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Case Report

Successful Intracorporeal Suturing Following Laparoscopic Resection of a Large Gastrointestinal Stromal Tumor Located at the Esophagogastric Junction

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Laparoscopic partial resection of gastric gastrointestinal stromal tumors (GISTs) $\leq$5 cm in size is widely performed, whereas that of large GISTs (size $>$5 cm) is controversial because of oncologic and technical safety. Furthermore, laparoscopic resection of GISTs located at the esophagogastric junction (EGJ) is difficult because of the high risk of narrowing or/and deformity of the EGJ. In the current study we report a case of laparoscopic partial resection of a large GIST located at the EGJ. A 74-year-old female patient visited our institution complaining of epigastric discomfort. An esophagogastroduodenoscopy and an abdominal computed tomography scan revealed a 7.5 $\times$ 4.0 cm GIST at the EGJ and upper stomach. The patient underwent laparoscopic partial resection with intracorporeal suturing, without any breakage of the pseudocapsule. The defect of the esophagogastric wall after resection was closed by intracorporeal running suture. The patient's postoperative course was uneventful. To the best of our knowledge, this is the first report of laparoscopic resection of a large GIST located at the EGJ. Our technique of intracorporeal manual suturing following laparoscopic gastric resection can be a valid option for minimally invasive surgery for a large GIST located at the EGJ.

Key words: Gastric GIST – Esophagogastric junction – Laparoscopic resection

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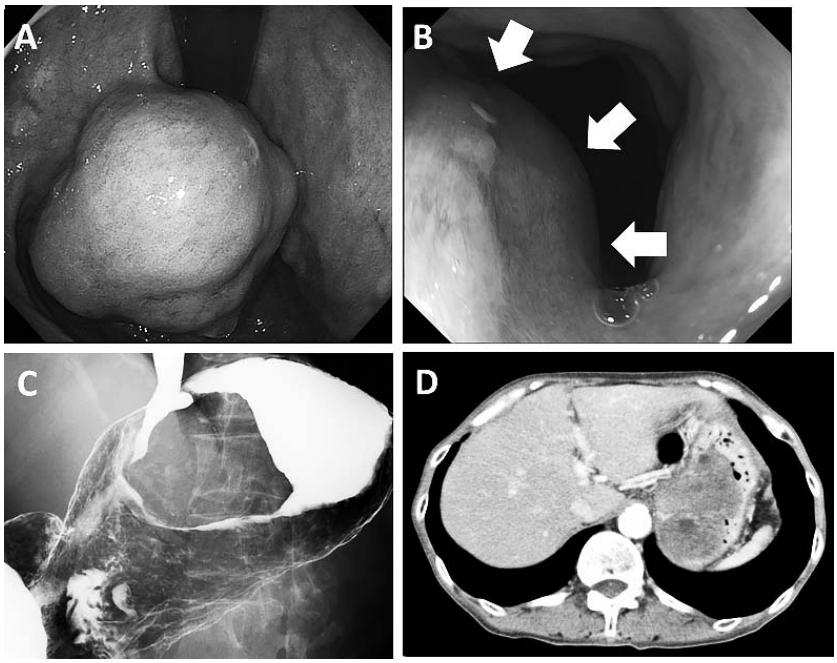

Fig. 1 (A) EGD showed a tumor with intraluminal growth pattern on the posterior side of the upper stomach. (B) An SMT located at the EGJ with one third of the circumference of the EGJ (white arrow). (C) Barium study showed that the gastric SMT was located in the upper stomach and at the EGJ. (D) Computed tomography of the abdomen showed an intramural and heterogeneously enhanced GIST (white arrow) 75 × 40 mm in size.

