*Case report*

# Single-incision, Laparoscopy-assisted, Subtotal Gastrectomy for Intractable Gastric Ulcer: A Case Report

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***Running title:*** SILS for Subtotal Gastrectomy

## Abstract

**Purpose**: Single-incision laparoscopic surgery (SILS) offers excellent cosmetic results and may be associated with decreased postoperative pain and accelerated recovery. Though there have been reports of cholecystectomy and appendectomy using SILS, there have been few reports of gastric resection with intracorporeal reconstruction of the digestive tract using SILS. The first single-incision, laparoscopic gastrectomy with intracorporeal reconstruction is reported.

**Methods**: Preliminary experience with single-incision, laparoscopic gastrectomy with intracorporeal reconstruction for a patient with an intractable gastric ulcer is reported.

**Results**: Single incision laparoscopy-assisted subtotal gastrectomy and Roux-en-Y reconstruction were performed. Operative time for gastrectomy and para-duodenal hernioplasty was 412 min, and blood loss was 90 g. No intra-operative or postoperative complications developed.

**Conclusions**: Single-incision, laparoscopy-assisted gastrectomy for intractable gastric ulcer is technically feasible. Intracorporeal reconstruction of the digestive tract was performed safely using a linear endoscopic stapler. This surgical approach is a further advance towards scarless surgery of the stomach.

**Key words:** gastric resection, gastric ulcer, laparoscopic surgery, para-duodenal hernia, Roux-en-Y reconstruction, SILS

## Introduction

Recently, single-incision, laparoscopic surgery (SILS) has been used successfully for cholecystectomy [1-4], appendectomy [5], colectomy [6,7], and bariatric procedures. [8-12] However, there have been no reports of gastrectomy with intracorporeal reconstruction because of technical difficulties; SILS tends to restrict the operative range of motion and results in "crowding" of the laparoscope and instruments. Here, a single-incision, laparoscopy-assisted, subtotal gastrectomy with Roux-en-Y reconstruction for an intractable gastric ulcer is described.

## Patient and methods

*Case report*

A 28-year-old woman presented with epigastralgia caused by an intractable gastric ulcer. She had been on anti-ulcer treatment for a *Helicobacter pylori*-negative gastric ulcer for several years, but the ulcer did not improve. Thus, surgery was suggested. Gastroscopic examination revealed an H1 stage ulcer in the gastric antrum (Fig. 1). In addition, a para-duodenal hernia with malrotation of the intestine was confirmed on preoperative enhanced multi-detector CT examination (Fig. 2). For such a young patient, the antrectomy with truncal vagotomy would be considered not only subtotal gastrectomy. We performed the informed consent about surgical treatment of gastric ulcer. Patient hoped the most effective radical surgery, because it was intractable ulcers unresponsive to various treatments. Therefore we chose the subtotal gastrectomy. The patient was offered a laparoscopic subtotal gastrectomy with Roux-en-Y reconstruction and para-duodenal hernioplasty using SILS; she gave her

informed consent for this surgical approach. The procedure was performed successfully. The total operative time was 412 min, and blood loss was 90 g. There were no postoperative complications. The patient started a normal diet on day 3 and was discharged on postoperative day 14 with no complications (Fig. 3). The histological diagnosis was a nonspecific ulcer, and no evidence of malignancy was seen.

**Surgical technique**

The patient was placed in the supine, split leg position. The surgeon stood between the patient's legs, and the assistant was located on the right side of the patient. The scopist was located at the right side while work was being done on the left side and at the left while work was being done on the right side. A single, intra-umbilical, 30-mm incision was made by pulling out the umbilicus. After exposing the fascia, a 12-mm trocar was placed through an open approach, and the abdominal cavity was explored with a 5-mm flexible Olympus endoscope. Pneumoperitoneum was induced and maintained at 8 mmHg with carbon dioxide. Two 5-mm ports were inserted through the anterior sheet of the abdominal rectus muscle, each placed 1 cm laterally from the laparoscope port. By adding a circumferential suture around the trocar, there was not air leakage. A 2-mm mini-loop retractor (Mini-loop retractor II; Hakkou-shoji, Japan) was inserted through an extra incision in the right subcostal space to create the operative field (Fig. 4). Forceps movement was primarily parallel.

