

Utility of Indocyanine Green Fluorescence Lymphography in Identifying the Source of Persistent Groin Lymphorrhea

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Summary: Surgical manipulation of the groin can result in lymphatic injury in a significant number of patients leading to poor wound healing or infectious complications. Surgical repair of lymphatic injury is greatly aided by the precise and prompt intraoperative localization of the injured lymphatic vessels. We assessed and identified lymphatic leaks in 2 cases of surgical wound lymphorrhea occurring after instrumentation of the groin using laser-assisted indocyanine green lymphography paired with isosulfan blue injection. Both cases healed without complication, and no lymphatic leak recurrence was observed during postoperative follow-up. Laser-assisted indocyanine green lymphography is a useful adjunct in the management of lymphatic leaks after surgery of the groin and may have potential for prophylactic evaluation of high-risk groin wounds. (*Plast Reconstr Surg Glob Open* 2014;2:e210; doi: 10.1097/GOX.000000000000135; Published online 9 September 2014.)

Surgical manipulation of the groin can lead to persistent lymphorrhea or lymphoceles with a reported incidence of 1.8%–18.9%.¹ The wound complications associated with such leaks lymphatic leak can lead to prolonged hospital stays,

additional operations, and increased healthcare costs for the patient and society.²

Initial management with pressure dressings and immobilization can progress to include aspiration, drain placement, sclerosant, radiotherapy, negative pressure wound therapy, lymphovenous anastomosis, surgical tissue transfer, and exploration with lymphatic ligation.^{2–5} Up to half of all patients with lymphatic leak develop an associated infection which can be catastrophic in the setting of a vascular graft.⁴

Vital dyes, such as isosulfan blue (Lymphazurin, Tyco Healthcare, Norwalk, Conn.), are commonly used for intraoperative identification of lymphatic leaks, thereby reducing time to resolution, complications, and need for reoperation.⁶ Indocyanine green (ICG) imaging is an emerging modality for lymphatic vessel visualization. We report the utility of laser-assisted ICG lymphography for intraoperative identification of lymphatic leaks presenting after surgical groin manipulation.

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PATIENTS AND METHODS

Using ICG lymphography, we identified and ligated symptomatic lymphatic leaks in 2 patients (1 man, 1 woman; 50–58 years old) occurring after surgical instrumentation of the groin for central vascular access (Table 1).

Operative Technique

Open wound exploration was carried out in a standard fashion before performance of ICG lymphography. A 1.0 mL intradermal injection of a 50:50 mixture of ICG (2.5 mg/mL; ICG for Injection USP, PULSION Medical Systems, LifeCell Corporation) and saline in the first web space of the ipsilateral lower extremity was placed intraoperatively. The centripetal progression of the dye and visual identification of the damaged lymphatic vessel were made using the SPY Elite system (LifeCell Corporation/Novadaq Technologies, Canada). The ICG dye mixture reached the level of the wound in approximately 4 minutes. Identification was verified with a similar injection of 0.5 mL of 1% isosulfan blue (Lymphazurin). The damaged lymphatic channel was suture ligated, and the wound was closed in layers over a drain.

RESULTS

Case Report 1

A 51-year-old man referred for surgical management of refractory high-volume groin wound lymphatic leak underwent intraoperative ICG lymphography as described. The lymphatic leak was easily identified and clamped before confirmation with isosulfan blue injection (Fig. 1). The damaged lymphatic channel was suture ligated, and the wound was closed in layers over a closed suction drain. Follow-up at 30 and 90 days revealed no evidence of leak recurrence, fluid collection, or extremity edema.

Case Report 2

A 58-year-old woman developed limb-threatening ischemia immediately after coronary bypass and aortic valve replacement. Thrombectomy and

patch grafting performed on the left common femoral artery was closed with a sartorius transposition flap for soft tissue coverage. Persistently high (~800 mL/d) drain output was suggestive of lymphatic leak. After conservative measures failed, the patient returned to the operating room for exploration and ligation using ICG lymphography. The lymphatic leak was identified, clipped, and the wound closed in layers over a closed suction drain. Follow-up at 32 days showed no evidence of continued lymphatic leak.

DISCUSSION

Postoperative lymphorrhea or lymphocele, seen after 1.8%–18.9% of all cases of groin surgery, increases the risk of infection, chronic wounds, and the need for additional procedures.¹ When surgical intervention is necessary, intraoperative lymphatic imaging aids the identification of involved lymphatic channels, reducing the risk of inappropriately extensive dissection and inadequate ligation. ICG dye is an emerging lymphatic imaging adjunct with demonstrated utility in sentinel node surgery and lymphatic mapping in lymphedema and intrathoracic chyle leak. Although the use of ICG lymphography was reported in one case of pudendal lymphocutaneous fistula, this series is the first to demonstrate the utility of intraoperative ICG lymphography for identification and treatment of lymphatic leaks in the groin.^{7,8}

The utility of intradermal ICG dye injection has expanded to lymphography with the use of laser-assisted near-infrared (NIR) imaging systems, allowing evaluation of lymphedema, lymphatic backflow, and lymphatic mapping.^{9–12} ICG dye is well tolerated with a side effect profile comparable with that of isosulfan blue dye as proven by more than 40 years of use for ophthalmologic angiography. Similar to isosulfan blue, ICG stains the area of lymphatic leak rendering subsequent injections less useful. ICG has the advantage over isosulfan blue of being detectable only when energized with NIR energy, leaving the operative field visually unaltered under normal lighting. Additionally, laser-assisted ICG lymphography imaging enables up to 2 cm of tissue penetration allowing real-time visualization of lymphatic flow and anticipatory localization guidance. In our series, intraoperative ICG injection identified the leak within 4 minutes.

