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Indocyanine green lymphography as a method for the diagnostics and management of a hylous ascitis. Clinical case

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Chylous ascites is an uncommon complication following invasive procedures, occurring in fewer than 5 % of cases. Most patients with low output lymphorrhea respond favourably to conservative management. However, in cases of persistent lymphatic leakage, surgical intervention may be warranted.

Case presentation. A 42-year-old male developed lymphorrhea following ultrasound-guided percutaneous drainage of a large perisplenic hematoma and hemoperitoneum. Despite repeated drainage of ascitic fluid (performed three times) and conservative therapy, including dietary modifications, the patient exhibited persistent chylous ascites that necessitated surgical intervention. A total of five abdominal computed tomography (CT) scans and two magnetic resonance imaging (MRI) studies failed to identify the site of lymphatic leakage. The patient was admitted to Riga East Clinical University Hospital, where additional CT and MRI imaging of the abdomen was performed. Surgical treatment was scheduled. During laparotomy, intraoperative fluorescence lymphography was employed using near-infrared imaging with indocyanine green (ICG) injection. Lymphatic leakage was identified in the vicinity of the left diaphragmatic crus. Approximately three minutes after paraaortic administration of ICG, intact lymphatic vessels became visible, and within five minutes, the precise site of leakage was localized via fluorescence-guided extravasation. The leaking lymphatic vessel was coagulated and sealed using a TachoSil® hemostatic patch. A surgical drain was placed adjacent to the repair site for postoperative monitoring. No recurrence of chylous ascites was observed during a four-month follow-up period. Intraoperative identification of lymphatic leakage remains challenging due to the small calibre of lymphatic vessels and the low-pressure flow of lymph, which is often imperceptible to the unaided eye. Fluorescence-guided lymphography using ICG significantly enhances intraoperative visualization of compromised lymphatic structures. In cases of refractory chylous ascites, surgical management incorporating this technique appears to be both safe and effective.

Conclusions. This case highlights the successful surgical management of refractory chylous ascites utilizing intraoperative indocyanine green fluorescence lymphography, which enabled precise identification and closure of the lymphatic leakage site.

Keywords
fluorescence guided surgery, indocyanine green, lymphography, lymphorrhea, lymphatic leakage, chylous ascites, image guided surgery, fluorescence lymphography, acute pancreatitis.

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Chylous ascites is an uncommon clinical condition, with incidence rates varying depending on patient population and clinical context. It is most frequently associated with disorders that disrupt lymphatic flow, such as lymphomas, malignancies, or infections involving the lymphatic system. Overall, chylous ascites accounts for less than 1 % of all ascites cases, including those due to cirrhosis and malignancy. In cirrhotic patients, the incidence ranges from 0.5 % to 1.0 %, while in malignancy-associated ascites it can reach up to 6.7 % [26].

Although lymphatic leaks are relatively rare, they can pose considerable clinical challenges. For instance, the incidence of lymphatic leakage following pancreatic resections is approximately 2.6% [17], while in gynaecological surgeries involving pelvic and/or para-aortic lymph node dissection, the rate is around 0.17% [20]. The management of such leaks is often complex and requires multimodal approaches. Traditional non-invasive and minimally invasive methods include percutaneous drainage and aspiration. More targeted techniques, such as lymphatic vessel ligation and sclerotherapy, may also be employed [14]. Given the higher incidence of lymphatic injury in vascular surgery – reported in up to 18% of arterial procedures – microsurgical interventions, including lymphatic-lymphatic and lymphatic-venous anastomoses, are increasingly utilized in managing lymphatic leakage and associated lymphedema [24].

We present the case of a patient who developed high output lymphorrhea and refractory chylous ascites following acute pancreatitis complicated by a large perisplenic hematoma and hemoperitoneum. After undergoing endovascular embolization of the splenic artery and percutaneous drainage via ultrasound-guided pigtail catheter placement, the patient developed persistent chylous ascites. Definitive treatment was ultimately achieved using intraoperative fluorescence-guided lymphography.

