



Welcome to S40M's Topic of the Day Series

Lymphatic Therapies:
Reviewing and Renewing — Part 3

Meet Our Speakers



Leslyn Keith OTD, OTR/L, CLT-LANA

Leslyn Keith is a certified lymphedema therapist and has a Clinical Doctorate in Occupational Therapy with an emphasis on lymphedema and obesity.

Dr. Keith has started four lymphedema therapy programs in California including two in private practice. She has treated lymphatic and fat disorders for over 20 years and currently researches, consults, and lectures on lymphedema, lipedema, and obesity nationally and internationally. She is the author of two books about and published several articles about the efficacy of a ketogenic diet for lymphatic and fat disorders. Currently, Dr. Keith is Director of Research and Board President for The Lipedema Project and an instructor in lymphedema therapy for Klose Training.

Professional memberships include National Lymphedema Network, Lymphology Association of North America, and Obesity Medicine Association.



Meet Our Speakers

Adie MacKenzie is a Medical Massage Therapist, Certified Lymphedema Therapist, Physical Therapist Assistant, and Board-Certified Health and Wellness Coach with over 40 years of experience in massage therapy. Currently, she divides her time between a private practice and clinical time at the Osher Center for Integrative Medicine at Vanderbilt. She sees Lymphedema patients and those with chronic pain and chronic illness in their homes or at the Osher clinic. As well, Adie serves as clinical advisor to AIROS Medical.

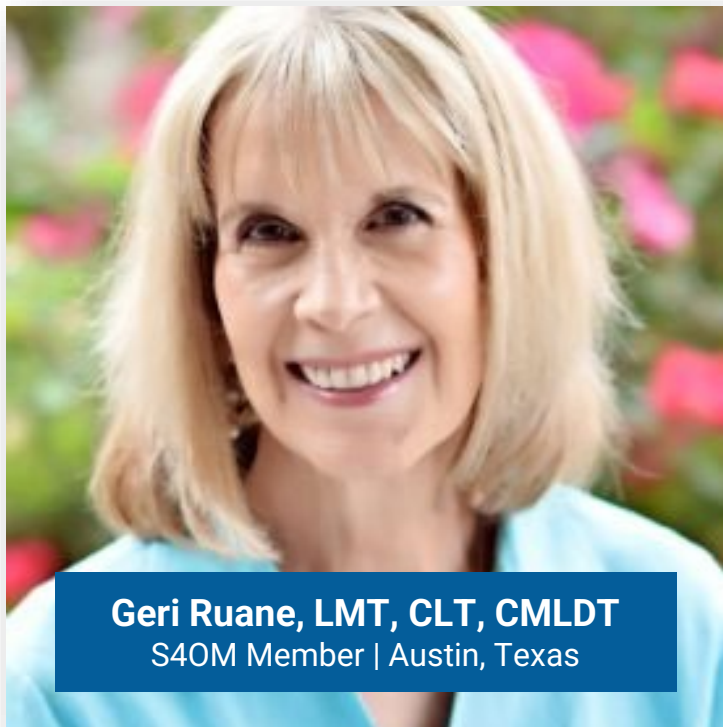
Her work at Vanderbilt has focused on treating voice and swallowing dysfunction and on breast cancer rehabilitation, particularly treatment for scar tissue adhesions, functional limitations and Lymphedema. At two of the biennial National Lymphedema Network Conferences in 2012 and 2014, she was selected to present case-study posters, and in 2016 participated in the elite Lymph Science Advocacy Program. (LSAP) Most recently, she presented a poster talk at the World Congress of Lymphology in Barcelona. A case study on head and neck lymphedema was published in Lymphlink in 2014.



Adie MacKenzie, PTA, LMT,
CLT-LANA, Health & Wellness Coach
S4OM Member | Nashville, TN



Meet Our Speakers



Geri Ruane, LMT, CLT, CMLDT
S4OM Member | Austin, Texas

Geri Ruane is a Texas licensed massage therapist since 2007 and is a certified lymphedema therapist as well as a certified manual lymph drainage therapist (Vodder technique) from Klose Training. Ruane received her oncology massage education through the 300-certification program from the Peregrine Institute of Oncology Massage Training.

She has also received massage therapy trainings (hospice, hospital, infusion and end-of-life) from Tracy Walton, Healwell, Greet the Day and Final Touch Training.

Geri's private practice, Two Roads Massage Therapy LLC, has attracted clients with various types of health issues and those with complex medical histories. The majority of her clients are men and women who are currently going through cancer treatment and/or have had a history of cancer. In addition, Ruane offers MLD (manual lymph drainage) to people who are experiencing lymphedema or have other lymphatic concerns.



Learning Objectives



Therapists will describe potential signs of central lymphatic dysfunction.



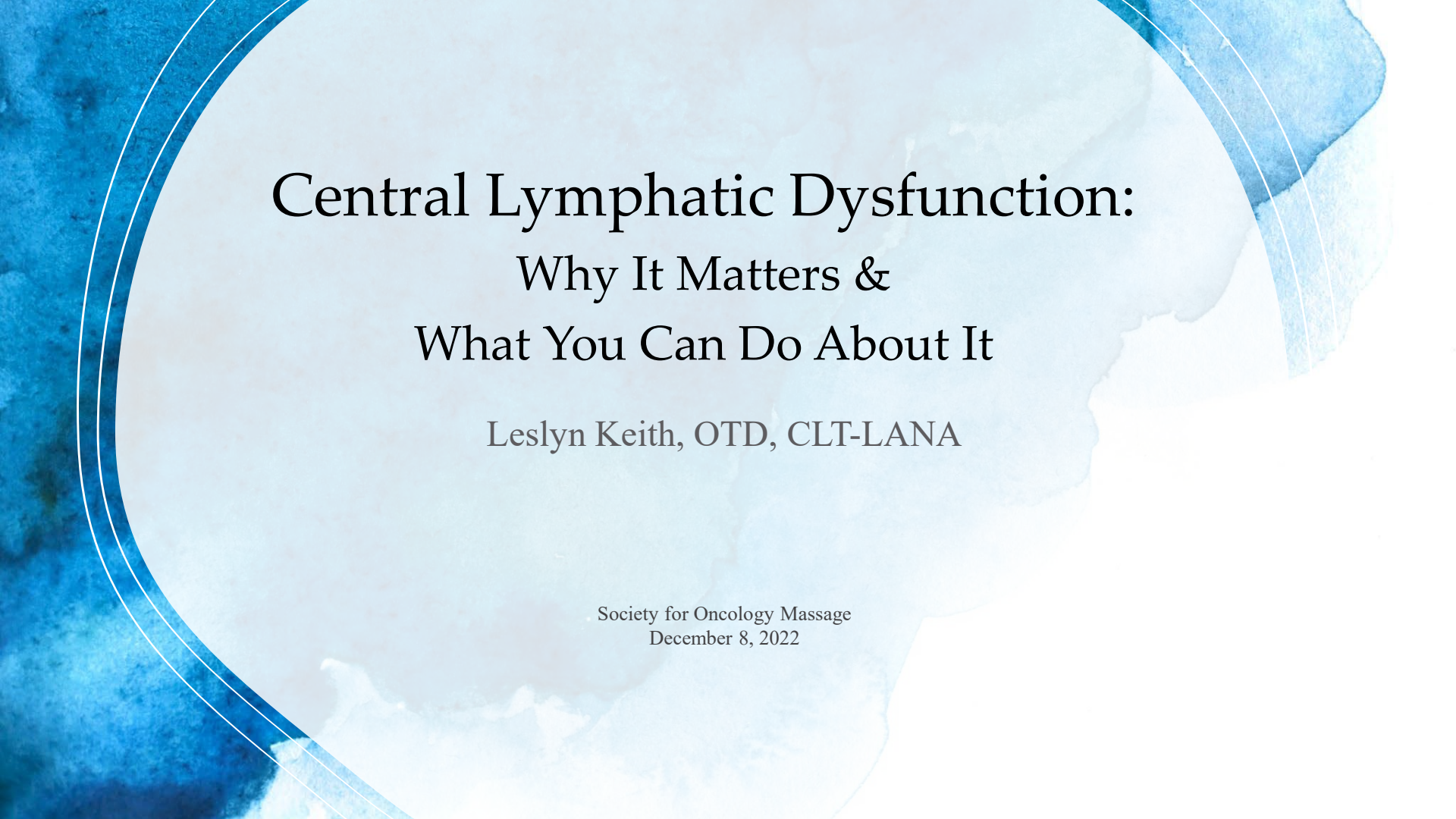
Learners will describe the current status of medications to address lymphedema.



