

Robotic Small Bowel Resection with Intracorporeal Anastomosis for a Proximal Jejunal Gastrointestinal Stromal Tumor: A Case Report

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Abstract

Background: Gastrointestinal stromal tumors (GIST) account for 1-2% of gastrointestinal neoplasms. Their metastatic risk is highly dependent on tumor size. While imatinib mesylate can be used for metastatic disease, the primary approach for GIST management is surgical resection. This case explores the use of robotic-assisted laparoscopic small bowel resection and intracorporeal anastomosis as an early intervention for GIST.

Summary: A 64-year-old female with a history of hypercholesterolemia presented with a four-day history of vague lower abdominal pain. Computed tomography (CT) scan revealed a 3.7 cm mesenteric mass in the small bowel, 30 cm distal to the ligament of Treitz. The patient underwent a robotic-assisted laparoscopic proximal jejunal resection and intracorporeal anastomosis with an en bloc resection of the GIST. Pathologic evaluation revealed a low-grade, low-risk spindle-cell GIST, with strong and diffuse *c-KIT* (CD117) and *DOG1* positivity on immunohistochemical staining and without lymphovascular invasion. Molecular analysis by next-generation sequencing did not demonstrate any mutations in *KIT*, *PDGFRA* and *BRAF* genes. Given the complex etiology of vague abdominal symptoms, obtaining an accurate diagnosis requires a proper patient history and physical, in combination with imaging and laboratory findings. Robotic surgery has proven to be an increasingly accessible and valuable approach to resection of gastrointestinal tumors.

Conclusions: Gastrointestinal tumors of the small bowel require early intervention and can be resected via robotic-assisted laparoscopic surgery. Oncologic work up must be completed after the procedure to guide development of a multi-disciplinary oncologic treatment plan.

Keywords: GIST; Robotic Surgery; Bowel Resection; Anastomosis; Neoplasm

Abbreviations

GIST: Gastrointestinal Stromal Tumors; PDGFRA: Platelet-Derived Growth Factor Receptor; IHC: Immunohistochemistry; CT: Computed Tomography; MRI: Magnetic Resonance Imaging; PET:

Positron Emission Tomography; SBR: Small Bowel Resection; FDA: Food and Drug Administration; IV: Intravenous; ERAS: Enhanced Recovery After Surgery

Background

Gastrointestinal stromal tumors (GIST) are the most common mesenchymal tumors of the gastrointestinal tract but are considered rare, accounting for only 1-2% of gastrointestinal neoplasms [1]. The most common presentation among patients is gastrointestinal bleeding, but other symptoms include abdominal pain, obstruction, and melena [2]. GIST are associated with a gain of function mutation in the *KIT* or platelet-derived growth factor receptor (*PDGFRA*) genes and often originate from the interstitial cells of Cajal, due to their morphological and immunophenotypic characteristics [3,4]. GIST are most commonly found in the stomach (55.6%), followed by the small bowel (31.8%), colon, and esophagus [1]. Approximately 10% to 30% of clinically diagnosed GIST follow a malignant course, and metastatic risk increases with larger tumor size but not mitotic rate [5,6].

Diagnostic techniques are limited to immunohistochemistry (IHC) patterns, which demonstrate 95% GIST positivity for *KIT* or *DOG1* gene mutations [7,8]. Imaging techniques such as computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography (PET) allow visualization of tumor location, size, and metastasis [1].

GIST are generally resistant to conventional chemotherapeutic approaches. First-line management of unresectable and metastatic GIST involves treatment with imatinib (Gleevec, Novartis Pharmaceuticals); however, the disease often progresses in patients after 2-3 years of therapy [7].

The primary approach to management of GIST without metastasis is surgical resection, which yields better results with early diagnosis and earlier intervention. Segmental small bowel resection (SBR), a common procedure that typically results in insignificant compromise to the body's water and nutrient absorption, may be useful for GIST resection, depending on the tumor location. The proximal and distal remaining segments are subsequently reconnected via small bowel anastomosis to recreate gastrointestinal continuity, circumventing the need for an ileostomy [9].

Since the Food and Drug Administration (FDA) approval of the da Vinci® Surgical System in 2000, robotic surgery has become increasingly popular because it is minimally invasive, offers

3-dimensional visualization, and has greater range of motion and ergonomic advantages over open or traditional laparoscopic surgery. Recent reports on robotic-assisted colectomies demonstrate that while both extracorporeal and intracorporeal anastomosis are safe and feasible approaches to restoring bowel continuity with equivalent postoperative morbidity, intracorporeal anastomoses result in significantly quicker return to normal physiological function, fewer conversions to open surgery, fewer postoperative complications, and shorter hospital length of stay [10-12].