① Greater curvature side processing and duodenum separation (Fig. 5a): The stomach wall on the greater curvature of the excision side was elevated by the

mini-loop retractor, and good space was maintained in the operative field. Blood vessel processing advanced along the stomach wall on the greater curvature side using the LigaSure V™ (Covidien, Boulder, Colarado, USA). Blood vessel processing on the lesser curvature side was similarly advanced to the duodenal ball level, and the duodenum was separated using the linear endoscopic stapler (EndoGIA, Covidien, Norwalk, CT, USA).

② Lesser curvature side processing and stomach separation: Blood vessel processing of the lesser curvature side advanced along the stomach wall. As appropriate, we could create the operative field of Lesser curvature dissection by using the shaft of mini-loop-retractor. The stomach was separated using the linear endoscopic stapler on the planned excision line.

③ Roux-en-Y reconstruction (Fig. 5b): The formation of the Treitz ligament was insufficient, so the duodenum was confirmed from the right side of the spine. After the jejunum had been separated at a site 20 cm distal to the beginning of the jejunum, a side-to-side gastrojejunal anastomosis was performed intracorporeally using the linear endoscopic stapler. The gastrotomy and jejunotomy used for stapler insertion were closed with the linear endoscopic stapler. The gastrotomy and jejunotomy borders were resected during their closure. For “Y leg” reconstruction, the side-to-side enteroenterostomy was created using the linear endoscopic stapler, and the entry hole was closed with hand sawing under direct vision through a minilaparotomy.

④ Para-duodenal hernioplasty (Fig. 5c): Incomplete fixation of the right-side colon was seen in the right upper abdomen, and the 3cm hernial orifice was seen

between the duodenum and the retroperitoneal area. The majority of the small intestine invaginated into the right upper hernia sac. After the hernia contents that invaginated into the hernia sac had been removed, a large opening was made in the hernial orifice by mobilizing the right-side colon. The appendix was excised.

## Discussion

SILS was described as early as 1992 by Pelosi et al.[5], who performed a single-puncture, laparoscopic appendectomy. The potential advantages of this approach are related to limiting the port incisions to one site, in addition to the advantages of traditional minimally invasive surgery. Positioning the single access within the umbilicus results in scarless healing and avoids muscle penetration, which minimizes incision pain. The substantial reduction in abdominal wall trauma translates into less postoperative pain, a more rapid recovery, fewer wound complications, and improved cosmetic outcomes.[8] In recent years, SILS has been focused upon as a bridge between natural orifice transluminal endoscopic surgery (NOTES)[13] and traditional laparoscopic surgery, because NOTES is technically challenging and current instruments need to be further improved.

In regard to SILS for gastric surgery, though Saber reported on sleeve gastrectomy for bariatric surgery in 2008, a subtotal gastrectomy without lymph node dissection and reconstruction as in the present case has never been reported. In this case, an intracorporeal, functional, end-to-end gastrojejunal anastomosis was performed using a linear endoscopic stapler, the side-to-side enteroenterostomy was created using a linear endoscopic stapler, and, for “Y-leg” reconstruction, the entry hole was directly

sutured by hand sawing through a minilaparotomy. Some reports of Roux-en-Y gastric bypass [9-12] and gastrojejunostomy [13] have been published showing the feasibility of intracorporeal anastomoses through SILS. In this case, the intracorporeal reconstruction of the digestive tract was safely performed using a linear endoscopic stapler, as in the previous reports.

The difficulty with SILS occurs from interference by the forceps. The instruments and laparoscope are introduced adjacent and parallel to each other through a single access. This tends to restrict the range of motion and results in “crowding” of the laparoscope and instruments, making surgical dissection through a single port more difficult than in conventional multiport laparoscopy. To avoid this, it is necessary to make the operation axis and to the corresponding operative field parallel to the port. In this case, we introduced the mini-loop retractor II to supplement the assistant’s forceps. Using this retractor, it was possible to create the operation axis and the fields for surgical dissection and reconstruction. However, in the intestinal tract, the retractor can cause damage because of its shape with a thin point. It may be preferable to use this retractor by grasping a small amount of gauze. In addition, a good operative field could be made using several retractors.

The flexible scope was more effective in SILS because the laparoscope and other instruments interfere with each other. The scopist in SILS should be more skilled than with conventional laparoscopic surgery, because it is necessary to master upper and lower, left and right angles in SILS.

