Supermicrosurgical lymphovenous anastomosis for the treatment of recurrent cellulitis-associated lymphedema in the lower limb

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ABSTRACT

Recurrent leg cellulitis can damage the lymphatic system and result in chronic lymphedema. Antibiotic therapy is administered to prevent cellulitis; however, antibiotic-resistant bacteria frequently occur. Supermicrosurgical lymphovenous anastomosis (LVA) can play a role in stopping the vicious circle by improving lymph circulation. In the present report, we have described the case of a 40-year-old male patient with frequent cellulitis and subsequent left leg edema. Based on the lymphoscintigraphy findings, LVA was performed on the left leg (six anastomoses). One year later, the lymphedema had subsided without further cellulitis. Lymphoscintigraphy revealed no dermal backflow. Thus, LVA is a treatment option for recurrent cellulitis-associated lymphedema. (J Vasc Surg Cases Innov Tech 2021;7:790-3.)

Keywords: Cellulitis; Lymphatic system; Lymphedema; Lymphoscintigraphy; Lymphovenous anastomosis

Lymphedema can be categorized into primary and secondary diseases. Primary lymphedema results from developmental errors in the lymphatic system. Secondary lymphedema is caused by injury to a normally developed lymphatic system, such as patients who have undergone regional lymph node dissection or radiation therapy.[1]

In 99% of adult cases, secondary causes will be responsible for the lymphedema.[2,3] Cellulitis can cause dilatation and edematous changes in the adjacent skin lymphatics. Once irreversible lymphatic duct damage has occurred, lymphedema might not be curable using only intravenous antibiotics or conservative therapy. In addition, the use of antibiotics can render the patient even more susceptible to recurrent cellulitis.[4-6]

Lymphatic microsurgery is a fundamental concept in managing microvascular anastomosis to bypass the lymphatic flow blockage to the vein. Lymphatic microsurgery has achieved promising results in the treatment of primary or secondary lymphedema.[7,8] Lymphatic microsurgery has further evolved into a supermicrosurgery technique, which uses highly delicate microsurgical instruments to accomplish small anastomoses (range, 0.3-0.8 mm) under an operating microscope.[9]

Because efficient lymphatic drainage plays a critical role in preventing cellulitis, physiologic restoration of lymph fluid flow using supermicrosurgical lymphovenous anastomosis (LVA) should be considered for the treatment of cellulitis-associated lymphedema.[10] In the present report, we have described a case of lower limb lymphedema associated with recurrent cellulitis. LVA was performed for the edematous leg. Post-treatment lymphoscintigraphy showed that lymphedema symptoms improved with resolution of dermal backflow.

The institutional review board of the Taipei Veterans General Hospital does not require approval for case reports. The present patient provided written informed consent for the report of his case details and imaging studies.

CASE REPORT

A 40-year-old man had presented with edema in the left leg. According to the patient, several episodes of cellulitis had occurred within 2 years before presentation. Thereafter, the patient had noted that his left leg would gradually become edematous when he had stood for a long time. The edema was relieved by the patient lying down and elevating the leg. His symptoms included left leg heaviness, intermittent tingling, and inconvenience in wearing boots. Physical examination showed pitting edema of the left leg with an enlarged circumference compared with that of the right leg. No skin ulcer was ever noted. The blood test results did not show any abnormalities in the heart, liver, or renal function. The initial vascular survey (duplex ultrasound, photoplethysmography) excluded deep vein thrombosis; however, valvular incompetence of the bilateral legs was noted. Magnetic resonance imaging showed diffuse subcutaneous tissue edematous changes without tumor

