

## Intragastric SILS for GIST, a New Challenge in Oncologic Surgery: First Experiences

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**Abstract.** *Background:* For treatment of Gastrointestinal Stromal Tumour (GIST) located in unreachable areas, such as the esophagogastric junction or pyloric ring, laparoscopic resection cannot be easily applied. We used single-incision laparoscopic surgery (SILS) for intragastric resection of GISTs. *Patients and methods:* We report on our cases (n=3) of GIST of the stomach treated with the SILS port placed intragastrically through the anterior wall of the stomach. A skin incision of only 2.5 cm was made to perform this intervention. *Results:* The patients mean age was 68.1 years (range=53-86). The mean operative time was 74.6 (range=67-82) minutes. No intra-operative complications occurred. No conversion was needed. The mean tumor size was 3.8 cm (range=2.7-6.8 cm). All patients healed without any complications. Re-alimentation was started on the third postoperative day. The mean postoperative stay was five days (range: 4-6 days). *Conclusion:* This intragastric SILS procedure for GIST is feasible and safe, and offers a benefit for further progress in oncologic surgery.

### Case Report

Surgical removal is the only curative therapy for Gastrointestinal Stromal Tumor (GIST). Traditionally, this has been achieved by open surgery. For over a decade now, laparoscopic resection of gastric GISTs is a widely accepted technique for these lesions, with proven feasibility and safety, and advantages of faster recovery, less postoperative pain, better cosmesis and shorter hospital stay. Despite these advantages, the laparoscopic wedge resection has certain limitations: GIST, located at the posterior wall or near the esophagogastric junction or pyloric ring, are more difficult. Intragastric wedge resection, which offers a direct

visualization of the tumor during resection, may be beneficial in these cases. We present our experience where a single-incision transgastric resection of gastric GIST was performed with the port placed through the anterior wall of the stomach. This technique opens up a new field for development of transgastric SILS devices.

### Patients and Methods

*Patients.* Single-incision laparoscopic intragastric wedge resection was performed on three cases at our hospital (Universitair Ziekenhuis Brussel). Preoperative diagnosis was made by endoscopy, endoscopic ultrasound (EUS) and barium-swallow imaging. Computed tomography (CT) of the abdomen was performed to determine the depth of tumor invasion, the presence of metastases and the relation with adjacent organs. Positron-emission tomography (PET) revealed the gastric lesions without metastases. In two cases, the lesions were located at the pyloric ring and in one case at the fundus of the stomach. Medical records of the patients were examined prospectively regarding operative time, time to re-alimentation, hospital stay, immediate postoperative complications, recurrence and follow-up results.

*Surgical technique.* The procedures were performed under general anesthesia with endotracheal intubation. The patients were placed in lithotomy position with the surgeon standing between the patient's legs. A 2.5-cm transverse skin incision was made at the left upper quadrant. An open technique was used to enter the abdomen. A Octoport port (Duomed®; Seoul, Korea) was inserted and a pneumoperitoneum of 12 mm Hg was created (Figure 1). A 5-mm 30° standard laparoscope was introduced through a trocar of the port. At exploration the GISTs were not visible at the stomach surface. The anterior wall of the stomach was grasped with a standard straight grasper and pulled up towards the skin incision. The SILS port was then retracted. The anterior wall of the stomach was partially exteriorized and opened with a standard coagulation hook over 2 to 3 cm. At this point several sutures were placed to attach the stomach wall to the skin (Figure 2). The internal ring of the SILS port was then introduced into the stomach and the SILS port was applied (Figure 3).

We used carbon dioxide for gastric insufflation and kept the intragastric pressure below 10-12 mm Hg. Bowel clamping was not performed and we did not encounter overdistention of the intestines.

We obtained a perfect intragastric view. The tumors were pendulant and the gastric wall could easily be held with a standard

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Figure 1. A SILS port (Octoport, Duomed) was inserted.



Figure 2. Several stitches were placed to attach the stomach wall to the skin.

straight instrument to lift up the lesion. The lesions were stapled with two or three endoscopic 45 mm linear staplers (Covidien®, Elencourt, France). The tumors were extracted through the SILS port, by opening its inlets, without contamination of the wound edges because of the presence of the wound protector. The SILS port was retracted at this level and the skin-stomach sutures were released. The incision in the anterior gastric wall was closed extracorporelly, in one layer, by hand and under direct vision, with an absorbable running suture (PDS 3.0, J & J, Ethicon®). The fascia and skin were closed with separated resorbable sutures (resp vicryl 1.0 and uncolored vicryl 4.0, J & J, Ethicon®). A nasogastric tube was inserted at the end of the operation to decompress the stomach.

**Diagnosis of GIST.** Final diagnosis was based on microscopic analysis, including immunohistochemistry with a panel of antibodies: CD (cluster of differentiation) 117, CD 34, S100, desmin, and smooth muscle actin.

