



# Endoscopic double-layered suturing: an updated technique for clip closure of large mucosal defects after endoscopic submucosal dissection

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## BACKGROUND

Endoscopic resection techniques, including EMR and endoscopic submucosal dissection (ESD), have become standard of care for early colonic neoplasia. However, there is still a fear of adverse events such as delayed bleeding and delayed perforation. Although these adverse events occur infrequently after colorectal ESD (estimated 1.5%-2.8% and 0.1%-0.4%, respectively<sup>1</sup>), the search for preventative techniques in high-risk cases has been of interest. Meta-analysis has suggested potential benefits of endoscopic clip closure in prevention of adverse events.<sup>2</sup>

In 2012, we reported the “double-layered suturing” technique, using endoclips applied to the ulcer bed to fold the muscle and then closing the mucosal edges with a second layer of clips, grasping the muscle between the mucosa.<sup>3</sup> This is done to minimize “dead space,” which can occur when only the mucosa is held by the endoclips. By simulating serosal-to-serosal apposition via inclusion of the muscle fold, the technique aims to achieve more durable and sustainable closure.<sup>4</sup> Retrospective analyses of modified double-layered suturing have proven its efficacy.<sup>5</sup>

Recently, we further modified our technique to allow for closure of even larger lesions while still minimizing dead space. After applying endoclips to the ulcer bed itself, we have begun to use an anchor-pronged clip (MANTIS clip; Boston Scientific, Marlborough, Mass, USA) to use the hold-and-drag technique described by Akimoto et al.<sup>6</sup> This allows us to secure the mucosal edges to the plicated muscle folds in the center of the defect and span ulcers that could not be grasped with standard clips. Closure of the remaining mucosal edges can then progress outward from the center using conventional clips.

*Abbreviation: ESD, endoscopic submucosal dissection.*

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## CASE PRESENTATION

A patient in their 70s was referred to our center after the discovery of a large, laterally spreading-type granular mixed polyp in the ascending colon following screening via fecal occult blood testing (Fig. 1A). The size was estimated at greater than 6 cm. For the purpose of en bloc resection, the patient consented to ESD.

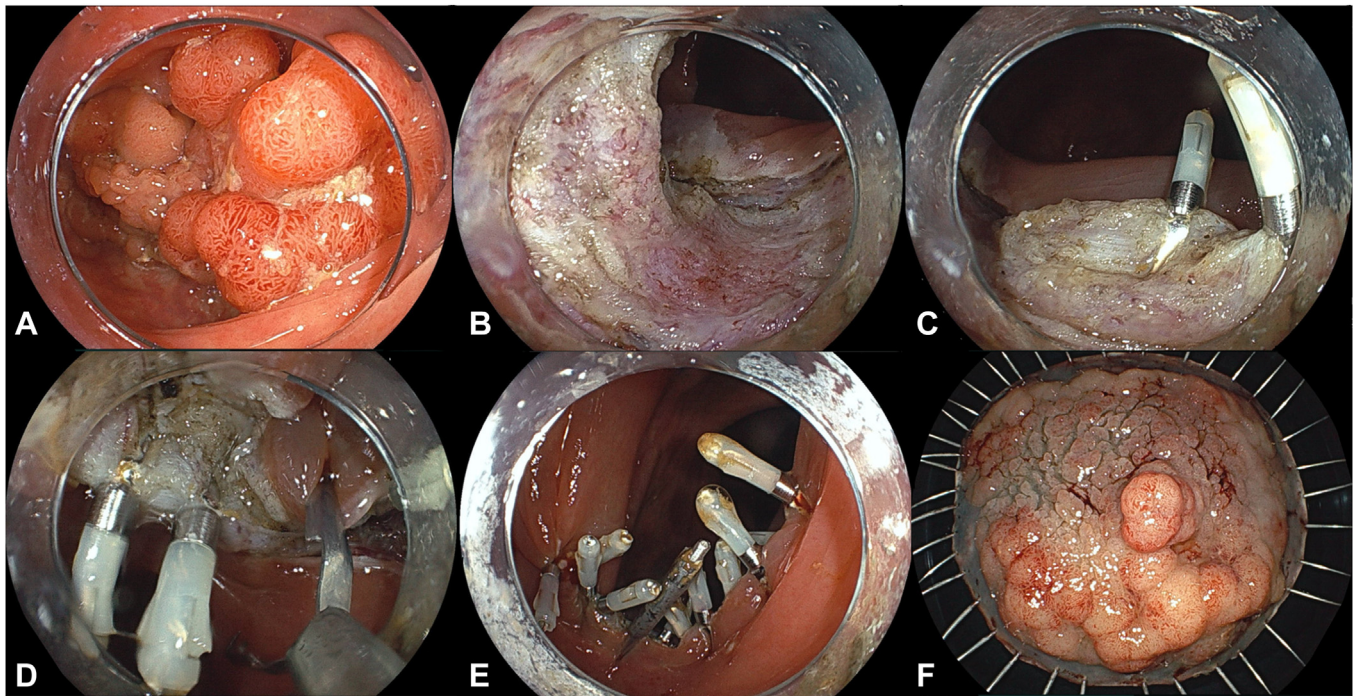
ESD was performed uneventfully using a ball-tip needle-type endoscopic knife (Video 1, available online at [www.videogie.org](http://www.videogie.org)). In this case, markings were not required because of the clear transition from polyp to normal mucosa. On completion, the ulcer bed was large (Fig. 1B). Closure was planned to decrease the risk of delayed perforation and bleeding, given the size and location. However, conventional endoscopic clips could not span the width of the ulcer. Thus, we decided to proceed with double-layered closure.