Therapists will define and describe several different treatment strategies for central lymphatic dysfunction



Learners will list 3 surgeries that are currently used to treat lymphedema.



Central Lymphatic Dysfunction: Why It Matters & What You Can Do About It

Leslyn Keith, OTD, CLT-LANA

Society for Oncology Massage
December 8, 2022

Special Thank You to...

Dr. Max Itkin
Interventional Radiologist
Treatment of Lymphatic Flow Disorders and
Conditions
Penn Medicine, Philadelphia, PA
contact: Maxim.Itkin@uphs.upenn.edu



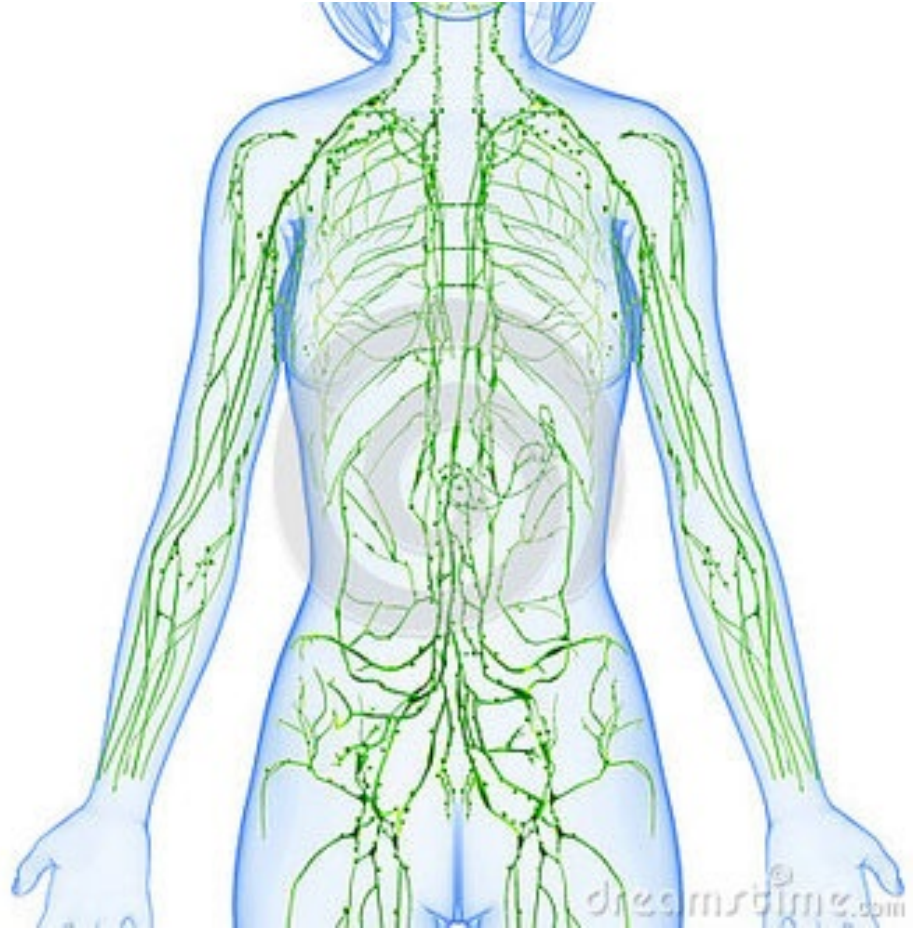
Kelly Bell
LE&RN N. Carolina Chapter
Veteran Fighting Lymphedema
www.vetfightinglymphedema.com



The Lymphatic System

“the network of vessels through which lymph drains from the tissues into the blood”

Oxford Dictionary





Every organ and system in the body requires healthy lymphatics to function properly, and to such an extent that in the future we may be treating a wide range of diseases *by treating the lymphatics.*

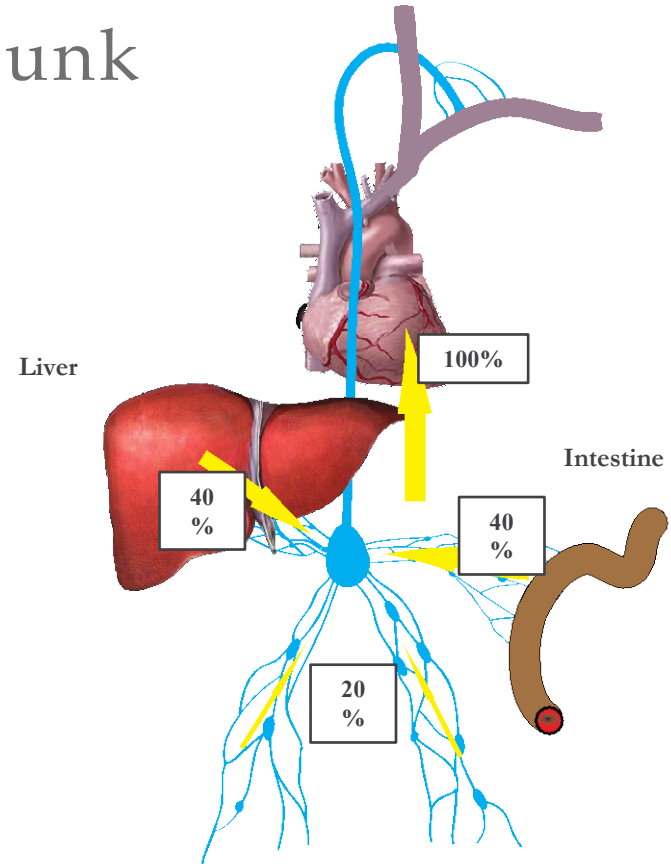
Dr. Stanley Rockson
NLN Conference, October 2020

Lymphatic Flow in the Trunk

Lumbar Lymphatics (20%)

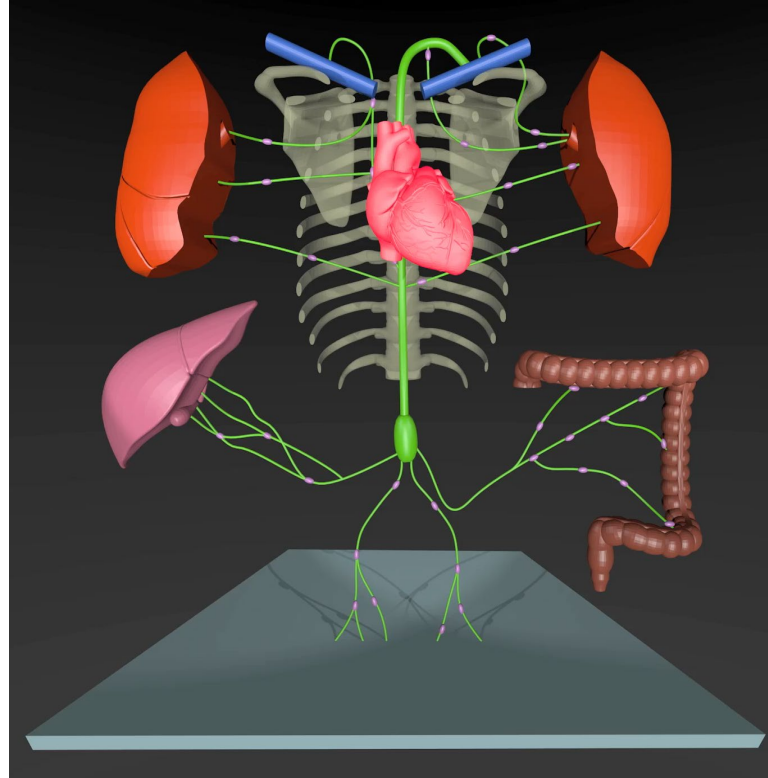
Liver (40%)

