



Carolyn De La Cruz MD
Assistant Professor of Surgery
Department of Plastic Surgery
University of Pittsburgh

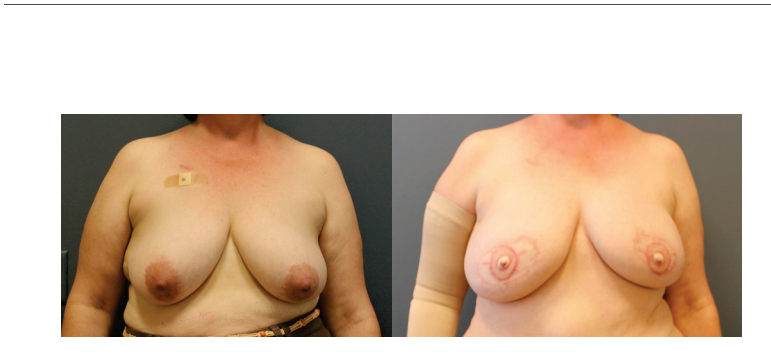
Why this occurs

Patient factors


Options for reconstructions

Special considerations for donor site lymphedema

Expected Outcomes



WHAT IS THE PROBLEM?




The Lymphedema Chase:
A Lancet
Fred Fisk, M.D.,
Michael Fisk, M.D.,
Leo Chodra, M.D.

In this article we discuss some recently published conflicting opinions concerning the pathobiology and degree of lymphedema and present a plea for the conservative treatment of this "wreaking and profligate" disease entity [1].

Physiology and Pathophysiology of the Lymph Vascular System

To understand lymphedema, the concept of the sufficiency of the lymph vascular system (LVS) has to be defined. The lymph vascular system is established at its maximum capacity to lower than the lymphatic bed. The expression, "maximum capacity" is defined by the highest possible lymph flow per unit of mass. We have proposed to establish three levels of lymph vascular insufficiency: 1) the occurrence of moderate vascular insufficiency; 2) the occurrence of moderate-to-severe vascular insufficiency; 3) the occurrence of severe-to-profound vascular insufficiency. In this sense, the lymphatic bed is anatomically and functionally normal but overwhelmed. The main propellers force of the lymph is generated by the contractions of the




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"Lymphedema is not a surgical disease"

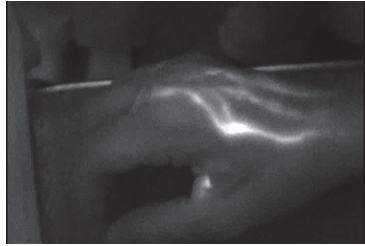


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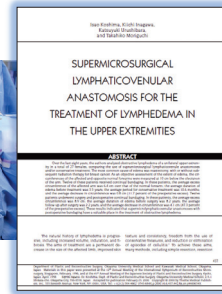
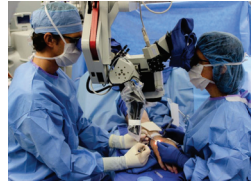
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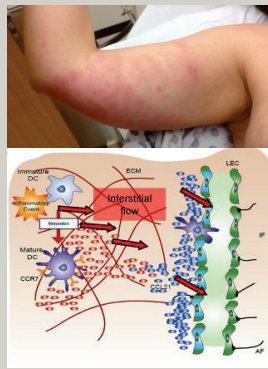
SURGICAL MANAGEMENT OF LYMPHEDEMA



JOURNAL OF RECONSTRUCTIVE MICROSURGERY VOLUME 16, NUMBER 6 AUGUST 2000

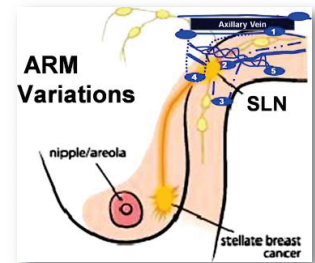
Immune Dysfunction

Repeat cellulitis
 How LE decreases ability to fight infection
 How the lymphatic system functions



