



Welcome to S40M's Topic of the Day Series

**Lymphatic Therapies:
Reviewing and Renewing — Part 2**

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 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 the central nervous system lymphatics and their potential role in brain health.



Therapists will identify key characteristics of lipedema and the role of manual therapies in long-term management of the condition.



Therapists will compare and contrast the original and revised Starling's Equilibrium for Capillary Exchange and how the revisions impact the significance of the lymphatic system's role in fluid balance.



Therapists will identify salient features of Ehlers-Danlos Syndrome and describe the role of massage therapy in its management



Therapists will define and describe how the function or impairment of the endothelial glycocalyx layer affects fluid load and lymphatic functioning.



Therapists can list 3 lymphatic therapies resources.

Continuing Education Credits

Our application has been submitted to NCBTMB to approve *Lymphatic Therapies: Reviewing and Renewing – Part 2* as 1.5 CE Credit Course, once our information has been approved we will issue a certificate.

We will notify everyone once the class has been approved!

Links to quizzes will be provided via email once we have received our approval.



What's New in Lymphatic S

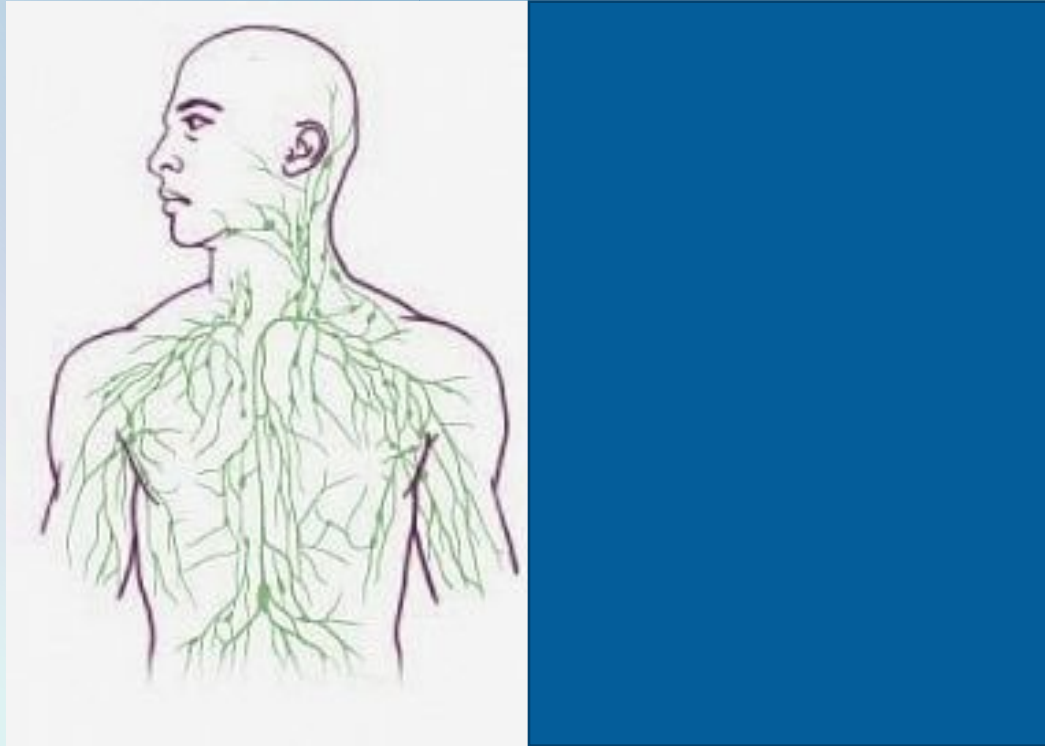
LESLYN KEITH, OTD, CLT-LANA
SOCIETY FOR ONCOLOGY MASSAGE
NOVEMBER 3, 2022

Today's Topics

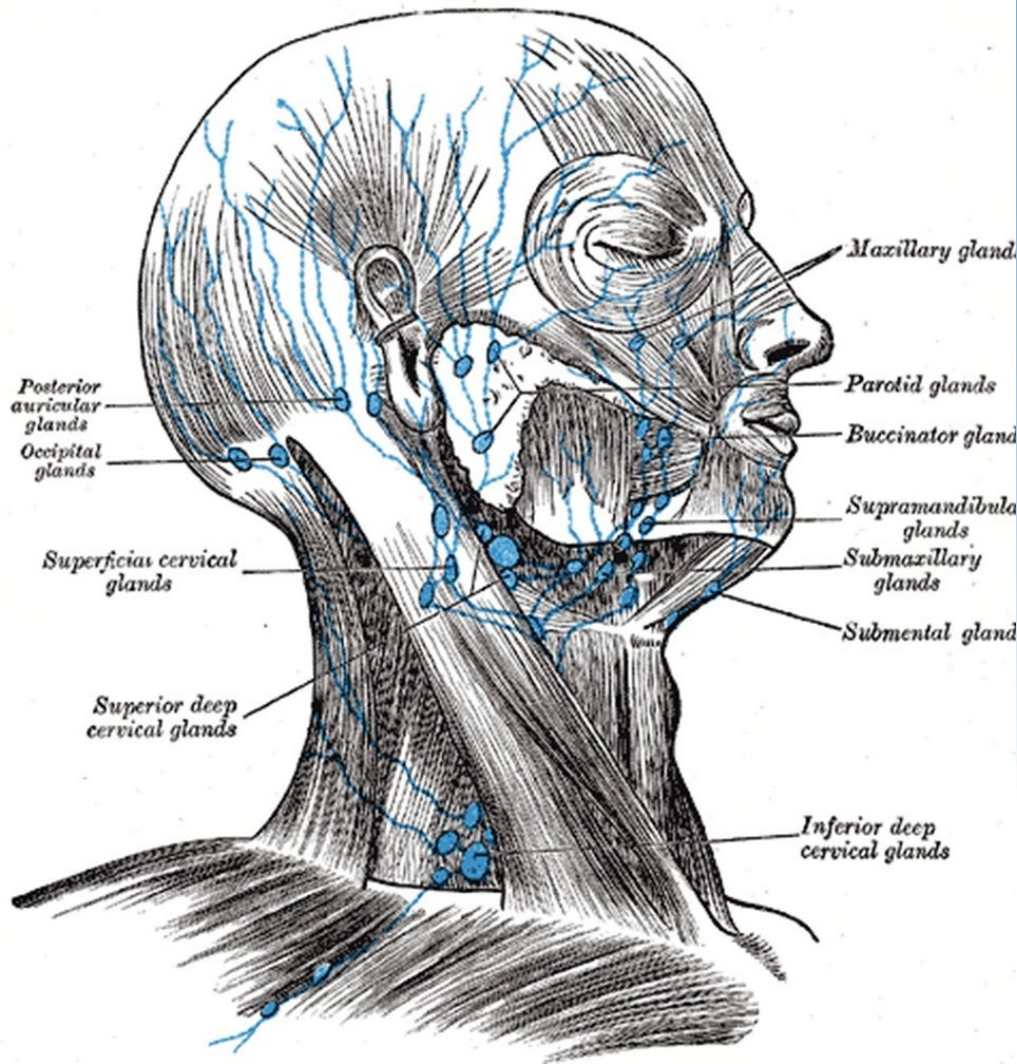


- Lymphatics of the Brain: Sleep, Cognition, and Lymphatic Health
- Glycocalyx: Function & Importance in Cardiovascular and Lymphatic Systems
- Revised Starling's Equilibrium: Changing the Relevance of Lymphatics
- Lipedema: How is it treated differently from lymphedema?
- Sneak Preview: Central Lymphatic Dysfunction

