



Successful endoscopic resection by using gel immersion and the technique of endoscopic papillectomy for a tumor adjacent to the papilla of Vater

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INTRODUCTION

Superficial nonampullary duodenal epithelial tumors are rare, and the establishment of optimized strategies for their treatment is an area of active investigation.¹ Endoscopic submucosal dissection (ESD) for superficial nonampullary duodenal epithelial tumors poses the risk of major adverse events (AEs), including a high rate of bleeding, intraoperative perforation, and delayed perforation.^{2,3} Lesions located in the duodenal flexure are associated with poor endoscope maneuverability.⁴ Moreover, endoscopic resection is particularly challenging for lesions on the descending duodenum's medial wall, especially those adjacent to the papilla of Vater (POV). If endoscopic resection is not possible, a pancreaticoduodenectomy, which is a highly invasive surgery, can be performed.

Gel immersion endoscopy is used to control gastrointestinal bleeding by flushing out blood and clots to secure a good visual field.⁵⁻⁷ Since there is no carbon dioxide (CO₂) insufflation during duodenal gel immersion endoscopy, endoscopic maneuvering remains stable with lower intraluminal pressure, thus preventing redundant loops in the stomach.⁸ Herein, we report a case in which various endoscopic techniques, including gel immersion endoscopy, were used to overcome the difficulty of endoscopic resection of a tumor that was adjacent to the POV (Video 1, available at www.giejournal.org). This gel immersion endoscopy procedure was approved by the institutional review board of Saitama Medical University International Medical Center (institutional ID: 2021-089, August 4, 2021).

CASE

A 69-year-old woman presented with a flat elevated tumor adjacent to the POV (Fig. 1A and B). The biopsy specimen was suspicious for a high-grade adenoma or a well-differentiated adenocarcinoma. Written informed consent was obtained from the patient, and ESD was selected for en bloc resection of the tumor and to determine a definitive pathological diagnosis. Duodenal ESD is associated with increased risks of delayed perforation

and bleeding, which are likely caused by exposure of the mucosal defect to pancreatic or biliary juices. Therefore, complete closure of the mucosal defect may effectively prevent AEs.^{9,10} However, we judged that closure of the entire mucosal defect after ESD was impossible in this case because of the tumor's proximity to the POV. In cases where closure of the entire mucosal defect is not possible and/or when a lesion is located near the POV, insertion of endoscopic nasobiliary drainage (ENBD) and endoscopic nasopancreatic drainage (ENPD) tubes for external drainage of biliary and pancreatic juices after ESD is reportedly effective at preventing delayed bleeding and perforation.^{11,12} Therefore, a bile duct stent and pancreatic duct stent were placed before treatment to improve lesion visualization and avoid ductal injury during ESD. The stents also facilitated the insertion of ENBD and ENPD tubes after resection (Fig. 1C). Thus, both stents were placed before tumor resection with the plan of leaving them in place.

Equipment and preparation

ESD was performed by using a therapeutic endoscope (GIF-H290T; Olympus Medical Systems Corporation, Tokyo, Japan) with a small-caliber-tip transparent hood (DH-33GR; Fujifilm, Tokyo, Japan). A local injection of 0.4% sodium hyaluronate (MucoUp; Boston Scientific, Tokyo, Japan) combined with a small amount of indigo carmine and epinephrine (dilution 1:100,000) was used to maintain high submucosal elevation. A DualKnife J 1.5 mm (KD655Q; Olympus) was used to make a mucosal incision or submucosal dissection. As a high-frequency electrosurgical unit, we used VIO 3 (Erbe Elektromedizin, Tübingen, Germany) with ENDO CUT I (effect 2, duration 3, interval 1) for mucosal incisions, forced coagulation (effect 4.5) for submucosal dissection, spray coagulation (effect 1.2) for hemostasis by using the tip of the knife, and soft coagulation (effect 6.0) for hemostasis by using Coagrasper (Olympus). We prepared the gel (VISCOCLEAR, Otsuka Pharmaceutical Factory, Tokushima, Japan) and an accessory channel (BioShield Irrigator, US Endoscopy, Mentor, Ohio, USA) for gel immersion endoscopy during ESD.

