Gastric Cancer (2014) 17:337–340
DOI 10.1007/s10120-013-0272-8

ORIGINAL ARTICLE

Laparoscopic wedge resection of the stomach for gastrointestinal stromal tumor (GIST): non-touch lesion lifting method

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Received: 15 January 2013 / Accepted: 15 May 2013 / Published online: 7 June 2013

Abstract
Background Laparoscopic surgery for GIST carries a risk of intraoperative tumor dissemination. To avoid tumor dissemination, we have utilized a "non-touch" method for surgical resection of GIST since 2000.
Methods Forty-two patients with gastric GIST were treated at our institution between 2000 and 2012. Laparoscopic wedge resection of the stomach was used as the standard procedure for tumors that were 2–5 cm in size. Tumors larger than 5 cm were treated with open surgery. Our non-touch procedure included a lesion-lifting method using traction sutures at the normal stomach wall around the tumor. Intraoperative gastroscopy was utilized to confirm the location of the tumor with laparoscopy. After lifting of the tumor, tumors with a clear operative margin were resected using a linear stapler. Tumors located at the posterior wall of the stomach or located near the esophagogastric junction were resected using traction sutures.
Results Median operative time was 140 min and median blood loss was 0 ml. Postoperative course was uneventful excepting one patient who experienced postoperative bleeding. The median postoperative stay was 7 days. One patient developed liver metastasis after surgery. None of the patients had local recurrence or peritoneal recurrence case.
Conclusion This non-touch lesion-lifting method was useful for the surgical management of gastric GIST.

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Keywords Gastrointestinal stromal tumors · Laparoscopic surgery · Gastric resection

Introduction

Gastrointestinal stromal tumor (GIST) is the most frequent tumor of the gastric submucosa. GIST has malignant potential, and DeMatteo et al. [1] reported that recurrence of GIST at the peritoneal surface or liver was usual. On the other hand, the postoperative outcomes for patients with GIST are better in Japan than in Western countries, as screening for gastric disease is more common in Japan, resulting in earlier detection of GIST.

Many studies have described the use of laparoscopic resection for gastric GIST, but its use remains controversial because of the associated risk of intraoperative tumor dissemination. A consensus conference of the European Society for Medical Oncology (ESMO) [2] recommended avoiding laparoscopic surgery because of the risk of injury to the tumor capsule but did endorse the use of laparoscopic resection for small (<2 cm) intramural tumors. Guidelines issued by the National Comprehensive Cancer Network (NCCN) [3] state that gastric GISTs ≤5 cm may be removed by laparoscopic wedge resection.

Various types of laparoscopic surgery for GIST have been described, including wedge resection of the stomach, intragastric tumor resection, and combined endoscopic-laparoscopic resection [4–11]. Wedge resection of the stomach is the ideal method for the GIST from the oncological aspect. However, the usual method utilized for wedge resection is not indicated for tumors located on the posterior wall of the stomach or in the area near the esophagogastric junction (EGJ). The present study describes the use of a "non-touch" lesion-lifting method

for patients with gastric GIST and investigates outcomes for patients who underwent that procedure.

Patients and methods

Forty-two consecutive patients with gastric GIST underwent laparoscopic wedge resection of the stomach at our institution between January 2000 and September 2012. In this series, we included only patients with gastric GIST, as confirmed by pathological examination, and excluded other types of submucosal tumor of the stomach. Laparoscopic wedge resection of the stomach was used as the basic procedure for tumors less than 5 cm in diameter. Tumors larger than 5 cm and tumors located on the EGJ were treated with open surgery.

Patient characteristics, operative time, complications, length of postoperative stay, risk categories using Fletcher's classification [12], and tumor recurrence were evaluated.

Surgical procedure

The procedure consisted of a non-touch lesion-lifting method using traction sutures at the normal stomach wall around the tumor. Three ports (15, 12, and 5 mm) were placed, and pneumoperitoneum was established. Intraoperative gastroscopy was used to confirm the location of the tumor with laparoscopy.

