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Single Case

Gastric Plexiform Fibromyxoma Resected Using Nonexposed Endoscopic Wall-Inversion Surgery: A Case Report

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Keywords
Plexiform fibromyxoma · Nonexposed endoscopic wall-inversion surgery · Submucosal tumor

Abstract
Gastric plexiform fibromyxoma is extremely rare. In our case, upper gastrointestinal endoscopy of a 41-year-old woman patient revealed a 1-cm submucosal tumor (SMT) in the greater curvature of the lower body of the stomach. On contrast-enhanced computed tomography, the tumor was hypervascular in the arterial phase with continuous enhancement in the postvenous phase. On endoscopic ultrasonography, it had a low echo pattern. The preoperative diagnosis was a gastric SMT with a rich vasculature; however because the biosy specimen did not contain tumor tissue, a malignant tumor could not be excluded. The patient underwent nonexposed endoscopic wall-inversion surgery (NEWS), and the tumor was completely resected. Immunohistochemical examination revealed that the tumor was positive for D2-40 and α-smooth muscle actin, but negative for c-kit, discovered on gastrointestinal stromal tumor-1, desmin, S100, Melan-A, signal transducer and activator of transcription 6, insulinoma-associated protein 1, CXCL13, ETS transcription factor, follicular dendritic cell, anaplastic lymphoma kinase, human melanoma black, h-caldesmon, and CD1a, 10, 21, 23, 31, 34, 68, and

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163. Approximately, 1–2% of the tumor cell nuclei were Ki-67-positive. Finally, we diagnosed the tumor as a plexiform fibromyxoma. In conclusion, NEWS is an effective method for the treatment of SMTs with a diameter of <3 cm.

Introduction

A plexiform fibromyxoma is a mesenchymal tumor with nonspecific clinical manifestation. It has a plexiform growth pattern and is composed of bland spindle cells separated by an intracellular myxoid matrix and a stroma with abundant small vessels [1]. Plexiform fibromyxoma is rare and generally occurs in the stomach; only 124 cases of gastric plexiform fibromyxoma have thus far been reported [2]. Gastric plexiform fibromyxoma is usually benign; there are no reported cases of lymph node or distant metastasis. Its treatment strategy is unclear. Most gastric plexiform fibromyxomas are surgically resected; in a few cases, laparoscopic and endoscopic cooperative surgery (LECS) or endoscopic submucosal dissection (ESD) was performed. LECS is a minimally invasive surgery for gastric submucosal tumors (SMTs), with minimal gastric deformity after resection. Nonexposed endoscopic wall-inversion surgery (NEWS) is a type of LECS. There are no reports on the use of NEWS for resection of gastric plexiform fibromyxomas.

Here, we report a case in which a plexiform fibromyxoma with no symptoms was completely resected via NEWS. The patient provided written informed consent, and the study was conducted in accordance with the principles of the Declaration of Helsinki.

Case Report

A 41-year-old woman was referred to our hospital because of an abnormal finding during an upper gastric endoscopic examination at an outpatient clinic. Her medical history included uterine myoma, duodenal ulcer, and hypothyroidism. Her family history indicated that her mother had thyroid, colorectal, and uterine cancer. The patient was currently undergoing thyroid hormone treatment. Her physical examination results were normal, and the laboratory data were within normal limits (data not shown). Upper gastrointestinal endoscopy revealed the presence of a SMT with a delle in the greater curvature of the lower body of the stomach (Fig. 1a). On endoscopic ultrasonography (EUS), the tumor had a low echo pattern and an irregular shape and was located in the submucosal layer of the stomach (Fig. 1b). Contrast-enhanced computed tomography (CECT) of the abdomen showed that the gastric tumor was hypervascular in the arterial phase (Fig. 1c) and exhibited continuous enhancement in the post-venous phase (Fig. 1d). The tumor diameter was approximately 1 cm, and no swollen abdominal lymph nodes were observed. The preoperative diagnosis was a gastric SMT with a rich vasculature. However, because the biopsy specimen did not contain any tumor tissue, we were unable to exclude malignant tumors such as gastrointestinal storomal tumors. The patient underwent NEWS (Fig. 2a–d); the operative time was 214 min. No adverse events occurred during or after the operation, and the patient was discharged 6 days after NEWS. Macroscopic examination of the resected tumor showed that the tumor was 9 × 8 mm in size and had well-defined borders. Microscopic examination revealed a proliferation of tumor cells with spindle-shaped nuclei in the submucosa (Fig. 3a, b).