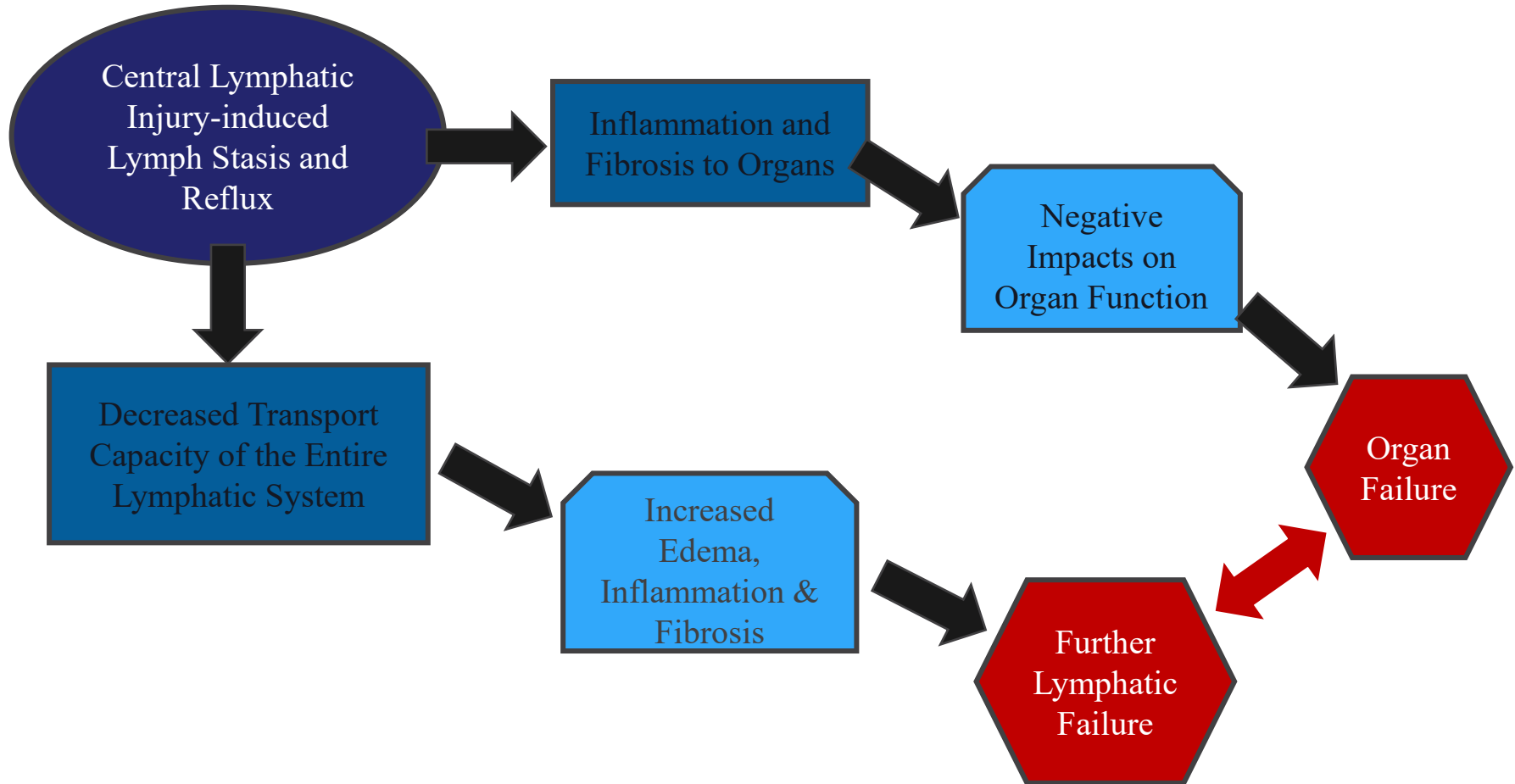
Intestine (40%)



Lumbar, extremities, soft tissue

Organ Lymphatic Flow to TD





Central Lymphatic Dysfunction: How Does It Happen?

Congenital Lymphatic Malformation

Generalized Lymphatic Anomaly (GLA)

Gorham Disease

Intestinal lymphangiectasia

Thoracic Duct Injury

Traumatic causes

Surgical - procedures on trunk (hysterectomy, gallbladder, heart etc.)

Non-surgical - trauma to the neck, thorax, upper abdomen, and occasionally due to straining or forceful vomiting and subclavian vein canalization

Non-traumatic Causes

Malignant - lung cancers, mediastinal tumors, sarcomas, and leukemia.

Non-malignant - benign tumors, liver cirrhosis, sarcoidosis, protein-losing enteropathy, etc.

Bojanapu et al.[Updated 2021 Aug 23]. In: StatPearls [Internet].

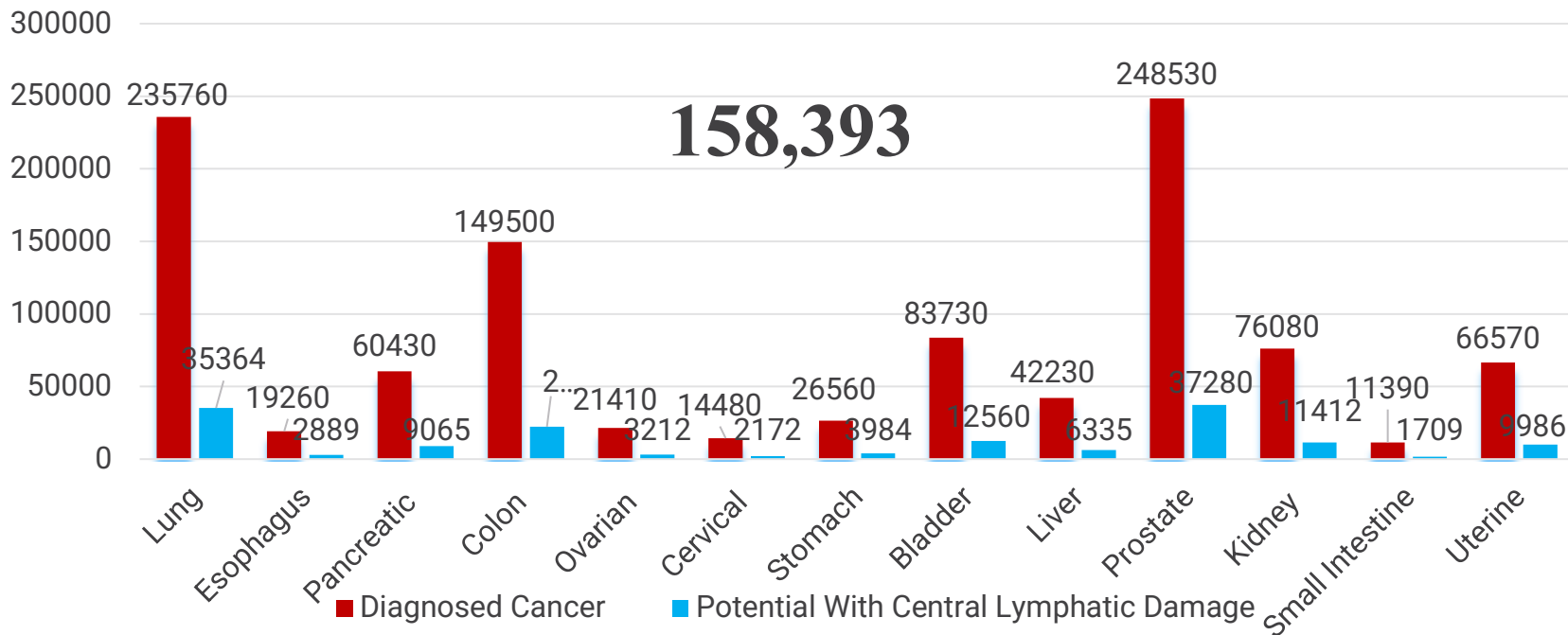
Treasure Island (FL): StatPearls Publishing; 2021 Jan-

. Available from:

<https://www.ncbi.nlm.nih.gov/books/NBK560549/>

How many are potentially affected?

