

# Total inverse transgastric resection with transoral specimen removal

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## Abstract

**Background** Laparoscopic local excision is accepted for gastrointestinal stromal tumors (GIST) and benign lesions of the stomach. Yet, tumors at the gastroesophageal junction, on the posterior wall, or in the distal antrum are difficult to approach. Such tumors often must be exposed via gastrotomy or using a rendezvous maneuver. Our method of total intragastric laparoscopic resection using ‘pneumogastrum’, rigid laparoscope, and conventional laparoscopic instruments is described in an intuitive video.

**Methods** Two cases of total inverse transgastric resection involved resection of a submucosal GIST, one at the front wall of the cardia and the other on the posterior wall of the antrum. The third case required excision of a large

prepyloric cystic lesion leading to a gastric outlet stenosis. After insertion of three trocars under laparoscopic control, a further trocar was introduced into the stomach and ‘pneumogastrum’ was established. Two additional 5-mm trocars were intragastrally placed. Intragastric endoscopy with a rigid optic provided an excellent view. The tumor was exposed resected with a linear stapler. The specimen was inserted into an Endo Pouch™ which was sutured to an orally inserted gastric tube. The Endo Pouch™ was gently pulled transorally. After removal of the intragastric trocars, the entrance points were laparoscopically closed.

**Results** From the first and second cases, we retrieved GIST tumors. In the third case, we retrieved a gastritis cystica profunda. Postoperative course was uneventful.

**Conclusions** Gastric GIST should be resected laparoscopically if negative margins are safely achieved regardless of its size. Tumors at the frontwall and exophytic backwall GIST are addressed by laparoscopic wedge resection. Tumors at the gastrojejunal junction, in the prepyloric region, and fundus as well as submucous GIST of the gastric backwall are best approached by intragastric laparoscopic resection. Transoral specimen retrieval is an interesting option in smaller tumors.

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Sebastian H. Lamm and Daniel C. Steinemann shared first and contributed equally to this study.

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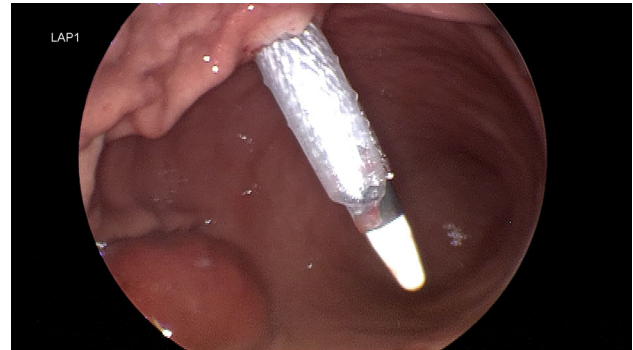
Laparoscopic wedge resection is largely accepted for treatment of gastrointestinal stromal tumors (GIST) and benign lesions of the stomach. However, tumors located near the gastroesophageal junction, on the posterior wall, or in the distal antrum are difficult to locate and approach laparoscopically, and such tumors often must be exposed via gastrotomy [1]. Alternatively, a laparoscopic–endoscopic

rendezvous maneuver can be used to visualize tumor borders and perform either laparoscopic wedge resection under endoscopic guidance or intragastric resection under laparoscopic control [2, 3]. Reports have also described positioning of an intragastric trocar to enable hybrid laparoscopic and endoscopic resection with gastroscopic assistance [4–7]. Such techniques allow the use of conventional laparoscopic instruments, such as stapling devices, for intragastric tumor resection [8]. Here, we describe our method for total intragastric laparoscopic resection using ‘pneumogastrum’ with visualization, a rigid laparoscope instead of a flexible gastroscope, and conventional laparoscopic instruments.

