



Case report

Near-infrared fluorescence clip guided robot-assisted wedge resection of a gastric submucosal tumour: A case report

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ABSTRACT

Background: The conventional near-infrared fluorescence clip (NIRFC): ZEOCLIP FS®, was difficult to observe using the Firefly on da Vinci. We improved the ZEOCLIP FS® and produced the da Vinci compatible NIRFC. In this report, we describe a robot-assisted wedge resection of a submucosal tumour (SMT) of the stomach using the da Vinci compatible NIRFC.

Presentation of case: Surgery was performed for an enlarging SMT (from 18 to 22 mm with an intragastric growth type). Through endoscopy, four da Vinci-compatible NIRFCs were placed at the tumour edge two days prior to the surgery. The location of the NIRFC was confirmed when observed with the Firefly. The distal NIRFC site was incised with a monopolar shear blade to identify the NIRFCs and tumour base. The open area was sutured in two layers using a 3-0 V-Loc. The operation time was 83 min, and the amount of blood loss was 2 g. There were no complications or clip dropout.

Discussion: This method could be performed without intraoperative endoscopist.

Conclusion: In this case, we were able to observe the position of the da Vinci-compatible NIRFC with Firefly on da Vinci. This technique may be an option as a simple procedure to minimize the resection area of the stomach.

1. Introduction

We have been involved in the development of near-infrared fluorescent clip (NIRFC): ZEOCLIP FS® (Zeon Medical, Tokyo, Japan) for intraoperative recognition of the location of gastrointestinal tumors. The NIRFC is effective in laparoscopic surgery [1,2]. However, this clip is difficult to observe with the da Vinci® Firefly (Fig. 1). One of the reasons for this difficulty is the difference in wavelength between the Firefly's observation target and the fluorescent clip. The Firefly is equipped with a laser beam that targets 805 nm for excitation and 830 nm for fluorescence observation, whereas the existing clips have a peak excitation light of 760 nm and a peak fluorescence of 790 nm. We have been involved in the improvement of ZEOCLIP FS®, and the da Vinci compatible NIRFC has been developed. We first applied the da Vinci compatible NIRFC to the intragastric growth-type SMT, which is difficult to recognize by white light observation from the side of the serosa.

In this report, we describe the first case of da Vinci-compatible NIRFC-guided robot-assisted wedge resection of a gastric SMT.

This work has been reported in line with the SCARE 2020 criteria

[3].

2. Presentation of case

An intragastric growth-type SMT was found on the upper anterior wall of the gastric body near the greater curvature in an Asian woman in her 50s with no previous medical history. The tumour had grown from 18 to 22 mm in one year, which was measured using a measuring tool under gastric endoscopy (Fig. 2). Surgery was then performed using da Vinci® Xi (Intuitive Surgical, California, USA).

2.1. Endoscopy

Four da Vinci-compatible NIRFCs were placed at the tumour edge, two at the proximal and two at the distal edge, two days prior to surgery as preoperative markings (Fig. 3).

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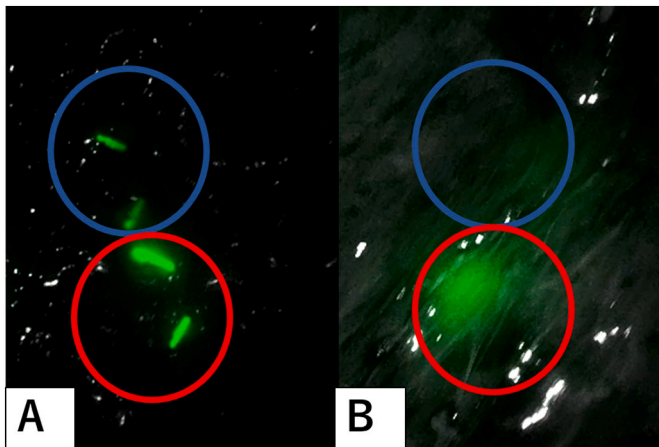


