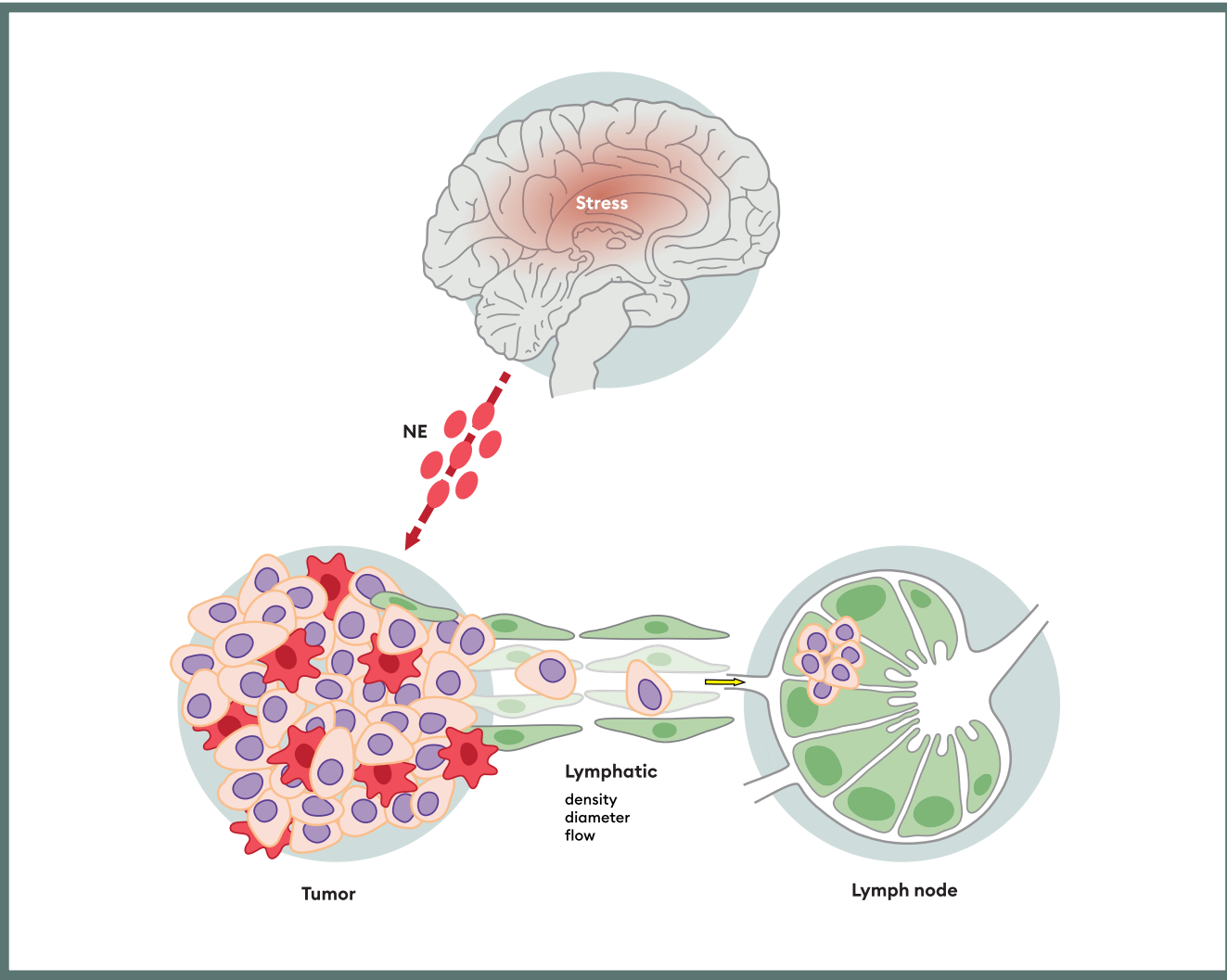


# Lymphatics & Yoga

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# 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.

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# 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:

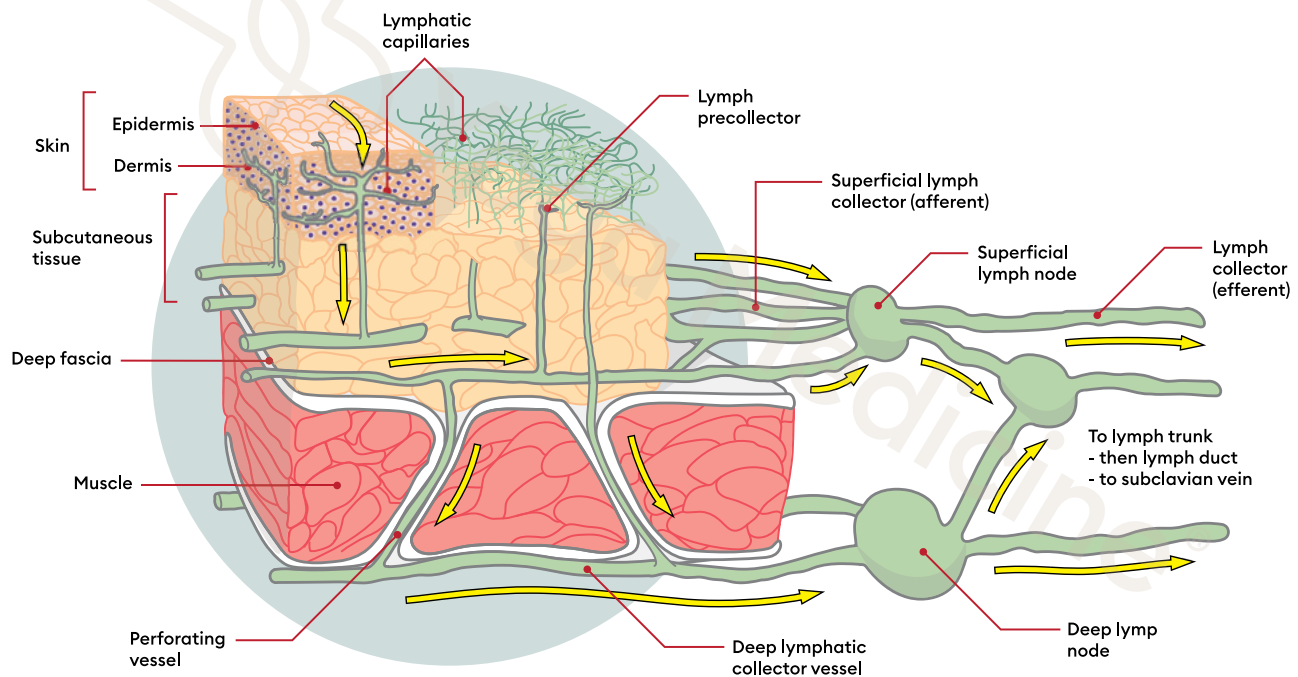
- Lymph- fluid that flows through the lymphatic system
- Lymphatic vessels- transport lymph (capillaries, collectors, lacteals, trunks & ducts)
- Lymph nodes-filtering stations
- Lymphocytes- white blood cells found in the lymph

## 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



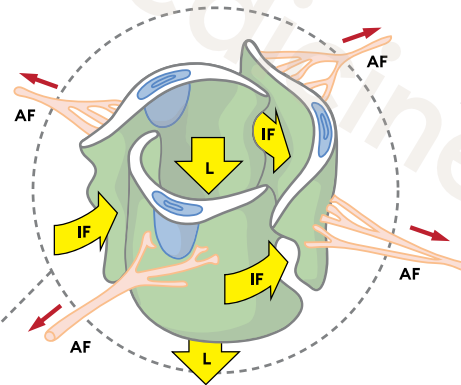
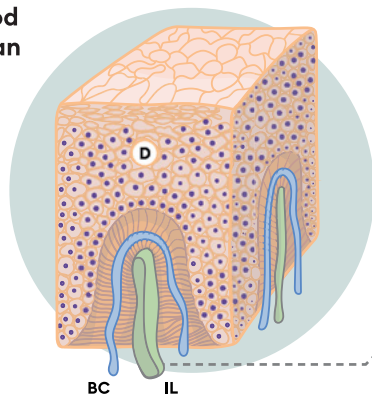
## Lymphatic Capillaries

### 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

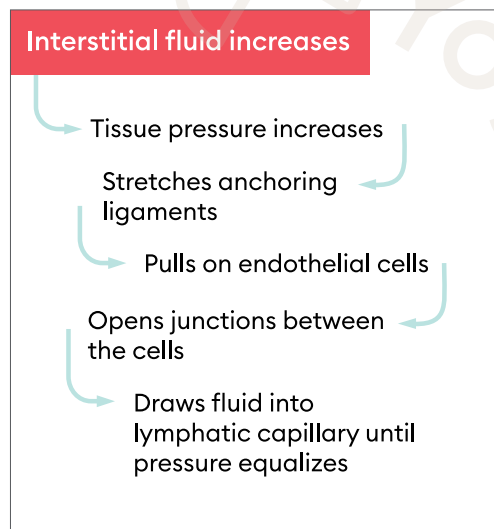
AF = Anchor filaments  
IF = Inflow of interstitial fluid  
L = Outflow direction of lymph