ICG lymphography is a valuable method for intraoperative identification of lymphatic leaks and functional evaluation of the lymphatic system.^{9,10,14–16} Improved lymphatic target identification using 2 modes of lymphatic mapping is well documented in

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Table 1. Case Summary

Demographic	Site	Comorbidities	Leak	Operative Approach	Outcome
Case 1 51-year-old man	Right groin access wound for ECMO	Transposition of great vessels, orthotopic heart transplant Deconditioning	Persistent lymphocele, draining lymphocutaneous fistulae	Excision of previous surgical incision and fistula track Lymphatic identification using ICG and isosulfan blue Lymphatic ligation Drain placement	Discharged on postoperative day 3 Drain removed in 1 wk No evidence of lymphocele or fistula after 30 and 90 d
Case 2 58-year-old woman	Left groin thrombectomy and patch grafting with sartorius transposition flap wound.	Diabetes (poorly controlled) Drug abuse (narcotic) 4-Vessel CABG AVR Left lower extremity ischemic insult secondary to thrombus Pneumonia LGIB ARF Afib with RVR HTN Pleural effusion	Persistent high-volume lymphorrhea and nonhealing wound	Wound exploration Lymphatic identification using ICG and isosulfan blue Lymphatic ligation ICG angiography for flap evaluation	Discharged on postoperative day 17 No evidence of lymphocele or fistula after 32 d

Afib with RVR indicates atrial fibrillation with rapid ventricular response; ARF, acute renal failure; AVR, aortic valve replacement; CABG, coronary artery bypass graft; COPD, chronic obstructive pulmonary disease; ECMO, extracorporeal membrane oxygenation; HTN, hypertension; ICG, indocyanine green lymphography; LGIB, lower gastrointestinal bleed.

oncologic surgery with both lymphoscintigraphy and ICG imaging.¹⁷ Furthermore, ICG is more effective than isosulfan blue in sentinel node lymphography, identifying 100% of sentinel lymph nodes identified by lymphoscintigraphy, whereas isosulfan blue identified only 86%.^{18,19} When using the dual-dye technique for leak identification, ICG lymphography should be performed first so that the operative field remains visually unobscured. ICG lymphography is limited by the need for digital imaging equipment,

whereas isosulfan blue requires no additional equipment. Institutions can increase utilization of existing NIR imaging equipment through performance of lymphography procedures.

Additionally, ICG angiography with the intravenous administration of ICG can be used during the same procedure to evaluate tissue perfusion. Due to the tissue staining that occurs with lymphography, we recommend performance of ICG angiography before lymphography procedures.

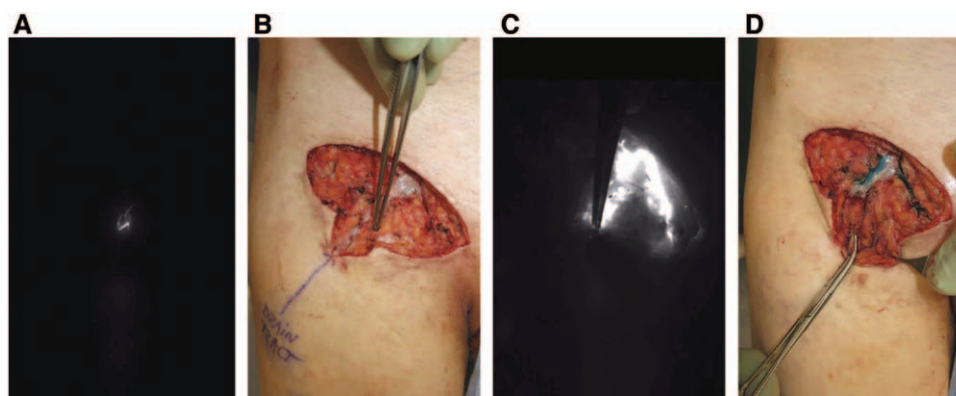


Fig. 1. Initial infrared groin imaging after injection of ICG revealed an isolated source of lymphatic egress into the epithelialized drain tract (A). This corresponded to an isolated cord-like structure (base of forceps, B). Delayed infrared imaging demonstrated marked lymph egress from this lymphatic channel (base of forceps, C). Injection of isosulfan blue colocalized the source of the leak to this lymphatic identified by ICG fluorescence lymphography (base of clamp, D).

CONCLUSIONS

ICG lymphography was successfully used to identify lymphatic leaks responsible for persistent lymphorrhea after groin surgery. The procedure provided a satisfactory outcome in 2 complicated patients with multiple comorbidities. The use of laser-assisted ICG lymphography for initial lymphatic injury identification allowed for subsequent dissection in a field that was not obscured by a visible dye. These cases demonstrate that ICG lymphography is a useful tool for the treatment of a symptomatic lymphatic leak and should be considered in the diagnostic and treatment algorithm.

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