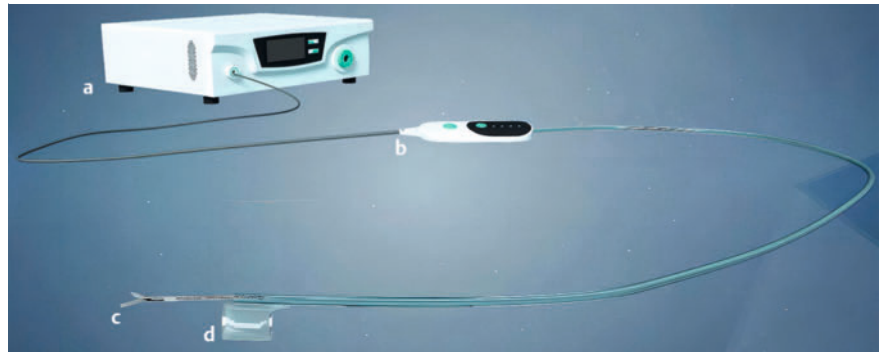


## Endoscopic submucosal dissection-assistance robot: a miniature surgical manipulator for endoscopic submucosal dissection

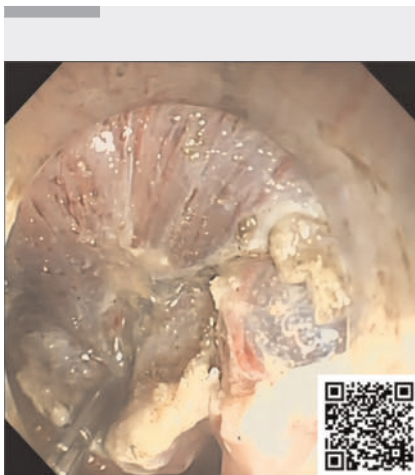
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One-handed operation and gravity-induced blind dissection are technical difficulties in endoscopic submucosal dissection (ESD) procedures [1]. In order to reduce the difficulty of the procedure and minimize the risk of perforation and bleeding, we have developed a microsurgical manipulator, the ESD-assistance robot, which provides a “second hand” with auxiliary traction, clamping, and fixation functions during procedures.

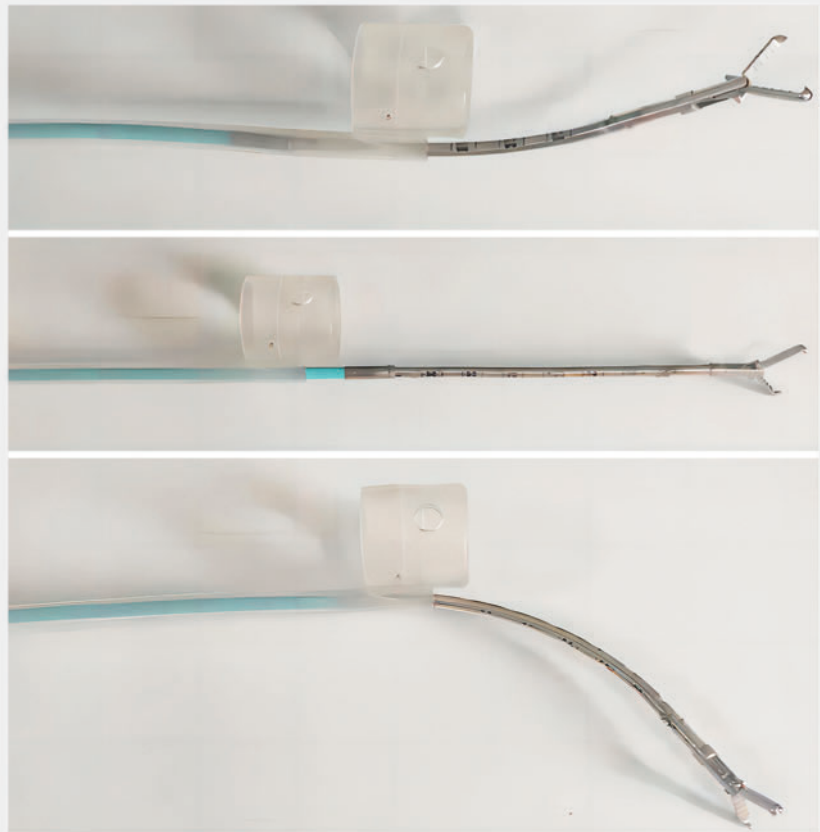
The ESD-assistance robot is composed of four main components: an end cap sheath tube, manipulator, servo driver, and command controller (► **Fig. 1**). When in use, the end cap sheath tube is fitted at the front end of the endoscope, and the endoscope is extended to extend the sheath tube. When performing dissection, the micromanipulator is voice controlled to move in forward/backward and clockwise/counterclockwise rotational directions, to bend forward/backward, and to open/close the mouth of the clamp (► **Fig. 2**); auxiliary traction is



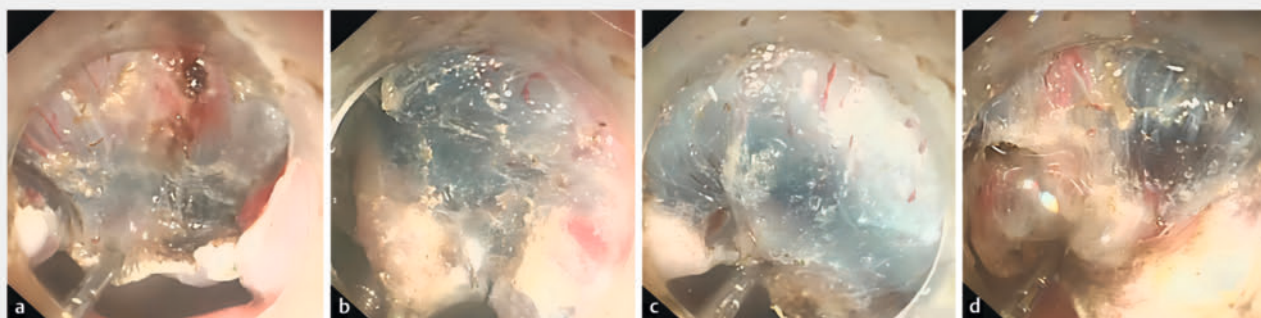
► **Fig. 1** Endoscopic submucosal dissection-assistance robot consists of: **a** a command controller; **b** a servo driver; **c** a manipulator; **d** an end cap sheath tube.



► **Video 1** Application of the endoscopic submucosal dissection (ESD)-assistance robot in gastric ESD.



► **Fig. 2** Photographs illustrating the movements of the manipulator.



► **Fig. 3** Endoscopic views of the endoscopic submucosal dissection (ESD)-assistance robot being used to assist with the application of traction, and with clamping and fixation.

applied to the pathologic tissue, maintaining the surgical field of view, thereby improving the dissection speed and reducing the difficulty of the procedure. A 60-year-old man was admitted to hospital with gastric cardia mucosal lesions and underwent diagnostic excision by ESD. During the procedure, traction from the ESD-assistance robot was used to obtain a clear submucosal field of vision, and to facilitate dissection, hemostasis, and submucosal injection (► **Fig. 3**), which together improved surgical efficiency (► **Video 1**).

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### Conflict of Interest

The authors declare that they have no conflict of interest.

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