## Anchoring Filaments

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

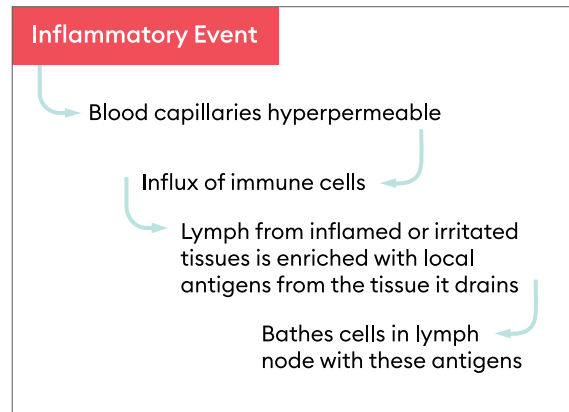
### Factors influencing this:

- 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

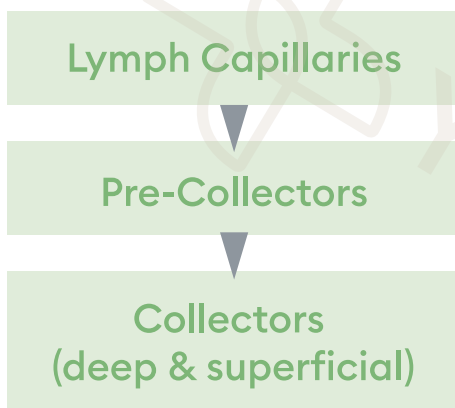


## Lymphatic Pre-Collectors

- 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

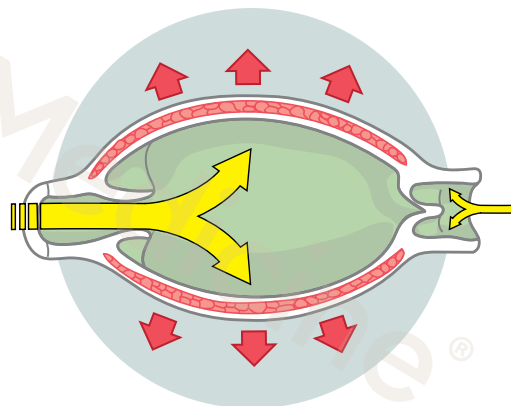
## Lymphatic Collectors

- 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
- Lymphangiomotricity= the rate of contraction, typically 10-12 per minute at rest



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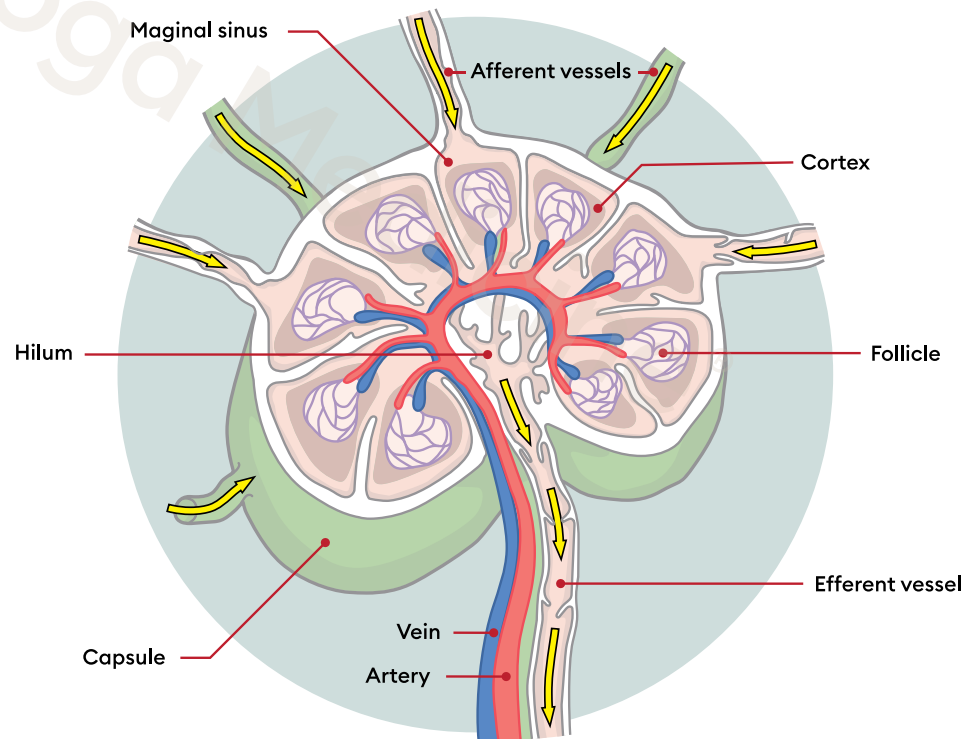
## Lymph Collaterals

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

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## 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

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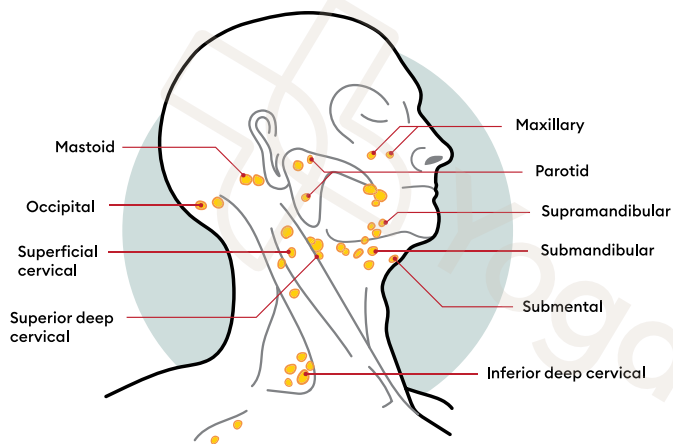
## 3 Main Drains