When tumors were located at the anterior wall of the stomach, traction sutures were placed at the normal stomach wall near the tumor, and these traction sutures were pulled out through the abdominal wall. If necessary, perigastric vessels were dissected using laparoscopic coagulation sheers. After lifting the tumor, tumors with a clear operative margin were resected using a linear stapler.

When tumors were located at the posterior wall of the stomach, traction sutures were placed at the anterior stomach wall, and these sutures were pulled out through the abdominal wall. Traction sutures could be used instead of forceps. Thus, the use of traction sutures enables minimization of the required number of ports. After dissecting perigastric vessels, some additional traction sutures were placed at the posterior stomach wall near the tumor. Traction sutures were pulled out through the abdominal wall, and the posterior stomach wall including the tumor was rotated to the front of operative field by applying traction to the sutures (Fig. 1). The lifted tumor was then resected using a linear stapler.

When tumors were located near the EGJ, traction sutures were placed in the area near EGJ and on the opposite side of the tumor. An appropriate distal margin was assured to avoid stenosis and deformity of the EGJ. Intraoperative endoscopy was used to assess for the presence of any gastric deformity and to resect the gastric wall across the gastric longitudinal axis, thereby avoiding the induction of stenosis and deformity of the stomach.

Results

Patient characteristics are summarized in Table 1. The patient population consisted of 15 men and 27 women, aged from 37 to 78 years (median, 66 years). Thirty tumors (71 %) were located in the upper third of the stomach; the remaining 12 tumors (29 %) were located in the middle third of the stomach. The median tumor diameter was 30 mm (19–52 mm). Thirty-six tumors (85 %) were classified as low-risk group, 4 tumors (10 %) were intermediate-risk group, and 2 tumors (5 %) were high-risk group according to Fletcher's classification.

Surgical and clinical outcomes are summarized in Table 2. The median operative time was 140 min (range, 89–307 min), and the median blood loss was 0 ml (range, 0–100 ml). Postoperative courses were uneventful, except for one female patient who experienced postoperative bleeding. The postoperative course of this case was uneventful until the third postoperative day. She complained of severe abdominal pain on the fourth postoperative day.

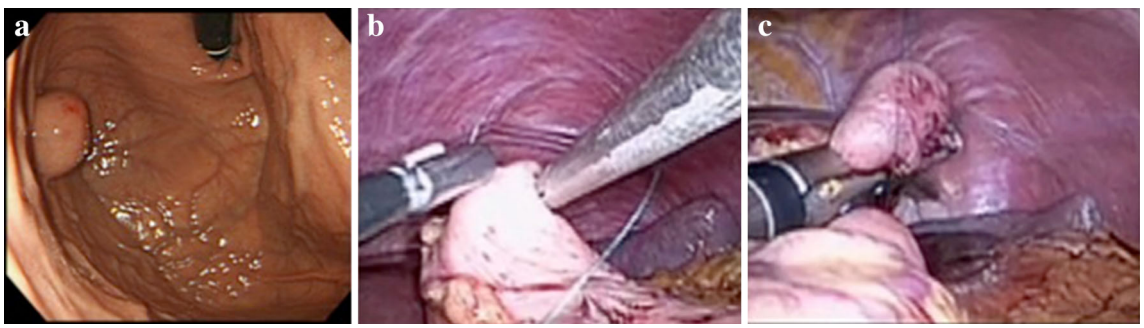

Fig. 1 Gastroendoscopic findings and laparoscopic views of a gastrointestinal stromal tumor located on the posterior wall of the stomach. **a** Tumor located in the posterior wall of upper part of the stomach. **b** Traction suture on the normal posterior wall of the stomach near the tumor. **c** Tumor resection using a linear stapler

Table 1 Patient characteristics

Patients	($n = 42$)
Age (years), median (range)	66 (37–78)
Sex	
Male	15 (36 %)
Female	27 (64 %)
Tumor location	
Upper third of stomach	30 (71 %)
Middle third of stomach	12 (29 %)
Tumor size (mm), median (range)	30 (19–52)
Risk categories	
Low	36 (85 %)
Intermediate	4 (10 %)
High	2 (5 %)