Conventional endoscopic clips were applied directly to the muscle layer (Figs. 1C and 2B) from one edge of the ulcer to the other, leaving room in the middle. This “tents” the muscle layer, slightly shrinking the size of the ulcer bed. Next, the anchor-pronged clip (Fig. 3) was used to approximate the mucosa in the center of the ulcer bed, with the tented muscle included in the grasp (Figs. 1D and 2C). This allows for minimization of the dead space under the mucosa (Fig. 4) and mimics a surgical “stay” suture. Subsequently, the remainder of the ulcer bed was easily closed with conventional clips (Figs. 1E and 2D). The specimen was then retrieved and pinned for examination.

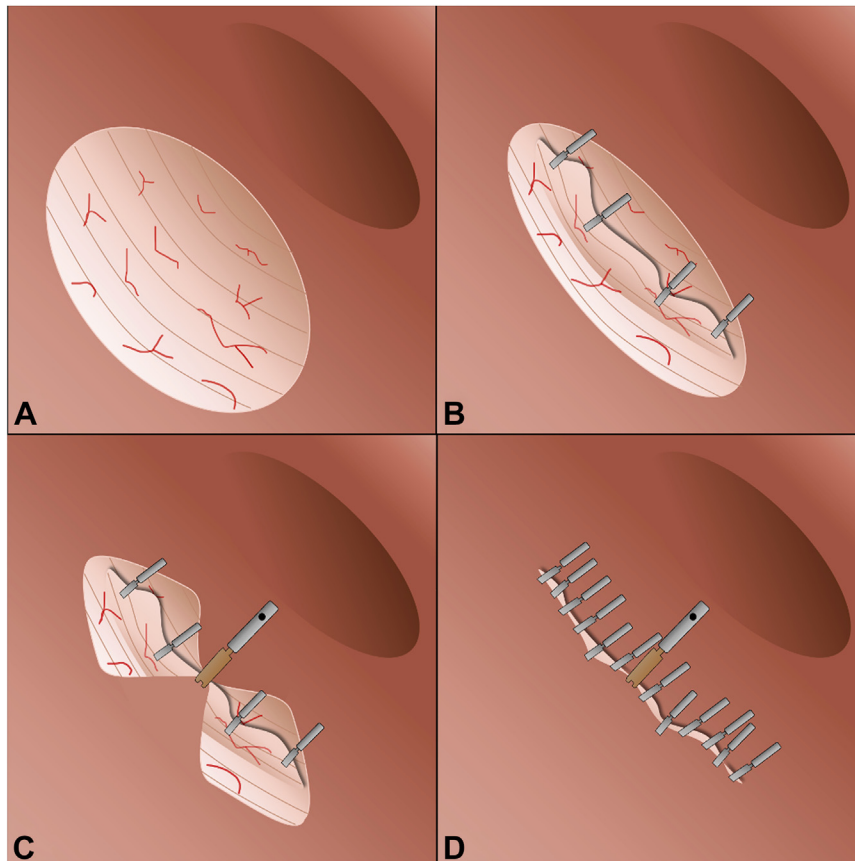
Histology confirmed a 56- × 47-mm early adenocarcinoma with pTis depth. Horizontal and vertical margins were clear, and there were no other high-risk features. The patient was discharged without issue, and there was no delayed bleeding or perforation. Given the curative resection, follow-up examination will occur in 1 year.