Fig. 1. From the serous side, a da Vinci-compatible NIRFC can be seen on Firefly from the serous side. Ex vivo bench observations were made in the resected stomach; (A) was from the mucosal surface and (B) was from the serous surface. Conventional NIRFC (blue circle) cannot be seen on the Firefly from the serous surface; on the other hand, a da Vinci-compatible NIRFC can be seen (red circle). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

2.2. Surgery

The location of the tumour was unclear under white light. The Firefly showed that the NIRFC locations were visible on the proximal and distal sides (Fig. 4). The distal NIRFC site was incised with a monopolar shear blade to identify the NIRFC and tumour base (Fig. 5). The open area was sutured in two layers using a 3-0 V-Loc®. The operation time was 83 min, and the amount of blood loss was 2 g with no complications or clip dropout.

2.3. Pathology

Histopathological examination revealed a gastrointestinal stromal tumour (GIST) (c-kit/CD34 positive, S100, desmin, SMA negative) with mitosis <5/50 HPF. No tumour necrosis was noted, and MIB1 index was <10% with negative margins.

2.4. Postoperative course

She is alive and recurrence-free 1 year after surgery.



Fig. 3. Four da Vinci-compatible NIRFCs were placed at the tumour edge. One non-fluorescent clip was also placed.

3. Discussion

In this study, we reported the first case of da Vinci-compatible NIRFC-guided robot-assisted wedge resection of the stomach. The adequacy of partial gastrectomy as a treatment strategy for gastric SMT was first reported by Yoshida et al. in 1997 [4]. Localized gastric resection using a stapler increases the resection area size and may cause gastric deformation; therefore, efforts have been made to minimize the resection area [5].

Subsequently, laparoscopy and endoscopy cooperative surgery (LECS) was reported by Hiki et al. in 2008 as a reliable and safe surgical method to minimize the resection area [6]. Although LECS is a useful surgical method because of its minimally invasive nature, it requires a skilled endoscopist, and the operation time is not short, approximately 170 min [6,7].

Robot-assisted gastric wedge resection has been reported, but there have been no reports of NIRFC-guided surgery [8]. da Vinci compatible NIRFC-guided robot-assisted surgery can be performed in a short time by first recognising the tumour location and without the need for an intraoperative endoscopist to perform small-area resection and suturing.

In this method, the localization of the tumour is important, which

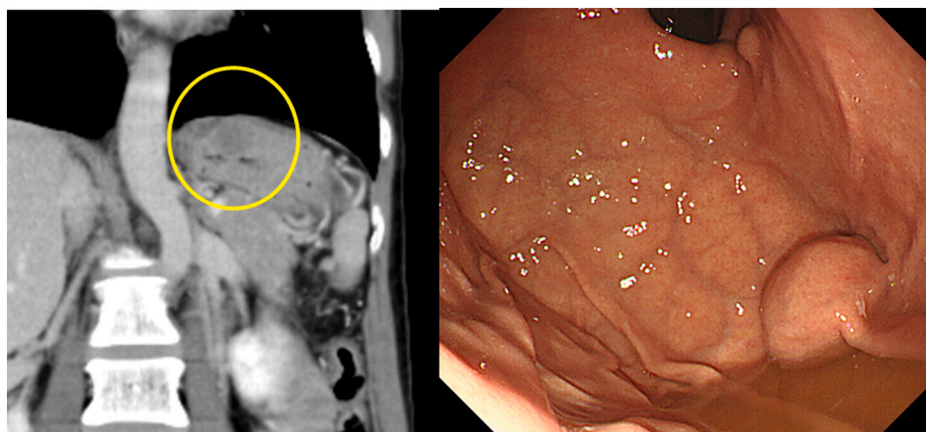


Fig. 2. Intra gastric growth type SMT was found on the upper anterior wall.

