gastrointestinal disorders

MDPI

Article

Preoperative Injection of Indocyanine Green Fluorescence at the Anorectal Junction Safely Identifies the Inferior Mesenteric Artery in a Prospective Case-Series Analysis of Colorectal Cancer Patients

Franco Roviello [1,2], Eleonora Andreucci [1], Ludovico Carbone [1,*], Natale Calomino [2], Stefania Piccioni [2], Lucia Bobbio [3], Riccardo Piagnerelli [2], Andrea Fontani [2] and Daniele Marrelli [1,2]

[1] Unit of Surgical Oncology, Department of Medicine Surgery and Neurosciences, University of Siena, IT53100 Siena, Italy
[2] Unit of General Surgery, Department of Oncology, Azienda Ospedaliero Universitaria Senese (AOUS), IT53100 Siena, Italy
[3] Unit of Anesthesia, Department of Surgery, Azienda Ospedaliero Universitaria Senese (AOUS), IT53100 Siena, Italy
* Correspondence: ludovicocarbone1@gmail.com

Abstract

Background: Indocyanine green (ICG)-guided surgery is an emerging technique to enhance intraoperative visualization of nodes and tumor location. However, there is no uniform protocol regarding the optimal timing, dosage, or injection site for ICG in colorectal cancer surgery. We assess the feasibility of ICG injection at the anorectal junction immediately before surgery to safely identify the inferior mesenteric artery (IMA). **Methods**: This was a prospective study involving robotic left hemicolectomy or anterior resection of the rectum for primary colorectal cancer in 2024 in a single center. A total of 10–20 mg was injected into the anorectal submucosa at four quadrants circumferentially using an anoscope immediately before robot docking. **Results**: In this first study, ICG allowed us to identify the IMA in 84.6% of 26 patients (mean age 66.5 years; BMI 26.7 kg/m^2), without intraoperative medical and surgical complications. Elevated BMI correlated with failure of IMA detection ($r = -0.77$, $p < 0.001$), despite high ICG doses trending toward improved vascular visualization ($p = 0.097$). A mean of 22 lymph nodes was harvested after ICG injection, with yields unaffected by the quality of IMA visualization. **Conclusions**: Submucosal injection of ICG is a feasible and easily adoptable option for early identification of the IMA, thereby preventing major vascular injuries, particularly in patients with challenging anatomy. A standardized protocol was implemented to improve reliability.

Keywords: indocyanine green fluorescence; inferior mesenteric artery; robotic; colorectal cancer; lymph nodes; Body Mass Index; case series

Academic Editors: Greger Lindberg and Andrew Day

Received: 16 October 2025
Revised: 27 November 2025
Accepted: 27 November 2025
Published: 28 November 2025

Citation: Roviello, F.; Andreucci, E.; Carbone, L.; Calomino, N.; Piccioni, S.; Bobbio, L.; Piagnerelli, R.; Fontani, A.; Marrelli, D. Preoperative Injection of Indocyanine Green Fluorescence at the Anorectal Junction Safely Identifies the Inferior Mesenteric Artery in a Prospective Case-Series Analysis of Colorectal Cancer Patients. *Gastrointest. Disord.* **2025**, *7*, 76. https://doi.org/10.3390/gidisord7040076

1. Introduction

Colorectal cancer ranks as the fourth most frequent malignancy, with its incidence steadily rising each year [1]. Surgical resection remains the cornerstone of curative treatment, and complete lymphovascular dissection along the inferior mesenteric artery (IMA) is essential for achieving oncological radicality in locally advanced colorectal cancer that involves serosa or is at high risk of recurrence [2]. However, the risk of vascular injury or intraoperative bleeding remains substantial. This is particularly high in patients with

visceral obesity or presenting risk factors for metabolic syndrome [3], and is further exacerbated by anatomical variations, posing additional challenges, especially for surgeons with limited experience [4]. In this context, accurate identification of the IMA is of paramount importance to ensure surgical safety.

