

Endoscopy-Assisted Laparoscopic Resection for Gastric Submucosal Tumors Located Within 5 cm Away from The Esophagogastric Junction; Combined Surgery at Difficult Localization

Özofagogastrik Bileşkeye 5 cm Yakınlıkta Yerleşen Mide Submukozal Tümörlerde Endoskopi Destekli Laparoskopik Rezeksiyon; Zor Lokalizasyonda Kombine Cerrahi

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ABSTRACT

Objective: Removal of the lesion with safe surgical margins is often sufficient including GISTs. Endoscopic resections can become challenging or impossible if the tumor is located near esophagogastric junction. Performing gastrectomy for these mostly benign lesions will also be a rather overtreatment method in most cases. Therefore, alternative minimal invasive resection techniques and their reliability should be evaluated.

The aim of this study is to evaluate the efficacy and safety of endoscopy-assisted laparoscopic transgastric resection method in proximally located submucosal tumors.

Method: Transgastric combined endoscopic and laparoscopic surgery (CELS) using an intragastric port was performed in one patient and transgastric CELS with gastrotomy was performed in six patients who had tumor located near esophagogastric junction at Ankara City Hospital between February 2019 and February 2020.

Results: Three male, and 4 female patients with an average age of 45.8 years (range 25-70) were included in the study. In five of the cases, four ports and Nathanson retractor were used for liver retraction. Three ports were used in one patient, and the stomach was suspended with traction suture. In one patient, 5 ports were used. The average operation time was 88 minutes (range 59-140 min). While gastrostomy line was closed with linear stapler in two patients, laparoscopic suturing method was used in the remaining patients. Intraoperative complication was not seen in any patient.

Conclusion: We are in the opinion that the laparoscopic transgastric resection approach for submucosal tumors close to the gastroesophageal junction, is a feasible and safe method, when used in combination with endoscopic guidance.

Keywords: Esophagogastric junction, gastric submucosal tumors, transgastric combined endoscopic and laparoscopic surgery.

Öz

Amaç: Submukozal tümör güvenli cerrahi sınırlar ile lezyonun çıkarılması genellikle GIST'ler dahil olmak üzere yeterlidir. Endoskopik rezeksiyonlar, tümör özofagogastrik bileşkenin yakınında bulunduğu zor veya imkansız hale gelebilir. Çoğunlukla iyi huylu bu lezyonlar için gastrektomi yapmak gereğinden fazla bir tedavi yöntemi olacaktır, bu nedenle alternatif minimal invaziv rezeksiyon teknikleri ve bunların güvenilirliği değerlendirilmelidir. Bu çalışmanın amacı, proksimal yerleşimli submukozal tümörlerde endoskopi yardımıyla laparoskopik transgastrik rezeksiyon yönteminin etkinliğini ve güvenliğini değerlendirmektir.

Yöntem: Şubat 2019 - Şubat 2020 tarihleri arasında Ankara Şehir Hastanesi'nde özofagogastrik bileşke yakınında submukozal tümörü olan hastalardan 1'ine intragastrik port ile transgastrik kombine endoskopik ve laparoskopik cerrahi (CELS), diğer 6 hastaya gastrotomi ile Transgastrik CELS uygulandı.

Bulgular: Yaş ortalaması 45,8 yıl (25-70 aralığında) olan 3 erkek ve 4 kadın hasta çalışmaya dahil edildi. Vakaların beşinde, karaciğer retraksiyonu için dört port ve nathanson retraktörü kullanıldı. Bir hastada üç port kullanıldı ve mide traksiyon sütürü ile askıya alındı. Bir hastada 5 port kullanıldı. Ortalama operasyon süresi 88 dakika (dağılım 59-140 dakika) idi. İki hastada gastrostomi hattı lineer stapler ile kapatılırken, kalan hastalarda laparoskopik olarak sütürasyon sağlandı. Hiçbir hastada intraoperatif komplikasyon görülmedi.

Sonuç: Gastroözofageal bileşkeye yakın submukozal tümörler için laparoskopik transgastrik rezeksiyon yaklaşımının endoskopi ile birlikte kullanıldığında uygulanabilir ve güvenli bir yöntem olduğu kanaatindeyiz.

Anahtar kelimeler: Özofagogastrik bileşke, mide submukozal tümörler, transgastrik kombine endoskopik ve laparoskopik cerrahi.

