

Usefulness of preoperative echography for detection of lymphatic vessels for lymphaticovenous anastomosis

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Abstract

Case 1: A 63-year-old woman with secondary lower limb lymphedema. As it was difficult to detect the lymphatic vessels in the right thigh in indocyanine green lymphography because of thick fat, we tried echography and observed circular structures beneath the superficial fascia. Intraoperatively, we found a dilated lymphatic vessel just as observed on echography. Case 2: A 45-year-old woman with primary lower limb lymphedema. As she was allergic to iodinated contrast medium, we could not use indocyanine green lymphography preoperatively. In echography, we found vascular architectures and found the dilated lymphatic vessels intraoperatively just as observed on echography. In conclusion, application of echography in detecting the lymphatic vessels was useful as a preoperative examination of lymphaticovenous anastomosis.

Keywords

Lymphedema, lymphaticovenous anastomosis, echography, ultrasonography, lymphatic vessel

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Introduction

Lymphaticovenous anastomosis (LVA) is one of the surgical treatments performed for lymphedema of the extremities. Several reports have been published about the efficacy of LVA.^{1–7} The important, and difficult, point of this procedure is finding the lymphatic vessels with good function and the subcutaneous veins, intraoperatively. We previously reported that LVA is most effective when the dilated lymphatic vessels are used for anastomosis and that detecting them is essential.⁵

Indocyanine green (ICG) lymphography or lymphoscintigraphy is commonly used to detect lymphatic vessels preoperatively.^{8,9} Although lymphoscintigraphy can detect both deep and superficial lymphatic vessels, it is not circumstantial enough to determine the incision site.¹⁰ On the contrary, ICG lymphography represents the location of the lymphatic vessels in detail and is more sensitive for detecting early-stage lymphedema, though only superficial ones.¹⁰ In addition, ICG lymphography cannot be performed for patients with allergy to iodinated contrast medium. Inadequate preoperative detection of lymphatic vessels can lead to LVA failure.

In this case report, we present two cases for which we applied echography to detect the lymphatic vessels preoperatively. Widespread use of this procedure will ensure the detection of the lymphatic vessels and increase the success

rate of LVA. The purpose of this article was to report the efficacy of preoperative echography for detecting the lymphatic vessels. This study was approved by our institutional ethics committee (approval no. 26-6), and written informed consent was obtained from each patient.

Case 1

A 63-year-old woman underwent hysterectomy, pelvic lymph node dissection, and postoperative radiotherapy for uterine cancer 11 years prior. After 5 years, lymphedema occurred in the bilateral lower limb. Although she started wearing elastic stocking, the deformity was so severe that she could not continue it. She tried wearing elastic bandages,

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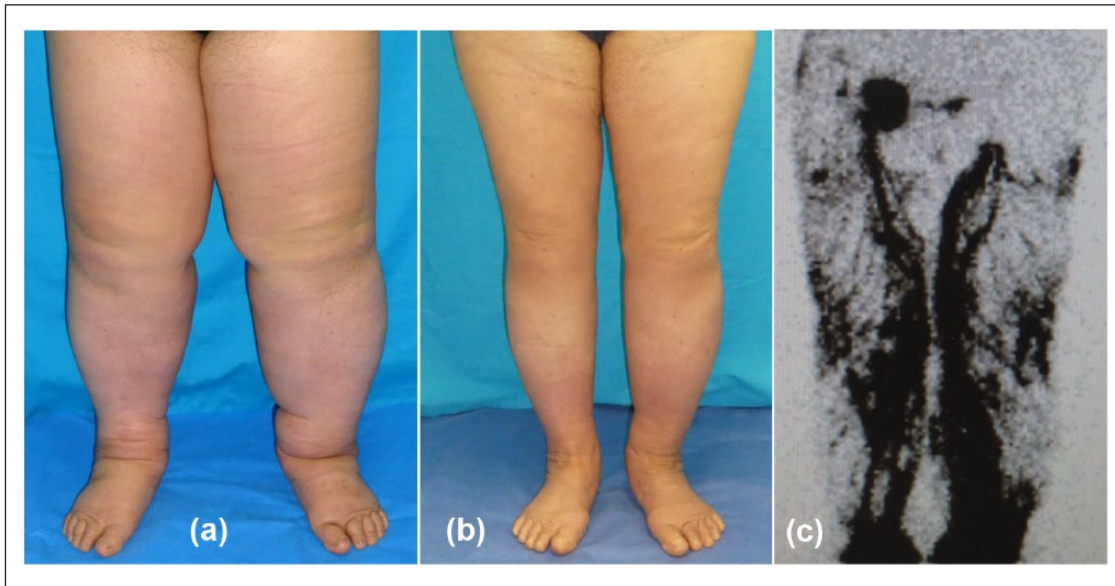


