



Double-tunneling butterfly method for endoscopic submucosal dissection of extensive rectal neoplasms

Ioannis Stasinou, MBBS, MRCP,¹ Takashi Toyonaga, MD, PhD,² Noriko Suzuki, MD, PhD¹

Background and aims: Endoscopic submucosal dissection (ESD) is the preferred technique for en bloc resection of superficial colorectal neoplasms. Resection of extensive lesions with ESD can be challenging, owing to loss of orientation in the submucosal space. In this case series, we describe the double-tunneling (DoT) butterfly method for ESD of extensive rectal neoplasms.

Methods: The key feature of the DoT butterfly method is the creation of 2 tunnels that are transformed into bilateral flaps, leaving a submucosal septum between them.

Results: Four rectal neoplasms measuring (maximum diameter) 7 cm, 8 cm, 9 cm, and 18 cm, respectively, were resected in 4 patients by use of the DoT butterfly method. The lesions included recurrent adenoma (n = 1) and dysplasia (n = 1) in longstanding ulcerative colitis. Curative R0 resection was confirmed in all 4 cases. Histologic examination showed tubular adenomas with low-grade dysplasia in 1 of 4 patients and focal high-grade dysplasia in 3 of 4 patients. One patient experienced postprocedural bleeding that required endoscopic reintervention.

Conclusion: The DoT butterfly method appears to be useful for the resection of extensive rectal neoplasms. A prospective study is required to assess whether these results can be reproduced in a large cohort of patients. (VideoGIE 2020;5:80-5.)

Endoscopic submucosal dissection (ESD) is the preferred technique for en bloc resection of superficial colorectal neoplasms when there is no evidence of metastatic disease.¹⁻³ Despite the proliferation in the use of ESD in recent years, it remains a technically challenging procedure.^{4,5} Several predictors have been associated with the degree of difficulty in ESD, and size of the lesion is one of them.⁶ Keeping good orientation in the submucosal space is paramount in order to perform safe ESD because it allows the endoscopist to maintain a dissection level parallel to the muscle layer and prevent adverse events such as perforation. This process can be challenging when applied to large extensive lesions where rolling of the mucosal flap can occur as a result of gravity.

METHOD

In this case series, we describe the double-tunneling (DoT) butterfly method for the resection of extensive rectal neoplasms (Fig. 1) (Video 1, available online at www.VideoGIE.org). The key feature of this technique is the creation of 2 tunnels, which are transformed into bilateral flaps.

First, a minimal (2-cm) mucosal incision is made at the distal edge of the lesion, followed by progressively deeper dissection of the submucosal layer to create a narrow tunnel. Starting again at the anal side, at a lateral distance of 2 cm from the first tunnel, a second tunnel is created, leaving a

submucosal septum between them. Changing the patient's position to adjust to gravity is not required when the tunnels are created because the injectate solution is not dispersed and adequate lifting of the submucosa is maintained. A proximal mucosal incision is then made to open both tunnels. Each tunnel is widened laterally, from the inner to the outer direction, to create 2 bilateral flaps. At this stage, the lesion simulates the shape of a butterfly: the flaps are the wings, and the submucosal septum is the corpus of the butterfly. The final step involves the dissection of the central submucosal septum from the anal side. Position changing may be required at this step to take advantage of gravity, especially when submucosal fibrosis is encountered.

Between December 2018 and March 2019, we achieved safe en bloc resection of 4 rectal neoplasms in 4 patients using the DoT butterfly method. Written consent was obtained from all patients before we used photos or videos from their procedures for publication. This is standard practice in our institution and takes place on the day of each procedure. All procedures were performed with the patients under sedation, by use of the Olympus PCF 260I colonoscope with a small-caliber transparent cap (DH-29CR; Fujifilm, Tokyo, Japan) attached. The lesions had been previously examined under high-definition white-light endoscopy and narrow-band imaging. Lesion morphology and surface pattern were classified according