Patients Diagnosed with Organ Cancers - 2021
15% may develop damage to Central Lymphatics



Indications of Possible Dysfunction of Central Lymphatics

1. Unexplained swelling in the limbs, neck, or head after surgeries or treatments of any kind in the thoracic cavity. Could be delayed.
2. Trunk/genital swelling with progression to limbs.
3. New onset of:
 - Breathing difficulty
 - GI disturbance
 - Truncal pain
4. Increased swelling in trunk after:
 - exercise
 - pneumatic pump on limbs
 - compression garments on limbs
 - prolonged sitting or standing
5. Swelling that is nonresponsive to CDT despite adherence.
6. Blood work: Triglyceride levels $>110\text{mg/dL}$ ($>240\text{ mg/dL}$ consistently reported) and cholesterol $<200\text{ mg/dL}$, elevated BUN/creatinine ratio and liver enzymes

Imaging – First Step Toward Diagnosis

Lymphoscintigraphy
Indocyanine Green

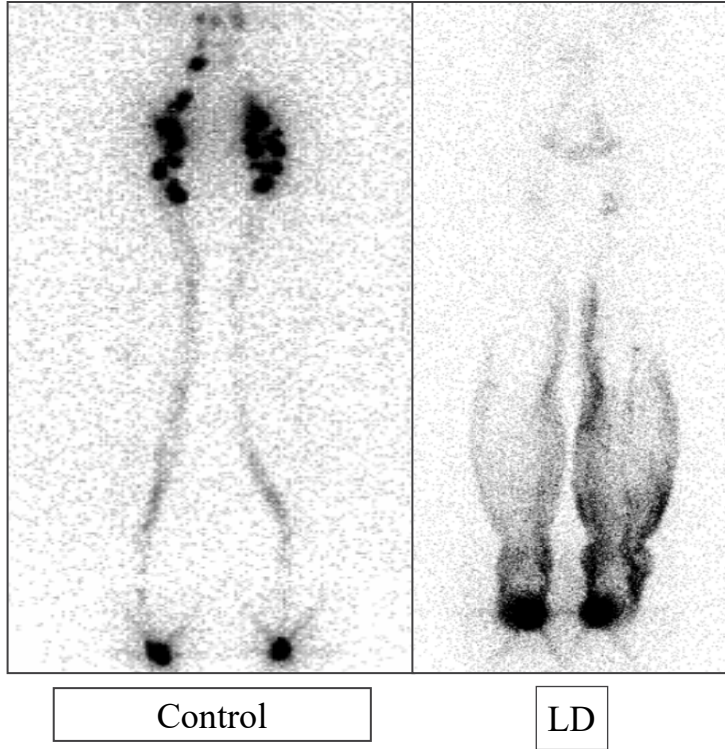
Magnetic Resonance Lymphography
Contrast Enhanced MR Lymphangiography



Locations:

University of Pennsylvania, Children's Hospital of Philadelphia
(Dr. Maxim Itkin)
Beth Israel Deaconess Medical Center, Boston
(Dr. Dhruv Singhal)

Lymphoscintigraphy



- Image of lymphatic *function*, *anatomy* is not visualized
- Trunk often not included
- Useful if clinical exam is inconclusive
- Radioactive Tracer injected between fingers/toes
- Several hours to complete
- Can be painful

Indocyanine Green (ICG) Near-Infrared Fluorescence

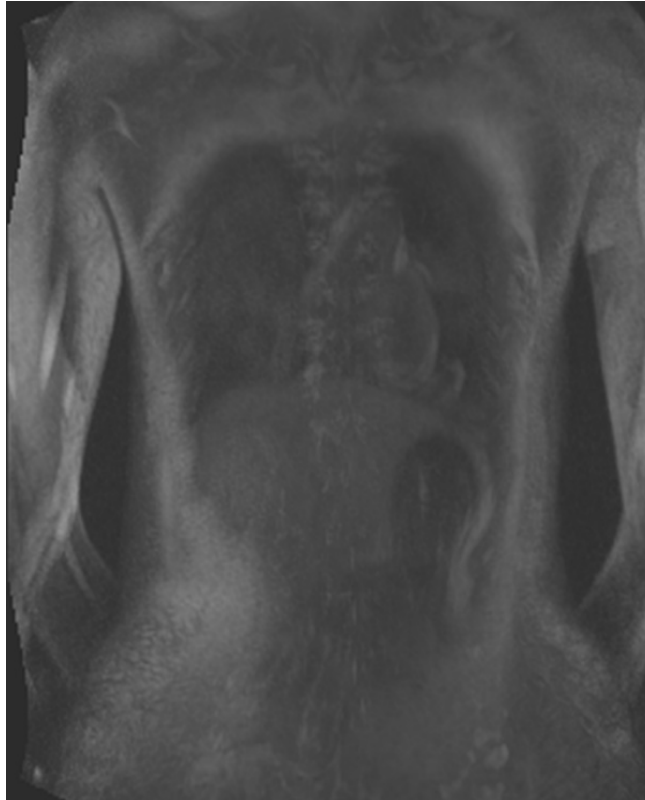


- Provides real time anatomical view
- Limited to 2 cm depth
- Can guide both microsurgery & treatment for peripheral and superficial lymphatics
- Unable to visualize deep lymphatics

Magnetic Resonance Lymphography (MRL) for Deep Thoracic Lymphatics

Polomska & Proulx (2021). Imaging technology of the lymphatic system, *Advanced Drug Delivery Reviews*, 170, 294-311.

Contrast Enhanced MR Lymphangiography

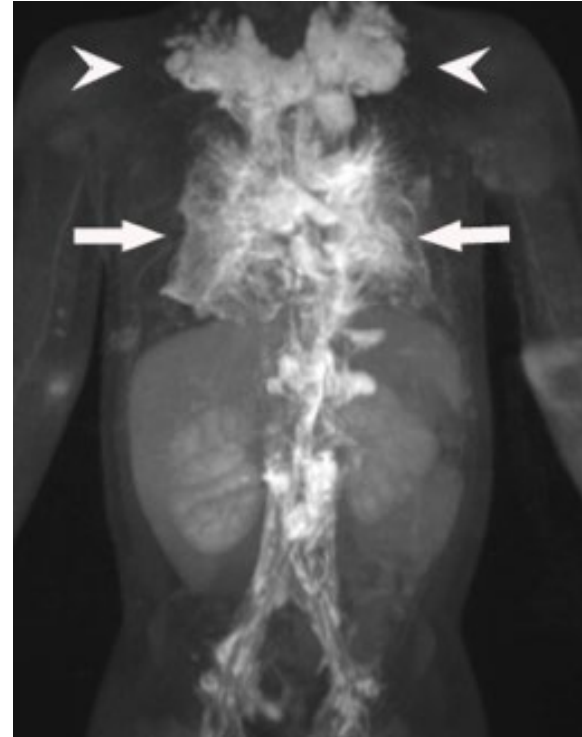


Idiopathic Chylothorax

Post-Cardiac Surgery Chylothorax

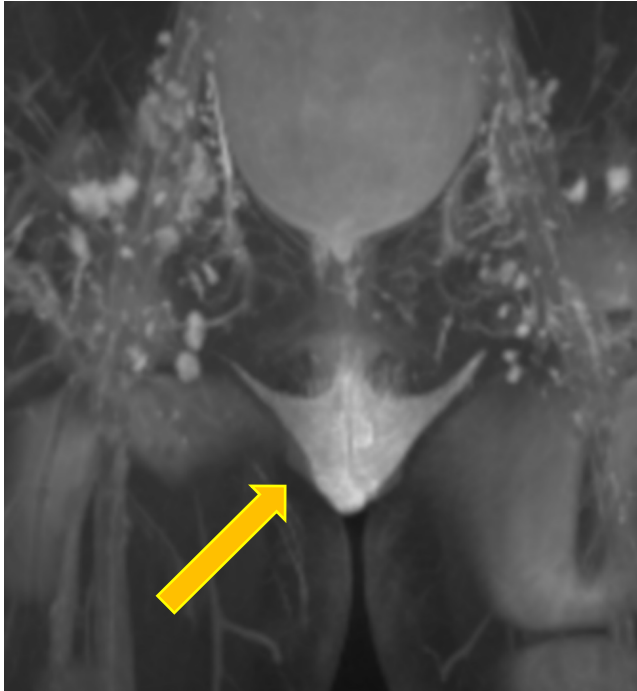
Pulmonary Lymphatic Perfusion
Syndrome

14/16 patients had an intact TD
PLPS may not be visualized with
traditional lymphoscintigraphy



Savla, J., Itkin, M., Rossano, J.
W., & Dori, Y. Post cardiac
surgery chylothorax JACC 2017
May

Scrotal/Vulvular Edema/Leakage





56-year-old female with primary lymphedema dx at 7 yrs. of age

Initially presented in RLE and LUE

1980s – pregnancy and childbirth
onset of swelling in other limbs and
abdomen

2015 – MRL showed lack of lymphatics in
limbs but also slow transit in thoracic duct



Kelly Bell

51-year-old male

Military career

Triathlete

2005 - Treated for misdiagnosed reflux with injection of polymer which infiltrated thoracic duct and then to organs

Symptoms:

Weight gain

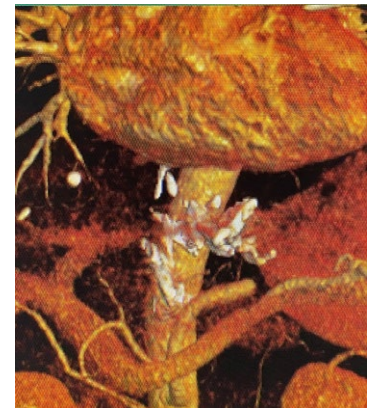
Swelling to legs, arms, trunk,

R side of face/neck

Difficulty breathing – CPAP, O₂

Severe pain

GI issues



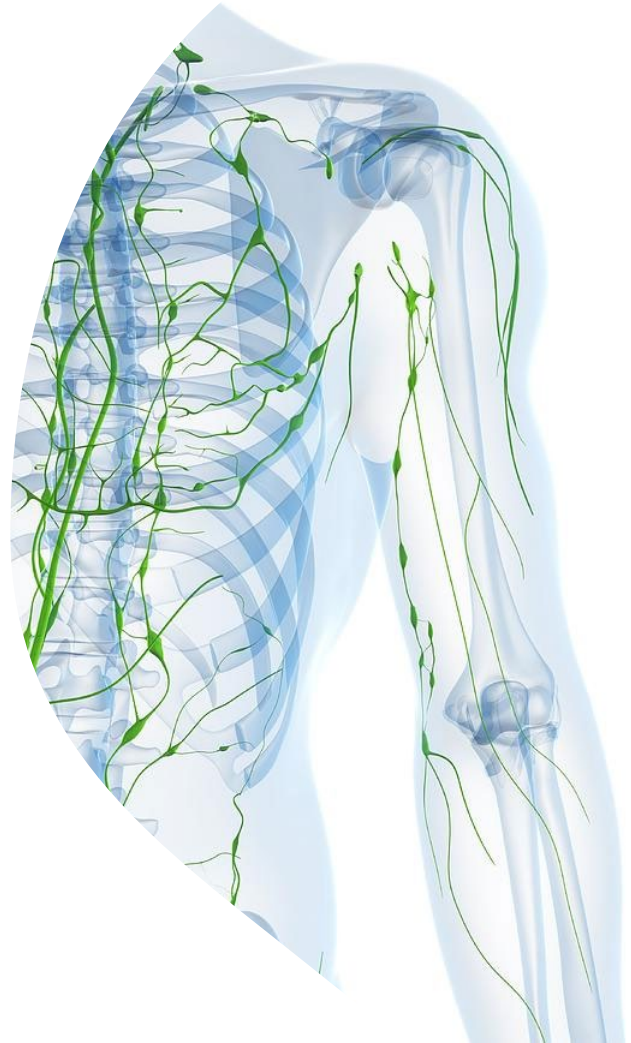
TWO QUESTIONS TO CONSIDER:

Are the traditional therapies for peripheral lymphedema (MLD, compression, exercise) helpful for deep central lymphatic dysfunction?

Are patients non-compliant...or is their central lymphatic lymphedema simply non-responsive to current gold standard for lymphedema treatment?

Intervention Strategies

- Nutrition
- Breathing Exercises
- Pneumatic Pump
- Surgical Intervention



Conventional Diet Recommendations

Low Fat Diet

Focus on Medium Chain Fats

Intention:

Reduce burden to lacteals and thoracic duct

Outcomes:

Short-term: Lymph production/load is temporarily reduced

Long-term: Essential fatty acid and fat-soluble vitamin deficiencies

McCray, S., & Parrish, C. R. (2004). When chyle leaks: nutrition management options. *Practical gastroenterology*, 60-77.

7 ways to use MCT oil ▼



MCT oil is made of medium-chain triglycerides, which are used for energy more easily (and stored as fat less often!) than other fats

MCT supports a healthy weight and can amplify the benefits of a low-carb, high-fat diets



mix MCT powder into soft foods like yogurt and soup



blend MCTs into coffee instead of sweetened creamer



add MCTs to smoothie and protein shake recipes



swap 1/3 of the oil in baked recipes for MCT oil



add MCT oil to salad dressings



sauté vegetables in a combo of MCT oil and other cooking oil



slurp down a spoonful for quick energy and satiety

Other Dietary Strategies

Ketogenic Diet

Keto Food List





January 2017



June 2018



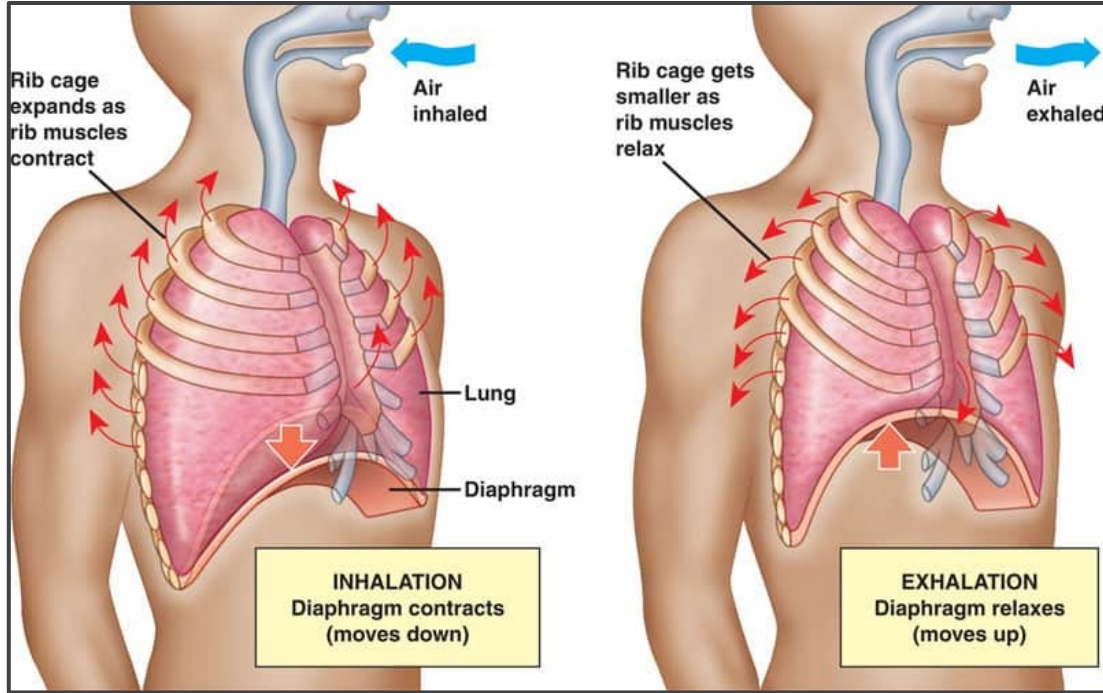
National Lymphedema Network

National Lymphedema
Network Conference
Cleveland, OH
November 17-20, 2022

Other Dietary Strategies

Intermittent &
Extended Fasting





Deep Breathing

- Reduces anxiety and pain
- Controls blood pressure
- Enhances relaxation

Deep Breathing

Increases lymph vessel contraction and lymph transport



Deep breathing along with external pressure to tolerance

Breathing Exercises for Thoracic Duct Dysfunction

provided by Kelly Bell



Position 1



Position 2

Pneumatic Pump

- Intensive deep trunk treatment/activation
- Must be laying flat (may need head elevated) with mild knee flexion
- Must do trunk pre-treatment before limbs are treated
- Limbs can also be treated, but focus on trunk (fluid in limbs—especially legs—may be a symptom of what is happening in the trunk)
- Pressure, frequency and duration suggestions:
 - Individualized to patient tolerance
 - Higher pressures may not necessarily increase benefit for the patient



Surgical/Procedural Intervention

- Thoracic Duct Ligation
- Lymphatic Embolization
- Thoracic Duct Embolization
- Interstitial Lymphatic Embolization
- Thoracic Duct Stenting
- Externalization of the Thoracic Duct
- Lymphatic Angioplasty



Microcoils



Glue: n-Butyl
Cyanoacrylate
(n-BCA)



