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Laparoscopic and endoscopic cooperative surgery for duodenal neuroendocrine tumor (NET) G1: Report of a case

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ABSTRACT

INTRODUCTION: We report a case of duodenal neuroendocrine tumor (NET) G1 resected by laparoscopic and endoscopic cooperative surgery (LECS) technique.**PRESENTATION OF CASE:** A 58-year-old woman underwent esophagoduodenoscopy, revealing an 8-mm, gently rising tumor distal to the pylorus, on the anterior wall of the duodenal bulb. Endoscopic ultrasonography suggested the tumor might invade the submucosal layer. The tumor was pathologically diagnosed as a G1 duodenal NET, by biopsy. Endoscopic submucosal dissection was attempted, but was unsuccessful because of the difficulty of endoscopically performing an inversion operation in the narrow working space. The case was further complicated by the patient's duodenal ulcer scar. We performed a full-thickness local excision using laparoscopic and endoscopic cooperative surgery. The tumor was confirmed and endoscopically marked along the resection line. After full-thickness excision, using endoscopy and laparoscopy, interrupted full-thickness closure was performed laparoscopically.**DISCUSSION:** Endoscopic treatment is generally recommended for G1 NETs <10 mm in diameter and extending only to the submucosal layer. However, some cases are difficult to resect endoscopically because the wall of duodenum is thinner than that of stomach, and endoscope maneuverability is limited within the narrow working space. LECS is appropriate for early duodenal G1 NETs because they are less invasive and resection of the lesion area is possible.**CONCLUSION:** We demonstrated that LECS is a safe and feasible procedure for duodenal G1 NETs in the anterior wall of the first portion of the duodenum.© 2014 The Authors. Published by Elsevier Ltd. on behalf of Surgical Associates Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/3.0/>).

1. Introduction

Gastroenteropancreatic NETs are graded as G1, G2, or neuroendocrine carcinoma (NEC), based on their proliferative activity determined using mitotic counts or the Ki-67 index and the World Health Organization (WHO) 2010 classification¹; G1 NETs are synonymously referred to as carcinoid tumors. In Japan, the duodenum is the third most common site for G1 NETs, after the rectum and stomach.² Endoscopic treatment is generally recommended for G1 NETs <10 mm in diameter and extending only to the submucosal layer.³ However, some cases are difficult to resect endoscopically because the wall of duodenum is thinner than that of stomach, and endoscope maneuverability is limited within the narrow working space. LECS is appropriate for early duodenal G1 NETs because they are less invasive and resection of the lesion area is possible. Herein,

we present a case of LECS for a NET G1 and a brief consideration of the literature pertaining to this tumor type.

2. Case report

A 58-year-old woman, without gastrointestinal symptoms, was diagnosed with a duodenal tumor during a screening gastroscopy. She subsequently underwent esophagoduodenoscopy, revealing an 8-mm diameter submucosal tumor on the anterior wall of the duodenal bulb, located just behind of pyloric ring of the stomach (Fig. 1a). Endoscopic ultrasonography (20 MHz, radial scanning) demonstrated a homogeneous, hypoechoic lesion located mainly within the submucosal layer (Fig. 1b). The tumor was pathologically diagnosed as duodenal NET G1, by biopsy, and contrast enhanced computed tomography did not show evidence of lymph node enlargement around the duodenum. Endoscopic submucosal dissection (ESD) was attempted, but was unsuccessful because resection of the tumor, behind the pylorus, an inverted scope maneuver was very difficult, with a flexible scope, within the

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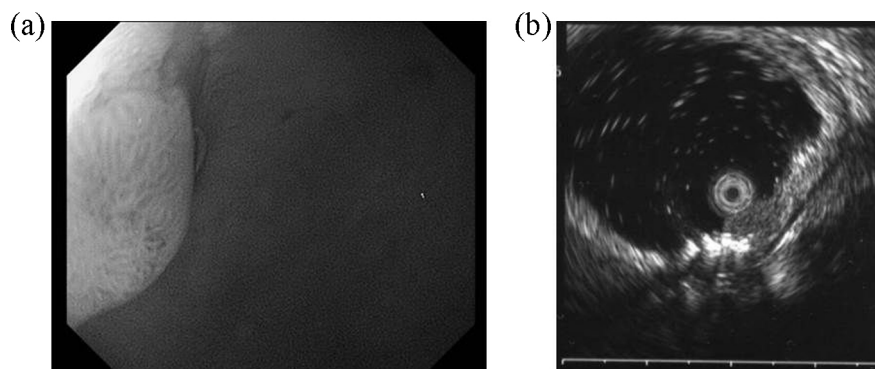


