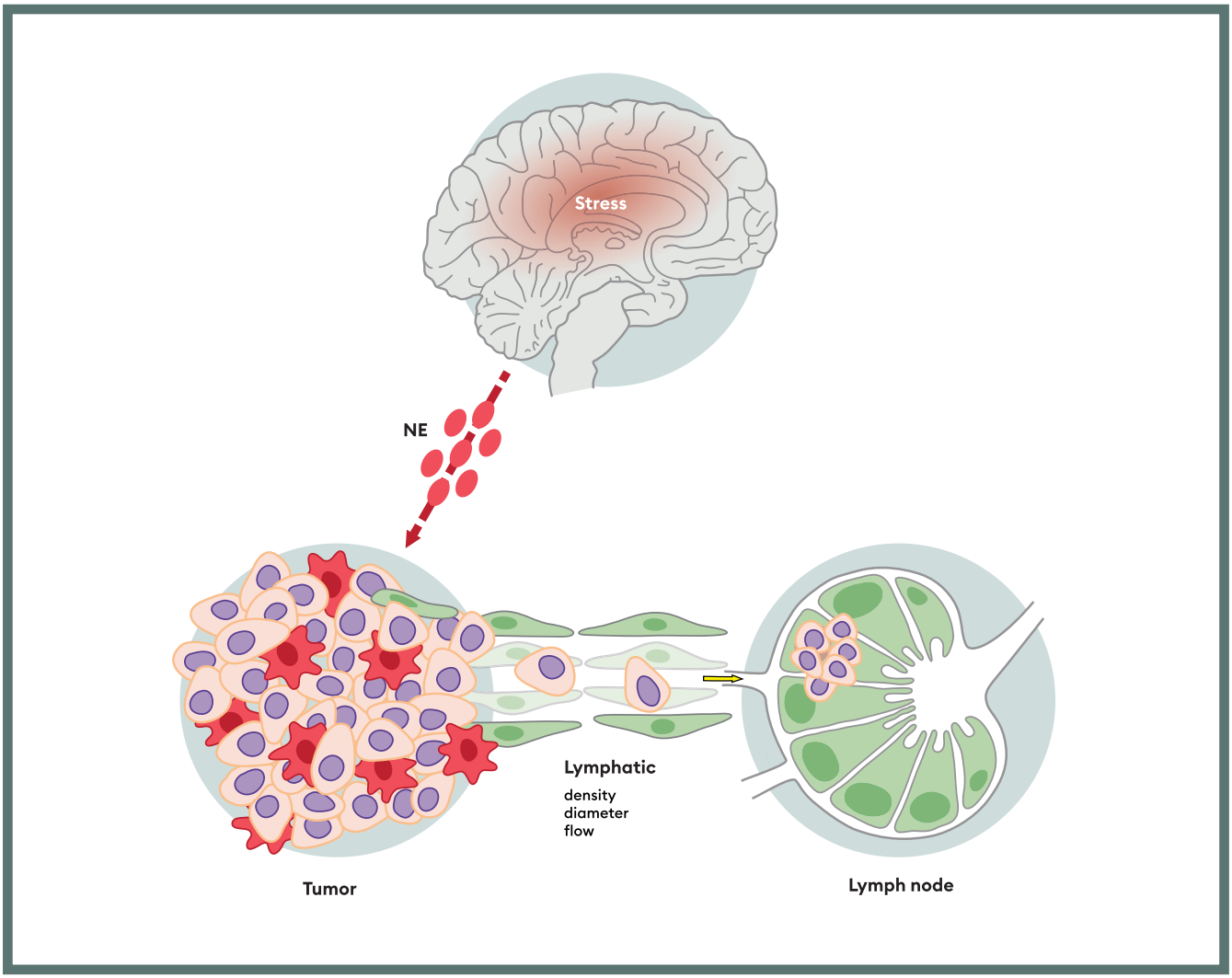
Lymphatics & Yoga

Tiffany Cruikshank, L.Ac
Doreen Wiggins, MD



Yoga Medicine®

Yoga Medicine
Vision & Mission

Vision:

Educate and empower teachers to use yoga therapeutically based on a deeper understanding of anatomy, physiology and the integration of modern science and research with traditional practices and experience.

Mission:

Create an international community of experienced yoga teachers who support the individuals and healthcare systems.

Contents

Anatomy of the Lymphatic System

Intro

Main Lymphatic System Functions:

- Return protein, water & waste from interstitium to the cardiovascular system
- Absorb protein, fat, and fat-soluble vitamins
- Support immune function by recognizing and responding to foreign cells and storing lymphocytes
- Inflammation initiation, regulation & resolution

Main Components of the Lymphatic System:

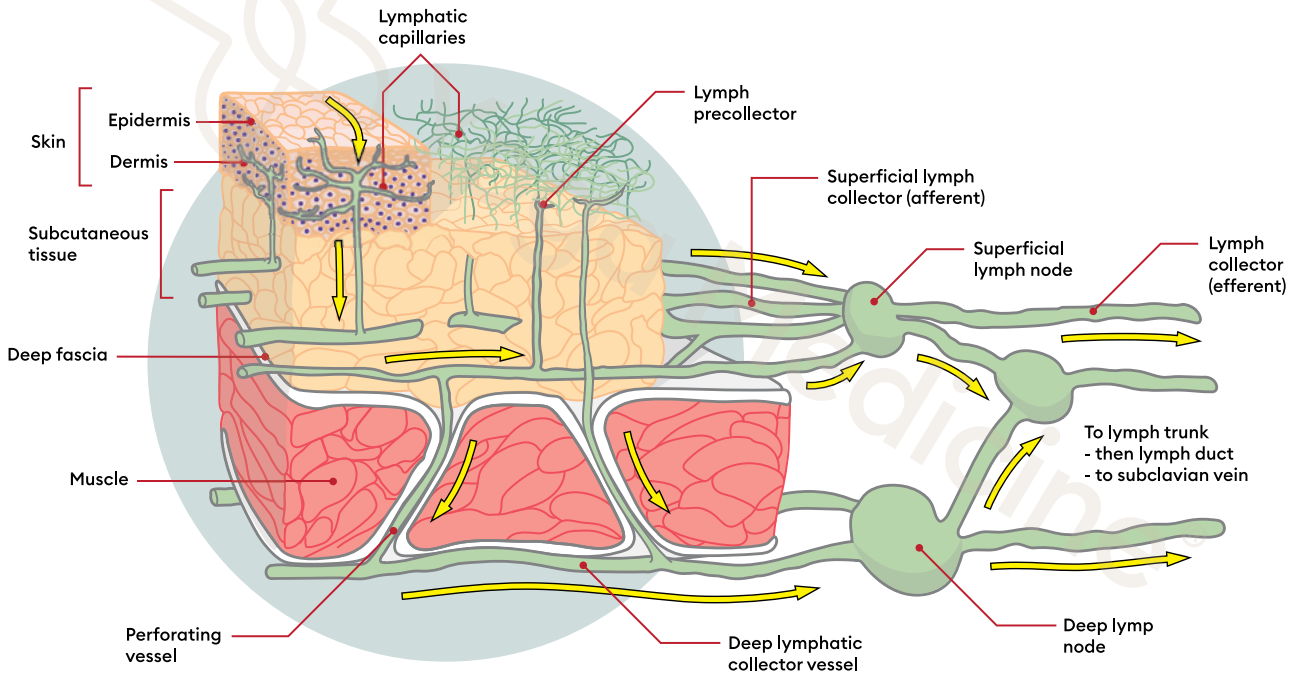
1. Lymph- fluid that flows through the lymphatic system
2. Lymphatic vessels- transport lymph (capillaries, collectors, lacteals, trunks & ducts)
3. Lymph nodes-filtering stations
4. Lymphocytes- white blood cells found in the

Superficial Lymphatic System

- Location: beneath epidermis, in the subcutaneous layer or superficial fascia
- Purpose: drains the skin
- Majority of lymphedema happens here

Deep Lymphatic System

- Location: beneath deep fascia
- Purpose: drain everything but the skin (muscles, tendons, joints, organs)
- Issues here less common in lymphedema
- Deep collectors often follow the arteries & veins in a common vascular sheath
- Superficial & deep systems connected by what are called perforating vessels

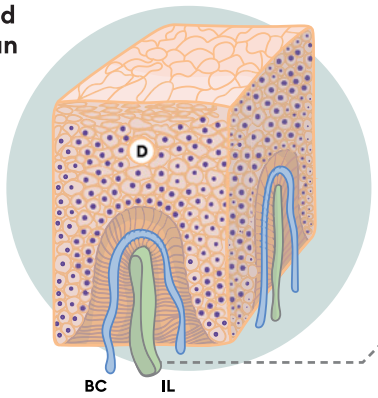


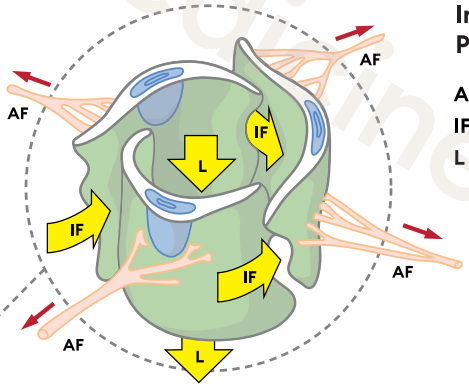
Lymphatic Capillaries

- Also known as the initial lymph vessels
- In the interstitial space alongside blood vessels
- Starts about 1mm deep, just below the epidermis
- Throughout the body (except avascular areas- hair, nail, tooth, cartilage, etc)
- Beginning of lymph formation
- Finger-like projections
- 1-3 projections on each lymph capillary
- Single layer of epithelial cells
- Closed ends (unlike the loop structure of blood capillaries)
- Each is responsible for an area approximately 3-4cm circumference
- Denser on palms & soles of feet (supplies 1.5-2cm circumference)
- Connected to the interstitium via anchoring filaments which help regulate the amount of cells & water coming into the system (lymph load)

Epidermis with blood capillary loop and an initial lymph vessel

BC = Blood capillary
IL = Initial lymph vessel
D = Dermis





Initial lymph vessel Phase of opening

AF = Anchor filaments
IF = Inflow of interstitial fluid
L = Outflow direction of lymph

Anchoring Filaments

Anchoring filaments help regulate interstitial fluids by pulling on endothelial cells to open the junctions and draw fluid in

Interstitial fluid increases

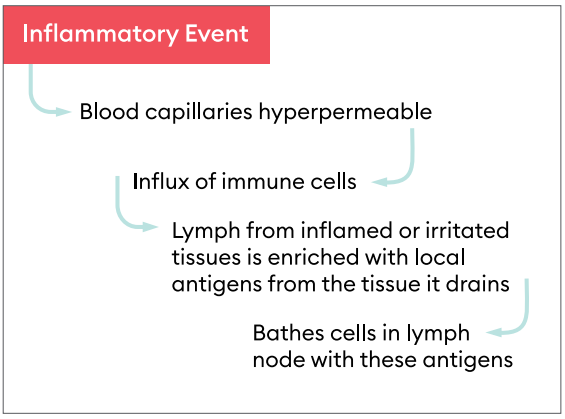
- Tissue pressure increases
- Stretches anchoring ligaments
- Pulls on endothelial cells
- Opens junctions between the cells
- Draws fluid into lymphatic capillary until pressure equalizes

Factors influencing this:

- Water content in interstitial tissues
- Manual & atmospheric pressure

Lymph

- Fluid that flows through the lymphatic system
- Contains: water, WBC's (mainly lymphocytes & macrophages), proteins, salts, fat (lymph from intestines), glucose
- Can also carry: metabolic waste, damaged cells, cancer cells, & foreign invaders
- Pickup pathogens and transport to lymph nodes to be destroyed

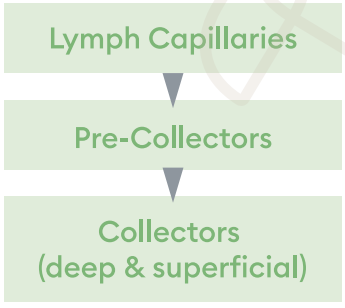


Lymphatic Pre-Collectors

- Connect capillaries with collectors to transport lymph fluid into the larger transporting vessels
- Possess absorbing functions like the capillaries but in some areas resemble transporting vessels containing smooth-muscle cells and valves

