

A new instrument for endoscopic submucosal dissection (with videos)

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Background: Although it is effective for treatment of early neoplasms, endoscopic submucosal dissection (ESD) can be technically demanding and time consuming. Furthermore, use of multiple instruments is often mandatory for performing various steps associated with the procedure.

Objective: To design, create, and evaluate a new instrument for ESD.

Design: Feasibility study by using an acute porcine model.

Setting: Center for preclinical research, university hospital.

Subjects: This study involved 6 female pigs.

Intervention: Gastric ESDs including circumferential incision and coagulation of bleeding vessels were performed by using a single device. Incision was done with the prototype instrument in a closed position by using cutting current. Submucosal dissection was performed by using an approach with 4 steps: (1) open forceps, (2) grasp submucosal fibers, (3) elevate and retract tip to avoid contact with muscle layer, (4) dissect fibers by using cutting current. Bleeding was terminated with the same instrument by grasping vessels and applying coagulation current.

Main Outcome Measurements: Overall feasibility and performance, time needed to achieve complete resection.

Results: The new instrument was useful for performing all single steps needed. Mean (\pm standard deviation [SD]) time needed for the whole procedure was 48.5 ± 9.9 minutes. Mean (\pm SD) time needed for incision and dissection was 37.8 ± 8.8 minutes.

Limitations: Animal study, limited number.

Conclusion: The new instrument has potential advantages in comparison with standard instruments used for ESD. Incision, dissection, and coagulation of vessels can be performed with a single instrument, and the technique of lifting submucosal fibers during dissection potentially decreases the risk of perforation. Comparison studies with larger gastric lesions treated with standard ESD techniques are needed.

Endoscopic submucosal dissection (ESD) is a common procedure for endoscopic therapy of early neoplasia if certain criteria are fulfilled.^{1,2} However, in Western countries, experience with this method is still limited³ because

Abbreviation: ESD, endoscopic submucosal dissection.

DISCLOSURE: The device was designed by the authors and built by KarlStorz (Tuttlingen, Germany). There is no financial association between any of the authors and KarlStorz. Parts of the research project have been granted to Dr. Meining by the German Research Association (DFG Forschergruppe FOR1321). A. Meining and T. Lüth received material support from KarlStorz. No other financial relationships relevant to this publication were disclosed.



This video can be viewed directly from the GIE website or by using the QR code and your mobile device. Download a free QR code scanner by searching “QR Scanner” in your mobile device’s app store.

the procedure is technically demanding, takes a long time, and is associated with a considerable incidence of bleeding and perforation, even in expert hands.^{4,5} Several new auxiliary tools have been developed⁶ to overcome these

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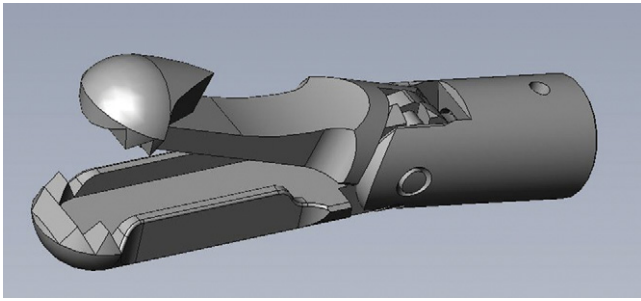


Figure 1. Schematic drawing of the Endo-Dissector.

shortcomings. In line with that, the present study was designed to evaluate the feasibility of a new resection tool aimed to make ESD easier, potentially faster, and thereby more amenable to endoscopists.

METHODS

Study subjects

The endoscopic instrument was evaluated in 6 female land-race pigs. The animals received regular feeding until 48 hours before the procedure. Subsequently, they had a liquid diet until 12 hours before endoscopy. The procedure was done with the animals under deep general anesthesia with endotracheal intubation and controlled ventilation. After completion of endoscopy, the animals were euthanized with a lethal dose of pentobarbitone. The experimental protocol was approved by the regional governmental commission for animal protection (Regierung von Oberbayern).

Materials

The Endo-Dissector is a prototype instrument designed and constructed to perform submucosal dissection. The device was designed by the authors and built by KarlStorz Company (Tuttingen, Germany). The instrument (Fig. 1) is based on standard forceps for flexible endoscopy with the following dimensions: total maximal diameter, 2.3 mm (7F); diameter at tip of instrument, 2.2 mm; minimum diameter (waist of forceps), 1.7 mm.

The tip of the instrument is thicker. Furthermore, there is a hook-like protrusion on the outer side of one cup. Both features were designed to enable circumferential incision of the mucosa. The inner sides at the tip of the instrument are partly saw-toothed. The saw-toothed design was chosen for better grasping of submucosal fibers or small vessels. The device can be rotated similar to any conventional biopsy forceps. Furthermore, because size and diameter are similar to conventional biopsy forceps, it can be used with the endoscope in a retroflex position.

A conventional gastroscope (Karl Storz, Tuttingen, Germany) with a 4-mm distance cap was used for the

Take-home Message

- Endoscopic submucosal dissection (ESD) is technically demanding, so a new device was designed and evaluated to ease ESD.
- When we used the Endo-Dissector, all steps necessary to perform ESD were successfully achieved with a single instrument in a relatively short time.

procedure. For dissection, Gastro-Cut of the AUTOCON II 200 HF-generator (KarlStorz) was used (cutting current 120 W, effect 3, coagulation current 50 W, effect 2).

Procedure

ESDs were performed in the pigs' stomachs, preferably located in the posterior wall of the corpus. Only a single resection was performed per animal. All procedures were performed by a single endoscopist (A.M.) who has sufficient experience in ESD, having performed more than 100 procedures with standard instruments. With the exclusion of two experiments in an ex vivo pig stomach, the device had not been used before initiation of the study. Before resection, areas of 15 to 30 mm in size were marked with the tip of the Endo-Dissector. A submucosal cushion was created by injection of sterile saline solution stained with a few drops of indigo blue (total amount of solution, 20–40 mL). Thereafter, a mucosal incision (about 2/3 of the circumference) was made with the instrument's forceps closed or only slightly opened. For incision, the outer hook on one jaw was used to lift the mucosa. Thereafter, submucosal dissection was performed as follows: (1) opening of forceps, (2) grasping submucosal fibers by closing the forceps, (3) lifting the instrument's tip to avoid contact with the muscle layer, (4) applying cutting current with slight retraction of instrument.

Thereby, complete submucosal dissection was performed and the remaining mucosal bridges were cut (Video 1 and Fig. 2). If oozing or spurting arterial bleeding occurred, the forceps were used to grasp the vessel, and coagulation current was applied to terminate bleeding (Video 2 and Fig. 3).

RESULTS

By using the approach as stated, all experiments were successfully performed, with areas resected in toto (single specimen with no visible marks on the remaining mucosa). Detailed inspection of the resection site did not reveal any signs of perforation, and air tightness was observed in all cases. One severe oozing bleeding and one spurting/arterial bleeding incident occurred during the procedure. In both cases, bleeding could be successfully terminated by grasping the vessel and applying coagulation current. No additional instruments were used apart

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