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Case Report

LAPAROSCOPIC-ENDOSCOPIC COOPERATIVE INTRAGASTRIC SURGERY FOR GASTRIC TUMORS: A CASE REPORT AND SURGICAL TECHNIQUE DESCRIPTION

CIRUGÍA INTRAGÁSTRICA COOPERATIVA LAPAROSCÓPICA-ENDOSCÓPICA PARA TUMORES GÁSTRICOS: REPORTE DE UN CASO Y DESCRIPCIÓN DE LA TÉCNICA QUIRÚRGICA

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Abstract

Introduction:
Gastric submucosal tumors (SMT) were traditionally treated through open or laparoscopic surgery. Nevertheless, these approaches carry a higher structural and functional morbidity. Laparo-endoscopic collaborative intragastric surgery (LECS) is a minimally invasive procedure which allows a more tissue conservative gastric SMT resection, reducing patient morbidity. Several cases of SMT resections using LECS have been presented, but there is still little literature about it. This work presents LECS as an alternative for gastric tumor resections based on a surgical case.
Case report and intervention:
An adult female diagnosed with a gastric subepithelial GIST was programmed for LECS tumor resection. Endoscopically the tumor was superficially dissected. Intragastric laparoscopic deeper dissection was performed and with linear cutting staplers a tumor of 31 mm was resected with negative margins. Surgical time was 58 minutes and operative minimal blood loss was obtained. The patient showed adequate post-operatory evolution since day one.
Conclusion:
LECS is an alternative for gastric SMT resection since it preserves the stomach with less operation time and adverse effects. This step by step surgical technique description confirms the safety and feasibility for its performance in middle-low income countries since it offers an appropriate functional outcome as well as an uneventful postoperative course. Nevertheless, more procedures need to be performed in order to evaluate accordingly for other parameters such as pain, cosmesis and long-term complications.

Keywords: Laparoscopy, Endoscopy, Gastrointestinal Stromal Tumor, Surgical oncology.

Resumen

Introducción:
Los tumores gástricos submucosos (TGS) tradicionalmente eran manejados mediante cirugía abierta o laparoscópica. No obstante, dichos enfoques representaban una alta moribilidad estructural y funcional. La cirugía laparoscópica-endoscópica cooperativa intragástrica (CLEC) es un procedimiento mínimamente invasivo que permite una resección conservadora de los TSG. Se han expuesto varios casos de resección de TGS usando CLEC sin embargo, aún hay poca literatura al respecto. Este trabajo presenta la cirugía CLEC como una alternativa para la resección de tumores gástricos submucosos aplicado a un caso.
Reporte de caso e intervención:
Paciente femenina adulta programada para CLEC por tumor submucoso del estómago. El tumor fue disecado circunferencialmente a través de instrumentación endoscópica. Mediante laparoscopia se realiza disección profunda y resección del tumor con márgenes negativos y mínima hemorragia. Adecuada evolución postoperatoria.
Conclusión:
CLEC es una alternativa para la resección de tumores gástricos submucosos, evidenciando mayor preservación gástrica con menos tiempo quirúrgico y complicaciones. Esta descripción de la técnica confirma su seguridad y su factibilidad para su ejecución en países de medianos-bajos ingresos. No obstante, se deben realizar más procedimientos con el fin de evaluar parámetros como dolor, resultados cosméticos y complicaciones a largo plazo.

Palabras clave: Laparoscopia, Endoscopia, Tumor estromal gastrointestinal, Cirugía oncológica.

Introduction

Gastric tumors, including gastrointestinal stromal tumors (GIST), have traditionally been treated with laparoscopic surgery or open resection. These surgical techniques offer negative margins tumor resection, which in most cases is curative. However, it requires wide tissue resection, which raises the risk of structural or functional alterations, especially for submucosal tumors (SMT) or those located in the lesser curve or esophagogastric junction [1-4].

Intragastric surgery techniques arise as tissue conservative surgeries for the resection of gastric neoplasms, especially gastric SMT. Minimally invasive intragastric surgery (IGS) was first described by Ohashi in 1995 [5] for early gastric cancer, with 3 ports placed in the gastric lumen. Then, in 2008, Hiki et al. [2] developed a laparoscopic and endoscopic cooperative surgery (LECS) for GIST resection. Finally, in 2011 Na et al. [6] presented a single port intragastric surgery.

