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Navigation lymphatic supermicrosurgery for iatrogenic lymphorrhea: Supermicrosurgical lymphaticolymphatic anastomosis and lymphaticovenular anastomosis under indocyanine green lymphography navigation

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Summary *Background:* Lymphorrhea can occur after surgical intervention to the lymphatic system. Most cases with lymphorrhea can be treated conservatively, but some cases are refractory to conservative treatments and require further surgical treatments.
Methods: Eight patients developed inguinal lymphorrhea after surgical intervention in the groin region. Navigation lymphatic supermicrosurgery (NLS) was performed for the treatment of iatrogenic lymphorrhea refractory to conservative treatments. Lymphatic vessels ruptured in a lymphorrhea lesion were identified under intraoperative indocyanine green (ICG) lymphography navigation and were anastomosed to a recipient vessel; an intact lymphatic vessel or a vein was selected as a recipient. Feasibility and efficacy of the method were evaluated.
Results: Among eight inguinal lymphorrhea patients, four patients with refractory lymphorrhea underwent NLS under local anesthesia. In all cases, a lymphatic vessel that caused an intractable lymphorrhea was successfully anastomosed to a recipient vessel (to an intact lymphatic vessel in one case, and to a venule in three cases), and the lymphorrhea was completely cured without lymphorrhea recurrence or lymphedema development. Treatment duration in NLS was significantly shorter than that in conservative treatments (5.0 $\pm$ 2.4 vs. 30.0 $\pm$ 8.1 days, $P = 0.006$).

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Conclusions: Intraoperative ICG lymphography helps a surgeon to find lymphatic vessels in and near a lymphorrhea lesion, which allows secure and easier treatment for an intractable lymphorrhea with preservation of lymph drainage function.

Lymphorrhea is a disease in which lymphatic fluid flows out the body surface with or without formation of a lymphatic cyst. Lymphorrhea can occur after any kind of surgical interventions to a lymphatic system. Conservative treatments such as compression, and aspiration of retained lymph fluid in a cyst, are usually effective for the treatment of lymphorrhea. Some cases, however, are refractory to conservative treatments, and require further surgical interventions.[1–3] Exploration of a lymphorrhea lesion and macroscopic ligation of subcutaneous tissue that seems to contain causative lymphatic vessels is considered the most common surgical approach to a lymphorrhea, but has several disadvantages; it is not always effective and disrupts lymph drainage function which may result in lymphedema development.[3–5]

Reconstruction of a lymphatic vessel that causes lymphorrhea is considered an ideal treatment for lymphorrhea. It is physiologically plausible to anastomose a lymphatic vessel ruptured in a lymphorrhea lesion to a recipient vessel for lymph fluid drainage, since all lymph fluid can be returned into the systemic circulation.[6,7] Lymphatic supermicrosurgery, supermicrosurgical anastomosis of a lymphatic vessel in an intima-to-intima coaptation manner, can be the treatment of choice for an intractable lymphorrhea.[7–14] Recently, indocyanine green (ICG) lymphography has been reported to be useful not only for pathophysiological evaluation of lymphedema but also for intraoperative navigation of lymphatic supermicrosurgery.[10,14–23] We applied navigation lymphatic supermicrosurgery (NLS) in treatment for iatrogenic lymphorrhea, and evaluated feasibility and efficacy of NLS for intractable iatrogenic lymphorrhea cases.

Patients and methods

Eight patients who developed inguinal lymphorrhea (one after inguinal lymph node biopsy, and seven after harvesting a superficial circumflex iliac artery perforator flap) were included in this study. Iatrogenic lymphorrhea were treated conservatively with compression, drainage, and aspiration. Patients with an intractable lymphorrhea refractory to conservative treatments underwent NLS. Under the University of Tokyo Hospital ethical committee-approved protocol, ICG lymphography and lymphatic supermicrosurgery were performed for the treatment of iatrogenic lymphorrhea. All patients gave written consent to this study.

NLS, ICG lymphography-navigated supermicrosurgical lymphatic anastomosis, was performed as follows. Immediately before making an incision, 0.2 ml of ICG (Diagnogreen 0.25%; Daiichi Pharmatical, Tokyo, Japan) was subcutaneously injected at the second web space of the foot for intraoperative lymphatic navigation. After local infiltration anesthesia using 1% lidocaine with 1:100,000 epinephrine was injected, an incision was made on the scar from the previous surgery. Lymph flows were visualized using an infrared camera system (Photodynamic Eye (PDE™); Hamamatsu Photonics K.K., Hamamatsu, Japan) and/or an operating microscope equipped with an integrated near-infrared illumination system (OPMI Pentero Infrared 800; Carl Zeiss, Oberkochen, Germany) intraoperatively. Lymphatic vessels that caused lymphorrhea were identified under ICG lymphography navigation. After confirmation of the ruptured lymphatic vessel, recipient vessels were dissected. An intact lymphatic vessel near the ruptured lymphatic vessel was located and dissected as the recipient vessel. When there was no lymphatic vessel suitable as the vessel, a small vein or a venule was used as the recipient vessel. The ruptured lymphatic vessel was anastomosed to the recipient vessel in an intima-to-intima coaptation manner using 11/0 nylon. Anastomosis patency was confirmed with intraoperative ICG lymphography.

Feasibility, efficacy, and perioperative complications of NLS were evaluated, and treatment durations were compared between the conservative treatment group and the NLS group. Treatment duration was defined as time from the first intervention to the last intervention, time from development of lymphorrhea to the last aspiration for conservative treatment group, and time from surgery to removal of a drain for NLS group. Recurrence of lymphorrhea and development of leg lymphedema were evaluated at postoperative 1 year. Plus−minus value expressed mean ± standard deviation. Mann−Whitney *U* test was used for statistical analysis. A P value <0.05 was defined as statistically significant.

Results

Four of eight patients were refractory to conservative treatments and underwent NLS (Table 1). All lymphorrhea patients who underwent NLS were successfully treated without perioperative complications. Lymphatic vessels that caused lymphorrhea could be successfully visualized by intraoperative ICG lymphography and were anastomosed to a recipient vessel: an intact lymphatic vessel in one case and a nearby vein in three cases.

The treatment duration in the NLS group was significantly shorter than that in the conservative treatment group (5.0 ± 2.4 vs. 30.0 ± 8.1 days, $P = 0.006$). No recurrence of lymphorrhea or development of leg lymphedema was observed.