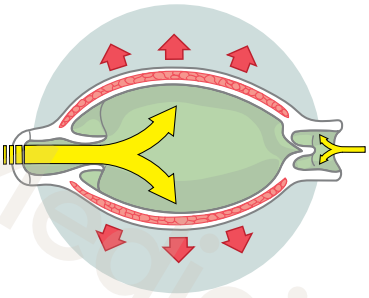
Lymphatic Collectors

- Structure like blood vessels (inner endothelial layer, middle layer of smooth muscle, and an outer connective tissue layer)
- Valves allow flow of lymph in one direction
- Transport lymph toward lymph nodes
- Drain specific areas of the body



Lymphangion

- The section between 2 valves
- Functional units within the lymphatic vessels that contain smooth muscle
- Contract like small hearts
- Lymphatic fluid enters the lymphangion stretching the smooth muscle causing a contraction that pushes it into the next lymphangion
- Lymphangiomotoricity= the rate of contraction, typically 10-12 per minute at rest

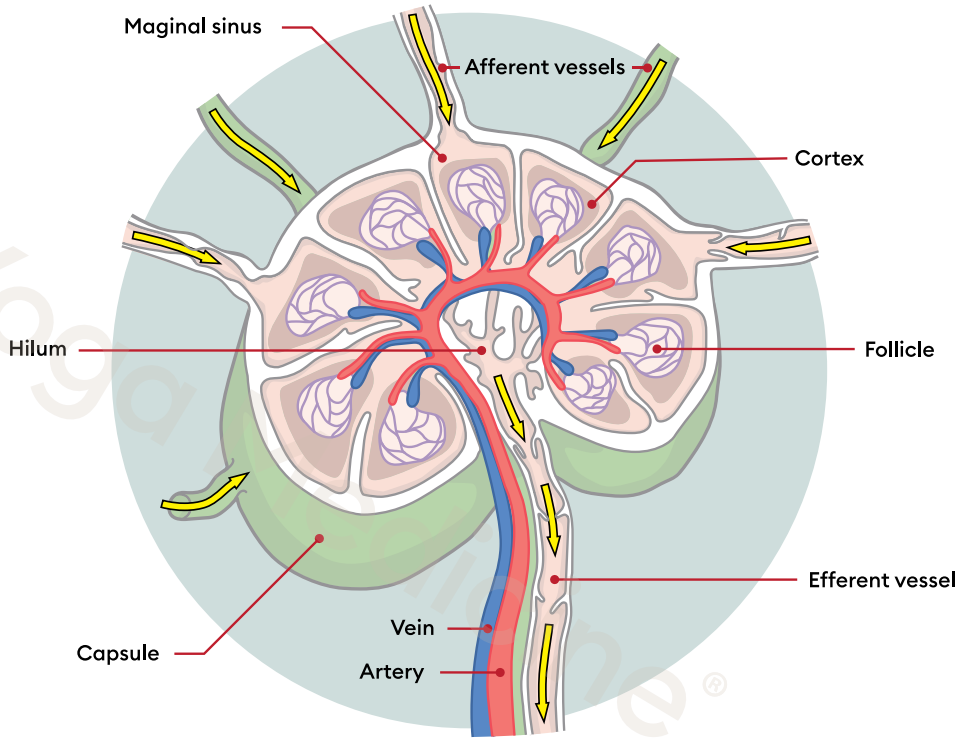


Lymph Collaterals

- Run parallel to collectors and connect the proximal portion of a collector with its distal portion
- Can relieve or replace the bypassed section

Lymph Nodes

- Born with around 600-800 lymph nodes
- Cannot regenerate
- Size in adults ranges from 0.2-3cm
- Comprised of chambers filled with immune cells
- Produce antigen stimulated lymphocytes, antibodies & thicken lymph fluid
- When a pathogen is detected, more lymphocytes are produced causing the node to swell
- Threats (bacteria, damaged cells, etc) are destroyed and turned into waste which travel back to bloodstream where they are removed by the liver & kidneys
- Afferent vessels drain into lymph node, efferent vessels leave the lymph node



Direct sympathetic innervation

Functions

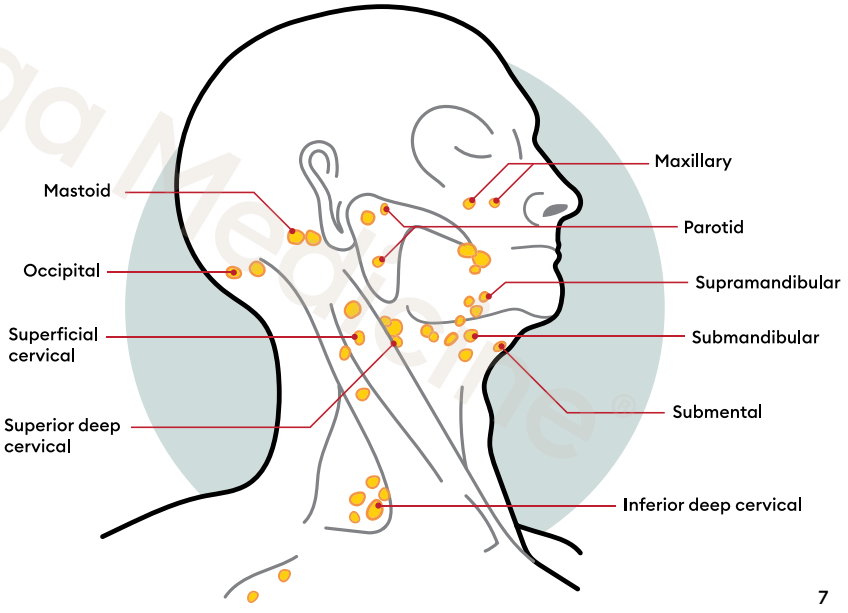
- Slows lymph flow to survey & respond to threats, filtering foreign/harmful material in the lymph fluid (bacteria, viruses, toxins, damaged or abnormal cells...)
- Store immune cells (esp lymphocytes & macrophages)
- Regulation of concentration of proteins in lymph excess water reabsorbed into blood capillaries

3 Main Drains

- Cervical nodes
- Axillary nodes
- Inguinal nodes

Cervical nodes

- Drains head & neck
- Located on each side of the neck



3 Main Drains (continued)

Axillary nodes

- Drains upper extremity, mammary and skin of thorax
- Located between pecs & lats

(image coming soon)

Inguinal nodes

- Drains abdominal, lumbar, gluteal, external genitalia, perineum & lower extremities
- Located in the femoral triangle
- Lymphatic trunks

Main Lymph Nodes

(image coming soon)

Lymphatic Trunks

- Large lymphatic vessel that forms from the convergence of efferent lymphatic vessels
- Lymphatic trunks drain into the lymphatic ducts (right lymph duct & thoracic duct) which return lymph to the blood by emptying into the subclavian veins

Lymphatic trunks:

- **Jugular**- in neck, drains head & neck (cervical nodes)
- **Subclavian**- under the clavicle, drains upper extremity (axillary nodes)
- **Bronchomediastinal**- in the chest, drains thoracic cavity
- **Intercostal**- drains the chest wall
- **Lumbar**- drains legs, lower quadrants, pelvis, external genitals & kidneys (inguinal nodes)
- **Intestinal (unpaired)**- drains the abdominal cavity, receives a mixture of lymph & fats

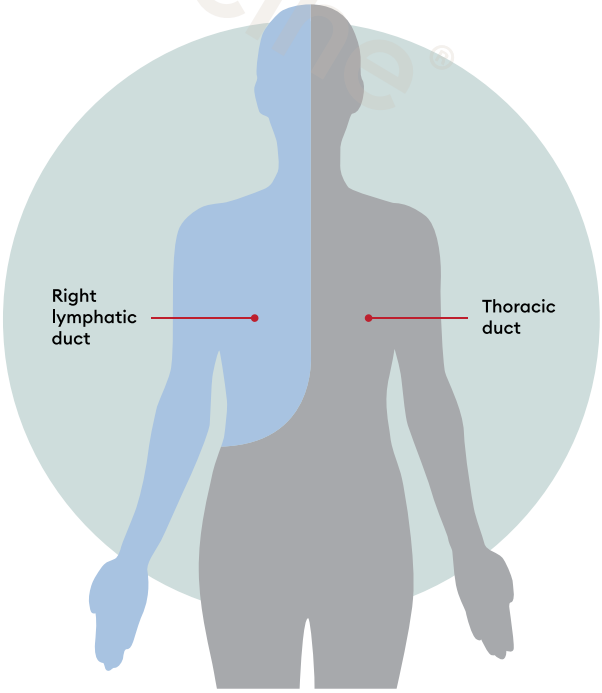
Lymphatic Ducts

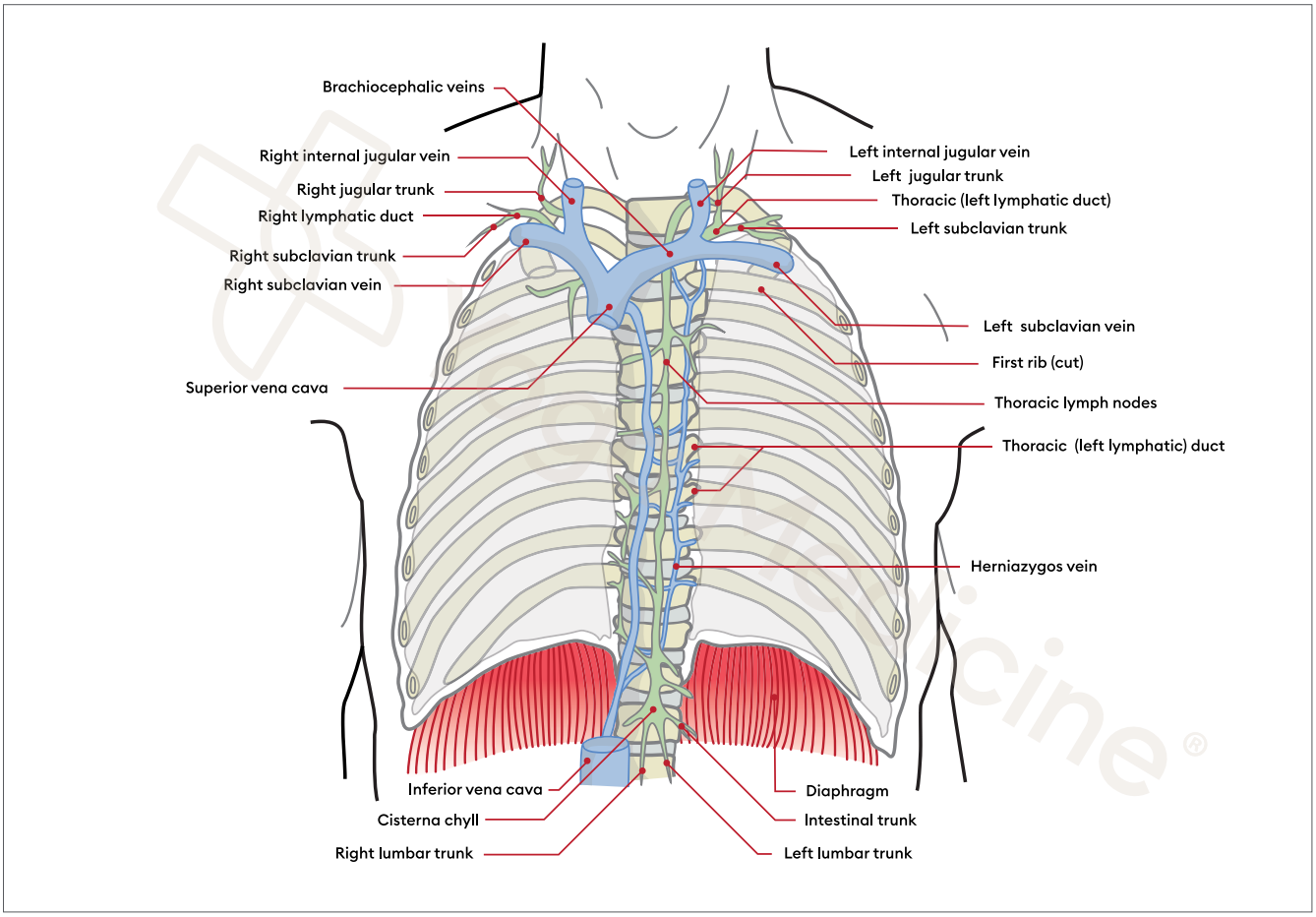
Right Lymphatic Duct

- Drains into the right subclavian vein
- Drains about 300ml in 24hrs
- Drains right upper quadrant, right arm and right face/head/shoulder
- About ¾" long