There is often no channel for the exhaust in SILS, so the operative view often becomes poorly visible because of the mist generated by the laparoscopic coagulating

shears (LCS). In this procedure, the generated mist was suppressed using the vessel sealing system (LigaSure V$^{TM}$), and the planned operation was performed under excellent view.

There have been two case reports of seroma formation at the surgical wound as complications following SILS for gastric surgery. [11] They were caused by an inappropriately small skin incision and a crush wound due to severe pressure of the port surrounding fat tissue for an extended period. Though there were no complications in the present case, appropriate care of the wound is necessary.

Moreover, in the present case, the patient had a para-duodenal hernia with malrotation of the intestine. The hernia orifice was opened sufficiently, and the hernia contents were drawn out from the hernia sac.

In conclusion, a case of subtotal gastrectomy with R-Y reconstruction by SILS was performed in a young woman with an intractable gastric ulcer. Single-incision, laparoscopy-assisted, subtotal gastrectomy for intractable gastric ulcers is technically feasible. This surgical approach represents progress towards achieving scarless surgery of the stomach.

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**Figure Legends**

Fig. 1: Gastroscopy shows an H1 stage ulcer in the gastric antrum.

Fig. 2: Enhanced multi-detector computed tomography shows the majority of the small intestine located in the right upper abdominal space (arrow).

Fig. 3: The resulting scars 1 month postoperatively.

Fig. 4: A mini-loop retractor is inserted through an extra incision in the right subcostal space.

Fig. 5a: The stomach wall on the greater curvature of the excision side is elevated by a mini-loop retractor (arrow), and good space is achieved in the operative field.

Fig. 5b: The gastrotomy and jejunotomy used for stapler insertion are closed with the linear endoscopic stapler.

Fig. 5c: The hernia sac is just being opened. The majority of the small intestine invaginates into the right upper hernia sac (arrow).