- Cervical nodes
- Axillary nodes
- Inguinal nodes

#### Cervical nodes

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

## Head & Neck Nodes

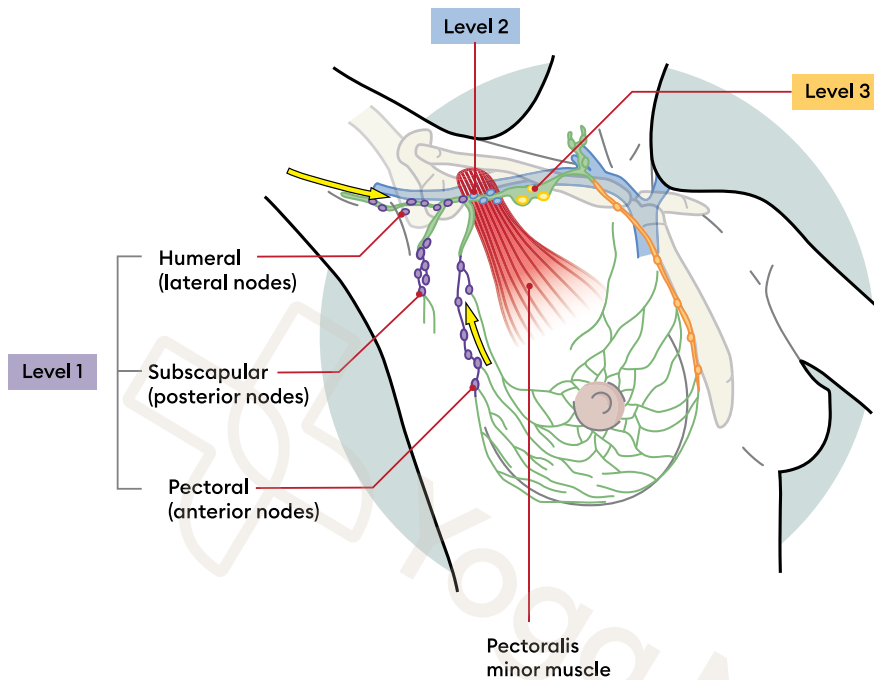


## 3 Main Drains (continued)

### Axillary nodes

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

## Axillary Nodes



## 3 Main Drains (continued)

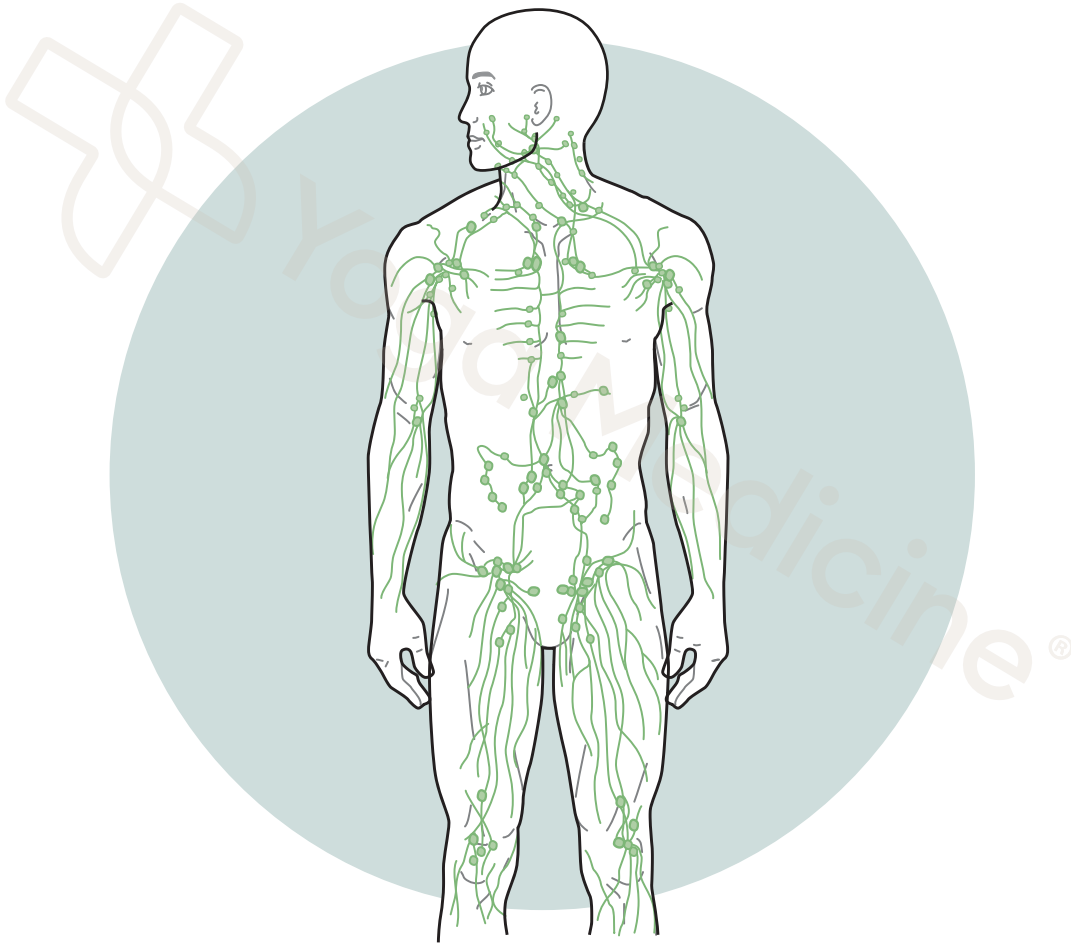
### Inguinal nodes

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



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## Main Lymph Nodes



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## 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

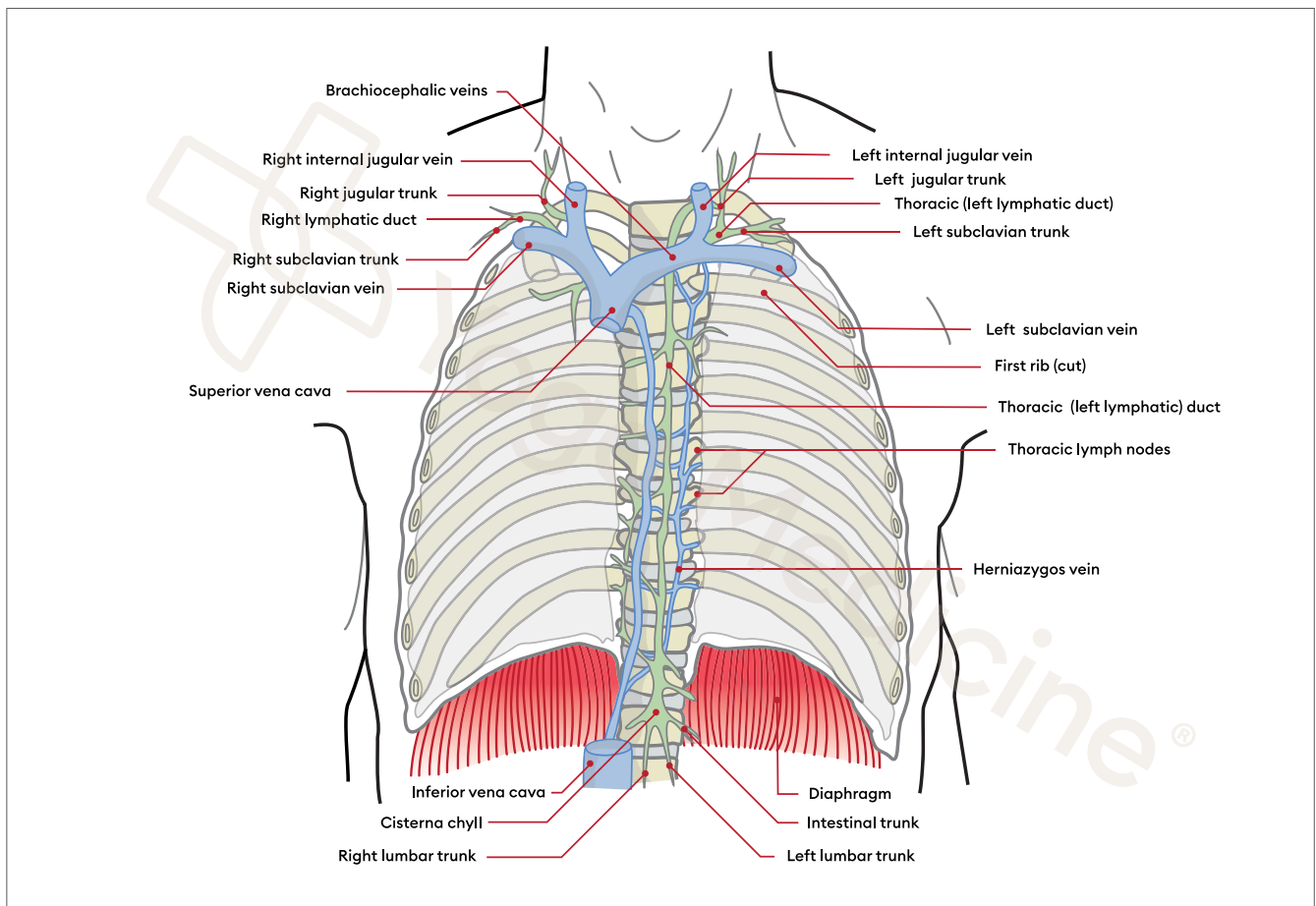
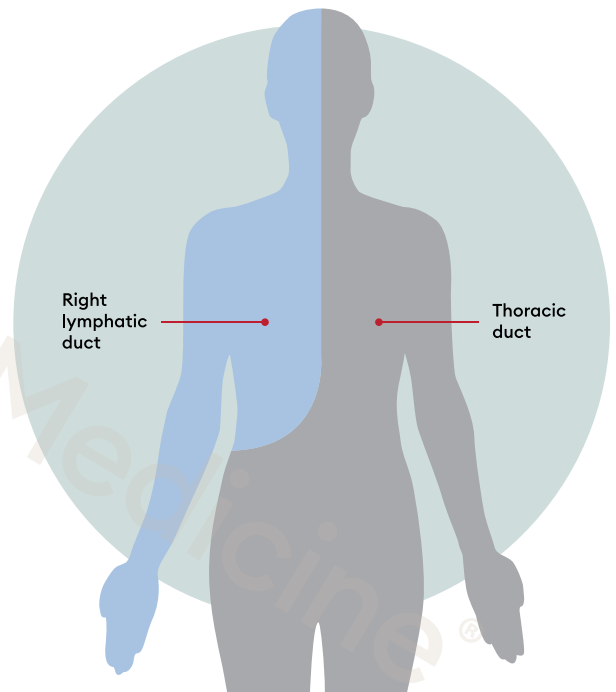
## Lymphatic Ducts

### 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  $\frac{3}{4}$ " long

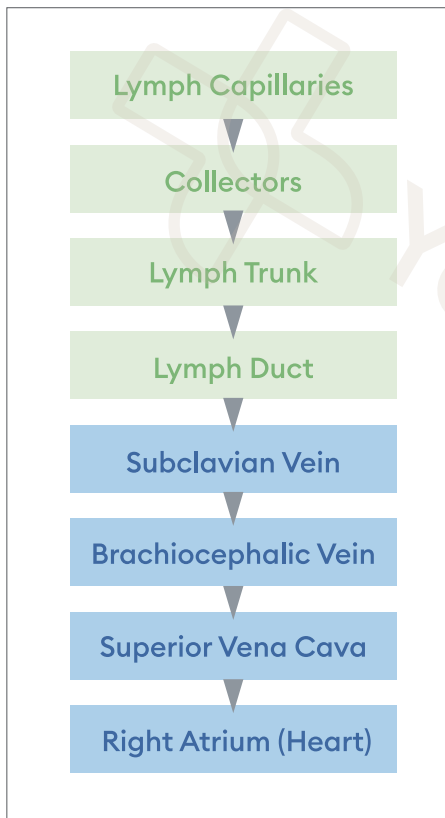
### Thoracic Duct (left lymphatic duct)

- 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)



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## Lymph Flow



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## 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

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## 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 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