Thoracic Duct (left lymphatic duct)

- Largest lymphatic vessel, 1-5mm wide in cadavers, about a pencil width in living humans
- Starts between T11 & L2 just anterior to the spine at the cisterna chyli
- Approximately 10-18" long with valves
- Runs through the diaphragm at the aortic hiatus with the aorta and drains into the left subclavian vein (venous angle)
- Flow lymph here increases significantly with abdominal breathing
- Drains 2-4 liters in 24hrs
- Drains everything else (lower extremities, lower quadrants, genitalia, left upper quadrant, left arm, and left face/head/shoulder)





Lymph Flow

Lymph Capillaries
↓
Collectors
↓
Lymph Trunk
↓
Lymph Duct
↓
Subclavian Vein
↓
Brachiocephalic Vein
↓
Superior Vena Cava
↓
Right Atrium (Heart)

Lymphatic Organs & Tissue

Lymphatic Organs

- **Bone marrow**- primary site of red & white blood cell (WBC) production, including lymphocytes- a type of WBC
- **Thymus**- very important early in life, where T-cells (a type of lymphocyte) mature to ensure they respond to antigens but not self
- **Spleen**- controls blood cell levels (RBC, WBC, platelets) by surveying and initiating immune cell production & recruitment, filters blood and dispose of aged RBCs, holds a reserve of blood

MALT: Mucosa-associated Lymphatic Tissue (act like large lymph nodes)

- Tonsils
- Peyer's patches (in small intestines)
- Appendix

Intestinal Lymphatics

- Lacteals: lymphatic vessels of the small intestine that absorb digested fats
- Chyle: milky fluid consisting of fat & lymph that drains from lacteals to larger lymph vessels to thoracic duct
- Chylomicrons: long-chain fatty acids packaged to be transported back back to circulation through intestinal trunk

Glymphatic System

Glymphatic System

- Named in 2012
- Waste clearance system of the central nervous system
- Functions mainly during sleep
- Turnover 150ml of cerebrospinal fluid (CSF) approximately 4 times a day
- CSF as the lymphatics of brain, bathing the brain & protecting it
- CSF contained in the ventricles of the brain & subarachnoid space (cranial & spinal)

Current understanding:

- Arterial pulsation drives CSF down to bathe the brain
  - » CSF inflow into deep brain regions happens along periarterial spaces
    - » CSF exchange with interstitial fluid (ISF) facilitated by glial aquaporin 4 (AQP4) water channels
      - » Efflux through perivenous space & meningeal lymphatics
- CSF reabsorbed in the arachnoid granulation villi and most likely much of this is happening at the exit of cerebral & spinal nerves as well
- Lymphatic vessels found (2015) in meninges that surround the brain, lymph capillaries exist near veins (esp at sinuses) which are drained by meningeal & cervical lymph vessels
- In peripheral nerves, the epineurium (outer connective tissue layer) also contains lymphatics, which probably pass to regional lymph nodes

Glymphatic System

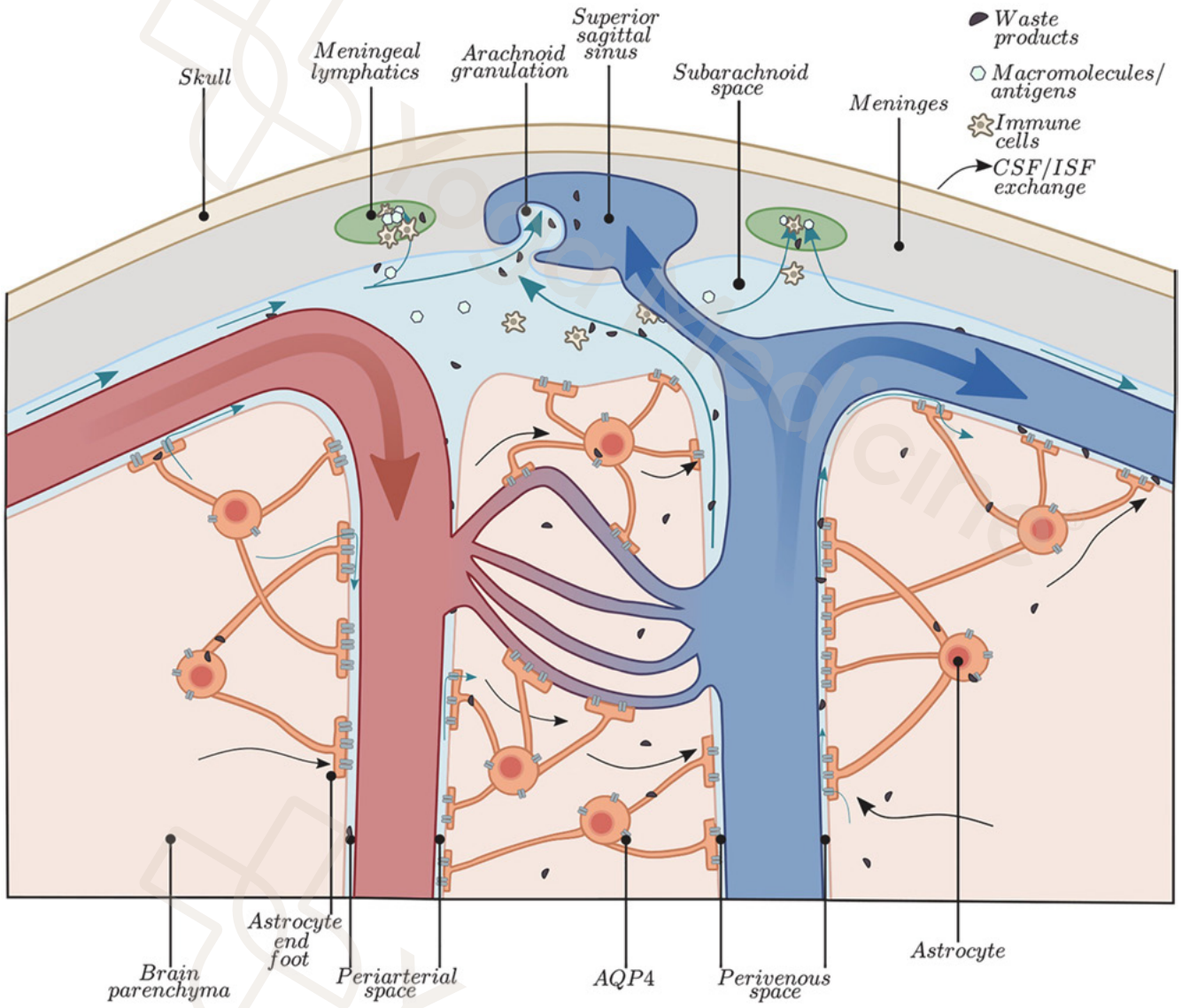


Image source:
The glymphatic system and meningeal lymphatics of the brain: new understanding of brain clearance
GALINA YANKOVA, OLGA BOGOMYAKOVA, ANDREY TULUPOV 2021

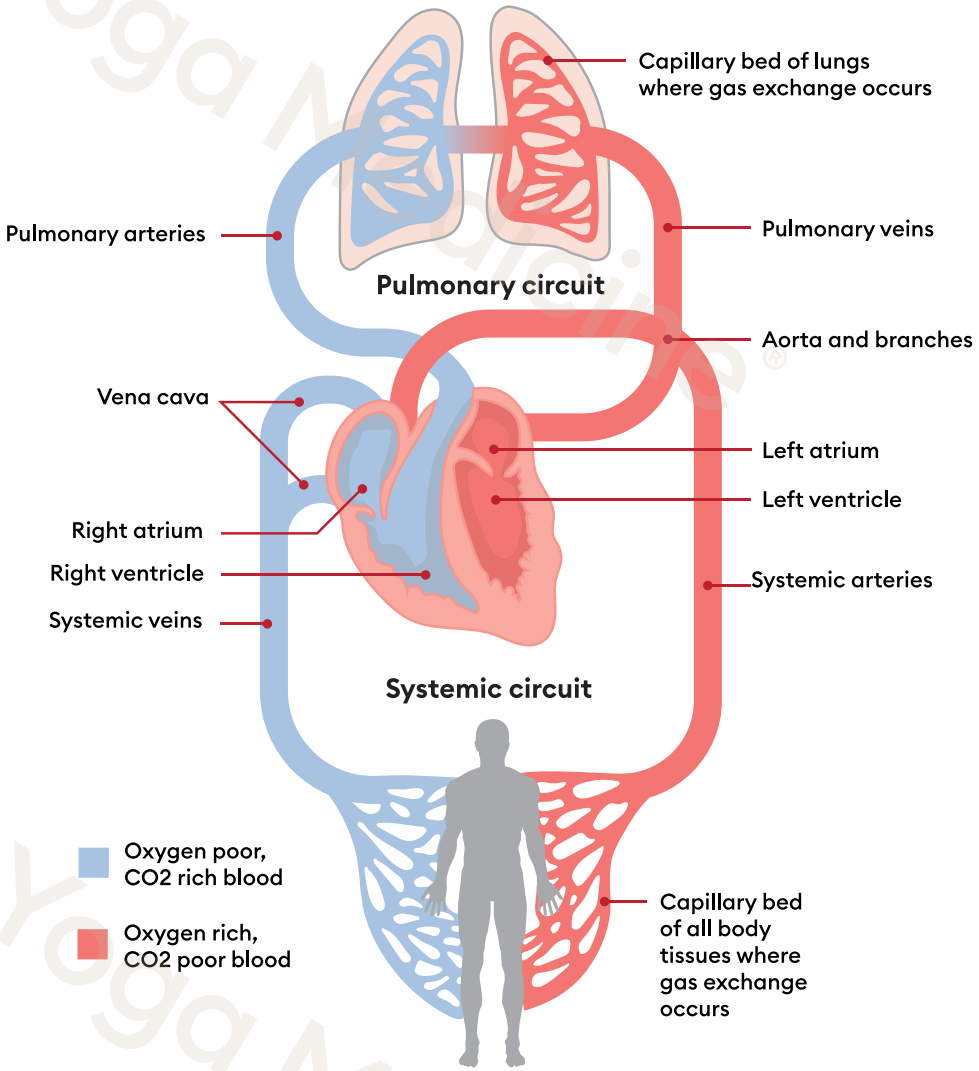
Glymphatic Implications

- Sleep
- Respiration
- Exercise
- Meditation
- Aging
- Stress & nervous system regulation
- Gravity
- Other: omega 3, intermittent fasting, alcohol

