Duodenal endoscopic submucosal dissection for a large protruded lesion located just behind the pyloric ring with a scissor-type knife

Tomoaki Tashima, MD,[1] Kouichi Nonaka, MD, PhD,[1] Shomei Ryozawa, MD, PhD,[1] Takashi Fujino, MD, PhD[2]

Recently, endoscopic submucosal dissection (ESD) has been applied to the treatment of GI lesions to enable en bloc curative resection.[1,2] Generally, large tumor size, protruded lesion, poor endoscope maneuverability, and other procedural factors may contribute to the technical difficulties of ESD and periprocedural perforation.[3,4] Among ESD procedures for GI lesions, duodenal ESD is the most technically challenging procedure because of the thin wall and narrow lumen of the duodenum, as well as poor maneuverability of the endoscope in the duodenum.[5,6] Herein, we report the successful en bloc and curative resection of a duodenal lesion presenting with all of the above-mentioned difficulties associated with ESD by performing ESD with a scissor-type knife and the submucosal dissection method (Video 1, available online at www.VideoGIE.org).

A 72-year-old man was found to have a large protruded tumor approximately 60 mm in diameter in the duodenal bulb. In many medical facilities, endoscopic resection for these lesions is regarded as a technically difficult procedure, and thus this case would be considered appropriate for surgical resection. However, this patient was referred to our digestive endoscopy department because of his strong desire for endoscopic resection. Preoperative endoscopic examination showed that a portion of the tumor protruded to the gastric side (Fig. 1A), whereas the majority of the tumor mass nearly circumferentially encompassed the area directly behind the pyloric ring on a retroflexed view from the duodenal bulb (Figs. 1B and C). The histologic diagnosis by analysis of a preoperative biopsy specimen was well-differentiated adenocarcinoma. Because no lymph node or distant metastasis was observed on abdominal CT, it was diagnosed as early duodenal cancer.

He underwent ESD under general anesthesia in the operating room. The ESD procedure was performed by use of an upper-GI endoscope (GIF260J; Olympus, Medical Systems Co, Tokyo, Japan) with a transparent attachment cap and a high-frequency generator unit (VIO300D; endocut I, effect 2, duration 4, interval 1; Erbe Elektromedizin, Tübingen, Germany) with carbon dioxide insufflation.

Even after pulling the tumor into the duodenal bulb, we could not accurately identify the proximal dissection line. The first reason was that the tumor was so large that it almost filled the inside of the duodenal bulb, and thus there was not enough space to place an endoscope between the tumor and the proximal margin. The second reason was poor maneuverability of the endoscope in forward view. It was so poor that the endoscope slipped out of the duodenal bulb to the gastric side very easily; even after several attempts, it was impossible to identify the proximal margin, let alone cut the lesion. Therefore, after local injection of sodium hyaluronate solution, initial mucosal incision and submucosal dissection were performed with a dual knife J 1.5 mm (KD655Q; Olympus) on retroflexed view. However, the large protruded tumor occupying the naturally narrow duodenal bulb reduced the working space of the endoscope, resulting in poor maneuverability of the endoscope. Moreover, in the retroflexed view, the tip of the dual knife was seen vertically positioned to the muscle layer, which could pose a potentially high risk of perforation. Therefore, we replaced the dual knife J with a 3.5-mm Clutch Cutter (Fujifilm Co, Tokyo, Japan). Even in the narrow space, the Clutch Cutter, a scissor-shaped serrated knife equipped with a tip rotation function, enabled an approach parallel to the muscle layer and precise holding of tissues. When a tumor resides directly behind the pyloric ring, it is very difficult to accurately locate the dissection line on the proximal side, ie, the so-called gastric side, of the tumor. Therefore, if we had decided to dissect the proximal margin of the tumor from the gastric side in direct view at an earlier stage of resection, we would have been required to dissect wider areas of mucosa encompassing from the pyloric antrum to the pyloric ring to provide a mucosal flap large enough to allow the endoscope to slide into the submucosal layer. We wanted to avoid dissecting such a large area of mucosa spreading from the antrum to the pyloric ring in the gastric side, which is the second and most important reason we chose the alternative method described in this report. That is, dissecting a wide area of the submucosal layer under and/or around the pyloric ring could have increased the risk of stricture of the pyloric ring during the healing process of the mucosal defect after ESD. For these reasons, we developed a novel strategy of ESD by merely cutting the mucosal layer at the proximal side from the duodenal bulb to the pyloric mucosa (Figs. 2A and B). Subsequently, the mucosal incision and submucosal dissection were conducted on forward view

