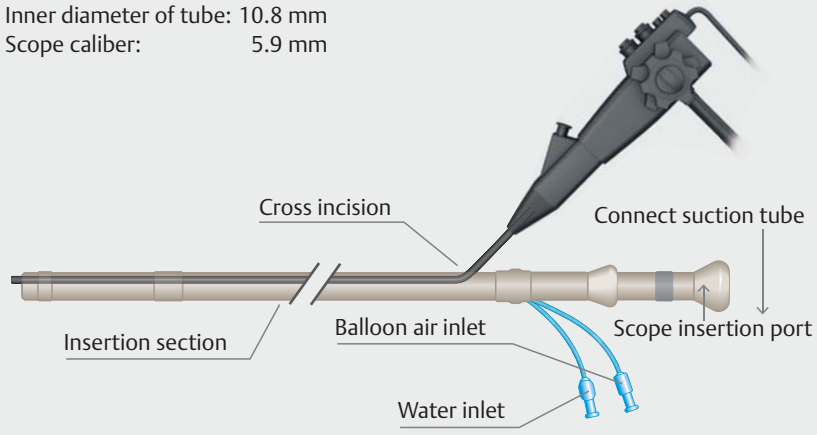
Novel method using small-caliber endoscope and balloon overtube for removing gastrointestinal residue

▶ **Fig. 1** The suction equipment used for this procedure, which includes a nasal endoscope and overtube.



▶ **Fig. 2** Detailed schematic of the equipment, including the suction channel with a 4.9-mm maximum diameter. The endoscope was inserted through the 10 × 10-mm cross-shaped incision at the base of the overtube.

The presence of gastrointestinal blood clots and food residue often makes emergent endoscopic procedures difficult [1, 2]. Removal procedures are conventionally performed using grasping forceps, but these techniques require long procedure times and leave behind large amounts of residue. Although a tube-assisted suction method has been recently reported [3], the ability to pass through a narrow space and the adequacy of suction with side-scope navigation seem limited due to poor followability. For this reason, we developed a novel method of gastrointestinal residue removal using existing instruments.

We conducted an experimental study on two beagle dogs with food jelly filling the upper and middle stomach (▶ **Video 1**). The equipment used consisted of a balloon overtube (TS-12140; Fujifilm, Tokyo, Japan) and a small-caliber endoscope (EG-L580NM7; Fujifilm) (▶ **Fig. 1**). First, a 10 × 10-mm cross-shaped incision was made at the base of the overtube (▶ **Fig. 2**), and the endoscope was fixed 2 mm from the distal tip of the overtube through the incision hole and connected at four points using silk thread (▶ **Fig. 3**). The maximum diameter of the suction channel was 4.9 mm, which is larger than the 3.2-mm forceps channel in a conventional endoscope. Next, the overtube was inserted into the stomach under visual observation via the endoscope. With this configuration, large amounts of residue were effectively aspirated through the channel (▶ **Fig. 4**). Suctioning the superficial mucosa, which is unavoidable unless preventive measures are taken, interrupts the smooth suctioning procedure. We therefore found it useful to push the mucosa using a biopsy forceps to maintain a clear view throughout the procedure (▶ **Fig. 5**). This procedure was successful in creating a clear operation field without any complications in both animals. The procedure time was 6 min on average.

This experiment demonstrates that this novel method may be efficient for removing upper gastrointestinal residue.

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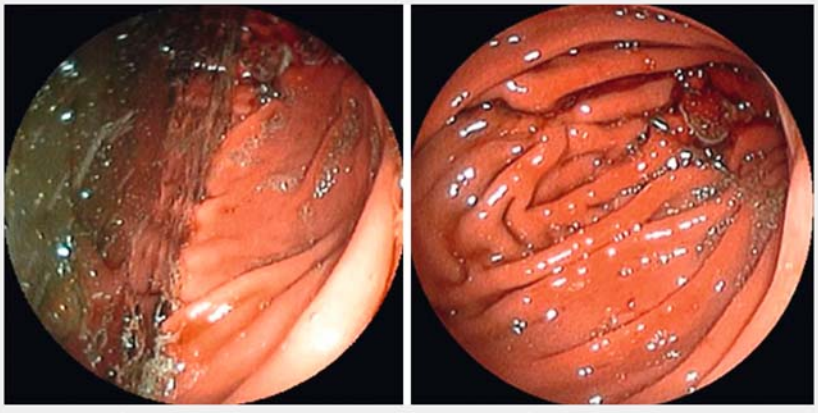
▶ **Fig. 3** The endoscope was fixed 2 mm from the distal tip of the overtube and connected to the overtube at four points using silk thread.

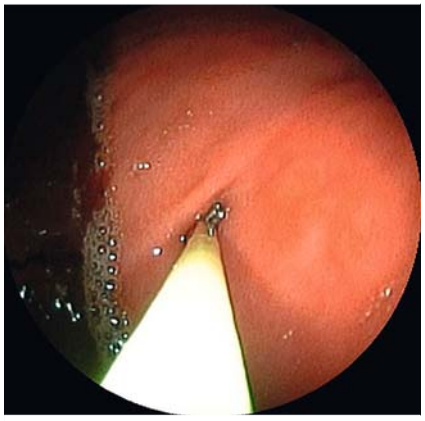
Competing interests

The authors declare that they have no conflict of interest.

Video 1 Suction equipment and procedure for the proposed novel, rapid, and safe method of removing upper gastrointestinal residue.



▶ **Fig. 4** Endoscopic images showing the operation field before and after the suction method was applied: **a** before, **b** after.



▶ **Fig. 5** Pushing the mucosa using a biopsy forceps was useful to maintain a continuously clear view.

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