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# Laparoscopic intraluminal (intragastric) surgery for early gastric cancer

## A new concept in laparoscopic surgery

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**Abstract.** A new laparoscopic operation for the treatment of mucosal or submucosal gastric lesions has been designed and performed on eight patients. In this procedure, all three trocars are placed in the gastric lumen, penetrating both the abdominal and stomach walls in order to perform a laparoscopic removal of gastric lesions. The operation is then carried out in the gastric lumen with currently available laparoscopic instruments and laparoscopic monitoring. The procedure is easy, safe, and feasible for mucosal or submucosal lesions of the stomach which cannot be treated by gastrofiberscopic technique. In this series, 6 patients with early gastric cancer, 1 with a submucosal leiomyoma, and 1 with giant polyp of the stomach were treated without complications. Since this technique is based on a new concept in laparoscopic surgery, the author has named this intraluminal operation "laparoscopic intragastric surgery."

**Key words:** Laparoscopic surgery — Early gastric cancer — Intraluminal surgery — Intragastric surgery

Recently, laparoscopic surgery has been widely applied not only to cholecystectomy but also to gastrointestinal operations. However, most of those procedures approach the target organ with surgical instruments inserted in the abdominal space.

The purpose of this article is to introduce our new operative technique, in which all trocars and surgical instruments are inserted directly into the gastric lumen to perform the resection of mucosal or submucosal lesions of the stomach. Since this technique seems to be based on a new concept in laparoscopic surgery, the author has named this intraluminal surgery "laparoscopic intragastric surgery" (L.I.G.S.) [6].

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## Patients and methods

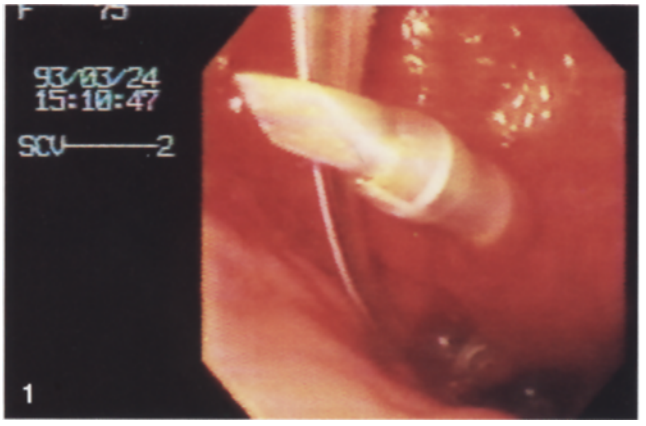
Between February 1993 and June 1994, L.I.G.S. was performed on 8 patients with gastric lesions: 6 with early gastric cancer, 1 with giant polyp, and 1 with submucosal tumor (leiomyoma) of the stomach (Table 1). The gastrofiberscopic examination and/or endoscopic ultrasound (US) scan were preoperatively employed in all patients to identify the location, size, depth, and histology of the gastric lesion. This procedure is able to remove lesions located in any part of the stomach except the anterior gastric wall (due to technical difficulties).

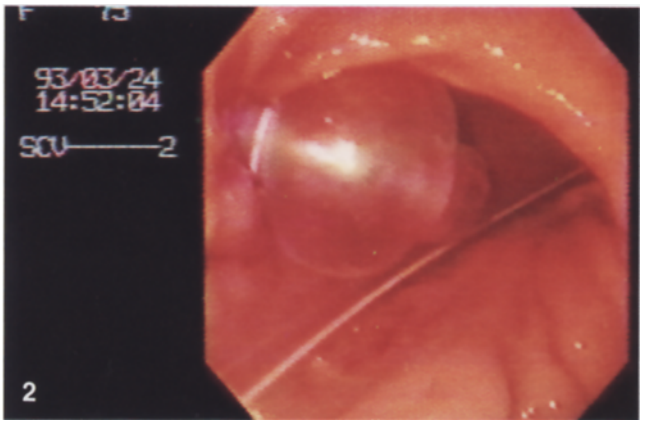
Under general anesthesia, a gastrofiberscope is inserted perorally into the stomach in order to visualize the gastric lesion on a monitor and to determine the adequate insertion points for three trocars. At this time, the stomach is filled with air in the same way as in a routine gastrofiberscopic examination. A nasogastric tube with a balloon is then placed in the duodenum and the balloon is inflated to prevent the air-flow from the stomach to the intestine. While observing the image from the gastrofiberscope on the monitor, the abdominal wall is compressed with a forefinger to select three adequate points for trocar ports. It is important to select those points in which the abdominal wall touches the anterior wall of the stomach when compressed with a forefinger. The three trocar points should be about 3 cm or more apart from each other. As to the type of trocars, it is also important to select those with a balloon on the tip such as a Hasson cannula to fix the gastric wall to the abdominal wall. Upon the selection of three trocar points, skin incisions of 1–2 cm each are made on the abdominal wall. After putting two holding stitches on the anterior wall of the stomach through the abdominal incision, Hasson cannulas (one 10-mm trocar for laparoscope and two 5-mm ones for surgical instruments) are inserted between the two stitches directly into the gastric lumen, three in a row, under gastrofiberscopic monitoring (Fig. 1). The balloon of the Hasson cannula is then inflated separately to fix the gastric wall to the abdominal wall (Fig. 2). After insertion and fixation of all three trocars in the stomach, the laparoscope (10 mm) is inserted through the central trocar to observe the gastric lesion, and two surgical instruments (5 mm) are also inserted through the other two trocars into the gastric lumen as shown in the schema (Fig. 3). After determination