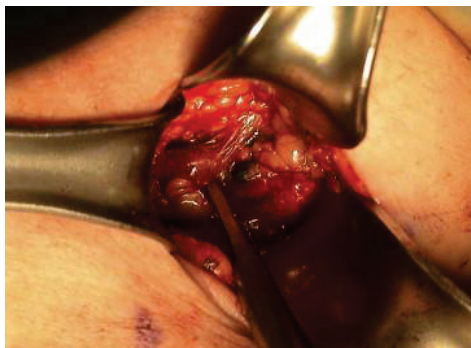
Lymphatic Anatomy

Different patterns of drainage
 How the lymphatic channels connect to the nodes




Axillary Reverse Mapping

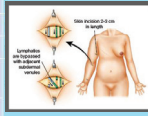
Developed by Suzanne Klimberg to identify and preserve lymph nodes that drain the arm




Surgical Management of Lymphedema Protocol

Active Patient Involvement		
Patient Evaluation	Decision for Surgery	Post-operative Care
<ul style="list-style-type: none"> No active Cancer No active Infection Medical Clearance 6 mths Conservative Therapy Photo Documentatinn Volumetric Measurements No Pitting Edema Lymphoscintogram 		<ul style="list-style-type: none"> Inpatient Hospital Stay 4 weeks Recovery Physical Therapy Resume Pre-op Routine at 1 month Follow up Measurements
<p>Patients seen weekly for 1 month and then 2mths 3 mths 6 mths and 1 year post-op</p>		<p>Patient monitored for post- operative complications</p>
Surgical Outcomes Documented and Evaluated		
Lymphedema Center Team Involvement		


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Establishing Goals and Expectations



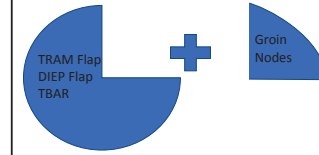
Establishing Goals and Expectations



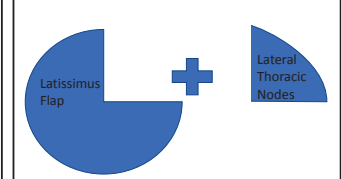
Goals of Surgery

- Prevent progression of disease
- Decrease incidence of infection
- Decrease risk of long term untreated LE
- Decrease volume
- Breast Reconstruction
- Restore Form and Function

Breast and Lymphatic Reconstruction using **lower abdominal tissue** and **lymph node transfer**



Breast and Lymphatic Reconstruction using **back tissue** and **lymph node transfer**



SURGICAL MANAGEMENT OF LYMPHEDEMA



RECONSTRUCTION

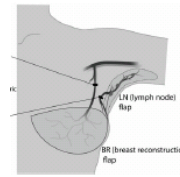
Total Breast Anatomical Reconstruction TBAR

Reconstructs breast and lymphatics using tissue and lymphatics from lower abdomen



Microvascular Breast Reconstruction and Lymph Node Transfer for Postmastectomy Lymphedema Patients
 Anne M. Saaristo, MD, PhD, Tarja S. Niemi, MD, Tiina P. Viitanen, MD, Tami V. Tervaho, MD, Paullina Harttalo, MD, PhD, and Erkki A. Suominen, MD, PhD

SURGICAL MANAGEMENT OF LYMPHEDEMA



RECONSTRUCTION

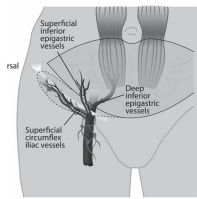
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SURGICAL MANAGEMENT OF LYMPHEDEMA



RECONSTRUCTION

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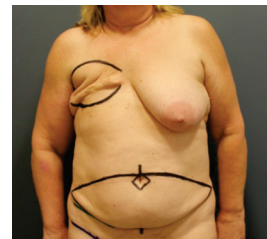
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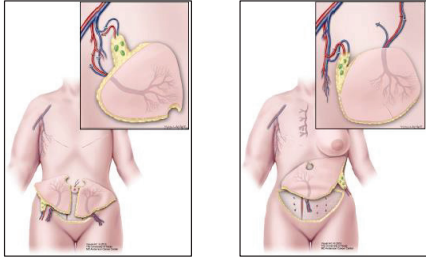
SURGICAL MANAGEMENT OF LYMPHEDEMA

