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Case Report

Single-Incision Laparoscopic Surgery for a Small-Intestinal Gastrointestinal Stromal Tumor: Report of a Case

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Our report concerns a 64-year-old man with a small-intestinal gastrointestinal stromal tumor (GIST), which was successfully treated with single-incision laparoscopic surgery (SILS). Small-bowel endoscopy detected a submucosal tumor located approximately 10 cm from the ligament of Treitz in the wall of the proximal jejunum. Contrast-enhanced computed tomography revealed a tumor (diameter, 4 cm) containing high- and low-density areas in the proximal jejunum. On 18F-fluorodeoxyglucose (FDG) positron-emission tomography (PET), the tumor demonstrated intense FDG uptake (maximum standard uptake value, 3.82), whereas it displayed high signal intensity on diffusion-weighted magnetic resonance images. No metastatic lesions were observed. The patient was diagnosed with a jejunal GIST. Wedge resection of the jejunum was performed using the SILS procedure. The tumor was histopathologically diagnosed as a low-grade malignant GIST. SILS is a useful resection technique for small-intestinal GIST.

Key words: SILS – Small intestine – GIST – Laparoscopic – FDG-PET – DWI

A 64-year-old man with a past history of diabetes mellitus was admitted to our hospital because of a suspected tumor in the small bowel, which was subsequently revealed by an abdominal ultrasonography screening examination. He had no digestive symptoms. He had a history of cigarette

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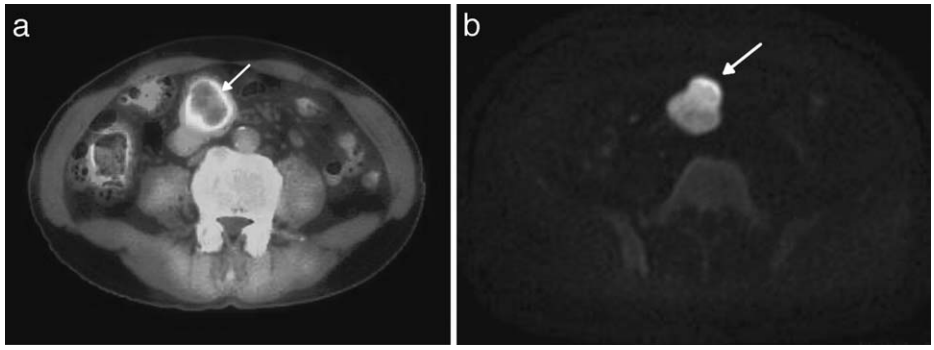

Fig. 1 (a) FDG-PET/CT scan showing that a tumor (diameter, 4 cm) displayed increased FDG uptake in the proximal jejunum (arrow). (b) Diffusion-weighted MRI showing that the tumor displayed high signal intensity (arrow).

smoking and alcohol use, but his family history was unremarkable, and he did not display elevated tumor marker levels. Small-bowel endoscopy showed a submucosal tumor located approximately 10 cm from the ligament of Treitz in the wall of the proximal jejunum. Contrast-enhanced computed tomography (CT) revealed a tumor (diameter, 4 cm) containing high- and low-density areas in the proximal jejunum. On 18F-fluorodeoxyglucose positron-emission tomography (FDG-PET)/CT, the tumor showed increased FDG uptake [maximum standard uptake value (SUV) = 3.82; Fig. 1a], whereas it displayed high signal intensity on diffusion-weighted magnetic resonance imaging (DWI Fig. 1b). No metastatic lesions were observed. The patient was diagnosed with a jejunal gastrointestinal stromal tumor (GIST).

We treated the tumor with single-incision laparoscopic surgery (SILS). In this procedure, an extra-small wound retractor (ALEXIS wound retractor XS, Applied Medical, Rancho Santa Margarita, California) was inserted through a 3-cm umbilical incision, and a surgical glove was used as the single port. Three 5-mm trocars were inserted into the surgical glove, which was then fixed to the outer ring of the wound retractor. The section of the small bowel close to the tumor was pulled toward the incision site, and the tumorous area of the jejunum was extracted through the incision. Wedge resection of the jejunum and closure of the enterotomy were performed outside the abdominal cavity (Fig. 2a and 2b). The tumor was elastic and had not invaded any adjacent structures. The dimensions of the tumor were $42 \times 43 \times 20$ mm.