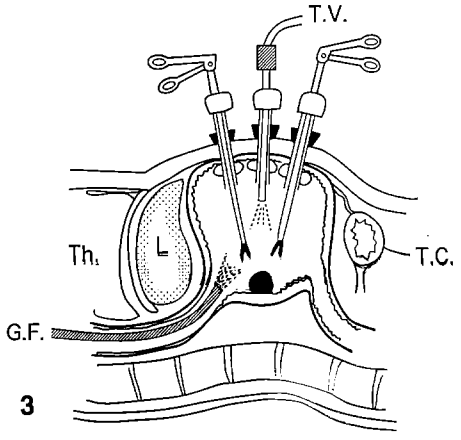
**Table 1.** Characteristics of patients and treatment[a]

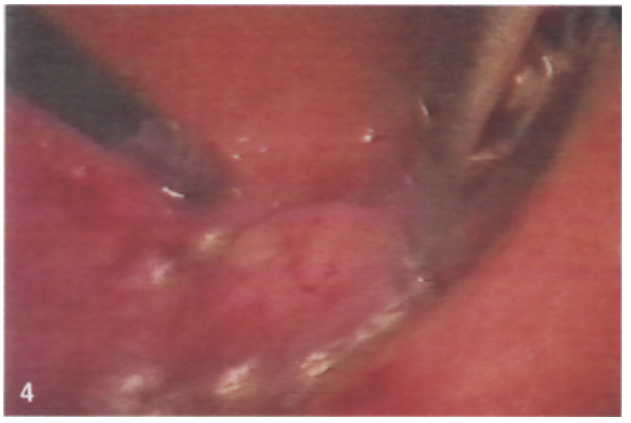
| No. | Age/sex | Diagnosis | Location | Size/depth | Treatment |
|---|---|---|---|---|---|
| 1. | 73 F | Adenomatous polyp | Gastric body (P) | 3 cm (m) | Polypectomy |
| 2. | 68 M | Leiomyoma | Fornix | 3 cm (sm) | Enucleation |
| 3. | 81 F | Adenocarcinoma | Gastric body (P) | 2 cm (m) | M.R. + laser |
| 4. | 80 M | Adenocarcinoma | Gastric body (P) | 2.5 cm (m) | M.R. + laser |
| 5. | 78 M | Adenocarcinoma | Cardia | 1.5 cm (m) | M.R. + laser |
| 6. | 82 M | Adenocarcinoma | Gastric body (P) | 2 cm (sm) | M.R. + laser |
| 7. | 65 M | Adenocarcinoma | Antrum (P) | 2 cm (m) | M.R. + laser |
| 8. | 81 M | Adenocarcinoma | Gastric body (P) | 2.5 cm (sm) | M.R. + laser |

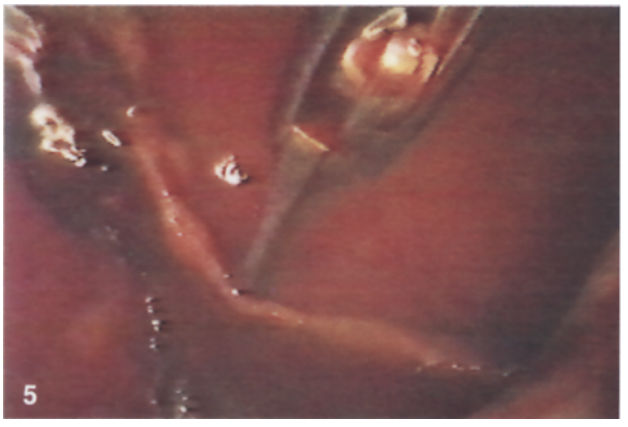
[a] (P) = posterior wall of the stomach, (m) = mucosal layer, (sm) = submucosal layer, M.R. = mucosal resection