Total Breast Anatomical Reconstruction

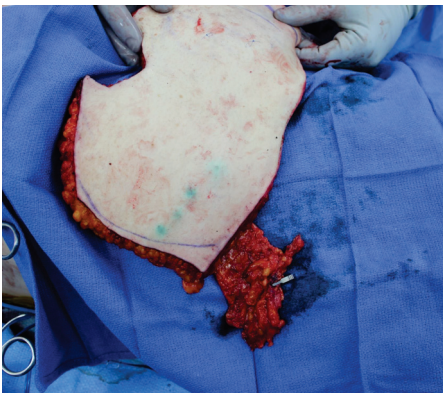
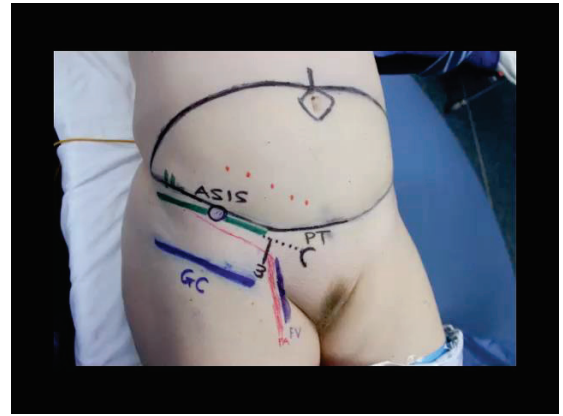


52 yo woman
 Hx of right breast cancer 2014
 s/p mastectomy with radiation
 Right arm lymphedema
 Otherwise healthy
 No previous abdominal surgery

An Algorithmic Approach to Simultaneous Vascularized Lymph Node Transfer with Microvascular Breast Reconstruction
 Alexander T. Nguyen, MD, FACS, I. Edward I. Chang, MD, Hiroo Suami, MD, PhD, David W. Chang, MD, FACS
 IDepartment of Plastic Surgery, The University of Texas MD Anderson Cancer Center, Houston, TX; 2Section of Plastic and Reconstructive Surgery, The University of Chicago Medicine & Biological Sciences, Chicago, IL



Ann Surg Oncol (2015) 22:2919–2924 DOI 10.1245/s10434-015-4408-4



SURGICAL MANAGEMENT OF LYMPHEDEMA

Total Breast Anatomical Reconstruction



ORIGINAL ARTICLE

Vascularized Lymph Node Transfer for Treatment of Lymphedema

A Comprehensive Literature Review

Alexis A. Hoff and David W. Chang, MD

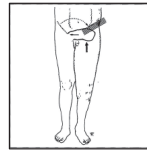
Background: Lymphedema is a chronic condition characterized by the accumulation of protein-rich fluid in the interstitial space, leading to swelling and tissue damage. It is a common complication of cancer treatment, particularly after lymph node dissection. The pathophysiology of lymphedema is complex, involving both structural and functional changes in the lymphatic system. The goal of this review is to provide a comprehensive overview of the current literature on the treatment of lymphedema, with a focus on the role of vascularized lymph node transfer (VLNT).

Summary: Lymphedema is a chronic condition characterized by the accumulation of protein-rich fluid in the interstitial space, leading to swelling and tissue damage. It is a common complication of cancer treatment, particularly after lymph node dissection. The pathophysiology of lymphedema is complex, involving both structural and functional changes in the lymphatic system. The goal of this review is to provide a comprehensive overview of the current literature on the treatment of lymphedema, with a focus on the role of vascularized lymph node transfer (VLNT).

CONCLUSIONS AND RELEVANCE

VLNT is a promising treatment option for lymphedema, particularly in cases of severe, refractory disease. It involves the transfer of a lymph node from a donor site to the recipient site, along with its associated vascular supply. This procedure aims to restore lymphatic drainage and reduce swelling. The current literature supports the use of VLNT as a viable treatment option for lymphedema, with several studies demonstrating significant improvements in lymphatic flow and patient quality of life.

Annals of Surgery • Volume 205, Number 5, May 2015



Original Article

The Lymphatics of the Groin Flap
 I. Chlebik, M.D., F.R.C.S., J. S. Smith, M.D., J. Brown, M.D., J. and G. Swartz, M.D.S.

