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The primary aim of *World Journal of Gastrointestinal Surgery* (*WJGS, World J Gastrointest Surg*) is to provide scholars and readers from various fields of gastrointestinal surgery with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJGS mainly publishes articles reporting research results and findings obtained in the field of gastrointestinal surgery and covering a wide range of topics including biliary tract surgical procedures, biliopancreatic diversion, colectomy, esophagectomy, esophagostomy, pancreas transplantation, and pancreatectomy, etc.

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Laparoscopic-assisted endoscopic full-thickness resection of a large gastric schwannoma: A case report

Cheng-Hai He, Shi-Hua Lin, Zhen Chen, Wei-Min Li, Chun-Yan Weng, Yun Guo, Guo-Dong Li

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Abstract

BACKGROUND

Schwannomas, also known as neurinomas, are benign tumors derived from Schwann cells. Gastrointestinal schwannomas are rare and are most frequently reported in the stomach. They are usually asymptomatic and are difficult to diagnose preoperatively; however, endoscopy and imaging modalities can provide beneficial preliminary diagnostic data. There are various surgical options for management. Here, we present a case of a large gastric schwannoma (GS) managed by combined laparoscopic and endoscopic surgery.

CASE SUMMARY

A 28-year-old woman presented with a 2-mo history of epigastric discomfort and a feeling of abdominal fullness. On upper gastrointestinal endoscopy and endoscopic ultrasonography, a hypoechogenic submucosal mass was detected in the gastric antrum: It emerged from the muscularis propria and projected intraluminally. Computed tomography showed a nodular lesion (4 cm × 3.5 cm), which exhibited uniform enhancement, on the gastric antrum wall. Based on these findings, a preliminary diagnosis of gastrointestinal stromal tumor was established, with schwannoma as a differential. Considering the large tumor size, we planned to perform endoscopic resection and to convert to laparoscopic treatment, if necessary. Eventually, the patient underwent combined laparoscopic and gastroscopic surgery. Immunohistochemically, the resected specimen showed

positivity for S-100 and negativity for desmin, DOG-1, α -smooth muscle actin, CD34, CD117, and p53. The Ki-67 index was 3%, and a final diagnosis of GS was established.

CONCLUSION

Combined laparoscopic and endoscopic surgery is a minimally invasive and effective treatment option for large GSs.

Key Words: Gastric schwannoma; Laparoscopy; Gastroscopy; Immunohistochemical staining; Operation method; Case report

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Core Tip: Gastric schwannomas (GSs) do not have specific clinical and endoscopic characteristics. Therefore, preoperative diagnosis may be difficult, and they can be misdiagnosed as gastrointestinal stromal tumors. In addition, while laparoscopic resection is possible, it is difficult to determine the location of intraluminal tumors. In contrast, endoscopic resection is only suitable for small submucosal tumors. Here, we present a case of a GS excised using laparoscopic-gastroscopic cooperative surgery. Additionally, we performed a literature review on computed tomography findings and surgical interventions used in the management of gastrointestinal stromal tumors and GSs.

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INTRODUCTION

Schwannomas are neurogenic tumors that emerge from Schwann cells. The most common site of a gastric schwannoma (GS) is the stomach, followed by the colon and rectum[1]. They usually arise from the muscular layer, with no specific clinical and endoscopic characteristics, and can frequently be misdiagnosed as gastrointestinal stromal tumors (GISTs), which are more common[2].

A GS can be managed by various surgical options, which have their advantages and disadvantages. Here, we report a case of a GS that was resected using combined gastroscopic and laparoscopic surgery.

CASE PRESENTATION

Chief complaints

A 28-year-old woman presented with a 2-mo history of epigastric discomfort and a feeling of abdominal fullness.

History of present illness

Two months before presentation, the patient developed epigastric discomfort, which was accompanied by a sensation of abdominal fullness. She did not experience abdominal pain, melena, and vomiting and exhibited no other symptoms of discomfort.

History of past illness

The patient was a non-smoker and did not drink alcohol. She reported no known food or drug allergies. Additionally, she had no history of blood transfusion or prior surgical procedure.

Personal and family history

The patient reported no significant family history.

Physical examination

Clinical data on admission were as follows: Body temperature, 36 °C; blood pressure, 120/84 mmHg; heart rate, 80 beats/min; and respiratory rate, 16 breaths/min. The abdomen appeared flat and soft, and the patient did not experience any abdominal tenderness or rebound pain.

Laboratory examinations

Routine blood tests, liver and kidney function tests, and electrolyte assay revealed no marked irregularities, and tumor markers were also negative.

