

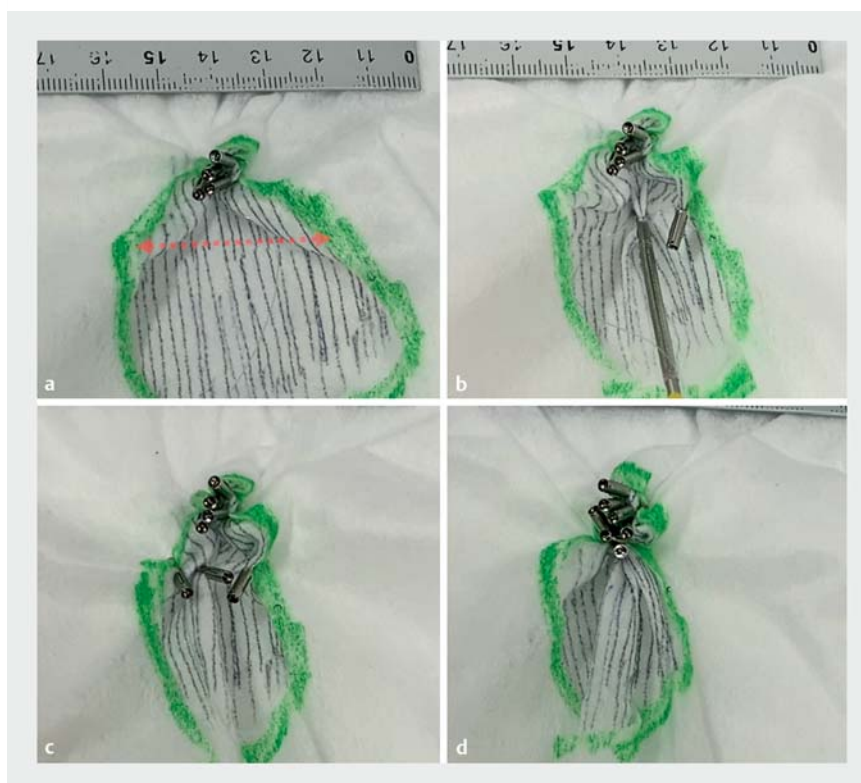
Reopenable clip over-the-line method with muscle layer grasping clips for large duodenal post-endoscopic submucosal dissection defects

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Postoperative perforation and bleeding are serious complications of duodenal endoscopic submucosal dissection (ESD) [1]. We previously described the reopenable clip over-the-line method (ROLM), a technique used to close mucosal defects after ESD using a line and a reopenable clip [2–4]. However, large mucosal defects remain incompletely closed even after ROLM, as complete closure is difficult to achieve. Therefore, we devised ROLM with muscle layer grasping clips (ROLM-M), which completely closes the mucosal defect and muscle layer without any dead space between the mucosa and muscle layers.

ROLM is a mucosal defect closure method that uses reopenable clips (Sureclip 8 mm; Micro-Tech Co. Ltd., Nan Jing, China) and a line (nylon line, 0.22 mm). First, a reopenable clip with a line is inserted through the accessory channel and attached to the distal mucosal defect edges and muscles (► Fig. 1, ► Video 1). Next, the line is passed through the tooth hole of a second reopenable clip, which is also used to grasp the muscle layer together with the contralateral defect edge. This process is repeated to close the defect. In the case of a large defect, ROLM placement of a reopenable clip only on the muscle layer at the base of the ulcer will eliminate the dead space and firmly fix the defect edge and muscle layer of the defect.

The patient was a 67-year-old man with a 60-mm early duodenal cancer in the descending duodenum (► Fig. 2). We resected the tumor completely by ESD using a pocket creation method with a calibrated, small-caliber tip, transparent hood [5]. The mucosal defect measured 80 mm in size. We used ROLM-M for complete closure. The remaining line was fixed to the normal mucosa using



► **Fig. 1** Schema of the reopenable clip over-the-line method with muscle layer grasping clips (ROLM-M). **a** A large mucosal defect (red arrow) after multiple ROLM closure. **b** ROLM placement of the reopenable clip on the central muscle layer of the mucosal defect. **c** ROLM placement of the reopenable clip on the contralateral mucosal defect and the nearby muscle layer. **d** Gradual closure of the mucosal defect by pulling the line, with no dead space between the mucosa and muscle layers.

the modified locking clip technique, and the line was cut [4]. The patient was discharged without any adverse events.