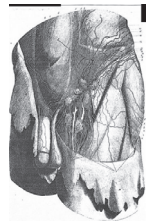
The lymphatics of the groin flap were first described by Chlebik et al. in 1971 (Fig. 1). These authors noted that the lymphatics of the groin flap were unique in that they were able to survive and function in a recipient site. This discovery led to the development of the groin flap as a lymphatic transfer flap for the treatment of lymphedema.

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Case Report

In Chlebik et al. (1971), a patient with moderate lymphedema of the left lower extremity and groin. An anastomosis was created between a groin flap and the recipient site. The patient was followed up for 10 years, and the lymphedema was significantly reduced. This case report demonstrated the effectiveness of the groin flap as a lymphatic transfer flap for the treatment of lymphedema.

Annals of Surgery • Volume 205, Number 5, May 2015





A case of donor-site lymphoedema after lymph node-superficial circumflex iliac artery perforator flap transfer

Gemma Pons, Jaume Masia, Pietro Loschi, Maria Luisa Nardulli, Joan Duch

Journal of Plastic, Reconstructive & Aesthetic Surgery

Volume 67, Issue 1, Pages 119-123 (January 2014)
DOI: 10.1016/j.bjps.2013.06.005

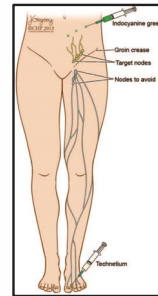
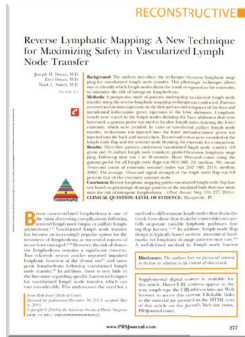


Fig 4. Filtered technetium is injected into the first and second webspaces of the foot. Indocyanine green is intracutaneously injected in four areas across the lower foot/ankle. (Published with permission from Elsevier)

Received: 18 April 2017 | Accepted: 3 July 2017
DOI: 10.1002/jor.24783

RESEARCH ARTICLE

WILEY *Journal of Orthopaedic Research*

The surgical anatomy of the vascularized lateral thoracic artery lymph node flap—A cadaver study

Ines E. Tinhofer MD¹ | Stefan Meng MD, PhD^{1,2} | Johannes Steinbacher MD¹ | Julia Roka-Palkovits MD³ | Eva Györi MD¹ | Lukas F. Reissig MD¹ | Ming-Huei Cheng MD, MBA, FACS, PhD⁴ | Wolfgang J. Weninger MD, PhD¹ | Chieh Han Tzou MD, MBA, PhD³

¹Department of Anatomy, Medical University of Vienna, Centre for Anatomy and Cell Biology, Vienna, Austria
²Department of Radiology, Hospital Kaiser-Franz-Josef, Vienna Hospital Association, Vienna, Austria

Background: One promising surgical treatment of lymphoedema nodes can be harvested from different locations; inguinal, axilla nodes are used most often. The aim of our study was to assess the lateral thoracic artery lymph node flap.

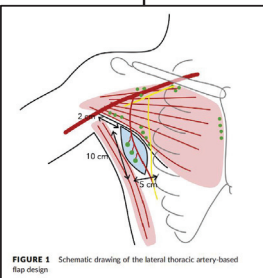


FIGURE 1 Schematic drawing of the lateral thoracic artery-based flap design

Latiomo Dorsi Flap With Vascularized Lymph Node Transfer for Lymphoedema Treatment: Technique, Outcomes, Indications, and Review of Literature

ANDRÉS MORALES, OSWALDO DE FREITAS, and DANIEL DE OLIVEIRA

Background and Objectives: One of the surgical treatment options for lymphoedema is vascularized lymph node transfer (VLNT). We present our technique with latissimus dorsi (LD) flap and VLNT for lymphoedema treatment. **Methods:** We describe the technique for the latissimus dorsi flap and VLNT for lymphoedema treatment. **Results:** We describe the technique for the latissimus dorsi flap and VLNT for lymphoedema treatment. **Conclusion:** The LD VLNT procedure is a safe and effective treatment for lymphoedema.