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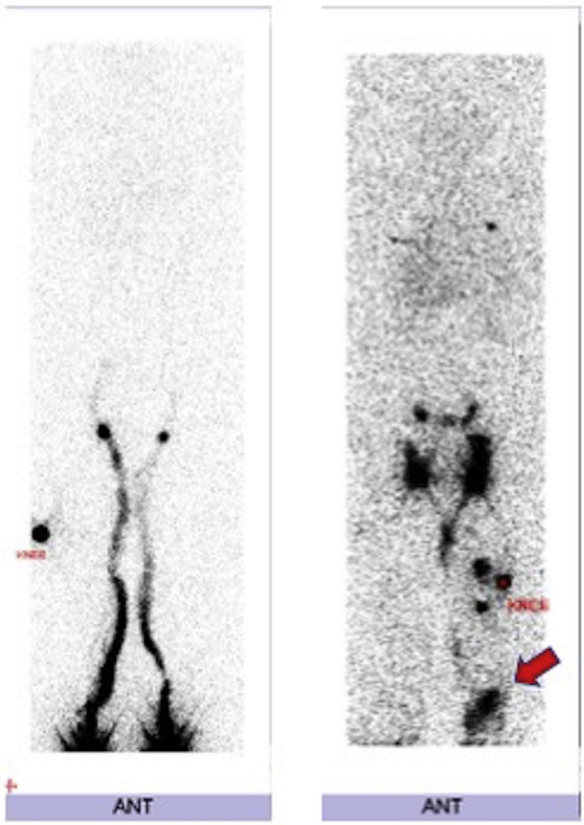

Fig 1. Right, Lymphoscintigraphy of the lower limbs at 10 minutes preoperatively. **Left,** Lymphoscintigraphy of the lower limbs at 2 hours preoperatively (*arrow* indicates dermal backflow over the left leg).

growth or vascular malformation. Lymphoscintigraphy showed patent lymph drainage over the bilateral lower limbs 10 minutes after 99m-technetium phytate injection at the first toe space (Fig 1, *Left*). However, dermal backflow was noted over the left leg 2 hours later (Fig 1, *Right*). International Society of Lymphology stage 1 lymphedema was diagnosed. Because frequent cellulitis occurred despite antibiotic therapy maintenance and because obvious lymph leakage over the left leg was observed on lymphoscintigraphy, we performed LVA with local anesthesia to improve lymph circulation and prevent cellulitis. Indocyanine green (ICG) was injected at 10 sites, ~0.1 mL per site, around the medial aspect of the left ankle. Functional superficial lymphatic vessels were identified using an ICG fluorescent camera (Moller 3-1000; Möller-Wedel Optical GmbH, Wedel, Germany). A subdermal venule or small collateral branch of the superficial vein (<0.8 mm) was used for the anastomosis. Six LVAs using 11-0 nylon suture were performed on the left leg. An example of an end-to-end LVA is shown in Fig 2. Postoperatively, an oral antibiotic (amoxicillin/clavulanate [Augmentin]) was prescribed for 3 days to prevent surgical site infection. A 6-in. short-stretch elastic bandage was applied for 6 months. The edematous status of the left leg gradually improved. The patient was satisfied with the outcome during follow-up. The girth was measured at 10, 15, 20, and 25 cm from the lower border of the patella.

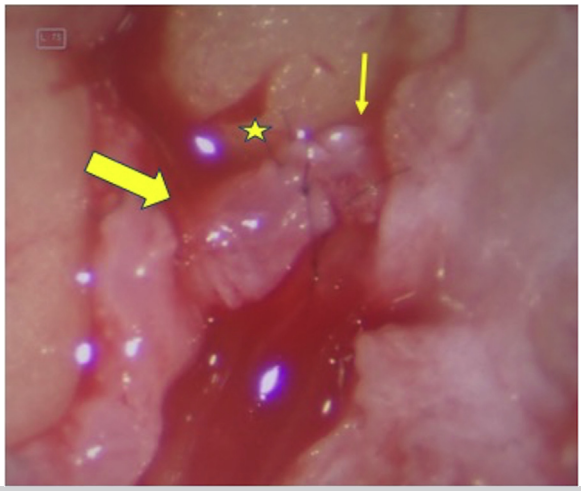

Fig 2. Lymphovenous anastomosis performed over the left lower limb (*arrowhead* indicates the vein; *arrow,* lymph vessel; *star,* anastomosis).