Endoscopy_UCTN_Code_TTT_1AO_2AI

Competing interests

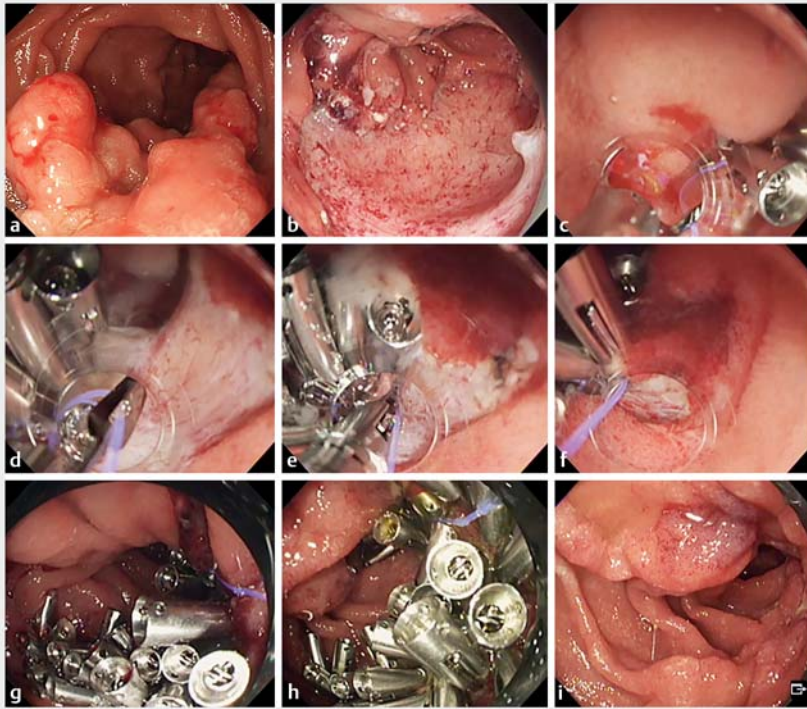
The authors declare that they have no conflict of interest.

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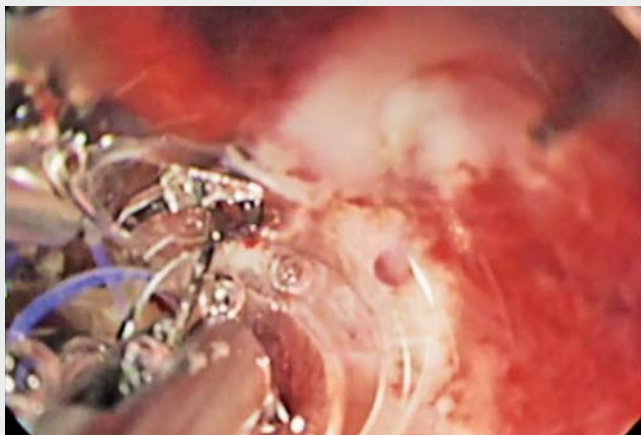
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► **Fig. 2** Closure of a mucosal defect using the reopenable clip over-the-line method with muscle layer grasping clips (ROLM-M). **a** The early duodenal tumor 60 mm in size. **b** The defect, 80 mm in size, after endoscopic submucosal dissection (ESD). **c** Gradual closure of the mucosal defect using ROLM. **d** The mucosal defect before applying muscle layer grasping clips. **e** A muscle layer grasping clip was used to grasp only the muscle layer. **f** The mucosal defect after reduction of the submucosal dead space following the use of muscle layer grasping clips. **g** The completely closed post-ESD duodenal mucosal defect. **h** The mucosal defect 4 days after ESD. **i** The mucosal defect 21 days after ESD.



► **Video 1** Closure of an 80-mm duodenal mucosal defect using the reopenable clip over-the-line method with muscle layer grasping clips.

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Endoscopy 2022; 54: E782–E783

DOI 10.1055/a-1810-7024

ISSN 0013-726X

published online 14.4.2022

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Georg Thieme Verlag KG, Rüdigerstraße 14,
70469 Stuttgart, Germany

