

Recent Advances in Management of Lymphedema

Amrutha J S¹, Ravi Kumar Chittoria²

How to cite this article:

Amrutha J S, Ravi Kumar Chittoria/Recent Advances in Management of Lymphedema/Physiotherapy and Occupational Therapy Journal. 2023;16(3): 153-158.

ABSTRACT

Lymphedema is a chronic condition characterized by swelling, typically in the arms or legs, caused by a compromised lymphatic system. It commonly occurs after lymph node removal or damage due to cancer treatment, trauma, or genetic disorders. The impaired lymphatic drainage leads to the accumulation of fluid, causing discomfort, decreased mobility, and an increased risk of infection. Although lymphedema is incurable, it can be managed through various approaches, including compression therapy, manual lymphatic drainage, exercise, and skin care. These strategies aim to reduce swelling, improve lymphatic flow, and enhance overall quality of life for individuals living with lymphedema. Early diagnosis and comprehensive treatment play a crucial role in effectively managing this condition.

Keywords: Recent; Management; Lymphedema.

INTRODUCTION

Lymphedema is a condition characterized by accumulation of protein rich fluid in the interstitial space and consequent tissue swelling. Early stages may have physical findings and symptoms of painless pitting edema, discomfort, and heaviness of the limb, especially after

continued use.¹ However, as time passes without treatment, the condition progresses to fibrosis, thickening of the skin, and irreversible non pitting edema. The etiology of lymphedema is classified as either primary or secondary. Primary lymphedema occurs due to a congenital anomaly or absence of the lymphatic system in certain populations. Secondary lymphedema occurs due to an acquired impairment in lymphatic flow. Common etiologies include trauma, chronic infection, and malignancy.³ The most common cause, in westernized countries, is treatment of malignancy, particularly breast cancer.

First line intervention of lymphedema includes conservative measures, such as complete decongestive therapy (CDT). CDT is a multidisciplinary treatment approach involving exercise, daily bandaging, manual drainage therapy and skin care. The intervention occurs as a 2 phase approach, with phase 1 focusing on reduction of lymphedema volume, and phase 2

Author Affiliation: ¹Senior Resident, Department of Plastic Surgery, ²Professor, Department of Plastic Surgery & Telemedicine, Jawaharlal Institute of Postgraduate Medical Education & Research, Pondicherry 605006, India.

Corresponding Author: Ravi Kumar Chittoria, Professor, Department of Plastic Surgery & Telemedicine, Jawaharlal Institute of Postgraduate Medical Education & Research, Pondicherry 605006, India.

E-mail: drchittoria@yahoo.com

Received on 03.06.2023

Accepted on 15.07.2023

focusing on maintenance of the reduced volume. Surgical treatment of lymphedema is suggested when conservative management fails, particularly early following the onset of the swelling. The field of lymphedema surgery is a constantly evolving field. Early techniques in management of lymphedema include ablative procedures such as the Homans or Charles procedures, which involve excision of the subcutaneous tissue beneath the affected skin and covering the defect with skin flaps or a full or split thickness grafts.^{13,14} Advances in microsurgical techniques have allowed the advent of more physiologic and effective methods such as vascularized lymph node transplant (VLNT) or lymphovenous anastomosis (LVA).

PHYSIOLOGIC THERAPY

Surgical techniques of lymphedema management can broadly be divided into physiologic therapy and ablative therapy. Physiologic surgical techniques are microsurgical procedures that foster the physiologic drainage of lymphatic fluid through anastomosis of lymphatic vessels with the venous system, or the incorporation of a functional lymph node in the region of ablative treatment.

LVA

LVA was first described in the 1960s by Nielubowicz and Olszewski. Artificial connection between a patent lymphatic vessel and adjacent venules to redirect lymphatic flow, allowing the lymphatic fluid to bypass obstructed lymphatic vessels. The anastomosed vessels have diameters ranging from 0.1 to 0.8 mm, requiring super microsurgical technique. LVA is more effective in early stages of lymphedema, rather than at later stages when irreversible tissue fibrosis has occurred and lymphatic smooth muscle is dysfunctional. Results not as good for lower extremity lymphedema because large size and constantly dependent nature of lower extremities may make them less likely to improve in symptoms in comparison to the upper extremity. In a meta-analysis Jorgensen *et al.* (2018) found that prophylactic LVA at the time lymphadenectomy reduced the risk of lymphedema by 77% compared to no prophylactic procedure ($P < 0.0001$).