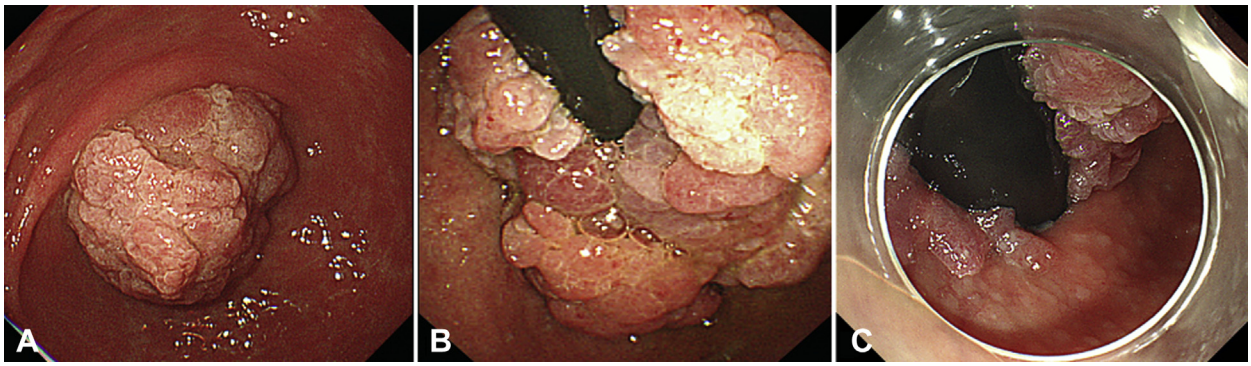

Figure 1. Endoscopic views. **A,** A large protruded tumor in the duodenal bulb of the duodenum on forward view from the antrum. **B,** The tumor on retroflexed view from the duodenal bulb. **C,** Protruded tumor whose basal portion was located in the duodenal bulb directly behind the pyloric ring (retroflexed view from the duodenal bulb).

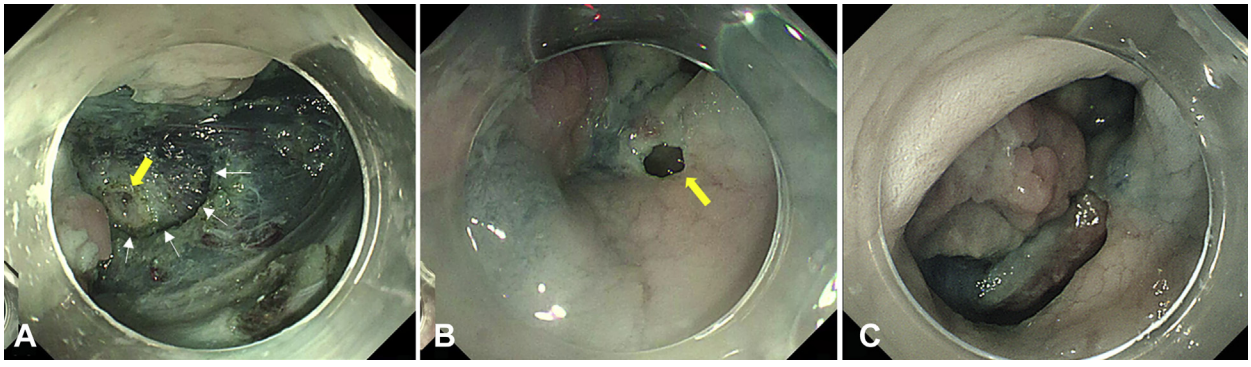

Figure 2. Duodenal endoscopic submucosal dissection. **A,** A small mucosal hole *(yellow arrow)* passing through the submucosal layer from the mucosal layer of the duodenal bulb to the mucosal layer of the pyloric ring was made. The pyloric ring *(white arrows)* viewed from the duodenal bulb is shown. **B,** The small mucosal hole *(yellow arrow)* penetrating toward the mucosal layer of the pyloric ring. **C,** The mucosal hole was expanded on the right and left sides (forward view from the pylorus).

from the pylorus side to widen the small mucosal hole. Finally, after the residual mucosa on both sides of the mucosal hole was cut out (Fig. 2C), the lesion was resected en bloc without any adverse events in 80 minutes. The mucosal defect extended nearly circumferentially along the duodenal bulb (Figs. 3A and B).