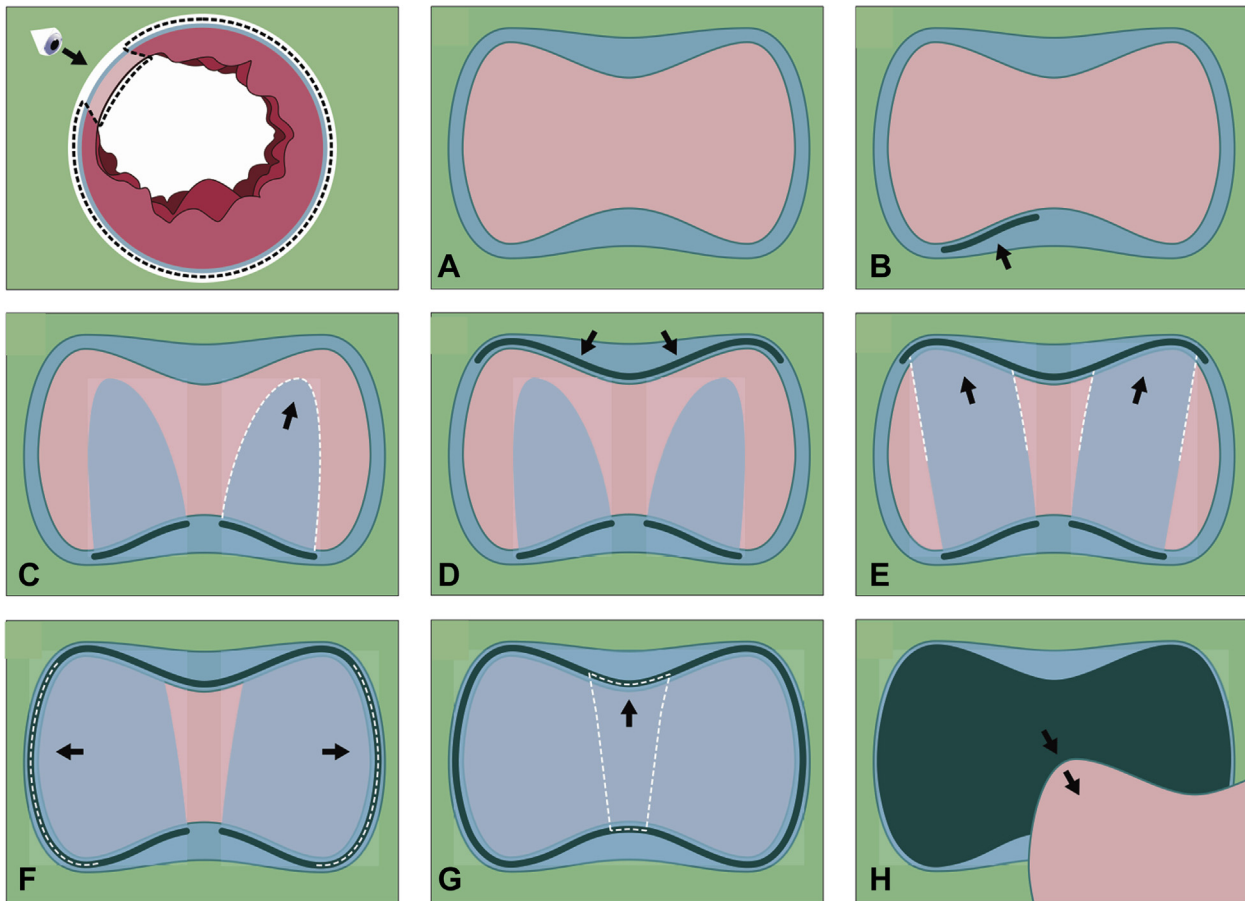


Figure 1. Sequence of the double-tunneling butterfly method for endoscopic submucosal dissection of an extensive rectal neoplasm. **A**, Lesion occupying >60% of the lumen circumference after submucosal injection (overview). **B**, Initial mucosal incision. **C**, Creation of 2 tunnels. **D**, Proximal mucosal incision. **E**, Opening of the 2 tunnels. **F**, Creation of bilateral flaps (butterfly). **G**, Dissection of the central septum. **H**, Dissection completed.