Discovery of Lymphatics in Brain

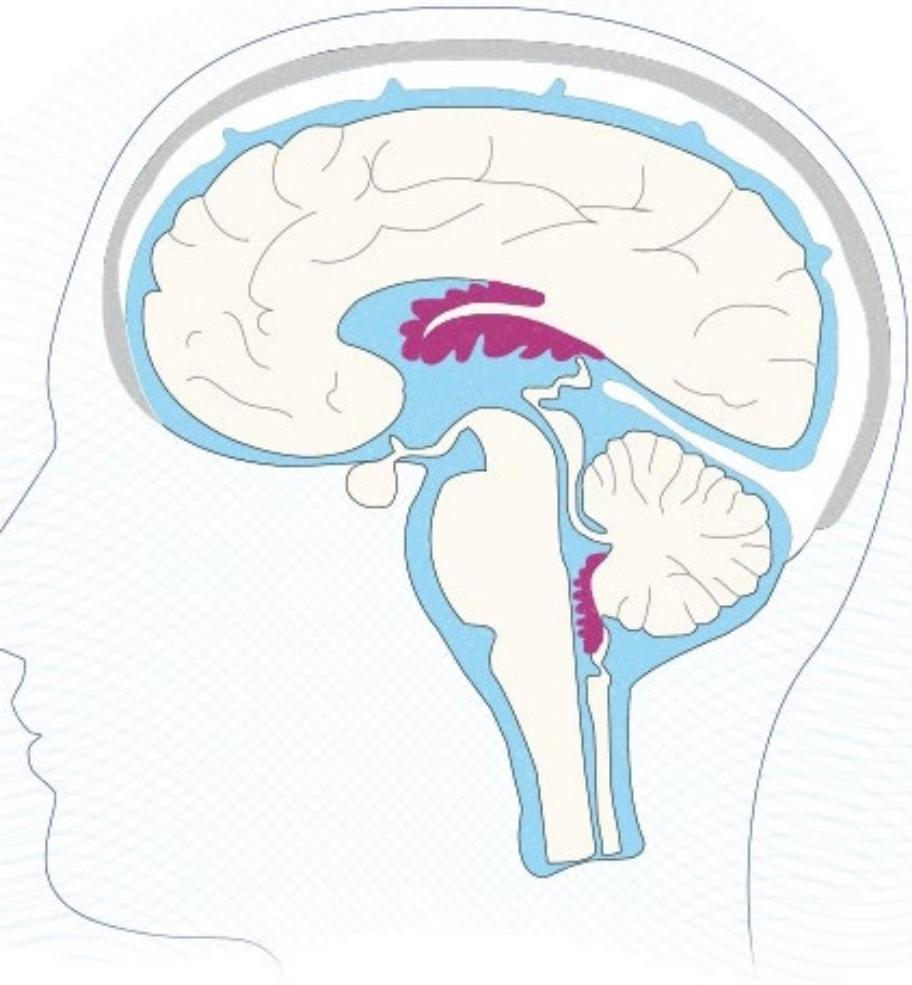


Glymphatic System & Meningeal Lymphatic Vessels



Functions

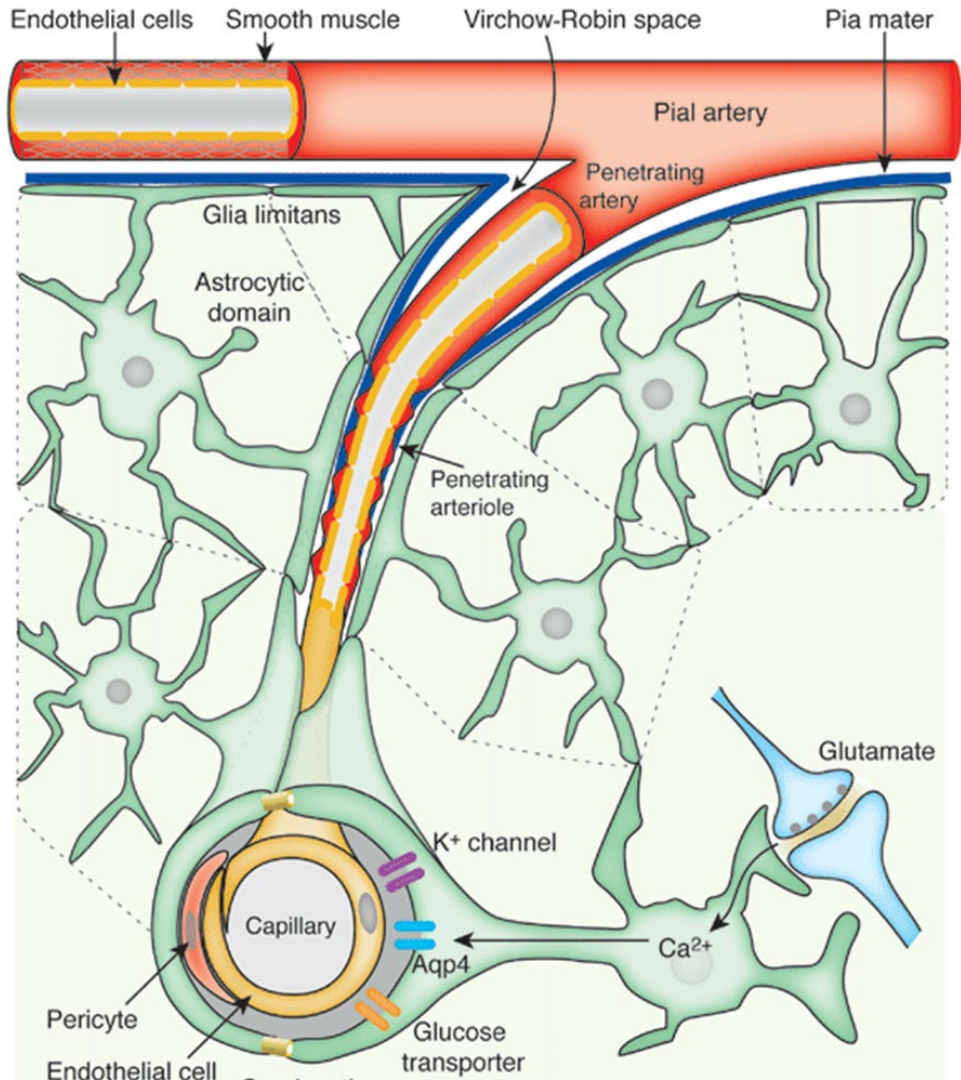
- Waste/noxious material removal
- Nutrient/compound distribution (glucose, lipids, amino acids, and neurotransmitters)
- Regulates cerebrospinal fluid (CSF) and interstitial fluid (ISF) transport, Potentially regulator of neuroinflammation
- Immune surveillance



Nutrient - Glymphatic Path of

Flow

Nutrients are delivered by capillaries in the choroid plexus → Mixes with CSF (produced in ventricles) → subarachnoid and perivascular spaces → brain tissue (parenchyma) via the glymphatic system where it mixes with the interstitial fluid to deliver nutrients and remove waste → drains into CSF in perivenous spaces → delivered to veins

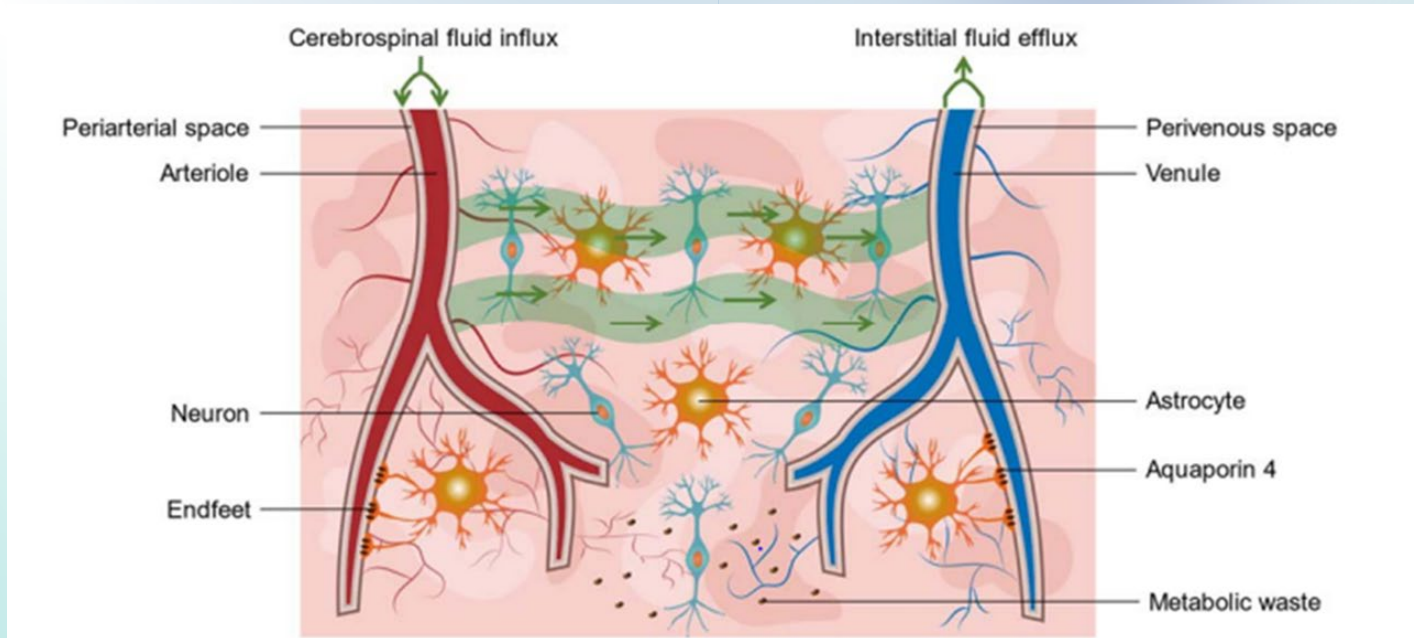


Glymphatic System: Glial Dependent Lymphatic Transport

- ✓ CSF flows through the perivascular space (formed by foot of astrocyte surrounding capillary)
- ✓ Fluid push out and flows through the brain parenchyma via glymphatics

