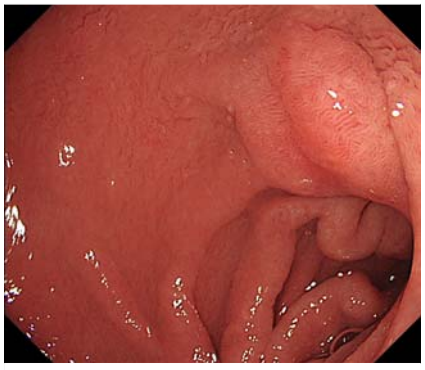
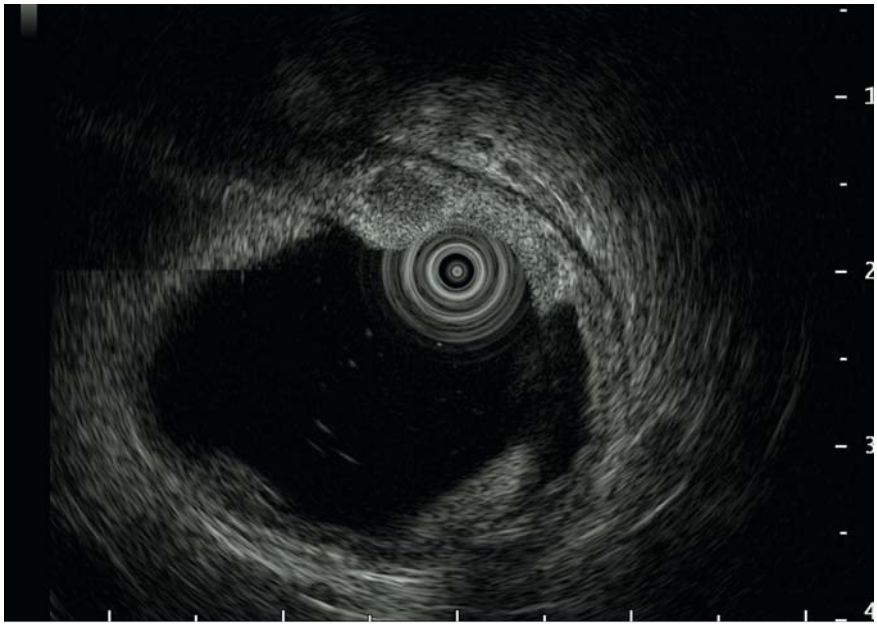
Published online: 2019-09-17

Laparoscopy and endoscopy cooperative surgery is a safe and effective novel treatment for duodenal neuroendocrine tumor G1



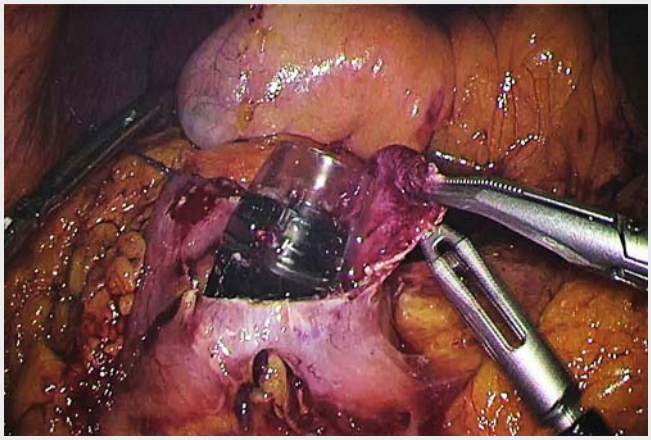
▶ **Fig. 1** Esophagogastroduodenoscopy revealed a 5-mm submucosal tumor at the duodenal bulb.



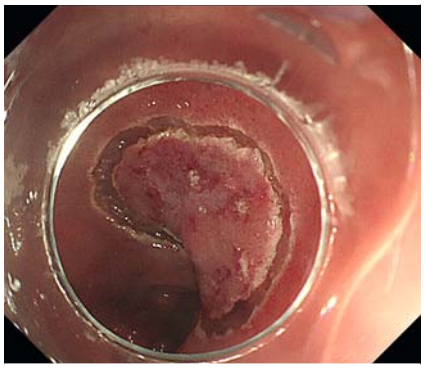
▶ **Fig. 2** Endoscopic ultrasonography revealed a hypoechoic lesion in the submucosal layer just above the muscularis propria.

The European Neuroendocrine Tumor Society guidelines recommend endoscopic resection for nonampullary duodenal neuroendocrine tumors (NETs) < 10 mm in size without any metastasis [1]; however, endoscopic resection for duodenal NETs is challenging [2]. Gincul et al. reported 32 duodenal NETs treated by endoscopic mucosal resection [3]. The R0 resection rate was 50 %, the overall complication rate was 38 %, and one procedure-related death occurred. Suzuki et al. reported the outcome of endoscopic submucosal dissection (ESD) for 37 rectal, 2 gastric, and 3 duodenal NET cases [4]. The R0 resection rate was 98 % but the perforation rate of duodenal ESDs was 66 %. Laparoscopy and endoscopy cooperative surgery (LECS) [5] is one of the options to resect duodenal NETs safely.