to the Paris classification and the narrow-band imaging International Colorectal Endoscopic (NICE) classification, respectively. Laterally spreading tumors (LSTs) were categorized as either granular type (LST-G) or nongranular type. The degree of fibrosis encountered during the procedure was rated from F0 to F2.⁷

Gelofusine (B. Braun Melsungen AG, Germany) with 2 drops of 0.2% indigo carmine was used for submucosal injection. The Flush knife BT 1.5 mm (Fujifilm, Tokyo, Japan) was used to perform the mucosal incision and submucosal dissection with Endocut I (effect 2, duration 2-3, interval 2) and forced coagulation (effect 2, 55W) on a VIO200D electro-surgical generator (ERBE Elektromedizin GmbH, Tübingen, Germany). Nonbleeding branch vessels were pre-coagulated with forced coagulation (effect 1, 10W). Hemostatic forceps (Coagrasper; Olympus) with soft coagulation (effect 5, 80W) were used to pre-coagulate penetrating vessels and control persistent bleeding.

RESULTS

Patient 1

A 71-year-old man was referred to our center with a recurrent polyp in the midrectum after previous EMR. Initial

endoscopic assessment showed an LST-G with a dominant nodule (Paris classification, 2a + 1s, NICE 2), measuring 7 cm in diameter. The lesion occupied approximately 60% of the rectal circumference. The dentate line was not involved. Submucosal fibrosis grade F2 was encountered. En bloc resection was achieved within a total procedure time of 270 minutes. The excised specimen measured 85 mm × 50 mm (Fig. 2). Histologic examination confirmed R0 resection of a tubular adenoma with low-grade and focal high-grade dysplasia.

Patient 2

An 84-year-old man was found to have an 8-cm LST-G (mixed type) (Paris classification 2a + 1s, NICE 2) in the rectum during flexible sigmoidoscopy performed for investigation of rectal bleeding. The lesion occupied approximately 75% of the rectal circumference and involved the dentate line. En bloc resection was achieved by use of the DoT butterfly method in 296 minutes. The resected specimen measured 90 mm × 40 mm (Fig. 3). Histologic examination confirmed R0 resection of a tubular adenoma with low-grade and focal high-grade dysplasia.