Indocyanine green fluorescence (ICG) has been proposed to enhance the intraoperative visualization of tumor location and adequate resection margins [5]. When administered intravenously, ICG is transported via the lymphatic system, enabling real-time mapping of lymphatic drainage pathways along the origin of the IMA [6]. Recent studies have also explored the efficacy of preoperative endoscopic ICG injection near the primary lesion prior to surgery, but its adoption remains limited due to the logistical challenges of coordinating between endoscopists and surgeons [7]. Alternatively, subserosal injection of ICG can be performed intraoperatively by the surgeon [8]. While this technique offers logistical convenience by eliminating the need for preoperative endoscopy, it could be technically demanding [5].

To address these limitations, we proposed a reproducible technique based on submucosal injection of ICG at the anorectal junction, performed directly by the surgeon under anoscopic visualization, immediately before robotic docking. Here, we report our initial prospective experience and describe a standardized algorithm aiming at empowering the vessel identification and reducing vascular injuries during minimally invasive left colectomy and rectal resection.

2. Results

2.1. Entire Cohort

A total of 26 patients fulfilled the inclusion/exclusion criteria (mean age 66.5 ± 15.2 years; mean Body Mass Index (BMI) 26.7 ± 5.8 Kg/m^2). Twelve patients had a tumor in the left side of the colon, and fourteen had rectal cancer. Eight patients with rectal cancer received preoperative therapy (Table 1).

Table 1. Clinical and surgical features in all series.

	Patients (n = 26)
Female	15 (57.7)
Age (mean ± SD)	66.5 ± 15.2
BMI (mean ± SD)	26.7 ± 5.8
<25	11 (42.3)
25–30	8 (30.8)
>30	7 (26.9)
Left colon cancer	12 (46.2)
Rectal cancer	14 (53.8)
Tumor size (mean ± SD)	4 ± 1.9
Neoadjuvant	8 (30.8)
IMA visualization	
Excessive	5 (19.2)
Excellent	13 (50.0)
Poor	4 (15.4)
No	4 (15.4)
Nodes retrieved (mean ± SD)	22 ± 9
Intraoperative complications	0 (0)
Pathological TNM	
pT1	4 (15.4)
pT2	6 (23.1)
pT3	14 (53.8)
pT4	2 (7.7)
Metastatic lymph nodes	7 (26.9)
Hospital stay (mean ± SD)	7.6 ± 3.9

BMI: Body Mass Index; IMA: inferior mesenteric artery.

Preoperative injection of ICG at the anorectal junction allowed for identification of the IMA in 84.6% (n = 22) of patients. The other four cases presented higher BMI (mean 35.4 ± 5.0 Kg/m^2; r = −0.77; 95% CI 0.89–0.56; $p < 0.001$; Figure 1).

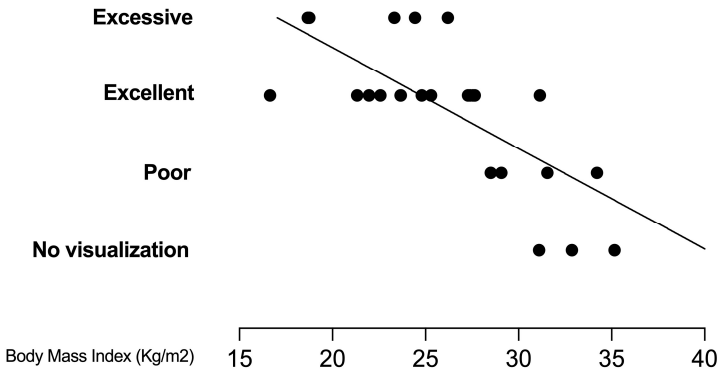


Figure 1. Correlation between Body Mass Index and the capacity for inferior mesenteric artery visualization.

All surgeries were concluded without intraoperative complications or vessel damage.

Interestingly, patients in whom the IMA was visualized by fluorescence had a shorter operating time (median 252.5 [interquartile range 220–305] vs. 310 [294–327.5] min).

