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GI IMAGE

Esophageal Adenocarcinoma Lymphatic Drainage with ICG Fluorescence Imaging

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A 55-year-old man with history of gastroesophageal reflux disease for 20 years underwent an upper endoscopy, which showed esophageal mucosal changes consistent with Barrett's esophagus, and nodularity at 38 cm at the 3 o'clock position. The pathology report showed a moderately differentiated esophageal adenocarcinoma. The endoscopic ultrasound failed to identify lymph node involvement. Endoscopic mucosal resection was performed, but the specimen showed cancer cells at the resection margins. We decided to perform an Ivor Lewis esophagectomy with assessment of the lymphatic drainage of the tumor with fluorescence imaging.

Before starting the laparoscopic phase of the operation, we performed an upper endoscopy. Using a standard adult endoscope and an injection therapy needle catheter (Boston Scientific, IN, USA), we injected with 1 cm^3 of indocyanine green (ICG) diluted in sterile water (2.5 mg) into the esophageal submucosa at the four quadrants around the tumor.

The first step of the operation was the mobilization of the greater curvature by the division of the gastrocolic omentum while preserving the gastroepiploic arcade, and by the division of the short gastric vessels. The gastrohepatic ligament was then divided preserving the right gastric artery, and the hiatus and distal esophagus were dissected. The left gastric artery and the coronary vein were then identified (Fig. 1). The advanced imaging laparoscopic platform (Stryker Endoscopy, San Jose, CA) allowed us for the use of near-infrared imaging that provided us with an enhanced visual assessment of the lymphatic drainage of the tumor (Fig. 2). After retrieving all the identified lymph nodes, we completed the laparoscopic preparation of the stomach for pull-up and then proceed with the thoracic component.

Esophageal cancer spreads in a multidirectional way through the submucosal lymphatics to regional nodal stations, and lymph node metastasis is one of the most important prognostic factors. Unfortunately, pre-operative imaging studies to evaluate the extent of lymph node involvement have several limitations. Therefore, new strategies to identify the anatomical lymphatic drainage of esophageal tumors are warranted. Near-infrared light fluorescent imaging has been recently proven to be a safe technology for esophageal and gastric lymphatic mapping offering improved visibility without the use of radioactive tracer.[1,2] Specifically, distal esophageal tumors appear to follow a specific lymphatic spread pattern, and the left gastric artery nodes seem to be the most likely first nodal station involved.[2] We also found that after 15–20 min from the ICG injection, the dye from the tumor migrated towards the left gastric artery nodal station (station 17). The lymphatic mapping technique has the potential of clearly identifying the lymph node drainage of a tumor, therefore limiting the extent of dissection.

The ICG dye has been extensively used intravenously for the identification of the extra-hepatic biliary anatomy during laparoscopic cholecystectomy, and for the assessment of the blood supply of gastrointestinal anastomoses with practically no serious adverse effects.[3]

Francisco Schlottmann and Marco G. Patti conceived the manuscript and helped with literature search and writing of the manuscript.

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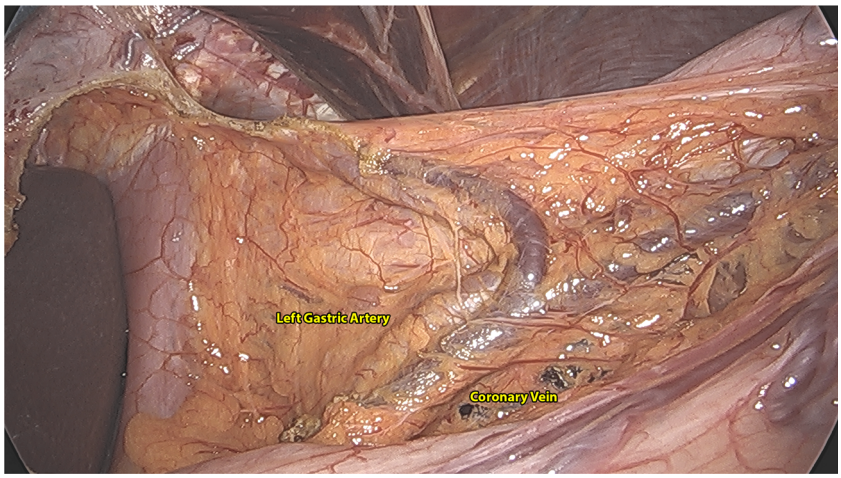

Fig. 1 Laparoscopy using standard white-light imaging showing the left gastric artery and the coronary vein

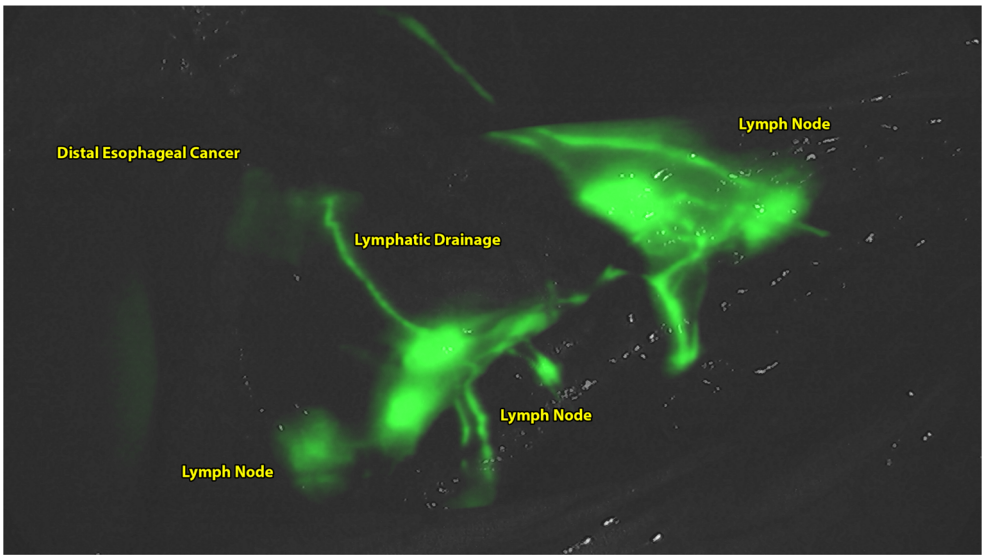

Fig. 2 Laparoscopy using fluorescence imaging showing the lymphatic drainage of the distal esophageal tumor

The use of fluorescence imaging technology for identification of the lymphatic drainage could have important clinical benefits:

- Sample of critical regional lymph nodes for better staging.
- Targeted lymphadenectomy rather than extensive nodal dissection could decrease operative time and post-operative complications.
- Select by laparoscopy early stage patients without nodal involvement for endoscopic resection, both T1a and T1b.

Overall, we believe this imaging technology has a tremendous potential to benefit patients with esophageal cancer.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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