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Indocyanine green and near-infrared fluorescence imaging in gastric cancer precision surgical approach

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Gastric cancer (GC) is the 4th most lethal cancer[1]. Radical gastrectomy is the main treatment for GC and D2 lymphadenectomy is recommended for advanced lesions, while limited lymph node dissection is adequate in early lesions, decreasing morbidity[2]. By tailoring the procedure according to the disease's extent, the best oncological results may be achieved while minimizing the patient's risk.

Currently, augmented reality is available and can be used for real-time assessment of the operative field and anatomy. One of the main modalities is the Indocyanine green (ICG) and Near-infrared (NIR) fluorescence imaging[3].

NIR light characteristics include low absorption, low scattering, and low autofluorescence, providing deeper tissue penetration than visible light. With fluorescent contrast agents, specific structures as lymphatic vessels, lymph nodes and blood vessels can be clearly visualized[3].

ICG is a sterile water-soluble tricarbocyanine dye, approved by the United States, Food and Drug Administration (FDA), with very rare reports of hypersensitivity reactions, besides being a nonionizing and nontoxic modality. It rapidly binds to plasma proteins, staying confined to the vascular compartment and, when excited by NIR light (700–900 nm), emits fluorescence at a wavelength of approximately 820 nm[3,4].

In GC, ICG and NIR fluorescence imaging may be used for sentinel lymph node biopsy and analysis, lymphadenectomy guidance and quality control, and localization of the tumor[4-6]. At present, a prospective, single-arm study is ongoing at our institution to evaluate the usefulness of ICG fluorescence imaging in GC (ClinicalTrials ID: NCT03021200). In this E-VIDEO*, we demonstrate ICG and NIR fluorescence applications in GC surgery.

First, a laparoscopic sentinel lymph node biopsy is performed. Intraoperative endoscopic injection of 0.2 mL of ICG is injected into the submucosal layer at four points around the lesion. The Sentinel Lymph node is identified (FIGURE 1) and removed for detailed analysis. Next, a robotic D2 gastrectomy in an obese patient is shown. ICG was endoscopically injected the day before and it allows for intraoperative identification of the lesion location and margin check (FIGURE 2), lymphadenectomy guidance and verification of its adequacy. In this particular case, a lymph node from station six was identified and rescued thanks to the NIR fluorescence (FIGURE 3). After the end of the surgery, the fluorescence system is activated, for final control of residual lymph nodes.

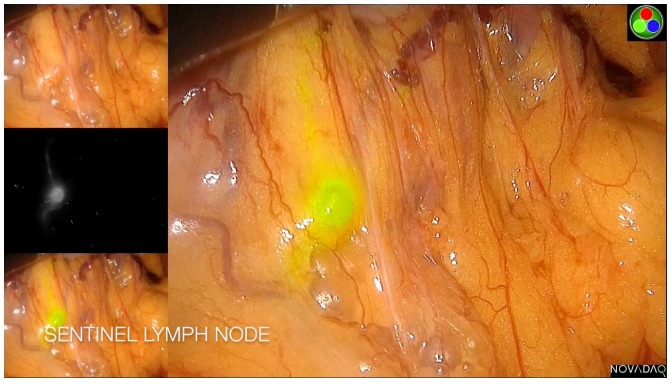

FIGURE 1. Sentinel Lymph node identification.

FIGURE 2. Localization of the tumor and determination of the surgical margins.

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***E-VIDEO: https://youtu.be/Dvue8Uuhlks**

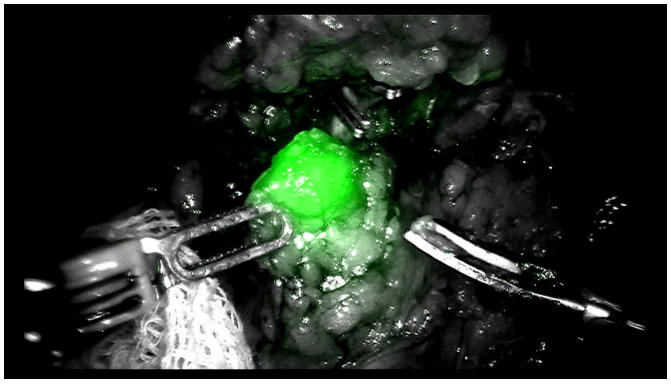

FIGURE 3. Station 6 lymph node.

Authors' contribution

Dias AR carried out the operative procedure. Safatle-Ribeiro AV performed the endoscopic procedures. Sakamoto E edited the video. Dias AR, Sakamoto E, drafted the initial manuscript. Ramos MFKP, Safatle-Ribeiro AV, Zilberstein B and Junior UR supervised and commented on the manuscript. All authors discussed the results and contributed to the final manuscript.

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