Figure 1. (a) Preoperative appearance of Case 1. Obvious edema can be observed in the bilateral legs. (b) Clinical appearance of Case 1, 7 months after lymphatic venous anastomosis. The condition of the lymphedema is improved. (c) Lymphoscintigraphic finding in Case 1. Radioisotope was injected in the bilateral dorsum of the foot. Many dilated lymphatic vessels and dermal backflow are observed in the bilateral legs.

which did not work. She also had acquired lymphangiectasia in the genital region and experienced cellulitis twice.

When she consulted our hospital, she had bilateral lower limb edema with a severe deformity (Figure 1(a)). Venous echography revealed no abnormal findings. On lymphoscintigraphy, we observed many dilated collateral lymphatic vessels and dermal backflow in the bilateral lower extremities (Figure 1(c)), which was classified as type 3 in accordance with Maegawa's classification.¹¹ We made a diagnosis of lymphedema and planned to perform LVA.

On preoperative day 1, we performed ICG lymphography as described previously.⁵ Briefly, we injected 0.1 mL of ICG (0.5% Diagnogreen, Daiichi Pharmaceutical, Tokyo, Japan) in the first web spaces of both feet. Soon after the injection, we observed the lymphogram with an infrared camera (Photodynamic Eye; Hamamatsu Photonics, Hamamatsu, Japan). Although we could observe the lymphatic flow in the lower limb, it was difficult to observe in the right thigh because of the thick fat tissue.

We tried to detect the lymphatic vessels using echography. We used a Noblus EUP-L65 linear probe (Hitachi Medical Corp., Tokyo, Japan) and could observe circular structures beneath the superficial fascia (Figure 2(a)). They were not colored on color Doppler. We diagnosed them as the collecting lymphatic vessels and marked them. Subcutaneous veins were also detected on echography.

We performed four LVAs for the right leg and two LVAs for the left leg in accordance with the findings from preoperative examinations (Figure 2(b)) and resection of genital acquired lymphangiectasia under local anesthesia. In the right thigh, we could find a dilated lymphatic vessel beneath

the superficial fascia, just as observed on echography. The operation time was 3 h 23 min. The perioperative course was uneventful. After the operation, her lymphedema was alleviated, and she could start wearing elastic stocking every day (Figure 1(b)). No cellulitis was observed postoperatively.

Case 2

A 45-year-old woman experienced sudden edema in the left leg without any cause 4 years ago. Although she started compression therapy using elastic stockings, the edema gradually worsened. Two years after, she underwent intravascular laser therapy under the suspicion of venous edema. During the treatment, she experienced eruption in several parts of the body, and allergy to iodinate contrast medium was suspected.

After she consulted our hospital, we performed lymphoscintigraphy and made a diagnosis of lymphedema (type 1 for the right leg and type 3 for the left leg; Figure 3). We determined to perform LVA.

She was suspected to be allergic to iodinated contrast medium, so we could not use ICG lymphography preoperatively. In echography, we found vascular architectures beneath the superficial fascia, which we marked as lymphatic vessels (Figure 4(a) and (b)). We also detected subcutaneous veins.