Lymphatic Circulation

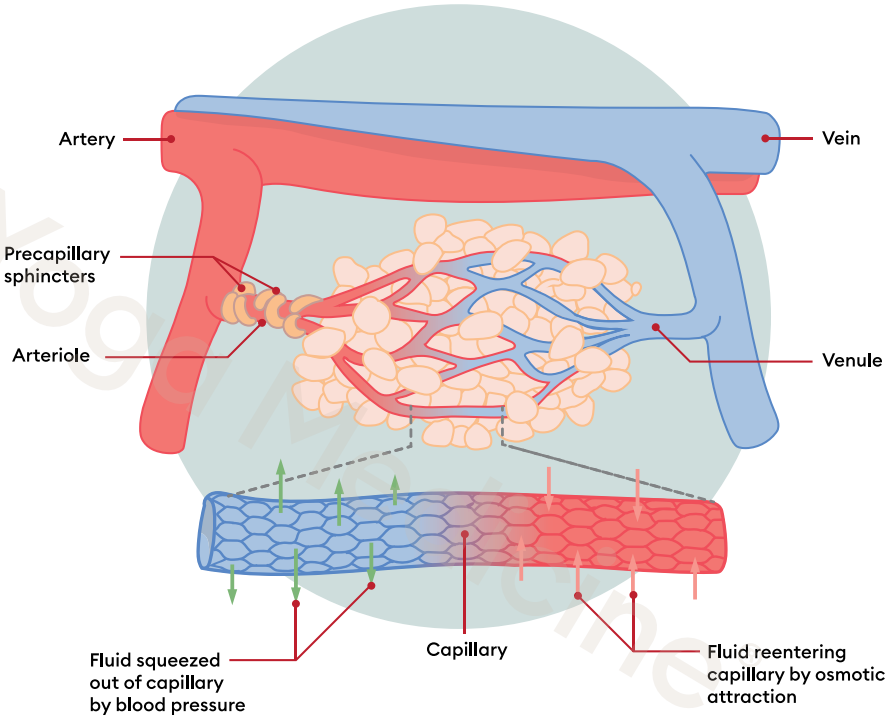
Blood Circulation

- Left Ventricle
- Aorta
- Arteries
- Arterioles
- Precapillary Arterioles
- Blood Capillaries
- Post Capillary Venules
- Venules
- Veins
- Vena Cava
- Right Atrium
- Right Ventricle
- Lungs
- Left Atrium
- Left Ventricle



Blood Circulation

- Closed pathway
- Arterial outflow driven by the heart pump
- Venous return relies on several factors including respiration, blood volume, cardiac suction, valves and muscular contraction
- During inspiration negative thoracic cavity pressure draws blood (& lymph) into the right atrium to return venous blood (& lymph) back to the heart
- Capillaries are where oxygen, nutrients & other substances are filtered into the interstitial spaces and CO2 & waste products are returned back into the capillaries

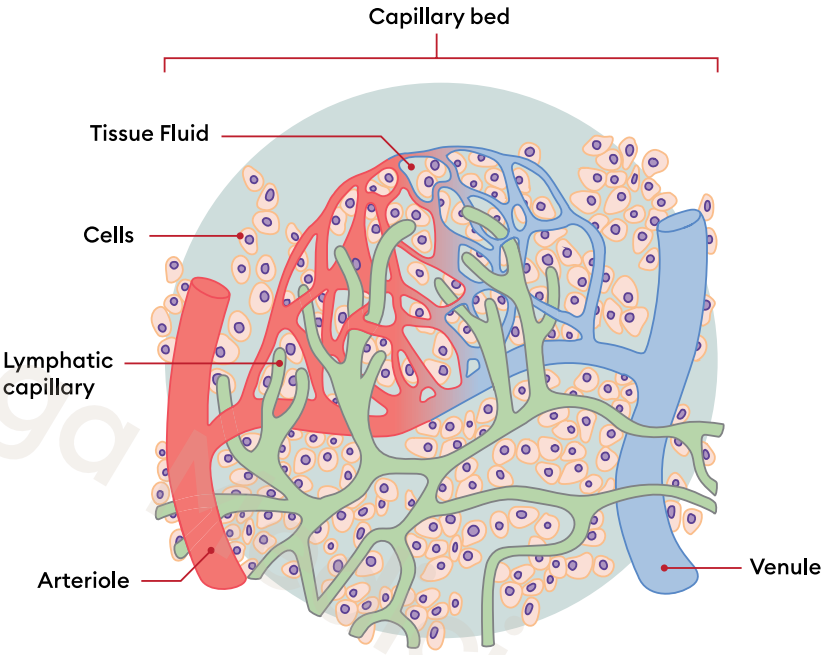


- Precapillary sphincters regulate blood flow here
- Regulation of precapillary sphincters by: nervous system, hormones, pH, O2 levels, exercise

At Blood Capillaries:

- Filtration: water leaves the arterial end of capillaries via filtration
- Reabsorption: water picks up waste products and is reabsorbed at the venous end of capillaries (80-90% reabsorbed)

Blood Circulation



The Starling Principle

- Fluid movements between blood and tissues are determined by differences in pressure between plasma inside vessels and fluid outside them (pressure exerted by fluids & proteins)
- Hydrostatic pressure: pressure of fluid in a confined space
- Oncotic pressure (colloid-osmotic pressure): force of proteins attracting water

Active Hyperemia

- Increase in local blood flow at the arterial end of the capillary due to massage, exercise, infection, etc
- Increased lymph load

Passive Hyperemia

- Inhibited venous outflow due to heart failure, pregnancy, obesity, chronic venous insufficiency, deep vein thrombosis, sedentary
- Increased lymph load

Hypoproteinemia

- Low level of protein in blood due to: excess protein in urine, inadequate intake, liver damage, intestinal issues
- Increased lymph load
- No MFR/massage, refer to Dr to treat disease process

Vasomotion

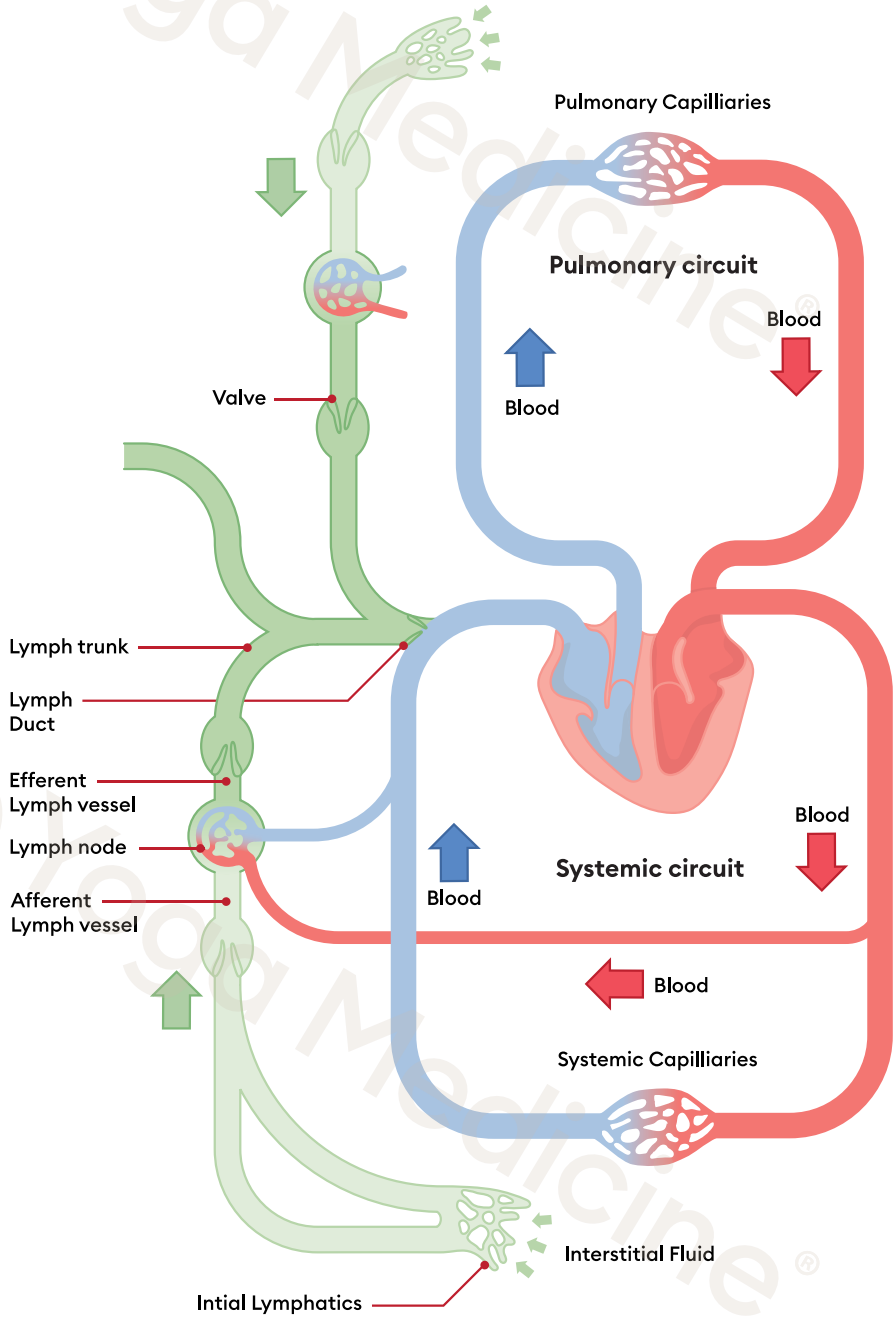
Spontaneous oscillation in tone of blood vessel walls

- Independent of heartbeat or innervation
- Driving force in flow of interstitial fluid into lymph capillaries
- About 10 pulses/min
- Precapillary arterioles have more smooth muscle (than post capillary/venous end) & affect blood capillary pressure through vasomotion
- Affected by concentration of O2 in tissues
  - » Oxygen concentration decreases = frequency of vasomotion increases to increase oxygen supply to tissues
- Affected by SNS due to sympathetic innervation in muscular wall of precapillary arterioles
  - » SNS activation causes contraction here which decreases blood flow in capillaries

Lymphatic Circulation

- One way system
- No central pump
- Used to drain leftover substances from blood circulation
- Starts in interstitium
- Acts as a filter for the interstitial spaces
- Sometimes considered part of the circulatory system

Interstitial Fluid
↓
Lymph Capillary
↓
Afferent Lymph Vessel
↓
Lymph Node
↓
Efferent Lymph Vessel
↓
Lymph Trunk
↓
Lymph Duct
(Right Lymphatic Duct or Thoracic Duct)
↓
Subclavian Vein
↓
Brachiocephalic Vein
↓
Superior vena Cava
↓
Heart
↓
Arteries
↓
Arterioles & Capillaries
↓
Interstitial Fluid



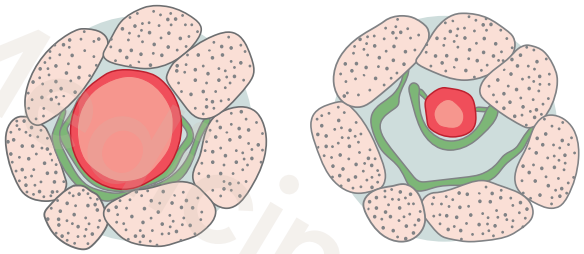
Lymphatic Load

- Cells, protein & water from the interstitial space cleared by the lymphatic system
- Approximately 10-20% of water remains in interstitial space to be cleared by the lymphatic system
- Proteins are too large to be reabsorbed at the venous end and must be removed from interstitial space by lymphatics
- 2-4 liters returned to venous system via the thoracic duct every 24hrs

Lymphatic Circulation

Pulsation of arteries

- Artery expands = lymph vessel compressed (emptying phase)
- Artery smaller= lymph vessel expands & fills (filling phase)



Factors influencing lymphatic circulation:

- Smooth muscle contraction
- Valves to prevent backflow
- Skeletal muscle contraction
- SNS innervation
- Changes in pressure (walking, underwater, flying, etc)
- Arterial pulsation
- Respiration
- Vasoregulatory factors such as nitric oxide (vasodilator)

Hyperemia = increased amount of blood in the vessels, increases lymph load

- **Active hyperemia:** (arterial side) with massage or exercise, increased circulation causes increased lymph load
- **Passive hyperemia:** (venous side) with poor venous return, causes increased lymph load

Lymphatic Load

Lymphatic time volume

- Amount of lymph transported by lymphatic system over a period of time
- Usually about 4L/day
- Normally 10% of the transport capacity