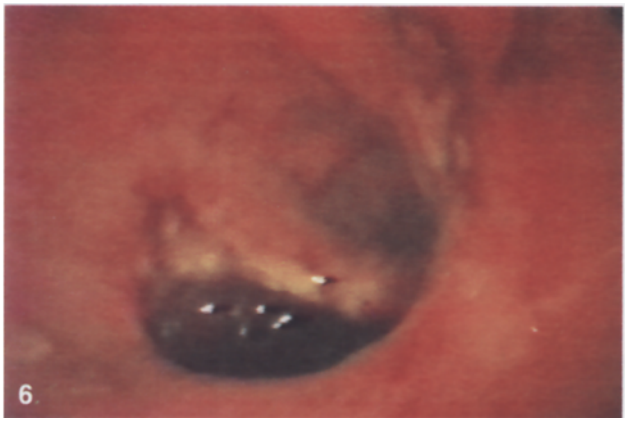




**Fig. 1.** Gastrofiberscopic view of the trocar insertion into the stomach.

**Fig. 2.** Balloon inflation to fix stomach to the abdominal wall.

**Fig. 3.** Schema of "laparoscopic intragastric surgery" (L.I.G.S.). *G.F.*: Gastrofiberscope, *Th.*: Thorax, *L.*: Liver, *T.V.*: Television monitor, *T.C.*: Transverse colon.

**Fig. 4.** Marking the adequate margin around the mucosal lesion with electrocautery (early gastric cancer).

**Fig. 5.** Dissection of the mucosal lesion (early gastric cancer).

**Fig. 6.** Mucosal defect after removal of the gastric lesion.

of an adequate removal margin around the lesion, the mucosal resection is started by dissecting the mucosal margin with forceps, electrocautery, and/or laser (Fig. 4, 5). The resected specimen is then extracted by a gastrofiberscope through the esophagus, or by special bag through the trocar (10 mm) in a malignant case. Electro- and laser cauterization are used to confirm hemostasis on the remaining mucosal margin and the muscular layer. The resected area was left untreated as a mucosal defect (Fig. 6). After deflating the balloon of each trocar, all instruments and trocars are pulled out of the gastric lumen. Each trocar port of the stomach is sutured between the two holding stitches, and the abdomen is closed.

## Results

In this series of eight cases, no intra- and postoperative complications were encountered and the mean hospital stay was 5 days. Conversion to open surgery was not necessary in this series. The duration of the operation ranged from 60 to 150 min (mean 105 min). Oral intake was resumed between the 2nd and 3rd postoperative day. The gastrofiberscopic examination was performed 1–2 weeks after the operation on all patients, indicating that the defect of the gastric mucosa after removal of the lesion was completely healed in all cases. The mean follow-up to date in patients with early gastric cancer was 9 months (maximum 15 months) and none of the patients have had a recurrence of the gastric cancer.

## Discussion

Historically, there have been many works written about the endoscopic approach to gastric lesions. Noninvasive treatments such as strip biopsy using a gastrofiberscope have been increasingly applied and developed in the field of internal medicine [2]. Less invasive gastrostomy using a gastrofiberscope has also been conducted by Ponsky et al. [7]. The intraoperative observation of the gastric cavity has been conducted by inserting an endoscope through gastrotomy in open surgery [5]. However, the aim of the intraoperative endoscopy was merely to observe the inside of the stomach during open surgery. Laparoscopic surgery, which has gained popularity in recent years, has been applied to various types of gastric diseases [1]. However, most of those procedures are performed in the abdominal space.

The concept of "laparoscopic intragastric surgery" (L.I.G.S.) is quite different from any other method of current laparoscopic procedures, since this technique is a type of intraluminal surgery of the stomach [6]. Recently, a similar type of intraluminal surgery has been described by Way et al. [8] and Gagner [3], in which the pancreatic cystgastrostomy is performed laparoscopically through the anterior wall of the stomach. Gagner et al. have also reported the technique of laparoscopic hepaticogastrostomy [4]. However, those operations seem to be a type of transgastric procedure, targeting the pancreatic cyst or biliary tree of the liver.

On the other hand, the target of L.I.G.S. is the lesions of the stomach itself. Therefore, L.I.G.S. described here is applicable to a wide range of gastric lesions such as early gastric cancer, mucosal, and submucosal tumors. In addition, L.I.G.S. will be able to extend the indications which have thus far been limited by the usual method of gastrofiberscopic treatment.

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