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INTRODUCTION

With the increasing use of upper gastrointestinal endoscopy, the incidence of tumors detected incidentally in the stomach has increased gradually. Some of these tumors are gastric submucosal tumors and have a wide range from ectopic pancreatic tissue to gastrointestinal stromal tumors (GISTs). Since these tumors are located under a normal mucosa, it is not possible to differentiate them endoscopically. However, these tumors can be distinguished from each other by immunohistochemical evaluation and pathological examination⁽¹⁾ but bite biopsy often does not give reliable results. Although most of these tumors have benign behavior and asymptomatic, it should be remembered that some of them may be malignant like some GISTs and leiomyosarcoms. Therefore, some algorithms have been proposed regarding the management of these tumors. While these algorithms state that asymptomatic lesions smaller than 2 cm can be followed endoscopically, they suggest that biopsy-proven GISTs should be removed regardless of size⁽²⁾. Resection is also recommended for symptomatic lesions, lesions bigger than 2 cm or those showing potential for malignancy during follow-up.

Gastric submucosal tumors grow inside the gastric wall and rarely cause lymph node metastasis. Therefore, removal of the lesion with safe surgical margins is often sufficient including GISTs⁽³⁾. In addition to endoscopic resection techniques, various techniques have been described where the tumor needs to be surgically removed. Gastrectomy, gastric wedge resection (exogastric), transgastric resection or transluminal (intragastric) resection are some of these techniques⁽⁴⁾. One of these surgical techniques can be selected for the patient depending on the location and size of the tumor and these resections can be performed by open or laparoscopic method. However, the known advantages of the laparoscopic method have been accepted by many surgeons, so it is more preferable today⁽⁵⁾.

In tumors located in the proximal region of the stomach (cardia, fundus) resection can be a bit challenging. Wide resections may cause stenosis due to the presence of the esophagogastric junction and thus pose a risk. Endoscopic resections can become challenging or impossible even if endoscopy can be confronted with a tumor mostly in retroflexion position. Performing gas-

trectomy for these mostly benign lesions will also be a rather brutal treatment method in most cases. Therefore, alternative minimal invasive resection techniques and their reliability should be evaluated.

The aim of this study is to evaluate the efficacy and safety of endoscopy-assisted laparoscopic transgastric resection method in proximally located submucosal tumors.

MATERIAL and METHODS

A retrospective review of all patients undergoing endoscopy- assisted laparoscopic surgery for gastric submucosal tumors located near esophagogastric junction at Ankara City Hospital between February 2019 and February 2020 was performed. All consecutive cases were identified using the prospectively maintained surgical database. Patient, operative, and tumor characteristics were obtained via chart review. Operative notes and preoperative imaging modalities were also reviewed. Since it is a retrospective evaluation, only operation consent was obtained from the patients before the procedure.

All patients were diagnosed by endoscopy and after that computed tomography (CT) and endosonographic ultrasound (EUS) were performed for differential diagnosis. The surgical decision was made as stated above, in accordance with the recommendations of the guidelines. The patient's own decision was also taken into consideration.

Endoscopy and laparoscopy teams worked together in the operating room and all cases were operated by the same surgical team. Transgastric resection was performed either through a gastrostomy incision or using intragastric ports;

Combined endoscopic and laparoscopic transgastric surgery (CELS) using intragastric ports: First, the abdomen was entered using the Hasson technique, and a 10 mm port was inserted through the umbilicus. The stomach was inflated with the endoscope and one 12 mm- and two 5 mm- ports were inserted into the abdomen to provide an endoscopic image of the larger curvature. Using an extra 5 mm port, jejunum was clamped from the distal to Treitz ligament with non-crushing forceps and thus preventing air leakage into

the intestines. A total of five ports were used. Gastrotomy was performed with cautery, then stomach was hung on the abdominal wall with 3/0 silk sutures and the ports inserted directly into the stomach. Stomach was then explored with 5 mm camera. The mass located in the proximal part was detected using endoscopic guidance, suspended with laparoscopic forceps, then resected with white cartridge endo-GIA stapler (Endocutter 60 staple, white cartridge; Ethicon Endo-Surgery) and the specimen removed with an endoscopic mesh basket. Port sites on the stomach were closed with 3/0 PDS and 3/0 prolene (Figure 1).