Transport capacity

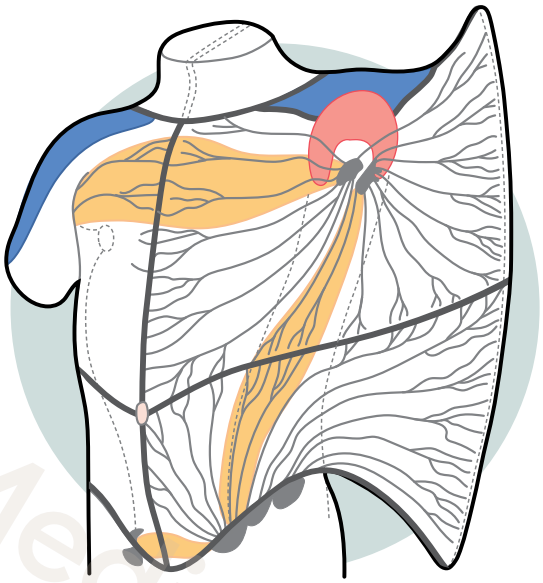
- Max amount of lymph the body is able to transport
- Usually 10xs greater than the normal lymph load

Functional Reserve

- The difference between the lymphatic time volume & transport capacity
- If load is increased this acts as a safety factor

Lymphatic Territories

- Drain the same body region and run toward the same group of regional lymph nodes
- Creates 4 quadrants on the trunk
  - » Upper right & left quadrants drain to respective axillary nodes
  - » Lower right & left quadrants drain to respective inguinal nodes



Lymphatic Watersheds

- Where lymph capillaries change direction
- Delineates/separates territories
- Refer to the superficial lymphatics
- Lymph collectors don't often cross watersheds

Watersheds:

1. Median-Sagittal (vertical)
2. 2 Transverse (horizontal)
   - » Clavicle—> spine of scapula
   - » Navel—>L1

Anastomosis

- Connections across watersheds between quadrants
- Work from problematic side toward healthy side

Anterior Anastomosis

- AAA (Anterior Axillo-Axillary) runs from axillary to the opposite axillary, runs in both directions across the body
- AIA (Axillo-Inguinal Anastomosis) runs between the axilla & inguinal nodes on the same side, runs in both directions up & down
- AII (Anterior Inter-Inguinal) runs from inguinal to the opposite inguinal, runs in both directions across the body

Posterior Anastomosis

- PAA (Posterior Axillo-Axillary) across back from one axilla to the other axilla
- PII (Posterior Inter-Inguinal) from inguinal to inguinal over the sacrum

Watersheds & Anastomoses

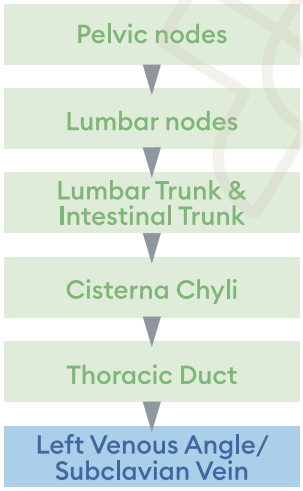
(image coming soon)

Lymphotomes

(image coming soon)

Lower Lymphatic Circulation

Lymph in Inguinal nodes



Arm Bundle Notes

Territories on extremities are called bundles

Lateral Upper Arm Bundle

- Deltoid area
- Important for draining or decongesting the arm
- Drains into axillary & supraclavicular nodes

Antecubital Fossa (inner elbow)

- Bottleneck area where forearm collectors converge
- Radial, ulnar & medial forearm bundles wrap around the forearm to converge here

Leg Bundle Notes

Ventro-Medial Bundle (inner & front leg)

- Drains most of the plantar & dorsal surface of feet, medial arch, medial malleolus and lower leg
- Bottlenecks at medial femoral condyle

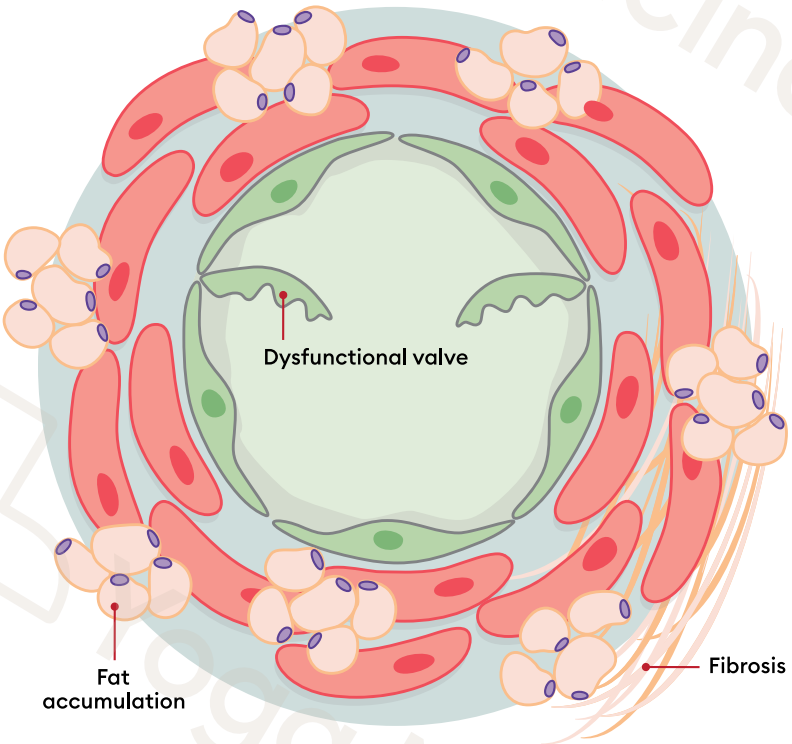
Dorso-Lateral Bundle (outer & back leg)

- Drains outer sole of foot, heel, lateral malleolus and achilles area up to popliteal fossa

Lymphedema, Lymphatic Issues and Assessment

Lymphedema

- Lymphedema is the accumulation of a colorless high protein fluid containing white blood cells, located just beneath the skin
- Progressive swelling
- Inflammation
- Fat accumulation
- Fibrosis

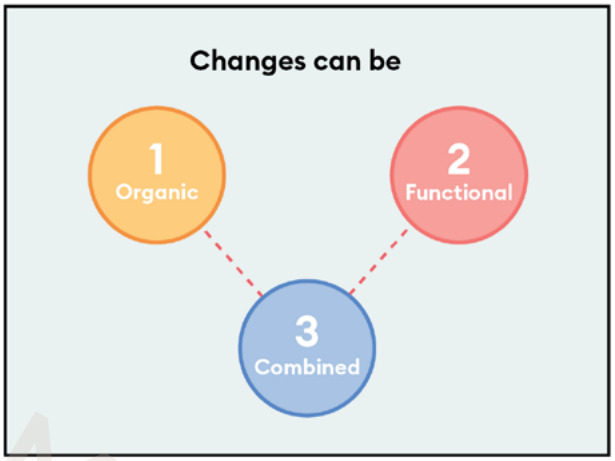


Lymphedema Signs and Symptoms

- Heavy feeling in the tissue, especially extremities
- Puffiness, thickening or stiffness of tissue
- Tightness of skin or tissue (rings, clothing, shoes do not fit)
- Decreased flexibility or ROM
- Different sensations: warmth, pain, numbness and paresthesia
- Pitting of the skin

Lymphedema

- Primary: developmental defect of lymph vessels &/or nodes (inherited)
- Secondary: pathological change
  - » Malignant form contraindicated for massage, etc- consult doctor (lymph pathways blocked by malignant tumor)
  - » Benign form causes mechanical or combined failure (surgery, radiation, chemotherapy, injury)

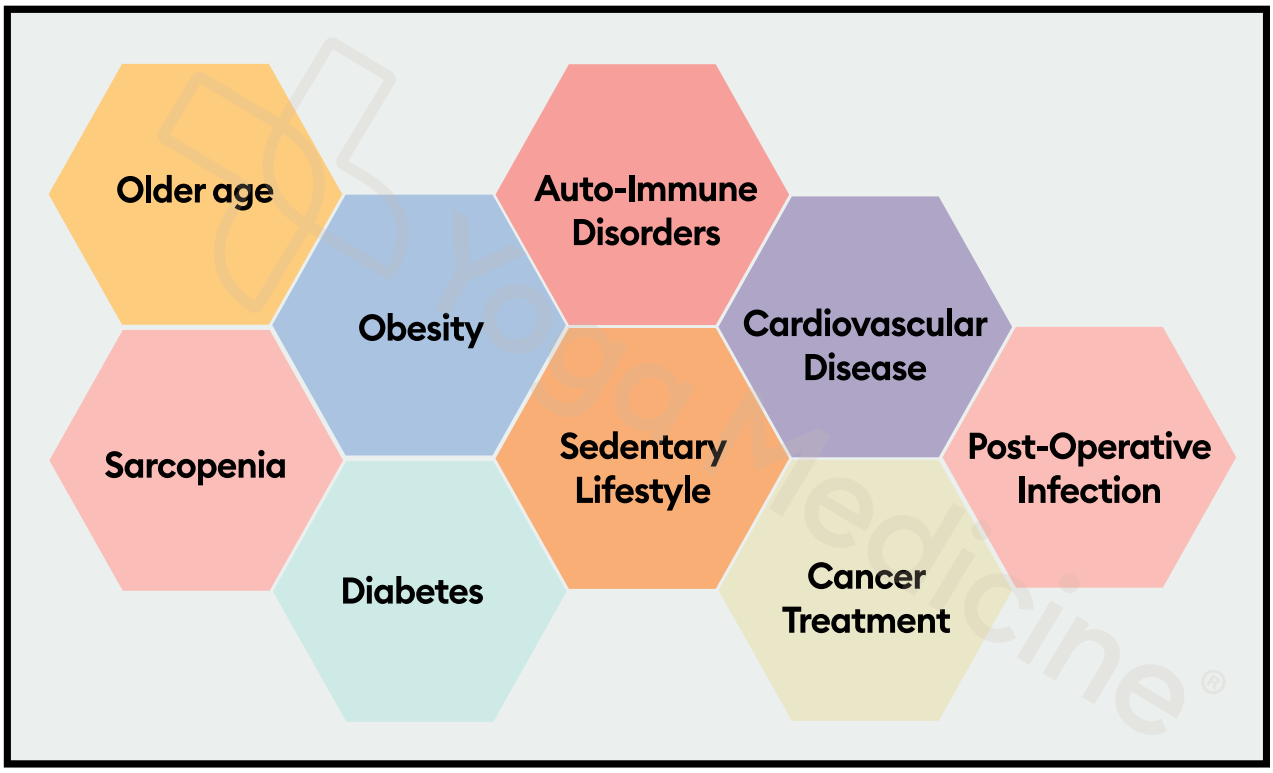


Assessments

Red Flags:

- Ask: Are you having any pain, heaviness, or swelling?
- Look:
  - » Is the edema symmetrical
  - » Pitting edema: 1+, 2+, 3+, record the time
  - » Surgical scars visible: in relation to lymph path, recordIncreased Risk for Lymphedema

Increased Risk for Lymphedema



Cancers with an Increased Risk of Secondary Lymphedema

- Melanoma
- Breast Cancer
- Female Pelvic Malignancies
- Colon Cancer
- Testicular and Prostate Cancers
- Any surgery requiring lymph node removal

Lymphedema Diagnosis

- "The presence of any edema, no matter what the cause, is a sign that the lymphatic system has been overwhelmed." Foldi M 1969

Simple Classification of Unilateral Lymphedema

- Mild lymphedema - < 3 cm difference between limbs
- Moderate lymphedema – 3-5 cm between limbs
- Severe lymphedema - > 5 cm between limbs

International Society of Lymphology

Stage 1	Early accumulation of fluid relatively high in protein content. Edema subsides with limb elevation. Pitting can be present.
Stage 2 - Early	Early–Pitting is present which does not resolve with elevation alone.
Stage 2 - Late	Tissue fibrosis develops, and pitting may or may not be elicited.
Stage 3	Lymphostatic elephantiasis with an absence of pitting. Trophic skin changes, lipodystrophy, and warty skin overgrowth develop. Most severe lymphedema.