Laparoscopy offers a conservative approach for the gastric tumor resections. However, through this technique it is not possible to accurately determine tumor margins, leading to unnecessary tissue resection and higher risk of blood vessels and nerves injury, which represents higher morbidity for the patient [7]. On the other hand, endoscopy allows tissue conservative tumor margins delimitation, blood vessels and nerves identification and preservation. It represents a safer approach for gastric tumor resections [7]. Nevertheless, endoscopically resections result insufficient for bigger tumors, and increases the risk of positive margins [8]. Combining endoscopy and laparoscopy, like in LECS, offers the combination of the strengths of intraluminal and intraperitoneal procedures in addition to diminishing the weaknesses and limitations of each separate approach. LECS entails the en-bloc resection with minimal margins, and gastric wall, blood vessels and nerves preservation. Hence, it is considered a feasible procedure for gastric SMT and GIST [2-4,9-12].

LECS has been performed in our institution since 2018. It is considered a relatively recent surgical technique which is why there is limited literature that encompass this surgical approach especially in Colombia and Latin-America. Understanding and applying LECS improves the knowledge and scope of this technique, offering accurate strategies for the patient's management. Currently, this technique has been performed in early gastric cancer resections and for the treatment of duodenal and colorectal tumors [7]. Given that the LECS approach is widely being carried out and its use is rapidly increasing, the aim of this work is to show the critical steps for performing this combined endoscopic and laparoscopic procedure and the feasibility of this surgical approach in a middle-low income country.

Case presentation

A 51-year-old female patient, presented with a subepithelial gastric antrum lesion in the fourth ultrasonographic layer of 30 mm, confirmed by endoscopic ultrasonography, compatible with GIST. Additionally, the patient presented a history of abdominal pain, mainly localized in the left upper quadrant and anorexia. The patient does not present a previous abdominal surgery in her medical record. Results of abdominal computed tomography showed negative lymph nodes and no other intra-abdominal abnormalities. The patient was taken to LECS with no complications. Average surgical time was 58 minutes with minimal intraoperative bleeding. The patient had a hospital stay of 1 day and oral intake was tolerated on the same day. Final pathology results showed a very low risk GIST of the fourth ultrasonographic layer with 31 mm size and less than 5 mitosis.

LECS Surgical Technique

Preoperative antibiotics were administered 30 minutes before incision. Under general anesthesia, the patient was placed in supine lithotomy position. The surgeon was positioned between the patient's legs, and the assistant was positioned to the patient's right. The assistant endoscopist was at the patient's head. A camera port was inserted into the umbilicus. A 5-mm laparoscope was inserted into the abdominal cavity. Two additional ports (one 12-mm port and one 5-mm port) were placed at the right upper and left upper quadrants respectively, with visual assistance of the laparoscopic image under 15-mmHg pneumoperitoneum. After exploration of the abdominal cavity, the assistant performed endoscopy and insufflated the stomach with CO2. Utilizing both laparoscopic and endoscopic views, the two balloon-tipped trocars (5- and 12-mm in diameter) were placed into the stomach (Figure 1).

Figure 1. Intragastric port placement.

The balloons on the trocars were inflated and the pneumoperitoneum was partially released to a pressure of 10 mmHg, allowing the stomach to be retracted against the anterior abdominal wall. Once this was achieved, using the endoscopic view and intragastric insufflation, we were able to identify and manipulate the tumor using conventional endoscopic and laparoscopic instruments. The tumor was grasped and retracted with the biopsy endoscopic grasper (Figure 2).

This allowed the surgeon to have a free handling of the two intragastric work ports. Blood vessels around the tumor were prepared using a vessel-sealing system or ultrasonically activated device. The blood vessels and nerves area require a meticulous manipulation and should be minimized in order to prevent postoperative gastric stasis and ischemia. The negative margin resection was achieved in a safer and easy way using the free laparoscopic graspers to improve the tumor's base exposition as well as the position of the linear cutting stapler. A linear cutting stapler with either 60 or 45mm loads (green and blue) were chosen according to the thickness of the tissue in the base of the tumor (Echelon Surgical

Figure 2. A: Intragastric laparoscopic tools placement, **B:** Laparoscopic view of the intragastric port. **C:** Endoscopic view of the tumor dissection.

Stapling Reloads, Ethicon EndoSurgery®). The loads were placed through the 12-mm transgastric port. Once resected, the tumor was placed in a laparoscopic retrieval bag and an endoscopic grasper was then used to retrieve the specimen through the mouth (Figure 3).

