Purely endoscopic appendectomy

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Surgical/laparoscopic appendectomy requires abdominal wall incisions/punctures that can subsequently cause hernias, pain, and delayed return to work and regular physical activity after surgical/laparoscopic removal of the appendix.[1] Natural orifice transluminal endoscopic surgery interventions were often performed with laparoscopic assistance and required advancement of an endoscope into the peritoneal cavity through gastric or vaginal wall with increased risk of infection and abdominal adhesions.[1-5] Recently developed DiLumen (Lumendi LLC, Westport, Conn, USA) double-balloon endoluminal interventional platform (DBEIP) consists of an overtube with 2 balloons: one (aft-balloon) is fixed to the oral end of the overtube, and the other (fore-balloon) can be extended forward or pulled back with 2 attached suture-loops providing traction to facilitate various endoscopic interventions.[6-10] We are now reporting the first purely endoscopic appendectomy by using DiLumen.

A middle-aged woman was referred for evaluation of an incidentally found lesion in her cecum. DiLumen was loaded on a colonoscope (PCF190, Olympus America, Center Valley, Pa, USA) and inserted into her cecum. A rounded cecal lesion covered by normal mucosa was identified (Fig. 1; Video 1, available online at www.giejournal.

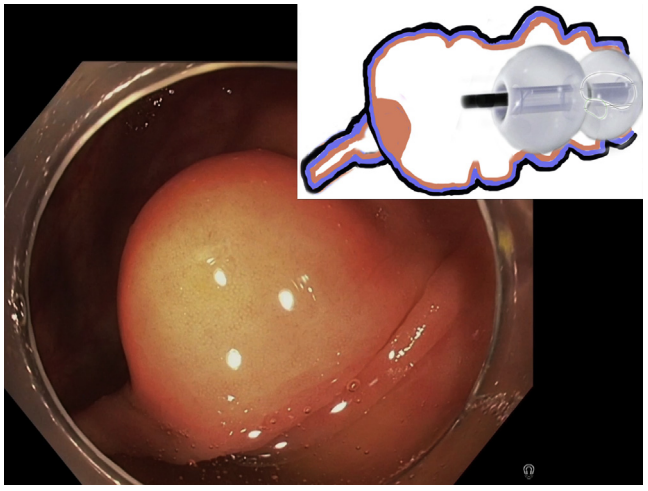

Figure 1. Cecal submucosal lesion. In the accompanying diagram, the mucosal layer is *orange*, submucosal layer is *blue*, and serosal layer is *black*.

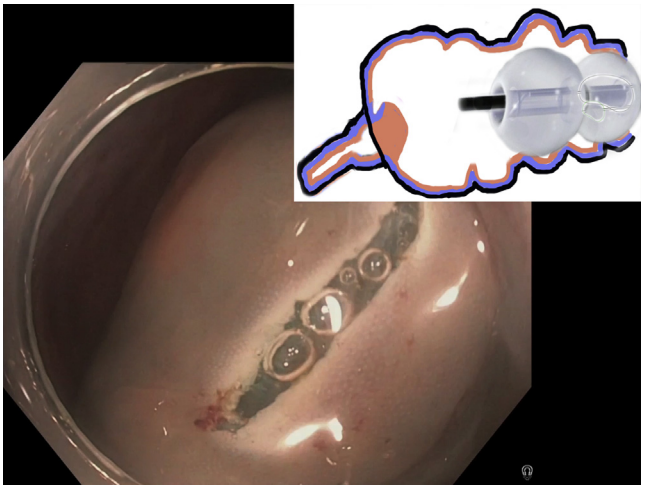

Figure 2. Circumferential incision around the lesion is performed with DualKnife (Olympus America, Center Valley, Pa, USA). In the accompanying diagram, the mucosal layer is *orange*, submucosal layer is *blue*, and serosal layer is *black*.