Surgical Intervention Challenges

Complex and variable anatomy

Small size of the lymphatic vessels

Difficulty in introduction of the contrast

Difficulty in identifying location of leak

Success rate of Thoracic Duct Surgeries

Ligation

Success rate = 70 to 100%

Invasive surgical procedure

More severe complications and adverse events

Embolization

Success rate = 72 to 90%

Minimally invasive

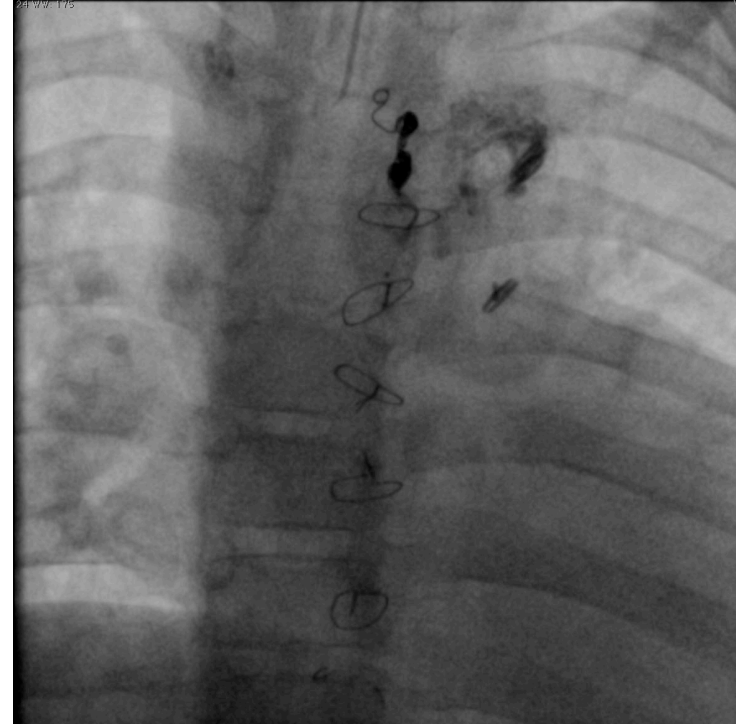
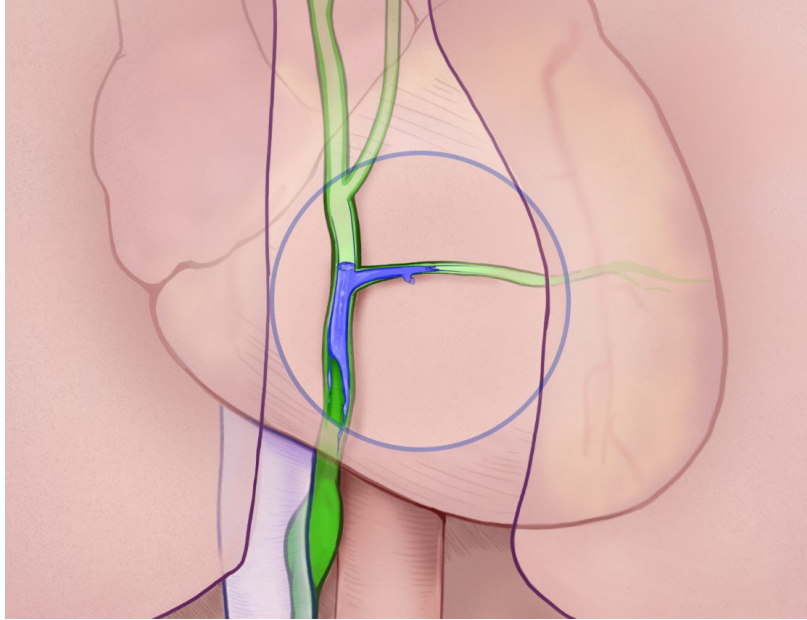
No major complications or deaths

Technically demanding procedure

Itkin et al. (2010). Nonoperative thoracic duct embolization for traumatic thoracic duct leak: Experience in 109 patients. *The Journal of Thoracic and Cardiovascular Surgery*, 139(3), 584–590.

Worrell & Chang (2018). Silencing the bird: Should surgical thoracic duct ligation shuffle off this mortal coil? *The Journal of Thoracic and Cardiovascular Surgery*, 156(2), p. 844.

TD Embolization - Glue injection





CATHERINE
Surgery Date:
7/18/22

1 Week Post-discharge

BUN/Creatinine Ratio went from 26 to 15
day after surgery

Skin coloring changed back to normal instead
of pale all the time

Face has thinned back out to normal.

Bra size has reduced 2 sizes in 7 days.

O₂ levels not dropping below 96% anymore
(daytime or nighttime)

Increased urination (pre-surgery 2x per day;
post-surgery 10-12x per day)

14 lbs of weight reduction in 7 days

Estrogen dropped 92.6% to be in normal
range 3 days post surgery (Prior it was over
1400)

2 Weeks Post-discharge

Compression that last fit properly
Nov. 2021 is now fitting better
Hematologist immediately knew

thoracic duct was the cause of my
iron saturation levels being very

Fluid around chest disappeared

Energy level is through the roof

No more coughing

No more sounding gargly

3 Weeks Post-discharge

I'm down 26lbs

Leg continues to shrink

Iron Saturation returned to normal
levels and in up in half the time
anticipated

Waist measure reduced from
123cm to 111 cm

I grew a 1.5" in height -- legs are
closer together because of reduced
girth

Down a total of 38 lbs

Heart issues completely resolved as seen in EKG done 8/21/22 compared to 12/2011.

Bra size down 3 sizes

Reduced compression from Class 3 stocking

layered with Class 2 stocking to

12 Weeks
Post-discharge



Thank you!

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<https://www.leslynkeith.com/>

Lymphatic Surgeries for Chronic Edema

Adie MacKenzie,

LMT, PTA, CLT-LANA, NBC-HWC

Disclosures:

Clinical Advisor to AIROS
Medical, a pneumatic pump
company



Isn't Surgery contraindicated in Lymphedema?

- Initially I was taught that it is too risky, poor outcomes
 - Recent developments have led to positive outcomes with the surgeries
 - Imaging advancements and microsurgical techniques have led to improvements
- 3 main types of surgeries
 - Some controversy between providers as to which is right for what patient
 - Attempts are being made to develop a decision tree/algorithm to guide choices

LyMPHA: Lymphatic Microsurgical Preventative Healing Approach

Done for patients who require lymphnode dissection in axilla, groin

Done at time of mastectomy with concurrent reconstruction

Creates a shunt to drain the lymph vessels affected into a nearby vein

Requires imaging studies to determine location for the anastomosis

Shows promise at preventing lymphedema from occurring

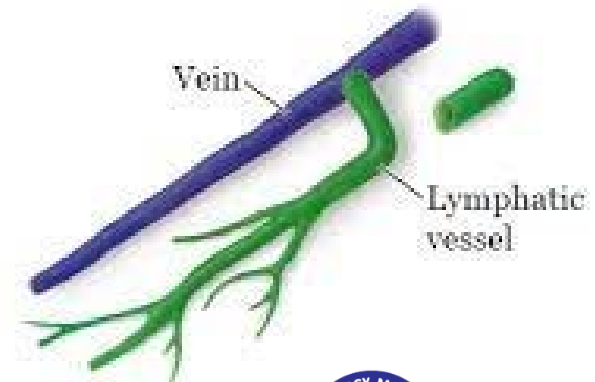
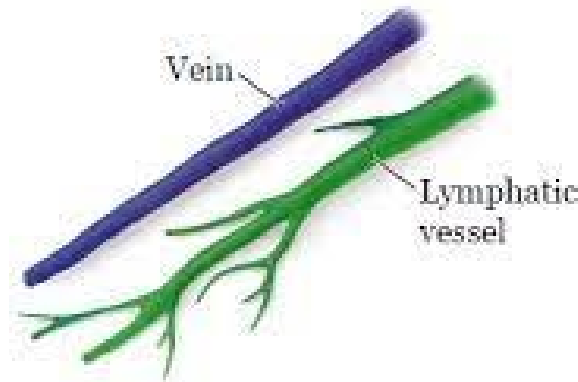
Lymph(atico)venous Anastomosis

Also referred to as Lymphovenous Bypass

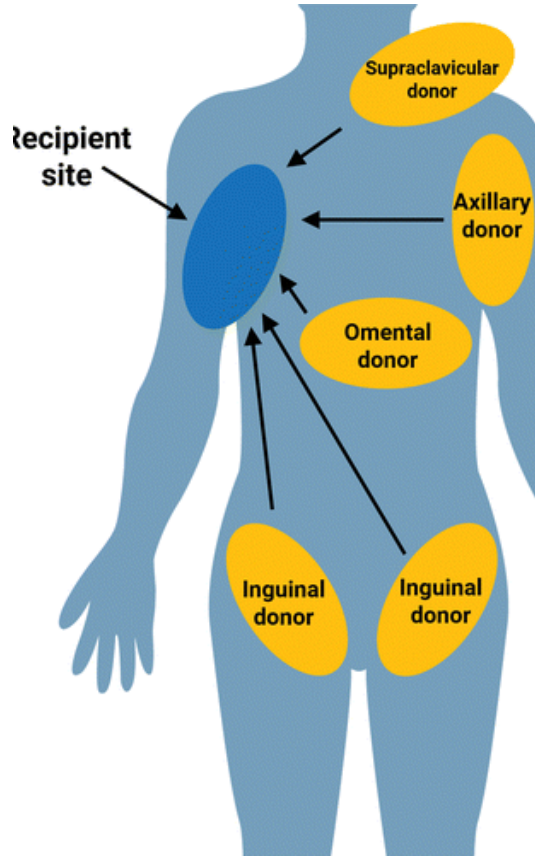
Same basic technique as LyMPHA but done later to restore drainage