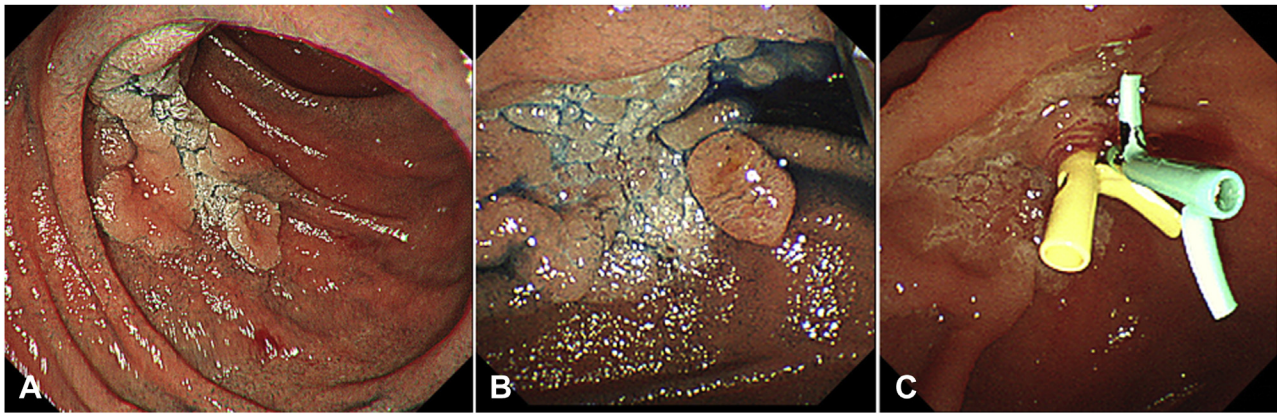


Figure 1. Preoperative endoscopic appearance of the tumor. **A**, Conventional duodenoscopy image (*forward view*). **B**, Side-viewing duodenoscopy image. A flat elevated tumor located adjacent to the papilla of Vater. **C**, Inserting a bile duct stent (7F-7 cm, Trough & Pass; Gadelius Medical, Tokyo, Japan) and a pancreatic duct stent (5F-7 cm, Geenen Pancreatic Stent Sets; Cook Japan, Tokyo, Japan) a week before endoscopic treatment.