Oncological radicality was achieved in all patients, with an average of 22 ± 9 lymph nodes excised. No correlation was observed between the number of lymph nodes removed and IMA detection. Specifically, 21.5 ± 12.1 nodes in the group with excessive visualization (n = 5), 22.1 ± 10.2 in cases of excellent visualization (n = 13), 19.0 ± 7.0 in cases of poor visualization (n = 4), and 24.2 ± 4.0 in the remaining patients.

2.2. Subgroup Analysis

Patients were stratified according to the dose of ICG administered at each injection point at the anorectal junction: 13 patients received 10 mg, 9 patients received 15 mg, and 4 patients received 20 mg of dye (Table 2). A trend toward excessive vascular visualization in patients who received higher doses of ICG was noted, while inadequate or absent vessel detection was more frequent in those administered lower doses ($p = 0.097$).

Table 2. Patients' features stratified by the dose of ICG administered.

	Period 1 ICG 10 mg (n = 13)	**Period 2 ICG 15 mg (n = 9)**	**Period 3 ICG 20 mg (n = 4)**	***p*-Value**
BMI				0.093
<25	5 (45.5)	5 (45.5)	1 (9.0)	
25–30	2 (25.0)	3 (37.5)	3 (37.5)	
>30	6 (85.7)	1 (14.3)	0 (0)	
Neoadjuvant	4 (50)	3 (37.5)	1 (12.5)	0.956
IMA visualization				0.097
Excessive	0 (0)	3 (60)	2 (40)	
Excellent	6 (46.2)	5 (38.5)	2 (15.3)	
Poor/No	7 (87.5)	1 (12.5)	0 (0)	

BMI: Body Mass Index; IMA: inferior mesenteric artery.

3. Discussion

In the last 20 years, minimally invasive surgery has been increasingly adopted as a standard approach in colorectal cancer [9]. However, laparoscopic techniques can be

technically challenging for distal tumor locations or in cases of obesity and extensive intra-abdominal adhesions [10]. These conditions may increase the likelihood of vascular or organ damage and, consequently, the rate of conversion to open surgery [11].

ICG has gained attention in surgical oncology for lymphatic mapping in colorectal cancer [12]. Such studies investigated different methods of administration, aiming to optimize the visualization of tumor or target structures [13]. Although recent consensus guidelines by the European Association for Endoscopic Surgery (EAES) have provided general recommendations for fluorescence-guided colorectal surgery, there remains no uniform protocol regarding the optimal timing, dosage, or injection site, including intravenous, subserosal (via a surgical approach), or submucosal (via an endoscopic approach) [14]. The efficacy of intravenous administration was investigated to assess bowel perfusion after vascular division, potentially reducing the rate of anastomotic leakage [15–17]. Nevertheless, a large multicenter phase 3 trial produced contrasting results, with a similar incidence of clinically relevant anastomotic leakage between patients who underwent ICG-guided surgery and those who underwent conventional surgery (7% vs. 9%) [18]. In contrast, injecting tracers into the colon wall via the subserosal route appears to be challenging and increases the risk of leakage into the peritoneal cavity or wall perforation. Chand et al. designed a prospective pilot study using a peritumoral subserosal ICG injection. The specimen was extracorporealised through a midline incision, and ICG was administered via subserosal injection at four sites around the tumor [19]. Other studies have explored submucosal ICG injection during colonoscopy performed intraoperatively, but it is a time-consuming process and demands interdisciplinary coordination [6,20].

In our series, the procedure was performed by a surgeon immediately before starting robotic docking, using an anoscope to allow direct visualization of the anorectal mucosa. Lymphatic drainage proceeded from station 251 to 253 along the origin of the IMA [21,22]. Visualization was achieved in 84.6% of cases within 15–20 min following submucosal injection, which corresponds to the interval required for abdominal access, insufflation, and robotic docking, typically faster than subserosal tumor injection. Notably, patients with successful IMA visualization had shorter operative times (median 252.5 vs. 310 min), suggesting that targeted lymphovascular pedicle identification may streamline dissection and improve surgical efficiency. The proposed technique demonstrated a favorable safety profile, with no anesthesia-related adverse events, such as significant desaturation following intravenous administration, and no intraoperative complications, including bleeding or organ damage.