Fig. 1

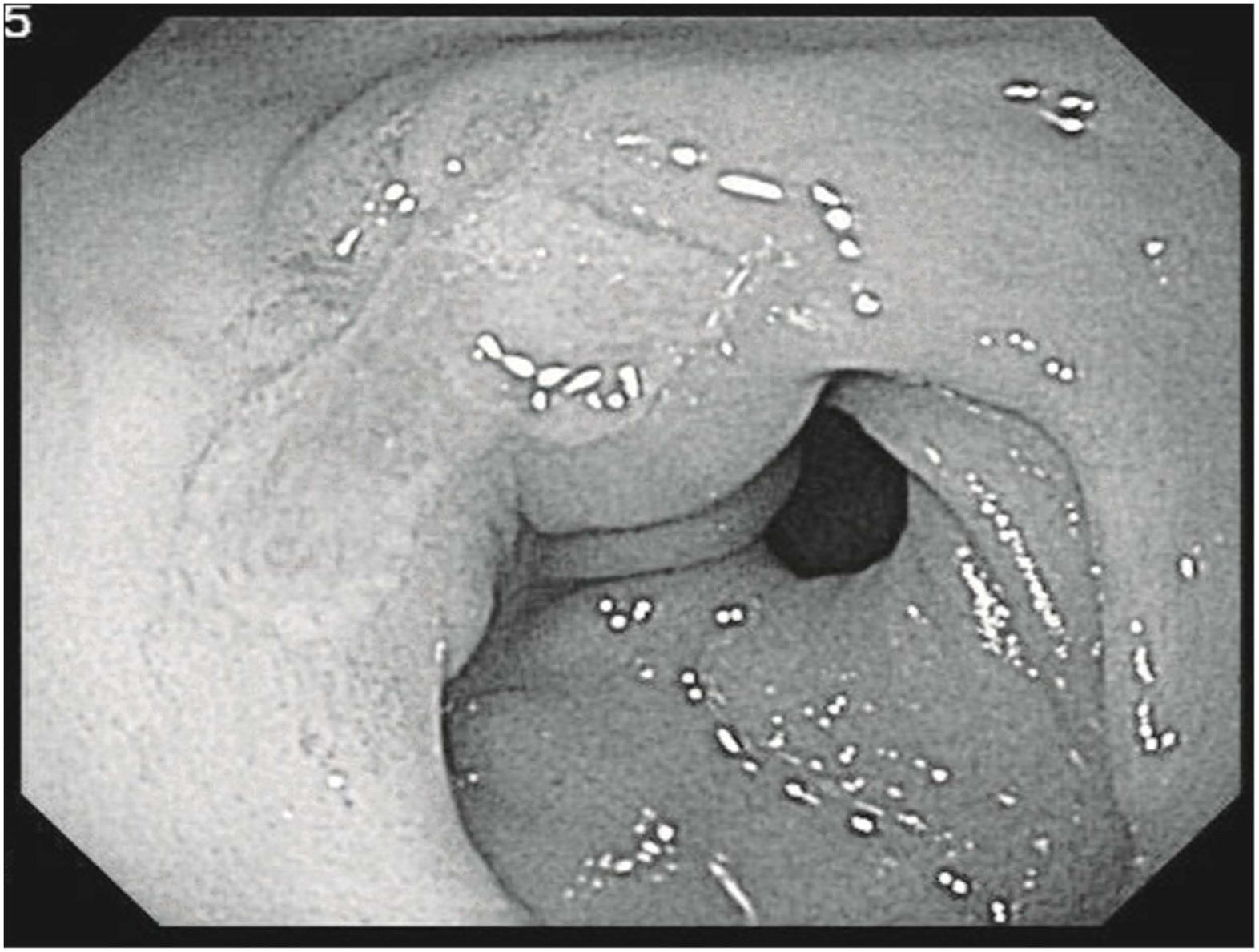

Fig. 2