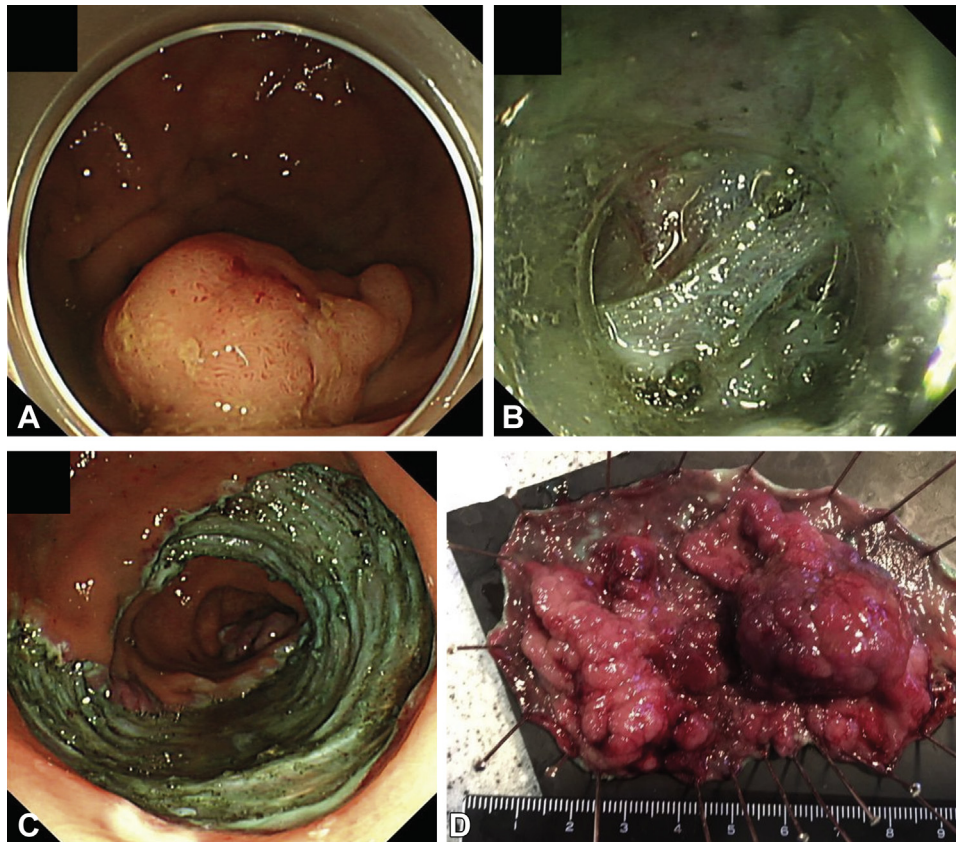


Figure 2. Endoscopic images of the double-tunneling butterfly method for endoscopic submucosal dissection (ESD) of an extensive recurrent rectal neoplasm in a 71-year-old patient. **A**, A 7-cm laterally spreading tumor (LST-G) in the low rectum. **B**, F2 fibrosis between the lesion and the muscle layer after creation of the 2 tunnels. **C**, Intact muscle layer and uncharred margins after ESD completion. **D**, Collected specimen measuring 85 mm × 50 mm.

Patient 3

An 81-year-old woman with a history of ulcerative colitis was referred with a well-defined LST-G (mixed type) in the rectum. The patient was known to have had pancolitis for more than 20 years but had missed endoscopic surveillance for the previous 10 years. The lesion measured 9 cm in maximum diameter and occupied approximately 90% of the rectal circumference, extending into the anal canal. The patient had been taking warfarin for long-term anticoagulation because of a previous aortic valve replacement and received bridging therapy with low-molecular-weight heparin before endoscopic therapy. The lesion was very vascular, with focal-grade F2 fibrosis. Significant intraprocedural bleeding was encountered from underlying hemorrhoids, which was managed with coagrasper forceps. En bloc resection with use of the DoT butterfly method was successful. The procedure time was 360 minutes. The resected specimen measured 100 mm × 50 mm (Fig. 4). The patient experienced postpolypectomy bleeding the following day, which required endoscopic reintervention but no blood transfusion. Histologic examination confirmed R0 resection of a tubular adenoma with low-grade dysplasia.

Patient 4

An 82-year-old man who had undergone placement of a permanent pacemaker was found to have an LST-G (mixed type) (Paris classification 2a, NICE 2) extending from the low rectum to the rectosigmoid junction. The lesion occupied approximately 90% of the rectal circumference and did not involve the dentate line. Grade F2 fibrosis was seen in the center. Two episodes of intraprocedural bleeding were managed with coagrasper forceps. En bloc resection was achieved by use of the DoT butterfly method in 420 minutes. The resected specimen measured 180 mm × 150 mm (Fig. 5). Histologic examination confirmed R0 resection of a tubular adenoma with low-grade and focal high-grade dysplasia.

DISCUSSION

ESD of extensive rectal neoplasms can be challenging. Loss of orientation caused by rolling of the mucosal flap is a common technical difficulty encountered during resection of such lesions. The main advantage of the DoT butterfly