VLNT

VLNT is a relatively new technique in the treatment of lymphedema. It was first clinically

described by Clodius *et al.* (1982), who transferred a pedicled groin flap with vascularized inguinal lymph nodes to the left lower extremity with partial success in reducing lymphedema. The technique involves transfer of a vascularized lymph node and surrounding tissue to a region where a lymph node has been removed or lymph flow is impaired. A microsurgical anastomosis is created between recipient site blood supply and the flap, thereby maintaining vascularization of the lymph node. Common donor sites for the lymph nodes include omental, inguinal, mesenteric, lateral thoracic, axillary, gastroepiploic, and submental nodes.^{32,33} Common recipient sites include the axilla, elbow, wrist, groin, and ankle.

Although the exact mechanism through which VLNT works is unclear, there are 2 main theories. The first is that lymph node transfer induces lymph angiogenesis at the recipient site, leading to improved lymphatic flow and alleviation of lymphedema. Lymphoscintigraphy show formation of new lymphatic channels at the recipient site following VLNT. The second proposed mechanism is that the transferred lymph node acts as a “pump”, wicking lymph fluid from the surrounding interstitial space, and projecting it into the efferent venous circulation. This is based on the observation that ICG dye injected in the tissue surrounding a transferred lymph node can be found in the afferent donor and recipient venules. Lin *et al.* (2009) reasoned that the high pressure afferent arterial flow to the lymph node flap creates a local pressure gradient that transports adjacent lymphatic fluid towards the transplanted node. An advantage that VLNT has over LVA is that it can be performed in the absence of patent lymphatic vessels at the recipient site. Although the volume reduction cannot be attributed to VLNT alone, the findings suggest that VLNT can be an effective treatment in advanced lymphedema, when performed with adjunct ablative procedures. A limitation of VLNT is the risk of donor site lymphedema. Reverse lymphatic mapping prior to surgery has been proposed as a technique to prevent donor site lymphedema following VLNT.⁴¹ This method allows the surgeon to visualize the donor site lymph nodes intra-operatively and actively avoid lymph nodes that drain the extremities, thereby lowering the risk of iatrogenic donor site lymphedema.

Ablative therapy

In advanced stages of lymphedema, where extensive interstitial tissue fibrosis has occurred,

physiologic therapies may not provide sufficient volume reduction. "Rescue" procedures such as ablative surgical procedures can be used at this stage to improve aesthetic outcome, although they do not address the root cause of lymphedema. Commonly used ablative procedures include subcutaneous excisional procedures and suction assisted lipectomy.

Excisional Procedures

One of the well known procedures today is the Charles procedure, which involves radical circumferential excision of subcutaneous tissue followed by full thickness skin grafting. Modified Charles procedure negative pressure wound therapy and delayed skin grafting, in an effort to improve graft take and wound recovery.⁴² Subcutaneous excisional procedures are generally preserved only for advanced lymphedema due to its poor aesthetic outcome, risk of lymphedema recurrence, infection, wound break down, and in severe cases amputation.

All Excisional Procedures produce the following Advantages:

1. Decrease limb size
2. Reduce episodes of cellulitis, and therefore improve the quality of life of the patients. Although these surgical procedures can be immediately effective to reduce the lymphedema volume, they can carry some risks including wound complications, swelling recurrence, and the need for the patient to wear compression garments lifelong to prevent recurrence.

LIPOSUCTION

Liposuction is a minimally invasive, yet effective method of lymphedema treatment. The technique involves removal of subcutaneous adipose tissue from the lymphedematous limb using a suction assisted lipectomy cannula. The target population are patients with chronic lymphedema whose pitting edema has been replaced by fatty deposits.⁴³ Patient satisfaction with the technique is high, as patients are encouraged to return to their daily routine with a short recovery time.^{44,45} Furthermore, it can be performed as an adjunctive procedure to physiologic treatments such as LVA or VLNT to improve outcomes. Decreased infection risk following combined therapy has been reported as well.^{46,47} The primary limitation of liposuction therapy is that patients must wear compressive garments indefinitely to maintain the reduced limb volume. Cosmetic and functional benefits of liposuction outweigh the burden caused by lifelong compression therapy.