Fig. 1. (a) Esophagastroduodenoscopy showing an 8-mm diameter submucosal tumor in the anterior wall of duodenal bulb, located just behind of pyloric ring of the stomach. (b) Endoscopic ultrasonography demonstrating a homogeneous, hypoechoic lesion, located mainly within the submucosal layer.

narrow working space of duodenum. Furthermore, the patient had a duodenal ulcer scar that hampered the procedure.

We decided to perform a full-thickness, local excision using LECS. After inducing general anesthesia, a 12-mm trocar was inserted through the umbilicus using an open technique, and pneumoperitoneum was established by insufflation of carbon dioxide to a 10-mmHg abdominal pressure. Two 5-mm trocars were placed into the right and left lateral abdominal regions. The endoscope was inserted through the oropharynx into the stomach, and was thoroughly irrigated with 2000 mL of saline. The duodenal tumor was confirmed, and the lesion was marking endoscopically. A full-thickness layer excision was performed along the marking points using a Dual knife and insulation-tipped-knife2 (Olympus, Tokyo, Japan) (Fig. 2a). After endoscopically completing approximately four-fifths of the excision, the tumor was inverted into the abdominal cavity and the final fifth of the resection was completed using an ultrasonic coagulation incision apparatus, under laparoscopic view. An en bloc resected specimen was removed, via the mouth, using an endoscopy basket. We sutured the postexcisional hole in the duodenal anterior wall with an interrupted full-thickness

closure, under laparoscopic view (Fig. 2b and c). After completing the full-thickness closure, the endoscope was inserted into the duodenum to confirm that it passed the suture site easily and that there was no air leakage, despite insufflation of the duodenum (Fig. 2d).

The surgical procedure was uneventful and the total operation time was 182 min. Pathological examination revealed small, nearly homogeneous neoplastic cells with round or oval nuclei and rich cytoplasm; they were arranged in an alveolar or cord-like proliferation pattern (Fig. 3a). Immunostaining for chromogranin (Fig. 3b) and synaptophysin (Fig. 3c) were positive, and the mitotic count was <2%. These findings led to the final diagnosis of a duodenal NET G1. Histologically, the depth of the tumor invasion was into the submucosal layer, but the horizontal and vertical margins were free of tumor cells. A postoperative contrast study did not reveal stasis or stenosis at the suture site (Fig. 4). The patient recovered uneventfully and was discharged on postoperative day 9.

Written informed consent was obtained from the patient for publication of this case report and the accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