We performed LVA based on the findings of preoperative examinations and found the dilated lymphatic vessels just as observed on echography (four LVAs for the left leg and one LVA for the right leg; Figure 4(c) and (d)). The operation time was 2 h 18 min. The perioperative course was uneventful.

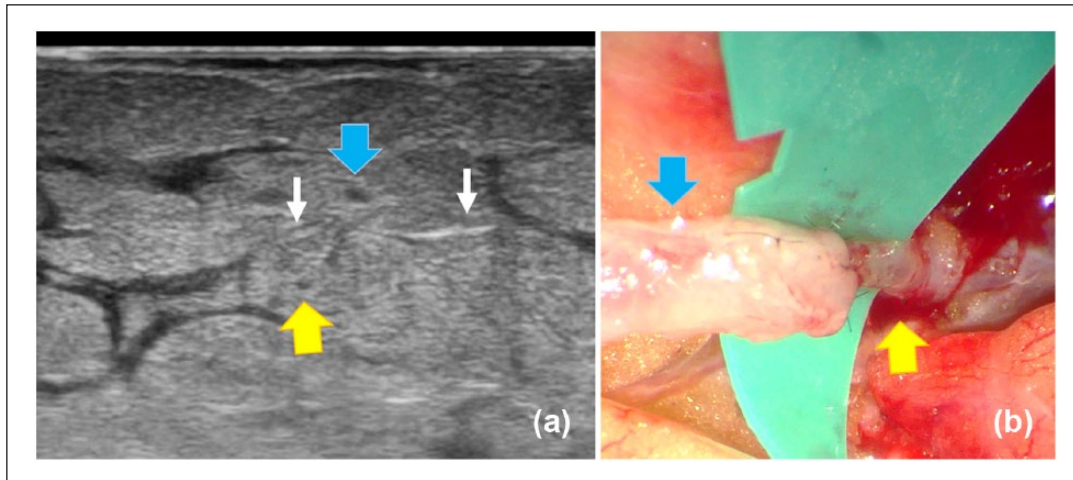


Figure 2. The preoperative echographic finding and intraoperative finding in the lymphaticovenous anastomosis (LVA) in Case 1. Blue arrow: subcutaneous vein; yellow arrow: collecting lymphatic vessel; and white arrow: superficial fascia. (a) Preoperative echographic finding in the right thigh. A circular structure which was thought to be the lymphatic vessel is observed beneath the superficial fascia. (b) Intraoperative finding in the right thigh. The subcutaneous vein and collecting lymphatic vessel can be observed just as on echography and we could anastomose them. The square in the green background indicates 1 mm.

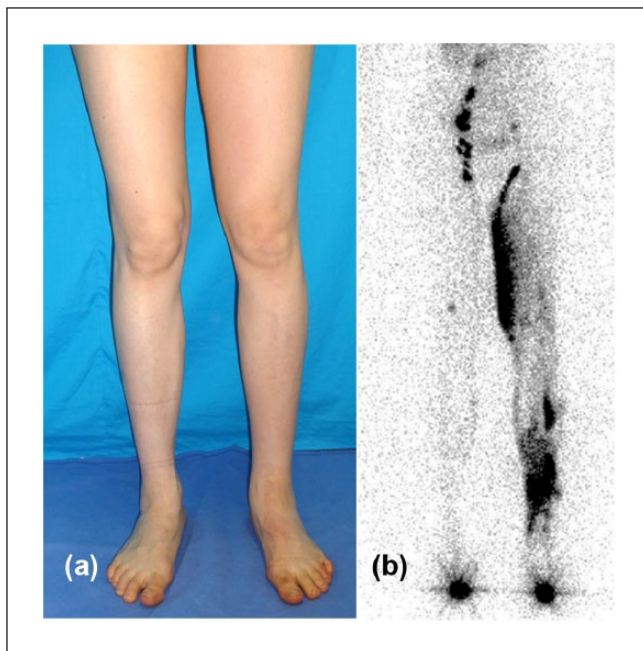


Figure 3. (a) Preoperative appearance of Case 2. Edema can be observed in the left leg. (b) Lymphoscintigraphic finding of Case 2. Radioisotope was injected in the bilateral dorsum of the foot. Linear lymphatic vessels and inguinal lymph nodes can be observed in the right leg. The left lower leg and thigh shows dermal backflow. The number of inguinal lymph nodes is limited.