The estimated preoperative leg volume (Fig 3, *Left*) using the truncated cone formula was 2640 cm^3. The postoperative volume was 2140 cm^3 (Fig 3, *Right*). Lymphoscintigraphy at 1 year showed complete resolution of dermal backflow at the left leg at 10 minutes (Fig 4, *Left*) and at 4 hours (Fig 4, *Right*).

DISCUSSION

Leg cellulitis is a common skin and subcutaneous tissue infection that recurs in ≤50% of patients.[11] Soo et al[12] showed that lymph drainage abnormalities were strongly associated with lower limb cellulitis. De Godoy et al[13] found significant lymphatic abnormalities in >70% of these patients with episodes of erysipelas. Recurrent cellulitis can lead to progressive damage of the lymphatic system.[13] Other types of injuries, such as blunt injury or penetrating trauma, have been recognized to carry a much lower risk of lymphedema.[14] Our patient did not have a history of trauma to the lower limb or malignancy but only episodes of cellulitis. The coexistence of cellulitis and lymphangitis is a possible explanation for lymph leakage. Another reason could have been the onset of swelling. Secondary lymphedema after lymphadenectomy and/or radiation typically begins 12 to 18 months after injury to a lymph vessel.[15] Edema that forms immediately after an injury to an extremity is inconsistent with the occurrence of lymphedema.

Compression therapy plays an important role in the treatment of chronic leg edema.[16] However, our patient had poor compliance with compression therapy. In addition, antibiotic treatment cannot prevent lymphatic vessel injury after infection or inflammation. However, LVA has been shown to be beneficial for the management of recurrent cellulitis-associated lymphedema.

LVA was first introduced in the 1960s and was gradually recognized as a treatment modality for lymphedema.[3]

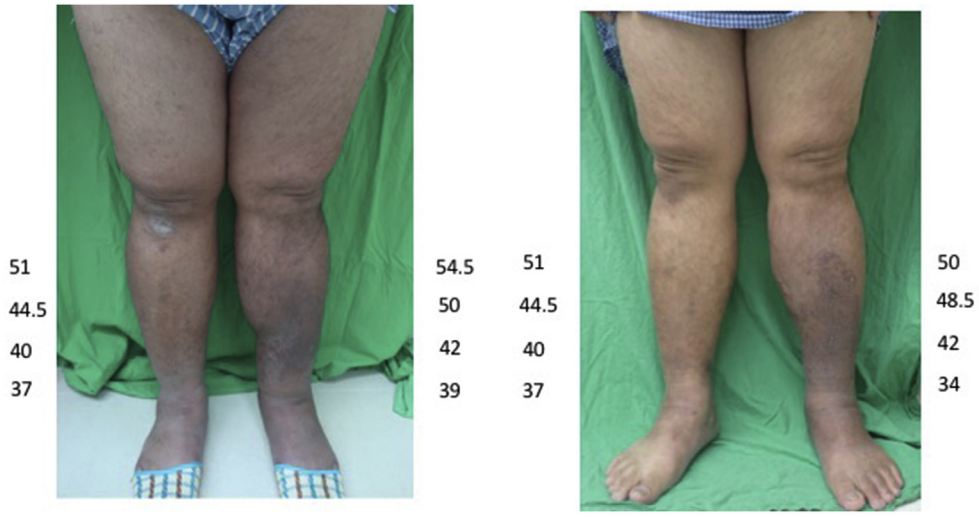

Fig 3. Right, Preoperative view of bilateral lower limbs. *Left,* One-year postoperative view of bilateral lower limbs. The girth was measured at 10, 15, 20, and 25 cm below the lower border of the patella.