Case presentation

A 42-year-old male was admitted to Riga East Clinical University Hospital with persistent high-output chylous ascites and lymphorrhea. These symptoms developed following abdominal hemorrhage due to ruptured splenic artery pseudoaneurysm complicated with a large perisplenic and intra-abdominal hematoma, which had been managed previously with ultrasound-guided drainage using a pigtail catheter.

This event resulted in chronic chylous ascites that persisted over a seven-month period. Prior to his referral to our institution, the patient was managed conservatively in one of largest hospitals in United Kingdom. Treatment included strict dietary modifications intended to reduce lymph production. During this time, he underwent three therapeutic paracenteses, five computed tomography (CT) scans, and two magnetic resonance imaging (MRI) examinations for the detection of possible lymphatic duct leakage. Ascitic fluid analysis showed markedly elevated triglyceride levels (16 mmol/L), low protein content, and no evidence of infection–findings consistent with chylous ascites.

The initial episode occurred on July 1, 2024, when the patient presented to a regional hospital in the UK with acute abdominal pain, generalized weakness, and dyspnoea. Laboratory investigations revealed severe anaemia (haemoglobin 5.1 g/dL), necessitating transfusion of five units of packed red blood cells. CT angiography demonstrated a splenic artery pseudoaneurysm, a large perisplenic and epigastric hematoma, hemoperitoneum, and multiple pancreatic pseudocysts. On July 2, the patient underwent endovascular embolization of the splenic artery. He was transferred from the intensive care unit (ICU) to the surgical ward on July 3.

Follow-up abdominal CT on July 15 showed no significant progression of the intra-abdominal hematoma. On July 18, ultrasound-guided percutaneous drainage of the epigastric hematoma was performed, yielding 300 mL of haemorrhagic fluid. A subsequent CT scan on July 20 revealed a marked reduction in the size of the haemorrhagic collection. The drainage catheter was removed on July 26, and the patient was discharged two days later.

The first signs of ascites appeared four months after the initial intervention. In November 2024, the patient underwent the first ultrasound-guided percutaneous drainage procedure due to progressive abdominal distension and discomfort. Approximately 8 litres of milky white ascitic fluid were drained. A second drainage procedure was performed one month later, yielding 11 litres of similar fluid. Despite additional CT and MRI imaging, the site of lymphatic leakage could not be localized. A third drainage was performed on January 21, 2025, shortly before the patient travelled to Latvia for further evaluation.

Upon admission to Riga East Clinical University Hospital on January 28, 2025, the patient reported mild abdominal pain, controlled with tramadol. He also described constitutional symptoms, including a 10 kg weight loss over six months. On physical examination, he was 184 cm tall and weighed 71 kg, reflecting a significant catabolic state. Persistent high output lymphorrhea was observed, with daily drainage volumes ranging from 800 to 1200 mL. Repeated CT imaging of the abdomen was performed but failed to identify the precise site of lymphatic leakage. MRI revealed mild fibrotic changes in retroperitoneal adipose tissue and a linear structure adjacent to the splenic vein, near the left diaphragmatic crus (Fig. 1). Although suggestive, these findings did not definitively confirm the location of the lymphatic leak. Due to the patient's deteriorating clinical condition–including severe malnutrition, chronic pain, ongoing protein and electrolyte losses, and increased risk of life-threatening complications–a multidisciplinary decision was made to proceed with surgical intervention. Since preoperative