Duodenal ESD is associated with an increased risk of delayed perforation, which is thought to be due to exposure of the ESD defect to pancreatic/biliary juices. Therefore, complete closure of the mucosal defect seems effective in preventing delayed perforation.[7,8] Among the various closure methods reported so far,[9,10] we have mainly been using the one with an over-the-scope clip (OTSC), a type of endoscopic full-thickness suturing device, and have published a few articles discussing its usage and usability.[5,11]

In this case, we had planned to achieve complete closure of the mucosal defect using a conventional clip and OTSC to prevent delayed perforation. However, the mucosal defect was situated directly behind the pyloric ring, and thus the whole defect could not be captured in forward view. Moreover, it was expected that the defect-closing procedure would be difficult because of the poor maneuverability of the endoscope, even in retroflexed view. Further, the duodenal bulb is characterized by thicker and harder mucosa resulting from the presence of Brunner glands, compared with the second portion of the duodenum. Therefore, complete closure of mucosal defects in the duodenal bulb, especially large mucosal defects, is often difficult to achieve. If we had performed the defect-closing procedure using a conventional clip and OTSC, there would have been a considerable risk for secondary perforation of the mucosal defect area by inadvertently handling the tip of the clip. Thus, we chose close follow-up observation after the ESD over defect closure in this case.

At the 1-month follow-up visit, the mucosal defect after ESD was healed without stricture of the pyloric ring (Figs. 3C and D). Histopathologic examination revealed that the lesion was a well-differentiated intramucosal cancer with no lymphovascular invasion and had negative margins (tumor diameter, 60 × 42 mm) (Figs. 4A and B). By using the Clutch Cutter, we could perform ESD for a large protruded lesion within the duodenal bulb without causing any adverse events such as severe bleeding and perforation. Furthermore, by merely cutting the mucosal layer at the proximal side connecting the duodenal bulb and pylorus, accurate identification of the dissection line