## DISCUSSION

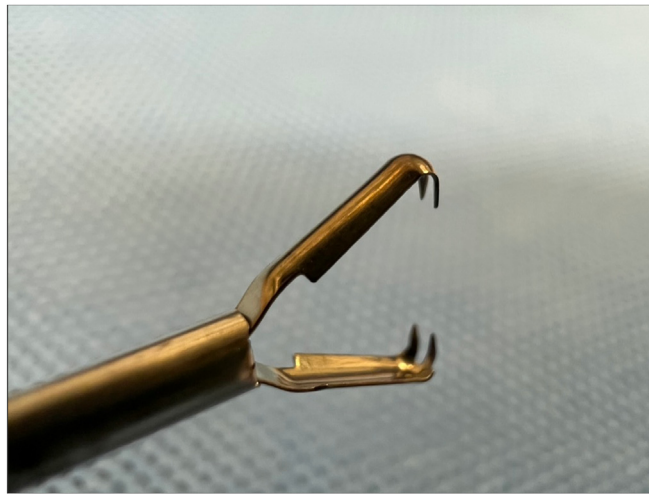
Double-layered suturing using endoscopic clips remains an effective method of closure for colonic lesions and has been further facilitated by the introduction of anchor-pronged reopenable clips. This method allows for efficient apposition and importantly does not require reinsertion of



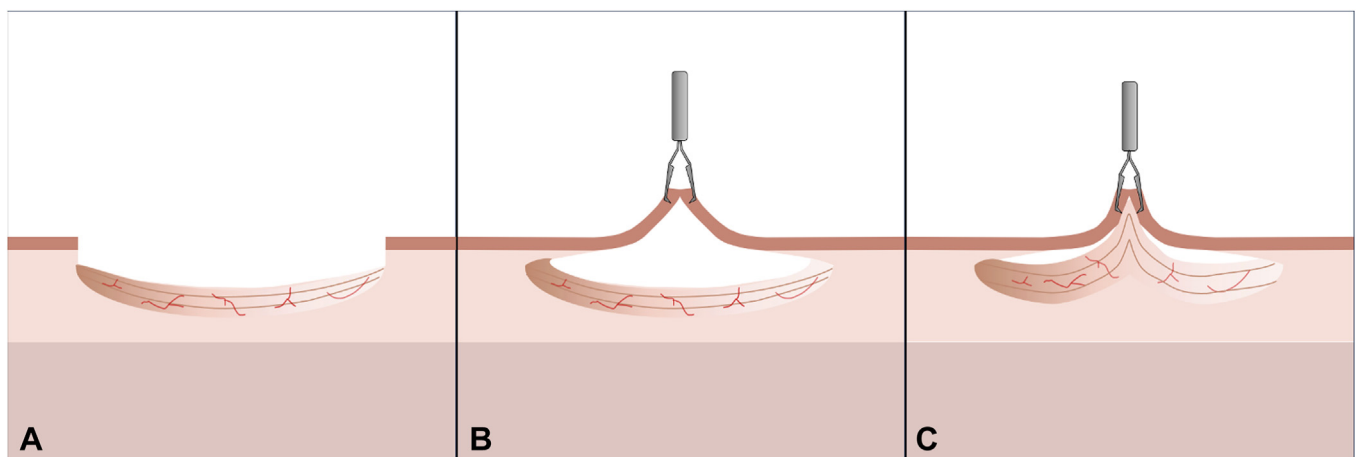
**Figure 1.** **A**, White-light image of a large, laterally spreading-type granular mixed polyp. **B**, Post-endoscopic submucosal dissection ulcer. **C**, Clips applied directly to the muscle layer. **D**, Double-pronged clip used to approximate the middle of the ulcer. **E**, Ulcer completely closed via conventional clips. **F**, Resected specimen.



**Figure 2.** **A**, Post-endoscopic submucosal dissection ulcer. **B**, Conventional clips applied directly to the muscle layer. **C**, Double-pronged clip used to approximate the middle of the ulcer. **D**, Ulcer completely closed via conventional clips.



**Figure 3.** Close-up view of the anchor-pronged clip.



**Figure 4.** **A**, Post-endoscopic submucosal dissection ulcer. **B**, Conventional closure leaving dead space. **C**, Grasping of tented muscle layer during double-layered suturing, minimizing dead space.

the endoscope to attach an external device. It also allows closure of large lesions that would be challenging even with conventional double-layered suturing. Given the relatively high price of other specialized closure devices, the cost effectiveness of double-layered suturing can also be advantageous, especially if using a reloadable clip system. However, the use of a substantial number of conventional clips, with the addition of the anchor-pronged clip, may lessen this cost advantage.

Other novel methods of ESD defect closure have been developed and proven effective, including helical tack systems<sup>7</sup> and endoscopic suturing devices.<sup>8</sup> Nonetheless, with these closure devices still awaiting regulatory body approval in many countries worldwide, we propose double-layered suturing as an accessible option using readily available tools.

## DISCLOSURE

Dr Toyonaga receives royalties from Fujifilm. The other authors did not disclose any financial relationships.

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