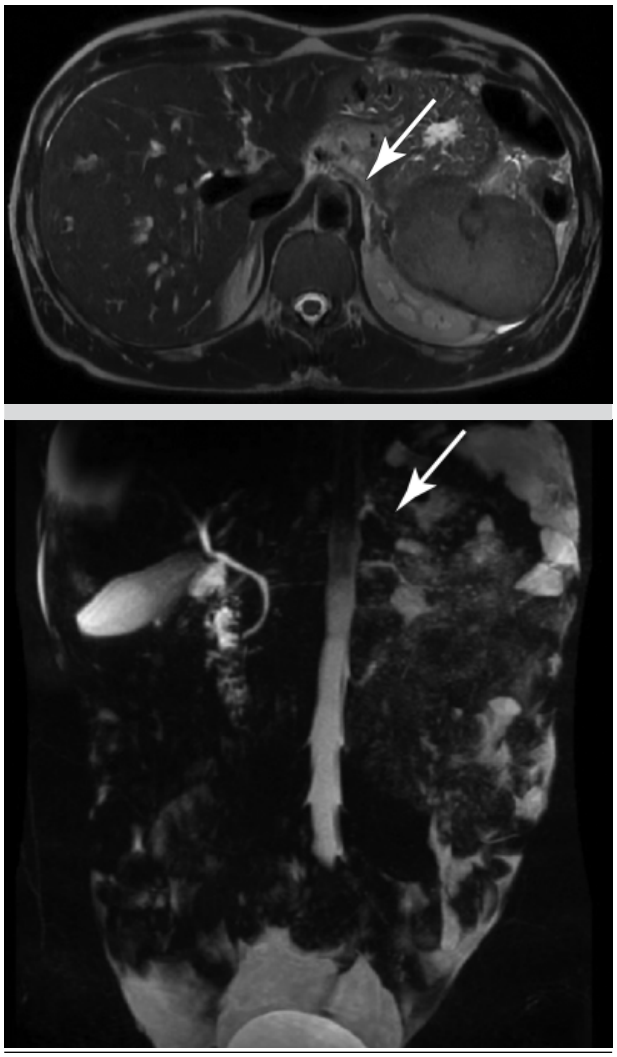

Figure 1. **MRI findings (arrow) – linear structure at the projection of the splenic vein close to the left pedicle of the diaphragm**

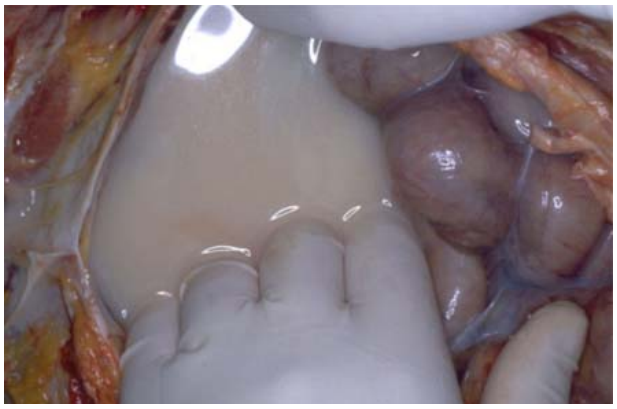

Figure 2. **White, milky content known as chylous ascites**

lymphangiography was not feasible, intraoperative fluorescence-assisted lymphography with indocyanine green (ICG) was selected to enable real-time localization of the lymphatic leak and guide definitive surgical repair.

Surgical Management

Under general endotracheal anaesthesia, an upper midline laparotomy was performed following three consecutive rounds of surgical site preparation using antiseptic disinfectant solution. Upon entry into the peritoneal cavity, a large volume of white, milky chylous fluid was encountered (Fig. 2).