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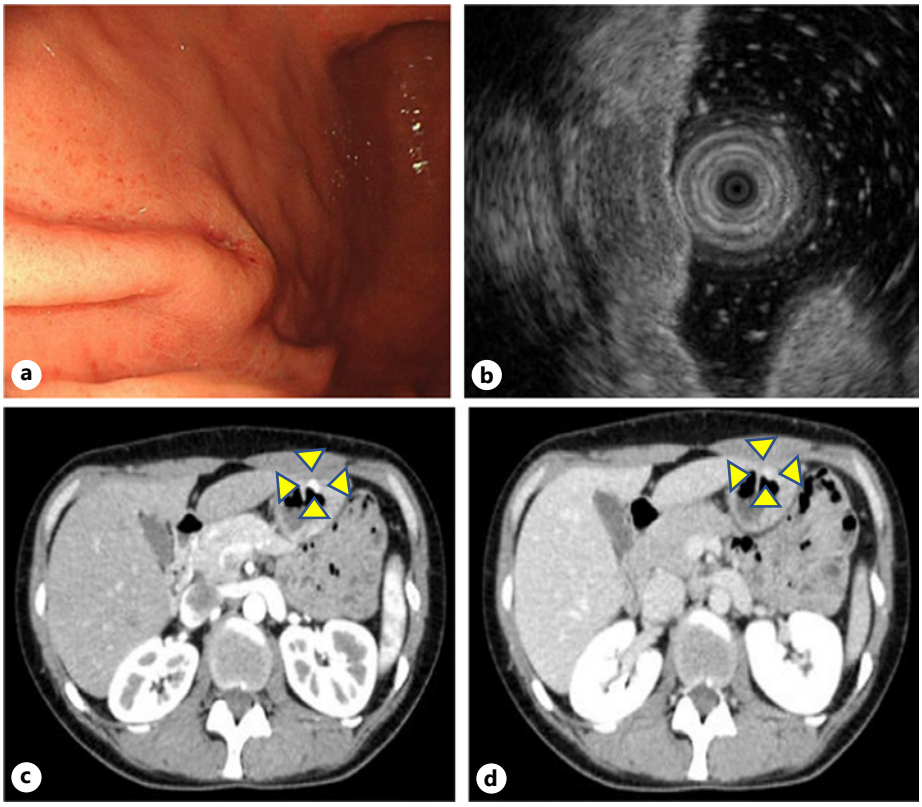

Fig. 1. a Upper gastrointestinal endoscopy revealed the presence of a SMT approximately 1 cm in size with a delle in the anterior wall of the gastric body. The tumor surface was covered with normal gastric mucosa, and the content of the tumor was hard. **b** EUS revealed a 1-cm tumor in the submucosal layer of the stomach. **c**, **d** Enhanced computed tomography showed that the tumor was hypervascular in the arterial phase (**c**), with continuous enhancement in the post-venous phase (**d**).

Immunohistochemical examination revealed that the tumor was positive for D2-40 (Fig. 3c) and α-smooth muscle actin (Fig. 3d), but negative for c-kit (Fig. 3e), discovered on gastrointestinal storomal tumors (Fig. 3f), desmin (Fig. 3g), S100 (Fig. 3h), Melan-A (Fig. 3i), signal tranducer and transactivator 6 (Fig. 3j), insulinoma-associated protein1 (Fig. 3k), CXCL13 (Fig. 3l), ETS transcription factor (Fig. 3m), follicular dendritic cell (Fig. 3n), anaplastic lymphoma kinase (Fig. 3o), human melanoma black, h-caldesmon, and CD1a (Fig. 3p), 10 (Fig. 3q), 21 (Fig. 3r), 23 (Fig. 3s), 31 (Fig. 3t), 34 (Fig. 3u), 68 (Fig. 3v), and 163 (Fig. 3w). Approximately, 1–2% of the tumor cell nuclei expressed the proliferation marker Ki-67 (Fig. 3x). There was some nuclear differentiation, but no necrosis. The final diagnosis was gastric plexiform fibromyxoma. Additional treatment was not necessary, and the patient will be followed up via imaging in a year.

Discussion

Gastric plexiform fibromyxoma is extremely rare; to date, only 124 cases have been reported worldwide [2]. The median age of occurrence is 45 years, the male-to-female ratio is 54:70, the mean tumor size is 5.1 ± 3.5 cm, and the maximum tumor diameter is 0.8–17 cm. The symptoms depend on the size of the tumor and, include abdominal pain, anemia, abdominal distension, melena, and abdominal discomfort. Plexiform fibromyxomas