A 77-year-old man was referred to our hospital for treatment of duodenal NET G1 diagnosed by biopsy. Esophagogastroduodenoscopy revealed a 5-mm submucosal tumor at the duodenal bulb (▶ **Fig. 1**). Endoscopic ultrasonography revealed a hypoechoic lesion in the submucosal layer just above the muscularis



Video 1 Laparoscopy and endoscopy cooperative surgery for duodenal neuroendocrine tumor G1. Selection of the appropriate resection area and initial mucosal incision (endoscopically) were followed by complete resection (endoscopically and laparoscopically) and suturing (laparoscopically).



▶ **Fig. 3** Mucosal circumferential incision was performed endoscopically.

propria (▶ **Fig. 2**). It was considered that an R0 resection would be too difficult to achieve and the risk of perforation would be too great with endoscopic resection. Hence, we selected LECS (▶ **Video 1**).

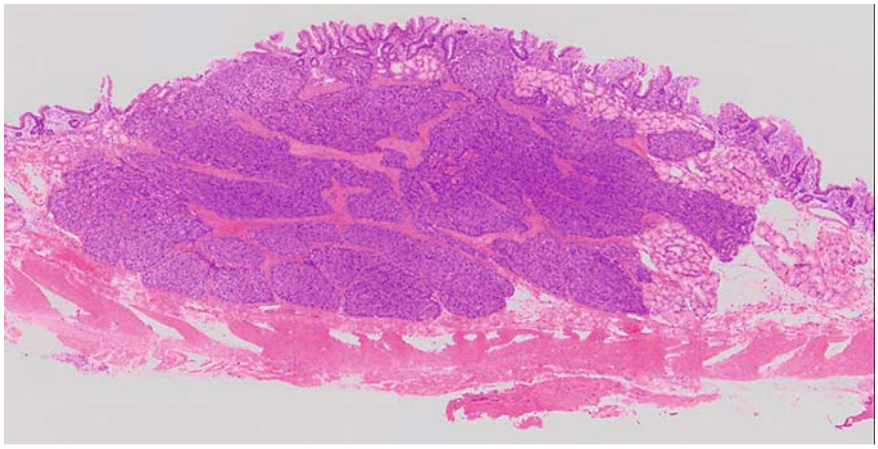
First, surgeons exposed the duodenal bulb and the second portion laparoscopically. Then, endoscopists and surgeons marked around the lesion, and mucosal circumferential incision was performed endoscopically (▶ **Fig. 3**). After that, we performed a quarter of the full-thickness incision endoscopically, with the remaining three-quarters being performed laparoscopically. Finally, surgeons performed laparoscopic suturing, and endoscopists confirmed duodenal lumen patency and no leakage. The overall operative time was 3 hours 41 minutes, and the hemorrhage volume was 10 mL.

The pathological diagnosis was duodenal NET G1, T1b-SM2, ly0, v0, HM0, VM0, and 5 mm in size (▶ **Fig. 4**). The NET invasion extended to just above the muscularis propria (▶ **Fig. 5**). Notably, endoscopic resection seemed impossible. At 3 years after LECS, local recurrence and metastasis have not been observed. Our findings suggest that LECS is an effective treatment for duodenal T1b NET G1.

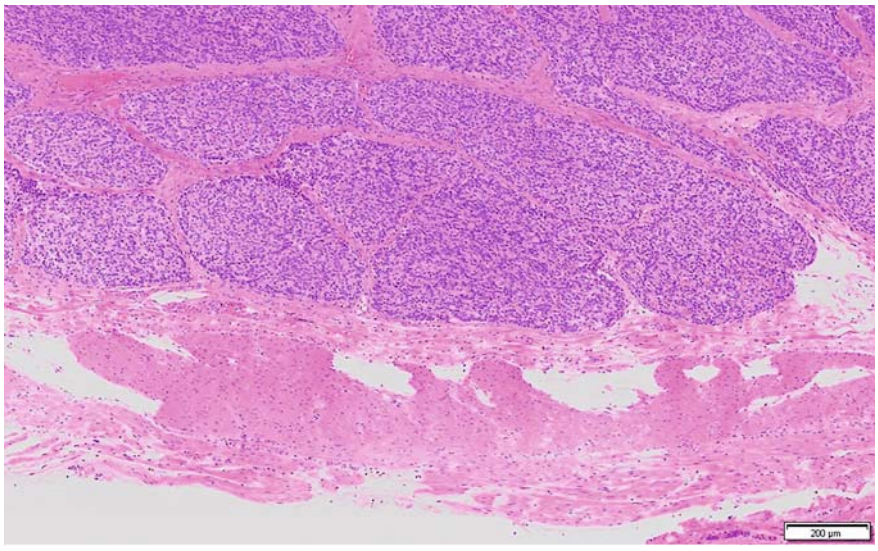
Endoscopy_UCTN_Code_TTT_1AO_2AN

Competing interests

None



▶ **Fig. 4** The pathological diagnosis was duodenal NET G1, T1b-SM2, ly0, v0, HM0, VM0, and 5 mm in size.



▶ **Fig. 5** The neuroendocrine tumor invasion extended to just above the muscularis propria.

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DOI https://doi.org/10.1055/a-0999-5172

Published online: 17.9.2019

Endoscopy 2020; 52: E68–E70

Stuttgart · New York

ISSN 0013-726X