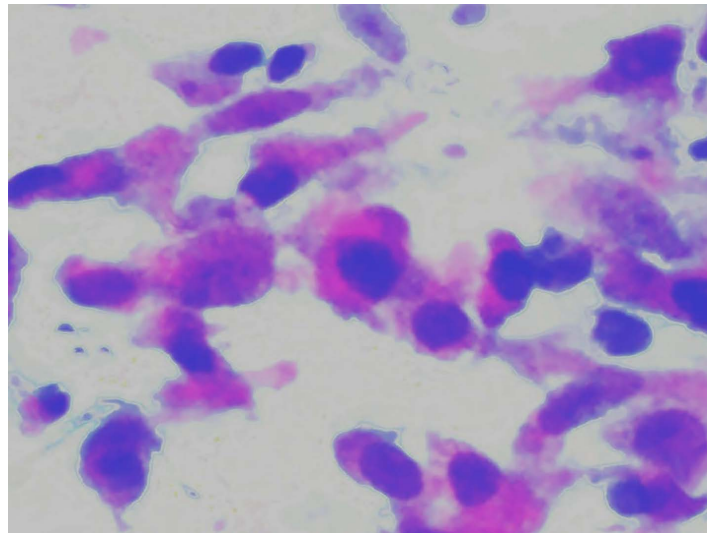


Figure 4. Fine needle aspiration biopsy of proximal gastric GIST. The image shows spindle cells without atypia in a fibrous matrix in the background: Hematoxylin and eosin, 200 \times .

postprandial fullness and progressive palpation of a solid tumor in the epigastrium, slightly mobile at 10 cm in size. A endoscopy and EUS confirmed a heterogeneous tumor, with a hypoechoic center in the gastric fundus with involvement of the lesser curvature, size 8 × 6 cm, which depended on the muscle layer. A CT scan confirmed a calcified tumor of 11 × 8.8 × 6 cm, suspicious for gastric GIST in lesser curvature, between the proximal and middle thirds that contacted the left hepatic lobe (**Figure 5**). A proximal gastrectomy was performed by laparotomy and reconstruction of the esophagus-gastro anastomosis in the cobra's head. No postoperative complications were reported during the eight days of hospitalization. The pathology report confirmed spindle cell GIST, with three mitoses/50 fields, size 13 × 8 × 7 cm, four lymph nodes negative, and negative margins with intermediate risk staging (pT4 pN0 M0) (**Figure 6**). She received adjuvant treatment with oral imatinib 400 mg to complete three years and no recurrence at 37 months of follow-up and not presenting reflux or stenosis.

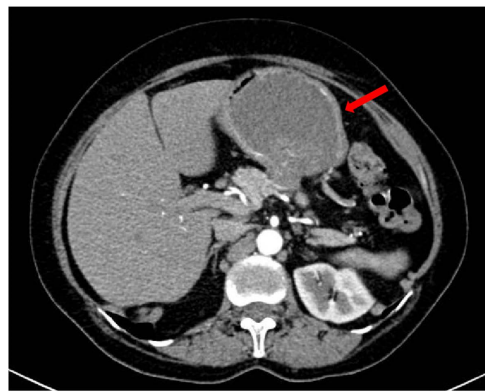


Figure 5. Abdominal CT scan demonstrating a proximal gastric calcified tumor of 110 × 88 × 60 mm, suspicious for gastric GIST at the lesser curvature in contact with the left hepatic lobe.

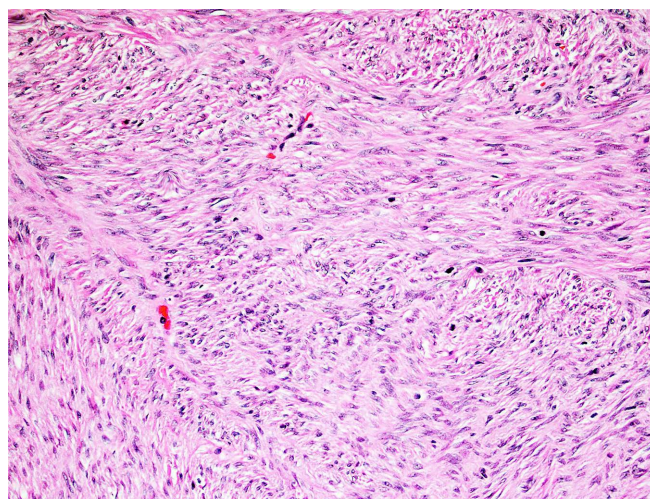


Figure 6. Photomicrography of gastric GIST showing a low-grade spindle-cell neoplasm composed of cells in short fascicles and whorls; the cells have pale eosinophilic fibrillary cytoplasm, ovoid nuclei, and ill-defined cell borders: Hematoxylin and eosin, 100×.