Glymphatic Transport

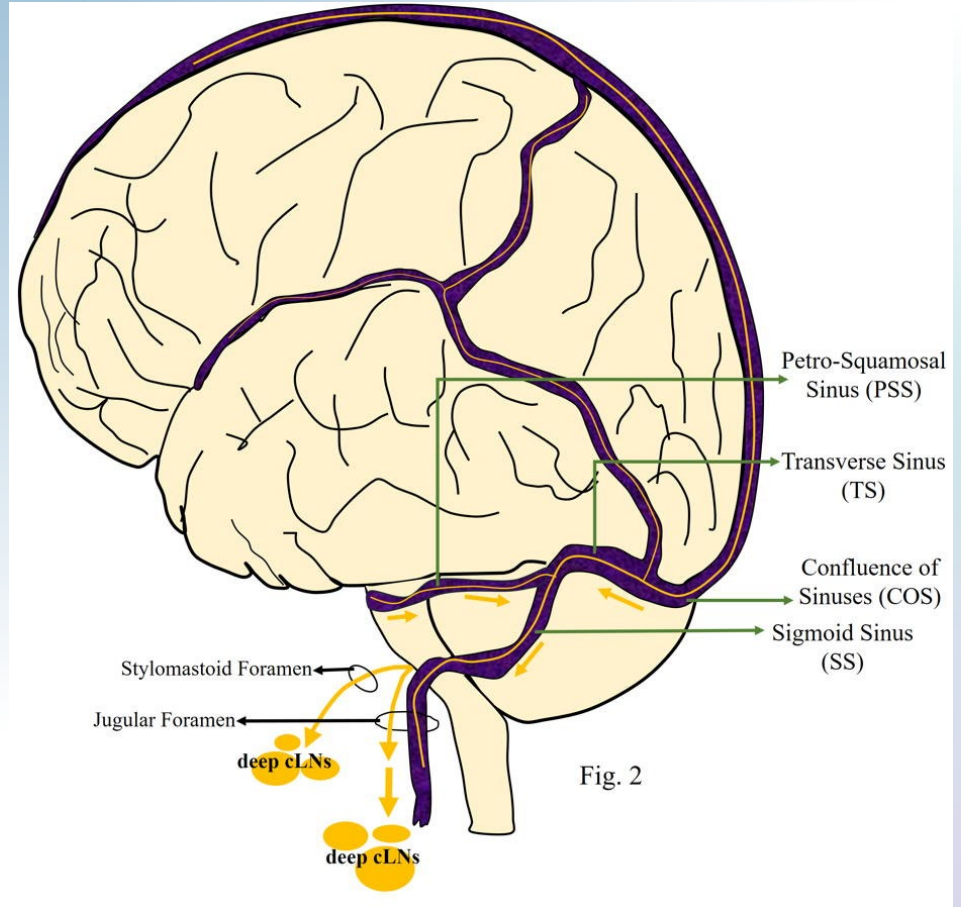
- Specific mode of transport is controversial
- Diffusion would be too slow
- Facilitated by action of glial cells?
- Dependent upon sleep

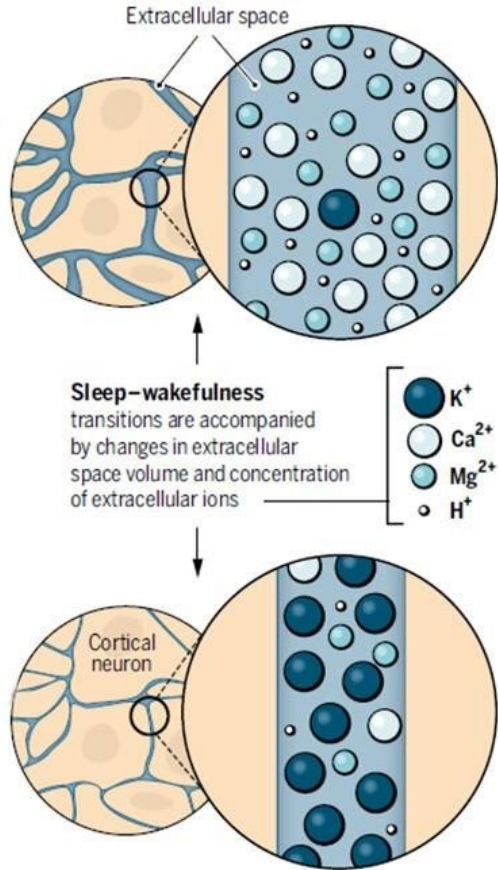


Meningeal Lymphatic Vessels

Drainage Pathway:

Outflow of fluid that was drained into perivenous spaces → across the dura into meningeal lymphatic vessels → deep cervical lymph nodes





Sleep, Lymphatics & Brain Health

Brain cells shrink during sleep, allowing waste and toxins to be efficiently removed by the **glymphatics system**.

Proper sleep may be very important to the prevention of Alzheimer's, Parkinson's and other neurodegenerative diseases.

Glymphatic/Meningeal Vessel Dysfunction



Primary Causes

Loss of sleep

Aging

Traumatic Brain Injury

May Result in Neurodegenerative Diseases

Dementias

Amyotrophic Lateral Sclerosis

Multiple Sclerosis...



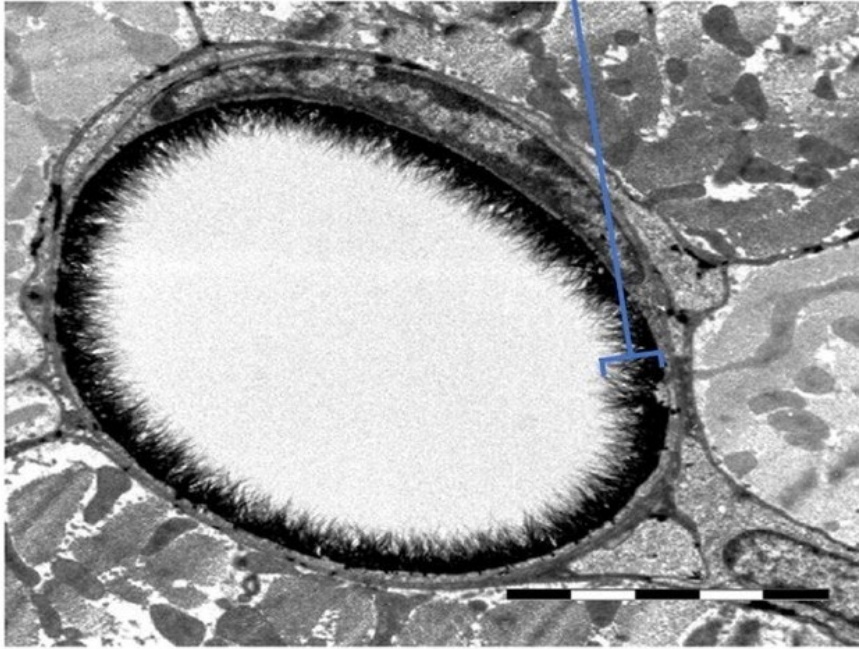
Strategies to Improve Brain Lymphatic Health

- Sleep hygiene/sleep position
- Omega 3 fatty acid intake
- Ketosis (Fasting or Ketogenic Diet)
- Reduce alcohol intake
- Exercise
- Minimize chronic stress