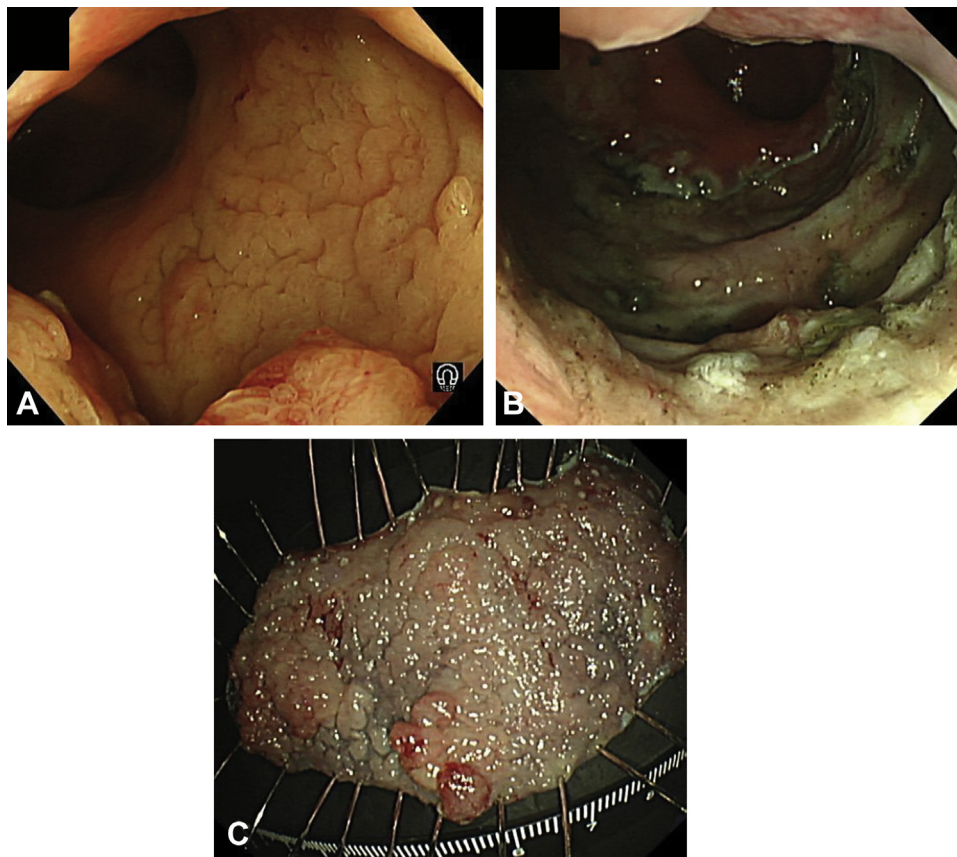


Figure 3. Endoscopic images of the double-tunneling butterfly method for endoscopic submucosal dissection (ESD) of extensive rectal neoplasm involving the dentate line in an 84-year-old patient. **A**, An 8-cm lateral spreading tumor in the low rectum. **B**, The exposed muscle layer involves the dentate line after ESD completion. **C**, Collected specimen measuring 90 mm × 40 mm.

method is the preservation of a central septum that acts as a pillar to prevent rolling of the mucosal flap and optimize submucosal views throughout the resection. In all 4 cases in this series, R0 resection was achieved, and rolling of the mucosal flap was avoided. Good traction was maintained during the entire procedure, allowing safe dissection of the submucosal layer at a level parallel to the muscle. Changing the patient's position to adjust to gravity was not required during the tunnel creation stage but seemed to facilitate the dissection of the septum. Creation of the 2 tunnels also allowed for submucosal fibrosis, when encountered, to be isolated and managed effectively.

An endoscopic multiple tunneling dissection technique for the treatment of superficial neoplasms in the esophagus and rectum has previously been described.^{8,9} The cornerstone of the DoT butterfly technique is the preservation of a central septum, which, according to our experience, may avoid the need to create a third tunnel.

Training in ESD remains a challenge in the Western world, mainly because of the lack of trainers and training facilities. In addition, the learning curve for ESD is relatively flat.^{10,11} Early experience from a training center in the United States showed that a 1-year ESD training program was successfully developed

and implemented as part of a traditional fourth-year interventional endoscopy fellowship, without compromising efficacy or patient safety.¹²

Providing nonexpert operators with structured strategies is important to optimize training in ESD. The pocket creation method described by Hayashi et al¹³ was the first method to provide a more uniform therapeutic strategy to overcome technical difficulties such as paradoxical movement and presence of fibrosis. The use of countertraction strategies appears to increase efficiency in ESD both in vivo and ex vivo.^{14,15} However, in those studies, lesions in the rectum were excluded, and the mean lesion size was smaller than the size of the lesions we resected in this case series. We recommend the DoT butterfly method for selected patients with extensive rectal lesions that are at least 6 cm in diameter and occupy >60% of the luminal circumference, where there is a higher risk of rolling of the mucosal flap. According to our experience, there is no need for additional traction devices when this method is used.

