Lymphedema occurs when lymph vessels, collectors, or lymph nodes are damaged, and the physiological flow of lymph fluid is disrupted. This fluid accumulation is countered by an inflammatory response that worsens the lymphatic disruption and leads to a vicious cycle of fluid accumulation, inflammatory response, fat hypertrophy, and fibrosis.

The first line of treatment for lymphedema is complex decongestive therapy (CDT), which consists of a combination of different nonsurgical and noninvasive treatment approaches including bandaging, compression garments, exercise, skin care, and manual lymphatic drainage (MLD). The aim of CDT is to decrease the swelling of the affected limb to normal or near-to-normal size.

MLD is a safe procedure that may furnish additional benefits to the therapist during the treatment session and potentiate the effectiveness of MLD. In this regard, indocyanine green (ICG), a fluorescent cyanine dye that has a high rate of binding to plasma proteins and therefore remains within the blood and lymphatics, is ideal for visualizing superficial lymphatic vessels upon stimulation with fluorescent and laser light [4,5]. Hence, it is one of the most useful tools for the diagnosis and evaluation of lymphedema [5]. Although several studies have investigated ICG imaging for the diagnosis, staging, and surgical planning of patients with lymphedema, to the best of our knowledge, no report has yet been published on ICG lymphography-guided MLD (LG-MLD).

In 2018, the lead author (PC) started using ICG lymphography to guide the lymphatic therapist while performing lymphatic drainage. In our early experiences, LG-MLD has proven to be an objective way to assess lymphatic flow during the procedure. With this technique, the therapist can drain the lymph through viable lymphatic pathways and individualize the treatment, which may make the procedure more effective and efficient. It is particularly useful in patients with early-stage lymphedema, where a higher fluid component of the disease is present and lymphatic vessels are still patent and somewhat functional. It can also help patients to develop certain limb movements or exercises that can work better for moving the excess lymph fluid.

Our technique of performing lymphatic massage aims to open the lymphatic vessels to let the excess fluid drain back to the proximal lymph nodes. First, intradermal injections of 0.3 mL of ICG (Dianogreen 0.25%; Daiichi Pharmaceutical, Tokyo, Japan) are performed in the second and fourth interdigital spaces in the hand of the affected extremity. An infrared camera is used to visualize the lymph channels. Figs. 1 and 2 depict a patient undergoing this procedure. Lymph flow can be seen in real time within minutes. The therapist uses hand movements to firmly but comfortably encourage the movement of the lymphatic fluid to a specific lymph node. Supple-
patient’s chart to guide future sessions without the need for repeating ICG lymphography.

In conclusion, ICG lymphography adds a real-time objective assessment of MLD and helps identify alternative pathways to tailor the massage in breast cancer-related lymphedema patients. The LG-MLD procedure is a valuable tool that may help improve the results of MLD. We are currently evaluating this procedure in a large series to further assess its potential long-term value for the treatment of extremity lymphedema.

Notes

Conflict of interest
No potential conflict of interest relevant to this article was reported.

Ethical approval
The study was performed in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained.

Patient consent
The patient provided written informed consent for the publication and the use of his images.

Author contribution
Conceptualization: P Ciudad. Methodology: P Ciudad, OJ Manrique, HC Chen, E Trignano. Project administration: P Ciudad, AJ Forte. Visualization: MT Huayllani. Writing - original draft: P Ciudad. Writing - review & editing: P Ciudad, SS Bustos.

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Supplementary material

Supplemental Video 1. Indocyanine green lymphography-guided manual lymphatic drainage. Supplemental data can be found at: https://doi.org/10.5999/aps.2020.01823.v001.

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