ORIGINAL ARTICLE

Use of inducible and limiting fluorescence in laparoscopic endoscopic cooperative surgery

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INTRODUCTION

Laparoscopic endoscopic cooperative surgery (LECS) is a surgical procedure conducted using both inside and outside approaches, which significantly reduces the extent of resection.[1,2] However, minimal deviations on both sides decrease LECS accuracy. Typically, using endoscopic forceps, the lesion or resection site is compressed and projected to the laparoscopic side. Although the compressed area is elevated, identifying it as a point is difficult. The special use of a fluorescent clip (ZEOCLIP FS; Zeon Medical Co, Ltd, Tokyo, Japan) is therefore suggested.[3,4] In 2019, this clip was manufactured and approved for clinical use in Japan. Originally, its use involves placing the clip in the first 1 to 2 days prior to laparoscopic surgery; thereafter, laparoscopic observation is performed under near-infrared light.[4] One of the disadvantages of this clip is that it could be dislodged before surgery, or it could be rendered invisible when it is located behind a fat tissue outside the GI tract. Herein, we propose a special and simple method that allows a detailed observation of the indicated position on the laparoscopic side while moving the clip into the GI tract during the LECS, using only 1 clip.

METHODS

The tip of the clip is equipped with a 5-mm-long resin containing indocyanine green. Under near-infrared irradiation, the tip emits a green light. When the entire clip is pushed out of the forceps, it emits a wide range of light, rendering it suitable for rough positioning (full version) (Fig. 1). When the tip of the clip protrudes 1 to 2 mm from the forceps, it glows as a dot, allowing the target position to be identified in any direction (tip version) (Fig. 2). The strategy is to touch the clip lightly without applying pressure to the wall.

Abbreviations: LECS, laparoscopic endoscopic cooperative surgery; NET, neuroendocrine tumor.

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CASE PRESENTATION

This is a case of a 39-year-old man with a 6-mm-diameter submucosal tumor in the duodenal bulb (Fig. 3). A diagnosis of a neuroendocrine tumor (NET) was established via biopsy. On EUS, invasion of the muscular layer was suspected; thus, localized whole-layer resection was performed via LECS. After port insertion, including the laparoscopic camera, an upper endoscope (GIF-H290T; Olympus Medical Systems, Tokyo, Japan) was inserted. In the full version, the tumor location was roughly confirmed from the anterior wall of the duodenal bulb to the superior wall using an infrared camera from the laparoscopic side (Fig. 4). After trimming of the surrounding fat, the tip version was used to assess the tumor boundaries as a point (Fig. 5). Support sutures were then laparoscopically placed in 4 locations outside the tumor in all layers. A full-thickness incision was made around the tumor using an IT2 knife (Olympus Medical Systems) through perforation with a needle-knife from the endoscopic side (Fig. 6). The resection site was sutured laparoscopically in all layers. Then, the sutured site was endoscopically confirmed to be free of stricture and bleeding. The final pathologic finding was as follows: a 20- × 19-mm excised specimen (Fig. 7) with an 8- × 3-mm tumor, with submucosal invasion and negative margins and without lymphovascular invasion (Fig. 8). The tumor cells were arranged in a rosette pattern, positive for chromogranin A and synaptophysin, 0/10 mitosis in the high-power field, and a Ki-67 index of 2.8%. Based on these findings, a diagnosis of NET G1 was established. The total surgery duration was 149 minutes.

DISCUSSION

By combining information obtained from the endoscopic observation with that of conventional laparoscopic observation,