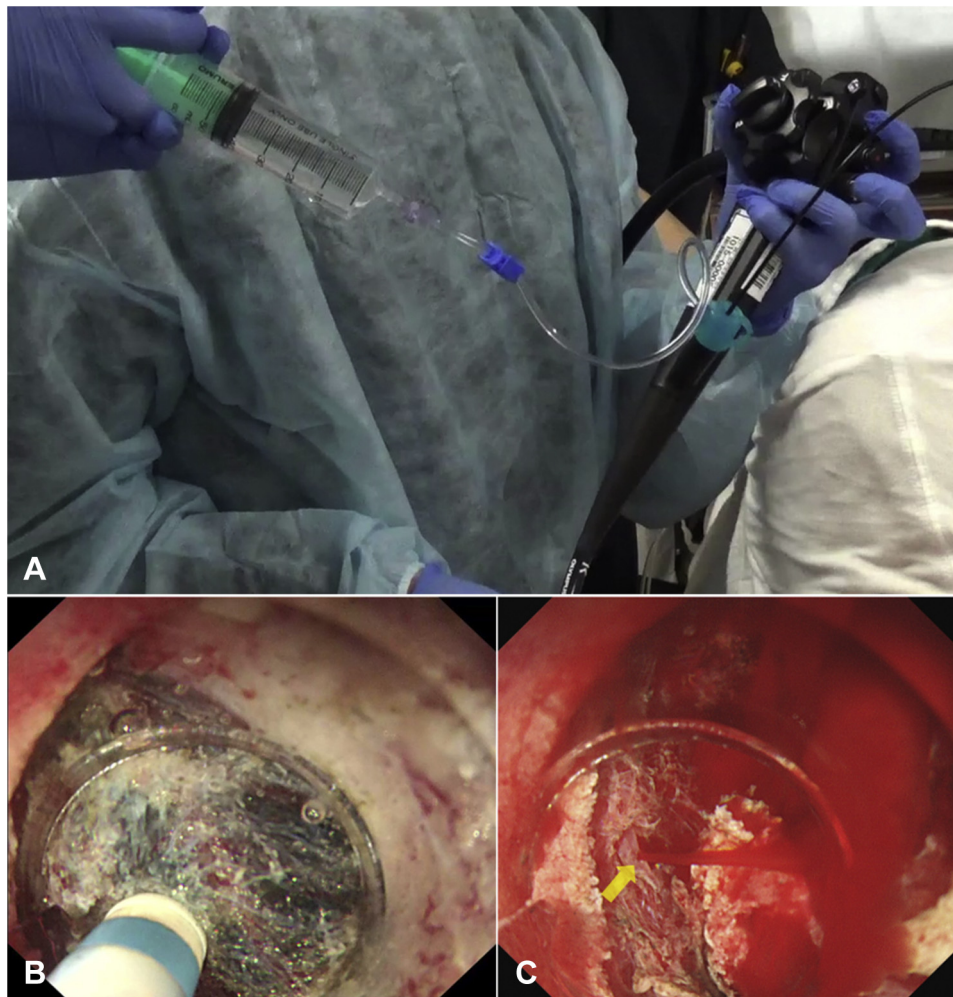


Figure 2. Gel immersion endoscopic submucosal dissection. **A**, A therapeutic endoscope with the accessory channel. The gel injection and the electro-surgical knife or hemostatic forceps were inserted simultaneously through the accessory channel. **B**, Gel immersion view during the submucosal dissection. **C**, Gel immersion view shows intraoperative arterial bleeding (*yellow arrow*).

Procedure

The surgery was performed with the patient under general anesthesia with laparoscopic assistance^{13,14} in

preparation for severe intraoperative perforation or massive arterial bleeding, which are difficult to resolve with endoscopic treatment. The laparoscopic Kocher

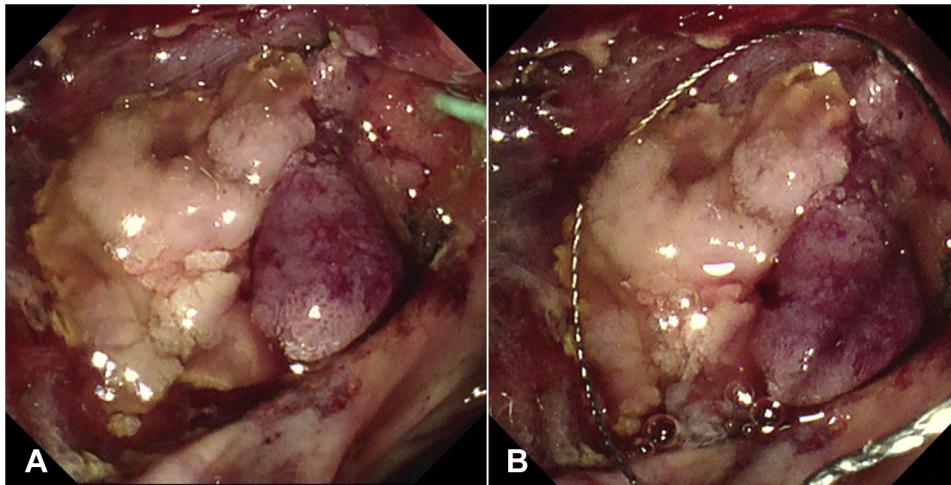


Figure 3. Endoscopic submucosal dissection combined with the technique of endoscopic papillectomy (side-viewing duodenoscopy image). **A**, A tumor that was almost dissected to the vicinity of the papilla of Vater. **B**, Resection by an electro-surgical snare (SnareMaster: 25-mm diameter; Olympus Medical Systems Corporation, Tokyo, Japan).

