Laparoscopic Resection of Gastric and Small Bowel Gastrointestinal Stromal Tumors: 10-Year Experience at a Single Center

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BACKGROUND: Complete curative resection remains the treatment of choice for nonmetastatic gastrointestinal stromal tumors (GISTs). The safety and feasibility of laparoscopy in the treatment of this disease has been shown, however, the long-term oncologic outcomes of this technique remain unclear.

STUDY DESIGN: An ongoing prospectively maintained database including all laparoscopically resected gastric and small bowel GISTs (n = 116) at Mount Sinai Medical Center from July 1999 to December 2011 was retrospectively analyzed. Recurrence and survival outcomes were calculated using the Kaplan-Meier method and compared with log-rank test.

RESULTS: Tumors were of gastric (77.6%) and small bowel (22.4%) origins. Overall mean tumor size was 4.0 cm (±2.7 cm) and R0 resection was achieved in 113 (97.4%) cases. Overall perioperative complication rate was 14.7%, with a reoperative rate of 4.3% at 90 days. When comparing gastric with small bowel GISTs, a more acute presentation requiring emergent resections was noted in patients with small bowel GISTs (p = 008). However tumor size, operative data, and perioperative outcomes were comparable in both groups (p = NS). At a median follow-up of 56.4 months (range 0.1 to 162.4 months), recurrence rate was 7.8% and comparable in both gastric and small bowel GISTs (p = NS). Risk factors for recurrence on univariate analysis were presence of ulceration/necrosis ($p < 0.001$) and tumor size >5 cm (p = 0.05). Overall 10-year survival rate was 90.8%. Gastric and small bowel overall survival rates were similar (90.7% vs 91.3%, respectively). Overall 10-year disease-free survival was 80.0% (84.3% gastric vs 71.6% small bowel; p = NS).

CONCLUSIONS: Our series demonstrates the safety and feasibility of laparoscopy in patients undergoing resection of small bowel and gastric GISTs. Comparable long-term oncologic outcomes with a 10-year survival of 90.8% were achieved. (J Am Coll Surg 2014;218:367−373. © 2014 by the American College of Surgeons)

Gastrointestinal stromal tumors (GISTs) are rare intestinal neoplasms of mesenchymal origin.[1-3] Complete surgical resection with disease-free margin is considered the treatment of choice for nonmetastatic disease, with a 5-year survival rate of 40% to 55%.[2,3] As demonstrated in historical series of open resections, factors associated with poor outcomes included tumor size, tumor location, mitotic index, presence of ulceration, and necrosis.[4-7] Extended tumor-free margins or lymphadenectomy have not been associated with improved oncologic outcomes.[2] These unique characteristics have led many centers to investigate the feasibility and safety of a minimally invasive approach in the treatment of GISTs (Table 1).[8-14] However, the long-term oncologic outcomes of this technique remain unclear. Local recurrence or distant metastasis might not be present until years after the initial diagnosis. In addition, there is paucity in the literature on the management and outcomes of laparoscopic small bowel GISTs.

As a tertiary center performing a large volume of GIST resections, we present an update of our previously published results.[15] The aim of this analysis was to examine our 10-year experience and better understand the long-term oncologic outcomes of laparoscopic resection gastric and small bowel GISTs. In addition, we describe factors significantly associated with survival from the time of resection.

Disclosure Information: Nothing to disclose.

Received September 28, 2013; Revised November 18, 2013; Accepted November 27, 2013.

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ISSN 1072-7515/13/$36.00
http://dx.doi.org/10.1016/j.jamcollsurg.2013.11.029

Table 1. Existing Series on Laparoscopic Resection of Gastrointestinal Stromal Tumors

First author	Year	n	Small bowel, n	Tumor size, cm, mean ± SD (range)	Conversions, %	Complications, %	Follow-up, mo, mean (range)	Recurrence rate, %	Survival % (years)
Novitsky[8]	2006	46	0	4.4 ± 2.0 (1.0–8.5)	0	8.7	36 (4–84)	8.0	96 (3)
Lai[9]	2006	28	0	3.4 ± 1.6	3.6	0	43.3	0	100 (5)
Sexton[10]	2008	63	0	3.8 ± 1.8 (0.4–9.0)	1.6	16.4	15 (0–103)	4.8	—
Catena[11]	2008	21	0	4.5 ± 2.0 (2.0–8.5)	0	0	35	0	100 (3)
Karakousis[12]	2011	40	0	3.6 (0.7–7.8)	32.5	15	28 (0.3–70)	2.5	—
De Vogelaere[13]	2012	31	0	4.4 (0.4–11)	0	3.2	64.0 (1–156)	0	100 (5)
Pucci[14]	2012	58	0	3.8 (0.7–11.5)	1.7	0	—	—	—