Lymphedema Diagnosis

- Measurement and assessment of limb and tissue
- Imaging Diagnostic Tools
  - » Lymphoscintigraphy, direct lymphography
  - » CT/ CT lymphogram/ CT-SPECT
  - » MRI/Magnetic Resonance Lymphangiography
  - » Near Infrared Fluorescent Imaging
  - » Doppler (ECHO, Laser), ultrasound

Self Examination

Upper Extremity Lymphedema

- Make a fist with both hands and compare the areas between the knuckles
- Bend both elbows and compare sizes in the mirror
- Compare arm shapes by extending arms laterally and horizontally in the mirror
- Palpate the breast, axilla, arms, and hands bilaterally for fluid retention, areas of congestion or fibrosis

Lower Extremity Lymphedema

Stemmer's sign - Inability to pinch the skin on the dorsal surface of the second toe

Contraindications

Refer out & get clearance from doctor first for:

- Sudden onset edema
- Redness locally with edema
- Fever (local or systemic) with edema
- Infection
- Pain with edema
- Symmetrical edema
- Heart, liver or kidney failure
- Significant, unidentified skin issues
- Pitting edema: 1+, 2+, 3+, record the time
- Cancer – get clearance, timing is important, not all cancer is the same
- WoundsConservative Management
- Goals: volume reduction, improve patient symptoms:
- Manual Lymphatic Therapy
- Manual Lymphatic Mapping
- Compression Decongestive Therapy
  - » Bandage wrapping, KT tape, pump

Indications for Lymphatic Support

- Post-operative, joint replacement, burns, swelling, eczema, diabetic ulcers, acne, Crohn's disease, Bell's Palsy, cellulite, MS, Parkinson's, sinusitis, lipedema, vein stripping, migraines, glaucoma, torn meniscus, downs syndrome, c-section...
- Pre-operative assessment on all surgical patients requiring lymph node removal, evaluation of risk factors, preventive measures, self-assessment, and exercises

Pharmacologic Therapy

- Currently, no data to support the use of medications in routine treatment of lymphedema
- Diuretics may worsen lymphedema
- Coumarin, Vitamin E, and pentoxifylline in randomized trials no evidence that they are useful for prevention or treatment
- Steroids can offer temporary relief, no benefit after one month

Surgical Intervention

- Ablative Surgical Procedures: Charles Technique
- Liposuction or lipectomy
- Lymphovenous Anastomosis
- Lymphatic microsurgical preventive healing approach (LYMPHA)
- Vascularized Lymph Node Transfer

Glymphatic Impairment

- Alzheimer's, ALS (Lou Gehrig's disease), Huntington's, Parkinson's- all characterized by accumulation of proteins in the brain that tend to stagnate/aggregate
- Impaired glymphatic clearance linked to neurodegenerative diseases
- Traumatic Brain Injury (TBI, concussion) can cause glymphatic impairment
- Research suggests that glymphatic system is involved in modulating or possibly protecting against these

Sarcopenia and Cancer Outcome

- Sarcopenia and sarcopenic obesity are related to increased mortality, poorer tolerance to cancer treatment, and lower quality of life scores
- Resistance exercises: weight-lifting, yoga, and rowing have shown to improve muscle mass, strength, ROM, decrease sarcopenia, improve QOL, may help prevent lymphedema, and decrease cancer recurrence and mortality

Cancer Treatments and Yoga

Survivorship Begins at Diagnosis

- Nutrition and Weight Management
- Physical Activity (daily movement, resistance)
- Screening for secondary cancers, and prevention
- Lymphedema
- Sleep disorders
- Pain
- Anxiety, depression, and trauma
- Cardiovascular disease
- Neuro-health (cognitive function, neuropathy)
- Hormonal changes and sexual function

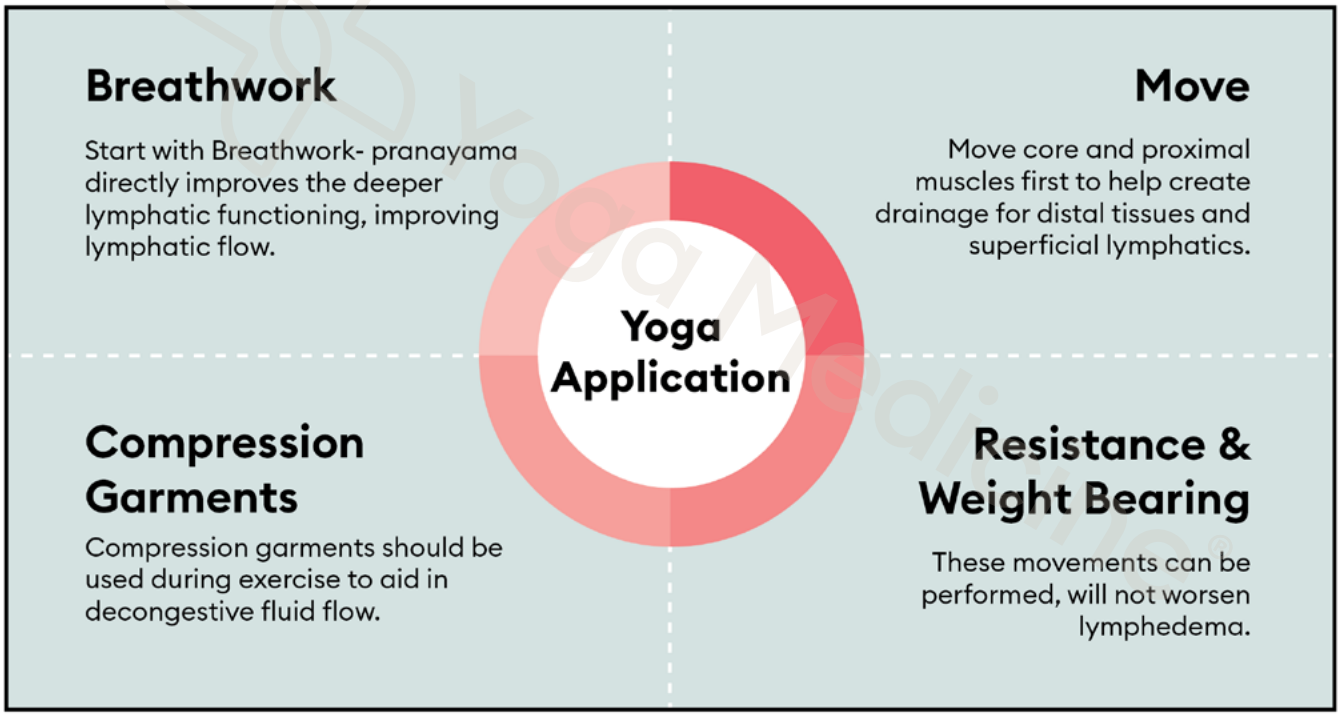
Yoga Intervention

Breast Cancer Lymphedema

- Yoga intervention improved physical, self-perception, and emotional functioning of quality of life in women with breast cancer-related lymphedema.
- The changing trend in physical, self-perception, emotional and cognitive functioning was raised as a result of the yoga intervention.
- The changing trend in some symptoms scale of quality of life such as fatigue and pain were reduced as a result of the yoga intervention.

Yoga

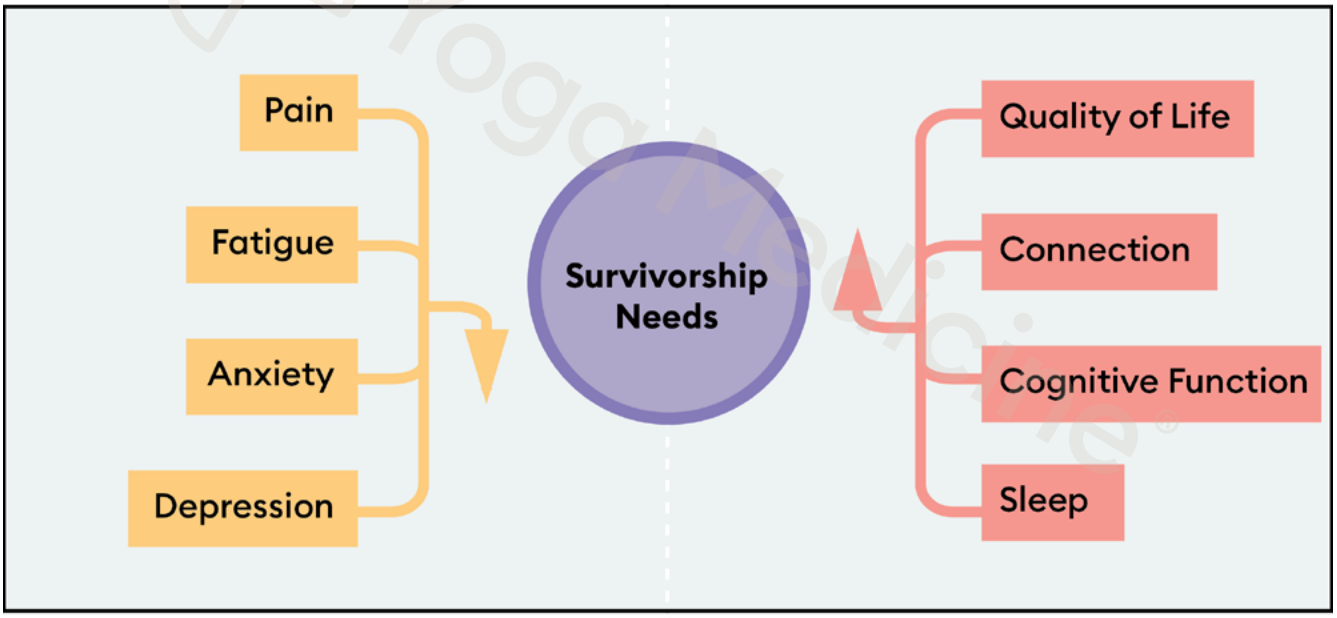
Lymphedema Prevention and Therapeutic Intervention



Evidence-Based Benefits

Yoga for Cancer Survivorship

- Increase range of motion
- Ability to "Hold Space" for the body on the mat
- Reconnection to the body, grounding the mind
- Increase energetic awareness and breath
- Engage the parasympathetic system for improved immune function
- Potential to reduce the risk of metastasis by changing the microenvironment



Yoga Intervention

Breast Cancer Lymphedema

- Insomnia and financial difficulties were reduced during the 4th and 8th week amongst women with breast cancer-related lymphedema who participated in the yoga classes.
- Four to eight weeks of yoga intervention did not affect the upper extremities' edema volume in women with breast cancer-related lymphedema.

What is Lymphatic Rhythm?

