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Original research

Comparison of the post-operative outcomes and survival of laparoscopic versus open resections for gastric gastrointestinal stromal tumors: A multi-center prospective cohort study

Jin Hu [1], Brian Ho Nam Or [1], Kai Hu, Ming Liang Wang*

Department of Surgery, Ruijin Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China

HIGHLIGHTS

- Laparoscopic resection is the preferred surgical approach in treating gastric GISTs.
- Long term complications and survival in GIST is equivalent between open and laparoscopic resection.
- Endoscopic-assisted laparoscopic surgery improves surgical precision.

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ABSTRACT

Background and objectives: Laparoscopic resection (LR) is increasingly performed for gastrointestinal stromal tumor (GIST). The aim of this study is to investigate the short-term outcomes and therapeutic effects of LR compared to open resection (OR) of gastric GISTs.
Methods: During 2009–2014, a prospective cohort of 200 patients with gastric GISTs indicated for resection underwent LR and OR procedures in three centers in Shanghai. Patient demographics, peri-operative complications, and clinical outcomes were compared between the two groups.
Results: After exclusions, 176 patients who underwent gastric GIST resections were compared, of which 91 were laparoscopic, 85 were open. Compared to open surgery, laparoscopic resection of GIST has shorter operative time (102 vs. 172 min, $p < 0.001$), lower blood loss (100 vs 144 ml, $p < 0.001$), and shorter length of stay (9.1 vs. 15.3 d, $p < 0.001$). No statistical significant difference is observed for time to bowel function or semi-liquid diet, complications, recurrence rates, and mortality.
Conclusion: LR is a safe and efficacious treatment for gastric GISTs, providing the advantages of shorter operative time, reduced blood loss, and shorter length of stay, all without compromising post-operative outcomes and survival.

1. Introduction

Gastrointestinal stromal tumor (GIST) is the most common mesenchymal tumor of the gastrointestinal (GI) tract [1]. GISTs emerge from the interstitial cells of Cajal, which are pacemaker cells found on bowel walls [2]. Whilst these tumors can be found throughout the GI tract, they occur most frequently in the stomach, accounting for at least half of all GIST. Macroscopically, gastric GISTs have similar appearance to leiomyoma, neuroma, and heterotopic pancreas tissue *in vivo* [3,4].

The current mainstay treatments for GIST are anti-tyrosine kinase therapy and surgical excision [5,6]. The standard treatment for localized tumor larger than 2 cm is surgical excision. As lymph node metastases are rare, R0 excisions are often feasible with local excision, and only in rare cases tumor size or location indicate total or partial gastrectomy with anastomosis. Compared to other gastric malignancies, GIST has a smaller preferred resection margin, at 10 mm, and lymph-node dissections are not recommended [2,6]. Because of its unique pathology, tumor rupture is strictly avoided in GIST resection; patients with ruptured GIST carry a near 100% risk of recurrence [7].

Although laparoscopic resection (LR) of GIST is becoming

* Corresponding author. 573 Xujiahui Road, Huangpu District, Shanghai, 200025, China.
E-mail addresses: vincyhu@hotmail.com (J. Hu), mingliang-99@hotmail.com (M.L. Wang).
[1] These authors contributed equally to this work.

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commonplace in clinical settings, its safety and efficacy has not been confirmed. Several recent retrospective studies reported that laparoscopic resection was superior to open resection (OR) in terms of perioperative outcomes, including lower blood loss, lower morbidity rates, and shorter hospital stays [5,8,9]. However, these are all retrospective studies, and selection bias might exist between patients undergoing LR versus OR. In a retrospective systematic review, Koh found that larger and higher-risk tumors are more frequently treated with OR than LR, and patients who underwent OR are more likely to have gastrectomies [5].

This is a multi-center, prospective cohort study determining the efficacy, safety, and post-operative outcomes of LR versus OR for gastric GIST tumors. We intend to mitigate selection bias through proactive long term follow-up to optimize retention.

2. Materials and methods

A prospective multi-center cohort study was performed beginning May 1st, 2009. We recruited patients who were admitted for gastric GIST at Ruijin Hospital Affiliated with the Shanghai Jiao Tong University School of Medicine, Shanghai Minimally Invasive Surgery Center, and Ruijin Hospital Luwan Branch. The recruitment ended in October 10th, 2014 as the sample size reached our intended limit of 200. This study was approved by our institutional review board (IRB). Patients between the age of 30 and 80, who were diagnosed, through both endoscopy and radiology, with primary gastric GIST without metastasis were included in the study. We excluded patients whose tumor diameter were under 2 cm (as their management remained controversial [10]), had co-existing malignancies, or were American Society of Anesthesiology grade 3 or higher. Patients were assigned to the LR or OR arm according to surgeon preference. Of all the patients identified in the study, 100 received LR and 100 OR. Post-surgical pathology excluded nineteen patients (7 in the LR arm and 12 in the OR arm) as their tumor pathologies were not GISTs. After the exclusion, a total of 181 patients were followed-up for durations between 6 and 60 months, with 93 in the LR arm and 88 in the OR arm.