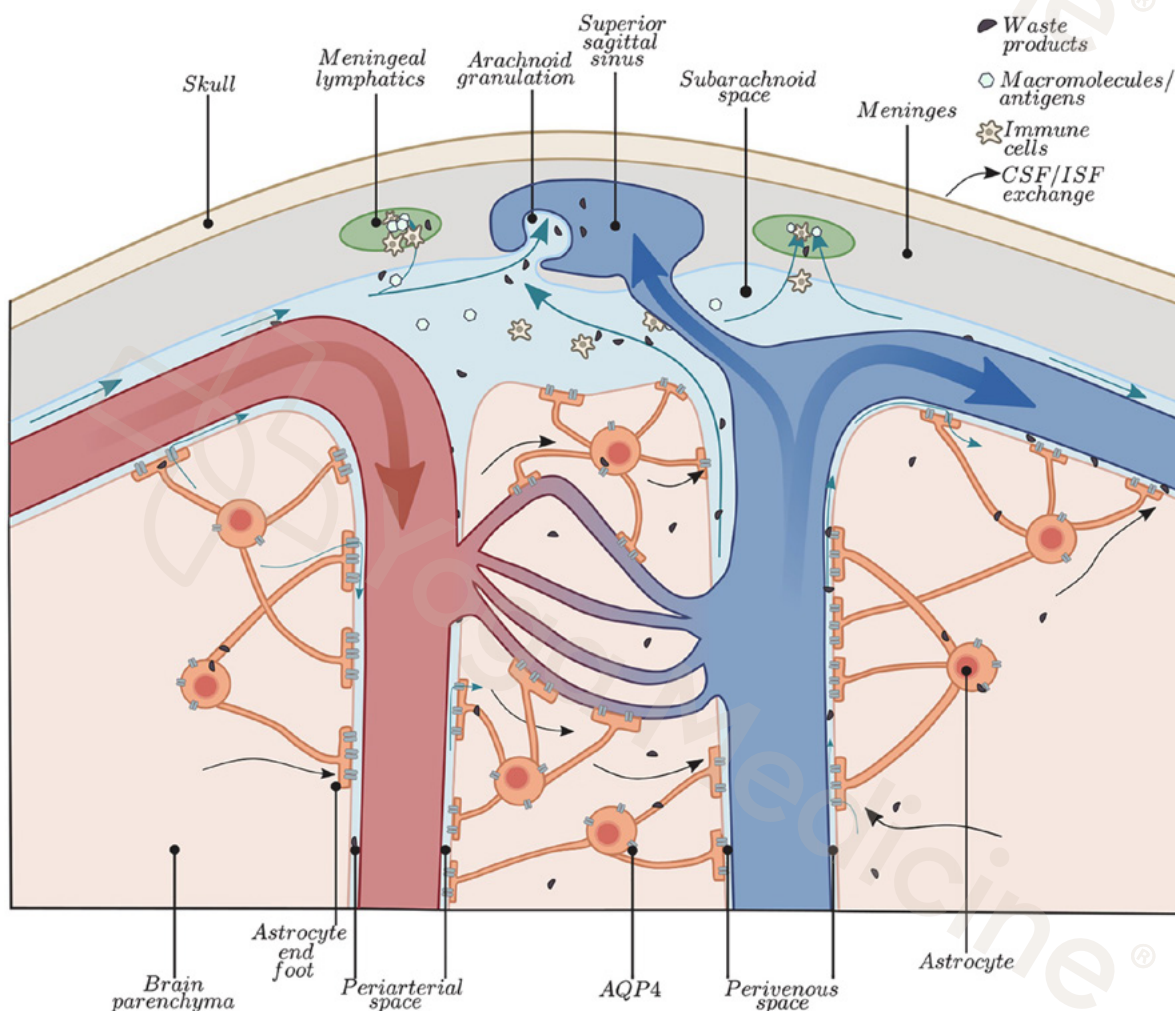


Image source: **The glymphatic system and meningeal lymphatics of the brain: new understanding of brain clearance**  
 GALINA YANKOVA, OLGA BOGOMYAKOVA, ANDREY TULUPOV 2021

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## Glymphatic System

### Current understanding:

- 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

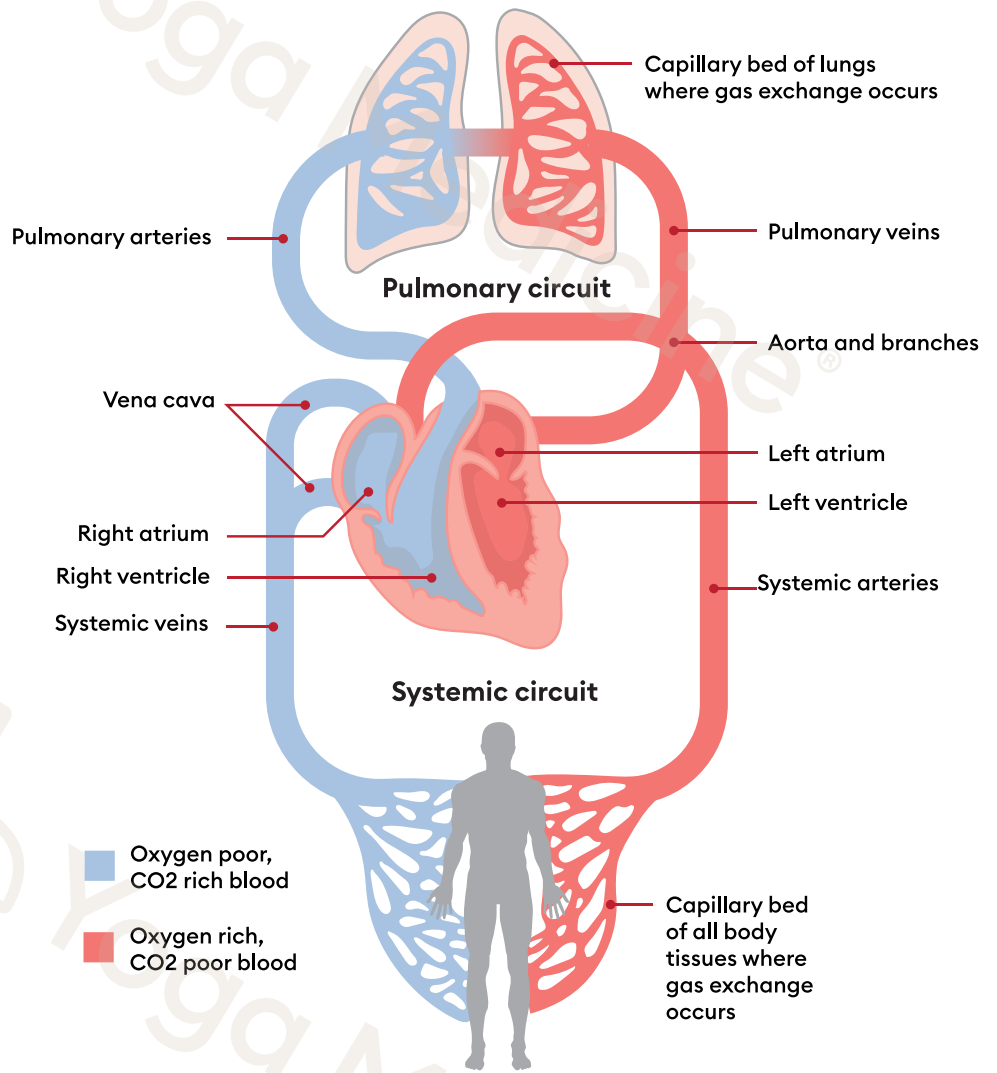
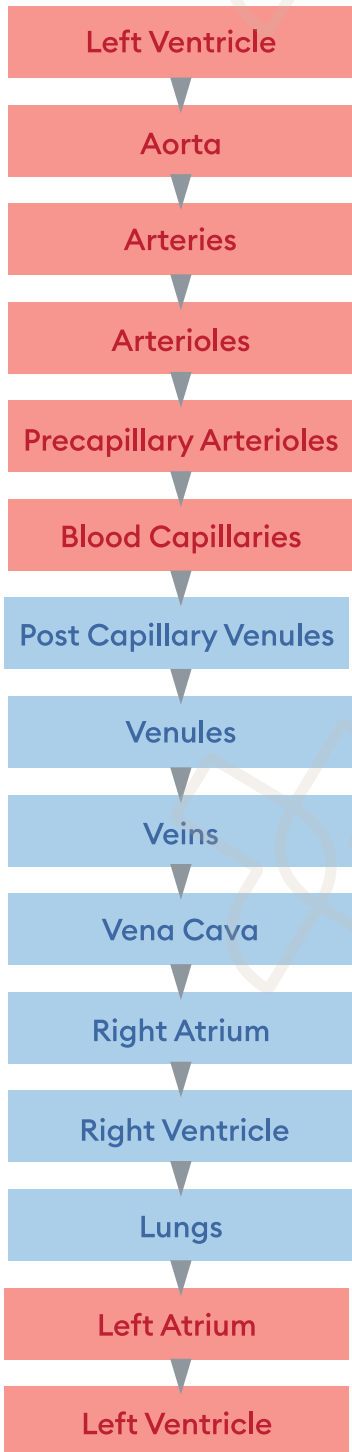
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## Glymphatic Implications