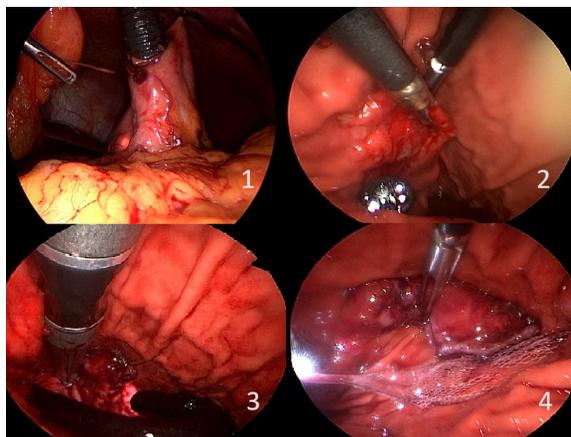


Figure 1. Transgastric combined endoscopic and laparoscopic surgery (CELS) with intra-gastric port (1-intra-gastric port placement and traction of the stomach to the abdominal wall with a suture; 2- The mass located in the proximal part is detected by endoscope guidance and hung with laparoscopic forceps; 3- Mass resected with white cartridge laparoscopic stapler ; 4- The specimen removed with an endoscopic mesh basket)

Transgastric CELS with gastrotomy: A 12 mm port was inserted from the left side of the umbilicus with the Hasson technique.

A 5 mm port was inserted from the upper right and a 10 mm port from the upper left quadrant. In one case, the stomach was hung on the abdominal wall with traction suture. In subsequent cases, the subcostal 5mm assistant port and the subxiphoid Nathanson retractor were used. The stomach was examined by endoscope and the mass in the cardia was detected and the gastrotomy line identified. Stomach was opened anteriorly with cautery or ligasure from the proximal corpus. The mass on the cardia was tractioned with forceps and resected with white cartridge endo-GIA stapler. The gastrotomy line was closed with green endo-gia stapler (Endocutter 60 staple, green cartridge; Ethicon Endo-Surgery) in the first two cases. Subsequent cases were closed with double layer sutures.

All tumors were processed and analyzed by the same pathologist. Stromal tumors were routinely subjected to immunohistochemical analysis to distinguish leiomyoma and GIST (CD117, CD34, smooth muscle actin, desmin, S-100, and MIB-1/Ki-67). Tumors were evaluated for histologic features, size, grade, and surgical margins (Figure 2).

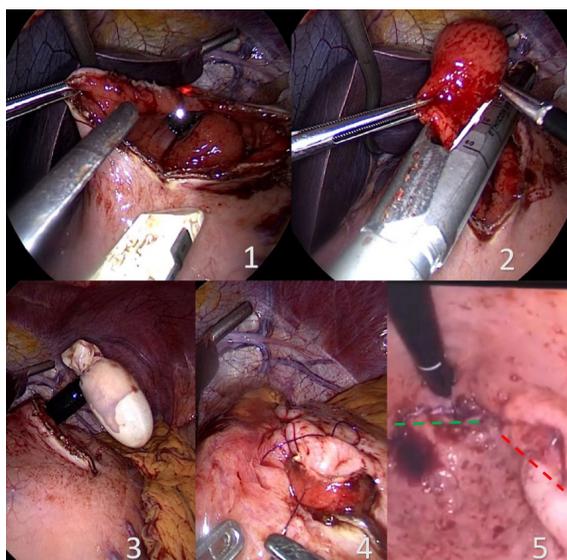


Figure 2. Transgastric CELS with gastrotomy (1- Stomach is opened anteriorly with cautery or ligasure from the proximal corpus; 2- The mass on the cardia is tractioned with forceps and resected with white cartridge laparoscopic stapler; 3- After the specimen was put in the finger of the glove, it was removed with endoscopy by holding it with snare; 4- The gastrostomy line was closed with double layer sutures; 5- Endoscopic visualization of the resection margine (green dotted line) and visualization of the gastrostomy line (red dotted line)

RESULTS

Three male and 4 female patients with an average age of 45.8 years (range 25-70) were included in the study. Three of the cases described dysphagia-like symptoms, while one had epigastric pain. One patient was detected while investigating the etiology of anemia. In the other two patients, the lesion was detected incidentally. Only three patients had preoperative comorbidities (hypertension, chronic obstructive pulmonary disease, coronary artery disease). None of the patients had a previous history of abdominal surgery.

All submucosal lesions were detected with gastroscopy. EUS was performed to six of the patients preoperatively and only three patients underwent CT examination. All of the tumors were in the localization less than

3 cm from the esophagogastric junction. This distance was evaluated during endoscopy. Gastrosopies were performed by an endoscopist specialized in endoscopic surgical resection, and after evaluation of the lesion by EUS or CT, lesions that were not considered suitable for endoscopic resection were directed to surgery.