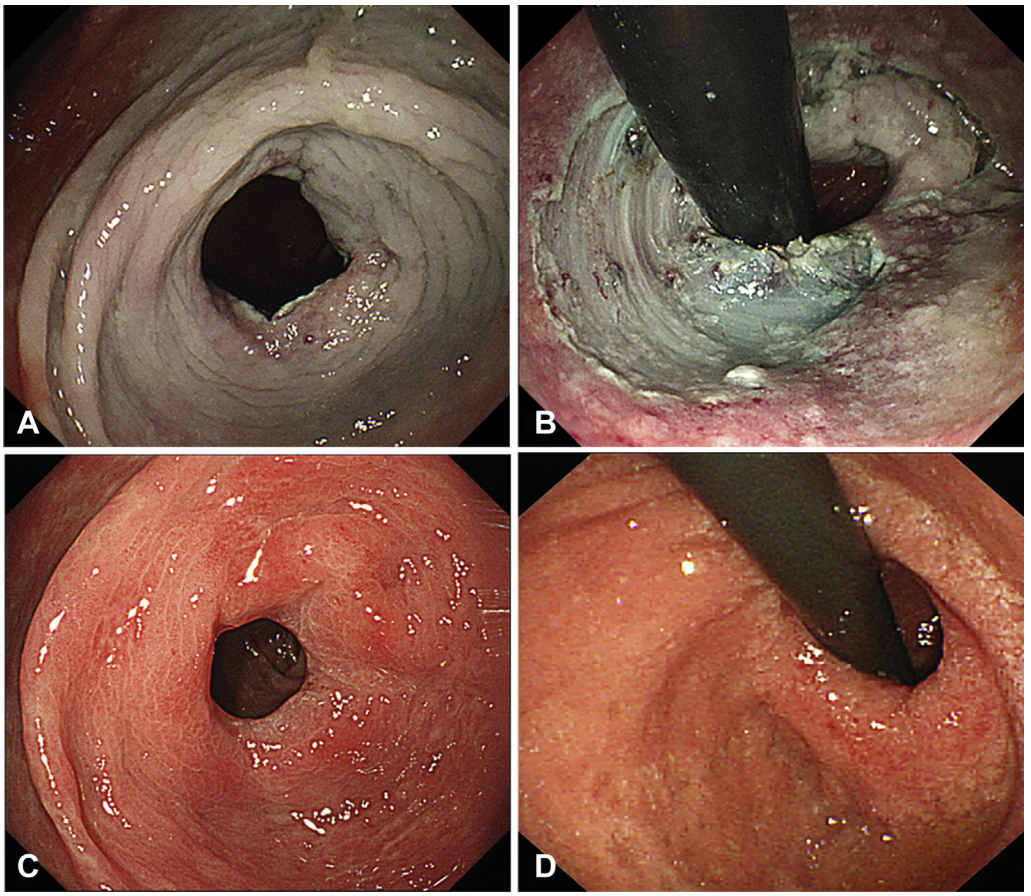

Figure 3. Endoscopic views of the mucosal defect just after endoscopic submucosal dissection (ESD) and at follow-up visit 1 month later. **A,** Endoscopic view of the mucosal defect from the pylorus side just after ESD. The pylorus had no mucosal defect after en bloc resection. **B,** Endoscopic view of the mucosal defect from the duodenal bulb just after ESD. Mucosal defect with no muscle injury and no perforation is seen. **C,** Endoscopic view of the mucosal defect from the pylorus 1 month after ESD. The pyloric ring had no stricture. **D,** Endoscopic view of the mucosal defect from the duodenal bulb 1 month after ESD. The mucosal defect was completely healed and had formed a scar.

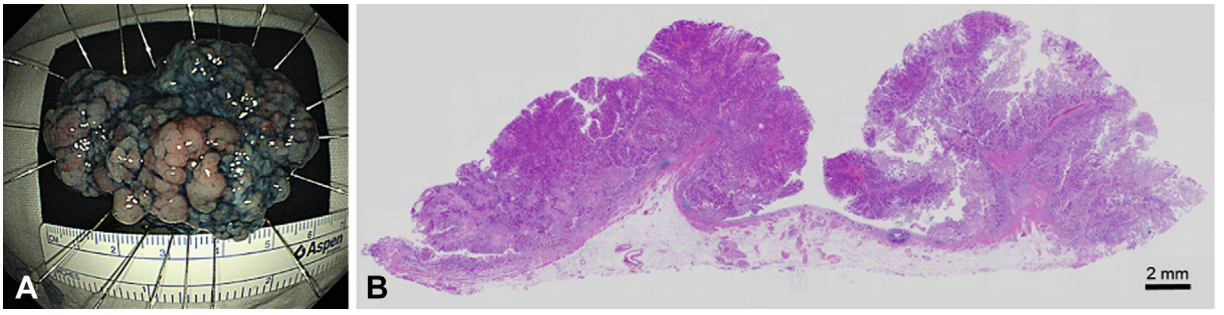

Figure 4. A, Resected specimen (diameter, 60 × 42 mm). **B,** Histopathologic examination of the resected specimen with a loupe revealed that the tumor was an intramucosal carcinoma with negative resection margins (H&E, orig. mag. ×10).

on the gastric side and minimizing the mucosal defect on the gastric side for mitigating the risk of postoperative stricture of the pyloric ring after ESD were achieved even in the presence of a large protruded lesion occupying the narrow lumen. This strategy resulted in an extremely small mucosal defect and no stricture.