Furthermore, oncological radicality and the retrieval of an adequate number of lymph nodes, according to international guidelines, were achieved in all patients [23]. Interestingly, the number of excised lymph nodes appeared to be independent of the dose of indocyanine green administered, with no observed correlation between the quality of arterial visualization and the lymph node yield. This finding is likely attributable to the standardized high-tie ligation technique, which ensures comprehensive lymphadenectomy [24].

We also noted a dose-dependent relationship between the quantity of ICG administered and the visualization of the IMA origin. Although the association did not reach statistical significance, decreased ICG doses were associated with poor vessel identification, observed in seven (53.5%) patients. Conversely, higher doses (20 mg) resulted in excessive fluorescence in 50% of cases. This correlation was reserved exclusively for patients with a BMI < 30, among whom only 5 of 19 (26.3%) exhibited excessive fluorescence.

While this first experience demonstrates the feasibility of the ICG injection, our findings are limited by the single-center design, relatively small sample size, and lack of a control group using intravenous ICG. Moreover, ICG doses were chosen arbitrarily without a standardized protocol. Notably, all cases of absent arterial visualization occurred in

individuals with a BMI > 30. Further comparative studies are warranted to validate these preliminary findings.

An ultimate consideration is the cost of the procedure. As a 25 mg vial of indocyanine green is estimated to cost approximately USD 200 [25], we recommend using the remaining solution for intravenous administration to evaluate bowel stump perfusion and anastomotic integrity. This dual-purpose strategy might enhance clinical outcomes while improving resource utilization.

Implemented Algorithm

Based on our results, a BMI-adjusted dosing algorithm has been refined: 2.5 mg per injection site in BMI < 25 (total 10 mg); 3.75 mg per injection site in BMI of 25–35 (total 15 mg); and 5 mg per injection site in BMI > 35 (total 20 mg), with injections performed at the 3, 6, 9, and 12 o'clock positions of the anorectal junction submucosa, immediately before robotic docking begins.

4. Materials and Methods

4.1. Population

This prospective cohort study included patients who underwent robotic surgery (Da Vinci Xi Robotic Surgical System, Intuitive) for colorectal cancer between January 2024 and December 2024 at the Azienda Ospedaliero Universitaria Senese (AOUS) in Siena (Italy).

Eligible participants were adults aged 18 years or older with a confirmed diagnosis of primary non-metastatic left colon cancer or high/mid-high rectal cancer, determined as ASA 1 or 2. Exclusion criteria comprised known hypersensitivity or allergic reaction to ICG, pregnancy, hemodynamic instability at the time of surgery, emergency setting, and previous colorectal surgery. Data were collected prospectively in an Institutional database.

This case series has been reported in line with the PROCESS Guidelines [26].

4.2. Procedure

All surgical procedures were performed by the same colorectal surgeon. Prior to surgery and after anesthesia induction, an anoscope was used to optimize exposure and facilitate access to the anorectal region (Figure 2).

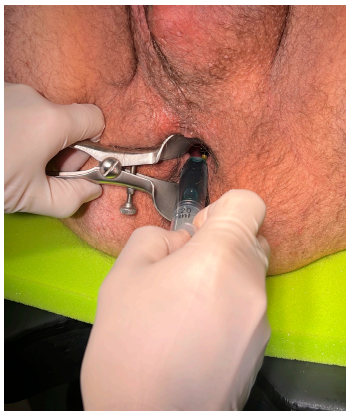


Figure 2. Anoscope-assisted exposure of the anorectal junction and submucosal ICG injection.