## Results

Between 1997 and 2011, 34 consecutive patients presenting with a primary gastric GIST were scheduled for laparoscopic resection at our hospital. Three cases were resected by SILS. All of the resections were performed by a single surgeon with experience in laparoscopic surgery. All patients for SILS resection were male. Their mean age was 68.1 years (range=53-86 years). The mean duration of the procedure was 74.6 minutes (range 67-82 minutes). No intraoperative complications occurred. The total blood loss was less than 30 ml in all cases. The procedures were completed without the need for additional ports. There was no conversion to laparoscopic or open surgery. The nasogastric tube was removed on the second postoperative day. The patients resumed oral diet, starting with liquids, on the third postoperative day. The average postoperative hospital stay was five days (range=4-6 days). All patients recovered uneventfully. Anatomico-pathological examination confirmed

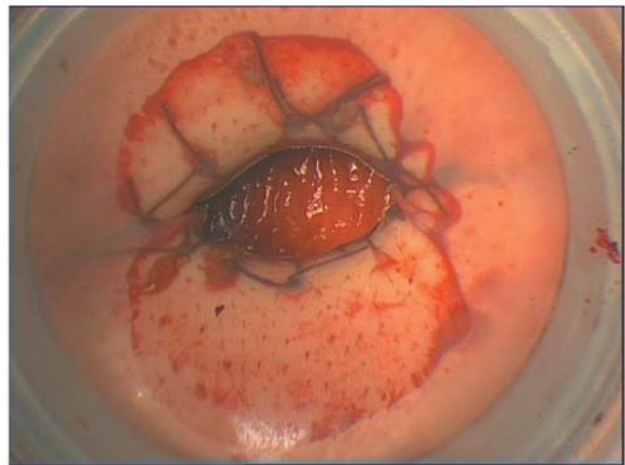


Figure 3. The internal ring of the SILS port was introduced into the stomach.

GIST and revealed complete resection of the lesion (R0). Mean tumor size was 3.8 cm (range=2.7-6.8 cm). Follow-up at 12, 15 and 20 months respectively was uneventful. Patients were extremely satisfied with the cosmetic results. There was no operative mortality or disease recurrence on follow-up.

## Discussion

GISTs are rare uncommon mesenchymal tumors that arise from the wall of the gastrointestinal tract, accounting for fewer than 3% of all gastrointestinal neoplasms. Local resection with macroscopically-negative surgical margins is the preferred and worldwide-accepted treatment of primary non-metastatic GISTs (1). Laparoscopic resection of gastric

Table I. Reports of laparoscopic intragastric surgery for gastrointestinal stromal tumours (GIST) of stomach with different trocars.

Authors (ref) (year)	Case (n)	Site	Number of trocars (n)	Mean tumor size (cm)	Resumption of diet (days)	Mean operative time (range) (min)	Mean hospital stay (days)	Compli- cations (%)	Recurrence (%)	Follow-up (months)
Ohashi <i>et al.</i> 1995	8	Posterior wall Cardia Fundus	3	1.5-3	NS	NS	NS	NS	NS	NS
Sekimoto <i>et al.</i> 1999	1	Fundus	2 (Stapling)	2	2	NS	NS	0	NS	NS
Choi <i>et al.</i> 2000	9	Posterior	No	NS	2.9	100-140	5.9	11.1	0	Up to 42
Ludwig <i>et al.</i> 2002	8	Posterior	2	1.3-3.8	4	67.1	10.2 (49-102)	12.5	0	1.5-24
Tagaya <i>et al.</i> 2002	6	Posterior Lesser curvature Greater curvature	2 or 3 (stapling)	2.4 (1.7-3.2)	1-2	168 (132-211)	9.8 (7-12)	0	0	27±11.6 (6-39)
Walsh <i>et al.</i> 2003	11	EGJ Posterior Fundus	2 or 3	2.4-5.8	NS	186 (120-320)	3-8	0	0	16.2 (1-32)
Nguyen <i>et al.</i> 2003	1	EGJ	3	2.8	NS	180	3	0	0	9
Uchikoshi <i>et al.</i> 2004	7	EGJ	3 (Enucleation or resection)	2.7-7.5	4.4 (3-7)	141.4 (95-200)	7.6	28.6	14.3	1.17-8.25
Li <i>et al.</i> 2002	3	Fundus Posterior wall		2-4	2-6	140-240	6-9	0	0	8-57

NS: Not specified in article; EGJ: esophagogastric junction.

GISTs has become a widely accepted technique, with advantages of faster recovery, less postoperative pain, better cosmesis and shorter hospital stay (2-4).