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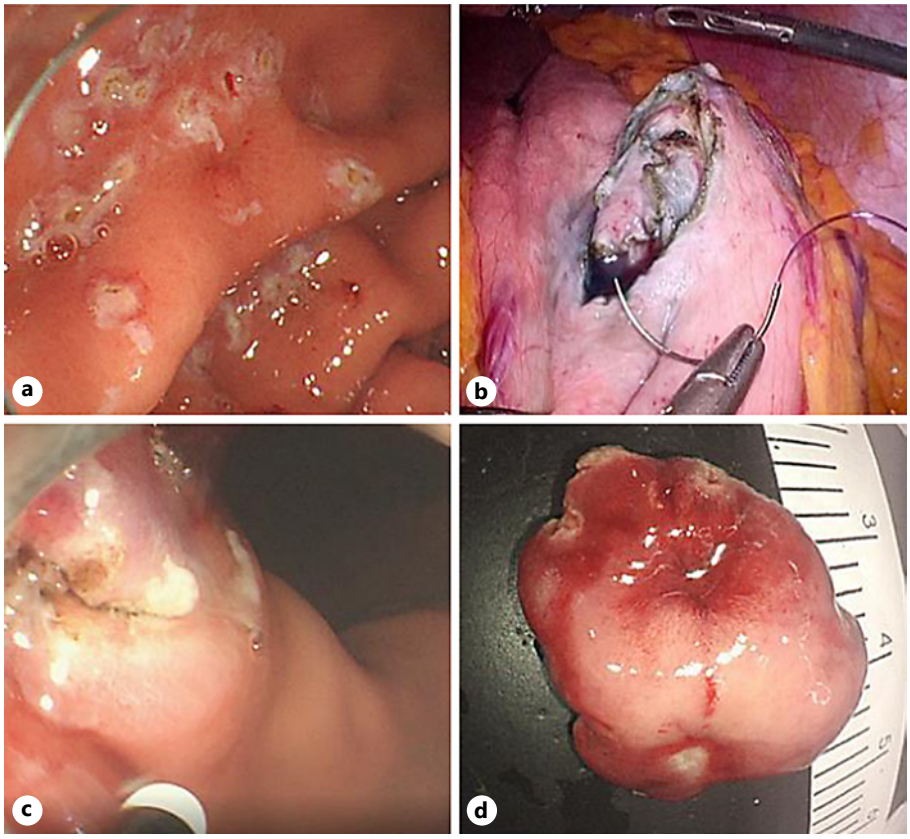

Fig. 2. The NEWS procedure. **a** The circumferential of the tumor was marked during upper gastrointestinal endoscopy. **b** A sero-muscular incision from the outside of the stomach was made during laparoscopy. **c** A muco-submucosal incision from the inside of the stomach was made during upper gastrointestinal endoscopy. **d** The resected specimen is shown.

are hypervascular tumors and bleeding signs or symptoms have been observed in 51 patients (41.1%); in these patients, a delle or ulcer was present on the tumor surface. Most of the reported plexiform fibromyxomas (83.6%) arose from the gastric antrum, whereas a smaller percentage (8%, 10 cases) arose from the gastric body [2]. The prognosis of gastric plexiform fibromyxoma is very good, and there have been no reports of recurrence after resection. In our case, a relatively small tumor emerged from the gastric body and was diagnosed incidentally.

Preoperative diagnosis of gastric plexiform fibromyxoma via imaging modalities such as gastrointestinal endoscopy, EUS, computed tomography, and magnetic resonance imaging is generally considered to be difficult. Moreover, preoperative diagnosis via immunohistochemical examination is not useful because plexiform fibromyxomas nonspecifically express markers such as α-smooth muscle actin, vimentin, and muscle-specific actin. A typical gastric plexiform fibromyxoma is a plexiform intramural growth with multiple micronodules containing paucicellular to moderately cellular myxoid, collagenous, and fibromyxoid neoplastic stromal elements [3]. In our case, a pathologist initially mistook the tumor for normal mucosa because the biopsy specimen did not contain tumor tissue. Although EUS-guided fine needle aspiration is helpful in diagnosing gastric SMTs [4], it was not used in our case. Based on the CECT and EUS findings, we preoperatively diagnosed the tumor as a gastric SMT with a rich vasculature, with differential diagnoses including a carcinoid tumor, malignant lymphoma, gastric cancer, aberrant pancreas, and a glomus