Combined Surgical Therapy

Recent reports of combined surgical therapy have demonstrated that performing physiological and ablative procedures together may have benefits beyond improved volume reduction (Table 1). Performing a physiological procedure such as VLNT or LVA in addition to liposuction has been shown to reduce the need for continuous compressive therapy following liposuction. While physiological procedures are most effective in early stages of lymphedema, the addition of ablative therapy can render them effective therapeutic options for late stage lymphedema as well.

Table 1: Advantages of combined therapies

Technique	Advantages over isolated procedure
LVA/LNT + Liposuction	- Improved volume reduction - Improved aesthetic outcome - Reduced requirement of compressive garment therapy
LNT + Subcutaneous Excision (e.g., Charles, Homan Procedures)	- Improved volume reduction - Improved utility in end-stage lymphedema - Reduced requirement of compressive garment therapy

Preventive Procedure

Immediate lymphatic reconstruction Lymphedema is a refractory disease that is challenging to treat. Immediate lymphatic

reconstruction has drawn attention as a novel preventive technique.^{17,18} After reverse mapping with ICG lymphography, surgeons connect lymphatic vessels of the upper and lower extremities to the surrounding vein. This can

improve lymphatic fluid drainage and reduce the lymphedema rate. The advantages and

disadvantages of each procedure described in table (Table 2).

Table 2: Advantages and disadvantages of various methods

Technique	Advantages	Disadvantages	Comments
Lymphovenous anastomosis	- Minimally invasive surgery with the use of ICG - Can be performed prophylactically at time of lymph node dissection	- Less effective for lower extremity lymphedema - Requires a patent lymphatic vessel for anastomosis	Performed in early stage lymphedema
Lymph node transfer	- Procedure not limited by recipient site lymphatic patency - Variety of donor sites available - Simultaneous breast reconstruction possible	Risk of donor site complications (e.g., seroma, lymphedema)	Can be performed at all stages, but most efficacious in early stage lymphedema
Liposuction	- Removes fibrofatty tissue unresolved by physiotherapy - High patient satisfaction	Requires continuous use of compressive garment therapy if performed alone.	Performed in all stages of lymphedema
Subcutaneous excision (e.g., Charles, Homans)	- Remove fibrofatty tissue unresolved by physiotherapy - Effective for severe lower extremity lymphedema (e.g., elephantiasis)	- Risk of surgical site complications (e.g., infection, wound dehiscence) - Poor aesthetic outcome	Performed at end stage lymphedema

REFERENCES

1. Tiwari A, Cheng KS, Button M, *et al.* Differential diagnosis, investigation, and current treatment of lower limb lymphedema. *Arch Surg* 2003;138:152-61.
2. Grada AA, Phillips TJ. Lymphedema: Pathophysiology and clinical manifestations. *J Am Acad Dermatol* 2017;77:1009-20.
3. Catherine L. McGuinness KGB. Chapter 49 – Lymphedema. In: Hallett JLM, Earnshaw JJ, Reekers JA, *et al.* editors. *Comprehensive Vascular and Endovascular Surgery* 2ed. Mosby, 2009:862-75.
4. Smeltzer DM, Stickler GB, Schirger A. Primary lymphedema in children and adolescents: a follow-up study and review. *Pediatrics* 1985;76:206-18.
5. Grada AA, Phillips TJ. Lymphedema: Diagnostic workup and management. *J Am Acad Dermatol* 2017;77:995-1006.
6. Cormier JN, Askew RL, Mungovan KS, *et al.* Lymphedema beyond breast cancer: a systematic review and meta-analysis of cancer-related secondary lymphedema. *Cancer* 2010; 116:5138-49.
7. Ezzo J, Manheimer E, McNeely ML, *et al.* Manual lymphatic drainage for lymphedema following breast cancer treatment. *Cochrane Database Syst Rev* 2015:CD003475.
8. Melam GR, Buragadda S, Alhusaini AA, *et al.* Effect of complete decongestive therapy and home program on health-related quality of life in post mastectomy lymphedema patients. *BMC Womens Health* 2016;16:23.
9. Mondry TE, Riffenburgh RH, Johnstone PA. Prospective trial of complete decongestive therapy for upper extremity lymphedema after breast cancer therapy. *Cancer J* 2004;10:42-8; discussion 17-9.
10. Lasinski BB, McKillip Thrift K, Squire D, *et al.* A systematic review of the evidence for complete decongestive therapy in the treatment of lymphedema from 2004 to 2011. *PM R* 2012;4:580-601.
11. Shih YC, Xu Y, Cormier JN, *et al.* Incidence, treatment costs, and complications of lymphedema after breast cancer among women of working age: a 2-year follow-up study. *J Clin Oncol* 2009;27:2007-14.
12. Head LK, Momtazi M. Economics of Lymphovenous Bypass. *Plast Reconstr Surg* 2019;144:751e-9e.
13. Homans J. The treatment of elephantiasis of the legs - A preliminary report. *N Engl J Med*

