

CASE REPORT

Indocyanine Green Fluorescence-Guided Small-Bowel Preservation after Severe Blunt Mesenteric Injury; a Case Report

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Abstract: Assessment of bowel viability after severe mesenteric trauma can be difficult despite a macroscopically pink intestine. A 38-year-old man presented in hemorrhagic shock after falling down stairs. Laparotomy revealed an approximately 8 x 8 cm mesenteric defect with arterial bleeding. After ligation and repair, a 2-cm bowel segment depended on a 7-8-mm residual mesenteric bridge. Focal venous congestion raised concern despite preserved color and mesenteric pulsations. Resection of at least 10 cm was considered to obtain healthy anastomotic margins beyond the surrounding mesenteric contusion and hematoma. After approximately 20 minutes of observation, 15 mg of indocyanine green was administered intravenously. Fluorescence appeared later in the questionable segment than in adjacent bowel and subsequently became clearly visible; the delay was not quantified. Combined with conventional assessment, this finding supported bowel preservation. Recovery was uncomplicated, and the patient reported no complaints at follow-up more than one month after surgery. This case illustrates short-term bowel preservation with indocyanine green as an adjunct to surgical judgment; longer follow-up is needed to exclude delayed ischemic stricture.

Keywords: Abdominal Injuries; Indocyanine Green; Mesentery; Intestine; Small; Optical Imaging

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1. Introduction

Blunt mesenteric injury may cause hemorrhage, bowel devascularization, and delayed ischemic complications; diagnosis can be difficult when abdominal computed tomography (CT) is technically limited (1). Intraoperative assessments using color, peristalsis, mesenteric pulsations, and bleeding remain subjective. Indocyanine green (ICG) fluorescence provides adjunctive perfusion information in emergency surgery (2). Trauma experience with ICG remains limited: a case report described avoiding resection (3), a case series reported changes in perfusion assessment and resection margins (4), and a retrospective cohort found an association with fewer complications after intestinal resection, without establishing causality (5). Emergency-surgery evidence remains heterogeneous (6). Here, we report small-bowel preservation after severe blunt mesenteric injury using combined conventional and ICG assessment.

1.1. Case Presentation

A 38-year-old previously healthy man was transferred by helicopter after falling down stairs. He was awake but acutely intoxicated. On arrival, blood pressure was 75/40 mmHg, heart rate was approximately 75 beats/min, and oxygen saturation was 98% on room air. The abdomen was diffusely tender with an epigastric contusion. Hemoglobin was 89 g/L, platelet count $266 \times 10^9/L$, and international normalized ratio (INR) 1.04. Prehospital resuscitation included approximately 4.5 L of crystalloid and 1 g of tranexamic acid.

Technically limited contrast-enhanced abdominal CT scan showed extensive hemoperitoneum without free air or solid-

organ injury, suggesting mesenteric bleeding (Figure 1). Persistent shock prompted emergency midline laparotomy.

Approximately 1,800 mL of free blood and 500 mL of clot were evacuated; 10 large laparotomy pads were heavily blood-soaked. No other intra-abdominal injury was found. At the jejunoileal transition, approximately midway along the small bowel, there was an 8 x 8 cm mesenteric defect without bowel-wall injury or perforation. An approximately 2-mm mesenteric arterial branch had been transected. One end produced pulsatile bleeding and the other demonstrated back-bleeding; both were ligated. The defect was closed with interrupted sutures without narrowing the remaining vascular pedicle.

An approximately 2-cm bowel segment remained attached to a 7-8-mm residual mesenteric bridge. The bowel was pink with visible mesenteric arterial pulsations, but focal reticular venous congestion raised concern. Peristalsis was insufficient for assessment; intraoperative Doppler was unavailable. No bowel-wall bleeding test or formal capillary refill assessment was performed. Resection of at least 10 cm was considered to place anastomotic margins beyond surrounding mesenteric contusion and hematoma in macroscopically healthy bowel and mesentery. Residual bowel length was not limiting; the priority was suitable anastomotic margins.