SILS is a further evolution of this minimally invasive technique that has been used for several intra-abdominal surgical procedures such as appendectomy, cholecystectomy, colonic surgery, gastric banding and sleeve gastrectomy (5-8). Only few case reports with use of extragastric gastrectomy by SILS for GIST have been described by Tom Henckens described the use of a Triport trocar (Olympus®) and double-bended instruments for extragastric wedge resection of GIST of the stomach (9). Bruna Esteban described another case with the use of a Covidien® port and endoscopic stapling to perform a wedge resection of an exophytic gastric GIST (10).

When the tumor is located at the esophagogastric junction or near the pyloric ring, the laparoscopic extragastric approach is complicated because the dissection of the stomach along the greater curvature or the formation of a gastrotomy at the anterior wall is necessary. To overcome these limitations, the intragastric approach can be used.

In 1995, Ohashi described the first laparoscopic intraluminal intragastric surgery technique for early gastric cancer using three laparoscopic trocars placed separately in the inflated gastric lumen, penetrating both the abdominal and the stomach wall, in order to perform a laparoscopic removal of a gastric lesion (11). A gastrofibroscope was

inserted orally into the stomach in order to visualize the gastric lesion on a monitor and to determine the adequate insertion points for three trocars. The tumor was extracted orally. Since then many case reports and small series have reported placing three or four laparoscopic trocars intragastrically for the resection of gastric submucosal tumors (12-20). The gastrostomies were closed with either intracorporeal sutures or extracorporeally through the abdominal incision. The results of these reported SILAS are described in Table I. Sasaki *et al.* reported a technique where a 12-mm trocar and three other trocars were placed through the same umbilical skin incision to resect a GIST using an endoscopic linear stapler after the tumor was elevated with a mini loop retractor or laparoscopic grasper. The three trocar sites were joined and closed to avoid incisional hernia (20).

In our case, we used an intragastric position of the SILS port through the anterior wall of the stomach *via* a 2.5 cm incision. This technique gave us a perfect inner view of the stomach. The specimen was extracted through this extended skin incision without contact with the peritoneum or skin to avoid spilling and recurrence. Extracorporeal suturing of the stomach was performed safely and quickly. The operation was carried out in the stomach with currently available laparoscopic instruments and laparoscopic monitoring.

Only one other report was found in the literature using the single incision laparoscopic intragastric wedge resection for

Table II. Reports of single-incision laparoscopic intragastric wedge resection for gastrointestinal stromal tumours (GIST) of the stomach.

Author (ref) Year	Case (n)	Site	Mean size (cm)	Use of endo- GIA	Resumating of diet (days)	Operative time (min)	Complications	Death	Recurrence (months)	Follow-up (months)
Jin-UK Na <i>et al.</i> 2011	5	Cardia Fundus Posterior	2.7 (2.3-3.8)	3 (1-4)	2.8 (2-3)	83.6 (70-105)	14.3%	0	0	NS
De Vogelaere <i>et al.</i> 2012, this report	3	Fundus Pyloric ring	3.8 (2.7-6.8)	2	3	74.6 (67-82)	0	0	0	12-20

NS: Not specified in article, GEJ: Gastroesophageal Junction.

gastric submucosal tumor between 2.3 and 3.8 cm by placement of a SILS port (Octoport, Duomed®, Darim, Seoul, Korea) at the umbilicus in seven patients (21). This article reported a complication rate of 14.3%. There was no recurrence or death in this previous series. The follow-up period was not specified.

Our report described this type of surgery for larger lesions (up to 6.8 cm) during a shorter operative time and we also did not report any complication or death. There was no recurrence during follow-up at 12 and 20 months (Table II). The advantage of this single-incision intragastric approach is that the dissemination of tumor cells into the peritoneal cavity is not possible in comparison with the laparoscopic technique, where rupture of the tumor during manipulation can give rise to dissemination in the peritoneal cavity and recurrence of disease. This single incision intragastric access offers a better view during surgery compared to conventional laparoscopy. Comparing our technique with the previously reported SILS techniques (Table I), we have performed this technique for lesions up to 6.8 cm, in a very fast manner, without complications, death or recurrence during follow-up. We need further follow-up to be sure of the long-term results. Based on our experience, the intragastric use of a SILS port into the stomach is safe and feasible, with improved cosmesis (only one incision) and improved pain control due to a reduced number of access ports, and with a greater overall patient satisfaction compared to a conventional laparoscopic procedure. This new technique may encourage development of transgastric SILS devices for other intragastric procedures. We only found one publication in the literature using the same technique. Prospective randomized studies are needed before the universal adoption of this new technique can be considered.

## Conclusion

Single-incision laparoscopic intragastric resection in selected cases of gastric GIST is a safe and feasible procedure which allows for direct visualization of the lesion and better control of the surgical margins. However, this challenging technique should only be performed by

experienced laparoscopic surgeons. This technique opens a way for further development of the intragastric use of the SILS device for other gastric pathologies.

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