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Surgical Management of Gastrointestinal Stromal Tumors of the Stomach

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ABSTRACT

Background: Laparoscopy has emerged as the "gold standard" procedure for many diseases that require surgical treatment. Our goal was to assess the outcomes of laparoscopic vs open partial gastrectomies for the management of gastrointestinal stromal tumors of the stomach (gGIST) using a national database.

Methods: Using the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database (2006–2009), we identified patients who underwent laparoscopic and open partial gastrectomy gGIST. Overall morbidity and mortality were assessed. The relationships between anesthesia time, operative duration, surgical site infection (SSI), and hospital stay were also examined. Two-sample *t* tests were used.

Results: Of 486 patients, 146 (30%) underwent laparoscopic resection (LR) and 340 (70%) underwent open resection (OR). Patients who underwent LP were older (mean: 65 vs 62 years; $P = .062$). Patients treated with LR experienced shorter anesthesia time (mean: 183 vs 212 minutes; $P < .05$) and shorter operative time (mean: 119 vs 149 minutes; $P < .05$) compared with those who underwent OR. All patients treated with LR had fewer SSIs compared with those who underwent OR (0.68% vs 6.7%; $P < .001$). Patients treated with LR were less likely to experience an overall morbidity (mean: 3.9% vs 11.7%; $P < .001$) or mortality (mean: 0.23% vs 0.72%; $P < .001$) and shorter total hospital stay (mean: 3.17 vs 7.50 days; $P < .001$) compared with those who underwent OR.

Conclusions: In ACS NSQIP hospitals, laparoscopic resection of gGIST appears to be preferable to open surgery. However, prospective studies with large sample sizes comparing both surgical approaches with size-matched tumors are strongly suggested.

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INTRODUCTION

A gastrointestinal stromal tumor (GIST) is a mesenchymal-derived tumor of the gastrointestinal (GI) tract with an estimated incidence of 5000 cases per year. GISTs can occur throughout the entire GI tract; the stomach accounts for 60% to 70% of all locations.[1] GISTs result from a mutation in the tyrosine kinase receptor protein (KIT) also called CD 117.[2,3] Most GISTs test positive for KIT (85%–95%); however, up to 15% do not carry this mutation.[4]

Predictors of tumor recurrence include mitotic index, size, and tumor location, with gGIST having a more favorable outcome. Because gGIST rarely metastasizes to lymph nodes, performing routine lymphadenectomy is unnecessary.[5] Wide resection margins have not been associated with improved oncologic outcomes when the above predictors are considered.[6] Moreover, tumor spillage can result in disease progression, recurrence, and ultimately poor survival. Simple wedge resection with negative margins has become the recommended surgical approach, and gGIST resection is therefore particularly amenable to a minimally invasive technique. An increasing number of laparoscopic experiences that demonstrate the feasibility of this approach have been reported.[7–10]

Much controversy exists regarding the maximum diameter of gGIST for laparoscopic resection. The 2004 National Comprehensive Cancer Network (NCCN) Clinical Practice Guidelines for optimal management of gGIST suggested that laparoscopic technique should be limited to tumors smaller than 2 cm.[11] However, this recommendation was increased to 5 cm in the 2007 NCCN guideline. This modification represents the advance in laparoscopic skills of today's surgeons.[12] Recently, there have been reports of laparoscopically resected gGIST with diameters ranging between 4 cm and 10 cm.[7,13–15] Open surgery is still recommended when resecting large tumors, tumors requiring more extensive dissection and those situated in difficult anatomic locations (eg, gastroesophageal junction, pylorus).

Comparison of laparoscopic with open resection of gGIST has been reported, but most reports are single-center series and are notably underpowered. This circumstance hinders the ability of these studies to distinguish the real significance of studied variables such as hospital stay, surgical site infection, operative time, anesthesia time, and overall morbidity and mortality. A multicenter approach would be an effective way to increase the power and validity of statistical analysis.

Recently, the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) has emerged as a valuable source of large-quantity and high-quality outcomes data. The NSQIP database is the first nationally validated, risk-adjusted, outcomes-based program used to measure and improve the quality of surgical care. It is the objective of this study to assess the outcomes of laparoscopic vs open partial gastrectomies for the management of gGIST at ACS-NSQIP hospitals.

MATERIALS AND METHODS

As a center contributing to NSQIP, our institution is granted access to the database. The NSQIP collects data on 135 variables, including preoperative risk factors, intraoperative variables, and 30-day postoperative mortality and morbidity outcomes for patients undergoing major surgical procedures in both inpatient and outpatient settings. Every surgical procedure is recorded in the NSQIP database by a distinct procedure code according to the *Current Procedural Terminology* (CPT).

After institutional review board approval, the NSQIP database was retrospectively reviewed from 2006 to 2009. All patients with CPT codes associated with open and laparoscopic partial/wedge gastrectomies were selected (**Table 1**). Total gastrectomies were excluded, as they were performed using only an open approach. The retrieved CPT codes were matched with a diagnosis code according to the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) that corresponded to GIST codes: 171.5-238.1-215.5.

The surgical approaches (open vs laparoscopic) were compared with regard to anesthesia time, operative duration, surgical site infection (SSI), overall morbidity, overall mortality, and hospital stay. Data were analyzed using SPSS 14.0 (SPSS, Chicago, Ilinois) software. Two-sample *t* test was used for statistical analysis. A P value $< .05$ was considered significant.