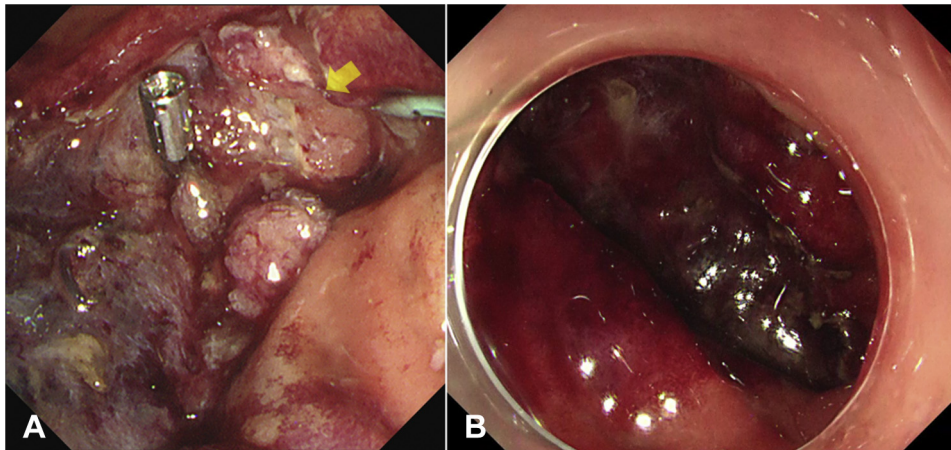


Figure 4. Endoscopic appearance of the mucosal defect after tumor resection. **A**, Conventional duodenoscopy image (forward view). **B**, Side-viewing duodenoscopy image. The perforation was completely closed by using an endoscopic clip. The mucosal defect extended to adjacent the papilla of Vater (*yellow arrow*), and the papilla of Vater was intact.

maneuver was performed until the posterior wall of the descending part of the duodenum was sufficiently exposed. Although we started with ESD, it was difficult to perform because of poor endoscope maneuverability at the duodenal flexure, where the endoscope slipped out of the lesion area to the proximal side and the gravity side submerged the lesion. When unexpected massive bleeding occurred during submucosal dissection, it became difficult to visualize the lesion and detect the bleeding point. Gel immersion endoscopy was then used. CO₂ insufflation was turned off, and the gastric and duodenal lumens were deflated. Subsequently, we injected gel through the accessory channel and filled the lumen around the tumor. Electro-surgical devices were simultaneously inserted through the accessory channel (Fig. 2A). Because organ collapse was maintained with lower intraluminal pressure, endoscope maneuverability

was stable and a good approach to the lesion was secured, allowing safe submucosal dissection (Fig. 2B). Bleeding slowed because of the gel's viscosity. Further injection of the gel resulted in good visualization of the bleeding site (Fig. 2C), enabling quick and easy hemostasis. Since the gel was viscous, the stagnation around the tumor was maintained long enough to perform ESD. A total of 400 mL of the gel was used. However, when the submucosa was mostly dissected, as the endoscope could not reach the peripapillary area (Fig. 3A), we abandoned ESD and converted to resection by using the endoscopic papillectomy technique. Afterward, most of the gel in the duodenum was suctioned. Thus, we reinserted a side-viewing endoscope (TJF-Q290V; Olympus), and the tumor was resected with an electro-surgical snare by using ENDO CUT I (effect 1, duration 4, interval 1) (Fig. 3B). A perforation occurred