In conclusion, the DoT butterfly method appears to be safe and effective for ESD of extensive rectal neoplasms. A prospective study is required to assess whether these results can be reproduced in a large cohort of cases and for lesions located proximal to the rectum.

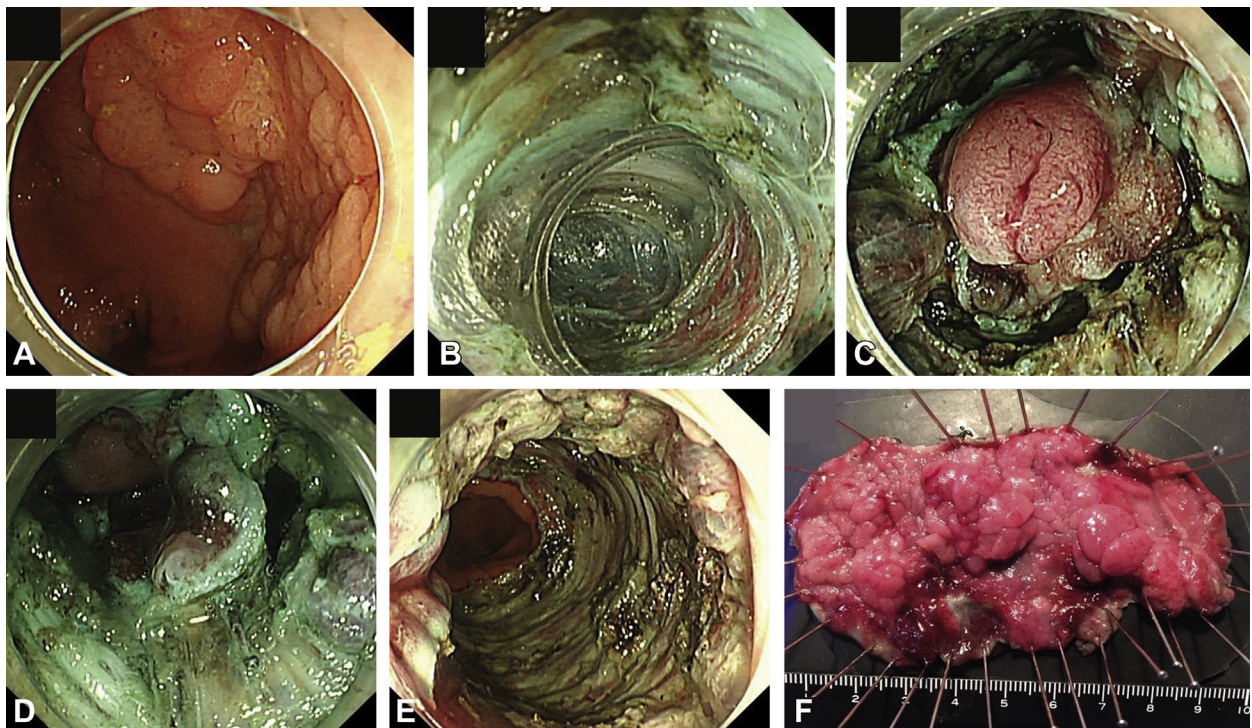


Figure 4. Endoscopic images of the double-tunneling butterfly method for endoscopic submucosal dissection of extensive rectal neoplasm in an 81-year-old patient with ulcerative colitis. **A**, A 9-cm laterally spreading tumor in the low rectum. **B**, Tunneling dissection. **C**, Creation of bilateral flaps in a butterfly shape. **D**, Dissection of the central septum. **E**, Final resection base with 85% of underlying muscle layer circumference exposed. **F**, Collected specimen measuring 100 mm × 50 mm.