After hemostasis and approximately 20 minutes of observation, ICG assessment was performed. During the estimated assessment period, intermittent noninvasive blood pressure recordings were approximately 85-90/50-55 mmHg (estimated mean arterial pressure 62-67 mmHg), with heart rate 65-70 beats/min and no vasopressors. VERDYE (25 mg/vial; Diagnostic Green Ltd., Athlone, Ireland) was reconstituted to 5 mg/mL, and a single 15-mg intravenous bolus was given. Near-infrared imaging was performed using an Olympus VISERA ELITE II system (OTV-S300 video system center; CLV-S200-IR light source; Olympus Medical Systems Corp., Tokyo, Japan).

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During real-time observation, fluorescence appeared later in the questionable segment than in adjacent bowel, then became clearly visible throughout its wall; the delay was not quantified (Figure 2). Combined assessment supported bowel preservation. Figure 2 photographs were retrospectively selected from a larger series taken from the monitor by a team member during assessment, to illustrate fluorescence progression.

A later intraoperative arterial blood gas showed pH 7.244, lactate 3.0 mmol/L, base excess -9.8 mmol/L, hemoglobin 95 g/L, and ionized calcium 0.94 mmol/L. Perioperative resuscitation included seven units of packed red blood cells, two units of fresh frozen plasma, two pooled platelet concentrates (eight constituent units), 2 g of fibrinogen, 50 mL of calcium gluconate, and 3.5 L of crystalloid. Vasoactive support was not required.

The patient was extubated the same day and was stable and afebrile by postoperative day 1, with a soft abdomen and audible peristalsis. Oral intake and bowel function recovered without reintervention; discharge occurred on day 6. On day 10, bowel movements were normal, with no colicky pain and resumption of usual activities. Subsequent visits included suture removal on day 16 and maxillofacial review on day 20. At surgical outpatient review on September 6, 2026, more than one month after surgery, he reported no complaints; wounds were satisfactory, without clinical evidence of herniation.

2. Discussion

Published trauma reports suggest that ICG may influence both decisions to preserve bowel and the selection of resection margins (3-5). However, evidence of improved outcomes remains limited. In a retrospective study of 100 patients with penetrating abdominal trauma, 20 underwent ICG fluorescence angiography and 80 served as controls. Overall postoperative complications were less frequent in the ICG group, whereas differences in anastomotic leakage and reoperation were not statistically significant (7). These findings support further evaluation, but their applicability to blunt mesenteric injury is limited by the different injury mechanism and nonrandomized design.

Delayed progressive fluorescence has been described in preserved bowel (8), but indicates perfusion at assessment rather than guaranteed viability. Our decision integrated bowel color, mesenteric pulsations, absence of bowel-wall injury, observation after hemostasis, hemodynamic context, and mural fluorescence. Without ICG information, the narrow mesenteric attachment and venous congestion would have favored resection. The particular challenge in our case was an intact bowel wall supplied through a very narrow residual mesenteric bridge after hemorrhage control. Thus, the potential value of ICG was to inform an uncertain preservation decision, rather than to assess an anastomosis following resection.

No validated quantitative ICG threshold defines bowel viability after traumatic mesenteric injury. Time-to-fluorescence and intensity-curve parameters have been investigated, but heterogeneous protocols and imaging systems limit comparability; standardization and validation remain necessary (2, 9).

Shock and low cardiac output can delay systemic ICG delivery, complicating interpretation of regional fluorescence (2). A small porcine study found no significant effect of increasing norepinephrine on time-to-peak fluorescence, but cannot es-

tablish reliability in hemorrhagic trauma (10). Despite hemorrhage control and no vasopressors, our patient's relatively low pressure remained a potential confounder.

The assessment was qualitative; unavailable video and timestamps precluded timing and intensity analysis. Follow-up beyond one month supports short-term preservation but cannot exclude delayed ischemia or post-traumatic stricture (11). Longer follow-up is needed to establish durable preservation. ICG should remain an adjunct to conventional assessment, not an independent determinant of bowel viability.