- 1936;215:1099-104.
14. Dellon AL, Hoopes JE. Charles Procedure for Primary Lymphedema - Long-Term Clinical Results. *Plast Reconstr Surg* 1977;60:589-95.
 15. Nielubowicz J, Olszewski W. Experimental lymphovenous anastomosis. *Br J Surg* 1968; 55:449-51.
 16. Nielubowicz J, Olszewski W. Surgical lymphaticovenous shunts in patients with secondary lymphoedema. *Br J Surg* 1968; 55:440-2.
 17. Jacobson JH, 2nd, Suarez EL. Microvascular surgery. *Dis Chest* 1962; 41:220-4.
 18. Koshima I, Inagawa K, Urushibara K, *et al.* Supermicrosurgical Lymphaticovenular Anastomosis for the Treatment of Lymphedema in the Upper Extremities. *J reconstr Microsurg* 2000;16:437-42.
 19. Chang DW. Lymphaticovenular bypass for lymphedema management in breast cancer patients: a prospective study. *Plast Reconstr Surg* 2010;126:752-8.
 20. Yamamoto T, Narushima M, Yoshimatsu H, *et al.* 510 Park *et al.* Surgical management of lymphedema© Gland Surgery. All rights reserved. *Gland Surg* 2020;9(2):503-511 | <http://dx.doi.org/10.21037/gs.2020.03.14> Minimally invasive lymphatic supermicrosurgery (MILS): indocyanine green lymphography-guided simultaneous multisite lymphaticovenular anastomoses via millimeter skin incisions. *Ann Plast Surg* 2014;72:67-70.
 21. Shih HB, Shakir A, Nguyen DH. Use of Indocyanine Green-SPY Angiography for Tracking Lymphatic Recovery After Lymphaticovenous Anastomosis. *Ann Plast Surg* 2016;76 Suppl 3:S232-7.
 22. Rosian K, Stanak M. Efficacy and safety assessment of lymphovenous anastomosis in patients with primary and secondary lymphoedema: A systematic review of prospective evidence. *Microsurgery* 2019; 39:763-72.
 23. Tourani SS, Taylor GI, Ashton MW. Long-Term Patency of Lymphovenous Anastomoses: A Systematic Review. *Plast Reconstr Surg* 2016; 138:492-8.
 24. Scaglioni MF, Fontein DBY, Arvanitakis M, *et al.* Systematic review of lymphovenous anastomosis (LVA) for the treatment of lymphedema. *Microsurgery* 2017;37:947-53.
 25. Chang DW, Suami H, Skoracki R. A prospective analysis of 100 consecutive lymphovenous bypass cases for treatment of extremity lymphedema. *Plast Reconstr Surg* 2013;132:1305-14.
 26. Boccardo FM, Casabona F, Friedman D, *et al.* Surgical prevention of arm lymphedema after breast cancer treatment. *Ann Surg Oncol* 2011; 18:2500-5.
 27. Jørgensen MG, Toyserkani NM, Sorensen JA. The effect of prophylactic lymphovenous anastomosis and shunts for preventing cancer-related lymphedema: a systematic review and meta-analysis. *Microsurgery* 2018;38:576-85.
 28. Cheng MH, Loh CYY, Lin CY. Outcomes of Vascularized Lymph Node Transfer and Lymphovenous Anastomosis for Treatment of Primary Lymphedema. *Plast Reconstr Surg Glob Open* 2018;6:e2056.
 29. Winters H, Tielemans HJP, Hameeteman M, *et al.* The efficacy of lymphaticovenular anastomosis in breast cancer-related Breast Cancer Res Treat 2017;165:321-7.
 30. Chung JH, Baek SO, Park HJ, *et al.* Efficacy and patient satisfaction regarding lymphovenous bypass with sleevein anastomosis for extremity lymphedema. *Arch Plast Surg* 2019;46:46-56.
 31. Clodius L, Smith PJ, Bruna J, *et al.* The lymphatics of the groin flap. *Ann Plast Surg* 1982;9:447-58.
 32. Suami H, Chang DW. Overview of surgical treatments for breast cancer-related lymphedema. *Plast Reconstr Surg* 2010; 126:1853-63.
 33. Schaverien MV, Badash I, Patel KM, *et al.* Vascularized Lymph Node Transfer for Lymphedema. *Semin Plast Surg* 2018;32:28-35.
 34. Ito R, Suami H. Overview of lymph node transfer for lymphedema treatment. *Plast Reconstr Surg* 2014;134:548-56.
 35. Liu HL, Pang SY, Lee CC, *et al.* Orthotopic transfer of vascularized groin lymph node flap in the treatment of breast cancer-related lymphedema: Clinical results, lymphoscintigraphy findings, and proposed mechanism. *J Plast Reconstr Aesthet Surg* 2018; 71:1033-40.
 36. Suami H, Scaglioni MF, Dixon KA, *et al.* Interaction between vascularized lymph node transfer and recipient lymphatics after lymph node dissection-a pilot study in a canine model. *J Surg Res* 2016;204:418-27.
 37. Lin CH, Ali R, Chen SC, *et al.* Vascularized groin lymph node transfer using the wrist as a recipient site for management of postmastectomy upper extremity lymphedema. *Plast Reconstr Surg* 2009;123:1265-75.
 38. Cheng MH, Huang JJ, Nguyen DH, *et al.* A novel approach to the treatment of lower extremity lymphedema by transferring a vascularized submental lymph node flap to the

