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CASE REPORT
Hand

Treatment of Symptomatic Lymphedema in the Hand with Omental Flow-through Flap

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Summary: Vascularized lymph node transfer (VLNT) is a surgical option to improve physiologic lymphatic drainage. This technique transfers healthy vascularized lymphatic tissue from various available donor sites to the existing lymphatics of the affected area. Here, we present a successful case halting the size progression and reversing lymphedema symptoms in a patient treated with vascularized omental lymph node transfer. A 56-year-old man presented with stage III malignant sarcoma of his left medial upper arm. Two-years after excision, flap reconstruction, and radiation brachytherapy, worsening diffuse left arm edema developed, causing pain, decreased range of motion, and paresthesia. A vascularized omental lymph node transfer was performed. The omental flap required a flow-through design, requiring anastomosis of both gastroepiploic arteries to obtain Dopplerable signals. The patient experienced progressive relief of lymphedema symptoms after this transfer. Treatment outcomes with the use of VLNT have been largely encouraging; however, objective measures of improvement and timing of neolymphangiogenesis in recipient lymph node sites still need to be defined. Understanding omental VLNT flow dynamics and expected time point changes during the postoperative course will define expected outcomes and allow for treatment of a greater number of patients affected by lymphedema. *(Plast Reconstr Surg Glob Open 2023; 11:e5219; doi: 10.1097/GOX.0000000000005219; Published online 22 August 2023.)*

Advances in our understanding of the anatomophysiology of the lymphatic system and lymphangiogenesis have encouraged the development of evolving surgical techniques to treat the distressing complications of patients with lymphedema.[1] Vascularized lymph node transfer (VLNT) is an option to restore physiologic lymphatic drainage.[2] Objective measures evaluating outcomes of VLNT are not standardized. The majority of patients report that an improvement in symptoms, more than a reduction in overall limb volume, is appreciated. In this report, we present a successful case halting the progression and reversing lymphedema symptoms in a patient treated with VLNT.

CASE PRESENTATION

A 56-year-old man presented with a stage III malignant sarcoma fibrous histiocytoma subtype of his left medial upper arm (Fig. 1). Seven weeks post-chemotherapy, he underwent oncologic resection, followed by reconstruction using a pedicled latissimus dorsi flap (Fig. 2). The patient re-presented 2-years later with symptomatic lymphedema (Fig. 3).The diffuse left arm edema and pain created decreased range of motion, and paresthesia along the ulnar nerve distribution was noted after performing strenuous upper extremity work. Lymphoscintigraphy confirmed lymphedema and overall diminished lymphatic drainage. The patient underwent VLNT using a free omental flap anastomosed in an end-to-side fashion of the right gastroepiploic artery to the radial artery. Over several months, he experienced progressive relief of lymphedema symptoms after surgery. Skin over the dorsum of his hand became pliable with a negative Stemmer's sign both at 1 month and 1 year postoperative. At 1 year postoperative, his arm circumference measurements were essentially unchanged, indicating a halt in progression of lymphedema (Fig. 4).

DISCUSSION

Of the widely accepted donor site options, the omental lymph nodes are gaining popularity. Advantages of an

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Fig. 1. A photograph of the initial presentation of a 56-year-old male patient with stage III malignant fibrous histiocytoma of the medial left upper arm. Initially, he noted a growth in his upper arm which grew to a 7.6×6.6×8.6cm soft tissue mass within 4 months. The patient received neoadjuvant external beam radiation therapy to the left upper arm and axilla. He received 5000 cGy in 25 treatments over 35 days via conformal beam technique, using 6 MeV photon beam.

Fig. 2. An intraoperative photograph of the same patient after tumor resection and coverage of exposed structures with a pedicled ipsilateral latissimus dorsi flap. The flap was covered with a split-thickness skin graft and healed uneventfully. The patient subsequently received four cycles of adjuvant AIM chemotherapy to reduce the risk of recurrent disease. Follow-up MRI demonstrated soft tissue alterations secondary to radiation therapy without further evidence of malignancy.

Fig. 3. A photograph of the same patient who re-presented 2 years postoperatively with symptomatic lymphedema of the previously treated extremity. With decongestive conservative therapy, his limb circumference measured 24.5 cm at the mid-hand (contralateral 24.5 cm), 20.5 cm at the wrist (contralateral 19.5 cm), 32 cm at the lateral epicondyle (contralateral 30.5 cm), and 37 cm 10 cm proximal to the lateral epicondyle (contralateral 34 cm). This worsened throughout the day and with use. The patient also experienced early fatigue and limited ability to make a fist.

Fig. 4. A photograph demonstrating the comparison of the upper extremities. One year postoperative VLNT of the upper forearm, no further progression of lymphedema was noted. Surveillance imaging 3 years after resection were negative for recurrence of oncologic disease. At this point, the patient is now an appropriate candidate for debulking of the arm. In the affected limb, the patient measured 20.5 cm at the wrist, 34 cm at the lateral epicondyle, and 37 cm 10 cm proximal to the lateral epicondyle. We noted a 2 cm postoperative increase (32–34 cm) in arm circumference at the lateral epicondyle, which is attributed to the transferred lymph node tissue. Of note, measurements at or proximal to the flap site are affected by the transferred tissue and do not solely reflect lymphedema.

omental lymph node donor include laparoscopic harvest of the lymph node and lower risk of inducing iatrogenic lymphedema to another area of the body. Additionally, the omental lymph nodes offer the most favorable approach for patients with limited peripheral donor sites.[3] The omentum provides two adequately sized vessels for anastomosis, and have both immunogenic and angiogenic properties. The vascular endothelial growth factor C, produced by the omental lymph node flap, promotes lymphangiogenesis, inducing the recanalization of the lymphatic vessels inside the recipient set and the lymph node transferred.[4] Potential limitations of using the omentum include prior extensive intra-abdominal surgery or intra-abdominal scar tissue. Repeat skin grafting (for skin graft loss) may be related to the peritoneum adherence to the omentum.