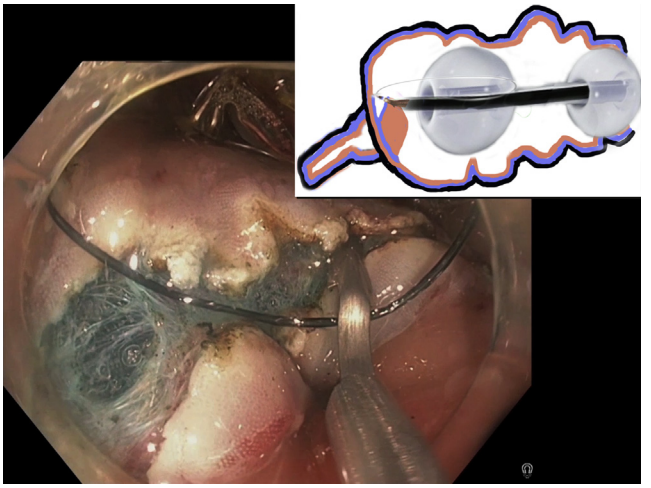

Figure 3. The lesion is attached with endoscopic clips (Resolution 360, Boston Scientific Corporation, Natick, Mass, USA) to a suture-loop mounted on fore-balloon of the double-balloon endoluminal interventional platform and pulled into the colonic lumen. In the accompanying diagram, the mucosal layer is *orange*, submucosal layer is *blue*, and serosal layer is *black*.

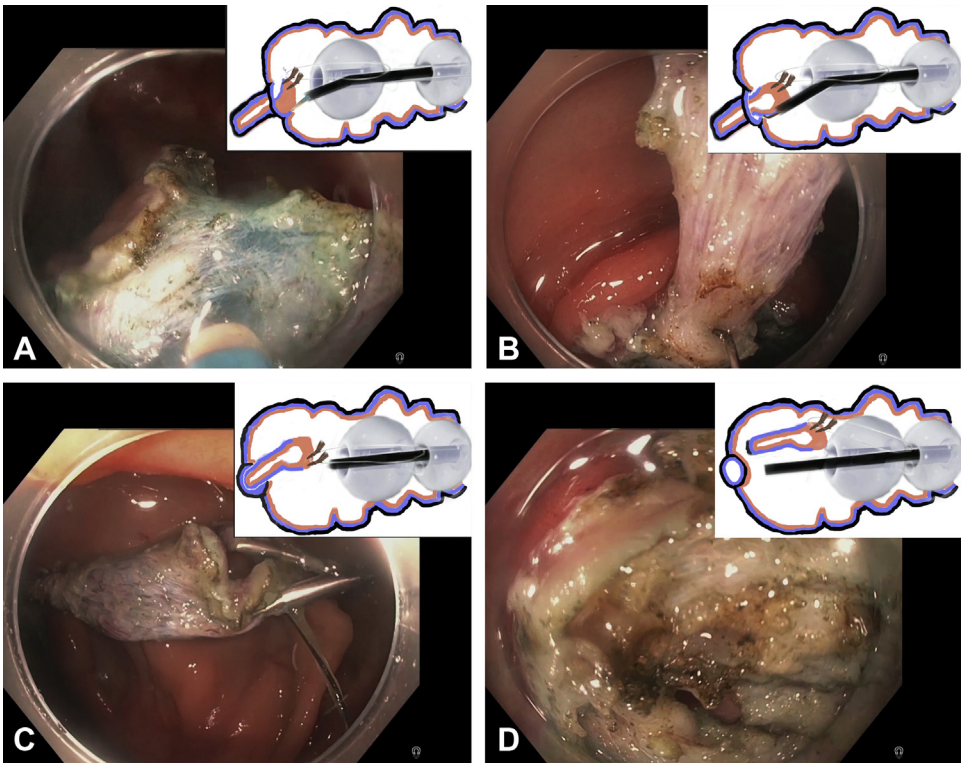

Figure 4. The lesion is carefully dissected from surrounding tissues. In the accompanying diagrams, the mucosal layer is *orange*, submucosal layer is *blue*, and serosal layer is *black*. **A,** Endoscopic submucosal dissection is started with Dual Knife. **B,** The dissection continued with HookKnife (Olympus America, Center Valley, Pa, USA). **C,** The entire appendix is pulled into the cecum and dissected from surrounding tissues. **D,** Full-thickness defect in cecal wall after dissection is completed and the appendix is separated from the cecum.

org). Endoscopic ultrasound confirmed the presence of a hypoechoic rounded submucosal lesion. After injection of Hydroxyethyl starch (HESPAN, Braun Medical Inc, Bethlehem, Pa, USA) with methylene blue (1:20,000 mL), a circumferential incision (Fig. 2, Video 1) was made by using DualKnife (Olympus America). The fore-balloon was deployed and the cecal mass was attached to the fore-balloon's suture-loop (Fig. 3, Video 1) by using 2 clips (Resolution, Boston Scientific, Natick, Mass, USA).

Figure 5. The entire appendix is resected and removed en bloc.