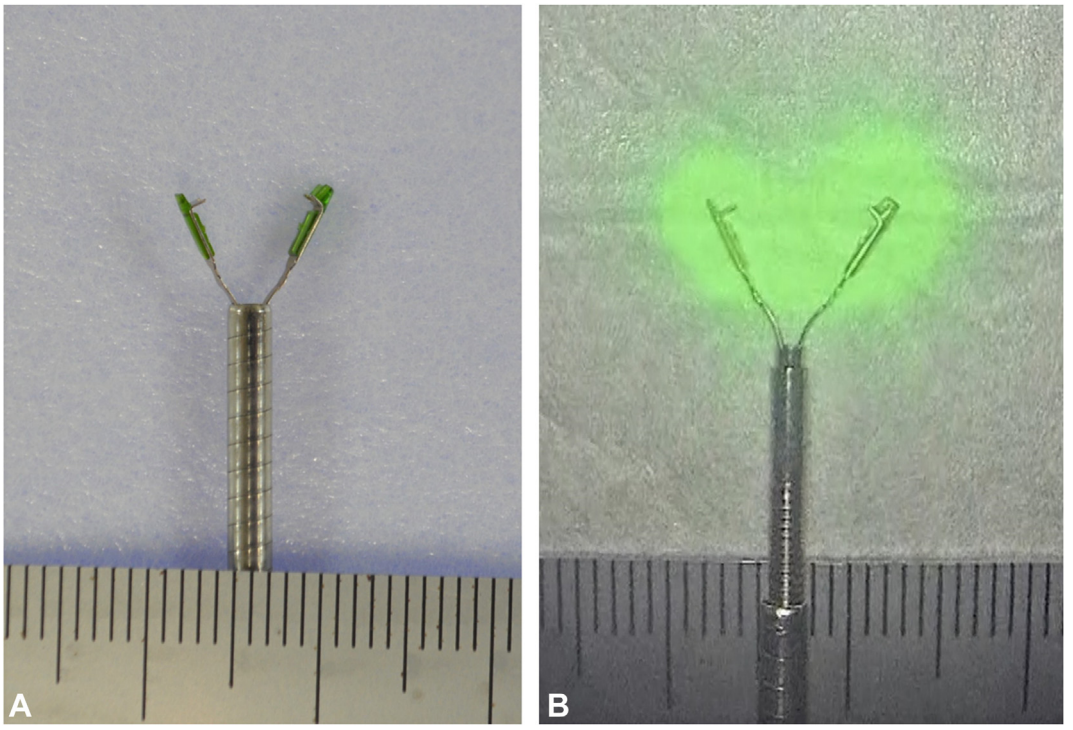

Figure 1. A, The fluorescent clip (ZEOCLIP FS; Zeon Medical Co, Ltd, Tokyo, Japan) in the open position. **B,** The fluorescent clip in the open position under near-infrared irradiation (full version).

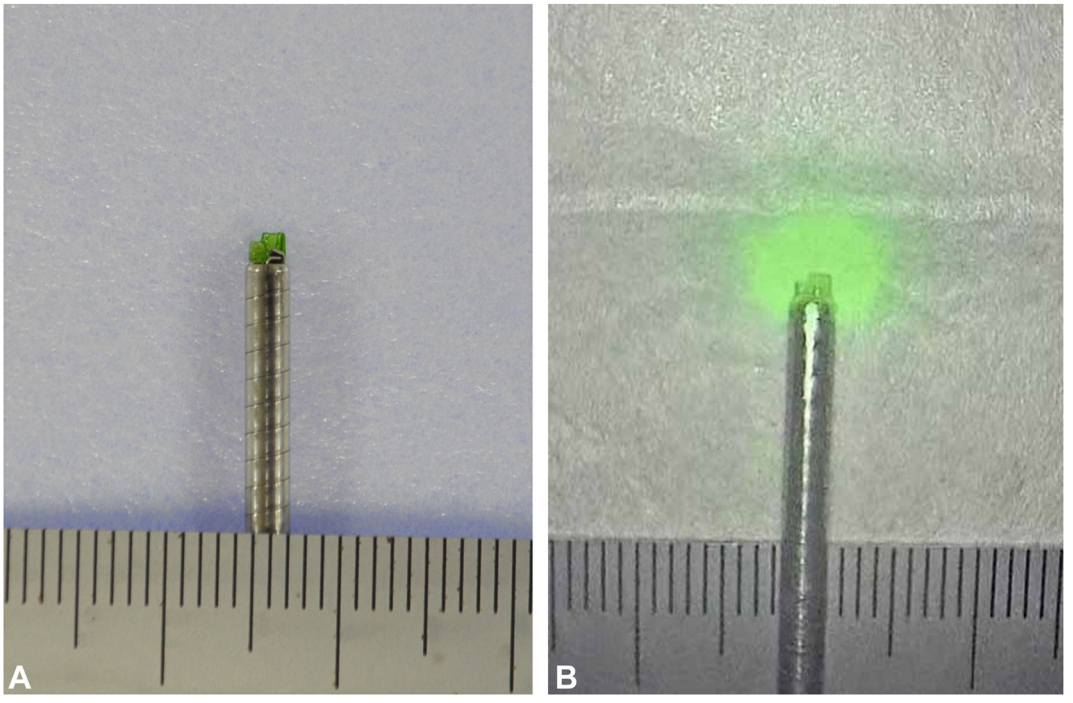

Figure 2. A, The fluorescent clip in the closed position. **B,** The fluorescent clip in the closed position under near-infrared irradiation (tip version).