Complete evacuation was achieved using suction and copious warm saline irrigation. Dense adhesions between intestinal loops and the abdominal wall were meticulously dissected using a LigaSure device to minimize tissue trauma and haemorrhage, thereby improving exposure and access to retroperitoneal structures. The abdominal cavity was irrigated until the effluent was macroscopically clear. Subsequently, the mesenteric root was exposed to facilitate intraoperative lymphatic mapping. Indocyanine green (ICG) dye at a concentration of 2.5 mg/mL was injected (1 mL) into three retroperitoneal sites. Near-infrared fluorescence imaging was initiated one-minute post-injection. Although several small-calibre, intact lymphatic vessels were visualized, no obvious leakage site was initially observed, prompting an extension of the surgical field. The lesser sac was accessed via division of the gastrocolic ligament. Significant venous engorgement along the gastroepiploic arcade was noted, suggesting portal hypertension. Careful dissection toward the left diaphragmatic crus–corresponding to a suspicious area previously identified on MRI was performed. During this stage, a lysed, haemorrhagic splenic cyst was encountered and evacuated. To improve visualization, an additional 7.5 mg of ICG dye (1 mL per injection) was administered into three para-aortic locations. Repeat fluorescence lymphography revealed focal extravasation of the dye, indicating active lymphatic leakage. The identified site was thoroughly irrigated with 0.9 % sodium chloride solution. Following field clearance, ICG lymphography was repeated to confirm the leakage site. Targeted coagulation of the leaking vessel was performed using monopolar electrocautery. Haemostasis and lymphostasis were reinforced by applying a 10 × 5 cm TachoSil® fibrin sealant patch over the treated area with gentle compression (Fig. 3, 4). A drainage tube was positioned adjacent to the repair site for postoperative monitoring. Final irrigation was completed, and the abdomen was closed in anatomical layers using non-absorbable sutures for fascia and absorbable sutures for skin.

The intraoperative and early postoperative courses were uneventful, classified as Clavien-Dindo Grade I.

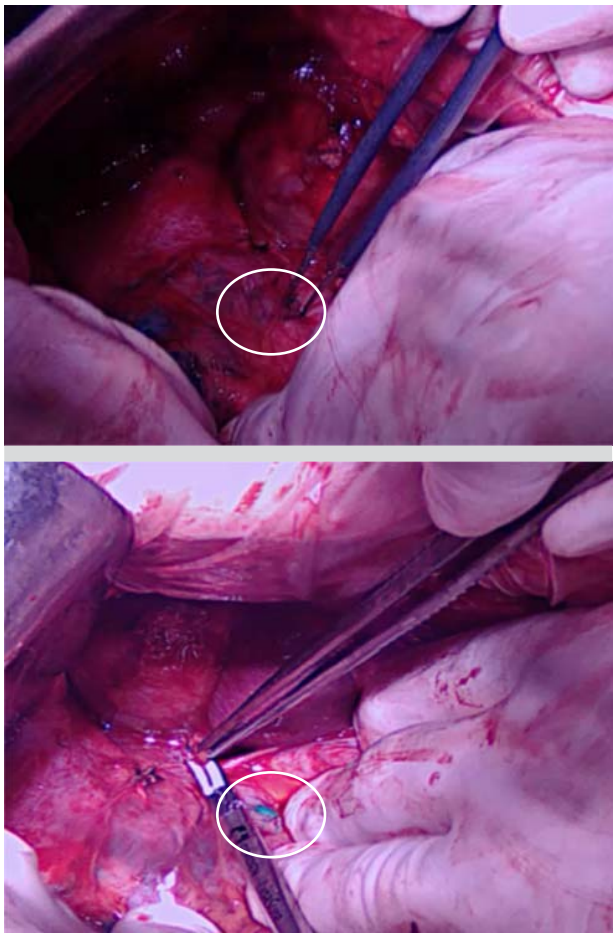

Figure 3. **Fluorescence lymphography, electrocoagulation knife coagulation of the damaged area**