Gastric submucosal tumors (SMTs) are rare, but their incidence is rising because the increased use of endoscopy facilitates diagnosis. Gastrointestinal stromal tumors (GISTs) occur most commonly in the stomach (60%–70%), and surgical resection is the only possible curative treatment.[1] GISTs rarely involve lymph nodes and require a resection margin that is only grossly negative, so partial resection is feasible for gastric GISTs.[2–4] Since the first report of laparoscopic resection of gastric GISTs in 1992, several authors have advocated for the safety and effectiveness of laparoscopic resection of gastric GISTs, including tumors located near the esophagogastric junction (EGJ).[5–8] We have also reported the usefulness and safety of laparoscopic resection by linear stapling of gastric SMTs $\leq$5 cm in size located near the EGJ.[9] However, laparoscopic resection by linear stapling cannot be adapted easily to large GISTs located directly at the EGJ because of the difficulty of handling in a narrow space and the risk of narrowing or/and deformity of the EGJ. Consequently, we have adapted intracorporeal suturing following laparoscopic resection for a large gastric GIST located at the EGJ. In the present report, we describe this new technique of laparoscopic partial resection.

Case Report

A 74-year-old woman complaining of epigastric discomfort was admitted to the Division of Gastrointestinal Surgery, Department of Surgery, Graduate School of Medicine, Kobe University. Following resuscitation, esophagogastroduodenoscopy (EGD) showed a gastric SMT with intraluminal growth pattern and no delle on the posterior side of the upper stomach and the EGJ (Fig. 1A). According to EGD and a barium study, the SMT was located in the upper stomach and at the EGJ with a size of one third of the circumference of the EGJ (Fig. 1B and 1C). A biopsy by endoscopic ultrasound-guided fine-needle aspiration confirmed the diagnosis of a gastric GIST. Computed tomography of the abdomen showed an intramural and heterogeneously enhanced tumor that was 7.5 × 4.0 cm in size, with no metastases to other organs and lymph nodes (Fig. 1D). According to tumor size and location, open proximal gastrectomy was recommended to the patient, but she insisted on laparoscopic partial resection. Therefore, she underwent laparoscopic resection after providing informed consent.

The surgeon stood on the right side of the patient. The first trocar was placed using a standard umbilical cut-down technique. Carbon dioxide was insufflated through this port at a pressure setting of 10 mmHg. A 30° laparoscope was introduced through the umbilical port, and diagnostic laparoscopy was performed. Four additional trocars were inserted into the left upper, left lower, right upper, and right lower quadrants (Fig. 2). After raising the lateral segment of the liver, the gastric lesion was identified by CO_2-insufflating flexible endoscopy.[10]

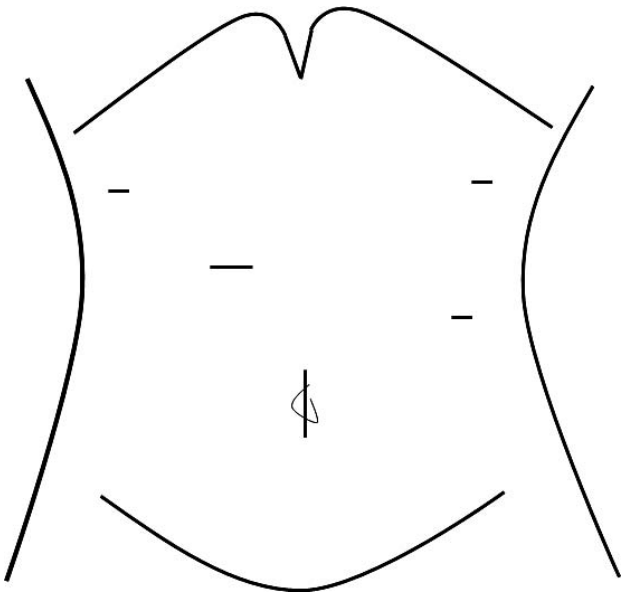

Fig. 2 Five trocars were inserted.