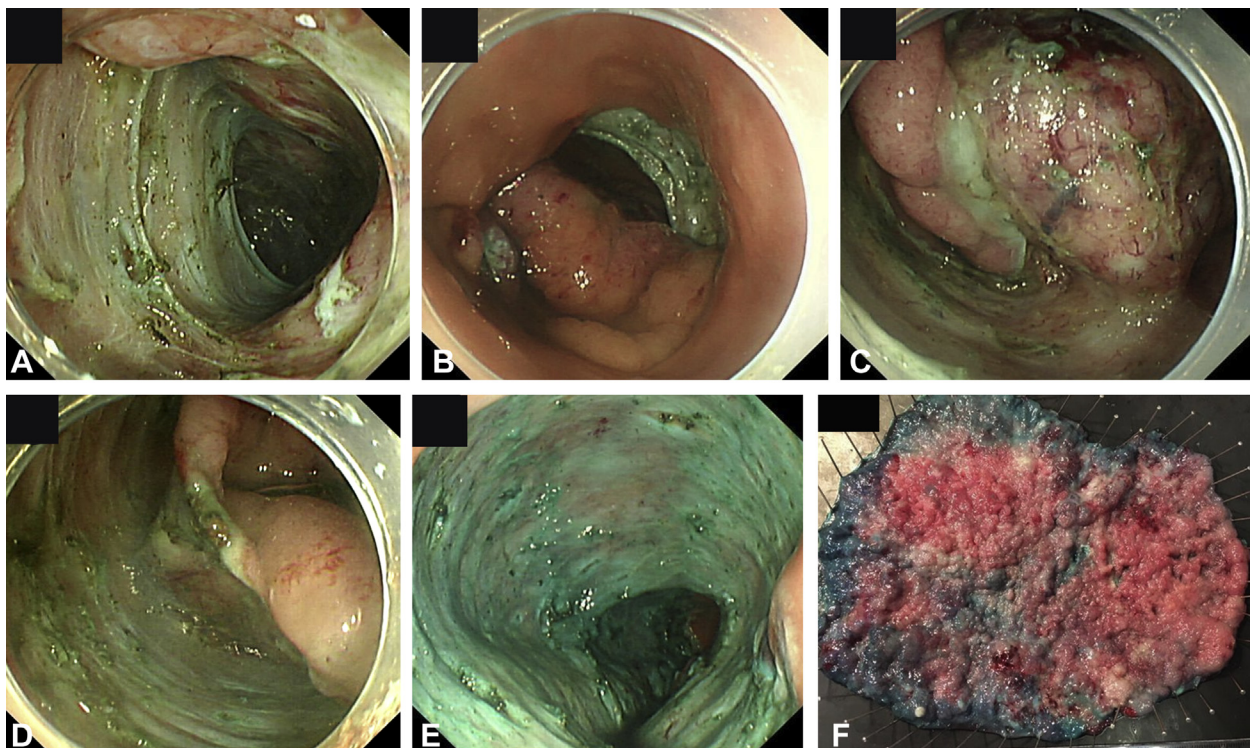


Figure 5. Endoscopic images of the double-tunneling butterfly method for endoscopic submucosal dissection of extensive rectal neoplasm in an 82-year-old patient. **A**, Tunneling dissection. **B**, Endoscopic view of the entry of the 2 tunnels from the anal side. **C**, F2 fibrosis between the lesion and the muscle layer after creation of the 2 flaps. **D**, Butterfly shape after creation of the 2 flaps. **E**, Final resection base with 90% of underlying muscle layer circumference exposed. **F**, The collected specimen measuring 180 mm × 150 mm.

DISCLOSURE

Dr Toyonaga is the recipient of royalties from Olympus and Fujifilm. All other authors disclosed no financial relationships relevant to this publication.

Abbreviations: DoT, double-tunneling; ESD, endoscopic submucosal dissection; LST, laterally spreading tumor; LST-G, LST granular type; NICE, narrow-band imaging, International Colorectal Endoscopic classification.

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The Wolfson Unit for Endoscopy, St Mark's Hospital, London, United Kingdom (1); Department of Endoscopy, Kobe University Hospital, Kobe, Japan (2).

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If you would like to chat with an author of this article, you may contact Dr Suzuki at n.suzuki@imperial.ac.uk.