A histopathologic examination revealed the bundle-like growth of spindle-shaped tumor cells with a mitotic rate of 3/50 high-power fields (HPF; Fig. 3). In immunohistochemical staining, the tumor was found to be positive for c-kit and CD34, but negative for keratin, smooth muscle actin, and s-100. In addition, 3.5% of the tumor cells were positive for Ki-67. As a result, we diagnosed the tumor as low-grade malignant GIST. After 6 months' follow-up, the patient is asymptomatic and displays no clinical evidence of tumor recurrence or metastasis.

Discussion

GISTs are the most common mesenchymal neoplasms of the gastrointestinal tract. GISTs most commonly occur at >50 years of age in the stomach (60%), jejunum and ileum (30%), duodenum (4%–5%), rectum (4%), colon and appendix (1%–2%), and esophagus (<1%).[1] Approximately 20% to 25% of gastric GISTs and 40% to 50% of small-intestinal GISTs are clinically malignant.[2] Furthermore, small-intestinal GISTs were reported to display a worse prognosis than gastric GISTs of comparable size with similar mitotic counts.[1,3] Considering the malignant potential of small-intestinal GISTs, a specific pretreatment diagnosis is required. Therefore, the diagnosis of GIST should be based on histopathologic and immunohistochemical examinations. Thus, endoscopic biopsy is generally recommended, but it is often not possible to obtain a representative tissue specimen for histologic confirmation of GIST due to its growth pattern. For example, small GISTs often form solid subserosal, intramural, or (less commonly) polypoid intraluminal masses, whereas the majority of larger GISTs form external, sometimes pedunculated, masses that attach to the outer aspect of the gut, including the muscular layers.[2] In such cases, imaging modalities such as FDG-PET/CT and magnetic resonance imaging (MRI) are helpful for confirming and staging GISTs. The FDG uptake and

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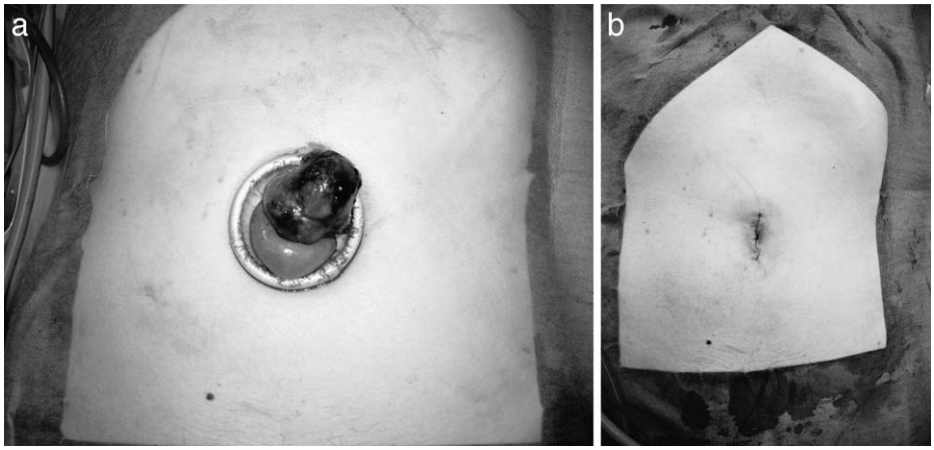

Fig. 2 (a) Intraoperative appearance after the tumor had been extracted through the umbilical incision. (b) Postoperative appearance of the umbilical incision.

malignant potential (determined by mitotic rate and Ki67 index) of gastric GISTs were reported to be significantly correlated, and malignant GISTs tend to display high SUV (>3.0).[4] DWI is a useful adjunct to assessing tumors with MRI. DWI involves the acquisition of magnetic resonance signals related to random thermal motion (Brownian motion) or the "diffusion" of water protons in tissue.[5] DWI has led to improvements in detection and characterization of tumors, treatment response monitoring, and recurrence detection in oncology patients.[5] DWI is also reported to be comparable to PET/CT with regard to its ability to visually detect GIST lesions and provides information similar to PET/CT during the diagnosis and treatment response evaluation of GIST patients.[6] In our case, the tumor displayed increased FDG uptake on FDG-PET/CT and high signal intensity on DWI. These findings support the abovementioned reports.