Division of the gastric vessels or the omentum in the excision area around the tumor was performed using ultrasonic coagulating shears (SonoSurg, Olympus Medical Systems, Tokyo, Japan). After placing an endobag into the abdominal cavity, we used ultrasonic coagulating shears to make a small hole in the gastric wall at the anal side of the tumor by endoscopic guidance. Then, using ultrasonic coagulating shears we cut through the full-thickness layer along the circumference with the minimal margin (Figs. 3A–3C and 4A). During dissection of the gastric wall, endoscopic and laparoscopic observation was performed to maintain a sufficient resection margin. As a preoperative finding, a GIST was found to be located at the EGJ with size of one third of the circumference of the EGJ (Fig. 1B), and resection of the EGJ with a safety margin reached a range of about one half of the circumference (Fig. 4B). After resecting the entire tumor, the resected specimen was retrieved immediately using an endobag placed into the abdominal cavity before resection. The resected specimen could be extracted through an umbilical incision 3 cm in length, without any breakage. The extended umbilical port site was partially closed and pneumoperitoneum was reestablished.

The defect of the esophagogastric wall was closed by intracorporeal running suture using 5 threads 12 to 20 cm in length of 3-0 Vicryl (Ethicon GmbH, Norderstedt, Germany) in the full-thickness layer (Fig. 3D). The running suture started from the anterior wall of the patient's right side. Next, after the lesser curvature of the upper stomach was inverted to the patient's left side by the assistant, suturing on the posterior side of the EGJ was done (Figs. 3D and 4C). During the closure, an endoscope was inserted into the stomach for bougienage of the EGJ, and great care was taken not to deform the EGJ. After the closure in the full-thickness layer, the stomach was reinflated in order to use laparoscopy to detect any bleeding or air leakage from the suturing line, and to confirm a patent lumen around

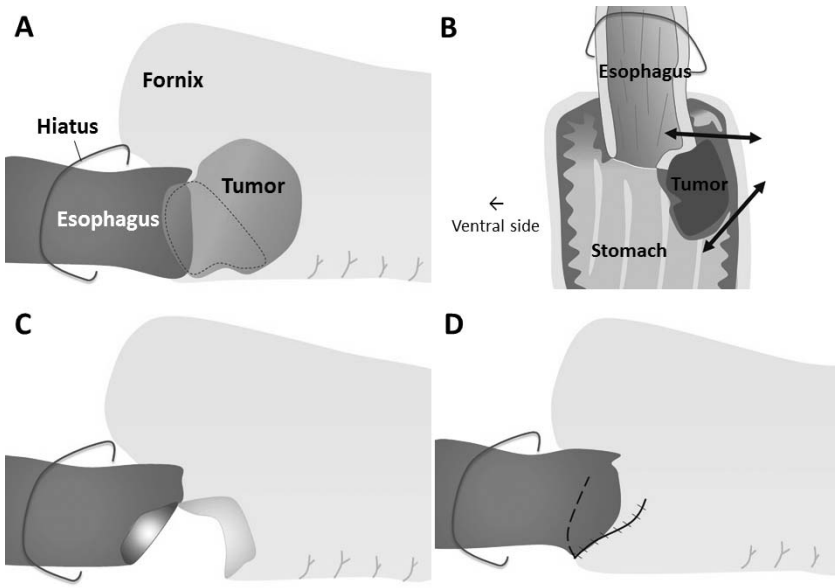

Fig. 3 (A) The tumor was located on the posterior wall of the EGJ and lesser curvature of the upper stomach. (B) Sagittal illustration of tumor location and line of resection (black arrow). (C) The defect of the EGJ wall after resection. (D) The illustration after intracorporeal manual suturing.