Glycocalyx: Function & Importance in Cardiovascular and Lymphatic Systems

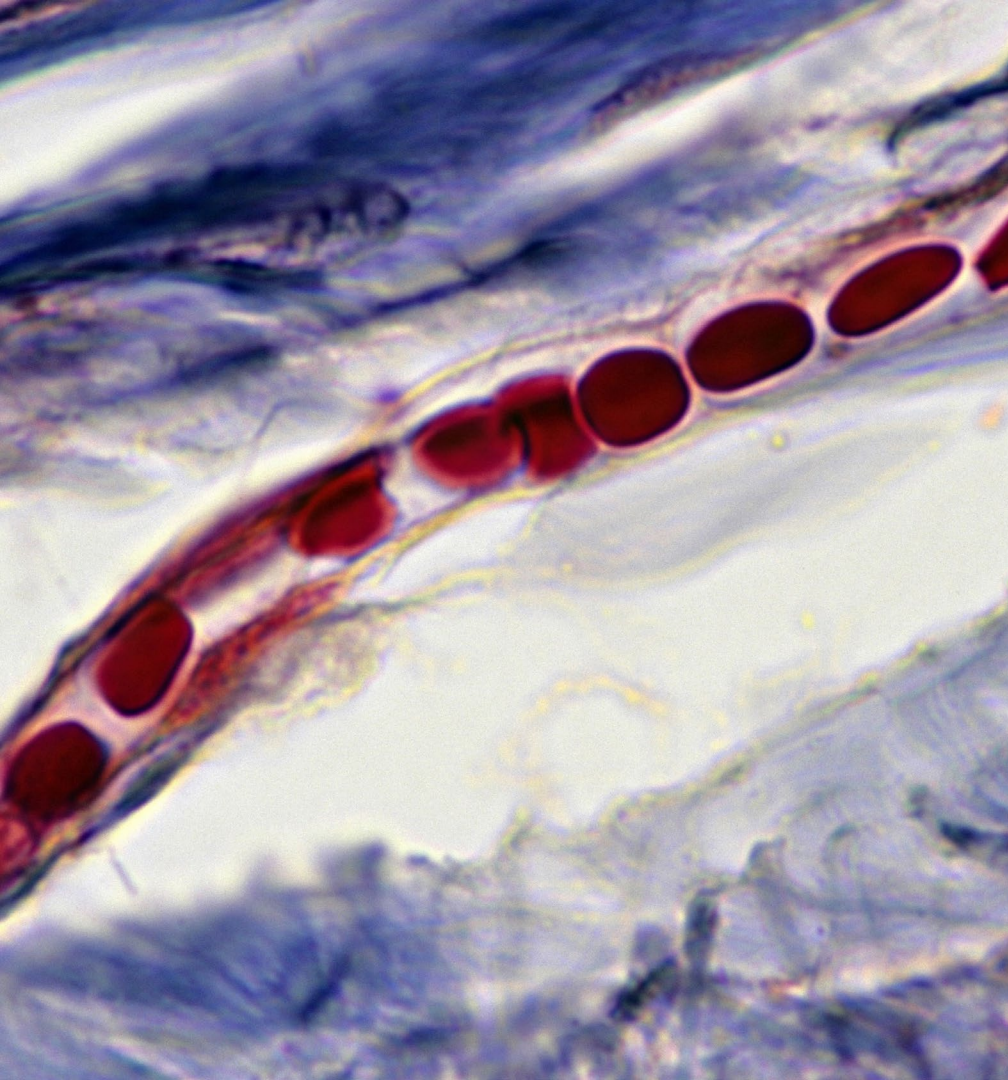
What is the Glycocalyx?

Glycocalyx



- This is a highly hydrated fibrous meshwork that lines blood vessels
- A slippery gel-like barrier layer above a carpet of tiny hair-like extensions
- Subglycocalyx space can hold a tremendous amount of water to replenish the system if needed

Electron micrograph of a cross-sectional image of a coronary endothelial glycocalyx (courtesy of B. van den Berg, Maastricht University)

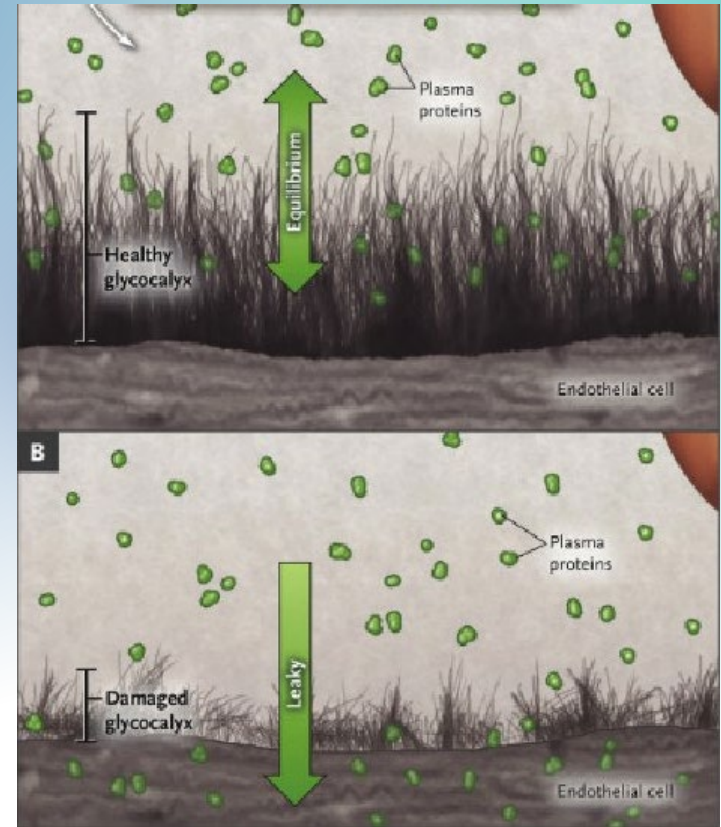


Functions of the Glycocalyx

- Regulates flow of fluid and particles across blood vessel walls – major determinant of capillary permeability
- Prevents adhesion of blood cells and other matter onto the vessel wall
- Produces nitric oxide in response to shear stress
- Serves as a reservoir of fluid/hydration (diuretics only dehydrate the glycocalyx and have no impact on lymphatics)

What damages the glycocalyx?

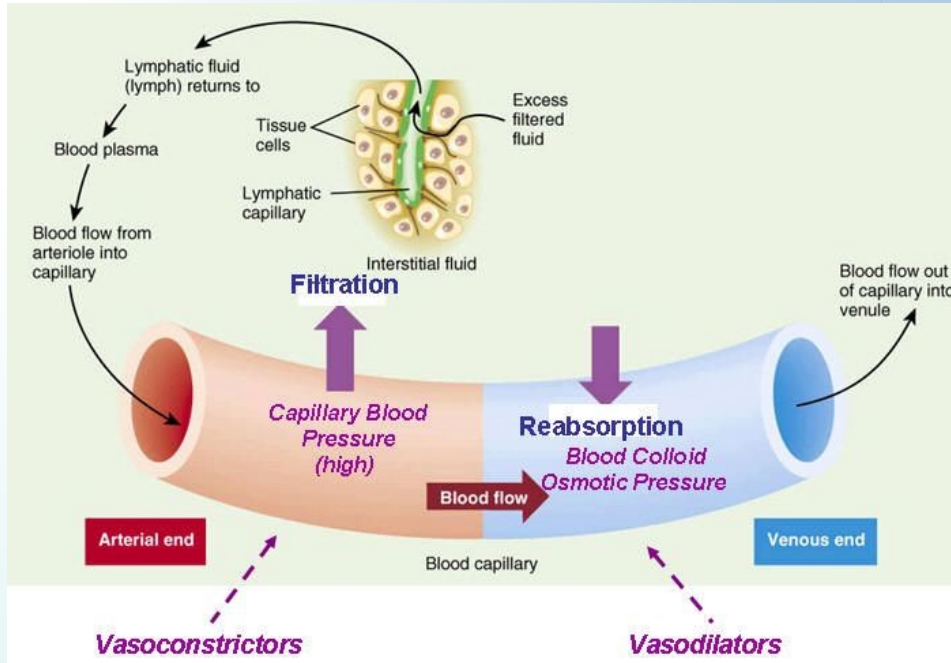
- Hyperglycemia
- Hypercholesterolemia
- Hypervolemia
- Ischemia/Reperfusion
- Trauma
- Inflammation



McDermid et al. (2014). Controversies in fluid therapy: type, dose and toxicity. *World Journal of Critical Care Medicine*, 3(1), 24.

Revised Starling's
Equilibrium: Changing the
Relevance of Lymphatics

Starling's Equilibrium



90% of interstitial fluid is reabsorbed into veins
10% evacuated by lymphatics

4 Forces

- Blood Capillary Pressure (BCP)
- Interstitial Fluid Pressure (IFP)
- Colloid Osmotic Pressure of Plasma (COP_p)
- Colloid Osmotic Pressure of Interstitium (COP_i)