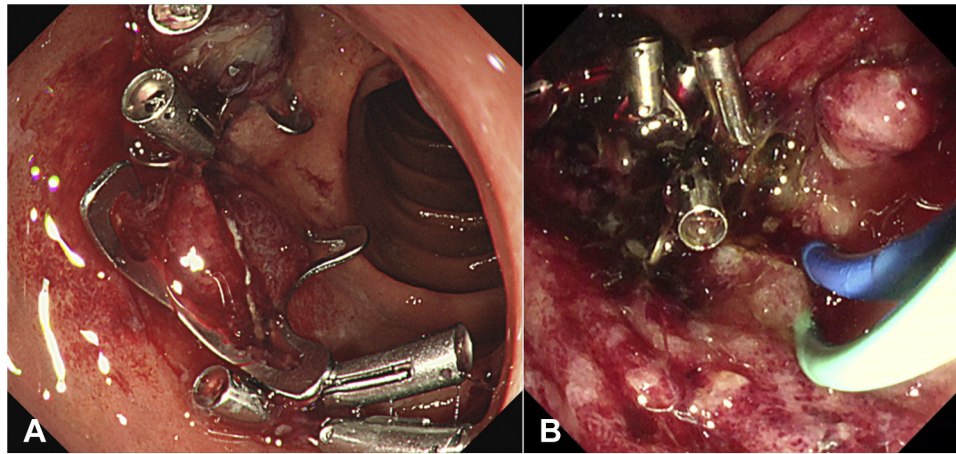


Figure 5. Prevention of delayed adverse events. **A**, Mucosal defect closure without obstruction of the papilla of Vater using endoscopic clips and over-the-scope clips. **B**, Insertion of endoscopic nasobiliary drainage tube (6F pigtail catheter, Flexima Nasobiliary Catheter; Boston Scientific, Marlborough, Mass, USA) and endoscopic nasopancreatic drainage tube (5F straight catheter, nasal pancreatic drainage set, G21466; Cook Japan, Tokyo, Japan).



Figure 6. Prevention of delayed adverse events. Abdominal radiographic image after the insertion of the endoscopic nasobiliary drainage and endoscopic nasopancreatic drainage tubes and placement of closed suction drains.

after tumor resection but was completely closed by endoscopic clipping by using a reopenable clip (SureClip 16 mm; Micro-tech, Nanjing, China) (Fig. 4A). The mucosal defect extended to nearly half of the circumference of the descending part of the duodenum adjacent to the POV (Fig. 4A and B).

Post-ESD mucosal defect closure and management

After specimen retrieval, prophylactic mucosal defect closure was attempted by using endoscopic clips and 2 over-the-scope clips (OTSCs) (Ovesco Endoscopy GmbH, Tübingen, Germany) without POV obstruction (Fig. 5A). Subsequently, ENBD and ENPD tubes were inserted

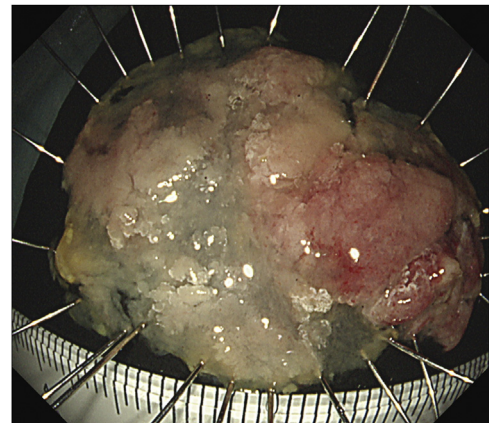


Figure 7. Gross appearance of the tumor showing the resected specimen (38 × 25 mm). The tumor (36 × 23 mm) was pathologically diagnosed as a nonampullary intestinal-type high-grade adenoma with negative margins.

(Fig. 5B). Finally, closed suction drains were placed adjacent to the right subdiaphragm and foramen of Winslow by laparoscopic surgery (Fig. 6).

Postoperative clinical course and outcome

Because this patient had a perforation after tumor resection adjacent to the POV and the mucosal closure was ultimately incomplete, we inserted ENBD and ENPD tubes and followed up with the patient stringently. The patient fasted and was intravenously hydrated for 7 days, including the ESD day. On postoperative day (POD) 7, the ENBD and ENPD tubes were removed after confirmation of no delayed perforation and leakage by endoscopy, gastrointestinal contrast radiography, or CT. On POD 8, oral intake was resumed by using liquid food, progressing to solid food after 1 day. The closed suction drains were removed on POD 11. The patient did not develop any AEs and was