3. Conclusion

In this case, intraoperative indocyanine green fluorescence provided additional perfusion information and supported small-bowel preservation after severe blunt mesenteric injury when conventional assessment remained equivocal. Fluorescence findings should be interpreted alongside conventional surgical findings and the patient's hemodynamic status. The uncomplicated course beyond one month supports short-term bowel preservation, while longer follow-up is needed to assess delayed ischemic complications.

4. Declarations

4.1. Acknowledgments

None.

4.2. Conflict of interests

The authors declare no conflicts of interest.

4.3. Funding and supports

None.

4.4. Authors' contributions

All authors participated in the clinical care and/or data collection relevant to this report. The first and second authors conceived the report; the first author prepared the initial draft; and the second author supervised manuscript development. All authors critically revised the manuscript, approved the final version, and agree to be accountable for all aspects of the work.

4.5. Ethical considerations

This case report was prepared in accordance with the ethical principles of the Declaration of Helsinki. Institutional ethics committee approval was not required for this single-patient case report in accordance with institutional policy.

4.6. Informed consent

Ethics and patient consent Written informed consent was obtained from the patient for the use of anonymized clinical information and medical images for scientific and educational dissemination.

4.7. Availability of supporting data

Deidentified clinical information supporting this report is available from the corresponding author upon reasonable request, subject to applicable privacy and institutional restrictions.

4.8. Using artificial intelligence chatbots

ChatGPT (OpenAI) was used to assist with English-language editing, manuscript organization, and journal-formatting

tasks. It was not used to generate clinical data or make clinical decisions. All clinical content and references were independently reviewed and verified by the authors, who take full responsibility for the final manuscript.

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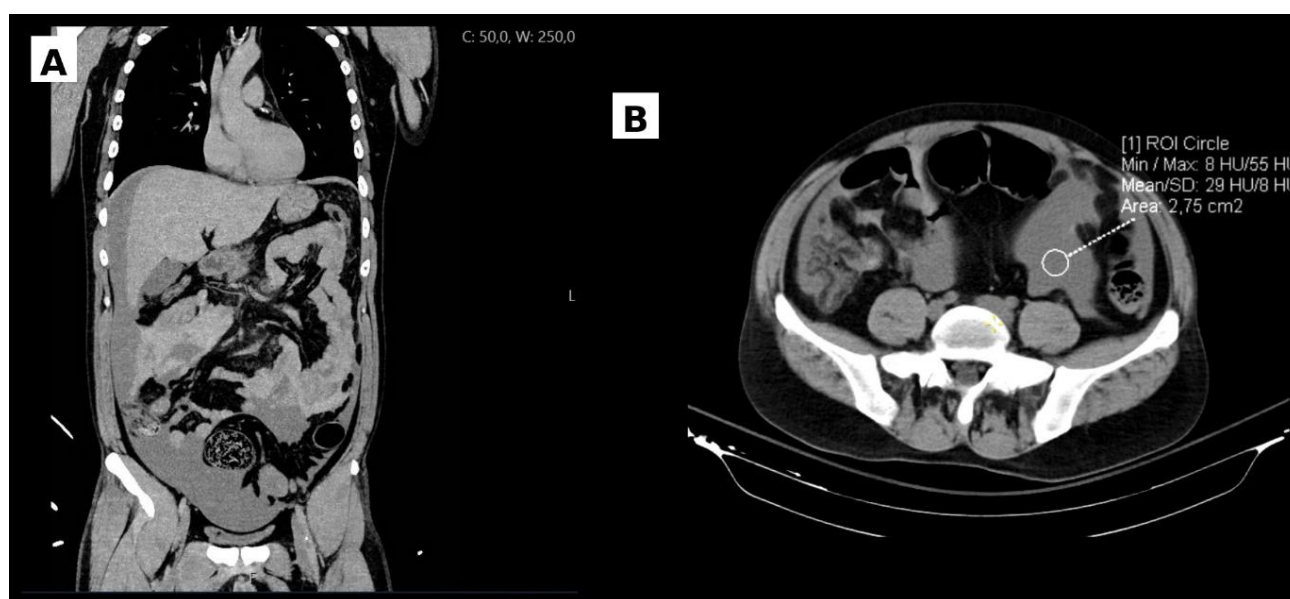


Figure 1: Technically limited contrast-enhanced abdominal computed tomography scan. (A) Coronal reconstruction shows free intra-peritoneal fluid around bowel loops and in the pelvis. (B) Axial image shows intermediate-density intraperitoneal fluid consistent with hemoperitoneum. No solid-organ injury was identified; adequate postcontrast phases could not be obtained.