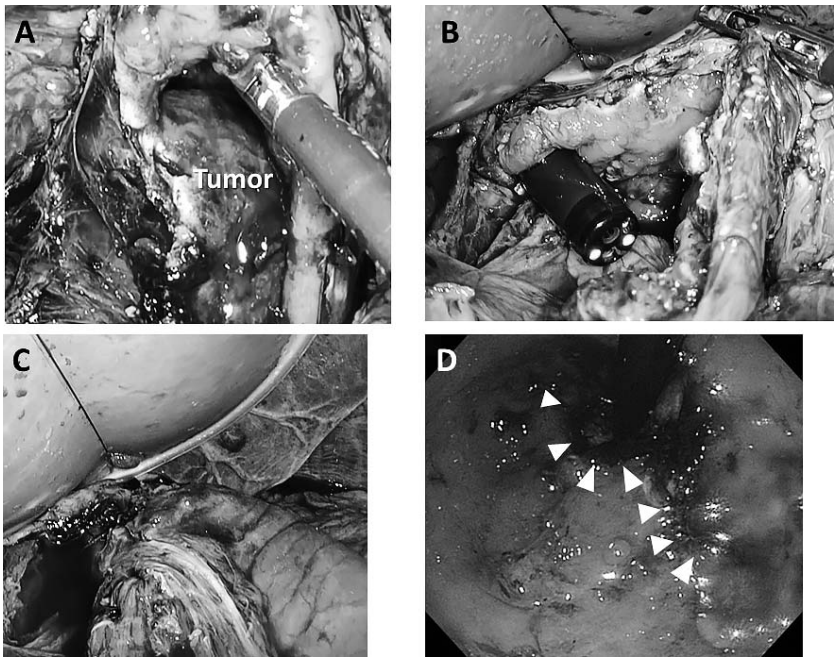

Fig. 4 (A) Gastric wall in the full-thickness layer was cut by laparoscopic coagulating shears along the margin of the tumor. (B) The defect of the EGJ after resection of the EGJ with safety margin reached a range of about one half of the circumference. (C) Laparoscopic observation after intracorporeal manual suturing. (D) The suturing line was finally confirmed by EGD (white arrows), and there was no leakage and stenosis.

the EGJ via intraluminal endoscopy. Subsequently, in the same way as for the full-thickness layer, additional suturing in the seromuscular layer was done by running suture using two 20-cm threads of 3-0 PDS (Ethicon) with Lapra-Ty clips (Ethicon). After the suturing, the completed suturing line was finally verified by laparoscopy and reinflated in order to confirm a patent lumen around the EGJ via intraluminal endoscopy (Fig. 4D).

Results

The operation time was 357 minutes, and the blood loss was negligible. The patient began walking the day after surgery. Oral intake was resumed on the sixth postoperative day without any complications, and discharge was permitted on the 15th postoperative day in patients without symptoms and inflammatory reactions.

The size of the resected specimen was $7.4 \times 5.2 \times 3.8$ cm; a very small margin was confirmed macroscopically, whereas excessive resection of the healthy region was not observed. Negative margin was confirmed pathologically without rupture of the pseudocapsule (Fig. 5A). Pathologic analyses showed positivity for c-kit and CD34 in the gastrointestinal stromal tumor, with 4 mitoses per 50 high-power fields. Stratification of the recurrence risk according to the Fletcher classification was intermediate risk.[11] Postoperative radiologic study in the supine position on the seventh day after surgery showed no reflux of contract medium to the esophagus (Fig. 5B). Further, EGD 2 months after surgery showed no reflux esophagitis, stenosis, or deformity at the EGJ and fundus (Fig. 5C).

Discussion

The National Comprehensive Cancer Network Clinical Guidelines for Optimal Management of Patients with gastric GIST suggest that laparoscopic wedge resection may be adapted to tumors <5 cm in size, and tumors >5 cm in size may be resected using a laparoscopic or laparoscopic-assisted technique with a hand port, depending on the location and shape of the tumor.[12] Recently, several case series reported successful laparoscopic resection of large GISTs (>5 cm in size) in the stomach.[13,14] However, because of oncologic and technical problems, there is still no consensus on the appropriate approach for large GISTs, especially those at difficult anatomic sites (*i.e.*, the EGJ and the pyloric region).

To secure oncologic safety for laparoscopic management of large GISTs, it is important to avoid grasping the tumor directly, in order to prevent forceful extraction of the tumor out of the abdominal cavity through the small incision; it is also important for the procedure to be performed only by expert surgeons.[13] In our case, the fibrous tissue or normal gastric wall around the tumor was grasped for