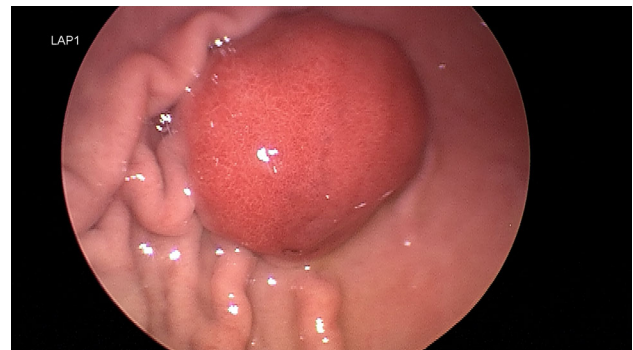
## Methods

Between April and November 2013, three patients with intragastric lesions underwent total inverse transgastric resection with transoral specimen removal. Two cases involved resection of a submucosal GIST, one at the front wall of the cardia close to the angle of His, and the other on the posterior wall of the antrum. The third case required excision of a large prepyloric cystic lesion due to gastritis cystica profunda leading to a gastric outlet stenosis. Each patient underwent a preoperative gastroduodenoscopy. Laparoscopy was performed under general anesthesia with administration of single-shot antibiotic prophylaxis with cefazolin. Patient was put in the French position. After pneumoperitoneum establishment, three 5–12-mm trocars were inserted based on the requirements and localization of the tumor. With a stay suture placed in the front wall of the stomach, it was approximated to the abdominal wall. Under laparoscopic control, a trocar sleeve and Veress needle were punctured directly through the abdominal wall into the stomach (Fig. 1). Through the sleeve, a 12-mm Verastep™ trocar (Covidien plc., Dublin, Ireland) was introduced into the stomach and ‘pneumogastrum’ of 12 mmHg was established. Using the same technique,

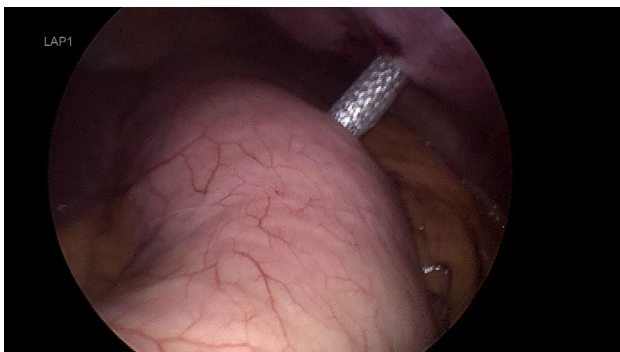
under laparoscopic control, two additional 5-mm trocars were intragastrally placed according to the tumor localization (Fig. 2). Intra-gastric endoscopy with a rigid 5-mm 30° optic provided an excellent view. The tumor was exposed using a 5-mm endo grasper (Fig. 3) and resected stepwise with up to three 45-mm reloads (3–4 mm) of a linear endo stapler (Fig. 4). The stapler line was controlled for bleeding and possible bleedings were overstitched using Vicryl 3-0 thread with extracorporeal knotting. The specimen was inserted into a 3 × 6 inch Endo Pouch™



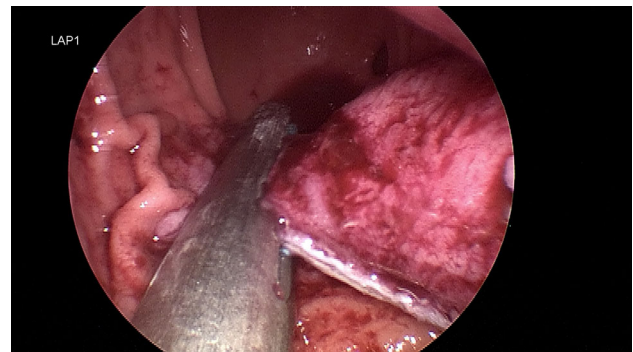
**Fig. 2** Trocar introduction into the stomach, controlled from inside the stomach



**Fig. 3** GIST tumor at the posterior wall of the antrum (second case)



**Fig. 1** Laparoscopic control of intragastric trocar introduction



**Fig. 4** Resection of GIST tumor by intragastric stapling

(Unimax Medical Systems Inc., Taipei, Taiwan), a gastric tube was transorally inserted, and the Endo Pouch™ suture was threaded through the gastric tube side openings and knotted to fix the Endo Pouch™ to the gastric tube. Then the Endo Pouch™ was gently pulled transorally, the intragastric trocars were removed, and the entrance points at the anterior stomach wall were laparoscopically closed with Vicryl 2-0 running sutures. The pneumoperitoneum was deflated and the remaining trocars were removed.

## Results

From the first and second cases, we retrieved GIST tumors (pT2) with diameters of 26 and 21 mm, respectively. In the third case, we retrieved a 25 × 15 × 13 mm prepyloric specimen containing a gastritis cystica profunda. All three patients experienced uneventful postoperative courses.

## Conclusions

Local excision of benign lesions and GIST in the stomach is a well-accepted practice. The National Cancer Care Network Guidelines (NCCNG), the guidelines of the Japan Society of Clinical Oncology (JSCO), and the consensus conference 2004 of the European Society for Medical Oncology (ESMO) all agree that GIST should be resected with an intact pseudocapsule and negative microscopic margins, with all possible measures taken to avoid tumor rupture. There are reportedly no benefits to formal lymph node resection or wider resection [9–11]. Compared to the laparoscopic resection of smaller tumors, laparoscopy for GIST of over 5 cm in diameter may be considered more technically challenging [12]. However, if tumor rupture can be safely prevented and complete resection is achievable, there is no formal contraindication for laparoscopic resection in such cases [9]. Recent studies have reported no differences in oncological safety and long-term oncological outcome between laparoscopic and open resections of GIST, including a systematic review comparing 381 laparoscopic versus 384 open procedures [13, 14].