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

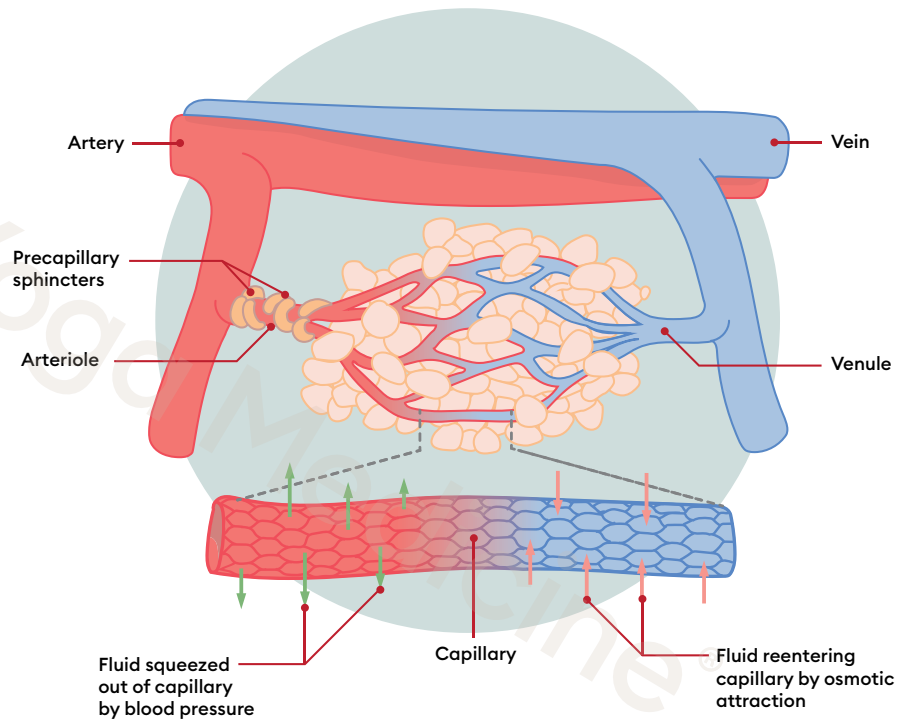
# Lymphatic Circulation

## Blood Circulation



## 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 CO<sub>2</sub> & waste products are returned back into the capillaries



- Precapillary sphincters regulate blood flow here
- Regulation of precapillary sphincters by: nervous system, hormones, pH, O<sub>2</sub> levels, exercise

### At Blood Capillaries:

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

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## 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

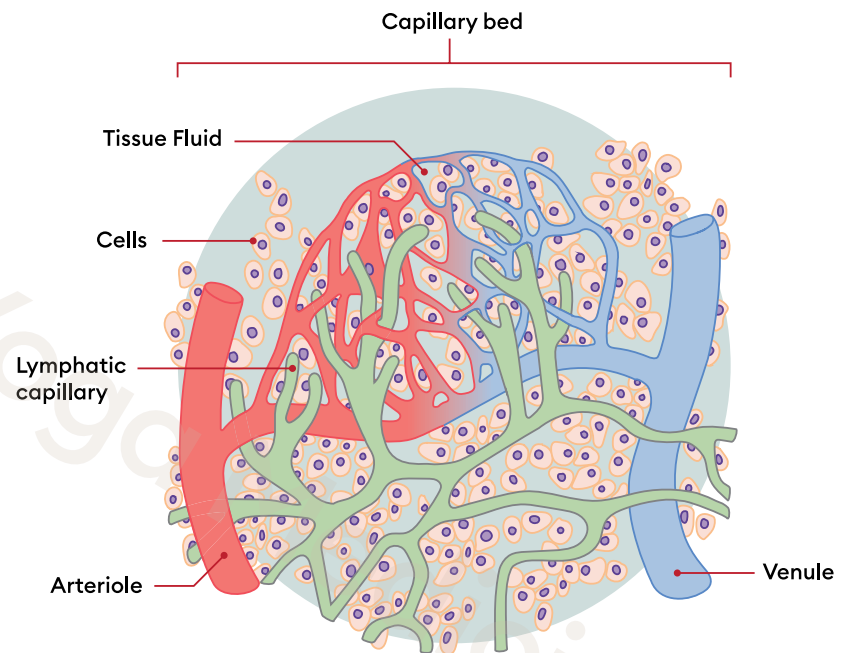
- Increase in local blood flow at the arterial end of the capillary due to massage, exercise, infection, etc
- Increased lymph load

### 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



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## Vasomotion

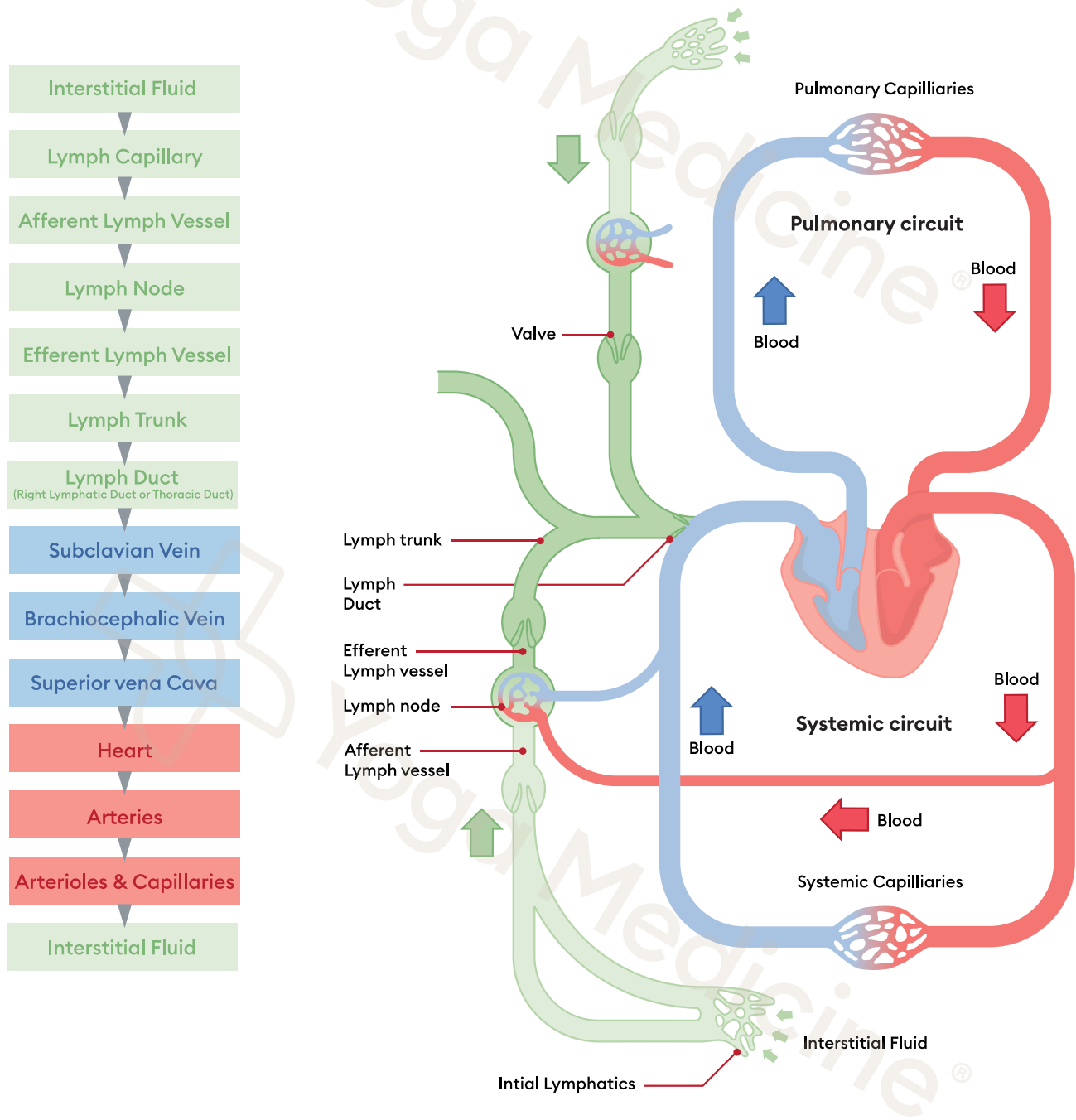
### Spontaneous oscillation in tone of blood vessel walls

- 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 O<sub>2</sub> 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



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## Lymphatic Load

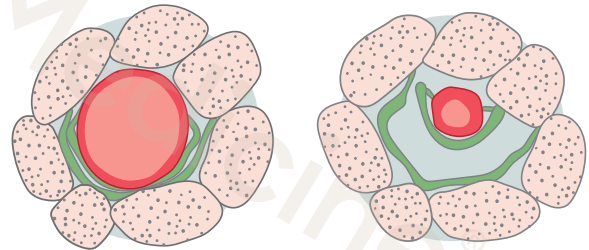
- Cells, protein & water from the interstitial space cleared by the lymphatic system
- Approximately 10-20% of water remains in interstitial space to be cleared by the lymphatic system
- Proteins are too large to be reabsorbed at the venous end and must be removed from interstitial space by lymphatics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

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## 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

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## 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

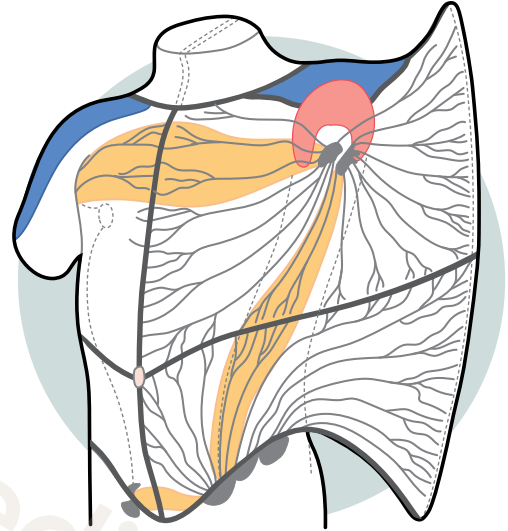
### Functional Reserve

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

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## 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



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## 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)
  - » Upper: Clavicle—> spine of scapula
  - » Lower: Navel—>L1