Surgeons disagree about number of connections that are best

Can be done in any affected body-part



Vascularized Lymph Node Transfer (VLNT)



- A surgical technique that involves moving lymph nodes with an intact blood supply – an artery and a vein that can be anastomosed to the recipient site – to restore or augment lymphatic drainage
 - Often done concurrently with reconstructive surgery, but nodes can be harvested from several body areas
 - May be transplanted to lymph node bed or other area
 - Can potentially lead to development of lymphatic collateral pathways
 - Can potentially lead to development of lymphedema at donor site
 - Imaging needed to identify appropriate nodes to use and sites to place; can be done with CT, US, MRI, ICG
 - Reverse mapping is a technique used to determine details
 - ICG imaging is only up to 4 cm deep
-
- <https://pubs.rsna.org/doi/full/10.1148/rg.2020190118>
 - <https://lymphedemasurgeon.com/lymph-node-transfer/>

Debulking: Charles Procedure

- Offers **radical excision of lymphedematous tissue followed by skin grafting**. This procedure is rarely offered because of the potential for complications, but it may provide excellent outcomes in improving quality of life.¹
- Not used as much lately but still may be used especially in obesity related concerns, lobes, etc.
- Cosmetic results are not optimal
 - 1.DOI:<https://doi.org/10.1016/j.jvs.2019.01.021>



Debulking: Charles Procedure

- Easy to see here why QOL may be benefitted by this procedure in extreme cases
 - These patients have primary Lymphedema
- https://www.researchgate.net/publication/24445412_Modified_Charles_Procedure_Using_Negative_Pressure_Dressings_for_Primary_Lymphedema

Annals of Plastic Surgery • Volume 62, Number 6, June 2009

Modified Charles Procedure for Lymphedema



FIGURE 6. Result after 12 weeks (same patient as Fig. 5).

define the abnormality and to exclude malignancy. Lymphoscintigraphy provides information regarding both lymphatic anatomy as well as lymphatic function. We find lymphoscintigraphy particularly helpful for secondary lymphedema when microsurgical bypass surgery is considered. We do not consider it to be useful for severe primary lymphedema.

Filariasis is traditionally detected in the peripheral blood. Circulating filarial antigen in the peripheral blood, with or without microfilariae, is considered diagnostic of filarial infection. Urine can be examined macroscopically for chyluria and then concentrated to examine for microfilariae. Eosinophilia is marked in filarial infection. The patients in this study presented with severe lymphedema (stage V), characterized by poor skin quality, recurrent infections, firm fibrotic subcutaneous tissues, and functional problems because



Debulking: Liposuction Suction Assisted Protein Lipectomy (SAPL)



- Specialized liposuction technique to remove fatty component of lymphedema that is not responsive to compression
- Respects lymphatic anatomy and avoids increased damage
- Does not remove skin, uses techniques including compression to reduce excess
- Done by surgeons who have specially trained to do this; the name used here is not used by all surgeons who do this type of approach
- “Problems associated with this approach include contour irregularity, seroma, hematoma, and skin necrosis” hence flying squirrel

https://www.researchgate.net/figure/Liposuction-of-arm-lymphedema-The-procedure-takes-about-2-h-From-preoperative-to_fig3_234043301

uploaded by [Håkan Brorson](#)

<https://lymphaticnetwork.org/ask-experts/e/hakan-brorson>

https://link.springer.com/chapter/10.1007/978-981-16-3484-0_26

Debulking: Flying Squirrel Technique

- Uses liposuction techniques to remove fatty component
- Uses skin reduction techniques to reduce impact of bulk loss; leads to best cosmetic and functional outcome
- Avoid complications aforementioned
- Still requires use of compression garments in future but may minimize
- Patients with significant fatty tissue reduction may benefit, have fewer complications
- <https://consultqd.clevelandclinic.org/using-flying-squirrel-liposuction-technique-to-treat-lymphedema/>



Implications for Massage Therapists:

- Each **surgery** has different post-surgical manual therapy instructions
- Each **surgeon** has their own attitude about manual therapy
- In general, safe to massage after **liposuction** within a day or two
- May be weeks to massage after LVA or VLNT
- *It is critical with these patients to be in contact with their surgeons/CLTs and to know the specific instructions!*

Medications

- Ketoprofen
 - Acebilustat
 - Bestatin (also known as ubenimex)
-
- <https://med.stanford.edu/news/all-news/2017/05/study-finds-first-possible-drug-treatment-for-lymphedema.html>



LE&RN Online Symposium:

**Do You Want to Participate
In a Human Drug Trial
for Lymphedema?**

Presented by
Stanley Rockson, MD, FACP, FACC



 Lymphatic Education
& Research Network



Lymphatic Therapies Resources

“Researching our Topics of the Day”

Central Lymphatic Dysfunctions

Lymphatic Surgeries

Medications for Lymphedema

Video Potpourri + Bonus

Central Lymphatic

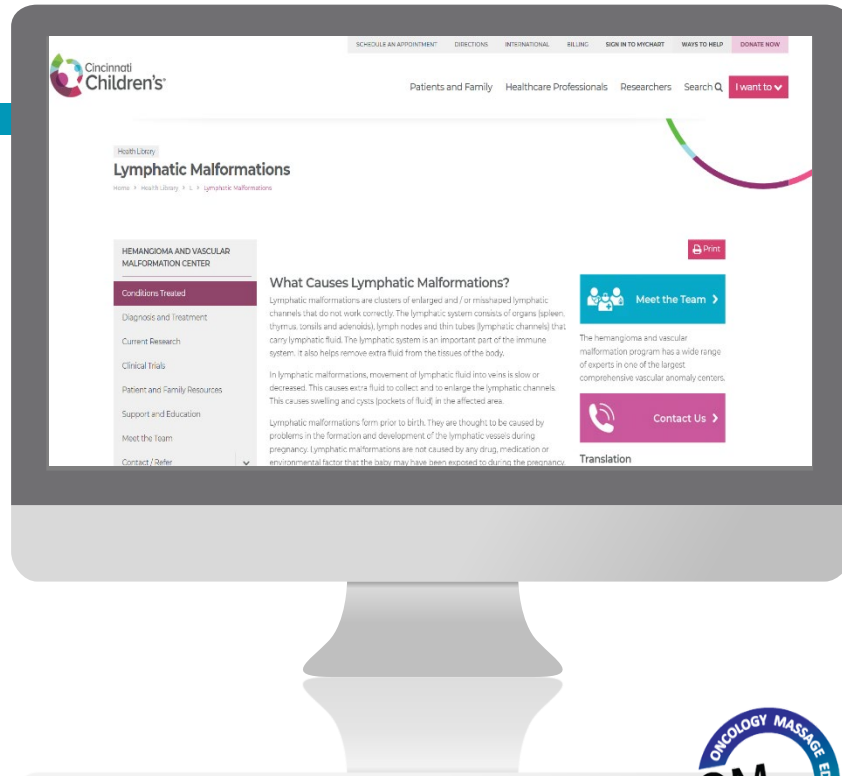
"The Development and Treatment of Lymphatic
Dysfunction in Cancer Patients and Survivors."
August 2020. National Library of Medicine (NIH)

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7466081/>



**Cincinnati Children's Hospital.
"Lymphatic Malformations."
Reviewed by Kiersten Ricci, MD.
March 2022.**

<https://www.cincinnatichildrens.org/health//lymphatic>



Lymphatic Surgeries: Lymphaticovenous Anastomosis (LVA) Surgery

“Lymphaticovenous Anastomosis for Lower Extremity Lymphedema: A Systematic Review.”
March/April 2020. National Library of Medicine (NIH).