3.3. Case 3

A 55-year-old woman with a history of two cesarean sections and an open appendectomy began five months previously with intermittent hematemesis and two weekly episodes of right subscapular pain without improvement with pump inhibitor plus intermittent dysphagia to solid foods. The endoscopy observed a 2-cm subepithelial tumor in the cardia. It was complemented with EUS confirming a subepithelial tumor in the cardia of 1.5 × 1 cm, hypoechoic, lobulated, and defined borders, with 50% partial obstruction and positive biopsy for low-grade GIST. An abdominal CT scan reported a 1.4 × 1.1 cm nodular tumor in the cardia, with no tumor activity elsewhere. Laparoscopic proximal gastrectomy was performed with reconstruction by esophagogastric anastomosis in the cobra head with an anti-reflux procedure. The patient did not develop postoperative complications and was discharged on the seventh day. The histopathological report concluded a GIST tumor of the cardia of 1.4 × 1.2 cm, without mitosis/5 mm², or necrosis, unifocal, negative margins, and three negative pericardial nodes with a pathological stage IA (pT1 pN0 M0). Therefore, it was classified as low risk remaining under surveillance. In the first month after surgery, she reported mild dysphagia to solids that improved with changes in diet and prokinetic medication. At a three-month follow-up, she did not report dysphagia, reflux, or stenosis.

4. Discussion

The best surgical experience in proximal gastrectomy for the cardia or gastric fundus tumors is in Japan and Korea, where the incidence of early gastric adenocarcinoma is high and does not require a D2 lymph node dissection [19]. This type of resection can apply to tumors with better oncological prognosis due to less aggressive behavior and minimum capacity for lymph node invasion, such as GIST or well-differentiated neuroendocrine tumors [20] [21]. The optimal surgical management of gastric GIST includes a complete surgical resection with negative margins and it is not necessary a lymph node dissection for small tumors (less than 5 cm) because <2% are metastatic to regional lymph nodes [22] [23].

Among the benefits observed with these limited gastric resections is the possibility of preserving a functional gastric remnant with an adequate excretory and reserve function by preserving the pyloric innervation of the celiac hepatic and vagal branches after limiting the extent of the gastric resection and lymph nodes at the level of the pylorus [24]. Clinically, it translates into less long-term weight loss, with lower rates of protein-calorie malnutrition [25] [26].

Concerning the type of reconstruction of the gastroesophageal anastomosis, this novel technique involves only one anastomosis, which reduces the risk of anastomosis leakage compared to other reconstruction techniques, such as Roux-en-Y [27]. In addition, the reconstruction of the proximal portion of the gastric tube has an amplitude twice that of the distal portion (6 cm vs. 3 cm),

reducing the incidence of stenosis of the anastomosis.

The significant morbidity in proximal gastrectomy is related to the possibility of gastroesophageal reflux in the short and long term, which leads to esophagitis [28]. This problem occurs after removing the angle of His and the lower esophageal sphincter as anti-reflux mechanisms [29] [30]. This problem was addressed by the original Japanese surgical team by adding a partial anti-reflux fundoplication with the cephalic surface in gastric reconstruction. The initial report of this technique was published in 2016; however, in 2021, the same group reported an update and extension of the laparoscopic technique, including some selected locally advanced cases of gastric adenocarcinoma. In this study, it was compared with the reconstruction of the conventional esophagogastric anastomosis with a circular stapler; the results showed the same rate of post-operative complications (11% vs. 10%), with no anastomosis leak and stenosis in both groups. Furthermore, esophagitis occurs less than circular anastomosis (10% vs 33%) [14] [31]. We reproduced this technique in three patients with proximal GIST gastric tumors. Early results in the follow-up have shown specific morbidities with this new surgical reconstruction. One patient reported esophagogastric reflux in the first six months that remitted after dietary modifications and proton pump inhibitor plus prokinetic without evidence of esophagitis in the annual endoscopic control. Furthermore, a second patient presented self-limited dysphagia to solids but we did not have evidence of stenosis and only we did some changes in the type and frequency of the diet.

Regarding the oncological safety of the cobra head reconstruction technique, in Asian cases of gastric carcinoma, it has shown similar long-term rates in locoregional recurrence of up to 7%, without a statistically significant difference, even for patients with locally advanced stages [31]. In our three cases treated with this technique, after a median follow-up of 26 months (2 - 40 months), no patient has shown locoregional or distant recurrence, even in the patient with the high-risk GIST that was receiving adjuvant therapy with Imatinib. Therefore, we are confirming the safety of this procedure from the oncological point of view for proximal gastrointestinal stromal tumors localized in the stomach.

One limitation of this case report is that we only have performed this surgical technique in GIST histopathology because these tumors have less aggressive biological behavior, and in our center, most of the gastric adenocarcinomas are locally advanced, with diffuse histology and require a total gastrectomy with D2 lymph-node dissection.

5. Conclusion

Open and laparoscopic proximal gastrectomy is a safe therapeutic option from the oncological point of view for gastrointestinal stromal tumors and early gastric cancer. Furthermore, to our knowledge, we are the first oncology group replicating in Latin America the reconstruction of the esophagus-gastro anastomosis in cobra head after proximal gastrectomy in gastric GIST tumors, with short- and medium-term functional and quality-of-life results similar to those of the

Japanese population, which has shown a lower incidence of gastroesophageal reflux and postoperative esophagitis in longer follow-up in a large population included.

Declaration of Authorship

All authors meet the criteria for authorship as per the guidelines of the International Committee of Medical Journal Editors (ICMJE); all have participated at 1) the Conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND 2) Drafting the work or revising it critically for important intellectual content; AND 3) Final approval of the version submitted; AND 4) Agreement to be accountable for all aspects of the work regarding the accuracy or integrity of the research.

Acknowledgment of Patient Consent

The authors confirm that the patients involved in this publication have given their consent for the information presented in the Case reports to be published.

Conflicts of Interest

The authors declare no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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