METHODS

An ongoing prospectively maintained database including all laparoscopically resected gastric and small bowel GISTs at Mount Sinai Medical Center from July 1999 to December 2011 was retrospectively analyzed. The majority of tumors (95.7%) were pathologically confirmed to be GISTs by CD117 expression. The remaining tumors were identified to have typical cytoarchitectural features of GISTs and express CD34. Records were reviewed with respect to patient demographics and outcomes, medical history, presenting symptoms, diagnostic workup, operative details, postoperative course, and pathologic characteristics. All operations were performed at our tertiary center by experienced laparoscopic surgeons. A laparoscopic to open conversion was classified as any case in which laparoscopy was used with therapeutic intent based on the operative report with subsequent creation of a laparotomy incision, regardless of the extent of attempted resection. Hand-assisted cases were classified as conversions. Mitotic rate was defined as number of mitoses per 50 high-power fields, and tumor size was defined as the maximal tumor dimension in the resected specimen. Curative resection was defined as removal of all gross disease at surgery with (R1) or without (R0) microscopic disease.

The majority of cases ($\geq$10) were performed at a single tertiary center by 5 different laparoscopic surgeons. The technical method used depended on tumor location, size, morphology, and surgeon's preference. A laparoscopic or laparoendoscopic approach was used to treat all gastric lesions in our series. The patients were placed in supine position using a split-leg table in the majority of gastric cases. The operating room setup and trocar placement were similar to those of most foregut operations. The abdominal cavity was explored before resection to rule out peritoneal spread or hepatic metastasis. When in doubt, an intraoperative ultrasound was used to confirm suspicious lesions. In general, exophytic tumors were amendable to wedge resection with a linear stapling device. Tumors located on the anterior wall required a limited gastric mobilization as supposed to posterior gastric lesions. The latter were approached with an anterior gastrotomy to allow adequate delivery of the tumor. Intraoperative endoscopy was routinely used for proximal gastric lesions to determine localization and extent of the tumor, appropriate technique for resection, as well as integrity of the staple line. An esophageal bougie was carefully positioned to assure a wide gastric inlet and its patency was confirmed with a post-resection intraoperative endoscopy. Similar to proximal tumors, distal (antral) lesions posed a technical challenge due to concern of narrowing the gastric outlet. When in doubt, a subtotal gastrectomy with Billroth II reconstruction was performed. For patients with small bowel GISTs, once the lesion

Table 2. Clinicopathologic Operative Data of 116 Patients with Gastrointestinal Stromal Tumors Undergoing Resection

Characteristics	
Age, y, mean (SD)	64.9 (13.7)
Sex, %, male/female	47.4/52.6
Urgent/elective surgery, n (%)	20 (17.2)/96 (82.8)
Tumor location, n (%)	
Gastric	89 (77.6)
Small bowel	26 (22.4)
Tumor size, cm, mean (SD)	4.0 (2.7)
Mitotic index >5/HPF	20 (17.2)
Necrosis/ulceration, n (%)	16 (13.8)
CD117, n (%)	111 (95.7)
Intraoperative endoscopy, n (%)	25 (21.6)
R0/R1 resection, n (%)	113 (97.4)/3(2.6)
Operative time, min, mean ± SD (range)	134.8 ± 67.8 (35–366)
Estimated blood loss, mL, mean ± SD (range)	114.3 ± 214.3 (5–1,500)
Length of stay, d, median (range)	3 (1–94)
Conversion, n (%)	13 (11.2)
Perioperative 30-d morbidity, n (%)	17 (14.7)
Perioperative 30-d mortality, n (%)	1 (0.86)
Perioperative 90-d mortality, n (%)	1 (0.86)
Reoperations, 90-d, n (%)	5 (4.3)
Overall recurrence rate, n (%)	9 (7.8)

HPF, high-power field; MI, mitotic index (number of mitotic cells per 50 high-power fields).