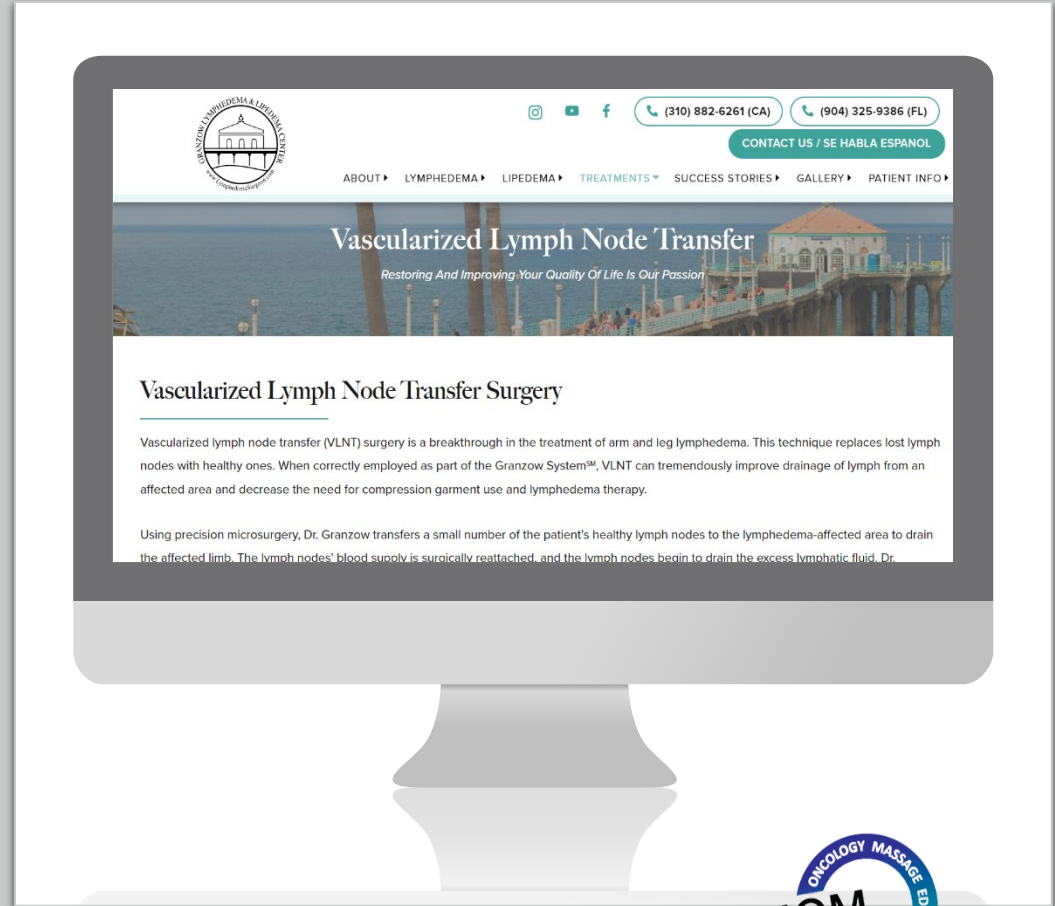
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7192660/>

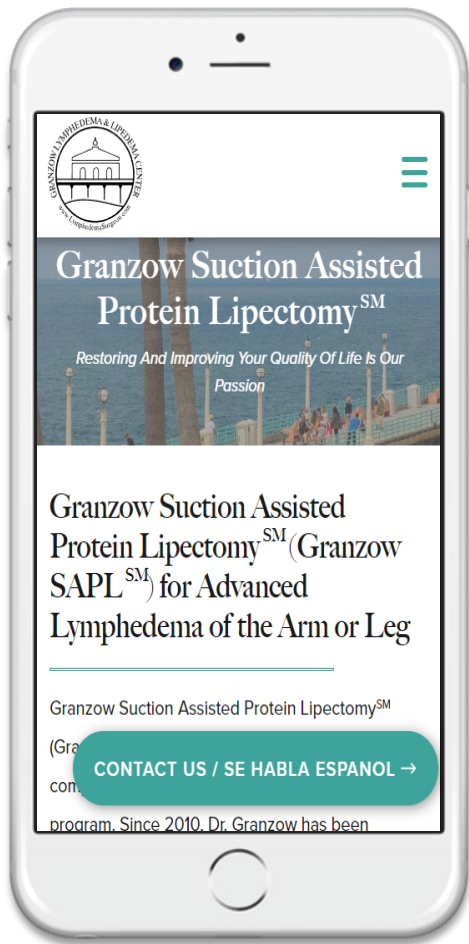


Lymphatic Surgeries: Vascularized Lymph Node Transplant

Granzow Lymphedema
and Lipedema Center.
“Vascularized Lymph
Node Transfer.”

<https://lymphedemasurgeon.com/lymph-node-transfer/>





Lymphatic Surgeries: Suction Assisted Protein Lipectomy

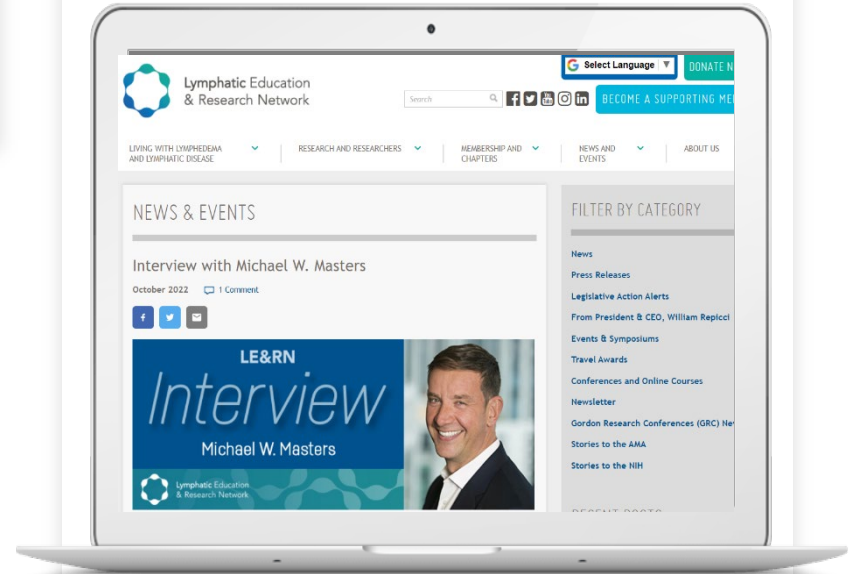
- Granzow Lymphedema and Lipedema Center. “Granzow Suction Assisted Protein Lipectomy.”

<https://lymphedemasurgeon.com/suction-assisted-protein-lipectomy-sapl/>

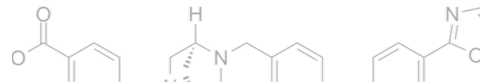
Medications for Lymphedema: An Investigational Drug- Acebilustat

- **Acebilustat. Lymphatic Education & Research Network (LE&RN) News and Events. Interview with Michael W. Masters. October 2022.**

<https://lymphaticnetwork.org/news-events/interview-with-michael-w.-masters>



Acebilustat Medication: A Little Backstory...



Here's a little background about the development of this investigational drug: Acebilustat.

Who is Michael W. Masters?

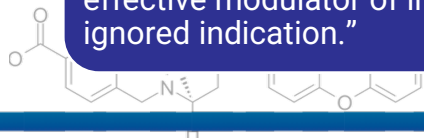
Michael W. Masters, founder and CEO of Celltaxis LLC in 2020.

What is the backstory of Celltaxis and Acebilustat from Mr. Masters?

"Celltaxis LLC is a clinical stage company developing Acebilustat, a potent immune system modulating drug. We believe that when taken orally once a day, Acebilustat may help reduce the inflammatory pathology and abnormal skin thickening of Lymphedema (LE).

Acebilustat, for arm lymphedema, will be investigated in a clinical trial at Stanford University, a LE&RN-designated Center of Excellence, led by Dr. Stanley G. Rockson. Acebilustat has been evaluated in several Phase I and II studies for other indications, and has demonstrated a favorable safety, tolerability, and PK profile.

"Many women's health indications do not receive the funding they deserve. Breast cancer survivors tell us they have been met with shrugs when complaining about their lymphedema, as though they should just be grateful their cancer is gone. It is our objective that all lymphedema patients have a high quality of life. We think our drug is in a unique position to be an effective modulator of inflammation in this chronic condition. Additionally, we like the idea of helping individuals in an ignored indication."



A Video Potpourri from LE&RN Symposium Series



Lymphatic Education
& Research Network

Dr. Stanley Rockson. “Lymphatic Endothelial Cell Biology.”

<https://lymphaticnetwork.org/symposium-series/lymphatic-endothelial-cell-biology>

Dr. Christopher Smith. “New Diagnostic Procedures and Interventions for Patients with Systemic Lymphatic Disease.”

<https://lymphaticnetwork.org/symposium-series/presenters/christopher-smith-md-phd>

Dr. Max Itkin. “Beyond Lymphedema: New Development in Central Lymphatic Imaging and Interventions.”

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