Table 2 Surgical and clinical outcomes

Outcomes	$n = 42$
Operation time (min), median (range)	140 (89–307)
Blood loss (ml), median (range)	0 (0–100)
Postoperative complication	1 (2.4 %)[a]
Postoperative hospital stay (days), median (range)	7 (6–14)
Recurrence	1 (2.4 %)[b]

[a] Postoperative bleeding

[b] Liver metastasis

Angiography in this patient revealed intraabdominal bleeding from the posterior gastric artery, and transarterial embolization (TAE) was performed, which resulted in hemostasis. However, this patient died of progressive metabolic acidosis. The posterior gastric artery had not been manipulated in this case, as the tumor was located on the anterior wall of the stomach. Thus, it is unclear whether this complication was related to the surgical procedure. This patient had chronic kidney disease requiring regular hemodialysis and had severe hypertrophic obstructive cardiomyopathy. Thus, it is possible that the posterior gastric artery ruptured spontaneously from a microaneurysm related to severe atherosclerosis. The median postoperative stay was 7 days (range, 6–14 days). One patient developed liver metastasis after surgery. None of the patients experienced local recurrence or peritoneal recurrence.

Discussion

Surgery is the standard strategy for management of resectable GIST. Because metastasis of GIST to the lymph nodes is rare, local resection with negative surgical margins is usually curative without the need for lymph node dissection. Laparoscopic surgery for GIST is a controversial approach because injury of the pseudo-capsule during a laparoscopic procedure can result in tumor dissemination. However, several groups of investigators have reported that laparoscopic surgery for GIST <5 cm in size was safe and suitable [4–11].

Several methods of laparoscopic resection for gastric GIST of the stomach have been described. The indication for intragastric resection is limited to tumors growing within the gastric wall. Combined endoscopic-laparoscopic resection is useful for tumors located near the EGJ, but use of this method for ulcerated tumors carries a risk of tumor dissemination. From the oncological view, wedge resection with negative surgical margins is the most certain method to achieve cure. In the present series, there was only one case of hepatic metastasis from gastric GIST, and none of the patients experienced local recurrence or peritoneal tumor dissemination after surgery. Laparoscopic wedge resection for the extragastric type GIST is widely accepted. Because the surgical technique for the intragastric type GIST involves a wider resection of the normal gastric mucosa, the indication for wedge resection for patients with intragastric-type GIST remains controversial. Gastric GISTs are frequently located in the upper part of the stomach, which has a wide area as compared with the lower part of the stomach. Furthermore, endoscopy was used during surgery to confirm the deformity of the stomach and to resect the gastric wall across the gastric longitudinal axis. Gastric stenosis or deformity did not occur in any of the patients. These observations suggest that this technique is a feasible method to manage GIST, including intragastric-type GIST.

Matsui et al. [10] described the efficacy of the fundic rotation technique for the management of submucosal tumors located on the posterior wall near the EGJ. The fundic rotation technique is useful but requires additional forceps to rotate the gastric wall. Although the laparoscopic technique described by Matsui et al. requires five ports, the technique described in this report requires only three ports. Thus, the use of traction sutures enables minimization of the required number of ports.

We had an experience of postoperative bleeding case on the fourth postoperative day. Although the cause of death was not clear, the surgical procedure, such as traction of the gastric wall, might influence the injury of the artery indirectly. We should avoid the same complication. Therefore, traction sutures should be pulled gently and slowly. Furthermore, for the patient suffering from severe atherosclerosis, open laparotomy may be recommended.

This study suggests that the present technique is useful for the surgical management of gastric GIST. This technique is easy to perform and does not require special procedures, such as combined endoscopic-laparoscopic

resection. Therefore, this technique might be indicated for nearly all cases of gastric GIST. However, for difficult cases (e.g., tumors >5 cm; tumor located on the EGJ or near the pyloric ring; cases with gastric wall deformity), other methods should be used, such as open laparotomy.

Conclusions

This non-touch lesion-lifting method was useful for the laparoscopic management of gastric GIST.

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