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## Anastomosis

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

### Anterior Anastomosis

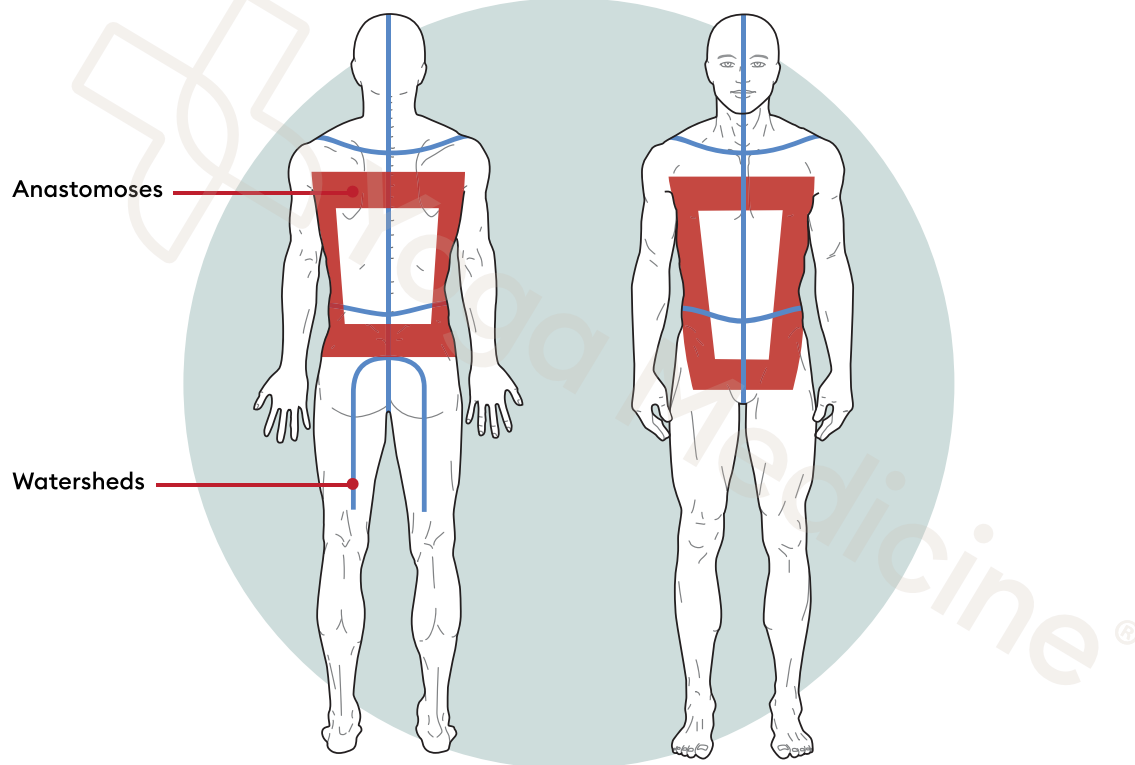
- AAA (Anterior Axillo-Axillary) runs from axillary to the opposite axillary, runs in both directions across the body
- AIA (Axillo-Inguinal Anastomosis) runs between the axilla & inguinal nodes on the same side, runs in both directions up & down
- AII (Anterior Inter-Inguinal) runs from inguinal to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

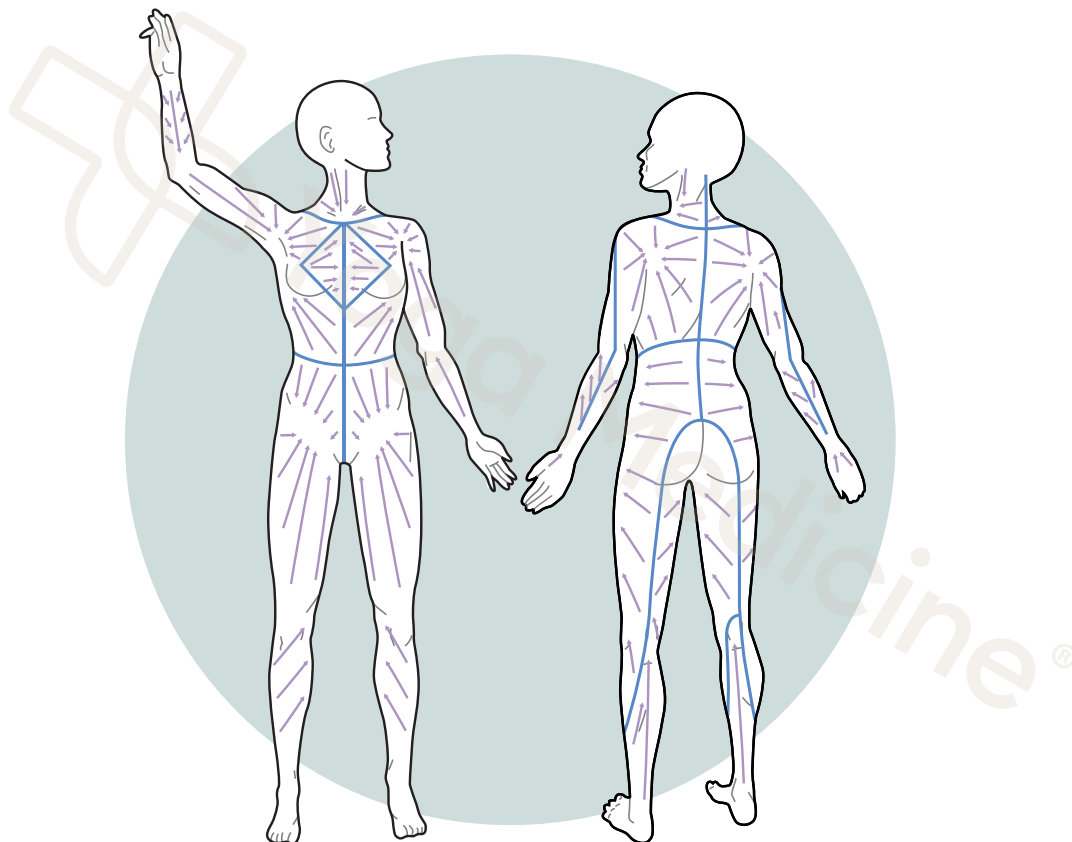
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## Watersheds & Anastomoses



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## Lymphotomes



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## Lower Lymphatic Circulation

### Lymph in Inguinal nodes



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## 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

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## 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

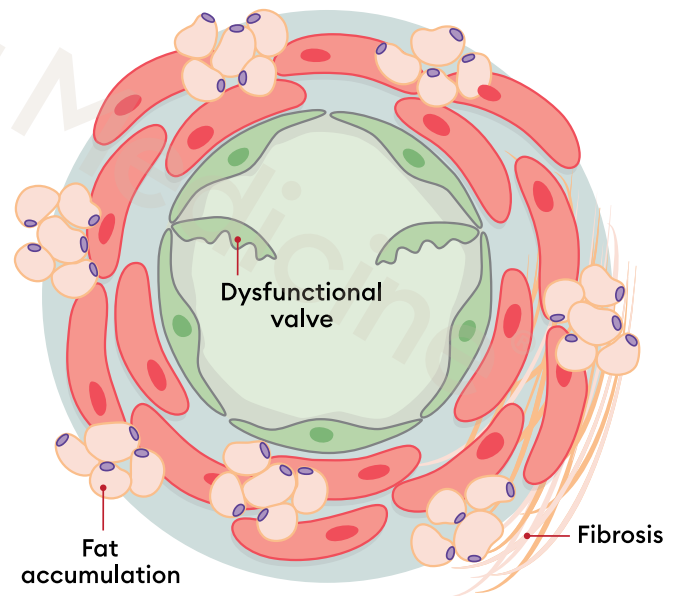
### Dorso-Lateral Bundle (outer & back leg)

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

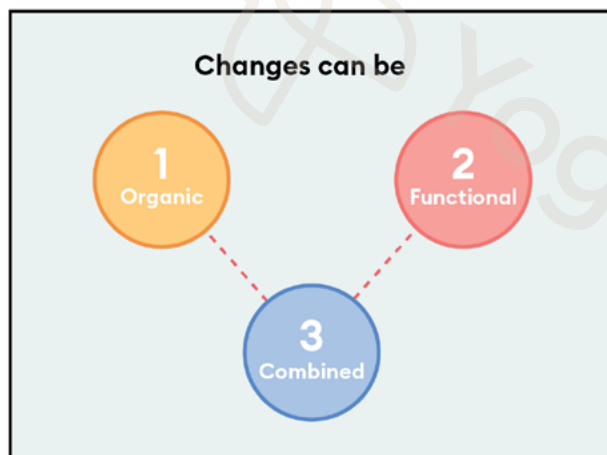
# Lymphedema, Lymphatic Issues and Assessment

