Article published online: 2023-03-23

Newly developed endoscopic retrieval device: funnel-shaped overtube formed by air inflation-deflation

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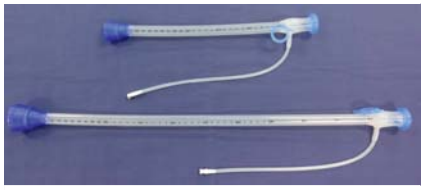
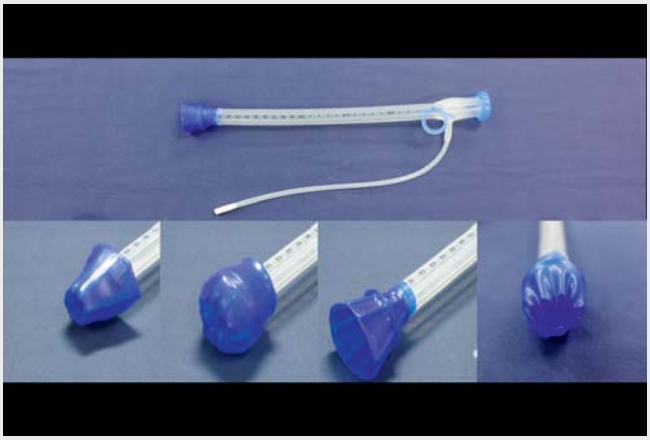


▶ **Fig. 1** Silicone overtubes in two sizes (60 cm and 35 cm) with conical wrapping balloons attached to their leading edges.

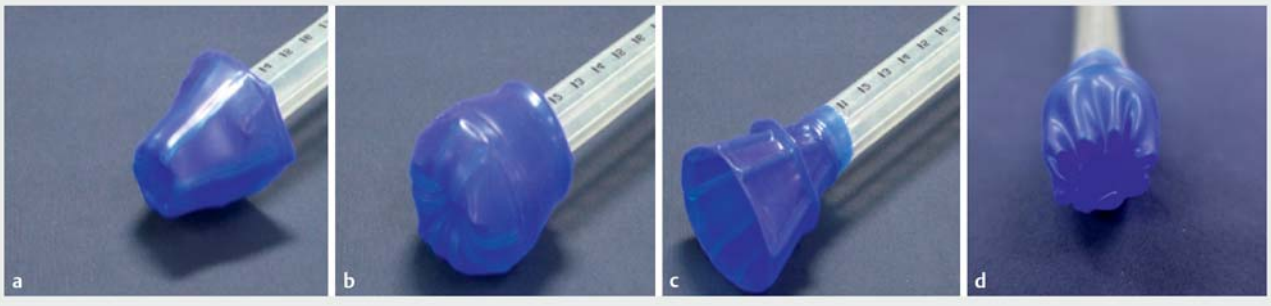


Video 1 We described animal experiments in which the developed device was used successfully for retrieving a 4-cm press-through package sheet placed in the esophagus and a handmade 30-mm submucosal tumor model placed in the stomach.

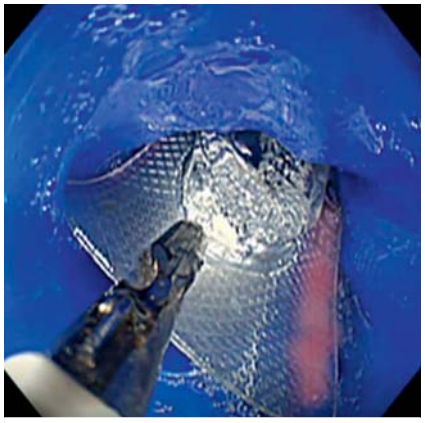
Techniques for endoscopic retrieval require further development. Traditional measures using nets, grasping forceps, and overtubes [1] are sometimes inadequate for retrieval of large, endoscopically resected specimens or sharp foreign bodies with a potential risk of perforation. Although new alternatives include plastic [2], laparoscopic [3], and commercially available bags [4], reliable retrieval of solid gastrointestinal mesenchymal tumors (GIMTs) during endoscopic full-thickness resection is still being investigated. Based on our previously published concept [5], we have developed a novel retrieval device, a funnel-shaped overtube formed by air inflation–deflation (Fuji Systems, Tokyo, Japan). We here report a successful animal experiment in which the device achieved retrieval of press-through package (PTP) sheets and simulated gastric GIMTs (▶ **Video 1**).