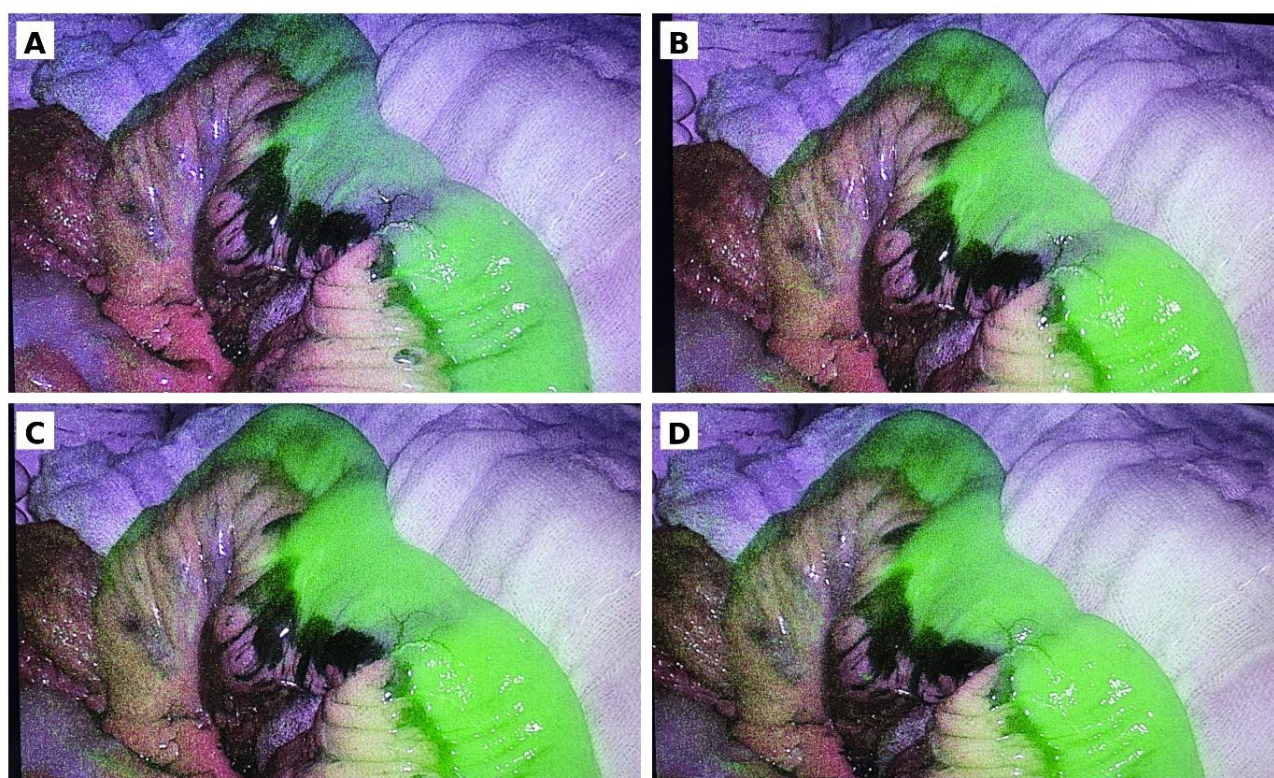


Figure 2: Sequential indocyanine green (ICG) photographs after a 15-mg intravenous bolus. (A-D) Progression to definite mural fluorescence beside the nonfluorescent mesenteric defect. Panels were retrospectively selected from sequential monitor photographs taken by a team member and are shown in acquisition order. Video and timestamps were unavailable; intervals cannot be reconstructed. The relative delay was observed intraoperatively, not measured from these photographs.