Case Presentation

A 64-year-old female presented to the emergency department with a 4-day history of diffuse abdominal pain and bloating, accompanied by a 1-day history of sweating and hot flashes. Past medical history included a previous laparoscopic appendectomy and a family history (father) with lung and prostate cancer. The patient denied recent weight loss, changes in bowel movements, and previous episodes of similar symptoms. Initial vital signs included a heart rate of 73 beats per minute (bpm), respiratory rate of 17 bpm, blood pressure of 165/95 mmHg, temperature of 96.8 degrees Fahrenheit, and oxygen saturation of 97% on room air. Upon physical examination, mild epigastric tenderness was noted, but the abdomen was otherwise soft and nondistended. Laboratory values were normal except for a mild leukocytosis of 11.8 k/ μ L.

CT imaging of the chest, abdomen, and pelvis with contrast revealed a 3.7 x 2.9 cm calcified mass in the left mid-abdomen originating from left jejunal mesentery but closely abutting the small bowel. Differential considerations included carcinoid tumor, GIST, and benign desmoid tumor. Upon evaluation, the patient was offered the option of a robotic-assisted laparoscopic resection of the jejunal/mesenteric mass with SBR due to the proximity of the mass to the jejunal lumen.

Intraoperatively, there was no evidence of tumor implants in the peritoneal cavity. Following robotic adhesiolysis, the mesenteric mass was identified approximately 30 cm distal to the ligament of Treitz. SBR was performed, along with a segmental wedge resection of the adjacent mesentery and en bloc tumor to avoid bowel ischemia from interruption of intestinal blood supply. A

functional end-to-end, stapled side-to-side robotic intracorporeal anastomosis was created with the proximal and distal ends of the jejunum. The specimen was removed from the peritoneal cavity using an endoscopic retrieval bag and submitted to Pathology. The patient tolerated the procedure well with no significant complications.

Pathologic evaluation showed low-grade, low-risk spindle-cell GIST (Figure 1), with strong, diffuse *c-KIT* (CD117) (Figure 2) and *DOG1* positivity (Figure 3) without lymphovascular invasion. Molecular analysis by next-generation sequencing did not demonstrate any mutations in *KIT*, *PDGFRA* and *BRAF* genes. The tumor was removed in its entirety with negative margins.

Figure 1: Benign duodenal mucosa (black arrowhead) with mural mesenchymal neoplasm comprised entirely of short fascicles of spindle cells with elongated nuclei containing vesicular chromatin, inconspicuous nucleoli, and moderate amounts of fibrillary pale eosinophilic cytoplasm (black arrows) (H&E, x20).

Figure 2: Immunohistochemical staining for *c-KIT* (CD117) showing strong and diffuse positivity in the tumor cells (Immunoperoxidase, x20).

Figure 3: Immunohistochemical staining for *DOG1* showing strong and diffuse positivity in the tumor cells (Immunoperoxidase, x20).

Discussion

Initial differential diagnosis included two types of tumors with potential malignancy, thus General Surgery was initially consulted for a robotic-assisted laparoscopic biopsy of the mesenteric mass. However, due to the location of the mass in relation to the jejunum, a biopsy alone presented the risk of bowel ischemia. If Pathology confirmed the malignancy of the mass, options for intervention would include chemotherapy, radiation therapy, hormone therapy, and/or surgical resection depending on the type of tumor. Thus, upon consideration of the patient presentation, CT findings, and mild leukocytosis, the decision to perform the segmental SBR was made preoperatively and performed without complications. Because Pathology identified the mass as a GIST, the patient was referred to an oncologist for further workup and appropriate treatment.

The patient was closely monitored postoperatively for return of bowel function and potential complications such as anastomotic leak, bowel ischemia, and/or infection. She had active bowel sounds and tolerated advancement of her diet with our robotic Enhanced Recovery After Surgery (ERAS) protocol, with passage of flatus on postoperative day 1 and with bowel movements on day 4. Her abdomen was consistently non-distended, soft, and appropriately tender to palpation. There were no apparent signs of infection, and her electrolyte levels and urine output were adequate. At her one-week follow up visit, the patient denied abdominal pain, nausea, vomiting, constipation, or diarrhea.

A faster return of bowel function and optimal recovery without development of a post-operative ileus can be attributed to robotic intracorporeal anastomosis. The wide range of motion and precision, offered by robotic technology, and the advantages of *in situ* bowel manipulation prevent mesenteric and serosal injury that can occur during externalization of the small bowel for creation of an extracorporeal anastomosis.

Conclusion

This case demonstrates how a proximal jejunal GIST was successfully managed with robotic-assisted laparoscopic SBR and intracorporeal anastomosis to promote early return of bowel function. Oncologic work up can be completed after the procedure to guide development of further treatment plans.

Lessons Learned

GIST of the small bowel and adjacent mesentery in symptomatic patients concerning for malignancy require early intervention. Robotic SBR with intracorporeal anastomosis should be considered as a treatment option for these tumors.

Meeting Presentations

ACS Clinical Congress, San Diego, CA, October 2022.

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