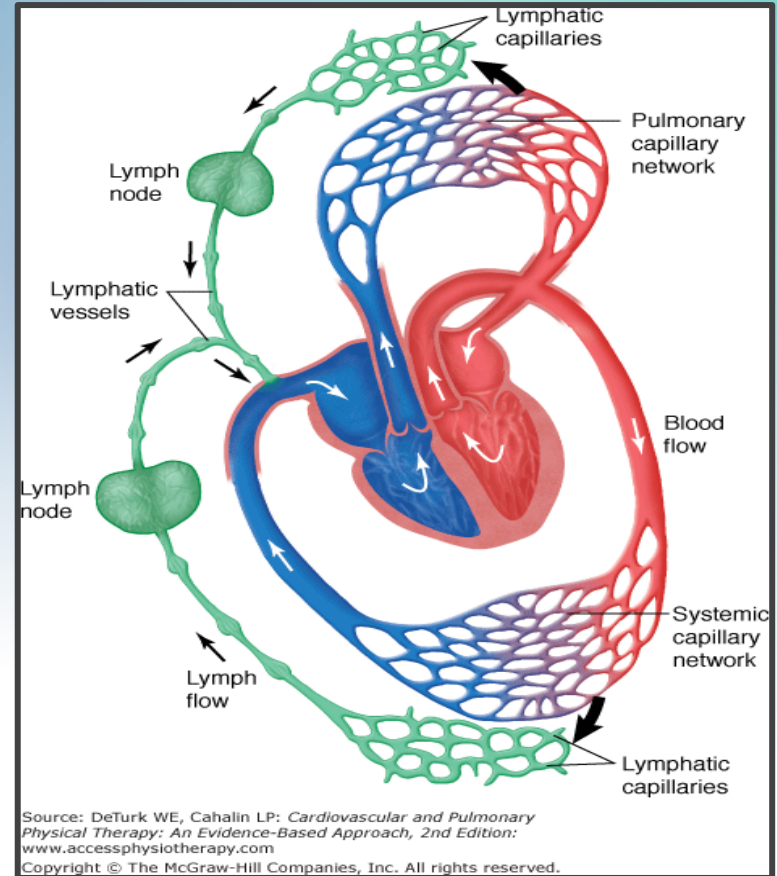
Revised Starlings Equilibrium

Filtration and the formation of lymph -
**Almost all interstitial fluid is returned
via lymphatics, not veins**

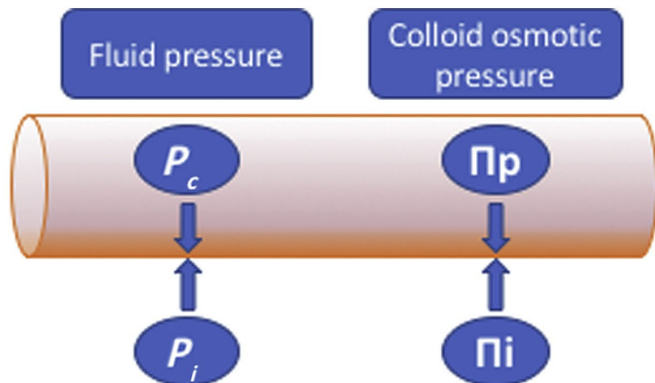
Lower pressure in lymphatic system
makes it the outlet for interstitial fluid
and cellular debris to exit tissues.

**Difference in pressure in plasma vs.
subglycocalyx** is more important than
difference in plasma vs. interstitial
pressure

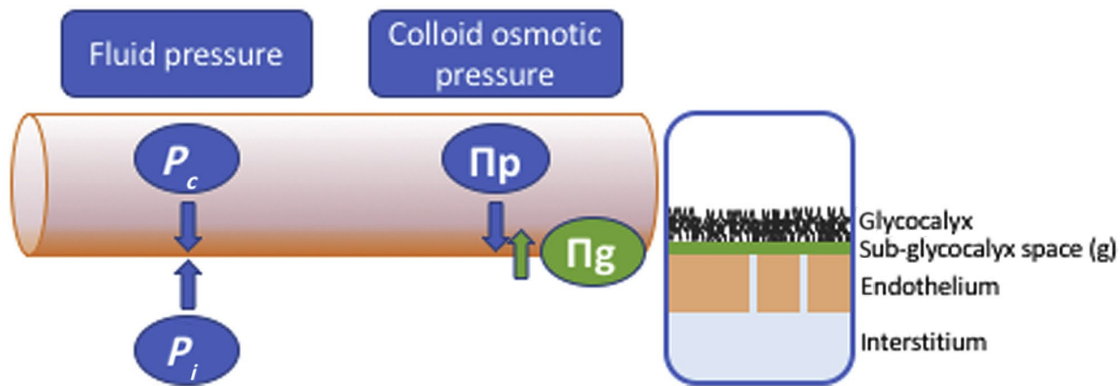
Levick, J. R., & Michel, C. C. (2010).



Classic
Starling
equation



Revised
Starling
equation



Lipedema: How is it treated differently from lymphedema?



Symptoms of Lipedema

- Disproportionate symmetrical deposition of fat to lower body/upper arms
- Non-pitting edema
- Hypersensitivity and pain
- Easy bruising
- Skin/tissue changes (nodules, cuffing, mattress-like appearance)
- Limited or no response in lower body/arms to typical weight-loss measures

MLD Sequence for Lipedema

- Short neck treatment
- Intensive abdominal treatment
- Treatment of inguinal LN
- Treatment of the legs and the buttocks

Note:

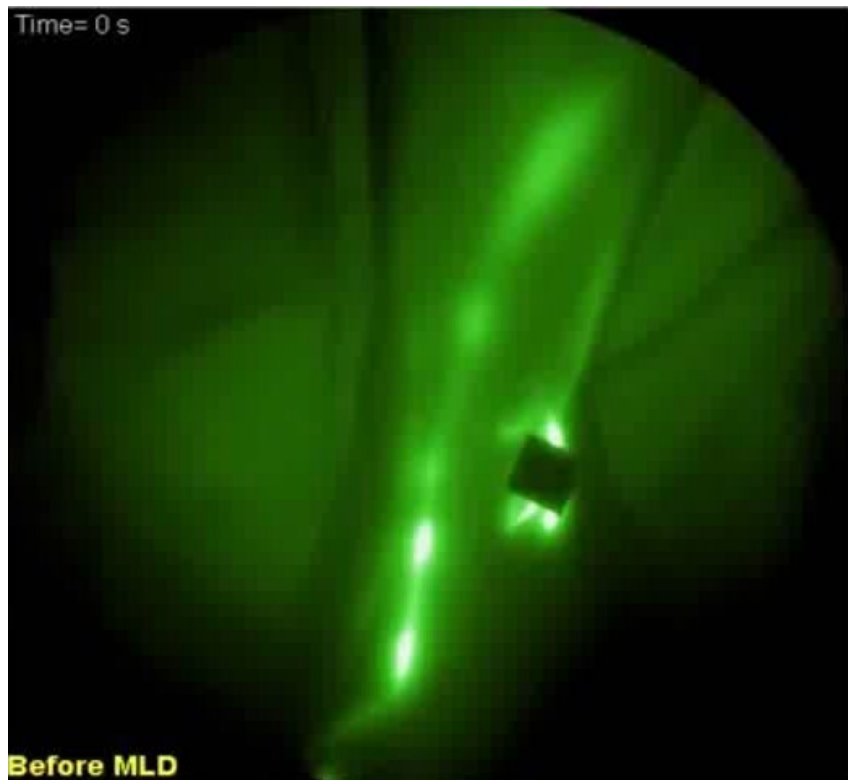
- Establishing anastomoses pathways to the axillary lymph nodes may not be needed
- May use firmer pressure to patient's tolerance
- Too much pressure may cause discomfort and bruising



Symptom Management: Edema

Manual Lymph Drainage

- Moves fluid out of congested area (Miller et al., 2017)
- Increases absorption of fluid into lymphatic vessels
- Increases contraction rate of lymphatic vessels (François et al., 1989)





Symptom Management: Pain

- CDT that included MLD was more effective in reducing pain in lipedema than skin care alone (Szolnoky et al. (2011))
- Pain threshold and pain tolerance was higher in healthy subjects after MLD (Keser & Esmer, 2019)
- Patients with fibromyalgia had significant pain relief with MLD (Ekici et al., 2009)



How Does MLD Reduce Pain?

- Removal of waste and toxins from tissues (Kurz et al., 1978)
- Reduction in inflammation (Aksoy et al., 2021; Amato, 2020)
- Manipulation of tissue interrupts pain pathway (Kim, 2014; Keser & Esmer, 2019)



Symptom Management: Fibrosis

- Occurs when normal healthy tissue is replaced by connective and scar tissue
- Develops in the areas of excessive fatty tissue
- Firm nodules or widespread scar throughout the fat
- May make the skin and tissue look uneven or dimpled
- Can cause discomfort and limitations in movement
- Decrease the health of skin and underlying tissue



Symptom Management: Fibrosis

- MLD resulted in measurable changes in tissue composition in body areas affected by fibrosis (Donahue et al., 2017)
- MLD may contribute to prevention of fibrosis formation (Torres Lacomba et al., 2010)
- Other firmer manual techniques may be required to manage more severe fibrosis



Symptom Management: Bruising

- Leaky blood vessels found in lipedema (Strohmeier et al., 2022)
- Blood vessel size and number is greater in lipedema compared to controls (Al-Ghadban et al, 2019)
- High incidence of venous diseases in lipedema (Herbst et al., 2021)
- CDT (including MLD) decreased frequency of bruising (Szolnoky et al., 2008)



Lipedema & Quality of Life

- All participants suffered from some level of depression – 11.2% - severe (Dudek et al., 2021)
- Symptom severity correlates with quality of life (Dudek et al., 2018)
- Overall QoL lower than healthy controls (Romeijn et al., 2018)