First, a conical wrapping balloon was attached to the leading edge of a silicone overtube (▶ **Fig. 1**). Next, the balloon was inflated with air and pushed forward, after which it was deflated to form a funnel shape, creating a space for retrieval of the relevant object. After the object had been wrapped up, the tip was closed by pulling a thread mounted on the overtube, thus encasing the object to enable retrieval via the mouth or anus, as relevant (▶ **Fig. 2**). A 30-cm device for the esophagus and rectum and a 60-cm device for the stomach have been developed.

In vivo experiments were conducted on three dogs. A 4-cm PTP sheet was placed in the esophagus and a hand-



▶ **Fig. 2** **a, b** The balloon is inflated with air and pushed forward. **c** The balloon is deflated to form a funnel shape, creating a space for retrieving the relevant object. **d** The tip is closed by pulling the thread mounted on the overtube to wrap up the objects, thus encasing it to retrieve it via the mouth.



▶ **Fig. 3** A 4-cm press-through package sheet is placed in the esophagus and pulled into the balloon using grasping forceps.

made 30-mm submucosal tumor model in the stomach. Using the retrieval device described above, the object was pulled into the balloon using grasping forceps and successfully extracted from the body without complications (▶ **Fig. 3**, ▶ **Fig. 4**). This prototype of a device that we aim to make available commercially may be useful for retrieval of solid gastric tumors or foreign bodies.

Endoscopy_UCTN_Code_TTT_1AO_2AL

Acknowledgments

We thank Akihiro Asai, Kazuaki Sato, Hidekazu Nakamura and Fumikazu Watanabe from Fuji Systems Co., Ltd. for their contribution to device mechanism design.
We thank Dr Trish Reynolds, MBBS, FRACP, from Edanz (https://jp.edanz.com/ac) for editing a draft of this manuscript.

Competing interests

The authors declare that they have no conflict of interest.

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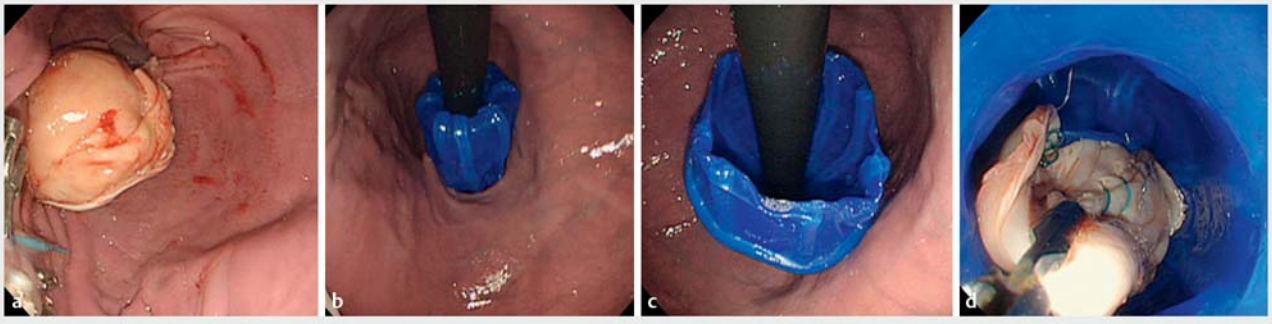

▶ **Fig. 4** **a** A handmade 30-mm submucosal tumor model is placed in the stomach. **b** The overtube is guided into the stomach via the endoscope. **c** The balloon is inflated and then deflated to form a funnel shape, creating a space to retrieve the relevant object. **d** The object is pulled into the balloon using grasping forceps.

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Endoscopy 2023; 55: E563–E565
DOI 10.1055/a-2040-3979
ISSN 0013-726X

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