- Lymphangions "lymphatic hearts"
- Like pacemakers contract regularly through lymphatics creating peristaltic waves
- Have parasympathetic and sympathetic innervation

(similar to alpha and beta receptors in blood vessels)

Yoga, exercise, breathwork, tai chi, Qigong all increase lymphatic rhythm and flow

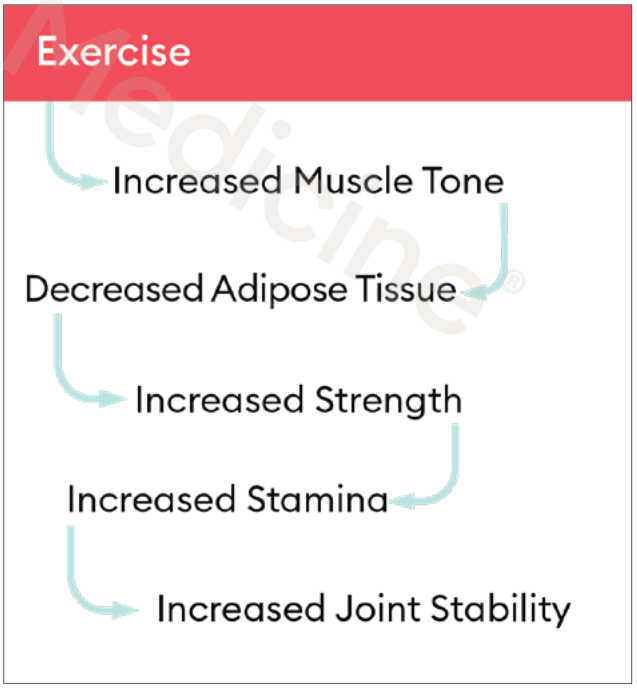
Primo Vascular System

- First discovered in the early 1960's, scientifically confirmed in 2002
- A unique anatomical and immunohistochemical signature that sets it apart from the arteriovenous and lymphatic systems.
- Plays a large role in biological processes, including tissue regeneration, inflammation, and cancer metastases

Not fully accepted yet in western medicine…

Yoga Guidelines for Lymphedema

- Compression garments are preferred (short-stretch bandage increases tissue pressure and enhances return in superficial and deep veins and lymphatics).
- Begin with deep breathing (stimulates cisterna chyll, thoracic duct, liver, and abdominal organ lymphatics)
- Modify postures as needed
- Postures should begin with proximal muscles, core, twists, inhale with extension, exhale with flexion, keep the respiratory pump flowing
- Move larger proximal limbs (hips, shoulders), then distal limbs with flexion and extension to aid in drainage.
- MFR, Flossing, tapping, and improving ROM, are ideal
- Avoid or adjust tourniquet simulating poses (Eagle, Supine Hero)



Resistance Training for Lymphedema

- Women with BCRL can safely perform moderate- to high-intensity upper body resistance exercises with both high and low loads without fear of exacerbating their lymphedema.
- 3 months of training (twice weekly) resulted in significant improvements in muscle strength, muscle endurance, and quality of life.

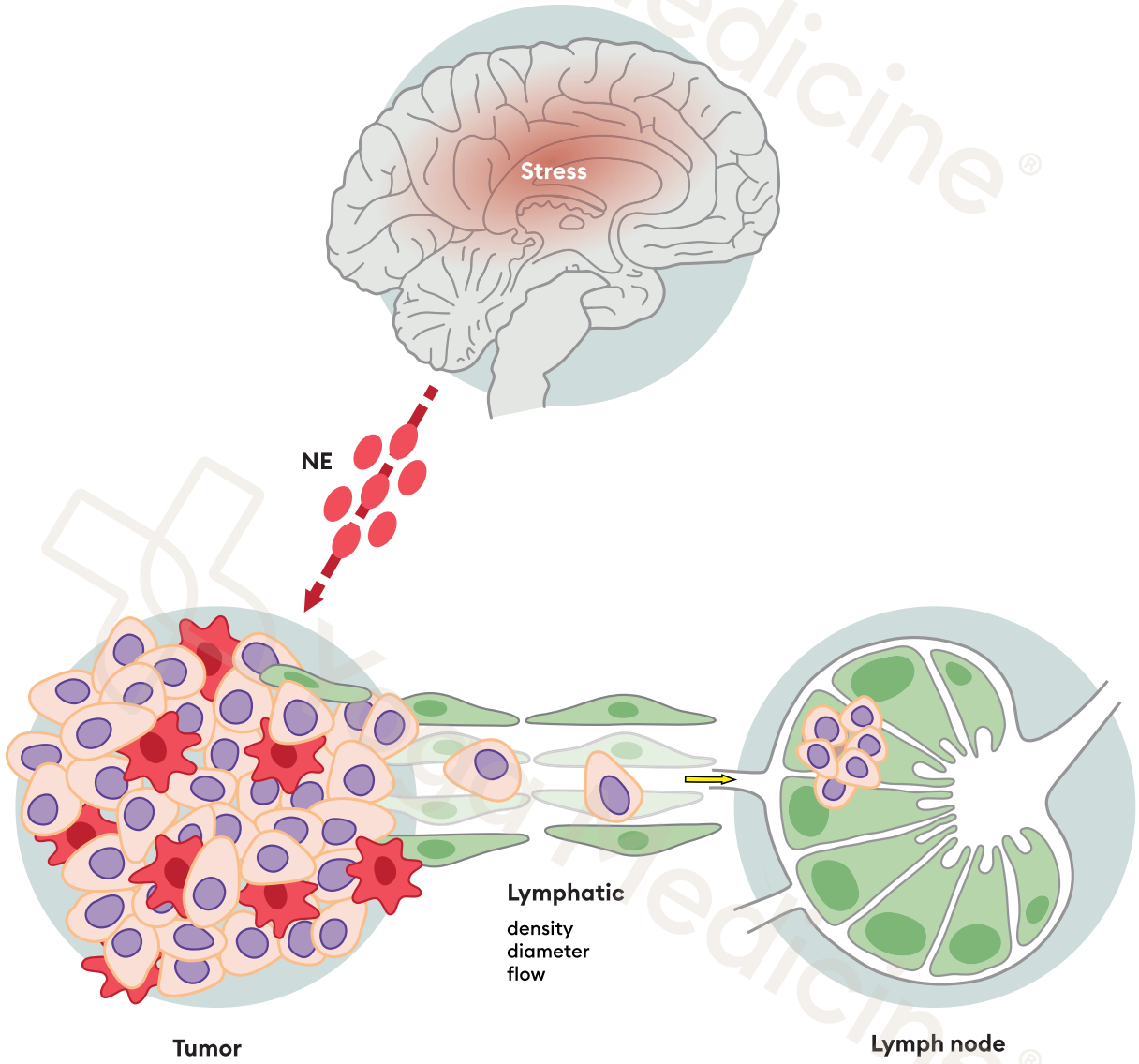
J CANCER SURVIV DOI 10.1007/S11764-013-0284-8

Benefits of Yoga

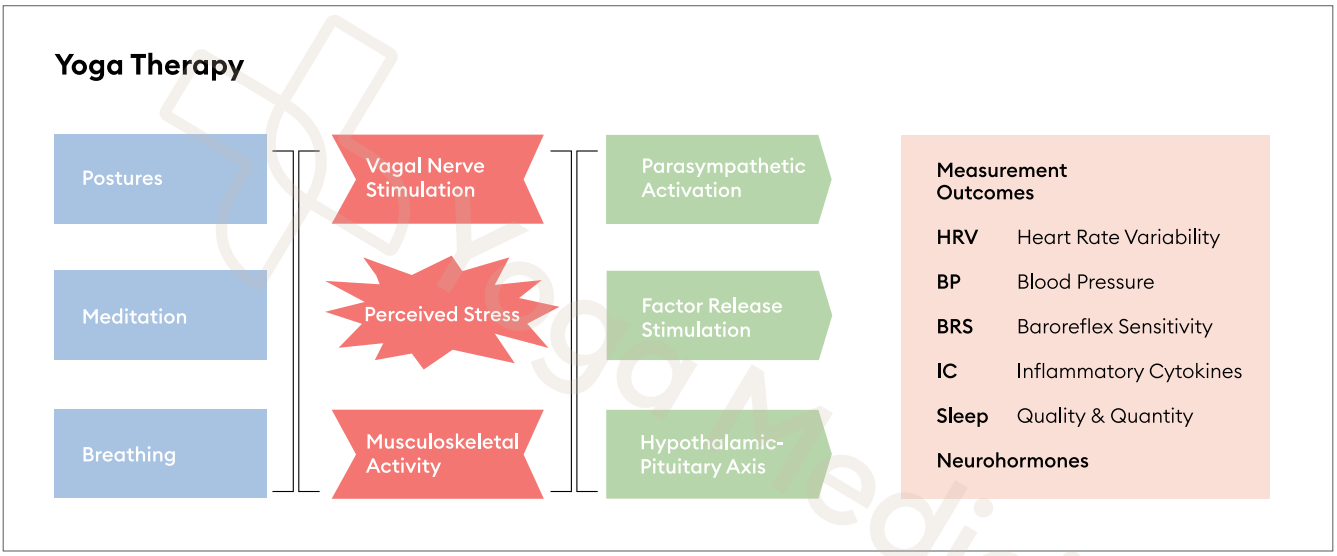
Cancer Survivorship

- Decrease stiffness in the body
- Increase range of motion
- Ability to "Hold Space" for the body on the mat
- Reconnection to the body, grounding the mind
- Increase energetic awareness and breath
- Engage parasympathetic system for improved immune function
- Potential to reduce risk of metastasis by changing the microenvironment

Stress and the Lymphatic System



Yoga to Improve Vagal Tone



HRV as a Biomarker in Cancer

- ↓HRV + ↑tumor growth by inflammation, oxidative stress, and sympathetic nerve activation
- ↓HRV in cancer suggests autonomic dysfunction
- Improving HRV with yoga could help promote coping abilities, decrease the stress response in the body and mind
- Improving personal coping can aid resilience

Yoga Applications

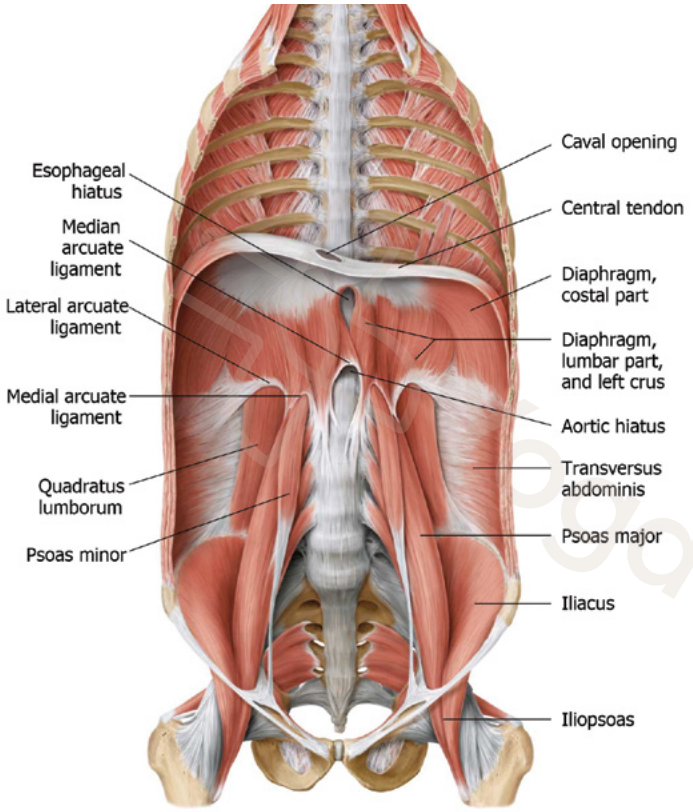
How

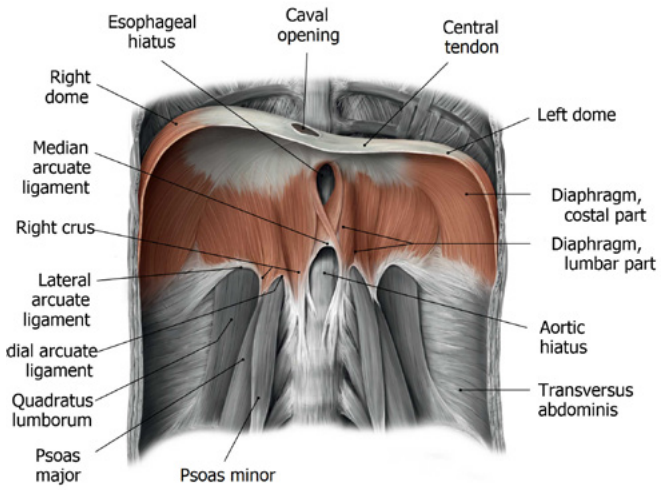
General:

1. Create an exit by starting & ending with all or some combination of breath, neck, & abdominal work
2. Open the drains: cervical, axillary, inguinal
3. Then work proximal to distal through extremities
4. Option to work your way back
5. End with diaphragmatic breathing

- Start with diaphragmatic breathing, neck, armpit, arm/elbow, wrist/hand, (optional arm/elbow, armpit), abdomen, groin, leg/knee, ankle/foot, (optional leg/knee, groin), abdomen, neck, breath
- For maintenance that could be just starting & ending with some combination of breath/abdominal/neck work since much of what we do is somewhat whole body oriented