The most commonly performed laparoscopic technique for gastric GIST is a wedge resection. The systematic review by Koh et al. [13] reported that this procedure carried a conversion rate as low as 4.7 %. The wedge resection is technically uncomplicated for an experienced laparoscopic surgeon and has been successfully performed for tumors measuring up to 19 cm in diameter. The largest tumors resected with this procedure have been lying subserosal and have had a pedunculated shape [14–17]. Localization of submucosal GIST may be facilitated using additional intraoperative gastroscopic guidance. With

endoscopic assistance, the half-circumference of the tumor is laparoscopically dissected neuromuscularly. The mobilized GIST can then be exteriorized and resected using a laparoscopic stapler [18–20]. GIST of the gastric back wall with an exophytic subserous growth pattern that can be clearly visualized laparoscopically may be resected without endoscopic control. Giant GIST of the greater curvature are also amenable to gastric sleeve resection [21].

Lesions near the gastroesophageal junction, the prepyloric area, and the fundus are difficult to reach by laparoscopic wedge resection. Furthermore, it can be challenging to avoid a stenosis. GIST in those locations, as well as submucous tumors of the gastric back wall, can best be approached via anterior gastrotomy, followed by tissue-saving-stapled wedge resection from the inside [22, 23]. Reports have described the use of the DaVinci surgical system (Intuitive Surgical Inc., Sunnyvale CA, USA) for wedge resection in the posterior wall, followed by closure with easily applicable sutures [24].

In the present case series, we describe a technique in which gastrotomy is avoided by placement of intragastric trocars. This method enables optimal visualization of the critical anatomic structures during local resection of GIST with difficult localization [25–27]. Additionally, the potential complications of gastrotomy closure are avoided and the risk of intraperitoneal contamination is minimized. Intragastric resection without gastrotomy makes the operation even less invasive.

A review of 51 cases out of seven case series of intragastric laparoscopic resection demonstrated the feasibility of this technique. Of those cases, 28 were localized in the gastroesophageal junction, 4 in the fundus, and 19 in the posterior wall. Tumor sizes ranged between 1.3 and 7.5 cm. Of the 51 resections, 3 (5.9 %) had to be converted to open procedures [25]. More recently, intragastric resection using a single-incision trocar has been reported for resection of GIST of 6.5 cm in diameter and localized near the gastroesophageal junction [28]. The technique used in this case series employed optimal rigid standard laparoscopic instruments, including endo-staplers and laparoscopic suturing devices.

Most authors advocate that the intragastric procedure should be assisted by gastroscopy and transoral specimen retrieval [25]. For larger tumors, an alternative route of specimen retrieval is via the transgastric trocar through the abdominal wall [28]. For the resection of large GIST, one author has described morcellation of the tumor in the removal bag to allow transoral retrieval [29]. However, in our opinion, morcellation prevents adequate pathological examination of the resection margin and is therefore not recommended and not in accordance with the aforementioned guidelines. In our experience, the use of a rigid laparoscopic–endoscope instead of a gastroscope optimizes

lesion visualization and exposure. Furthermore, this technique eliminates the need for gastroscopy and rendezvous maneuver. In the presently reported cases, transoral specimen removal was possible without gastroscopy. With transoral extraction, the procedure is fully laparoscopic, leaving only small trocar scars. This procedure may also reduce postoperative pain and enable faster recovery.

In summary, the available guidelines state that gastric GIST of any size should be resected laparoscopically if negative margins can be safely achieved and tumor rupture can be avoided. Tumors at the gastric front wall and exophytic GIST of the gastric back wall are typically removed by laparoscopic wedge resection. Endoluminal GIST are resected using a half-exteriorized technique with assistance of gastroscopic visualization. For GIST in difficult locations, such as the gastrojejunal junction, prepyloric region, and gastric fundus, and for submucous GIST of the gastric back wall, the best approach is by intragastric laparoscopic resection. In such cases, transoral specimen retrieval is a good option if the tumor size allows easy passage through the lower esophageal sphincter.

**Disclosures** Drs. Sebastian H. Lamm, Daniel C. Steinemann, Georg R. Linke, Dietmar Eucker, Thomas Simon, Andreas Zerz, and Reinhard Stoll have no conflicts of interest or financial ties to disclose.

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