

From Theory to Evidence: Long-Term Evaluation of the Mechanism of Action and Flap Integration of Distal Vascularized Lymph Node Transfers

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Abstract

Background Nonanatomic (distal) placement of vascularized lymph node (VLN) transfers have shown efficacy in the treatment of extremity lymphedema, but the mechanism by which these flaps provide relief of lymphedema remains unclear. Intrinsic lymphovenous connections have been previously shown to exist in the transferred flap. But, the long-term interaction of the VLN flap and surrounding lymphedematous extremity has not been previously investigated.

Patients and Methods A retrospective review of a prospective maintained database of patients who underwent VLN transfer was evaluated. Patients who underwent distal VLN transfer and had more than 1-year follow-up were identified. Lymphodynamic evaluation was performed using 0.3 to 0.6 mL indocyanine green (ICG) injection at 5 cm proximal to the flap edge on identified patients. Migration direction of dye and latency period was evaluated.

Results In total, 20 patients were identified who met inclusion criteria. Average long-term follow-up was 27.3 months. The average circumference reduction of the affected extremity was 40.5%. ICG appearance within the VLN flap was found in all patients occurring on average in 178.3 seconds. In all cases, flow occurred in the distal direction (toward the flap) with proximal placement of dye. Latency period was found to inversely correlate with circumference reduction ($p < 0.01$).

Conclusions Distal, nonanatomic placement of VLN flaps provide sustained limb circumference reduction in extremity lymphedema patients following a minimum of 1-year postoperatively. Flap integration with the recipient site reliably occurs as witnessed with consistent ICG drainage, and occurs in the gravity-dependent direction. Faster clearance of ICG will result in improved clinical limb circumference reduction.

Keywords

- ▶ vascularized lymph node transfer
- ▶ lymphedema
- ▶ lymphatic microsurgery
- ▶ lymphedema surgery
- ▶ indocyanine green

Surgical treatment of lymphedema utilizing vascularized lymph node (VLN) transfer has become increasingly popular in recent years. Despite its popularity, the mechanism by which VLNs provide relief for symptomatic obstructive lymphedema is poorly understood. The most commonly regarded theory is based on the induction of lymphangiogenesis and

reconstitution of lymphatic channels. Animal studies have described the basis for this theory,¹⁻⁴ which has prompted clinicians to use VLN flaps to treat obstructive lymphedema.⁵⁻⁸

Anatomic (proximal) placement of VLNs is a popular recipient site and is likely based on the theory of local lymphangiogenesis and reconstitution of normal lymphatic

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