ICG was dissolved in sterile water to obtain a final concentration of 1.25 mg/mL. Using a fine needle, the dye was injected transanally into the submucosal layer of the anorectal junction at four quadrants corresponding to the 3, 6, 9, and 12 o'clock positions. The needle was advanced approximately 2–3 mm into the submucosa, and the correct

depth was confirmed by the appearance of a slight mucosal bulge. A successful injection was defined by homogeneous submucosal elevation without leakage. (Figure 3)

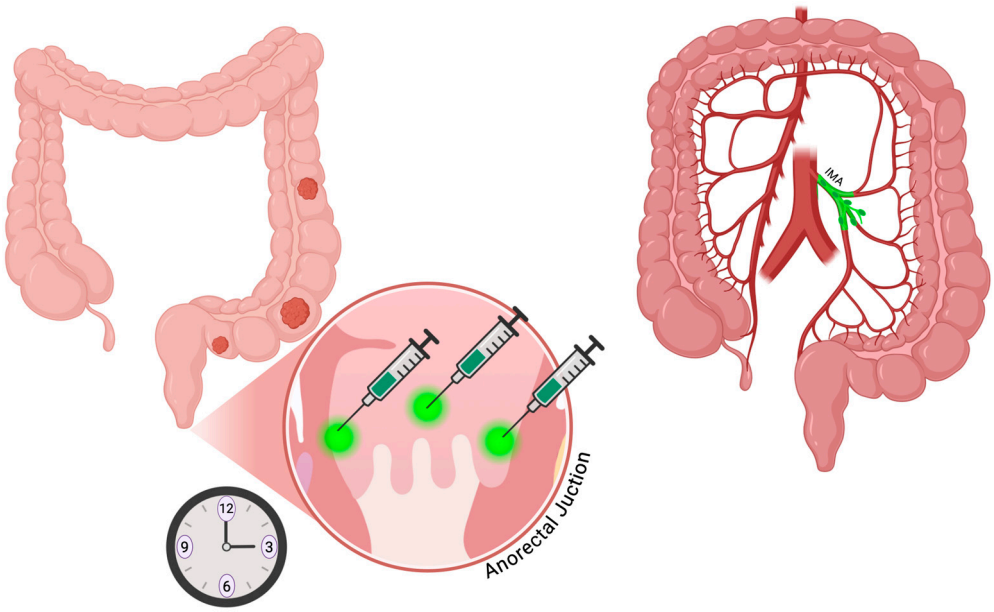
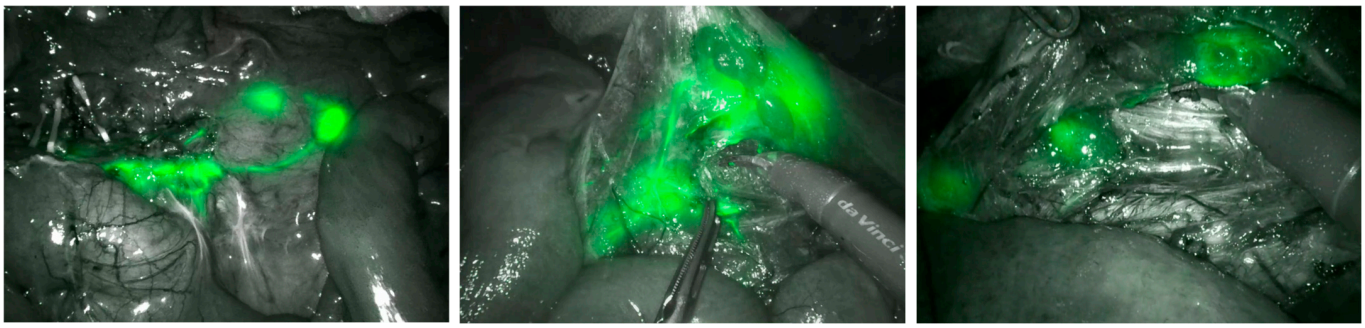


Figure 3. Submucosa injection of indocyanine green at four quadrants of the anorectal juction circumferentially on the left; inferior mesenteric artery (IMA) and lymphatic visualization (green) on the right.

The total ICG dose per patient ranged from 10 to 20 mg, depending on the study period: period 1 (January–April), 10 mg (2.5 mg per point); period 2 (May–August), 15 mg (3.75 mg per point); and period 3 (September–December), 20 mg (5 mg per point).

The colorectal procedure begins with the preparation of the gastrocolic ligament to access the retrogastric cavity. During this time, the IGC moves with the lymphatic flow. The Firefly system allows the intraoperative visualization of lymphatic drainage pathways and targeted dissection of nodal basins (Figure 4). Successful IMA identification was defined intraoperatively as distinct fluorescence visualization of the IMA under NIR imaging approximately 15 to 20 min after the injection, coinciding with the start of the vascular dissection phase. The area with the strongest staining is the origin of the IMA, high-tied in all cases.