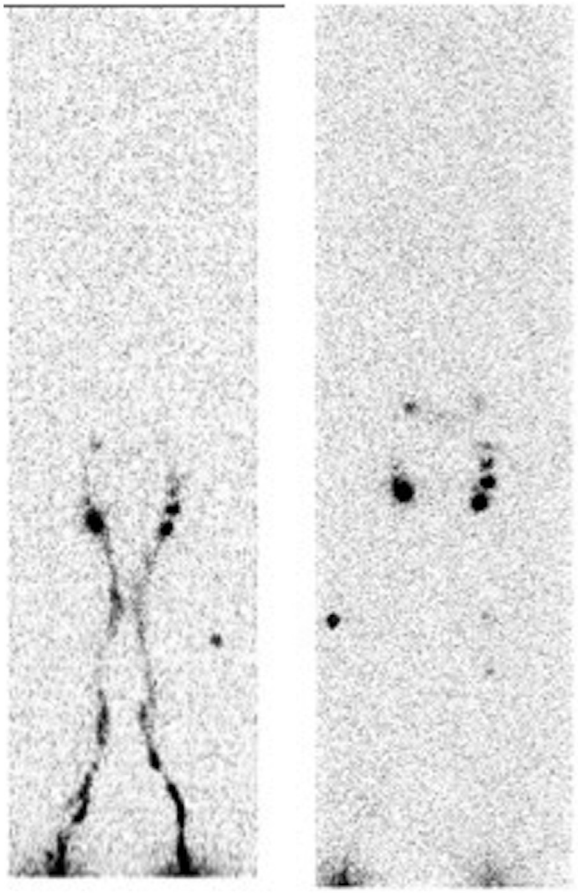

Fig 4. Right, Lymphoscintigraphy of the lower limbs at 10 minutes postoperatively. **Left,** Lymphoscintigraphy of the lower limbs at 4 hours postoperatively.

Koshima et al[17] reported that LVA can improve lymphedema by channeling the lymphatic fluid from the lymphatic collecting vessels into the vein. Chang et al[18] showed that LVA is more effective in reducing the severity of early-stage lymphedema than of late-stage lymphedema. However, performing LVA in the lower limb has remained challenging for several reasons, including that the location is lower than that of the heart, the presence of a thickened and/or fibrotic subcutaneous fat layer in edematous regions, and difficulty in obtaining optimized venules.[6,19,20] The role of LVA in the treatment of moderate-to-severe lymphedema has remained controversial owing to lymphatic functional failure.[6]

The success of LVA depends on several factors, including suitable lymph vessels and veins with consideration of the size, location, function, and flow direction. Yang et al[21] reported that the size and comparative discrepancy between the lymphatic vessel and vein are the determining factors for proper anastomotic configuration selection during LVA. In addition, however, the LVA results will depend on the experience, surgical skills, and preferences of each surgeon because the proportion of anastomotic configurations performed could vary among surgeons.[22] The intraoperative considerations required to minimize the risk of anastomotic thrombosis is to create anastomoses in the proximity of the venous valves.

The success of LVA in preventing cellulitis and easing the lymphedema for our patient can be attributed to several factors. The first factor was the early intervention based on a precise imaging study. Intraoperative ICG imaging is important for superficial lymphatic mapping. Second, residual superficial functional lymphatic vessels were observed, indicating a patent lymphatic lumen and lymphatic flow from the lymphatic lumen. Third, the cellulitis-associated lymphedema pattern was localized and not diffused. Fourth, a sufficient number of LVAs were performed. These factors are important in

restoring lymph flow to the circulation and significantly reducing the incidence of cellulitis.

CONCLUSIONS

For our patient, supermicrosurgical LVA was effective, not only for relief of the clinical symptoms associated with lymphedema, but also for the prevention of cellulitis. LVA is a treatment option for recurrent cellulitis-associated lymphedema.

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