Introduction: Upper gastrointestinal (GI) tract biopsies are acquired during esophagogastroduodenoscopy (EGD) normally done using conscious sedation. Sedation makes EGD relatively expensive and inconvenient and presents additional challenges for infants, young children, and pregnant women. These issues have motivated the exploration of obtaining upper GI biopsies through an unsedated, transnasal approach. Because transnasal endoscopes are inherently thin, biopsies acquired through their limited-diameter instrument channels are small and sometimes inadequate. Here, we describe an image-guided, small-diameter cryobiopsy probe for obtaining biopsies that has the potential to improve the size of unsedated transnasal endoscopy (uTNE) biopsies or be used standalone through a nasogastric/nasojejunal tube.

Material and Methods: The cryobiopsy device consists of a dual-lumen 1.2-mm-diameter tube terminating in metal tip, through which Freon is injected. The device also comprises an optical fiber that enables the acquisition of non-scanning (M-mode) optical coherence tomography (OCT) images used to determine when the metal tip is in contact with the tissue. To demonstrate the capability of the cryoprobe to acquire upper GI tract biopsies, it was deployed endoscopically and used to take biopsies from the stomach and duodenum of patients undergoing EGD. Standard forceps biopsies (Boston Scientific; 2.4 mm) were taken from adjacent sites for comparison (MGH IRB 2018-P000734).

Results: 8 adults (mean age: 64, male: 6, female: 2) were enrolled. Stomach biopsies were obtained from 3 subjects and duodenal biopsies from 4 subjects. There was one failed cryobiopsy attempt from inadvertent irrigation of the cryobiopsy device during capture. Figures 1A and 1B show the cryobiopsy tool through the endoscope’s working channel and corresponding OCT images without and with probe-mucosa contact, respectively. Forceps biopsies were obtained from 3/8 subjects. An H&E histology comparison for cryobiopsy vs. standard biopsy is shown in Figures 1C and 1D, respectively. Morphometric analysis of the histology revealed that cryobiopsy and standard forceps biopsy sizes were similar (5.4 mm ± 1.0 mm (stdev) width, 0.54 mm ± 0.03 mm depth for cryobiopsies; 5.7 mm ± 1.8 mm width, 0.56 mm ± 0.12 mm depth for standard forceps. H&E histology quality was not visibly altered by freezing.

Conclusion: Early results using the 1.2-mm-diameter cryobiopsy probe show that biopsy size and histological quality is similar to that of the larger, 2.4-mm-diameter biopsy forceps. Given its diminutive diameter, these findings indicate that cryobiopsy may be superior for obtaining uTNE biopsies. In addition, owing to its incorporation of image guidance that determines probe-tissue contact, the cryobiopsy device has the potential to be used through standard NG/NJ tubes without necessitating sedated endoscopy.
Fig. 1 (A, left) is an endoscopic image of the duodenum from a patient showing the cryobiopsy device not in contact with the duodenal wall and (A, right) shows the corresponding M-mode OCT image. (B, left) is an endoscopic image showing the cryobiopsy device tip in contact with the duodenal wall and (B, right) is the corresponding M-mode OCT image confirming contact as indicated by the increase in the signal intensity illustrated by the red arrow. (C) shows an H&E histology slide of a biopsy sample obtained from the patient’s duodenum with the cryobiopsy device. (D) shows the H&E histology slide of the corresponding standard forceps biopsy device (Boston Scientific Radial Jaw™ 4, 2.4 mm Jaw O. D), taken adjacent to the biopsy shown in (C).

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