Discussion

In this case report, we present two cases of application of preoperative echography to detect the lymphatic vessels. An observation of the lymphatic vessels of healthy people using

echography was previously reported by Hayashi et al.¹² This is the first case report on the use of echography for the preoperative detection of lymphatic vessels.

Although we usually use ICG lymphography for the preoperative marking of the lymphatic vessels, as it depicts the lymphatic flow in real time without radiation exposure,⁴ we cannot perform it for patients with allergy to iodinate contrast medium. Moreover, ICG lymphography allows for observation of only superficial lymphatic vessels, which are difficult to detect in the extremities with advanced lymphedema. Lymphoscintigraphy is too rough to mark the exact location of the lymphatic vessels, and performing LVA without ICG lymphography has been difficult. Echography is a useful tool for detecting the lymphatic vessels in these cases and can be used as subsidiary equipment with ICG lymphography.

Echography is a minimally invasive tool for observation of various tissues and organs. It is not painful to the patients and does not need contrast medium injection. One of the demerits of using echography to detect the lymphatic vessels is the need of technological proficiency. Originally, the reliability of echography depends on the examiner's technique. Observation of the lymphatic vessels seems to need more inurement. Another difficulty is the small diameter of the lymphatic vessels. The diameter of the normal collecting lymphatic vessel is approximately 0.2 mm.^{3,13} In the extremity with lymphedema, they are dilated to approximately 0.5–1 mm. Although these expanded lymphatic vessels are thought to be relatively easy to detect using echography, normal ones are difficult. Despite these disadvantages, we believe preoperative echography can be a good help for LVA.

When we look for the lymphatic vessels using ultrasonography, we usually detect the small hypoechoic