All patients underwent endoscopy-assisted laparoscopic transgastric resection and no conversion to open surgery was required. In six cases, gastrostomy incision was used for transgastric resection, while in one patient, resection was performed using intragastric ports. In five of the cases, four ports and a Nathanson retractor were used for liver retraction. While three ports were used in one patient, the stomach was suspended with traction suture. In one patient, 5 ports were used. The average operation time was 88 minutes (range 59-140 min). While gastrostomy line was closed with linear stapler in two patients, laparoscopic hand sewing method was used in the remaining patients. No patient had intraoperative complications. Only three patients had a drain left at the end of the operation.

Enhanced recovery after surgery (ERAS) protocols was applied to all patients. Permanent nasogastric and urinary catheters were not used in any patient. Drains

were withdrawn on the first or second postoperative day. Liquid meal was started on the postoperative first day and its amount was gradually increased. Pneumonia was observed in only one patient. Apart from this, no complication was observed in any of the patients. The average length of hospital stay was 4.8 days (range 4-8 days). Pathological diagnosis was leiomyomas in five of the patients, while the diagnosis was reported as GIST in two patients. The average tumor diameter was 26 mm (range 10-37mm). The surgical margin is safe in all patients.

Table 1 shows clinical characteristics, preoperative assessment, operative and postoperative data of all patients.

DISCUSSION

With the widespread use of endoscopy and endosonography the number of gastric lesions detected has also increased⁽⁶⁾. The issue of which of these masses is of clinical importance, which lesions can be followed and should be removed has been the framework of many studies. The result of these studies is that lesions smaller than 2 cm and asymptomatic can be followed and the other tumors or biopsy-proven GISTs must be

Table 1. Clinical characteristics, preoperative assessment, operative and postoperative data of all patients.

Patient's no:	1	2	3	4	5	6	7
Age (year)	25	47	60	43	24	52	70
Gender	Male	Female	Male	Female	Female	Female	Male
Comorbidities	None	None	COPD	CAD	None	None	COPD
Symptom	Dysphagia	Dysphagia	Dysphagia	None	Epigastric pain	None	Anemia
Pre-op EUS	None	M.propria	M.propria	M.propria	M.mucosa	M.propria	M.mucosa
EUS tumor size (mm)	None	30x15	20x15	24x20	21x6.2	10	35
CT tumor size (mm)	30x20	30x23	None	None	20x14	None	30
Operation time (min)	140	105	77	95	59	65	75
Port number	5	3 + gastric traction suture	4+nathanson	4+nathanson	4+nathanson	4+nathanson	4+nathanson
Closure of gastrostomy	Suture	Stapler	Stapler	Suture	Suture	Suture	Suture
Drain	1	1	1	None	None	None	None
Conversion	None	None	None	None	None	None	None
Diet	ERAS	ERAS	ERAS	ERAS	ERAS	ERAS	ERAS
Complication	None	None	Pneumonia	None	None	None	None
Length of stay (days)	5	4	8	4	5	4	4
Pathology	Leiomyom 28x21 mm	Leiomyom 32x17 mm	Leiomyom 25x18 mm	Leiomyom 30x25 mm	Leiomyom 20x15 mm	GIST 10x6 mm	GIST 37x25 mm

removed, regardless of their size ⁽⁷⁾. Often the patient's symptoms, endoscopy, endoscopic biopsy, EUS and CT evaluation will help to make this decision. Sometimes, in the presence of a followable lesion, the patient's own will may affect this decision.

There are several methods that can be performed in patients who have decided to undergo surgery, and thanks to the developments in minimally invasive surgery in recent years, most of these methods are now performed laparoscopically. Since these lesions are mostly benign and rarely require lymph dissection, it is sufficient to remove them with safe surgical margins ⁽⁸⁾. Basically, the size and location of the lesion is effective in deciding the surgical method to be performed. However, removal of lesions close to the upper or lower gastric sphincters with limited resection can be challenging due to the risk of disruption and narrowing of the sphincter ⁽⁹⁾. Therefore, in such tumors, it is very important not to disrupt the anatomy of the sphincter, and to perform resection without compromising oncological principles by resection of minimal gastric tissue.

We mostly prefer endoscopic resection options for these types of lesions. However, in tumors close to the gastroesophageal junction, it is not possible to work in a straight position, and the endoscope often remains retroflexed, making the procedure very difficult. Therefore, although the procedure is endoscopically initiated in all tumors close to the junction, the laparoscopic surgery team is ready to intervene and is included in the procedure when necessary. In such cases, we prefer endoscopy-assisted laparoscopic surgery because we believe that it has some advantages, especially in tumors close to the gastroesophageal junction ⁽¹⁰⁾.