LECS can limit the resection site of the intestines. However, the method used for projecting the detailed positional information obtained from the endoscopic observation to the laparoscopic side is conventionally performed via compression. The position can be limited relatively easily if the forceps can be compressed perpendicularly. Conversely, in cases in which the forceps can

Figure 3. A 6-mm neuroendocrine tumor was confirmed at the duodenal bulb.

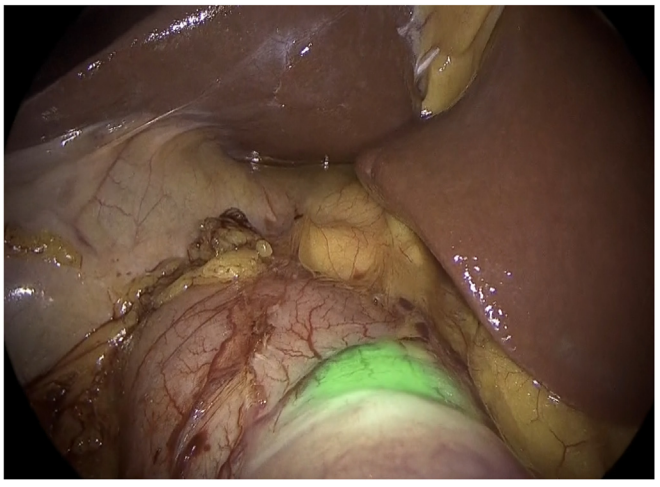

Figure 4. In the full version, the tumor location was confirmed from the anterior wall of the duodenal bulb to the superior wall.

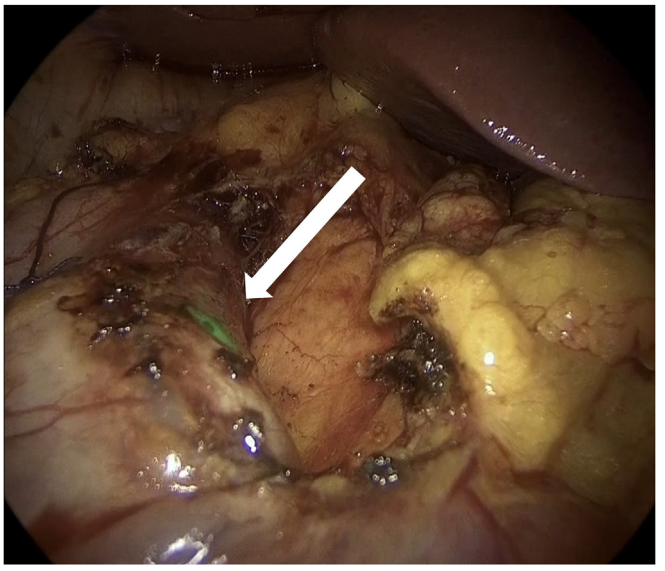

Figure 5. In the tip version, the tumor border can be observed as a dot (*white arrow*).

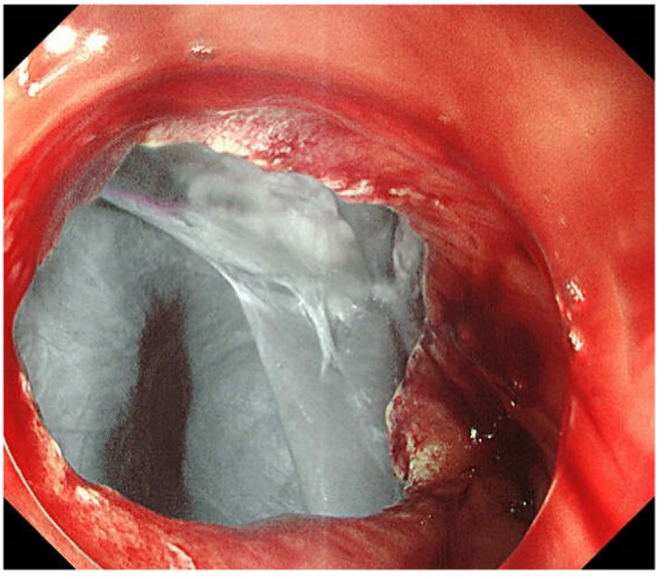

Figure 6. A full-thickness incision was performed after placing 4 sutures around the tumor.

only be pressed laterally or in cases with a thickened wall, the positional information is difficult to obtain. In the method we developed, the approximate target position can be confirmed in the full version, and a limitation of 2 to 3 mm can be used in the tip version by adjusting the length of protrusion of the fluorescent clip when it is attached to the endoscopic forceps. Additionally, the protruding length of the resin part is 1 to 2 mm in all directions; thus, the direction of the forceps has no restrictions.