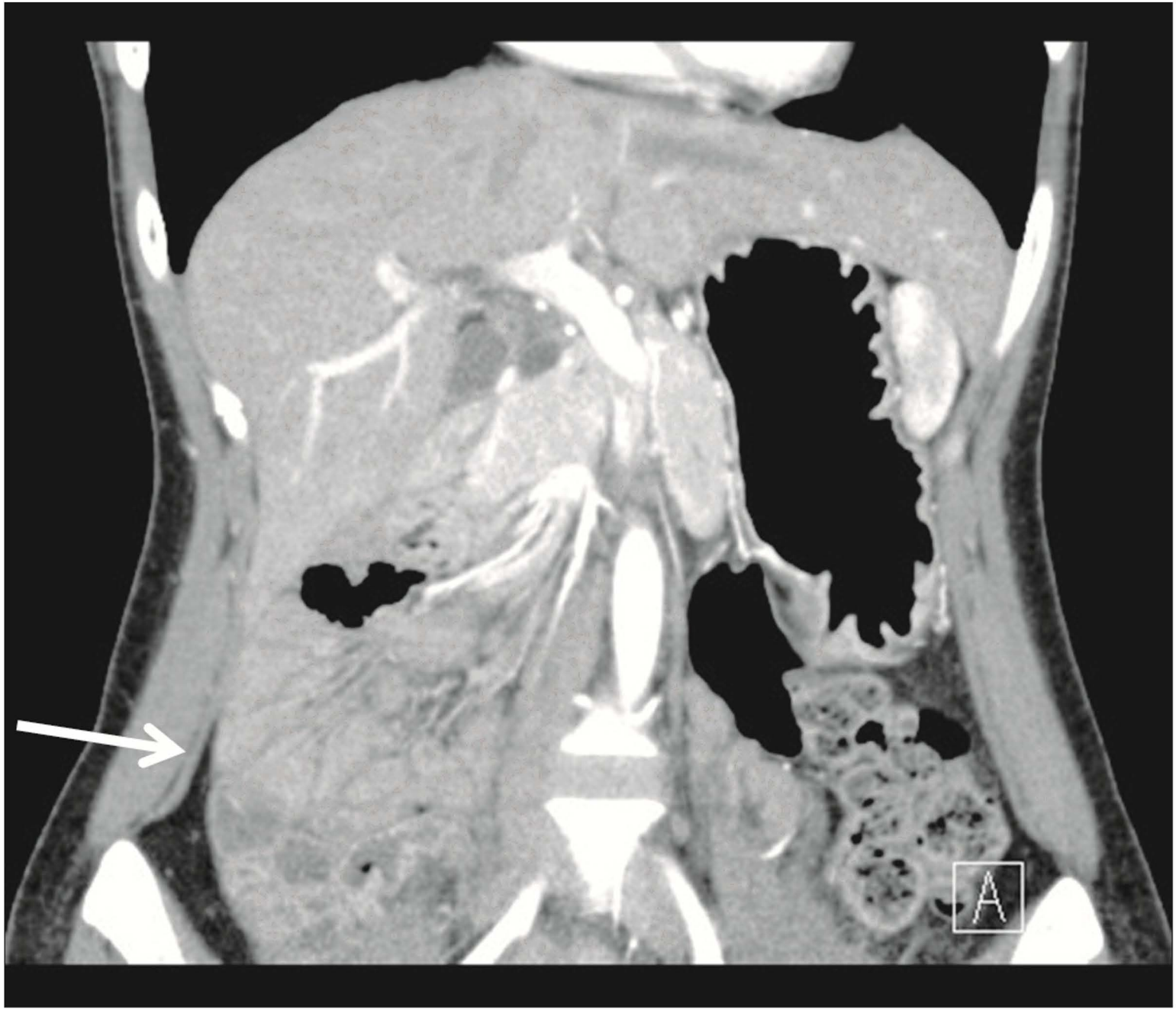

Fig. 3

Fig. 4

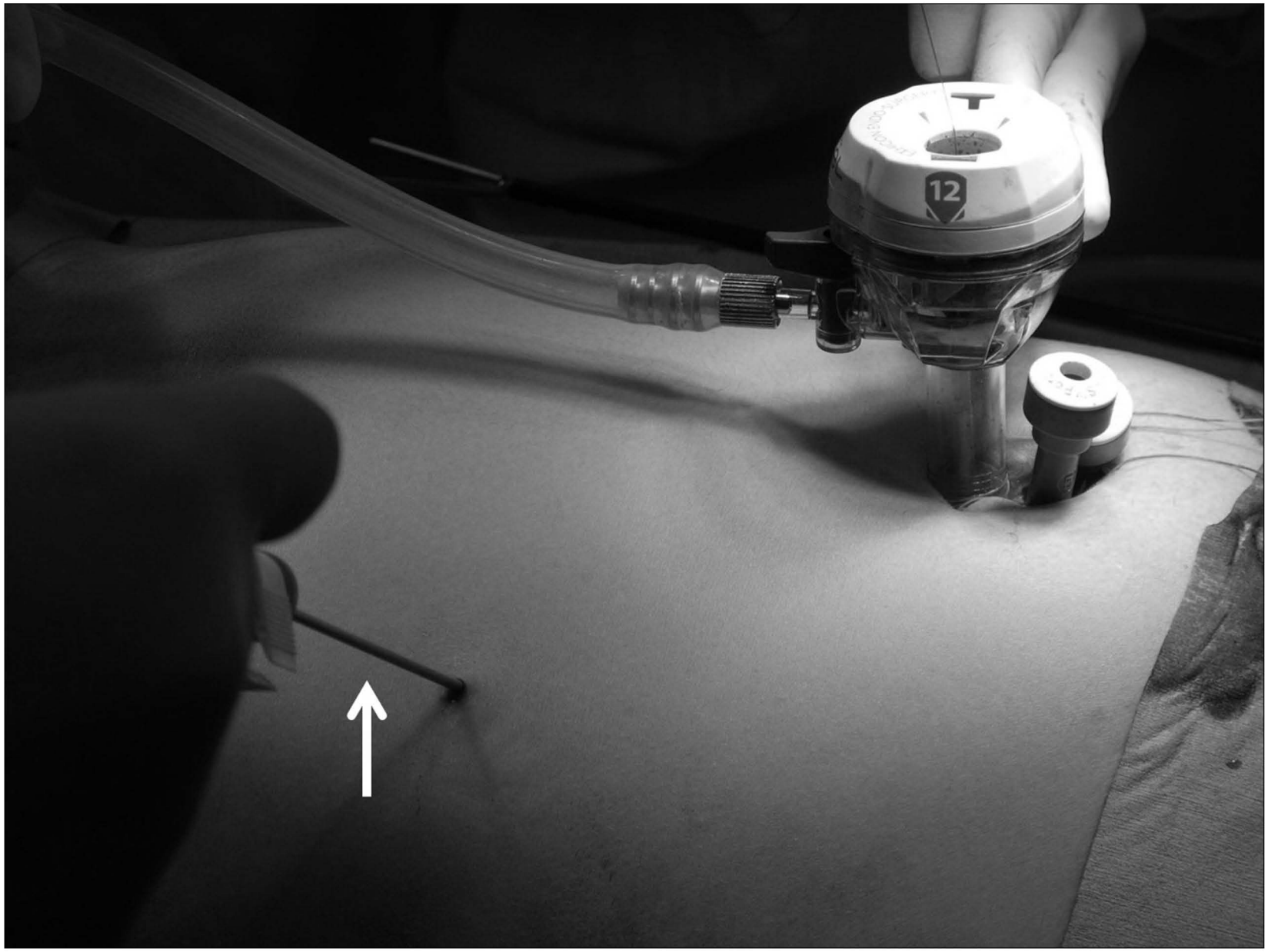