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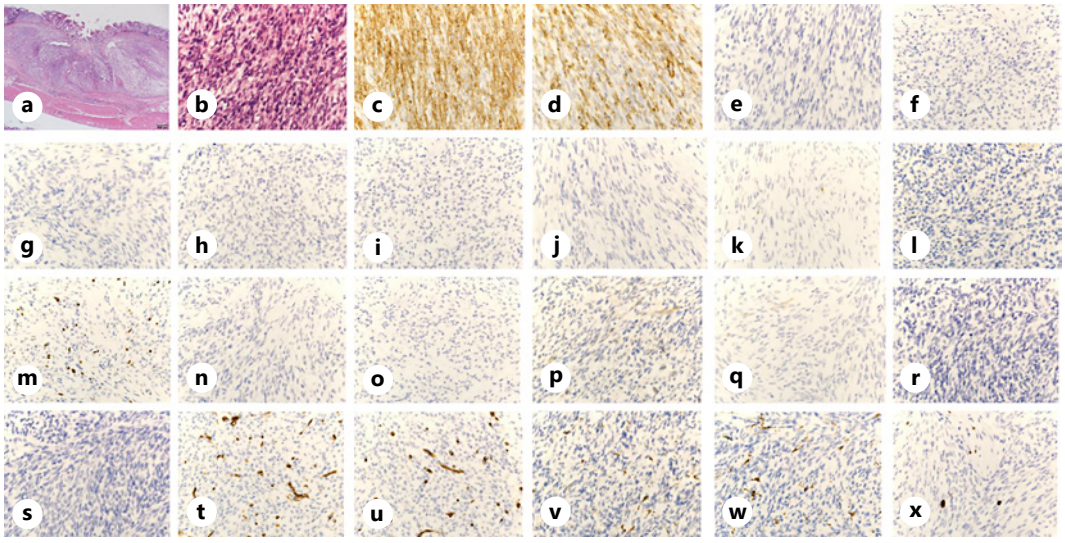

Fig. 3. Microscopic analysis of the tumor specimen. **a** Hematoxylin and eosin staining showing a proliferation of spindle-shaped tumor cells in the submucosa (original magnification, ×2). **b** Hematoxylin and eosin staining showing the spindle-shaped tumor cells at a higher magnification (original magnification, ×400). **c** Immunohistochemical examination revealed D2-40 positivity in the tumor cells (original magnification, ×400). **d** Immunohistochemical examination revealed aSMA positivity in the tumor cells (original magnification, ×400). **e–w** Immunohistochemical examination revealed c-kit, discovered on GISTs, desmin, S100, Melan-A, signal transducer and transactivator 6, insulinoma-associated protein 1, CXCL13, ETS transcription factor, follicular dendritic cell, anaplastic lymphoma kinase, CD1a, 10, 21, 23, 31, 34, 68, and 163 negatively in the tumor cells (original magnification, ×400). **x** Approximately, 1–2% of the tumor cell nuclei expressed Ki-67 (original magnification, ×400). GIST, gastrointestinal storomal tumor.

tumor. Although the tumor was very small (approximately 1 cm in diameter), it was hypervascular with an ulcer on the surface; therefore, we decided to perform LECS for tumor resection. In Japan, the use of LECS for SMTs was first reported by Hiki et al. [5]. Using LECS, we can resect the tumor on the ideal resection line; thus, the number of postoperative stomach deformities is lower after LECS than after laparoscopic wedge resection. As described by Goto et al. [6], NEWS is a full-thickness resection technique in which there is no contact with the region between the intra-abdominal space and intragastric space during the entire procedure. Because the tumor in our case had a delle, avoiding contact with this region was advisable. Although the tumor was approximately 1 cm in size and confined to the submucosa, we resected it using NEWS rather than ESD. En bloc resection of SMTs via ESD, which is used for treatment of SMTs, is difficult. A MEDLINE search did not uncover any published reports on the use of NEWS for resection of gastric plexiform fibromyxomas. Hence, this is the first case report in which this technique was utilized for this purpose. The tumor in our case expressed D2-40 as determined via immunohistochemistry. There are no previous reports of D2-40 immunostaining in plexiform fibromyxomas. D2-40 is a selective marker of lymphatic vessels [7]; it is not present in the vascular endothelium. It is used to diagnose malignant mesothelioma [8] and to detect lymphatic invasion in primary cancers of the breast, skin, prostate, cervix, and colon. In our case, D2-40 staining was incidental. Whether D2-40 is expressed in plexiform fibromyxomas is unclear, and examination of more cases is necessary.

We retrospectively examined the CECT and EUS findings in this case. The plexiform fibromyxoma described herein had a rich vasculature, and the CECT findings matched the final diagnosis. NEWS is an effective method for the treatment of SMTs with a diameter of <3 cm.

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Statement of Ethics

Written informed consent was obtained from the patient for publication of this case report and accompanying images. This retrospective review of patient data did not require ethical approval in accordance with Japanese guidelines.

Conflict of Interest Statement

The authors declare that they have no conflict of interest.

Funding Sources

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Author Contributions

Kazuhiro Nagao, Takuya Saito, and Shintaro Kurahashi performed laparoscopic and endoscopic surgery. Tomoya Sugiyama, Kazuhiro Yamamoto, and Yoshiharu Yamaguchi drafted the manuscript. Kazunori Adachi, Yasuhiro Tamura, and Shinya Izawa drafted figures. Yasushi Funaki, Naotaka Ogasawara, Makoto Sasaki, Toyonori Tsuzuki, and Kunio Kasugai gave many critical advices.

Data Availablity Statement

All data generated or analyzed during this study are included in this article. Further inquires can be directed to the corresponding author.

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