(**a**) (**b**) (**c**)

Figure 4. Near-infrared fluorescence imaging (green) showing the lymph nodes alongside the origin of the inferior mesenteric artery: (**a**) excellent visualization; (**b**) excessive visualization; (**c**) poor visualization.

Moreover, the quality of visualization was classified as excellent, excessive, or poor based on the brightness, contrast, and anatomical clarity. Excellent indicated a clear, well-defined fluorescence precisely outlining the IMA origin; excessive referred to an overly

intense or diffuse signal extending beyond the target area, causing background saturation that could hinder precise identification; and poor described weak or discontinuous fluorescence insufficient for reliable anatomical identification.

4.3. Aim

The aim of this study is to assess the feasibility of ICG administered via submucosal injection for visualizing the origin of the IMA during left hemicolectomy or anterior resection of the rectum. The secondary endpoints are to identify intraoperative complications, such as systemic (allergic or hypersensitivity responses) and surgical adverse events (including injection-site complications, bleeding, and organ damage), and to determine whether the quality of IMA visualization influences the number of harvested lymph nodes.

4.4. Statistical Analysis

Categorical variables were summarized as frequencies and percentages. Means with standard deviation (SD) were used for normally distributed variables. Differences among patients stratified by the dose of ICG administered (10, 15, or 20 mg) were assessed by the chi-square test for categorical variables and by ANOVA for continuous variables. Data analysis was performed using 27.0 SPSS Statistics (IBM Corp., Armonk, NY, USA).

5. Conclusions

In conclusion, the anorectal administration of ICG enhances real-time visualization of the origin of the IMA during robotic left hemicolectomy or rectal cancer surgery and could facilitate its swift ligation, especially for surgeons with more limited experience. While the technique shows considerable promise, further validation of a standardized protocol is required in larger cohorts of patients before it can be widely adopted in colorectal surgery, particularly for patients with a higher BMI or who have received chemotherapy or radiotherapy.

Author Contributions: Conceptualization, F.R. and D.M.; methodology, L.C. and A.F.; validation, E.A., N.C. and R.P.; formal analysis, L.C.; investigation, L.B. and R.P.; data curation, E.A., S.P. and A.F.; writing—original draft preparation, E.A. and L.C.; writing—review and editing, N.C., L.B. and R.P.; visualization, A.F. and D.M.; supervision, F.R. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Ethics Committee of Azienda Ospedaliero Universitaria Sense (protocol code 22703, 6 February 2023).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author due to ethical and privacy considerations.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