Imaging examinations

On upper gastrointestinal (GI) endoscopy and endoscopic ultrasonography (EUS), we detected a hypoechoic submucosal mass, which arose from the muscularis propria and projected into the lumen, in the gastric antrum (Figure 1). Computed tomography (CT) images revealed a nodular lesion (4.5 cm × 4 cm) showing homogeneous enhancement on the gastric antrum wall (Figure 2).

Initial diagnosis

A working diagnosis of GIST was established, with schwannoma as a differential.

FINAL DIAGNOSIS

Histopathological examination confirmed that the tumor was localized within the gastric muscularis propria. The tumor was well circumscribed and comprised fusiform cells. Immunohistochemically, it showed S-100 (+), 3% Ki-67 index, desmin (-), DOG-1 (-), α -smooth muscle actin (-), CD34 (-), CD117 (-), and P53 (-). Accordingly, a final diagnosis of a GS was established (Figure 3).

TREATMENT

First, endoscopic resection was performed: Endoscopic full-thickness resection (EFTR) was conducted under general anesthesia with endotracheal intubation. A smooth submucosal lesion measuring 5 cm in diameter was observed on the anterior wall of the gastric antrum. We marked the edge of the lesion, injected a solution of methylene blue and saline into the mucosa, and subsequently excised the tumor gradually using a hook knife. Bleeding was minimal and easily controlled with electric hemostatic forceps. Following a successful EFTR, a large full-thickness defect was left on the gastric wall. A supplementary laparoscopic surgery was conducted considering the large defect size and difficulties with endoscopic closure and tumor extraction *via* the esophagus. The patient was placed in a supine position, and a tiny arc-shaped incision was made under the umbilicus. Next, the abdominal cavity was punctured using a pneumoperitoneum (PP) needle and filled with CO₂ gas to generate a peak pressure of 1.59 kPa. The PP needle was then removed. Subsequently, a cannula needle was used to puncture the abdominal cavity. The inner core of the cannula was removed, and the needle was placed into a laparoscope. Two trocar punctures were made on the left and right sides of the abdomen using the open technique. A defect measuring 5.5 cm × 5 cm was detected on the anterior wall of the gastric antrum, approximately 2 cm from the pylorus, and surrounded by small amounts of bloody fluid. The large excised tumor measuring 5 cm × 4 cm dropped into the abdominal cavity and was placed in an extraction pouch, which was subsequently removed *via* the main surgical incision. The edge of the defect on the stomach wall was trimmed using an ultrasonic knife. Subsequently, the wound was closed with a 3-0 slipper thread. Finally, we confirmed the absence of bleeding in the abdominal cavity, extracted the laparoscope, checked for appropriate retrieval of all instruments and gauze, and closed the incision and puncture sites with silk thread.

OUTCOME AND FOLLOW-UP

The patient recovered fully and was discharged on postoperative day 7, and a check-up was performed 3 mo after the surgery. Gastroscopy showed an improvement in the healing of the gastric wall. Figure 4 illustrates the timeline of the clinical course of the patient.

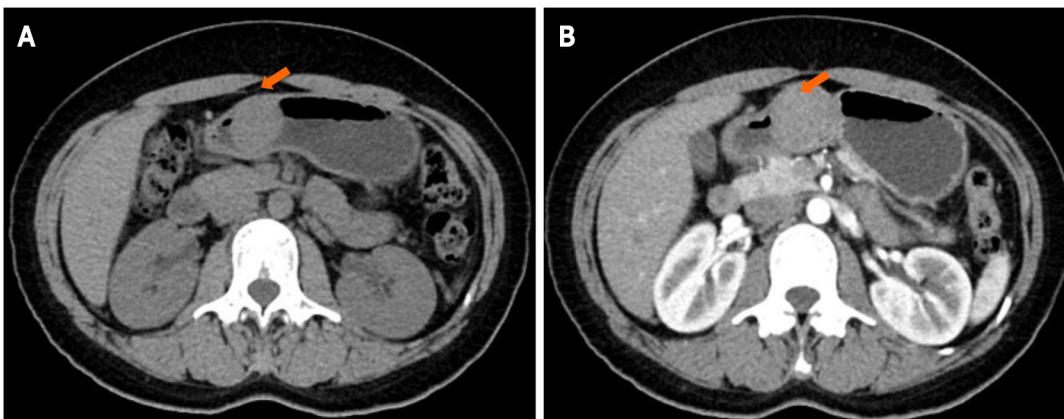
DISCUSSION

GI mesenchymal tumors comprise a wide range of spindle cell tumors, including GISTs, leiomyomas, leiomyosarcomas, and schwannomas[3]. Furthermore, schwannomas are spindle cell mesenchymal tumors that originate from Schwann cells. GSs originate from the gastrointestinal neural plexus. Most GSs are benign, and only a few malignant cases have been reported in the literature[4,5]. Schwannomas are generally asymptomatic in affected patients; however, they may cause abdominal discomfort, pain, or digestive symptoms in some cases. A palpable mass may be detected if the tumor is large and exophytic. Dysphagia and obstipation are possible symptoms when the lesions originate from the



