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VIDEO FORUM

Simultaneous transabdominal and transanal indocyanine green fluorescence imaging for low colorectal anastomosis

M. Kryzauskas[1,2] · M. Jakubauskas[1,2] · E. Poskus[1,2] · K. Strupas[1,2] · T. Poskus[1,2]

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Anastomotic leakage (AL) is one of the most devastating complications in colorectal surgery. Despite new technologies and initiatives, the AL rate can be as high as 19% [1]. Air-leak tests and intraoperative colonoscopies help to reduce the AL rate; however, they cannot eliminate AL completely [2]. Adequate perfusion of the anastomosis is crucial for preventing AL. Indocyanine green (ICG) fluorescence angiography imaging has been described as an intraoperative tool for evaluating perfusion of the bowel wall, possibly preventing AL [3]. In the attached video, we show the technique of simultaneous transabdominal and transanal ICG testing for low colorectal anastomosis.

The patient provided informed consent to use images and video material of this procedure and to participate in the study. Patient details are presented in supplementary material. A standard laparoscopic-assisted low anterior resection was performed. The distal part of the rectum was transected using two 60 mm firings of a laparoscopic linear stapler (ECHELON FLEX™ GST System, ETHICON). Resection of the rectum was performed extracorporeally and the 28 mm diameter anvil of the circular stapler (Circular Stapler, ETHICON) was inserted into the proximal colon. Two identical laparoscopic systems (KARL STORZ, Tuttligen, Germany) with near-infrared fluorescence imaging camera (IMAGE 1S™, KARL STORZ, Tuttligen, Germany) and xenon light source (D Light P system, KARL STORZ, Tuttligen, Germany) were used for simultaneous ICG testing. The first ICG (12.5 mg/5 ml) intravenous injection was administered after removing the resected bowel. The perfusion of the proximal end of the bowel (Fig. 1) and the stump of the distal rectum (Fig. 2) was checked using near-infrared fluorescence imaging. Parameters of adequate perfusion were the illumination of clear visible arterial branches and subsequent illumination of bowel wall tissue at the area of anastomosis. Perfusion was determined to be adequate and an end-to-end stapled anastomosis was performed. The anastomosis was formed on one side of staple line in order to have one "dog ear" instead of two. There was no tension on the anastomosis and the floppy bowel reached anastomosis easily. The anastomosis was 4 cm from the anal verge. Finally, after the anastomosis was finished, the proximal end of the bowel was clamped intraabdominally without compromising the vascular supply. A rectoscope (RECTOVISION®, KARL STORZ, Tuttligen, Germany) was inserted into the anus and the second ICG (12.5 mg/5 ml) injection was administered. Manual air insufflation was used to maintain an adequate endorectal view. The perfusion of the anastomosis transabdominally and viability of the anastomotic mucosa transanally was evaluated using two laparoscopic cameras simultaneously (Figs. 3, 4). Additionally, an air-leak test was performed. There were no technical problems while performing the perfusion tests. After the evaluation of perfusion with fluorescence imaging and negative air-leak and tension tests, the surgeon made the decision not to perform a preventive ileostomy.

The postoperative course is presented in the supplementary material. The follow-up colonoscopy 6 months after the operation showed an intact anastomosis (Fig. 5).

We present a technique of thorough evaluation of a low colorectal anastomosis using air-leak testing, transrectal evaluation of the anastomotic mucosa and with simultaneous transabdominal and transanal evaluation of perfusion of the anastomosis using ICG. This extended evaluation can be used when performing any gastrointestinal anastomosis,

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✉ T. Poskus
tomas.poskus@santa.lt

[1] Clinic of Gastroenterology, Nephrourology and Surgery, Faculty of Medicine, Institute of Clinical Medicine, Vilnius University, Vilnius, Lithuania

[2] Center of Abdominal Surgery, Vilnius University Hospital "Santaros Klinikos", Santariskiu Str. 2, LT-08661 Vilnius, Lithuania