ICG	Indocyanine green
IMA	Inferior mesenteric artery
BMI	Body Mass Index

References

1. Argilés, G.; Tabernero, J.; Labianca, R.; Hochhauser, D.; Salazar, R.; Iveson, T.; Laurent-Puig, P.; Quirke, P.; Yoshino, T.; Taieb, J.; et al. Localised colon cancer: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Ann. Oncol.* **2020**, *31*, 1291–1305. [CrossRef] [PubMed]
2. Hashiguchi, Y.; Muro, K.; Saito, Y.; Ito, Y.; Ajioka, Y.; Hamaguchi, T.; Hasegawa, K.; Hotta, K.; Ishida, H.; Ishiguro, M.; et al. Japanese Society for Cancer of the Colon and Rectum (JSCCR) guidelines 2019 for the treatment of colorectal cancer. *Int. J. Clin. Oncol* **2020**, *25*, 1–42. [CrossRef]
3. Kudra, A.; Muszyński, D.; Sobocki, B.K.; Atzeni, A.; Carbone, L.; Kaźmierczak-Siedlecka, K.; Połom, K.; Kalinowski, L. Insights into oral microbiome and colorectal cancer—On the way of searching new perspectives. *Front. Cell. Infect. Microbiol.* **2023**, *13*, 1159822. [CrossRef]
4. Ferraro, L.; Formisano, G.; Salaj, A.; Giuratrabocchetta, S.; Giuliani, G.; Salvischiani, L.; Bianchi, P.P. Robotic right colectomy with complete mesocolic excision: Senior versus junior surgeon, a case-matched retrospective analysis. *Int. J. Med. Robot. Comput. Assist. Surg.* **2022**, *18*, e2383. [CrossRef]
5. Son, G.M.; Ahn Hmin Lee, I.Y.; Ha, G.W. Multifunctional Indocyanine Green Applications for Fluorescence-Guided Laparoscopic Colorectal Surgery. *Ann. Coloproctol.* **2021**, *37*, 133–140. [CrossRef]
6. Watanabe, J.; Takemasa, I.; Kotake, M.; Noura, S.; Kimura, K.; Suwa, H.; Tei, M.; Takano, Y.; Munakata, K.; Matoba, S.; et al. Blood Perfusion Assessment by Indocyanine Green Fluorescence Imaging for Minimally Invasive Rectal Cancer Surgery (EssentiAL trial). *Ann. Surg.* **2023**, *278*, e688–e694. [CrossRef]
7. Qiu, W.; Hu, G.; Mei, S.; Li, Y.; Quan, J.; Niu, H.; Mei, L.; Jin, S.; Liu, Q.; Tang, J. Indocyanine green highlights the lymphatic drainage pathways, enhancing the effectiveness of radical surgery for mid-low rectal cancer: A non-randomized controlled prospective study. *Eur. J. Surg. Oncol.* **2025**, *51*, 109520. [CrossRef] [PubMed]
8. Ho, M.F.; Futaba, K.; Mak, T.W.C.; Ng, S.S.M. Personalized laparoscopic resection of colon cancer with the use of indocyanine green lymph node mapping: Technical and clinical outcomes. *Asian J. Endosc. Surg.* **2022**, *15*, 563–568. [CrossRef]
9. Kuipers, E.J.; Grady, W.M.; Lieberman, D.; Seufferlein, T.; Sung, J.J.; Boelens, P.G.; van de Velde, C.J.; Watanabe, T. Colorectal cancer. *Nat. Rev. Dis. Primers* **2015**, *1*, 15065. [CrossRef]
10. Coppola, A.; La Vaccara, V.; Cascone, C.; Farolfi, T.; Carbone, L.; Greco, C.; Ramella, S.; Ciccozzi, M.; Angeletti, S.; Coppola, R.; et al. Laparoscopic total mesorectal excision (L-TME) for rectal cancer surgery: Does elective diverting ileostomy really protect? An observational retrospective cohort study. *Ann. Ital. Chir.* **2021**, *92*, S0003469X21036101. [PubMed]
11. Stafford, C.; Francone, T.; Roberts, P.L.; Marcello, P.W.; Ricciardi, R. What influences conversion to open surgery during laparoscopic colorectal resection? *Surg. Endosc.* **2021**, *35*, 1584–1590. [CrossRef]
12. Joosten, J.J.A.; Strobbe, L.J.A.; Wauters, C.A.P.; Pruszczynski, M.; Wobbes, T.; Ruers, T.J.M. Intraoperative lymphatic mapping and the sentinel node concept in colorectal carcinoma. *J. Br. Surg.* **1999**, *86*, 482–486. [CrossRef]
13. Nagata, K.; Endo, S.; Hidaka, E.; Tanaka, J.I.; Kudo, S.E.; Shiokawa, A. Laparoscopic sentinel node mapping for colorectal cancer using infrared ray laparoscopy. *Anticancer Res.* **2006**, *26*, 2307–2311.
14. Cassinotti, E.; Al-Taher, M.; Antoniou, S.A.; Arezzo, A.; Baldari, L.; Boni, L.; Bonino, M.A.; Bouvy, N.D.; Brodie, R.; Carus, T.; et al. European Association for Endoscopic Surgery (EAES) consensus on Indocyanine Green (ICG) fluorescence-guided surgery. *Surg. Endosc.* **2023**, *37*, 1629–1648. [CrossRef]
15. Garoufalia, Z. The promise of indocyanine green in colorectal surgery. *Lancet Gastroenterol. Hepatol.* **2024**, *9*, 897–898. [CrossRef] [PubMed]
16. Lin, J.; Zheng, B.; Lin, S.; Chen, Z.; Chen, S. The efficacy of intraoperative ICG fluorescence angiography on anastomotic leak after resection for colorectal cancer: A meta-analysis. *Int. J. Color. Dis.* **2021**, *36*, 27–39. [CrossRef]
17. Somashekhar, S.P.; Reddy, G.R.K.; Deshpande, A.Y.; Ashwin, K.R.; Kumar, R. A prospective study of real-time identification of line of transection in robotic colorectal cancer surgery by ICG. *J. Robot. Surg.* **2021**, *15*, 369–374. [CrossRef]
18. Faber, R.A.; Meijer, R.P.J.; Droogh, D.H.M.; Jongbloed, J.J.; Bijlstra, O.D.; Boersma, F.; Braak, J.P.B.M.; Kranenbarg, E.M.-K.; Putter, H.; Holman, F.A.; et al. Indocyanine green near-infrared fluorescence bowel perfusion assessment to prevent anastomotic leakage in minimally invasive colorectal surgery (AVOID): A multicentre, randomised, controlled, phase 3 trial. *Lancet Gastroenterol. Hepatol.* **2024**, *9*, 924–934. [CrossRef]
19. Chand, M.; Keller, D.S.; Joshi, H.M.; Devoto, L.; Rodriguez-Justo, M.; Cohen, R. Feasibility of fluorescence lymph node imaging in colon cancer: FLICC. *Tech. Coloproctol.* **2018**, *22*, 271–277. [CrossRef] [PubMed]
20. Watanabe, M.; Murakami, M.; Ozawa, Y.; Yoshizawa, S.; Matsui, N.; Aoki, T. Intraoperative Identification of Colonic Tumor Sites Using a Near-Infrared Fluorescence Endoscopic Imaging System and Indocyanine Green. *Dig. Surg.* **2017**, *34*, 495–501. [CrossRef] [PubMed]
21. Zhang, C.; Zhang, L.; Xu, T.; Xue, R.; Yu, L.; Zhu, Y.; Wu, Y.; Zhang, Q.; Li, D.; Shen, S.; et al. Mapping the spreading routes of lymphatic metastases in human colorectal cancer. *Nat. Commun.* **2020**, *11*, 1993. [CrossRef] [PubMed]
22. Leake, I. Understanding the routes of metastasis in colorectal cancer. *Nat. Rev. Gastroenterol. Hepatol.* **2014**, *11*, 270. [CrossRef]