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Figure 1 Preoperative endoscopy and endoscopic ultrasonography. A: Upper digestive tract endoscopy showing a submucosal tumor along the greater curvature of the anterior gastric antrum wall; B: Endoscopic ultrasonography showing a mass within the gastric antrum, which originated from the muscularis propria; C: Gastroscopy 3 mo after surgery revealing appropriate incision healing.



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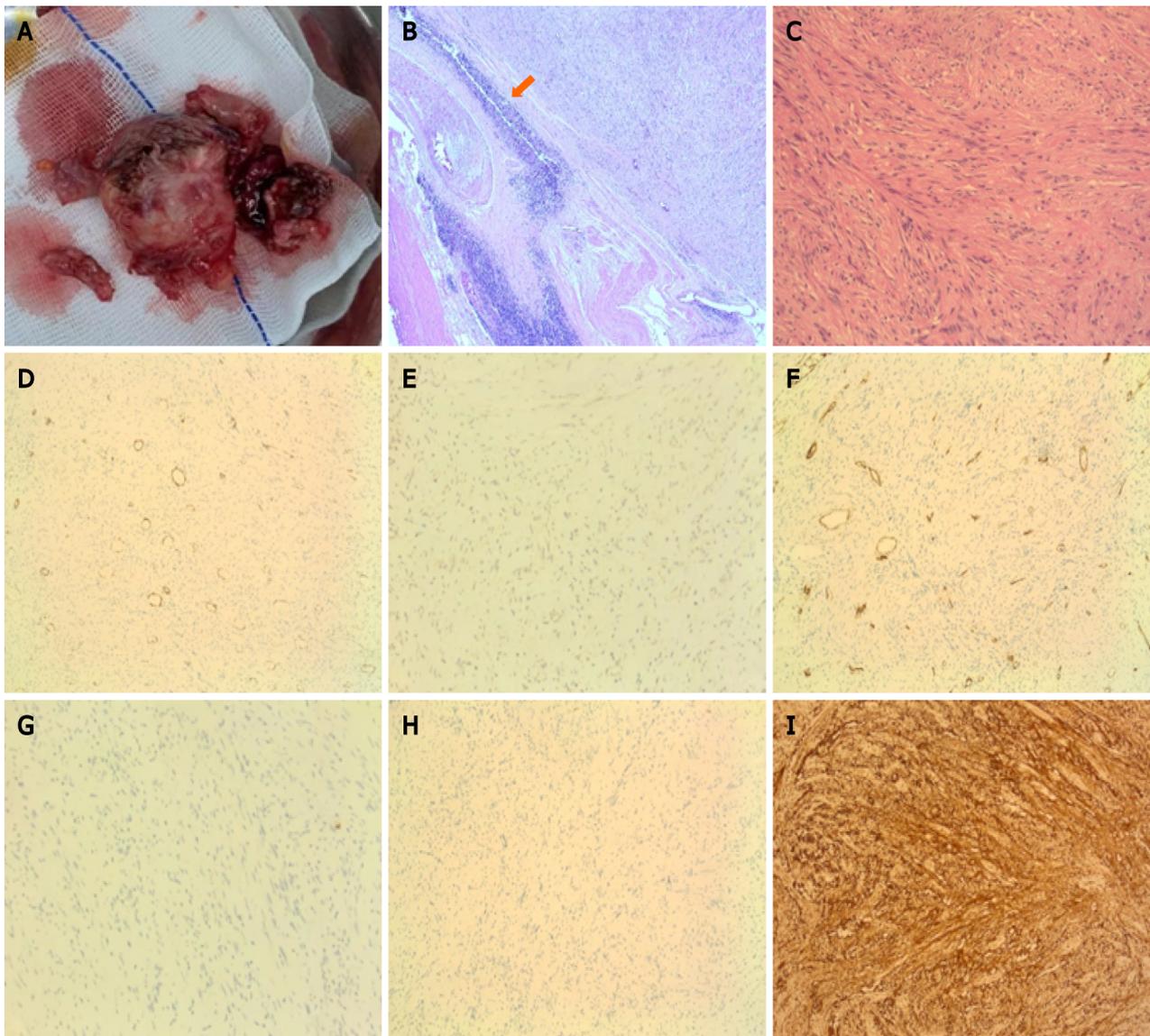
Figure 2 Computed tomography scan. A: Computed tomography showing an oval mass in the antrum of the stomach, with intracavitary growth; B: Enhanced computed tomography shows obvious enhancement of the mass in the arterial phase.

esophagus or rectum, respectively. Bleeding may occur if deep ulcerations are present[6,7].