MLD & Quality of Life



- MLD can favorably impact those with psychological stress (Kim 2014)
- Improves emotional functioning (Williams et al., 2002)
- Reduces feelings of anxiety, depression and improve sleep (Williams et al., 2002)

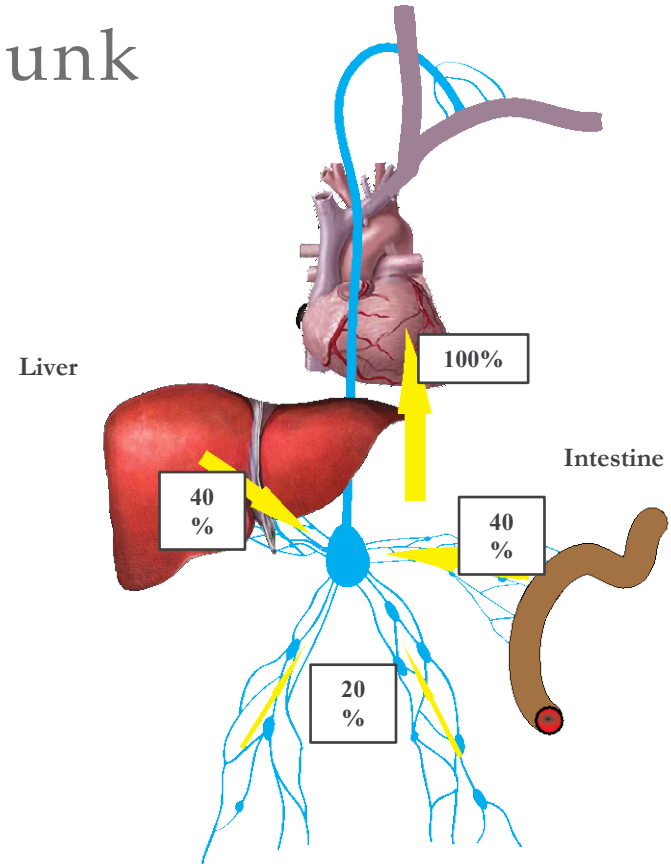
Sneak Preview: Central Lymphatic Dysfunction

Lymphatic Flow in the Trunk

Lumbar Lymphatics (20%)

Liver (40%)

Intestine (40%)



Lumbar, extremities, soft tissue

Indications of Possible Dysfunction of Central Lymphatics

1. Unexplained swelling in the extremities, 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 (pleural effusion)
 - GI disturbance (Gut-Lung Syndrome)
 - 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
6. Daily weight fluctuations matching weight of TD daily transport capacity.

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THANK YOU!

MY POSTER PRESENTATION FOR THE
EHLERS-DANLOS SYNDROMES
INTERNATIONAL SCIENTIFIC SYMPOSIUM


Rome, IT, September 2022

2022 INTERNATIONAL SCIENTIFIC SYMPOSIUM

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**INTERNATIONAL SCIENTIFIC
SYMPOSIUM ON THE EHLERS-DANLOS
SYNDROMES (EDS) & HYPERMOBILITY
SPECTRUM DISORDERS (HSD)**

 **ROME, ITALY**

SEPTEMBER 14-18, 2022



What is EDS?

- ciety



THE BEIGHTON SCORING SYSTEM Measuring joint hypermobility

A. 5th FINGER / 'PINKIES'

Test **both sides**. Rest palm of the hand and forearm a **flat surface** with palm side down and fingers out straight.

Can the **fifth finger** be bent/lifted upwards at the knuckle to go back **beyond 90 degrees**?

If yes, add **one point** for each hand.



B. THUMBS

Test **both sides**. With the arm out straight, the palm facing down, and the wrist then fully bent downward, can the thumb be pushed back to touch the forearm?

If yes, add **one point** for each thumb.



D. KNEES

Test **both sides**. While standing, with knees locked (bent backwards as far as possible), does the lower part of either leg extend **more than 10 degrees forward**?

If yes, add **one point** for each side.



C. ELBOWS

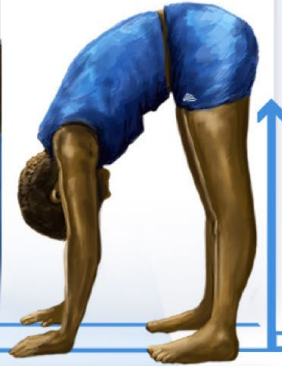
Test **both sides**. With arms outstretched and palms facing upwards, does the elbow extend (bend too far) upwards **more than an extra 10 degrees** beyond a normal outstretched position?

If yes, add **one point** for each side.

E. SPINE

Bend forward, can you place the palms of your hands **flat on the floor in front of your feet without bending your knees**?

If yes, add **one point**.



What are the Ehlers-Danlos syndromes?

For more information,
ehlers-danlos.com





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What is Lipedema?



www.S4OM.org

MASSAGE THERAPY FOR A WOMAN WITH HYPERMOBILE EHLERS-DANLOS SYNDROME & LIPEDEMA: A CASE REPORT

ADRIEN GREY MACKENZIE, L.M.T., P.T.A., C.L.T., L.A.N.A., N.B.C.-H.W.C.
OSHER CENTER FOR INTEGRATIVE HEALTH, VANDERBILT UNIVERSITY MEDICAL CENTER, NASHVILLE, TN, USA

BACKGROUND:

Hypermobile Ehlers-Danlos Syndrome (hEDS) and Lipedema are disorders of the connective tissue. [1] [2] There is a growing body of evidence revealing a comorbid frequency between these disorders. [1] In a clinical massage therapy setting caring for many patients with the hEDS diagnosis, the therapist has frequently noted significant physical attributes of lipedema in these cases.

Purpose: To highlight a case where a patient presents with both hEDS and Lipedema characteristics

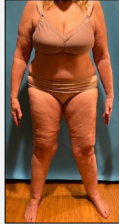


Figure 1
Front and side views of report subject

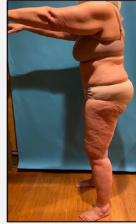


Figure 2

OBSERVATION:

- 64 y/o. Female patient w/ hEDS
- Initially referred to Massage Therapist-Certified Lymphedema Therapist (M-CLT) for management of Lymphedema w/ Manual Lymphatic Drainage (MLD)
 - Lower extremity Lymphedema noted after emergency colon resection due to ruptured diverticulum
 - Patient had:
 - No previous Massage Therapy (MT)
 - High pain
 - Anxiety

SIGNIFICANT CO-MORBIDITIES:

- Stage II Lymphedema
- GERD
- Hx of colostomy
- 2 subsequent surgical revisions
- Hernia w/ mesh repair
- Chronic back & hip pain
- Ankle fracture
- Chronic sinusitis
- Dental infections
- Obesity
- Fatigue
- Pelvic floor issues
- Chronic sciatic pain
- Chronic shoulder pain
- Chronic headache



Figure 3: Patient with multilayer compression bandaging to address Stage 2 lower extremity lymphedema



Figure 4: Patient with temporary skin support from micro massage compression garments often utilized by lipedema patients.

4 STAGES & 5 TYPES OF LIPEDEMA



STAGE 1 - Normal skin surface; increased fat deposition; disproportion of upper and lower body

STAGE 2 - Uneven skin texture with indentations in the fat, larger mounds of tissue growing as vasoconstrictor masses

STAGE 3 - Large protrusions of tissue causing deformation especially on the thighs and around the knees

STAGE 4 - Lipo-lymphedema
Advanced stage - lipedema with lymphedema (localized fluid retention and tissue swelling caused by a compromised lymphatic system)



Figure 5 - Stages and 5 types of Lipedema, courtesy of Lipedema Simplified

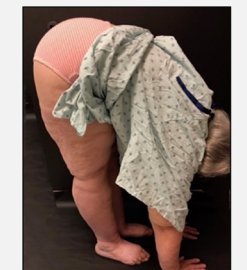


Figure 6
A patient with both hypermobility & lipedema, courtesy of Dr. Steven Dean

Some of the Potentially Shared Features, Signs and Symptoms of Hypermobility Disorders and Lipedema:

Heritable
Connective Tissue Disorder
Soft, velvety skin
Skin hyperextensibility/fragility
Easy bruising
Potentially difficult wound healing
Joint hypermobility
Joint subluxations/dislocations
Joint pain
GI issues
Chronic inflammation
Potential Association POTS, MCAS
Joint abnormalities especially in knees and ankles
*Features may or may not be shared between diagnoses

METHOD:

- Method:**
 - Initially, MLD only per lymphedema referral
 - Basic exercise & compression garment recommendations
 - M-CLT referred to CDT in a Physical Therapy (PT) setting
- Additional MT interventions:**
 - Myofascial Release to support proper joint alignment
 - Scar Tissue Mobilization to address post-surgical adhesions
 - Deep Swedish-Style Massage to address lipedema fat tissue nodularity and pain
 - Gentle Cupping Massage to support mobilization of fascia and scar tissue
 - Graded Mechanical Negative Pressure to mobilize tissue and maximize lymphatic flow
 - Kinesiology Taping taught to the patient to provide additional joint and lymphatic flow support which can be self-administered
 - MLD continues to be utilized

FINDINGS:

- Once lymphedema was treated with CDT and compression stockings:
 - Patient was able to focus on reducing pain patterns associated with joint dysfunction and lipedema
- Per her statements, MT continues as a significant intervention
 - To address joint and tissue pain [5]
 - To address scar tissue adhesions
 - To address movement limitations
- The calming nature of MT helps reduce related anxiety [3]
- Over 3 years, the patient experienced a positive outcome
- Continues to benefit from these interventions presently

CONCLUSIONS:

- Patients with hEDS and Lipedema experience significant pain and functional limitations [1] [4]
- Skilled MT includes techniques that can address these concerns in a calming, patient-centered atmosphere [3] [5]
- Skilled MT should be considered by referring providers as a means of maximizing Quality of Life (QOL) [6]
- Bi-weekly intervention is a non-negotiable adjunct to her wellness practices
- Further study is warranted
- Although no published QOL scales were utilized in this patient's massage therapy care, patient reports "Massage Therapy is what keeps me going..."

REFERENCES / RESOURCES / ACKNOWLEDGEMENTS

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Resources

- Lipedema Landmines: How MCAS, hEDS, and POTS Show Up and Affect Lipedema Treatment. *16 June 2022. https://www.youtube.com/watch?v=_L0C8S0BhCw. Accessed 23 July 2022.
- Dean, Steven M. "Lower Lymphedema 2022: A Review of the United States Lymphedema Guidelines, 2022"

Acknowledgements:

- Deepest gratitude to the subject of this report who is dedicated to providing helpful information to others who experience similar life challenges, and to helping to encourage better care for her children who share her physical characteristics.
- Many, many thanks to Dr Paula Donahue without whose encouragement, assistance and feedback could not present this information.
- Thanks to Dr Steven Dean for the use of helpful images and information, and for inspiring this report with his numerous virtual presentations.
- Thanks to LeAnn Keith, Catherine and Karen Smith for so much supportive input and education in the presentations and management of Lipedema.



What do they have in common?



HERITABLE



CONNECTIVE TISSUE
DISORDER



SOFT, VELVETY SKIN



SKIN
HYPEREXTENSIBILITY/
FRAGILITY



EASY BRUISING



POTENTIALLY DIFFICULT
WOUND HEALING



JOINT HYPERMOBILITY



JOINT
SUBLUXATIONS/DISLOCATIONS



JOINT PAIN



GI ISSUES



CHRONIC INFLAMMATION



POTENTIAL ASSOCIATION
WITH POTS, MCAS



JOINT ABNORMALITIES
ESPECIALLY IN KNEES AND
ANKLES



BACKGROUND:

- Hypermobile Ehlers-Danlos Syndrome (hEDS) and Lipedema are disorders of the connective tissue. [1] [2] There is a growing body of evidence revealing a co-morbid frequency between these disorders. [1] In a clinical massage therapy setting caring for many patients with the hEDS diagnosis, the therapist has frequently noted significant physical attributes of lipedema in these cases.
- **Purpose:** To highlight a case where a patient presents with both hEDS and Lipedema characteristics





Figure 3:
patient with multilayer compression
bandaging to address Stage 2
lower extremity lymphedema



Figure 4:
Patient with temporary skin imprint
from micro massage compression garments
often utilized by lipedema patients.

Method

- Initially, MLD only per lymphedema referral
 - Basic exercise & compression garment recommendations
 - MT-CLT referred to CDT in a Physical Therapy (PT) setting
- Additional MT interventions:
 - *Myofascial Release* to support proper joint alignment
 - *Scar Tissue Mobilization* to address post-surgical adhesions
 - *Deep Swedish-Style Massage* to address lipedema fat tissue nodularity and pain
 - *Gentle Cupping Massage* to support mobilization of fascia and scar tissue
 - *Graded Mechanical Negative Pressure* to mobilize tissue and maximize lymphatic flow
 - *Kinesiology Taping* taught to the patient to provide additional joint and lymphatic flow support which can be self-administered
- *MLD* continues to be utilized



FINDINGS:

- Once lymphedema was treated with CDT and compression stockings:
 - Patient was able to focus on reducing pain patterns associated with joint dysfunction and lipedema
- Per her statements, MT continues as a significant intervention
 - To address joint and tissue pain [5]
 - To address scar tissue adhesions
 - To address movement limitations
- The calming nature of MT helps reduce related anxiety [3]
- Over 3 years, the patient experienced a positive outcome
- Continues to benefit from these interventions presently

CONCLUSIONS:

- Patients with hEDS and Lipedema experience significant pain and functional limitations [1] [4]
- Skilled MT includes techniques that can address these concerns in a calming, patient-centered atmosphere [3] [5]
- Skilled MT should be considered by referring providers as a means of maximizing Quality of Life (QOL) [6]
- Bi-weekly intervention is a non-negotiable adjunct to her wellness practices
- Further study is warranted
- Although no published QOL scales were utilized in this patient's massage therapy care, patient reports
- "Massage Therapy is what keeps me going..."

Lymphatic Therapies

Resources

Glymphatics

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Revised Starling's Equation

*

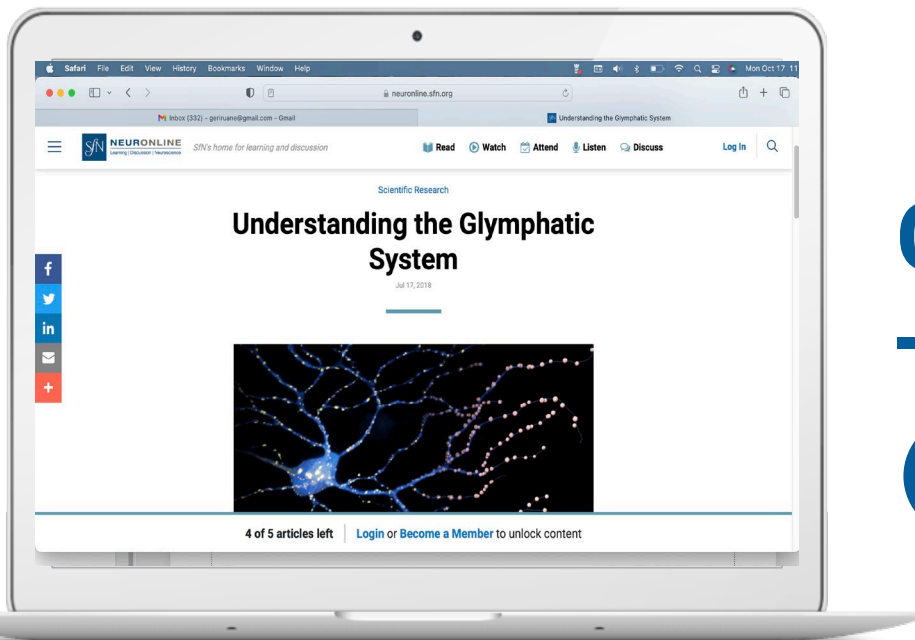
Glycocalyx

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Ehlers-Danlos Syndromes

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Lipedema



Glymphatics

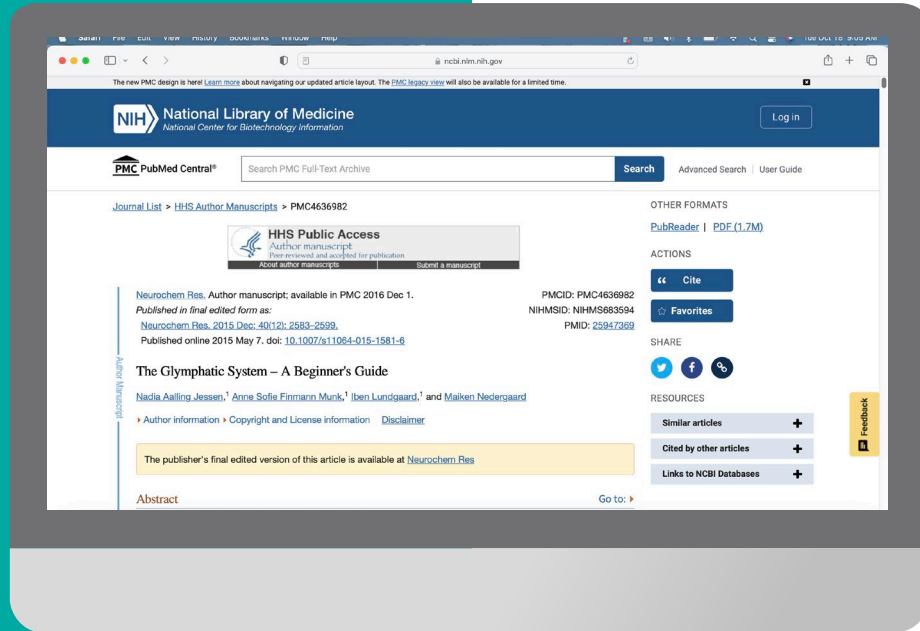


Society for Neuroscience

<https://neuroonline.sfn.org/scientific-research/understanding-the-glymphatic-system>