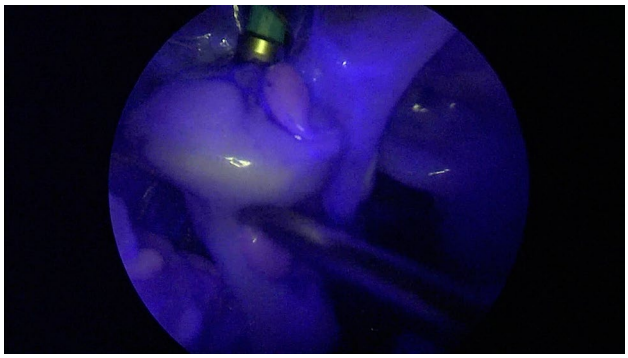

Fig. 1 Blood perfusion in the proximal end of the bowel, transabdominal view

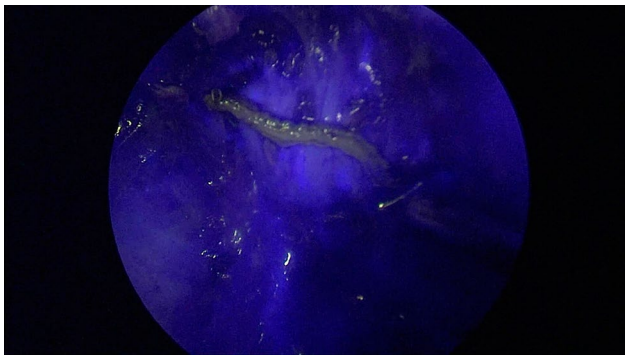

Fig. 2 Blood perfusion in the stump of the distal rectum, transabdominal view

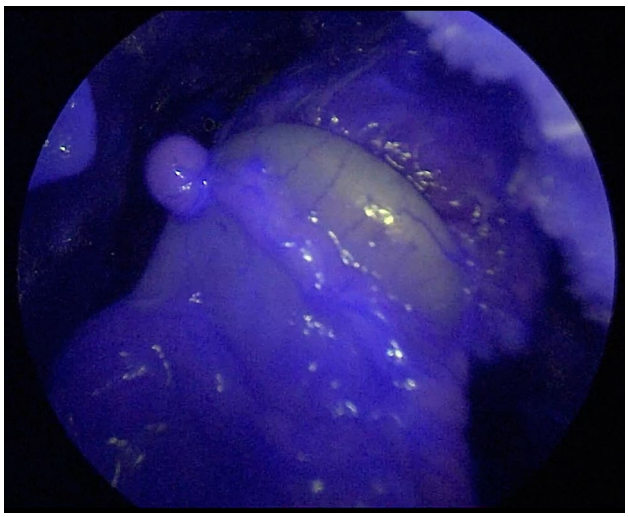

Fig. 3 Blood perfusion of the anastomosis, transabdominal view

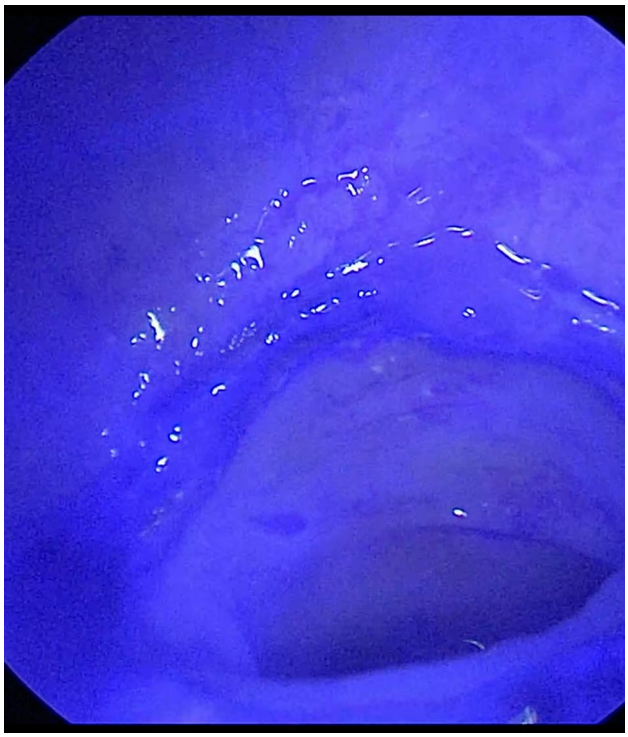

Fig. 4 Viability of the anastomosis mucosa, transanal view

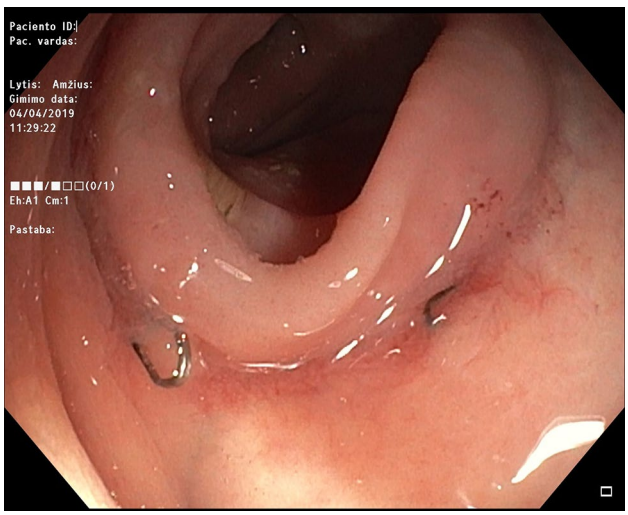

Fig. 5 Follow-up colonoscopy

which can be reached with an endoscope. However, in our opinion, the biggest benefit can be seen when evaluating low colorectal anastomoses, as they are notorious for high leak rates. Furthermore, the use of ICG can not only help reduce the AL rate, but may also reduce the need for defunctioning ileostomy. In the case presented here, the stoma was avoided successfully even though the patient had a high risk anastomosis: she had undergone preoperative chemoradiation and the anastomosis was low [2].

Transanal ICG fluorescence imaging is not a widely used [4]. Sujatha-Bhaskar et al. demonstrated that endoscopic white light evaluation of anastomotic perfusion can predict

AL, thus necessitating immediate intraoperative modifications [5]. Theoretically, the addition of ICG imaging during endoscopic evaluation should increase the ability to predict AL. However, no studies have been done to prove the correlation of this technique to the clinical outcome.

Although ICG fluorescence imaging has potential, other risk factors for AL besides anastomotic perfusion are also important and should be taken into account when deciding whether a preventive ileostomy is needed. Mizrahi et al. showed that ICG fluorescence imaging reduces the AL rate, but is still imperfect and subjective as it is unable to predict all cases of AL [4]. Moreover, there is insufficient high-quality data to definitely prove the efficacy of ICG imaging in reducing AL. At the moment, there are three ongoing randomized controlled trials that are evaluating the role of ICG imaging in lowering AL rates [3].

Simultaneous transabdominal and transanal ICG fluorescence imaging is a promising new technique for testing the perfusion of low colorectal anastomoses. Further studies are necessary to evaluate its clinical significance.

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Compliance with ethical standards

Conflict of interest The proctoscope and an additional laparoscopic system with near-infrared fluorescence imaging camera that were used in this technique were provided without pay by KARL STORZ, Tuttligen, Germany. Marius Kryzauskas, Matas Jakubauskas, Eligijus Poskus, Kestutis Strupas and Tomas Poskus declare that they have no additional conflict of interest.

Ethical approval All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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