We followed a surgical technique similar to a previously published report by Ceppa et al.[5] However, we noted a need to anastomose both the right and left gastroepiploic artery (GEA) to obtain a Doppler signal in the flap. Our lymphatic transfer consisted of the omentum between the transverse colon and the stomach. The right GEA was anastomosed to the radial artery end-to-side and the left to the cephalic vein. Flow dynamics of omental flaps, similar to those of other fascial flaps, seem to be different than those with cutaneous capillary beds. This phenomenon may be related to the size of the flap when solely using the omentum between the transverse colon and the stomach. When we have used the entire omentum, we have not uniformly found it necessary to anastomose both vessels. For this patient, we anastomosed the right GEA to the radial artery. When the left was clamped, no signal could be obtained, but when blood was allowed to flow through the right side, a strong signal is appreciated, seen in our attached intraoperative video. (**See Video [online],** which displays the vascularized omental flap with the right gastroepiploic artery anastomosed end to side to the radial artery with the omental vein anastomosed to the venae comitantes of the radial artery. The video demonstrates the inability to achieve a Doppler signal in the omental flap until the left gastroepiploic artery is unclamped. The left gastroepiploic artery ultimately was anastomosed to the cephalic vein.)

In total, two venous and two arterial anastomoses were performed, including the creation of an arteriovenous flow-through phenomenon to successfully relieve venous hypertension and obtain a consistent and reliable Doppler signal, a strong indication of flap survival.

The formation of an A-V fistula gives the capacity to autoregulate arterial inflow to the lymph nodes and minimizes the potential risk of venous hypertension, while preserving physiologic perfusion. This theory aligns with previous studies that have provided evidence for the hemodynamic benefits of the flow-through flap to offset venous congestion.[6] A major and frequent criticism of VLNT is concern for venous hypertension after flap inset; however, this was not the case in this patient, which is consistent with patients undergoing creation of a fistula for hemodialysis access. In a similar study, the authors reported there were no flap losses or other surgical complications using a flow-through omental free flap for breast cancer–related lymphedema. A distinct advantage of this inset includes the ability to moderate the arterial inflow to the omental flap to avoid an inflow-outflow mismatch and alleviate venous hypertension.[6]

Before VLNT surgery, the patient reported limitations of his condition that negatively impacted his ability to sleep, perform activities of daily living, perform domestic activities, and work. He is now able to make a composite fist, which he was unable to do before surgery. At 1 year postoperative, the patient has been scheduled for debulking of the arm flap.

Monitoring lymphedema post lymph node transfer is not standardized for methods or set time points and remains a challenge as objective modalities to assess treatment success are evolving. Extremity circumference is affected by a number of factors, including regular use of compression garments, activity level of the day, and time spent in the dependent position with the affected limb. Lymphoscintigraphy has been used to assess functional lymphatic drainage; however, this procedure is not routinely covered by insurance and results may not mirror the clinical improvement.[7] There are several hypotheses explaining the process of spontaneous lymphangiogenesis after the transfer of a healthy lymph node to the affected limb, yet the timing of this process remains unclear. Neovascularization has shown to occur in weeks; however, lymphangiogenesis seems to take much longer before significant reductions in circumference size are appreciated. Nonetheless, subjective symptoms seem to improve quicker. VLNT coverage by health insurance is not uniform and remains a challenge for patients with lymphedema. It is hoped that the growing number of successful reports should guide future policy.

CONCLUSIONS

Treatment with VLNT for symptomatic lymphedema is safe and effective. More objective studies evaluating the success of lymphedema surgery can standardize the assessment of successful surgical outcomes in a greater number of patients.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

REFERENCES

1. Schaverien MV, Coroneos CJ. Surgical treatment of lymphedema. *Plast Reconstr Surg*. 2019;144:738–758.
2. Silva AK, Chang DW. Vascularized lymph node transfer and lymphovenous bypass: novel treatment strategies for symptomatic lymphedema. *J Surg Oncol*. 2016;113:932–939.

3. Chu YY, Allen RJ, Jr, Wu TJ, et al. Greater omental lymph node flap for upper limb lymphedema with lymph nodes-depleted patient. *Plast Reconstr Surg Glob Open*. 2017;5:e1288.
4. Forte AJ, Cinotto G, Boczar D, et al. Omental lymph node transfer for lymphedema patients: a systematic review. *Cureus*. 2019;11:e6227.
5. Johnston ME, Socas J, Hunter JL, et al. Laparoscopic gastro-epiploic lymphovascular pedicle harvesting for the treatment of extremity lymphedema: a novel technique. *Surg Laparosc Endosc Percutan Tech*. 2017;27:e40–e43.
6. Johnson AR, Bravo MG, Granoff MD, et al. Flow-through omental flap for vascularized lymph node transfer: a novel surgical approach for delayed lymphatic reconstruction. *Plast Reconstr Surg Glob Open*. 2019;7:e2436.
7. Forte AJ, Boczar D, Huayllani MT, et al. Lymphoscintigraphy for evaluation of lymphedema treatment: a systematic review. *Cureus*. 2019;11:e6363.