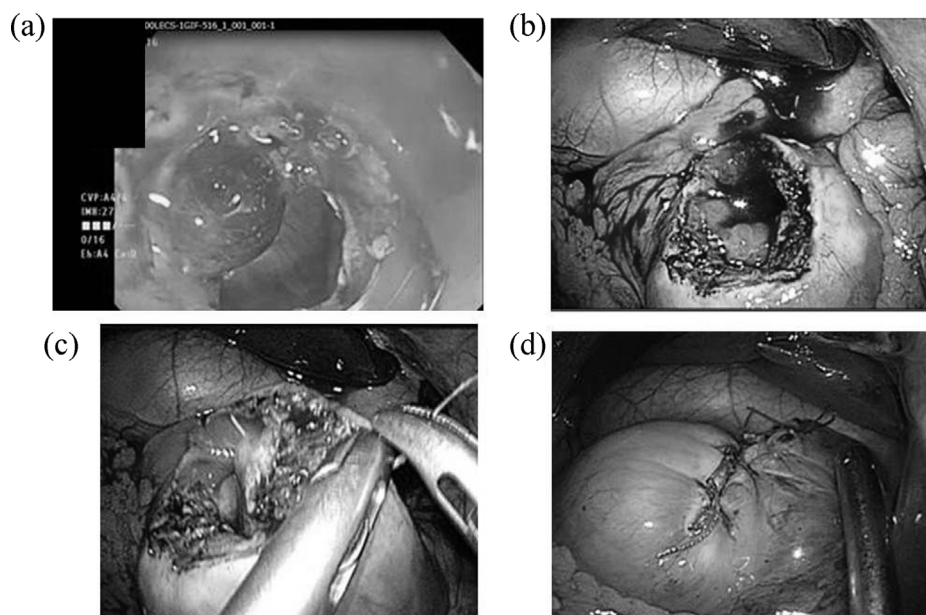


Fig. 2. (a) Full-thickness excision along the marked dissection line using a Dual knife and insulation-tip-knife2. (b) A post-excisional defect in the anterior duodenal wall. (c) The post-excisional is sutured with an interrupted, full-thickness closure, laparoscopically. (d) The endoscope passes the suture site easily; no air leakage was detected despite insufflation of the duodenum.

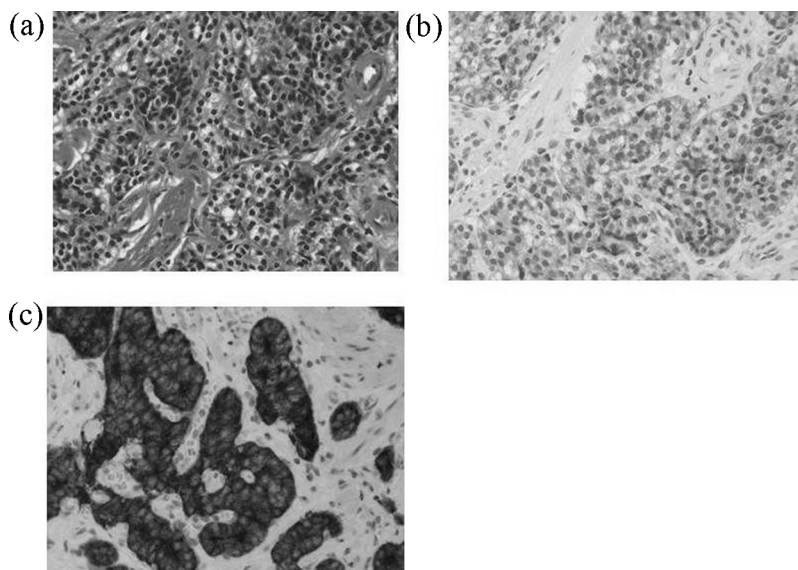


Fig. 3. (a) A pathological examination reveals small, nearly homogeneous neoplastic cells, with round or oval nuclei and rich cytoplasm; they are arranged in an alveolar or cord-like proliferation pattern (hematoxylin–eosin staining, $\times 400$). Positive immunostaining for chromogranin (b, $\times 400$) and synaptophysin (c, $\times 400$).

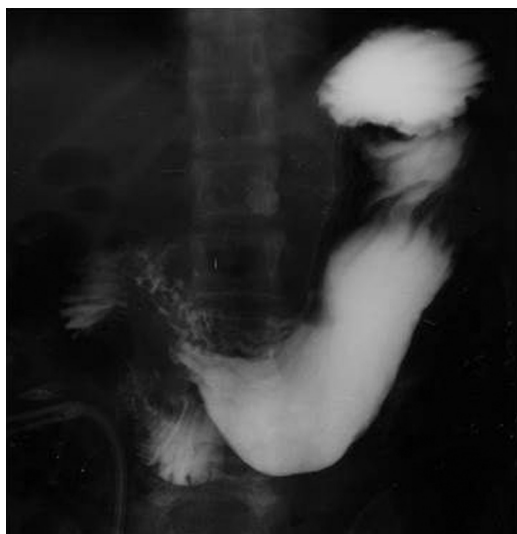


Fig. 4. A postoperative contrast study shows no stasis or stenosis at the suture site.