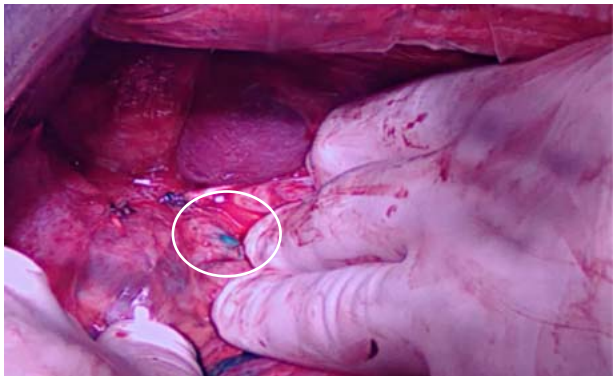

Figure 4. **Fluorescence lymphography, visualization of the damaged area**

No chylous drainage was observed over the first three postoperative days, and the drain was removed accordingly. The patient was discharged on postoperative day four in stable condition with appropriate outpatient follow-up. No recurrence of lymphatic leakage or ascites was observed during subsequent evaluations during the period from March to June.

Discussion

Chylous ascites refers to the pathological accumulation of triglyceride-rich, milky-appearing lymphatic fluid in the peritoneal cavity, typically resulting from traumatic disruption of lymphatic vessels. The condition was first described in the literature in 1912 [4]. Common ethiologies include trauma, lymphatic obstruction with consecutive rupture, malignant infiltration of the cisterna chyli, disruption of retroperitoneal lymphatic pathways or the thoracic duct, and elevated peritoneal lymphatic pressure [7]. Loss of chyle from the lymphatic system compromises nutritional, immunological, and fluid balance. Key complications include severe protein depletion, electrolyte imbalance, immunosuppression, and dehydration. These complications are particularly pronounced in high output lymphorrhea (> 1000 mL/day) [21], and thus necessitate early diagnosis and timely intervention to mitigate morbidity and preserve quality of life. Conservative therapy remains the first-line approach and includes dietary modification (low-fat, high-protein, MCT-enriched diet), total parenteral nutrition, and pharmacologic agents such as somatostatin or octreotide. However, resolution is only achieved in approximately 62 % of patients treated conservatively [1], highlighting the importance of timely surgical referral in refractory cases. The intraoperative identification of lymphatic injury is technically challenging due to the microscopic size of lymphatic vessels. While the thoracic duct measures 2–5 mm in diameter [23], most abdominal lymphatics are < 1 mm and capillaries range from 10–60 μm [19], making them difficult to visualize intraoperatively without adjunctive tools. Patients with postoperative lymphatic leakage often present with non-specific symptoms–progressive abdominal distension, dyspnoea, fatigue, malnutrition, and hypoalbuminemia [5]. Diagnostic evaluation includes biochemical analysis of ascitic or drainage fluid (appearance, triglyceride concentration), imaging (CT, MRI), lymphangiography, lymphoscintigraphy, and diagnostic paracentesis [12]. Lymphatic injuries, although rare, may occur even after minimally invasive procedures. Reported incidences range from 2.6 % in left colectomies to 9.6 % in right colectomies [18, 27], reflecting proximity of key lymphatic structures to retroperitoneal dissection planes. Surgical intervention is generally reserved for cases unresponsive to conservative therapy. Standard operative strategies include laparotomy or laparoscopy with identification and ligation of the leaking lymphatic channel, often augmented by haemostatic sealants (e.g., fibrin glue, oxidized cellulose) [6, 8]. Preoperative localization improves success rates to nearly 97 % [18], but guidelines for

management when the site remains unidentified are lacking. In this case, intraoperative ICG fluorescence lymphography was used successfully to localize and treat a persistent lymphatic leak when conventional imaging failed. Although only a few cases employing this technique have been reported, ICG lymphography offers clear advantages by providing real-time visualization of lymphatic flow and allowing precise targeting of the leak.