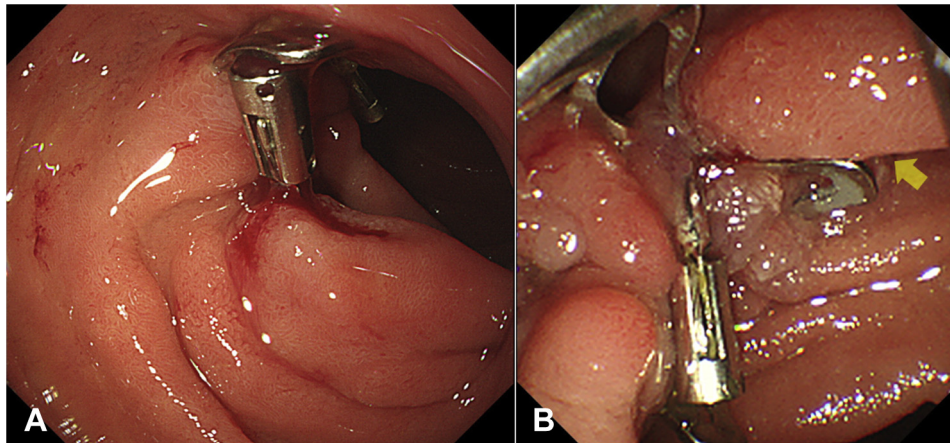


Figure 8. Follow-up endoscopic image. **A**, Conventional duodenoscopy image (forward view). The mucosal defect was completely scarred within 2 months. **B**, Side-viewing duodenoscopy image showing the papilla of Vater (*yellow arrow*). No residual tumors were identified.

discharged on POD 14. The tumor was diagnosed as a non-ampullary intestinal-type high-grade adenoma with negative margins (Fig. 7). The mucosal defect scarred entirely within 2 months, and no residual tumor was identified (Fig. 8).

DISCUSSION

For duodenal ESD, we selectively combine laparoscopic and endoscopic approaches when endoscopic resection and closure are suspected to be technically difficult. In the present case, we expected that the laparoscopic Kocher maneuver would provide some additional benefits to make ESD easier by mobilizing the duodenum.¹⁵ However, it did not work as expected. For improving endoscope maneuverability, laparoscopy may not have been necessary, and gel immersion alone could have been used.

The “water pressure method” has recently become the mainstream procedural innovation in duodenal ESD.^{16,17} We should have tried performing this method instead of conventional ESD. However, it was difficult to secure the visual field, as the injected water rapidly mixed with the massive luminal arterial bleeding that occurred during submucosal dissection. Hence, gel immersion was superior to water immersion for this case. The advantages of using gel immersion during ESD include an easy approach to the submucosal layer owing to the buoyancy effect, clear visualization of the bleeding site, and the ability to perform the procedure with lower intraluminal pressure because insufflation is not required. Nevertheless, when the gel migrates from the lesion, and/or to remove bubbles and bleeding caused by incision and dissection, additional gel injection is required. Recently, we have been actively performing gel immersion ESD in organs with a narrow lumen where gel immersion is easy.¹⁸⁻²⁰

For mucosal defect closure, OTSC placement is not routinely required. Previously, we reported the potential of using OTSCs to prevent AEs after duodenal ESD.¹⁰ Yahagi et al² reported that delayed bleeding after ESD was significantly more common with lesions on the medial wall than with other lesions. In the present case, because the closure was incomplete and the defect extended to the medial wall, we performed closure as strongly as possible using OTSCs without covering the POV. The cautions for OTSC placement are to prevent burying the residual lesion in the submucosa and the need to confirm endoscopically the presence of a tumor-free margin before placement.

CONCLUSIONS

By using various tumor resection techniques, mucosal defect closure methods, and AE-prevention approaches, we achieved safe endoscopic treatment and avoided pancreaticoduodenectomy in a technically challenging duodenal case.

DISCLOSURE

All authors disclosed no financial relationships.

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Abbreviations: AEs, adverse events; ENBD, endoscopic nasobiliary drainage; ENPD, endoscopic nasopancreatic drainage; ESD,

endoscopic submucosal dissection; OTSC, over-the-scope clip; POD, postoperative day; POV, papilla of Vater.

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