## Lymphedema 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)

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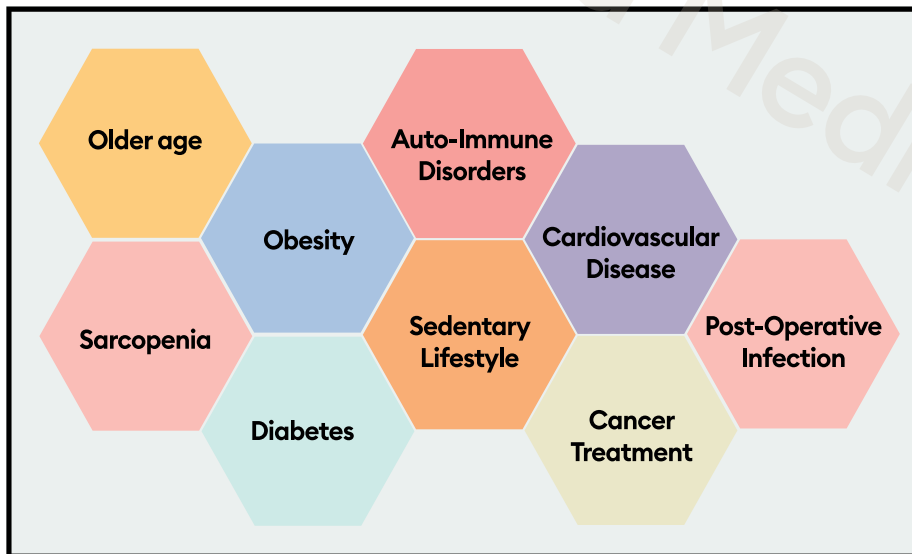
## Assessments

### 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, record Increased Risk for Lymphedema

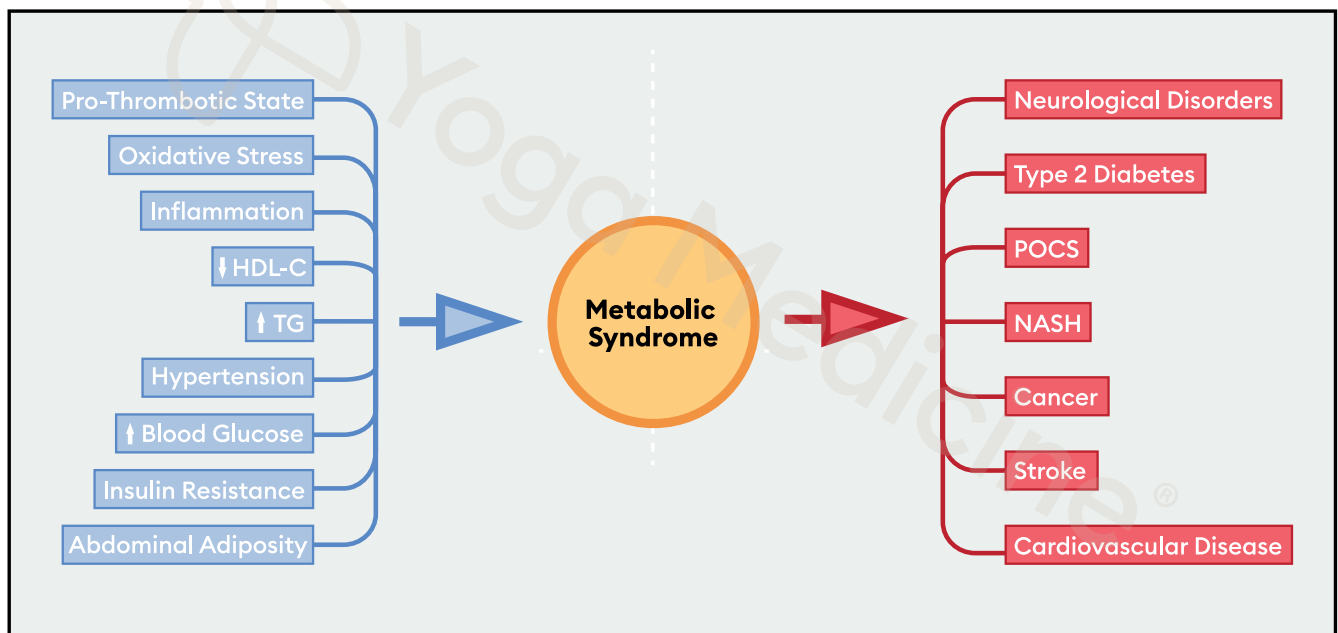
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## Increased Risk for Lymphedema



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## Consequences of Metabolic Syndrome



## 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
  - » Bioimpedance spectroscopy



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## 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

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## Lower Extremity Lymphedema

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

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## 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
- Wounds

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## Conservative Management

- Goals: volume reduction, improve patient symptoms:
- Manual Lymphatic Therapy
- Manual Lymphatic Mapping
- Compression Decongestive Therapy
  - » Bandage wrapping, KT tape, pump

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## 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

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## 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

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## Surgical Intervention

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

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## 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

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## 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

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## ECM: Tumor Microenvironment

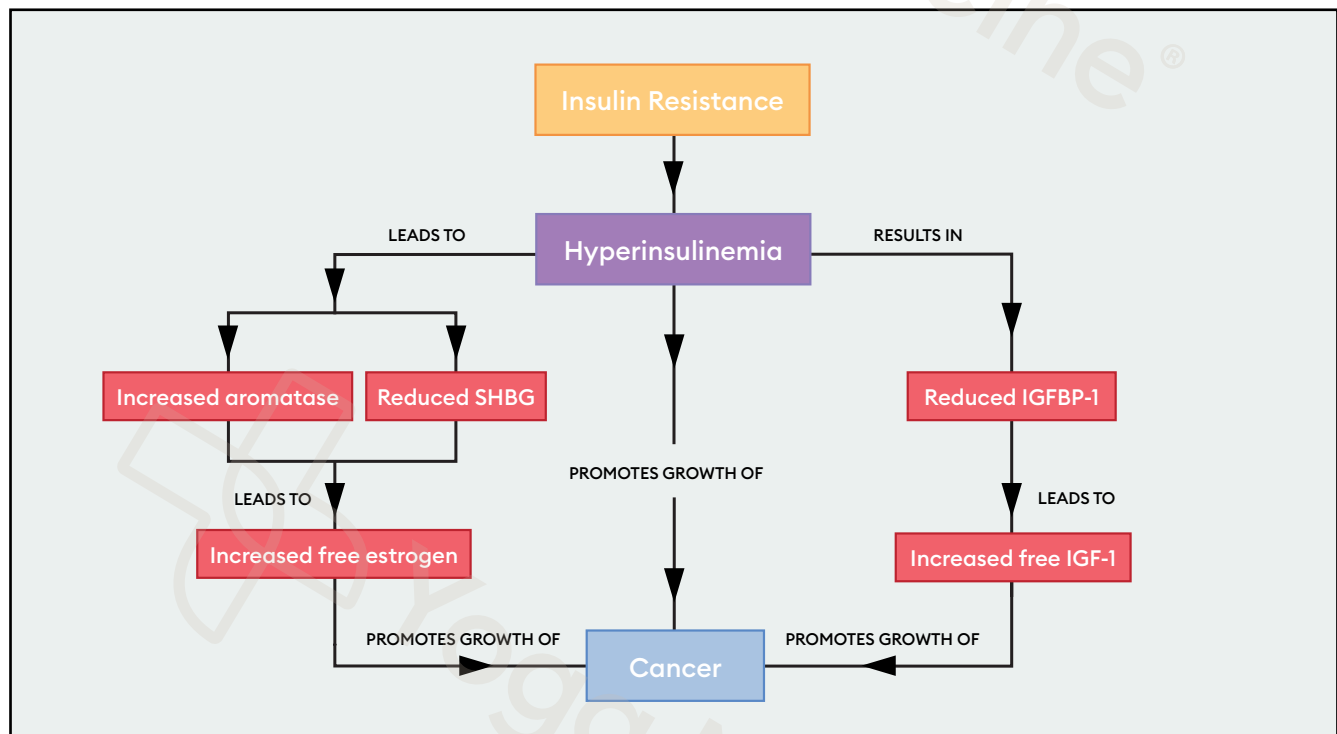
- Tissue stiffness is a contributor to fibrotic process leading to cancer, induces hypoxia
- Cancer research has primarily focus on the cancer cell and changes within: "cell centric"
- ECM and metabolic abnormalities can promote neoplastic transformation
- Clinical applications personalize and targeted treatment, promote strategies to aid prevention
- Potential to develop cancer resistant extracellular environment: aspirin for colorectal cancer, metformin for breast cancer