Conclusions

Chylous ascites remains a rare but challenging complication, particularly in patients with high output lymphorrhea refractory to conservative management. Surgical intervention is often required, yet intraoperative identification of the leaking lymphatic vessel is frequently impeded by the anatomical complexity and extremely small size of the lymphatic system. This case highlights the clinical utility of intraoperative ICG fluorescence lymphography as an effective diagnostic and therapeutic adjunct in the surgical treatment of chylous ascites. By enabling real-time visualization of lymphatic structures and extravasation, ICG lymphography facilitates accurate localization and targeted intervention, significantly improving outcomes. Only a limited number of such cases have been described in the literature, emphasizing the need for broader clinical experience and research. Further studies are needed to establish standardized protocols for ICG use in lymphatic surgery and to evaluate its long-term efficacy in the management of chylous ascites. Nonetheless, this case exemplifies the value of innovative intraoperative techniques in resolving complex surgical dilemmas and advancing patient care.

Declaration of interests

The authors declare that they have no conflict of interests.

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Ethics approval and written informed consent statements

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Authors contributions

Acquisition of data – J. Pāvulāns, S. Lūkina, R. Laguns, V. Lobarevs, H. Plaudis; drafting the article – J. Pāvulāns, S. Lūkina, H. Plaudis; critical revision of the article – J. Pāvulāns, H. Plaudis.

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Лімфографія з індоціаніном зеленим як метод діагностики та лікування гілозивного асциту. Клінічний випадок

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Хільозний асцит є рідкісним ускладненням після інвазивних процедур, що трапляється менш ніж у 5 % випадків. Більшість пацієнтів із низьким рівнем лімфореї добре реагують на консервативне лікування, але у випадках, коли витік лімфи триває, може знадобитися хірургічне втручання.

Клінічний випадок. Описано випадок 42-річного чоловіка, який отримав пошкодження лімфатичної судини після черезшкірного дренування великої перипанкреатичної гематоми та гемоперитонеуму під контролем УЗД. Попри багаторазове дренування (тричі) та консервативну терапію (зміна дієти), у пацієнта спостерігався стійкий хільозний асцит, що потребував хірургічного втручання. Загалом було проведено п'ять комп'ютерних томографій (КТ) черевної порожнини та дві магнітно-резонансні томографії (МРТ), проте місце витоку лімфи виявити не вдалося. Пацієнта було госпіталізовано до Ризької Східної клінічної університетської лікарні, де було проведено додаткові КТ та МРТ черевної порожнини та заплановано хірургічне лікування. Під час лапаротомії була застосована інтраопераційна флюоресцентна лімфографія з введенням індоціаніну зеленого в ближньому інфрачервоному діапазоні. Витік лімфи було виявлено в ділянці лівої ніжки діафрагми. Приблизно через три хвилини після парааортального введення індоціаніну зеленого стали видимими інтактні лімфатичні судини, а протягом п'яти хвилин за допомогою флуоресцентно-керованої екстравазації точне місце витоку лімфи було локалізовано. Пошкоджена судина була коагульована та герметизована за допомогою гемостатичної губки TachoSil. У ділянці втручання було встановлено хірургічний дренаж для післяопераційного контролю. Протягом чотиримісячного періоду спостереження рецидивів хільозного асциту не спостерігалося. Інтраопераційне визначення витоку лімфи залишається складним завданням через малий калібр лімфатичних судин і витік лімфи під низьким тиском, що робить процес непомітним для неозброєного ока. Використання інтраопераційної флюоресцентної лімфографії з індоціаніном зеленим може значно полегшити виявлення пошкоджених лімфатичних структур. У випадках стійкого хільозного асциту хірургічне лікування із застосуванням цієї методики є безпечним та ефективним.

Висновки. Наведений випадок демонструє успішне хірургічне лікування стійкого хільозного асциту з використанням інтраопераційної флуоресцентної лімфографії з введенням індоціанінового зеленого для точного визначення місця витоку лімфи та його закриття.

Ключові слова: флуоресцентно-асистована хірургія, індоціанін зелений, лімфографія, лімфорея, витік лімфи, хільозний асцит, хірургія під візуалізаційним контролем, флуоресцентна лімфографія, гострий панкреатит.

FOR CITATION

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