- ankle. *Gynecol Oncol* 2012;126:93-8.
39. Cheng MH, Chen SC, Henry SL, *et al.* Vascularized groin lymph node flap transfer for postmastectomy upper limb lymphedema: flap anatomy, recipient sites, and outcomes. *Plast Reconstr Surg* 2013;131:1286-98.
 40. Becker C, Assouad J, Riquet M, *et al.* Postmastectomy lymphedema: long-term results following microsurgical lymph node transplantation. *Ann Surg* 2006;243:313-5.
 41. Dayan JH, Dayan E, Smith ML. Reverse lymphatic mapping: a new technique for maximizing safety in vascularized lymph node transfer. *Plast Reconstr Surg* 2015;135:277-85.
 42. van der Walt JC, Perks TJ, Zeeman BJ, *et al.* Modified Charles procedure using negative pressure dressings for primary lymphedema: a functional assessment. *Ann Plast Surg* 2009; 62:669-75.
 43. Greene AK, Maclellan RA. Operative Treatment of Lymphedema Using Suction-Assisted Lipectomy. *Ann Plast Surg* 2016;77:337-40.
 44. Bolletta A, Di Taranto G, Chen SH, *et al.* Surgical treatment of Milroy disease. *J Surg Oncol* 2020;121:175-81.
 45. Hoffner M, Bagheri S, Hansson E, *et al.* SF-36 Shows Increased Quality of Life Following Complete Reduction of Postmastectomy Lymphedema with Liposuction. *Lymphat Res Biol* 2017;15:87-98.
 46. Agko M, Ciudad P, Chen HC. Staged surgical treatment of extremity lymphedema with dual gastroepiploic vascularized lymph node transfers followed by suction assisted lipectomy-A prospective study. *J Surg Oncol* 2018;117:1148-56.
 47. Granzow JW, Soderberg JM, Dauphine C. A novel twostage surgical approach to treat chronic lymphedema. *Breast J* 2014;20:420-2.