Recently, a wide range of technical variations of ESD and new devices have been reported in efforts to improve the outcome of situations in which resection of lesions by conventional ESD is particularly difficult. Nagata[12] published a case report on performing underwater ESD in saline solution with a hook knife J (bent-type, monopolar; Olympus, Tokyo, Japan) in a particular situation in which the lesion was located on the gravitational lower side and severe fibrosis at the submucosal layer was observed. Owing to the anatomic features of the duodenum, it is usually difficult to adjust the

orientation of the lesion inside the duodenum relative to the gravitational direction by changing the patient's posture. Also, dissection of areas with severe fibrosis is prone to perforation. Underwater ESD is a useful method for overcoming these technical difficulties. Ge et al[13] reported a few cases of ESD in which small submucosal tumors were successfully resected. To achieve complete resection of submucosal tumors, in addition to performing submucosal dissection with sufficient resection margin, Ge et al[13] adopted a countertraction method using a rubber band. Also, a useful method is available to close mucosal defects in the duodenal bulb, whose complete closure is usually difficult to achieve, with a continuous running stitch by use of an endoscopic suturing device (Overstitch; Apollo Endosurgery, Austin, Tex, USA). Traction methods are often effective in treating lesions in the duodenum, as seen in the cases mentioned above, and we previously reported a case treated by traction-assisted duodenal ESD using dental floss and a clip.[14]

In conclusion, the creative strategy in ESD of selecting an electrosurgical knife such as a scissors-type knife suitable for the operational situation accomplished safe and complete resection to avoid surgical resection, even in a technically highly difficult case of duodenal lesion.

DISCLOSURE

All authors disclosed no financial relationships relevant to this publication.

Abbreviations: ESD, endoscopic submucosal dissection; OTSC, over-the-scope clip.

REFERENCES

1. Draganov PV, Wang AY, Othman MO, et al. AGA Institute clinical practice update: endoscopic submucosal dissection in the United States. Clin Gastroenterol Hepatol 2019;17:16-25.e1.
2. Pimentel-Nunes P, Dinis-Ribeiro M, Ponchon T, et al. Endoscopic submucosal dissection: European Society of Gastrointestinal Endoscopy (ESGE) Guideline. Endoscopy 2015;47:829-54.
3. Saito Y, Uraoka T, Yamaguchi Y, et al. A prospective, multicenter study of 1111 colorectal endoscopic submucosal dissections (with video). Gastrointest Endosc 2010;72:1217-25.
4. Imai K, Hotta K, Yamaguchi Y, et al. Endoscopic submucosal dissection for large colorectal neoplasms. Dig Endosc 2017;29:53-7.
5. Tashima T, Ohata K, Sakai E, et al. Efficacy of an over-the-scope clip for preventing adverse events after duodenal endoscopic submucosal dissection: a prospective interventional study. Endoscopy 2018;50:487-96.
6. Yahagi N, Kato M, Ochiai Y, et al. Outcomes of endoscopic resection for superficial duodenal epithelial neoplasia. Gastrointest Endosc 2018;88:676-82.
7. Inoue T, Uedo N, Yamashina T, et al. Delayed perforation: a hazardous complication of endoscopic resection for non-ampullary duodenal neoplasm. Dig Endosc 2014;26:220-7.
8. Kato M, Ochiai Y, Fukuhara S, et al. Clinical impact of closure of the mucosal defect after duodenal endoscopic submucosal dissection. Gastrointest Endosc 2019;89:87-93.
9. Akimoto T, Goto O, Nishizawa T, et al. Endoscopic closure after intraluminal surgery. Dig Endosc 2017;29:547-58.
10. Yahagi N, Nishizawa T, Akimoto T, et al. New endoscopic suturing method: string clip suturing method. Gastrointest Endosc 2016;84:1064-5.
11. Tashima T, Nonaka K, Ryozawa S, et al. Endoscopic purse-string suturing with multiple over-the-scope clips for closure of a large mucosal defect after duodenal endoscopic submucosal dissection. Dig Liver Dis 2018;50:1368.
12. Nagata M. Underwater endoscopic submucosal dissection in saline solution using a bent-type knife for duodenal tumor. VideoGIE 2018;3:375-7.
13. Ge PS, Thompson CC, Aihara H. Successful removal of duodenal submucosal tumors with endoscopic submucosal dissection. VideoGIE 2018;3:275-8.
14. Tashima T, Nonaka K, Kurumi H, et al. Successful traction-assisted endoscopic submucosal dissection using dental floss and a clip for a huge superficial nonampullary duodenal epithelial tumor with severe fibrosis (with video). JGH Open 2019;3:179-81.

Department of Gastroenterology (1), Department of Pathology, Saitama Medical University International Medical Center, Saitama, Japan (2).

https://doi.org/10.1016/j.vgie.2019.06.001