The low number of cases in our study is a disadvantage, but even these cases have shown us the following;

- Endoscopy is very useful both in localizing the tumor and in maintaining the integrity of gastroesophageal junction during resection with staples and should be used throughout the procedure.
- This option is especially useful in submucosal tumors with an intragastric growth pattern. It is not suitable for exophytic tumors that can be resected with stapler and gastric wedge resection.
- We completed our first case using intragastric ports. However, after locating ports on stomach,

we fixed the large curvature with traction sutures on the abdominal wall because of the absence of a balloon trocar. To prevent bowel dilatation with endoscopic insufflation, we had to enter another port to clamp the jejunum distal to the Treitz. The duodenum balloon catheter used in the study performed by Tagaya et al. ⁽¹¹⁾ can be considered as an alternative to the jejunal clamp to prevent gas insufflation into the intestines. We believe that materials such as duodenum balloon catheter and balloon trocar in addition to conventional laparoscopic instruments, may be difficult to insert through intragastric ports for the resection of intragastric lesions.

- While our first operation was intragastric resection, one of the biggest reasons for continuing with transgastric resection later was the fact that our intragastric port application was much more challenging than the transgastric resection due to the ports entered along the major curvature and limitations of left subcostal margin and the difficulty of triangulation, which is the main working principle of laparoscopy. Because of intragastric port entry points and trocar angles are perpendicular, suturing of gastric port locations was also more difficult than transgastric procedure.
- Transgastric resection provided wider point of view and easier visualization of the mass in our cases. Although the number of cases is not high, the case that we performed intragastrically lasted 140 minutes, but the longest duration was 105 minutes for the cases we performed transgastric resection, and it was still shorter than our intragastric resection time. In the study of Tagaya et al. ⁽¹¹⁾ the mean operation time was 168 ± 33.1 minutes.
- For the closure of anterior gastrotomy, although we used stapler in two cases, we closed anterior gastrotomy with a double layer suture in other five patients because of the need for clip-suture procedures in the stapler line due to bleeding. R0 resection margin was achieved in all patients and there was no capsule injury or deterioration of mass integrity. Although these masses can also be removed by enucleation, high recurrence rates have been reported for GIST with this method ⁽¹²⁾.

Bedard et al. ⁽¹³⁾ suggested that stenosis may result after resection with stapler, due to excess tissue loss in the gastro-esophageal junction and proposed repair via

cutting and suture and bougie tube techniques⁽¹³⁾. However, in our study, dysphagia was not observed in any patient during postoperative and control follow-ups. Also, during resection with staples, the endoscope acts as a bougie tube by passing the gastroesophageal junction and staying in the stomach. Villano et al. stated in their study that resection is very difficult or impossible in patients with an endophytic (intra-gastric) growth pattern using a standard laparoscopic approach, and this can be overcome by creating an intra-gastric port⁽¹⁴⁾. We think that tumor localization can be determined with transgastric approach by performing it under endoscopic guidance. In other words, we use the endoscope for tumor localization and also as a bougie tube.

We also think that the transgastric approach has some advantages over the intra-gastric approach. First of all no sutures or balloon trocars are needed to hang the stomach on the abdominal wall. Secondly, triangulation, which is the working principle of laparoscopy, is easier in the transgastric approach. Thirdly, intra-gastric approach is a challenging approach due to staying at upright angles during port closure of the intra-gastric port entrance with staples or sutures, whereas in the transgastric approach, the gastrotomy line is sutured more easily.

Although it was thought that gastric fluid might cause abdominal contamination in the transgastric approach, none of our patients had a clinical manifestations of an intra-abdominal infection that required use of an imaging method or intervention. Except for one of our patients with pneumonia, antibiotherapy was not required. We started liquid food for all of our patients at the postoperative 4th hour. In pathological examination, R0 resection margin was achieved in all of our patients. We did not use postoperative nasogastric drainage or urinary catheter in any of our patients.

Conclusion

We strongly suggest laparoscopic transgastric resection approach for submucosal tumors close to the gastroesophageal junction, because it is a feasible and safe method, when used in combination with endoscopic guidance.

Ethics Committee Approval: This Study is designed retrospectively, so Ethics Committee Approval was not taken.

Conflict of Interest: No conflict of interest was declared by the authors.

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Informed Consent: This manuscript is a retrospective study.

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