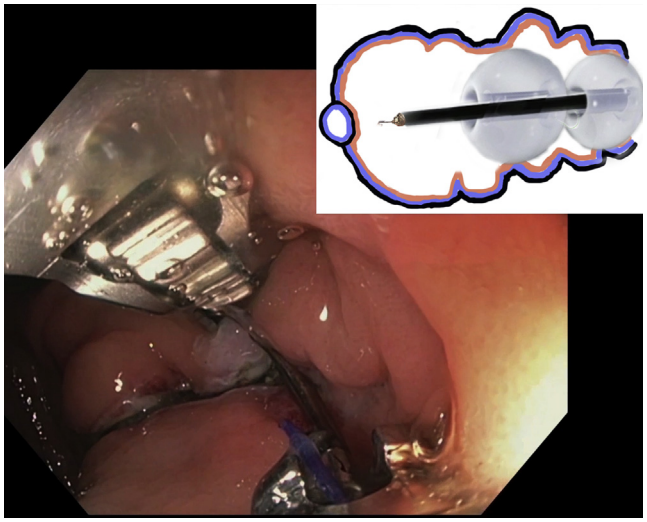

Figure 6. Overstitch endoscopic suturing device (Apollo Endosurgery, Austin, Tex, USA) is delivered to the cecum through the double-balloon endoluminal interventional platform. In the accompanying diagram, the mucosal layer is *orange*, submucosal layer is *blue*, and serosal layer is *black*.

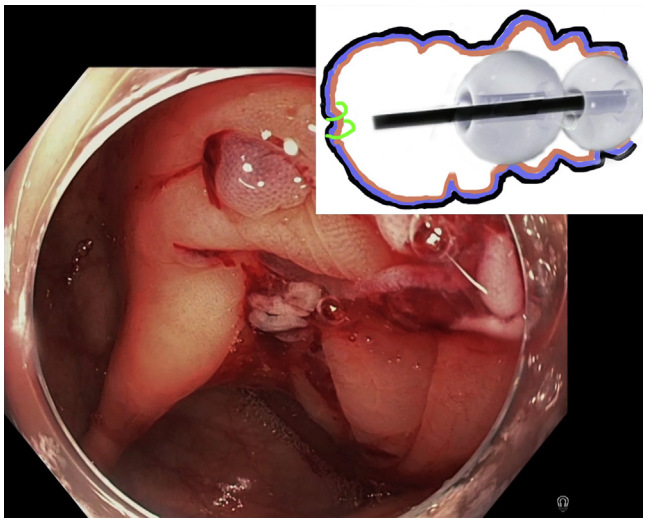

Figure 7. Full-thickness defect post appendectomy is completely closed with 2 continuous sutures. In the accompanying diagram, the mucosal layer is *orange*, submucosal layer is *blue*, and serosal layer is *black*.

The lesion was pulled into cecum and dissected (Fig. 4, Video 1) by using DualKnife and HookKnife (Olympus America). During dissection, we realized that the lesion was located in the appendix. Dynamic multidirectional retraction with DiLumen allowed pulling the entire appendix from the peritoneal cavity into the colonic lumen (Fig. 5, Video 1). The appendix was resected en bloc and removed through DiLumen. Then, Overstitch (Apollo Endosurgery, Austin, Tex, USA) was delivered through DiLumen (Fig. 6, Video 1) to close the defect in the colonic wall after removal of the appendix (Fig. 7, Video 1) with 2 continuous sutures. The total procedure time was 1 hour and 41 minutes.

The patient did not have any pain and went home post-appendectomy on oral antibiotics. The next morning, she restarted work and regular physical activity. The final pathology diagnosis was consistent with appendicular intussusception.

In conclusion, purely endoscopic appendectomy with the DiLumen platform does not require laparoscopic assistance and advancement of the endoscope into the peritoneal cavity. It eradicates abdominal wall incisions and punctures; decreases the risk of postoperative adverse events; eliminates pain, the need for hospital admission, and restrictions of physical activity; allows early resumption of work; and can become an alternative to laparoscopic, surgical, and natural orifice transluminal endoscopic surgery appendectomy.

DISCLOSURE

Dr Kantsevoy is a cofounder of Endocages; has equity in Endocages, LumenDi, Vizballoons, and Slater Endoscopy; is a consultant for Endocages, LumenDi, Medtronic, Olympus, Vizballoons, and Slater Endoscopy; and is on the advisory board for LumenDi. All other authors disclosed no financial relationships.

Abbreviation: DBEIP, double-balloon endoluminal interventional platform.

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Part of this case was presented during the American College of Gastroenterology 2020 Video Forum.

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