Table 1.
Groupings of Current Procedural Terminology Codes for Laparoscopic and Open Partial Gastrectomies at ACS NSQIP Hospitals

Procedure	CPT Code
Excision of stomach lesion (open)	43610–43611
Removal of stomach, partial (open)	43631–43632
Laparoscopic wedge resection of stomach	43659*

*There are no specific CPT codes for laparoscopic excision of a gastric lesion, laparoscopic partial gastrectomy, and laparoscopic wedge resection of the stomach. Code 43659, unlisted laparoscopic procedure, stomach, is reported to describe each of the three procedures listed.

RESULTS

Using the NSQIP database, we selected 486 patients who underwent partial/wedge gastric resection for gGIST. LR was performed for 146 patients (30%), whereas 340 (70%) underwent OR. Patients who had LP were older (mean: 65 years) than patients with OR (mean: 62 years). However, there was no statistical difference noted ($P = .062$).

Patients treated with LR experienced shorter anesthesia time: mean of 183 minutes for LR vs 212 minutes for OR ($P < .05$; 95% confidence of interval [CI]: 48.14–9.56). Similar results were observed with operative time: mean of 119 minutes for LR vs 149 minutes for OR ($P < .05$; 95% CI: 47.05–12.70). Additionally, the LR group had a shorter hospital stay with a mean of 3.17 days for LR vs 7.50 days for ORs ($P < .001$; 95% CI, 5.29–3.36) (**Table 2**).

When SSIs were evaluated, our results indicated that patients treated with LR were significantly less likely to develop them compared with the OR arm (0.68% vs 6.7%; $P < .001$). The LR group was also less likely to experience an overall morbidity (mean: 3.9% vs 11.7%; $P < .001$; 95% CI, 0.096–0.059) or mortality (mean: 0.23% vs 0.72%; $P < .001$; 95% CI, 0.06–0.03).

DISCUSSION

Laparoscopy is being used with increasing frequency as a surgical option for gGIST.[7–9,17,18] Currently, no large prospective randomized trials have been published comparing laparoscopic with open approaches. However, several retrospective small series have demonstrated the superiority of laparoscopy with respect to morbidity, mortality, and length of hospital stay. None of these series reported a head-to-head comparison with the open surgical method.[7–10] Outcome assessment of the open vs laparoscopic technique has been reported in three published series[14,19–20] with results comparable with ours. This study

Table 2.
Laparoscopic vs Open Partial Gastrectomies for gGIST, Distribution of Variables, ACS-NSQIP 2006–2009

Variable	Laparoscopic (mean)	Open (mean)	*P* Value	Confidence of Interval (95%)
Age (y)	65	62	.062	—
Anesthesia time (min)	183	212	<.05	48.14–9.56
Operative time (min)	119	149	<.05	47.05–9.56
Surgical site infection (%)	0.68	6.7	<.001	—
Overall morbidity (%)	3.9	11.7	<.001	0.09–0.05
Overall mortality (%)	0.23	0.72	<.001	0.06–0.03
Hospital stay (days)	3.17	7.5	<.001	5.29–3.36

represents the largest multi-institutional series that compares laparoscopic and open approaches based on a national database.

The operative time in the literature ranged from 49 minutes to 194.3 minutes. It appears to be related to the location and size of the gGIST as well as the surgical procedure performed. Mean operative time for laparoscopic resection ranged from 135 minutes to 151.9 minutes in the larger series compared with the mean of 119 minutes found in the current series. The published cases often included a subset of patients who underwent esophagogastrectomy for GE junction tumors, antrectomy for distal lesions, and transgastric resections, which yield longer intraoperative time.[7–10] The mean length of hospital stay was between 3.8 days and 4.8 days in the literature, similar to the current series of 3.17 days.[7–10,14]

Laparoscopic partial gastric resections for gGIST appears to have some advantage compared with open surgery, as evident from our results. However, the observed advantages of laparoscopy may be skewed by selection bias toward size and tumor location. Tumors located in challenging areas (GE junction, pylorus) or large-sized masses are generally resected via an open approach, as they frequently involve more extensive resections.[21] This difference may explain why the open approach has longer operative and anesthesia times. These patients are also prone to more complications as reflected by the overall morbidity and longer hospital stay.

The current series, although comparable with findings in the literature, must be considered with several limitations in mind. The ACS NSQIP does not collect information regarding tumor size, location, or conversion rates from laparoscopic to open method. These observations may directly affect outcomes as they relate to operative time, anesthesia time, SSI, and hospital stay. Moreover, ACS NSQIP does not collect information about patient symptomatology, diagnostic studies, or preoperative diagnoses. Important variables such as size and tumor location (GE junction, fundus, corpus, and pylorus) also cannot be determined. The ACS NSQIP has recognized these limitations and is currently implementing a procedure-specific approach to case selection and data recovery. This latest retrieval method will record unique variables of a particular operation.[22–24] One way to avoid selection bias is to ensure that the two surgical arms (laparoscopy vs open) are size-matched and to exclude tumors in difficult-to-access locations necessitating the open approach.

Karakounis et al.[20] compared 40 patients who underwent laparoscopic gGIST resection with 40 patients who underwent an open approach. The two groups were 1:1 matched by tumor size (±2 cm). Patients with GE junction tumors, patients with additional organ resection, and those with multifocal disease were excluded to establish greater parity between the two surgical groups. The median operative time was similar, although median hospital stay was lower in the laparoscopic arm (4 vs. 7 days; $P <$ .05). There was no operative mortality, and a similar 30-day morbidity was noted.

Laparoscopic gastric resection for selective cases of gGIST is safe, feasible, and effective. A minimally invasive approach should be the preferred surgical treatment in patients with small- and medium-sized gGIST. Tumor size and location along with surgeon's laparoscopic skills are clearly important selection factors when choosing the operative approach. Therefore, prospective studies with large sample sizes comparing both surgical approaches with size-matched tumors are strongly suggested to achieve better evidence-based recommendations.

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