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HOW I DO IT

How to Utilise Indocyanine Green to Localise Low Rectal Lesions and Perform an Intracorporeal Anastomosis

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1 | Introduction

Dating back to 1958, endoscopic tattooing has a long tradition in marking colonic lesions for oncological resection [1]. The technique of endoscopic tattooing has been shown to have significant benefits, leading to better lymph node harvest and more accurate resection margins [2, 3]. This procedure is considered safe, easy to perform, and confers a high accuracy [2].

As opposed to colonic tumours, rectal tumours are rarely tattooed [1]. Detractors to the practice suggest that these lesions are easier to identify intraoperatively using digital rectal exam, flexible sigmoidoscopy, or anatomical landmarks [2]. Many rectal surgeons would also agree that endoscopic ink can ablate the mesorectal plane, both visually and through local fibrotic reaction, especially if injected into the mesorectum inadvertently, making total mesorectal excision (TME) challenging [1, 3]. Additionally, marking with endoscopic ink in the rectum prior to MRI staging could lead to upstaging of tumours through regional lymph node uptake, leading to more aggressive and potentially unnecessary neoadjuvant treatment [4].

Indocyanine Green (ICG) has previously been investigated as an endoscopic correlate; however, it is often dismissed due to its quick tissue diffusion. The substance binds to proteins such as albumin and is made visible when exposed to near infrared wavelengths [5]. Its use is well established, safe, and cost-effective in colorectal surgery [6]. We describe its use as an effective adjunct to increase efficiency in localising low rectal tumours, especially smaller tumours, during surgery. The technique confers the benefits of traditional ink without the adverse effects that deter rectal surgeons.

2 | Case Background

A 50 year-old female presented with per rectal bleeding against a background of a family history of bowel cancer. Colonoscopy performed at a peripheral hospital suggested a small malignant lesion 13–16 cm from the anal verge. CT staging could not visualise the lesion and there was no metastatic disease. The patient was transferred for a robotic high anterior resection to our regional service. At the operation, the tumour was identified much lower at about 5 cm, necessitating an ultra-low anterior resection.

3 | Technique

1. TME dissection and preparation for rectal division
   A 4-port robotic configuration for an anterior resection was utilised. Following medial-to-lateral dissection of the left colon and high ligation of the inferior mesenteric artery, the TME dissection was performed.
2. Accurate tumour localisation
   A flexible sigmoidoscope was performed to identify the precise location of the lesion after dissection beyond the upper rectum (Figure 1a).