Breathwork as the Pump





Breathwork as the Pump

- Inhale suspension & diaphragmatic breathing to facilitate venous & lymphatic return
- Lengthen exhale or brahmari to decrease SNS
- Sama vritti or box breathing or inhale suspension & lengthen exhale (5:5:10, 4:7:8) for both

Movement

- Any exercise or movement is helpful, especially if sedentary
- Many of the lymph vessels are next to arteries so enhanced pulsation of arteries helps drive lymph flow, changes in pressure & muscular contraction also assist lymph flow
  - » Full body movement
  - » Local movement, proximal to distal & back to proximal
  - » Jumping, bouncing, vibration, rocking
  - » Muscular contractions
- *If they have compression garments from doctor, these NEED to be worn during exercise (unless otherwise instructed by doctor), these will enhance the effects by providing external compression*

Pumping

- Lymph nodes congregate around the major joints (shoulder, hip, neck, elbow, knee) utilizing the pressure changes there to facilitate lymph flow in simple movements like walking
- Practices that use pressure changes to facilitate lymphatic flow
- Hip, shoulder, elbow, knee, wrist, ankle, hand, foot or neck
- Pumping, circles, movements to support lymph flow

Examples:

- Lifting arm above nodes in shoulder/armpit, using gravity to assist (or arm circles or other movements)
- Pressure changes when make a fist (or both- when make a fist overhead)
- Held compression & release (ie- groin nodes: pigeon hold then savasana)
- Alternating compression & release (ie- groin nodes: wind relieving pose)
- Supine ankle pumps on a sticky mat (calves as the second heart to facilitate venous & lymph return from the legs, gentle stretch & release posterior superficial fascia & lymph)

Brushing & Tapping

- Light flicking or brushing (with toothbrush or dry skin brush) in direction of lymph flow working proximal to distal
- Light tapping around nodes, start at neck then tap proximal to distal nodes for about 1 minute at each group of nodes
- Can combine with pranayama to enhance effects

Myofascial Work

- Light pressure to skin & superficial fascia
- Gentle stretch of skin then direct toward lymph nodes & release.
- Starting proximal and working distal
- Deeper work in abdomen & nodes

Examples:

- Gently drag neck skin posteriorly & then inferiorly toward clavicle
- Belly roll with diaphragmatic breathing
- Diaphragm or abdominal MFR
- Light scribble action on feet & hands

Lymphatic Issues

Types of lymphatic insufficiency:

- Dynamic: increased lymph load (venous insufficiency, heart failure)
- Mechanical: damage to lymphatic system (radiation) or removal of nodes (surgery)

Lipedema

- Lower body fat accumulation unresponsive to dieting, diuretics or exercise
- Cause unknown, runs in families so maybe genetic, almost exclusively in females
- Feels sensitive, sore, painful, uncomfortable, cold, & bruises easily
- Swelling worse in the afternoon, evening, after activity or hot weather
- Symmetrical, hips down, not usually feet, no pitting
- Accumulated fat can block lymphatic pathways
- Causes a build-up lymph which can lead to secondary lipo-lymphedema
- MLD, compression, & exercise (for mobility & circulation) are useful tools

Lymphatic Issues

Goals with Lymphedema:

- Limb swelling reduction
- Decrease infections, fibrosis & pain, increase ROM

Tools for lymphedema:

- Complete Decongestive Therapy (CDT): Manual Lymphatic Drainage (MLD), compression garments/bandaging, exercises, & skin care

1. Compression bandaging/garments- specifics given by doc/therapist
2. Skin care- specifics given by doc/therapist
3. MLD- by certified MLD massage therapist
4. Self lymphatic massage to support this
5. Yoga with compression bandaging/garments, small movements, using gravity & pumping

Signs of Lymph Congestion

- Acne & skin issues (itchy skin, eczema, rashes)
- Allergies, bronchitis, sinus congestion/infections, chronic earaches/infections/clogged, sore throat
- Bloating/water retention/edema
- Brain fog
- Chemical & environmental toxins (mold, etc.)
- Constipation
- Slow wound healing
- Digestive issues
- Swollen lymph nodes, enflamed tonsils
- Fatigue
- PMS, peri/menopause, PCOS, fibroids, cysts, endometriosis, pelvic pain
- Headaches/migraines
- Lymphedema
- Muscle stiffness, joint pain, arthritis
- Puffy face/neck
- Scar tissues

Manual Lymphatic Drainage

Pioneers of Manual Lymphatic Drainage (MLD)

- Dr. Emil Vodder
- Dr. Michael Foldi
- Used for: lymphedema, lipedema, lipo-lipedema, chronic venous insufficiency, post-surgical, injury swelling, cellulite, anti-aging, chronic fatigue, fibromyalgia, migraines, detoxification, swollen lymph nodes, to accelerate healing
- Potential signs of lymph congestion: acne/skin issues, allergies, bloating/water retention, brain fog, bronchitis, chemical sensitivity, chronic earaches/clogged ears, constipation, slow wound healing, digestive issues, difficulty losing weight, edema, swollen lymph nodes, fatigue, fibroids/cysts, headaches/migraines, hormonal imbalance (symptoms associated with PMS, perimenopause, menopause, PCOS), inflamed tonsils, itchy skin, eczema, rashes, lymphedema, muscle/joint stiffness, pain/arthritis, obesity, puffy face/neck, scar tissue, sinus congestion & infections, sore throats

Contraindications for Self-Lymphatic Massage

Contraindications:

- Untreated malignant tumor or undiagnosed breast mass
- Acute infection: e.g. cellulitis
- Congestive heart failure
- Kidney failure
- Acute thrombosis (DVT)
- Acute phlebitis
- Acute bronchitis (chronic ok)
- Cardiac edema, severe unmanaged hypertension
- Carotid sinus syndrome
- Short of breath easily and not seen by a dr

Possible contraindications:

- Cancer (consult dr)
- Hyperthyroid (omit neck)
- Bronchial asthma (inhaler near, shorter self-massage if needed)
- Hypotension & autonomic dystonia (shorter self-massage)
- Serious heart & kidney issues (consult dr)
- Pregnancy (omit deep abdominal work)
- Aortic aneurism, psychiatric conditions, heart conditions, hypersensitive carotid sinus, clot prevention devices, recent surgery, arteriosclerosis, vein inflammation, pain with swelling
- Precancerous skin conditions (omit that area)
- Chronic inflammation (consult dr)

Contraindications for Self-Lymphatic Massage

- Neck: omit over 60yrs & hyperthyroid
- Abdominal: omit in pregnancy & aortic aneurysm, start gentle with intestinal issues, gentle or skip during menses (may cause heavier flow)
- Issues that may arise: asthma in asthmatics (have inhaler), drop in BP, hypoglycemia in insulin-dependent DM (have food source), issues with heart failure (talk to doc prior)

Surgical Considerations

Axillary Web Syndrome-Cording

- Presents as a “tight” cord in the subcutaneous tissue in the axilla, lymphatic fibrotic band
- Most commonly develops 2–8 weeks following breast cancer surgery, can occur months to years later, can resolve & relapse
- Incidence ranges from 6%-86% following breast cancer surgery
- Pain, weakness, decreased ROM, difficult abduction
- Massage, PT, stretching, swimming
- The safety of “breaking a cord” is not well studied

Seroma

- Accumulation of fluid in the space where nodes were removed
- Risk of infection
- Self-lymphatic massage to move fluid

Post- Surgery

1. **Protective phase: 6 weeks post surgery**

- Follow doctors' orders, focus on physical/ occupational therapy here and start yoga after (tissues knit back together, lymph vessels rerouting, etc.)
- Avoid anything inflammatory that could overwhelm the region (contact sports, bowling, golf, etc), no deep ROM/stretching or local massage, individualized progression
- Avoid inactivity (normal daily activities as much as possible- dressing, grooming, cleaning, walking, etc.)

2. **Maintenance phase: 6 weeks+**

- Should know if they need to wear compression garments/bandaging, but in general wear during yoga if:
  - » Swollen area becomes larger or a feeling of fullness or heaviness during or after activity
  - » If swollen area becomes firmer during or after
  - » Wear with walk, run, exercise, awkward
  - » Can try without as long as have strategy to help after

Radiation & Chemotherapy

Radiation

- Follow doctors' orders, expect tissue inflammation in the area for at least 2-3 weeks after
- Avoid stretching, massage, or strength work in the treatment field (ok outside of field but fatigue with radiation)
- Once skin heals gentle stretch/movement (not till at least 6 weeks post)

Chemotherapy

- Can safely participate in cardiovascular & strength training without risk of lymphedema
- Completion rates of chemo higher in exercising groups than those not
- Limits of course- listen to body & doctor

ALL

- Modify according to pre-treatment habits/ fitness, medical conditions, and response to practice

Cancer

Be aware of a few associations with cancer treatments:

- Increased risk for fractures
- Increased risk for cardiovascular events with hormonal therapies and chemotherapy
- Limitations due to meds or pre-existing conditions

Self-Lymphatic Massage

Specific Goals:

- Increase lymph flow by stimulating nodes
- Direct & increase lymph flow (enhance lymphangiomotoricity & move fluid)
- Manipulate anchoring ligaments to increase lymph production
- Decrease SNS
- Soften fibrosis
- Flush out inflammatory mediators
- Move fluid/lymph, decrease edema
- Support immune function
- Decrease pain

Big picture:

- Increase lymph production
- Increase lymph flow
- Reroute lymph (for node removal)
- Increase venous return
- Soothe sympathetic nervous system

Function: manipulate anchoring ligaments, stimulate lymph nodes & assist lymph flow

4 main components: 1- breath, 2- self-lymph massage, 3- asana, 4- nervous system regulation

How:

- Skin on skin
- Don't slide or squeeze
- Nickel pressure
- Relax hands, usually a broad contact
- Drag/stretch skin
- End in direction of draining nodes
- Slow, loving touch (1 second on, 1 second off)
- Should never cause redness or pain

Techniques:

- Vessels/capillaries
  - » Half circle/rainbow or pump: guide lymph toward draining nodes
  - » Nickel pressure
  - » Working phase & rest/release phase for each
  - » 2-3 passes over a larger area or 5-10 reps in a smaller area
- Nodes/terminus
  - » Circular, tap, scrub, pump
  - » Deeper pressure to stimulate regional nodes
  - » No working/resting phase
  - » 5-10 reps or 15-30 seconds in an area

Nervous System Regulation

- Direct SNS innervation
- ANS regulation by:
  - » Learning to relax (enhance parasympathetic tone)
  - » Regular introspective practices
  - » Supporting cortisol rhythm (active/SNS in AM, passive/PNS in PM)
- Using:
  - » Yin
  - » Restorative
  - » Pranayama
  - » Meditation
  - » Nidra
  - » Calming practices
  - » Progressive relaxation, body scans

Deep Lymphatics

- Compression (folds)
- Twists
- Abdominal MFR
- Diaphragmatic breathing
- Inhale suspension to encourage venous & lymphatic return
- Kapalabhati, Nauli & Agnisara
- Use breath in any tender, tense, full areas- breathe into hand on inhale, soften area as hand sinks in on exhale

Abdominal Massage Areas:

- 4 corners (pelvic nodes, liver, stomach/spleen)
- Navel area (Peyer's patches/SI)
- Rainbow (large intestine motility)
- Knife edge of hand to work more broadly

Other

- Recapture lost range of motion (to optimize flow)
- Resistance training (muscular contractions)
- Nerve flossing (for lymphatic pumping)
- Inversions to support venous & lymphatic return
  - » Savasana modification with slight 2-3" lift under feet & calves

Also great but NOT in our scope:

- Lymphatic taping (traditional kinesiotaping)
- Lymphatic cupping
- Manual Lymphatic Drainage (MLD)

Support for Glymphatics

1. Sleep support & nervous system regulation (decrease NE)
   - » Calming pranayama, restorative, yin, meditation, MFR
   - » Movement that calms
   - » Practices to support natural cortisol rhythm
2. Active practices for circulation
3. Pranayama & deep breathing to facilitate CSF flow
4. Self-lymph massage for neck, face, head, & scalp
5. Breath centric practices