GISTs are the most prevalent mesenchymal tumors of the GI tract, and 60%–70% of cases occur in the stomach. They are similar to GSs in terms of age of onset, clinical manifestations, and gross and histological appearance; however, the prognoses differ. Generally, schwannomas are mostly benign and have a good prognosis, while 10%–30% of cases of GIST are malignant[3]. Therefore, it is essential to distinguish between a GS and GIST and to develop a targeted treatment plan. The diagnostic workup for gastric tumors mainly includes upper GI endoscopy, CT, magnetic resonance imaging, and intracavitary (endoscopic) ultrasound. On endoscopy, both GS and GIST present as elevated submucosal lesions with a firm consistency. On EUS, a GS usually shows a hypoechoic lesion originating from the muscularis propria[8]. Reports on EUS assessment show that round shape, definite borders, heterogeneous hypoechoogenicity or isoechoogenicity, and lack of cystic alteration and calcification are crucial markers for GS diagnosis. In contrast, on EUS, a GIST usually shows a hypochoic or anechoic and slightly heterogeneous tumor. Hyperechogenicity is a potential sign of malignancy. GISTs are usually observed in the third or fourth layer of the gastric wall and rarely in the second layer[8]. Unlike GISTs, on CT, schwannomas appear to be uniform, significantly contrast-enhancing tumors with no evidence of hemorrhage, necrosis, cystic alteration, or calcification[9]. Despite these differences, establishing accurate preoperative diagnoses of GSs and GISTs is challenging.

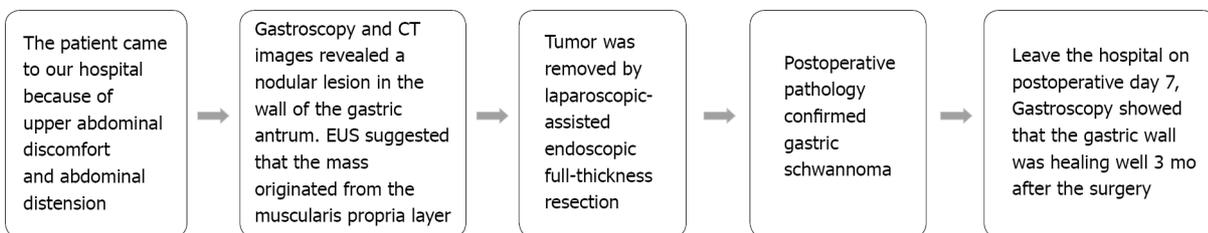
In this patient, the tumor was detected on abdominal CT and was initially thought to be a GIST. Gastroscopic and EUS findings were not contradictory; therefore, the tumor was misdiagnosed as a GIST until a correct diagnosis was established based on the tumor's immunohistochemical profile.

A GS rarely presents with specific clinical features and imaging characteristics. Therefore, preoperative diagnosis is challenging, and definitive diagnosis can only be established after careful pathological examination of the resected specimen. Given these challenges, surgical resection is the optimal treatment approach. Local extirpation, wedge resection, and partial, subtotal, or total



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Figure 3 Specimen after surgery, hematoxylin and eosin-stained pathological sections, and immunohistochemistry. A: The resected tumor; B and C: The tumor comprises intertwined bundles of spindle cells with tapered nuclei; mitotic figures are rare. Lymphocyte infiltration is observed in the tumor tissue, and a characteristic peripheral lymphoid cuff is present (B: 4 × C: 20 ×); D-I: Immunohistochemical staining of the gastric mass confirming a gastric schwannoma with positive staining for S-100 protein (I) and negative staining for α-smooth muscle actin (D), DOG-1 (E), CD34 (F), CD117 (G), and desmin (H).



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Figure 4 Timeline of case occurrence. CT: Computed tomography; EUS: Endoscopic ultrasonography.

gastrectomy are all acceptable approaches. Laparoscopic techniques can also be employed[10].