The use of LECS may not be necessary for resection. For example, EMR, endoscopic submucosal dissection, the "band-and-leave" technique, and endoscopic resection using an over-the-scope clip may be appropriate. Unexpected

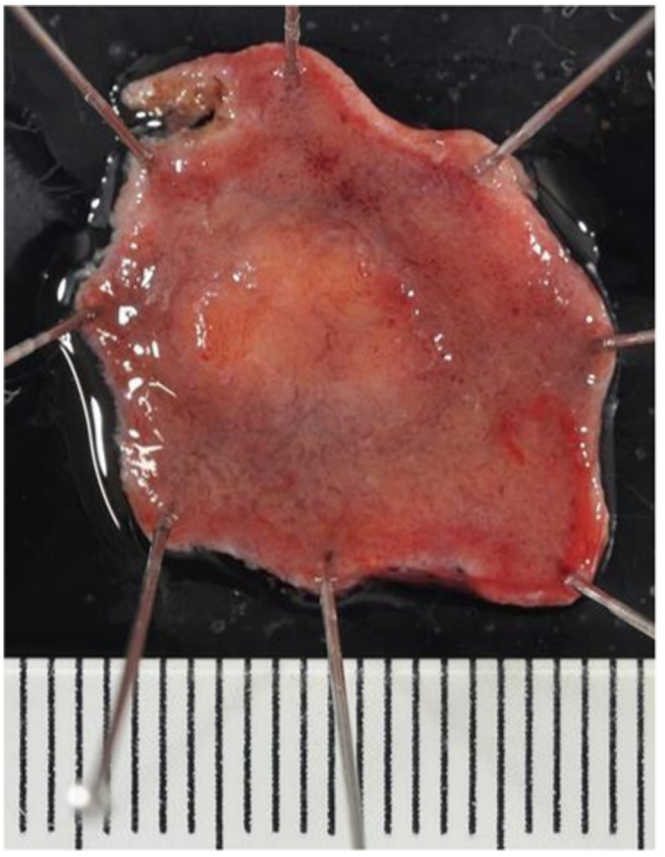

Figure 7. The tumor was placed in the center of the 20- × 19-mm specimen.

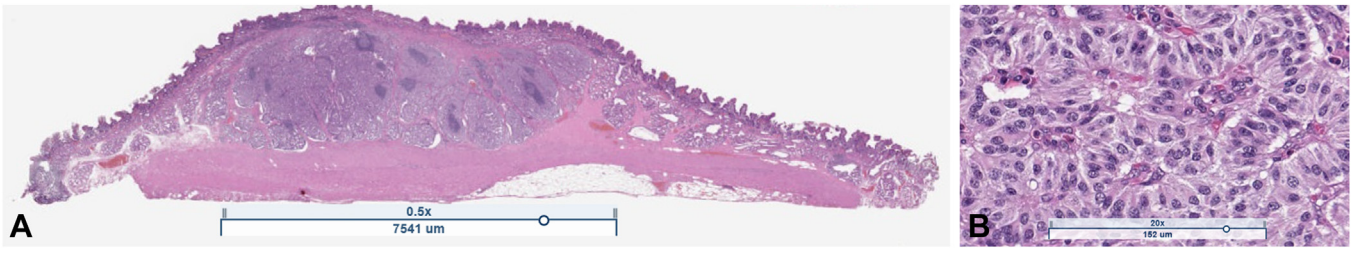

Figure 8. A, Histopathologic findings revealed that the tumor measuring 8 × 3 mm was located in the submucosa with a lateral margin of 3 to 6 mm with no lymphovascular invasion (H&E, orig. mag. ×10). **B,** The tumor cells were arranged in a rosette pattern (H&E, orig. mag. ×400).

perforation could not be completely avoided by these endoscopic techniques alone, and a margin-free full-thickness resection cannot be ensured in tumors such as the present case, in which invasion into the muscle layer is suspected. For these reasons, LECS was selected.

CONCLUSION

Near-infrared optical observation through the adjustment of the protruding length of the fluorescent clip resin section from the forceps can easily allow confirmation of the intraluminal tumor position from a rough to a precise location on the laparoscopic side (Video 1, available online at www.videogie.org).

DISCLOSURE

The authors did not disclose any financial relationships.

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