Key Words: lymph node transfer; lymphoedema; latissimus dorsi

INTRODUCTION
Lymphoedema is a condition characterized by the accumulation of lymphatic fluid in the interstitial space, leading to swelling and discomfort. The most common cause of lymphoedema is the obstruction or damage to the lymphatic system. The treatment of lymphoedema is challenging, and the goal is to reduce the volume of lymphatic fluid and improve the quality of life of the patient. One of the surgical treatment options for lymphoedema is vascularized lymph node transfer (VLNT). VLNT involves the transfer of a lymph node from a donor site to the recipient site, along with its blood supply. This procedure aims to restore the lymphatic drainage and reduce the swelling. The latissimus dorsi (LD) flap is a common choice for VLNT due to its large size and reliable blood supply. The LD flap is a musculocutaneous flap that can be harvested from the lower back and transferred to the recipient site. The LD flap is a well-established flap for various reconstructive purposes, and its use in VLNT has been reported in the literature. The LD VLNT procedure is a safe and effective treatment for lymphoedema, and it has been shown to improve the quality of life of the patient. The LD VLNT procedure is a complex surgical procedure that requires a multidisciplinary approach. The surgeon must have a thorough understanding of the anatomy of the LD flap and the lymphatic system. The LD VLNT procedure is a promising treatment option for lymphoedema, and it should be considered for patients who are not responsive to medical treatment.

Simultaneous Breast Reconstruction and Treatment of Breast Cancer-Related Upper Arm Lymphedema With Lymphatic Lower Abdominal Flap

Chen, Ru MD¹; Mu, Lan MD, PhD²; Zhang, Han MD³; Xin, Mingqiang MD, PhD⁴; Luan, Jie MD, PhD⁵; Mu, Dalí MD, PhD⁶; Liu, Chunjun MD, PhD⁷; Ji, Kai MD⁸; Hu, Jiejie MD⁹; Sun, Jingjing MD¹⁰; Xuan, Lixue MD¹¹; Rong, Yongying MD¹²; Zheng, Liping MD¹³; Tang, Peng MD¹⁴; Zhong, Xiaojie MD¹⁵; Wu, Huangfu MD¹⁶; Zou, Tiansheng MD¹⁷; Yang, Zhuangqing MD¹⁸; Becker, Corrine MD, PhD¹⁹

Annals of Plastic Surgery: September 2014 - Volume 73 - Issue - p S12-S17
doi: 10.1097/SAP.0000000000000322



Combining Autologous Breast Reconstruction and Vascularized Lymph Node Transfer

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Jaume Masia
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Mark L. Smith
³ Division of Plastic Surgery, Northwell Health System, Lake Success, New York



Seminars in Plastic Surgery 2018; 32(01): 036-041
DOI: 10.1055/s-0038-1632402

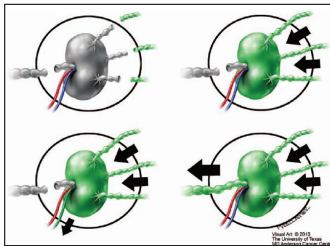


An Algorithmic Approach to Simultaneous Vascularized Lymph Node Transfer and Microvascular Breast Reconstruction

Alexander T. Nguyen, Edward Chang, Hiroo Suami, David W. Chang
 Annals of Surgical Oncology
 September 2015, Volume 22, Issue 9, pp 2919-2924



Latissimus dorsi flap with vascularized lymph node transfer for lymphedema treatment: Technique, outcomes, indications and review of literature
 Amir Inbal MD
 Chad M. Teven MD
 David W. Chang MD, FACS



RECONSTRUCTIVE
The Mechanism of Vascularized Lymph Node Transfer for Lymphedema: Natural Lymphaticovenous Drainage