Submucosal gastric tumor therapies have greatly advanced in recent years, thereby enabling a more frequent use of minimally invasive endoscopic techniques, such as snare polypectomy, endoscopic submucosal dissection, and EFTR. Some studies have shown that EFTR is safe and effective for schwannomas and other tumors originating from the muscularis propria[11,12]. However, for larger

Table 1 Literature review of laparoscopic endoscopic cooperative surgery for gastric schwannoma resection

Ref.	Gender	Age (yr)	No. of cases	Tumor size (cm)	Pathology	Treatment	Hospital stay (d)
Eom <i>et al</i> [16]	3 Males; 11 Females	Median 61.0 IQR (51.0–66.8)	14	Median 2.6 IQR (2.3–3.7)	9 GISTs, 2 GS, 3 Leiomyomas	LECS	Median 5.0 IQR (4.0– 5.5)
Mahawongkajit <i>et al</i> [17]	Female	50	1	2.1	GS	NEWS	NR
Sugiyama <i>et al</i> [18]	Female	49	1	1.7	GS	NEWS	5
Matsuda <i>et al</i> [19]	47 Males; 53 Females	mean ± SD: 59.8 ± 13.2	100	mean ± SD: 3.09 ± 1.06	75 GISTs; 11 GS; 6 Leiomyomas; 5 Ectopic pancreas; 2 Neuroendocrine tumor; 1 Lymphangioma	LECS	mean ± SD: 8.4 ± 10.2
Mitsui <i>et al</i> [15]	Males	58	1	2.4 × 2.3 × 1.9	GS	NEWS	7
Hiki <i>et al</i> [13]	7 Females	Range 34–66	7	mean ± SD: 4.6 ± 0.3	6 GISTs 1 GS	LECS	mean ± SD: 7.4 ± 8.1

LECS: Laparoscopy-endoscopy cooperative surgery; NEWS: Non-exposed endoscopic wall-inversion surgery; GISTs: Gastrointestinal stromal tumors; GS: Gastric schwannoma; NR: Not reported; IQR: Interquartile range.

GSs, endoscopic resection should not be indicated without careful consideration because we believe that this could increase the risk of surgery and the incidence of postoperative complications.

Although laparoscopic resection can be used to treat GSs, it is difficult to precisely locate tumors within the gastric lumen with a laparoscope from the serosal surface alone. Consequently, a large portion of the stomach wall may be removed, leading to gastric deformity and outlet obstruction. Laparoscopic endoscopic cooperative surgery (LECS) was first introduced by Hiki *et al*[13] as a surgical intervention for GISTs and is currently classified as “classical LECS.” LECS is superior to laparoscopic or robot-assisted wedge resection and partial resection because the gastric serosa resection area is substantially reduced, which lowers the possibility of post-surgical gastric deformity and reduces the negative impact on patients’ quality of life[14]. Subsequently, Mitsui *et al*[15] developed another non-exposure technique, known as “non-exposure endoscopic wall-inversion surgery” (NEWS), that can prevent contamination and tumor dissemination into the peritoneal cavity. Only a few studies[13,15-19] have previously reported GS resection using LECS and NEWS (Table 1). Shoji *et al*[20] reported that LECS or NEWS is suitable for submucosal tumors measuring less than 5 cm in diameter. In this case, because the diameter of the gastric tumor reached 5 cm, we considered that endoscopic treatment alone might be complicated by difficulties in closing the gastric wall defect after tumor excision and removing the specimen through the esophagus. Therefore, after discussing with the patient, we decided to remove the tumor endoscopically, and if difficulties arose, laparoscopy would be performed. Accordingly, we could excise the tumor completely without removing a large part of the gastric wall while causing minimal trauma and ensuring safety. The tumor was removed using a gastroscope. The large defect in the gastric wall after tumor resection was difficult to close; therefore, suturing was performed laparoscopically. This combined surgery resulted in complete tumor excision and prevented wound expansion. Although our procedure differed from classical LECS in terms of surgical details, the goal of treatment was still to achieve complete resection of the lesion and avoid the expansion of the incision. Postoperative patient management included gastric acid inhibition, fluid replacement, dietary restriction, and nutritional support. The patient was mobile on postoperative day 1. She recovered completely and was discharged from the hospital 1 wk after surgery. Considering the outcomes of this case, we believe that laparoscopic-assisted endoscopic full-thickness resection can reduce the risk of endoscopic surgery and simultaneously achieve precise resection of lesions, which should be evaluated in future studies.

CONCLUSION

GSs are uncommon and generally mostly benign. Despite advances in endoscopic and imaging techniques, accurate preoperative diagnosis of a GS is difficult to establish. Final diagnosis requires histopathological and immunohistochemical examinations. Surgical resection is the optimal treatment option, and the emergence of techniques, such as EFTR, has greatly increased the possibility of minimally invasive removal of small tumors. For larger GSs, combined laparoscopic and gastroscopic surgery is recommended for tumor resection.

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