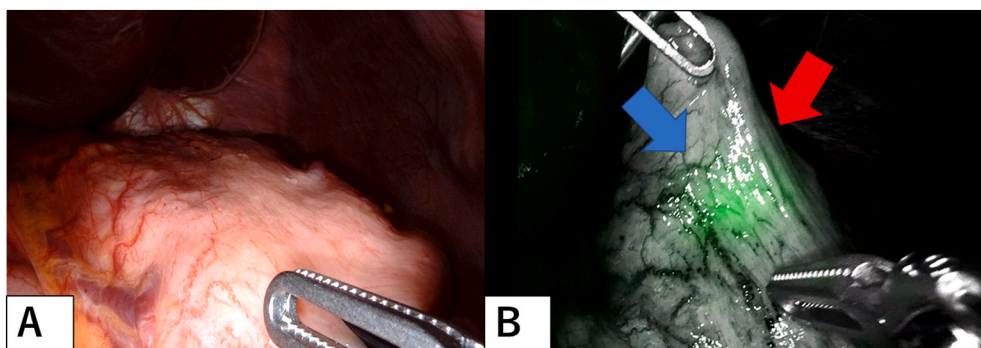


Fig. 4. Firefly showed the location of tumour edge by the scene of NIRFC. Under white light, the location of the tumour could not be recognized (A). Firefly showed that the NIRFC locations were visible on the proximal and distal sides (B) (blue arrow shows distal NIRFCs and the red arrow shows proximal NIRFCs). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

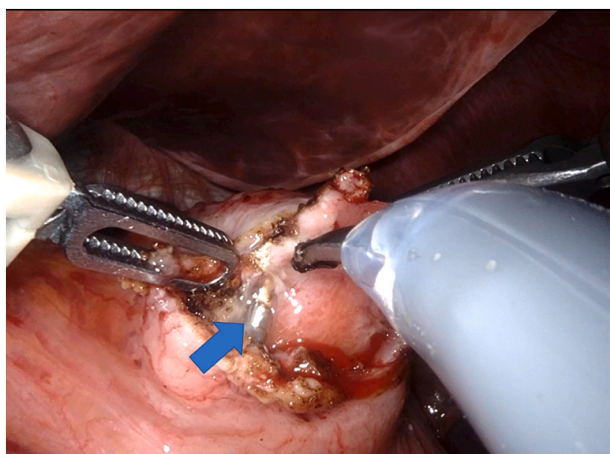


Fig. 5. Near the tumour edge was incised under identification of the NIRFC on the tumour edge. The blue arrow shows the distal NIRFC, which was exposed by incision. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

may be difficult to determine in the case of intragastric growth-type SMT.

In this case, we performed a robot-assisted wedge resection of the stomach for an SMT, using the da Vinci compatible NIRFC to determine the localization of the tumour.

The da Vinci compatible NIRFC-guided robot-assisted wedge resection of the stomach is a simple procedure that retains the usefulness of LECS.

A possible limitation of this method is the tumour in the abdominal cavity due to the opening of the gastric wall during the procedure. For this reason, it is not suitable for SMT with ulcer formation and luminal exposure, and such cases are better treated with non-exposed endoscopic wall-inversion surgery (NEWS) or other methods that do not expose the tumour to the abdominal cavity [9].

4. Conclusion

In this case, we were able to observe the location of the da Vinci compatible NIRFC in the lumen of the stomach with the Firefly onboard da Vinci from the serosal side. This technique may be an option for GISTs without ulcer formation as a simple and quick procedure.

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Ethical approval

This study has been exempted by our institution. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Informed consent

Written informed consent was obtained from the patient for publication of this case report and the accompanying images.

CRedit authorship contribution statement

JT: study design, data collection, data analysis, writing. MY: critical revision. YS: final approval of the article. Any other authors: study design, data collection. All authors read and approved the final manuscript. The SCARE 2018 Statement: Updating Consensus Surgical CASE REport (SCARE) Guidelines.

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Declaration of competing interest

None.

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