Ming-Hsi Cheng, M.D., Joseph Hoang, M.D., Chih-Hsi Wu, M.D., Chun-Hsiung, M.D., Chia-Hsi Lin, M.D., Nien-Yi Hsueh, M.D., Lida Rubin, M.D.
 Background: Vascularized lymph node transfer for the treatment of upper and lower limb lymphedema has had promising results. This study was performed to investigate the mechanism of lymph drainage of a vascularized lymph node flap both experimentally and clinically.
 Methods: In the experimental study, 10 Sprague-Dawley rats were used to create 30 flaps, either a great lymph node flap or an abdominal omentum flap that did not contain lymphatics. Lymphatic agents were injected into the edge of 12 lymph node flaps, directly into a lymph node of 12 lymph node flaps, and into the edge of 12 omentum flaps. In the clinical study, an identical study design was used, with 24 vascularized lymph node flaps and 12 omentum flaps containing lymphatics.
 Results: Experimentally, fluorescence was detected in the pedicle after a mean latency period of 10.3 ± 1.0 seconds when the edge of the lymph node flap was injected and 12.8 ± 3.1 seconds when the lymph node was directly injected. Fluorescence was not detected in the pedicle vein of the omentum flap (P < 0.001). Clinically, fluorescence was detected in the pedicle vein after a mean latency period of 14.0 ± 2.0 seconds when the edge of the lymph node flap was injected and 23.5 ± 2.1 seconds when the lymph node was directly injected. Fluorescence was not detected in the pedicle vein of the omentum flap (P < 0.001).
 Conclusion: The vascularized lymph node flap drains lymph into the pedicle vein both experimentally and clinically. (Plast Reconstr Surg 131: 200, 2014.)
 CLINICAL QUESTION: LEVEL OF EVIDENCE: Therapeutic, V.

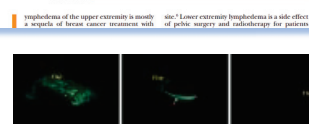


Table 1. Summary of Included Studies

Reference	Design	Lymphedema Site	Operative Technique	No.	P/U (no.)	LOS
Chang et al. 2012 ¹	RCT	U/L	LNT	12	2/6	0
Cheng et al. 2014 ²	RCT	U/L	LNT	9	1/9	0
Cheng et al. 2015 ³	RCT	U/L	LNT	14	2/14	0
Cheng et al. 2015 ⁴	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ⁵	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ⁶	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ⁷	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ⁸	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ⁹	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ¹⁰	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ¹¹	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ¹²	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ¹³	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ¹⁴	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ¹⁵	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ¹⁶	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ¹⁷	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ¹⁸	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ¹⁹	RCT	U/L	LNT	12	2/12	0
Cheng et al. 2015 ²⁰	RCT	U/L	LNT	12	2/12	0

Operative Treatment of Peripheral Lymphedema: A Systematic Meta-Analysis of the Efficacy and Safety of Lymphovenous Microsurgery and Tissue Transplantation
 Basta, Marten N. B.A.; Gao, Lin Lin M.D.; Wu, Liza C. M.D.

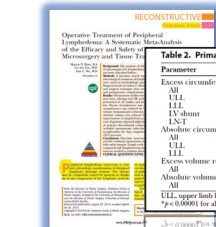
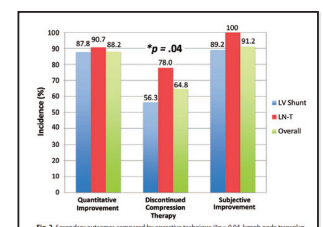


Table 2. Primary Outcomes*

Parameter	No. of Studies	No.	Mean (95% CI)	P (%)
Excess circumference reduction, %				
All	11	171	48.8 (42.5-54.8)	0
U/L	7	90	40.0 (30.0-50.0)	0
L/L	4	81	57.4 (44.5-70.3)	0
LV shunt	7	80	46.9 (40.7-53.2)	0
LNT	4	51	48.3 (35.3-61.6)	89
Absolute circumference reduction, cm				
All	11	178	3.81 (3.28-4.08)	0
U/L	6	79	2.75 (1.68-3.83)	16
L/L	5	92	3.32 (2.28-4.75)	0
Excess volume reduction, %				
All	4	165	35.6 (17.5-60.0)	78
Absolute volume reduction, %				
All	2	60	23.6 (11.5-35.7)	72

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SURGICAL MANAGEMENT OF LYMPHEDEMA

Conclusions of the study were

Excess circumference ↓ 48.8 %
Excess volume ↓ 56.6 %

Absolute volume ↓ 23%
Absolute circumference ↓ 3.31 cm (8.5%)

No improvement 11.8 %
91.2% patient subjective improvement
64.8% discontinued garment use