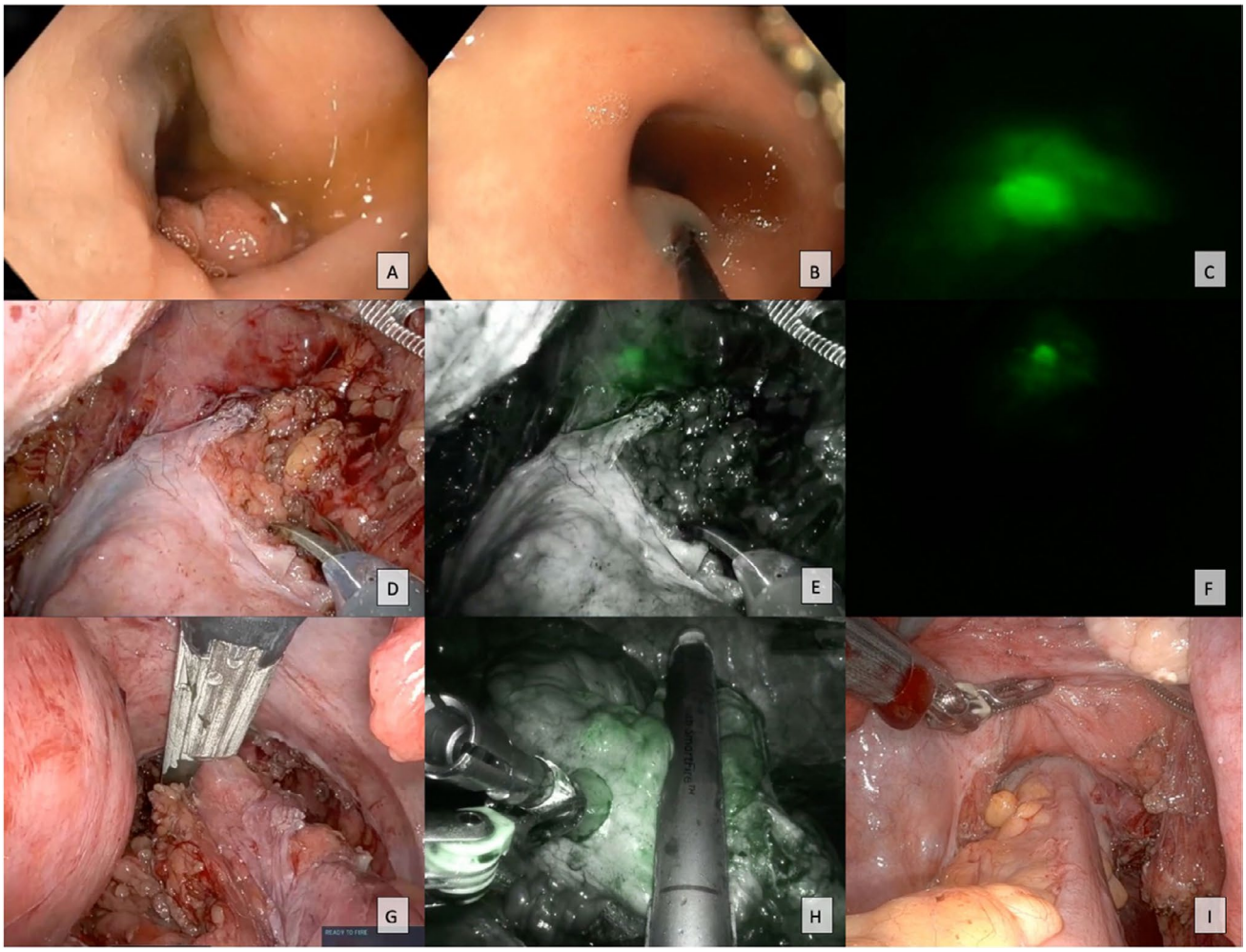

FIGURE 1 | Robotic Ultra-low anterior resection with ICG localisation and intracorporeal anastomosis. A: Low rectal tumour. B: Tattoo of tumour. C: ICG Firefly mode localising tumour location. D–F: Intra-operative images showing ICG localisation from normal 3D (D) near infrared (E) and infrared (F) modes. G: Rectal transection. H: Proximal division with anvil placed and ICG perfusion test. I: Creation of Baker type side to end anastomosis.

3. Preparation of endoscopic ICG
   To reduce ICG diffusion, the tattoo is applied during the TME dissection phase only and not before. Ten millilitre of sterile water was mixed with 25 mg of ICG and drawn up and primed in the endoscopic tattoo syringe.

4. ICG tattoo infiltration
   Switching to Firefly near infrared vision, ICG is visualised as being injected into the anterior wall of the rectum, away from the mesorectum (Figure 1b,c) and 10–20 mm distal from the tumour, within the submucosal plane. 1.5 mL is used to mark the lesion.

5. Division of rectum aided by ICG tattoo
   The landing zone for the stapler was created at the level of the ICG, and the distal resection margin was transected with a SureForm green 60 mm stapler (Figure 1d–g). No rectal digitation or further endoscopy was required.

6. Perfusion check of conduit with ICG
   Intravenous ICG was utilised to check the perfusion of the proximal colon (Figure 1h). Importantly, the flush of systemic ICG was visibly distinct from submucosal tattoo ICG.

7. Intracorporeal anastomosis
   An intracorporeal functional side to end (Baker type) stapled anastomosis was performed, with the anvil secured intracorporeally (Figure 1h,i). The specimen was extracted through the 12 mm stapler port, with an extra small Alexis. A check flexible sigmoidoscopy confirmed a negative leak test and widely patent anastomosis.

4 | Outcome

The patient had an uncomplicated post-operative course, was discharged on day 3 post-op. The final tumour was staged as a T2N0 adenocarcinoma with 0/20 lymph nodes involved.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

References

1. M. Yang, D. Pepe, C. M. Schlachta, and N. A. Alkhamesi, "Endoscopic Tattoo: The Importance and Need for Standardised Guidelines and Protocol," *Journal of the Royal Society of Medicine* 110, no. 7 (2017): 287–291.

2. A. Trakarnsanga and T. Akaraviputh, "Endoscopic Tattooing of Colorectal Lesions: Is It a Risk-Free Procedure?," *World Journal of Gastrointestinal Endoscopy* 3, no. 12 (2011): 256–260.

3. J. Wlodarczyk, D. Kim, C. Finney, A. Gupta, R. Cannom, and M. Duldulao, "Inking Outside the Box: Systematic Review on the Utility of Tattooing Lesions in Rectal Cancer," *International Journal of Colorectal Disease* 37, no. 10 (2022): 2101–2112, https://doi.org/10.1007/s00384-022-04239-y.

4. G. Gasljevic, N. Boc, E. Brecelj, J. But Hadzic, M. Klancic, and J. Mlakar, "Overstaged Rectal Cancer by MRI due to Fibrosis Induced by Tattoo Marker," *Case Reports in Gastroenterology* 12, no. 3 (2018): 602–607.

5. A. Hackethal, M. Hirschburger, S. O. Eicker, T. Mücke, C. Lindner, and O. Buchweitz, "Role of Indocyanine Green in Fluorescence Imaging With Near-Infrared Light to Identify Sentinel Lymph Nodes, Lymphatic Vessels and Pathways Prior to Surgery - A Critical Evaluation of Options," *Geburtshilfe Und Frauenheilkunde* 78, no. 1 (2018): 54–62.

6. Z. Garoufalia, "The Promise of Indocyanine Green in Colorectal Surgery," *Lancet Gastroenterology & Hepatology* 1, no. 10 (2024): 897–898, https://doi.org/10.1016/S2468-1253(24)00235-8.