2.1. Operations

The operations were performed by various experienced surgeons following the principles of surgery laid out by the NCCN guideline: complete gross resection without tumor rupture [10]. Abdominal and peritoneal organs were inspected for signs of metastasis, and lymph node dissection was not performed except in cases with proven lymphatic involvement. In both laparoscopic and open resections, all tumors were excised with over 10 mm gross margins and removed with extraction bags.

2.2. Laparoscopic resection

Prophylactic antibiotics were administered and the operations were performed under general anesthetics. Nasogastric tube and Foley catheter were placed. After abdominal insufflation, patients were put in the Trendelenburg position. With 4- to 5-trocar approach, abdominal structures including peritoneal surfaces, recto-vaginal or recto-vesical space, small intestines from the ligament of Treitz to the cecum, and liver were explored for concomitant tumor and metastasis. We identified the gastric tumors laparoscopically or with intraoperative endoscopic assistance. The excision approach – laparoscopic wedge resection (LWR), laparoscopic proximal gastrectomy (LPG), laparoscopic distal gastrectomy (LDG), or total gastrectomy – was decided based on tumor size and location. Excised tumors were removed with extraction bags and gastric endoscopy was performed.

2.3. Open resection

Patient preparation is same as LR. 8-cm upper midline incisions were used for laparotomy, and excision approaches, based on tumor size and location, included wedge resection, proximal gastrectomy, distal gastrectomy, or total gastrectomy. If necessary, the midline incisions were extended to facilitate tissue extraction.

2.4. Baseline and clinicopathological data

Baseline and clinicopathological data including patient demographics, BMI, alcohol and tobacco use, presence of clinical symptoms, history of surgery, ASA grade, tumor size and location were obtained. Surgery type and duration, blood loss, and occurrence of tumor rupture were collected from surgical and anesthetic records. Relevant postoperative outcomes including time to return of bowel function, time to semi-liquid diet, total and post-operative length of stay, and post-operative complications were recorded. GIST pathology were defined according to definitions by Miettinen and Lasota [11]. Tumor risk stratifications were carried out using Fletcher's criteria [12].

2.5. Statistical analysis

Statistical analyses were performed using SPSS for Windows, version 19.0 (SPSS Inc., Chicago, IL, USA). Univariate analyses were performed using Student's t-tests, Mann-Whitney U tests, and Chi-squared tests where appropriate. A P value < 0.05 was considered significant.

3. Results

Of the 200 patients recruited for the study, 19 were excluded for non-GIST pathology, and an additional five patients (three from the LR and two from the OR group) were lost to follow-up. We compared 91 patients who underwent LR to 85 patients who underwent OR for the excision of gastric GISTs.

3.1. Demographics and clinical characteristics

Demographics and clinical characteristics are described in Table 1. The average age of the entire cohort was 62.1 years. The LR group was composed of 91 (51.7%) patients, with 50 (55%) males, and has a mean age of 61.1 ± 10.4 years. There were no statistically significant differences with respect to age, gender, body mass index (BMI), comorbidities, alcohol or tobacco use between the two arms. We also analyzed the clinical symptoms and ASA score, and there were no significant difference between the LR and OR groups.

3.2. Operations

Operations and outcomes are described in Table 2. Of the 91 patients who underwent laparoscopic resections, 76 (84%) had wedge resection, 3 (3%) underwent proximal gastrectomy, 11 (12%) underwent distal gastrectomy, and 1 (1%) underwent total gastrectomy. The ratio of the surgery types in the open resection group ($n = 85$) is similar. All tumors were extracted without rupture, and no laparoscopic procedure was converted to laparotomy. There were no statistically significant differences in the resection types between the LR and OR groups. Operative time was shorter ($p < 0.001$) in the LR group (102.6 ± 24.0 min) compared to the OR group (172 ± 23.5 min). Patients had lower blood loss ($p < 0.001$) in the LR group (100 ± 84 ml) than the OR group (144 ± 104 ml). Time to return of bowel function was similar in both groups (3.2 d vs. 3.6 d, $p = 0.494$), as was the time to semi-liquid diet (7.6 d vs. 8.2 d,