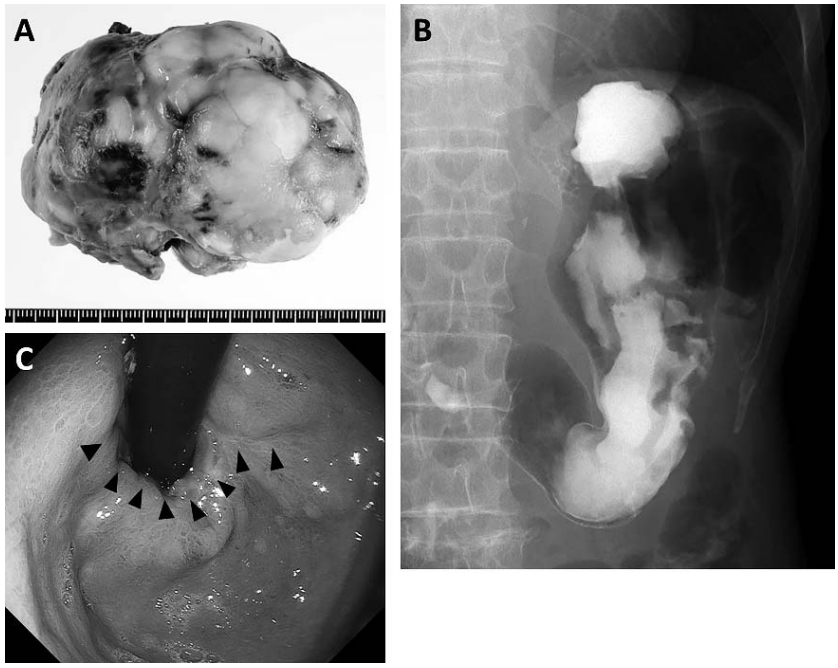

Fig. 5 (A) The size of the tumor with the resected specimen was 74 × 52 × 38 mm, and negative margin was confirmed pathologically without rupture of the pseudocapsule. (B) EGD at 2 months after surgery showed no stenosis or deformity at the EGJ (black arrow shows sutured scar). (C) Postoperative radiologic study in the supine position showed no reflex of contract medium to the esophagus.

traction, and great care was taken to avoid touching the tumor directly. However, considering the possibility of intraoperative dissemination, our procedure should be carefully adapted for large GISTs with delle. In our case, because the tumor was soft, the tumor placed into an endobag could be extracted safely by passing it through a 3-cm-long incision without dissemination. Furthermore, we are highly experienced with regard to laparoscopic resection of gastric GISTs, including tumors that are close to the EGJ.[9]

Laparoscopic resection of a large GIST at the EGJ requires some special techniques that are not necessary for gastric GISTs at other locations. First, an endoscope was inserted into the stomach during the closure. The endoscope functioned not only for bougienage, but also as a landmark for the suturing line on the EGJ. Further, considering the large defect after resection, the running suture is a more simple method and requires less operation time compared with the interrupted suture. Laparoscopic running suturing using a long thread, such as a 30- to 40-cm thread, is hard to handle, so we use threads that are 10 to 20 cm in length. Despite these tips, our technique for resection of a large GIST at the EGJ is mainly dependent on the surgeon's skill. Lack of technical skill with intracorporeal suturing may cause critical complications, such as anastomotic leakage and stenosis. To standardize our procedure, robotic surgery may facilitate intracorporeal suturing following laparoscopic resection of large GISTs located at the EGJ.[14]

We consider the laparoscopic approach for cardiac GIST to have several benefits compared with open surgery. Magnified view by laparoscopy enables safe resection with minimal margin of the tumor and efficient suturing of the EGJ defect in a narrow space, especially on the posterior side. With these advantages, laparoscopic approach for cardiac GISTs may be able to avoid proximal gastrectomy. However, further examinations are needed to determine the width of resection of the EGJ that is allowed to preserve cardiac function. We consider that laparoscopic resection of the EGJ within one half of the circumference of the EGJ can be performed safely. However, when resection of the EGJ reaches the angle of His, the diaphragm leg, and/or the lower thoracic esophagus, further management is needed to prevent antireflux (such as wrapping the cardia).

Conclusion

Intracorporeal manual suturing following laparoscopic gastric resection can be a less invasive option for a large GIST at the EGJ. However, further study is warranted to determine the best procedure for large GISTs at the EGJ.

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