3. Discussion

Gastrointestinal tumors, composed of neuroendocrine cells, and showing characteristic histologies have been defined as “carcinoid tumors” since 1907 when Oberndorfer et al. described these slow-growing, small, intestinal tumors that have good prognoses.⁴ In 2010, the WHO classified NETs as G1, G2, or NEC, according to their mitotic count and Ki-67 index¹; many cases of conventionally-defined carcinoid tumors are equivalent to low proliferative potential G1 NETs. The European Neuroendocrine Tumor Society recommends endoscopic treatment for G1 NETs ≤ 10 mm that do not extend beyond the submucosal layer and do not demonstrate lymph node metastasis. Tumors ≥ 20 mm, with lymph node metastasis, are indicated for surgical treatment.³ The treatment strategy for tumors 10–20 mm in size remains controversial. Waisberg et al. performed endoscopic excision of duodenal G1 NETs, 10–20 mm in diameter; however, 4 of the 10 patients (40%) needed

additional surgical treatment because of incomplete endoscopic resection; the authors concluded that a new endoscopic resection or surgical treatment was required for G1 NETs of that size.⁵ ESD is widely accepted for early gastrointestinal tumors, including NET G1, and has the advantage of a higher probability of success for larger and more consistent resection of lesions just above the muscle layer than endoscopic mucosal resection. However, the duodenal wall is generally thinner than that of the stomach and ESD for duodenal tumors is associated with an increased perforation risk⁶; maneuvering the flexible endoscope is also technically difficult in the tiny duodenal lumen. We tried to perform an ESD for the present duodenal lesion; however, we had to abandon the procedure because the forward operation of the flexible endoscope did not approach the tumor, located distal to the pylorus, and it was very hard to perform inverted scope maneuvers in the narrow working space of the duodenum. The present patient also had a duodenal ulcer scar that further complicated the procedure.

Conventional surgical operations may be excessively invasive for early duodenal tumors, and determination of the proper extent of resection of duodenal lesions is difficult. LECS was first reported by Hiki et al.⁷ and has the advantage that the minimum extent of resection is marked and the full-thickness cuts, along the designated margins, are performed endoscopically. Additionally, the defect formed by the resection is also closed in a less invasive manner. There are many reports on the use of LECS for gastric lesions, including early gastric cancers, gastrointestinal tumors, and leiomyomas^{7–9}; however, only six detailed cases, including the present one, have been reported for duodenal lesions (Table 1).^{10–12} These lesions were located at or near the anterior wall of first or second portion of the duodenum; LECS was considered suitable for all of these lesions. Mobilization of the duodenum might be needed for lesions in the posterior wall or the third portion of the duodenum. The post-excisional defects were sutured closed, by hand, in five of the six cases; a stapling device was used in one case and was carried out during a single-port operation. Substantial suturing skill is required to close the defect under laparoscopic view. However, we believe that suturing is better than stapling for closing duodenal post-excisional defects because stapling may occasionally cause severe stenosis.¹³ Endoscopic confirmation of the absence of air leakage and free passage of the endoscope past the repaired defect

Table 1
Six cases of LECS for duodenal lesion.

	Age	Male/female	Location	The number of port	Closure of incision line	Operation time	Tumor size	Pathology
Sakon et al. ¹⁰	49	Male	1st portion, anterior	4	Hand-swen technique	156	20 mm	Adenoma
	49	Female	2nd portion, a site opposite the duodenal papilla	5	Hand-swen technique	179	18 mm	Adenoma
Ohi et al. ¹¹	59	Male	2nd portion	1	Stapling device	186	35 mm	GIST
Tsujimoto et al. ¹²	76	Male	2nd portion	5	Hand-swen technique	130	8 mm	NET G1
	62	Male	1st portion	5	Hand-swen technique	102	6 mm	NET G1
Our case	58	Female	1st portion, anterior	3	Hand-swen technique	182	8 mm	NET G1

are important steps that need to be performed when suturing is performed.

4. Conclusion

We demonstrated that LECS is a safe and feasible procedure for duodenal G1 NETs in the anterior wall of the first portion of the duodenum, and is likely feasible for early tumors in the anterior wall of near the first and second sections of the duodenum. Whether LECS is indicated for lesions in the posterior wall or the third portion of the duodenum will be discussed in the future.

Conflict of interest

The authors declare that they have no competing interests.

Funding

None.

Ethical approval

Written informed consent has been obtained by the patient.

Author contributions

Takaaki Tsushimi analyzed and interpreted the patient data and drafted the manuscript. Hiromi Ohnishi performed the histological examination of the tumor.

Takasuke Harada, Hirohito Mori, Takashi Nagase and Yoshitaka Ikeda critically revised the manuscript.

All authors read and approved the final manuscript.

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