23. Benson, A.B.; Venook, A.P.; Adam, M.; Chang, G.; Chen, Y.-J.; Ciombor, K.K.; Cohen, S.A.; Cooper, H.S.; Deming, D.; Garrido-Laguna, I.; et al. Colon Cancer, Version 3.2024, NCCN Clinical Practice Guidelines in Oncology. *J. Natl. Compr. Cancer Netw.* **2024**, *22*, e240029. [CrossRef]
24. Zeng, J.; Su, G. High ligation of the inferior mesenteric artery during sigmoid colon and rectal cancer surgery increases the risk of anastomotic leakage: A meta-analysis. *World J. Surg. Oncol.* **2018**, *16*, 157. [CrossRef]
25. Liu, R.Q.; Elnahas, A.; Tang, E.; Alkhamesi, N.A.; Hawel, J.; Alnumay, A.; Schlachta, C.M. Cost analysis of indocyanine green fluorescence angiography for prevention of anastomotic leakage in colorectal surgery. *Surg. Endosc.* **2022**, *36*, 9281–9287. [CrossRef] [PubMed]
26. Mathew, G.; Sohrabi, C.; Franchi, T.; Nicola, M.; Kerwan, A.; Agha, R. Preferred reporting of case series in surgery (PROCESS) 2023 guidelines. *Int. J. Surg.* **2023**, *109*, 3760–3769. [CrossRef] [PubMed]