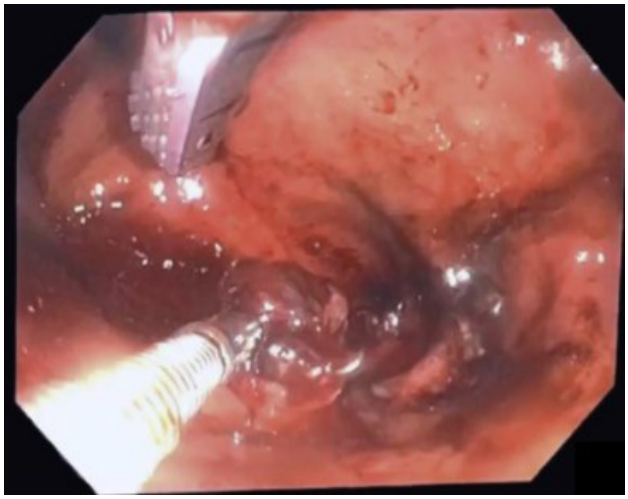

Figure 3. Endoscopic view of intragastric laparoscopic tumor resection and extraction.

Additionally, a polydioxanone 3-0 intracorporeal laparoscopic suture was then used from within the peritoneal cavity to close the gastrostomies. Finally, we confirmed the absence of air leaks at the suture line by endoscopic insufflation, and the absence of bleeding was confirmed both endoscopically and laparoscopically.

Postoperative Management

The patient received intravenous infusion with antibiotics administration for 1 day after the surgical procedure. Proton-pump inhibitors were infused for 24 hours then were continued orally for the next 6 weeks. Additionally, the patient started a clear fluid diet on postoperative day 1. The patient was discharged by postoperative day 1 given that no abdominal pain was present and tolerance to oral intake was adequate.

Discussion

The majority of gastric subepithelial lesions can be treated with wedge resection and safe margins through laparoscopic approach using a stapling device without the need of lymphadenectomy. However, when gastric lesions are located in the esophagogastric junction or in the lesser gastric curve, the patient will require a total or subtotal gastrectomy. Using endoluminal approaches, this type of major gastric resection can be avoided. Transgastric surgery or so called endoluminal gastric surgery, is based on the common concept of the insertion of an endoscope and surgical instruments into the gastric lumen percutaneously, with some technical variation. Hiki et al. [2] invented a combined method with a per-oral endoscopic and laparoscopic approach, which is referred to as laparoscopic and endoscopic cooperative surgery [9-12].

There are several operative techniques described in the literature. The different approaches are classified in three categories; depending on the role of the endoscopic and laparoscopic team. Each technique encounters its own strengths and weaknesses as described below. To start with, the first category outlines the scenario where the resection is performed primarily by the endoscopist, known as laparoscopic assisted endoscopic resection (LAER). In this particular approach, the laparoscopy team provides an extraluminal control of any complication during the tumor's resection as well as the assistance for the presentation of the tissue to the endoscopic team [7]. The second category is the endoscope assisted laparoscopic resection (EALR), where the tumor resection is undertaken under laparoscopic control, but the endoscopic team has a major role in locating the tumor, monitoring the laparoscopic procedure and assisting with tissue exposure. In this group the most common combined technique is the endoscope-assisted wedge resection and the single port intragastric

surgery (SPIS) which is performed specifically for posterior gastric wall benign lesions [7].

SPIS was introduced by Na. et al as a variant of IGS [6]. Intragastric single port surgery has a higher risk of postoperative pain and port site herniation just like single-incision laparoscopic surgery (SILS). SPIS is performed by means of exteriorization of the gastric wall through the abdominal wall and placement of a single-port device with intragastric access. It differs from conventional laparoscopic or single-port surgery by the intragastric approach with direct endoluminal visualization of possible tumors, and the intragastric procedures capacity. On the contrary, LECS avoids the need of exteriorization of the gastric wall, with a lower cost since there is no need for a single port device. It is well known that intragastric single-port surgery can be used in obese patients. Nevertheless, it is considered insufficient in those patients with a body mass index higher than 50 kg/m2. Fortunately, in the context of morbid obesity, LECS can be considered a viable option since it overcomes this limitation [5,6,19,20].

Ultimately, the third category brings together the combined laparoscopic endoscopic resection (CLER) that consists of a simultaneous laparoscopic and endoscopic approach. LECS is classified as CLER, where the lesion is located and partially dissected via endoscopy and then completed via laparoscopy. Other variations of the technique have been described such as inverted LECS, where tumor resection and extraction are done intraluminally, with the objective of prevention of tumor dissemination in the peritoneal cavity [7]. The latter was not considered by our team given the very low risk characteristics of the patient's tumor and because we always avoid the rupture of the tumor's capsule.