The Glymphatic System - A Beginner's Guide

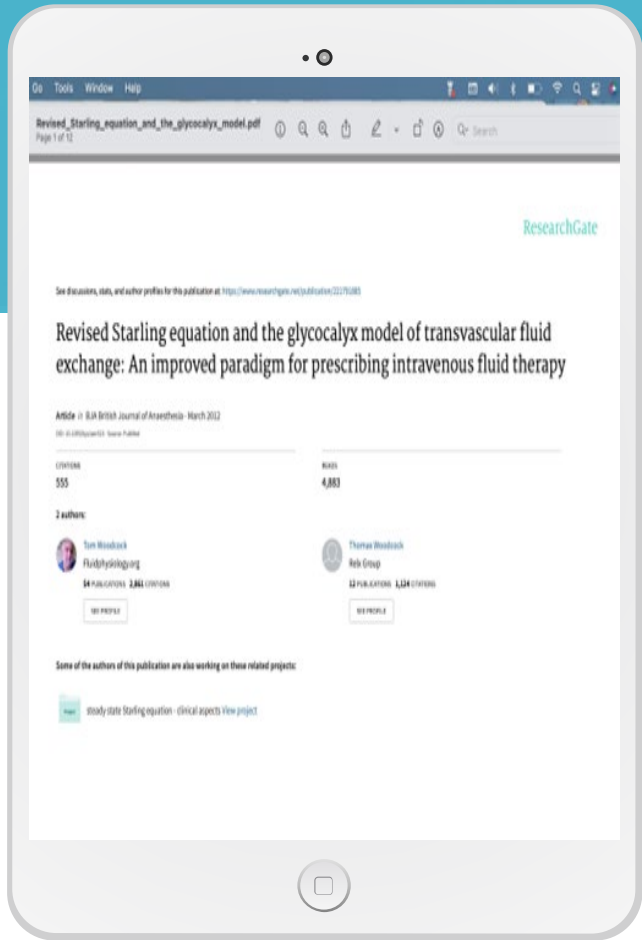


National Library of Medicine

✓ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4636982/>



Revised Starling's Equation



BJA (British Journal of Anaesthesia)

<https://academic.oup.com/bja/article/108/3/384/419160>



ResearchGate

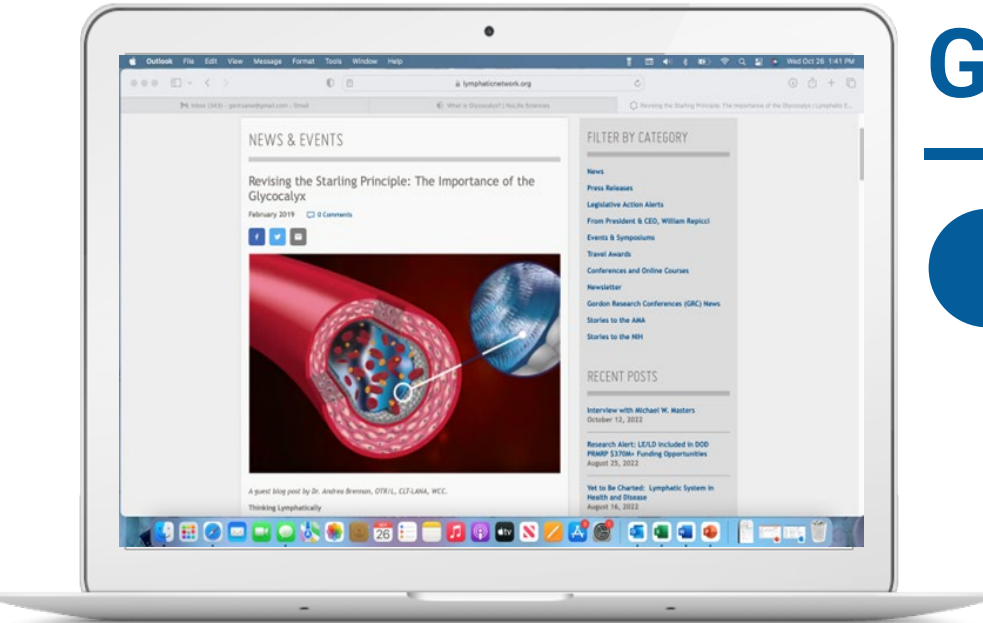
https://www.researchgate.net/publication/221791885_Revised_Starling_equation_and_the_glycocalyx_model_of_transvascular_fluid_exchange_An_improved_paradigm_for_prescribing_intravenous_fluid_therapy



Glycocalyx

● Guest blog –

Dr. Andrea Brennan. “Revising the Starling Principle: the Importance of the Glycocalyx.” Lymphatic Education & Research Network, February 2019. Available at: <https://lymphaticnetwork.org/news-events/revising-the-starling-principle-the-importance-of-the-glycocalyx>



Functions of the Glycocalyx



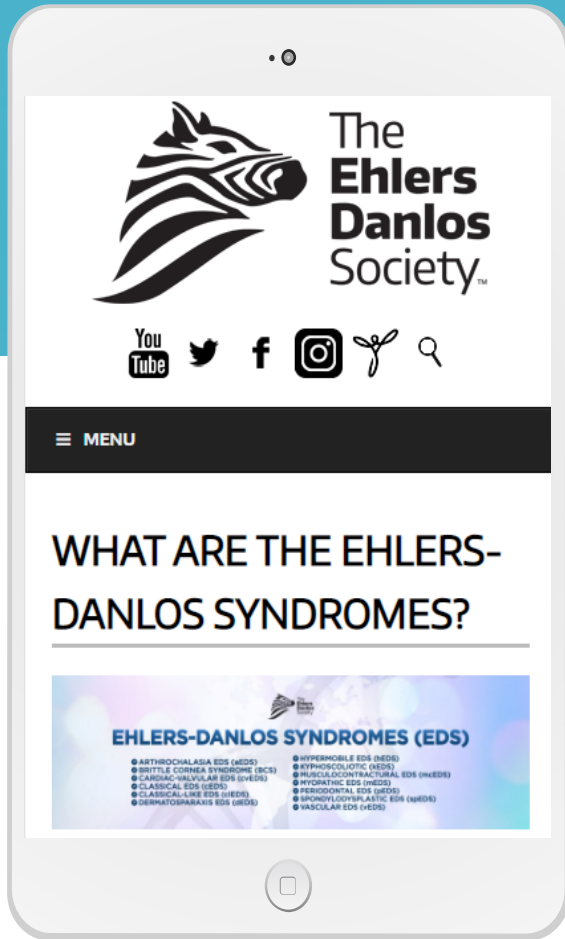
From Quora.com:

<https://www.quora.com/What-is-the-glycocalyx>

Author: Ken Saladin, former professor of histology (microscopic anatomy)

Protection	Cushions the plasma membrane and protects it from physical and chemical injury
Immunity to infection	Enables the immune system to recognize and selectively attack foreign organisms
Defense against cancer	Changes in the glycocalyx of cancerous cells enable the immune system to recognize and destroy them
Transplant compatibility	Forms the basis for compatibility of blood transfusions, tissue grafts, and organ transplants
Cell adhesion	Binds cells together so tissues do not fall apart
Fertilization	Enables sperm to recognize and bind to eggs
Embryonic development	Guides embryonic cells to their destinations in the body

Ehlers-Danlos Syndromes



Ehlers-Danlos Society:

<https://www.ehlers-danlos.com/what-is-eds/>



Marfan Foundation

<https://marfan.org/conditions/ehlers-danlos/>



NORD (National Organization of Rare Diseases)

<https://rarediseases.org/rare-diseases/ehlers-danlos-syndrome/>



Lipedema



Resources



Lymphatic Education & Research Network (LE&RN) What is Lipedema and Lymphedema?

<https://lymphaticnetwork.org/living-with-lymphedema/faqs-about-lipedema/>



The Lipedema Project

<https://lipedemaproject.org/social-resources/>



Lipedema Simplified

<https://lipedema-simplified.org>



Lipedema University

<https://lipedema-university.lipedemaproject.org>