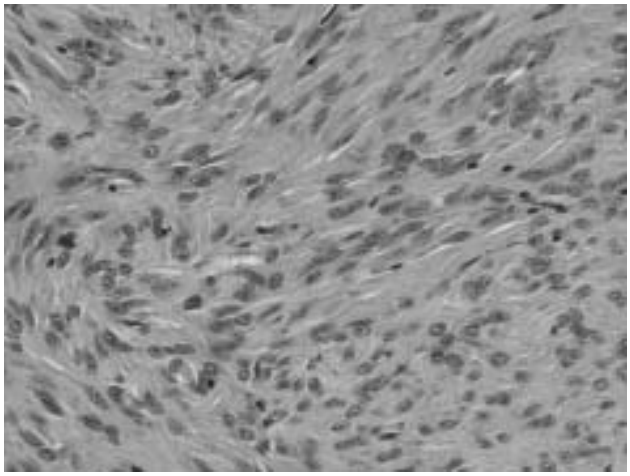

Fig. 3 Histologic examination detected the bundle-like growth of spindle-shaped tumor cells (×66).

For the surgical treatment of GISTs, local resection of the tumor has proven to be sufficient because lymph node metastases are very rare.[7] In gastric GISTs, a laparoscopic approach has been reported to be the preferred resection technique in most patients with small- and medium-sized GISTs.[8] For small-intestinal GIST, several reports have considered laparoscopic resection to be a safe and useful alternative to open resection.[9,10] SILS is derived from natural orifice transluminal endoscopic surgery (NOTES)[11]; that is, to address the risk of intra-abdominal contamination during NOTES caused by access to the peritoneal cavity through the normal viscera, surgeons began to use the umbilical scar as the entry portal into the abdomen, giving rise to "transumbilical surgery," or SILS,[11] As SILS is still being developed, there is a need for randomized, controlled trials to compare the completion rates, complications, cosmetic results, and morbidity rates of SILS with those of standard laparoscopic surgery.[12] However, SILS has been reported to have several advantages over current laparoscopic procedures because of the reduced number of incisions required; for example, it displays lower frequencies of associated morbidities, including wound infection, pain, bleeding, visceral injury, and port site herniation.[12] Furthermore, the cosmetic results obtained by using the umbilical scar as the single portal of entry is one of the greatest attributes of SILS.[11] Conversely, there are several disadvantages to SILS, such as its inadequate triangulation and the impaired view caused by in-line viewing.[12] Gener-

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ally, the small intestine is easily mobilized from the ligament of Treitz to the terminal ileum. Thus, small-intestinal GISTs that have not invaded the adjacent organs can be treated through minimal incisions via tumor retrieval and intestinal reconstruction. Because the umbilical incision used for SILS can also be used for specimen retrieval and can be converted to a circumumbilical incision when a larger incision is required,[11] SILS is suitable for the treatment of small-intestinal GISTs. The use of a single-access device made of a surgical glove and a wound retractor, which was employed in this case, has been described in several papers.[13,14] Although several devices for SILS have been developed, our glove-based technique has the advantage of being performed with conventional instruments (*i.e.*, without extra cost). Follow-up after surgical resection of a GIST is an important issue. A follow-up CT every 3 to 6 months is recommended after surgical resection of GIST, according to some guidelines.[15,16] Thus, further follow-up is still needed in our case.

In conclusion, FDG-PET/CT and MRI are considered to be helpful for diagnosing small-intestinal GISTs, and SILS is a useful resection technique for small-intestinal GISTs.

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