LECS has several advantages in comparison to other techniques used for the resection of upper gastrointestinal tumors. In the first place, it is characterized by a highly magnified endoscopic view that helps to accurately identify structures in the soft tissue around the tumor, specifically normal muscle bands, soft connective tissue in the submucosa, and small caliber vessels. Identifying and differentiating these structures from the pseudo-capsule when performing transgastric traction aids the cutting procedure in such a way that it can be precisely accomplished no matter how irregular the tumor configuration is, just like it was shown in our case. In the second place, it allows the surgeon and gastroenterologist to sense the characteristic softness of the normal gastric muscle. Additionally, the procedure does not need hand-sew suture technique with interrupted suture in a radial pattern. Finally, successfully performed LECS technique typically proceeds with an uneventful postoperative course among a low risk of stenosis, anastomosis leakage or bleeding as well as the benefit of a shorter surgical time [13-15].

In clinical trials, laparoscopic intragastric surgery with several trocars has been used to treat gastric GIST. The largest series (n = 59) demonstrated a 29-month cumulative disease-free survival rate of 96.6% [2]. Incidence of bleeding reported in the largest series of intragastric surgery was 1.6% (1 patient). Many researchers have attempted this procedure and reported that LECS is a feasible procedure for gastric submucosal tumors (GSMTs) that can be used regardless of tumor location [13, 16-18].

The different types of laparo-endoscopic intragastric techniques described above are not recommended for lesions expanding to the esophagus, 2 cm above the z-line or for exophytic tumors. Experts limit these types of techniques for tumor diameter of 5 cm or less, due to the increased risk of tumor rupture. Our long-term patient outcome seems acceptable compared with other reports. The tumor was successfully resected

en-bloc without rupture of the tumoral capsule. Especially because pathological examination revealed a negative margin with a very low risk GIST of the fourth ultrasonographic layer, with 30 mm size and less than 5 mitosis. Therefore, there was no need for adjuvant therapy with imatinib. Certainly, LECS is considered the preferable option in carefully selected patients with subepithelial lesions or GISTs, when it is performed by a skilled laparo-endoscopic surgeon since it offers a chance to preserve the stomach, with no limitations of BMI or previous surgical interventions. [20, 21].

Another organ preserving option in the treatment of submucosal tumors is the percutaneous endoscopic intragastric surgery (PEIGS) which was reported by Kanehira et al [16]. This technique is based on performing laparoscopic intragastric surgery with several trocars to treat gastric GIST, showing en bloc enucleation and negative margins without tumor rupture in all patients. This technique has an average operation time of 172.3 minutes, which is 115,3 minutes longer than our case. Additionally, the PEIGS has a higher rate of complications as shown by the authors who reported 3 postoperative complications including one localized peritonitis, one bleeding, and one surgical site infection. We must highlight that the average tumor size was 35.6 mm, which is 4,6 mm higher than our patient's tumor size. As a final point, the survival rate is reported as 100% with a disease-free rate of 98.3% at 12 months and 96.6% at 29 months, with a follow-up period of 101 months. Based on the above, PEIGS seems to be a curative procedure as well as other aggressive resection methods such as proximal gastrectomy [21, 22]. Despite this, reasons to support LECS technique is the uneventful postoperative course contrary to PEIGS identified risks.

The results obtained in this case when using LECS technique denotes certain differences when compared to the academic information reported in literature. Ntourakis et al. [7] described an average surgical time and length of hospital stay of 120-180 minutes and 5-11.6 days respectively. In contrast, the surgical time reported in our case was almost 2-3 times lower (58 min) and the patient only required one day of hospitalization. On the other hand, blood loss was minimal, and no complications were observed, which is consistent with the data reported in literature [7].

The selection criteria of LECS procedure for this patient was based on the fact that this combined technique has more strengths and less weaknesses in terms of nerves and vessel injury at the same time as it allows a high rate of organ preservation. Furthermore, this technique offers oncologic negative margins for this low risk SMT avoiding the need of major gastric resections without the morbidity and the prolonged hospital stay of other organ preserving techniques.

We cannot recommend LECS with just one case. Nevertheless, with this step by step description of the technique we confirm the safety and feasibility of this minimally invasive surgical procedure. This approach can salvage the entire stomach of patients with SMT lesions in the lesser curve and in the esophagogastric junction, who otherwise would have to undergo total or proximal gastrectomy; offering not only an appropriate functional outcome but also a fast and uneventful postoperative course. We need to perform more cases for future comparative studies in terms of parameters such as pain, complications, oncological results and cosmesis.

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