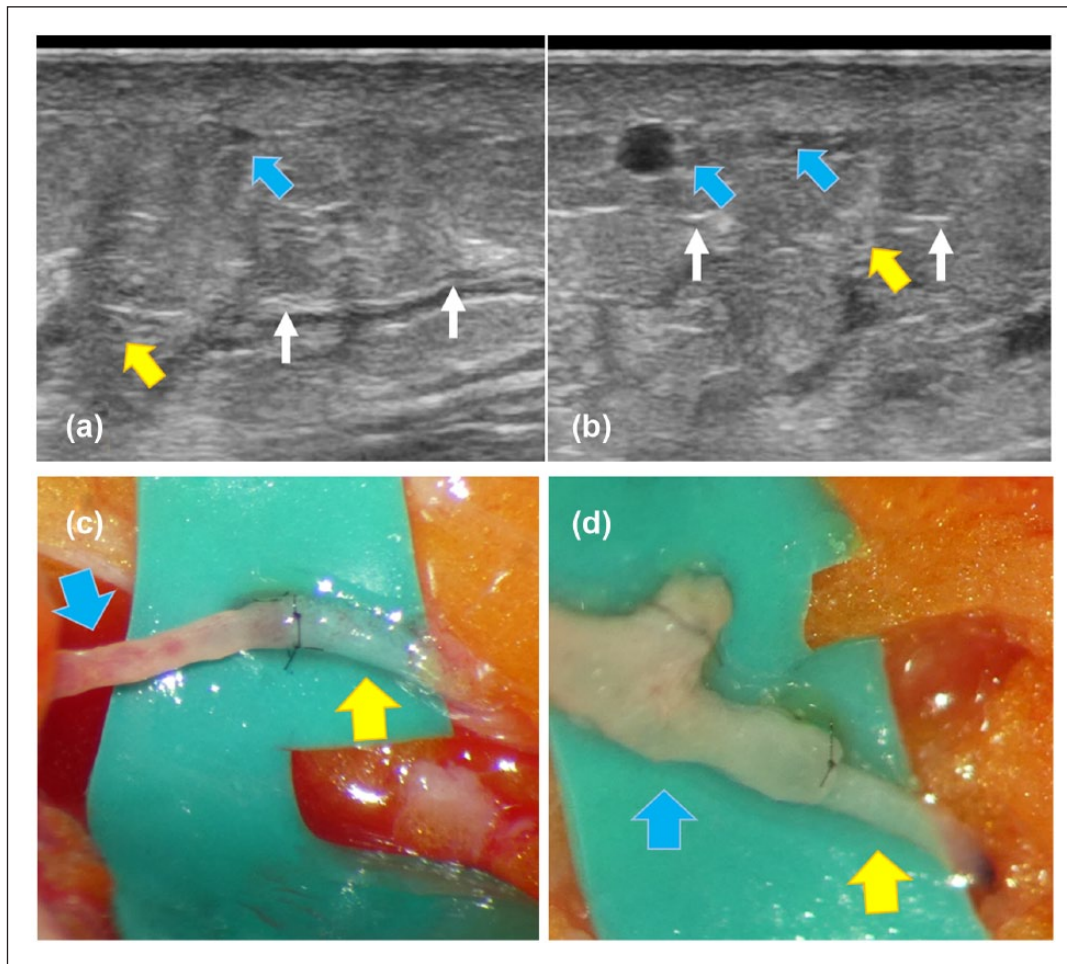


Figure 4. Preoperative echographic finding and intraoperative findings in lymphaticovenous anastomosis (LVA) in Case 2. Blue arrow: subcutaneous vein; yellow arrow: collecting lymphatic vessel; and white arrow: superficial fascia. (a) Preoperative echographic finding in the left proximal thigh in Case 2. A circular structure can be observed beneath the superficial fascia and seems to be the lymphatic vessel. (b) Preoperative echographic finding in the left distal thigh in Case 2. (c) Intraoperative finding in the left proximal thigh. The subcutaneous vein and collecting lymphatic vessel can be observed just as on echography and we could anastomose them. The square in the green background indicates 1 mm. Lymphatic fluid flowing into the vein is shown. (d) Intraoperative finding in the left distal thigh. The square in the green background indicates 1 mm. Lymphatic fluid flows into the vein.

circles, which indicate the inner lumen of the lymphatic vessels. If the lymphatic vessels are not dilated, which are normal, the lumen is too small to observe with ultrasonography. On the other hand, the expanded lymphatic vessels which are suitable for LVA are easily detected with ultrasonography because the lumen is as large as 0.5–1.0 mm. Although it is sometimes difficult to distinguish the sclerotic lymphatic vessels from the small nerves, those lymphatic vessels are not suitable for LVA and we do not care about this point. To avoid misunderstanding other small objects as the lymphatic vessels, we try to trace along the objects. If the object with hypoechoic circle has long tubular shape, and do not colored with color Doppler, it is diagnosed as the lymphatic vessels.

In Case 1, the patient had genital acquired lymphangiectasia, which indicated an increased lymphatic inner pressure. Resections of the lesion and LVA were considered necessary

for radical treatment to decrease the inner pressure.¹⁴ Primary lymphedema has no known cause and has various pathologies.³ Lymphatic function is sometimes impaired after varicose vein treatment and this might have occurred in Case 2 in this case report.¹⁵

In conclusion, application of echography in detecting the lymphatic vessels was useful as a preoperative examination of LVA.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

Ethical approval to report this case was obtained from Ethics Committee in Saiseikai Kawaguchi General Hospital (approval number: 26-6).

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Informed consent

Written informed consent was obtained from the patient for their anonymized information to be published in this article.

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