Fig. 5a

Fig. 5b

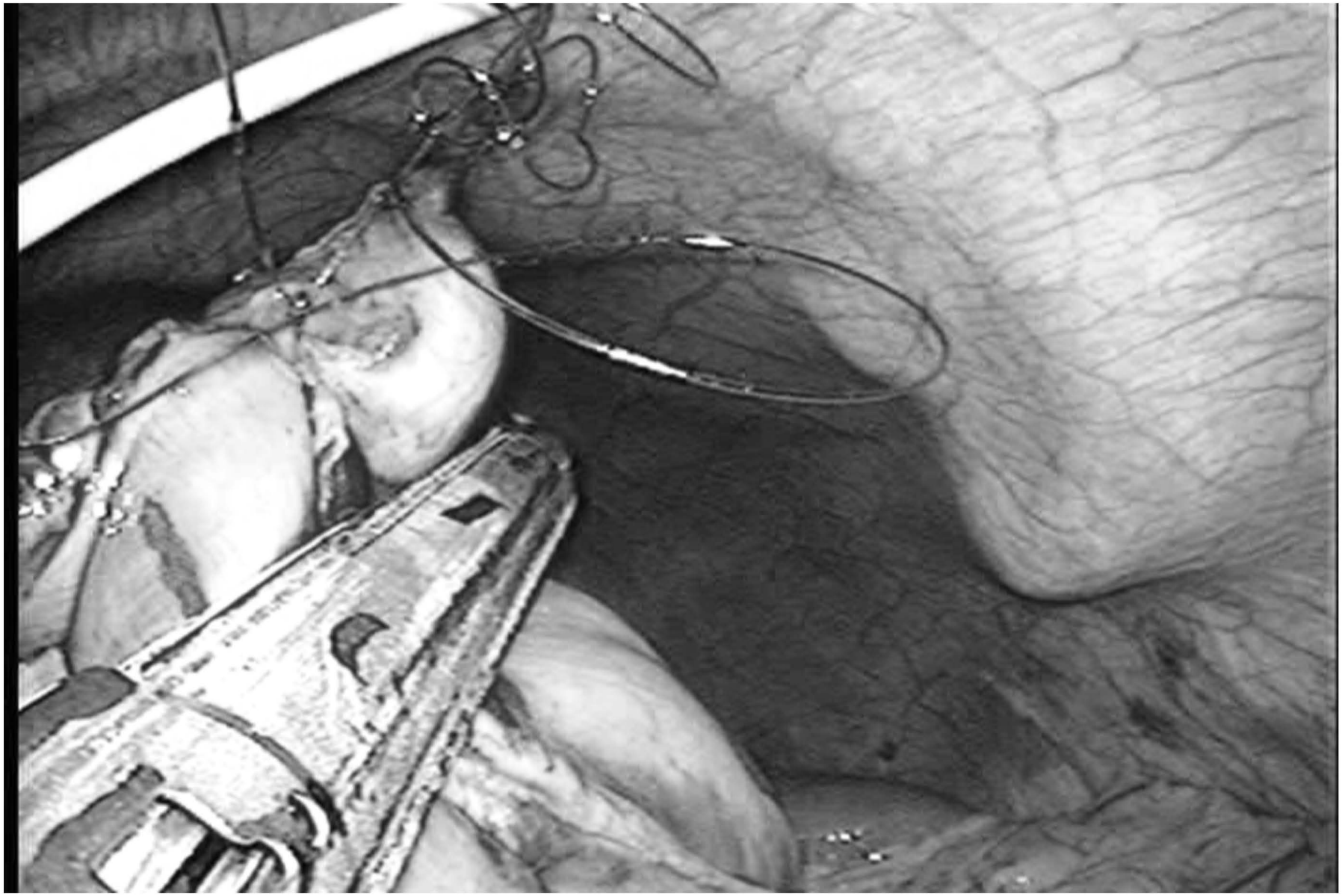

Fig. 5c