# 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

## Metabolic Syndrome and Cancer Propagation



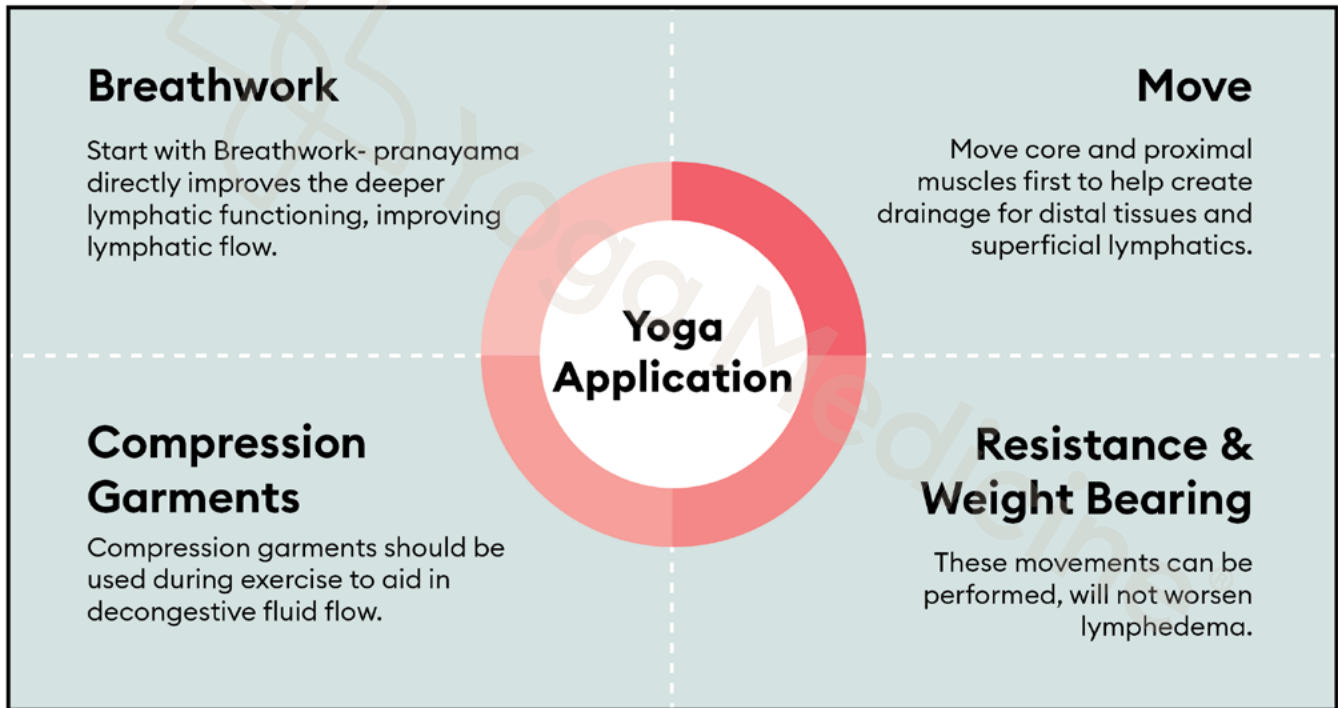
## Yoga Intervention

### 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

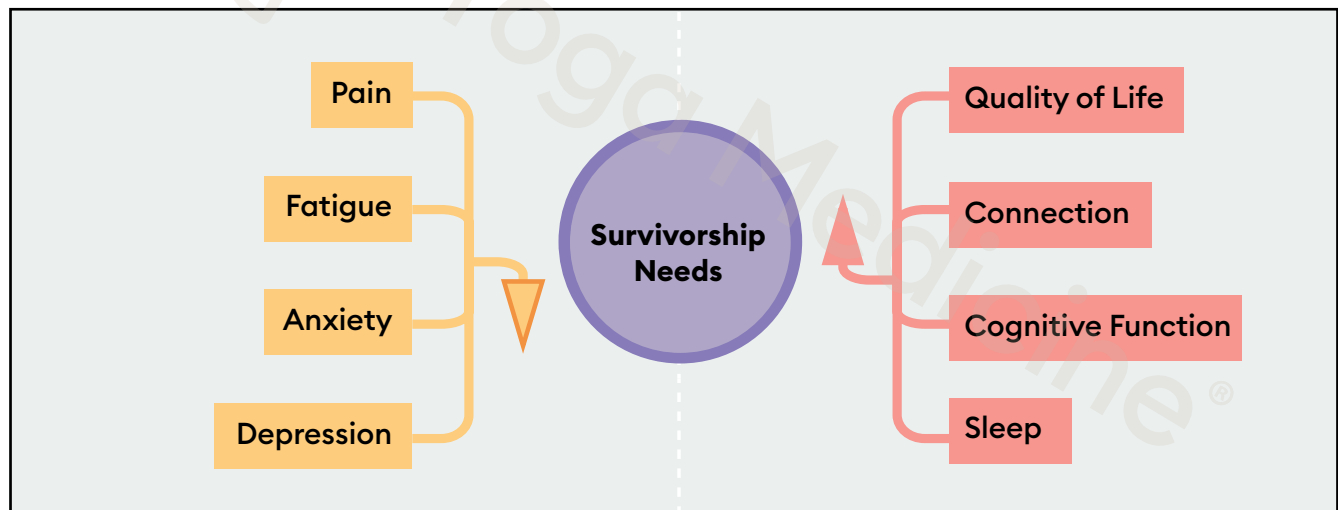
## Lymphedema Prevention and Therapeutic Intervention



## 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



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## 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.

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## 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

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## Primo Vascular System

- Within fascia
- Penetrated through blood brain barrier
- Sophisticated channel system, exosomes, hyaluronic acid, Ca-ion channels for cell movement
- Electromagnetic signals
- Immune function
- Physical structure for the meridians
- 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...

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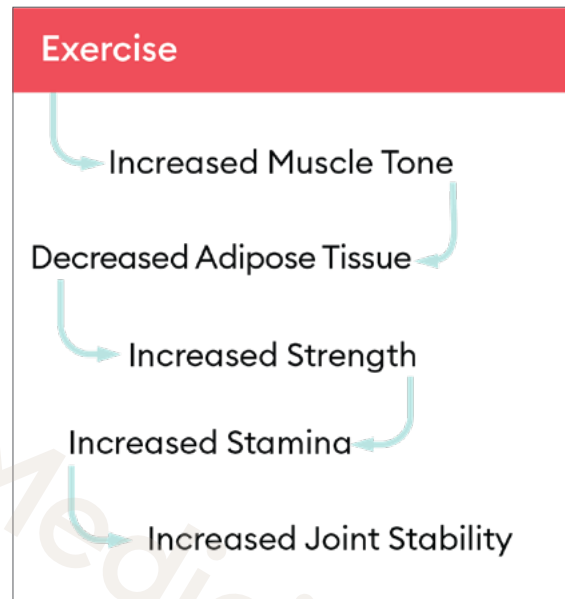
## Yoga Guidelines for Lymphedema

- 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 chyli, 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

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## Yoga Guidelines for Lymphedema

- 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)



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## 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

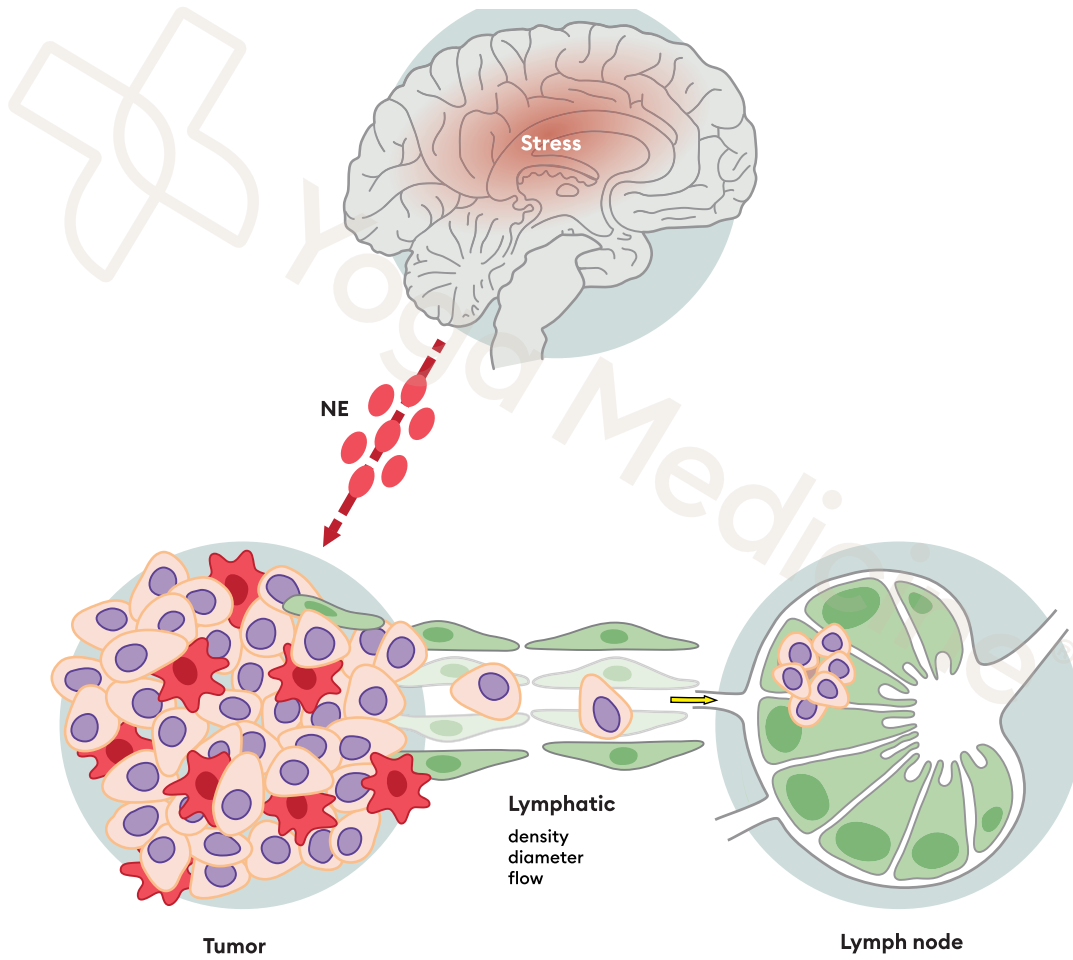
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## Benefits of Yoga

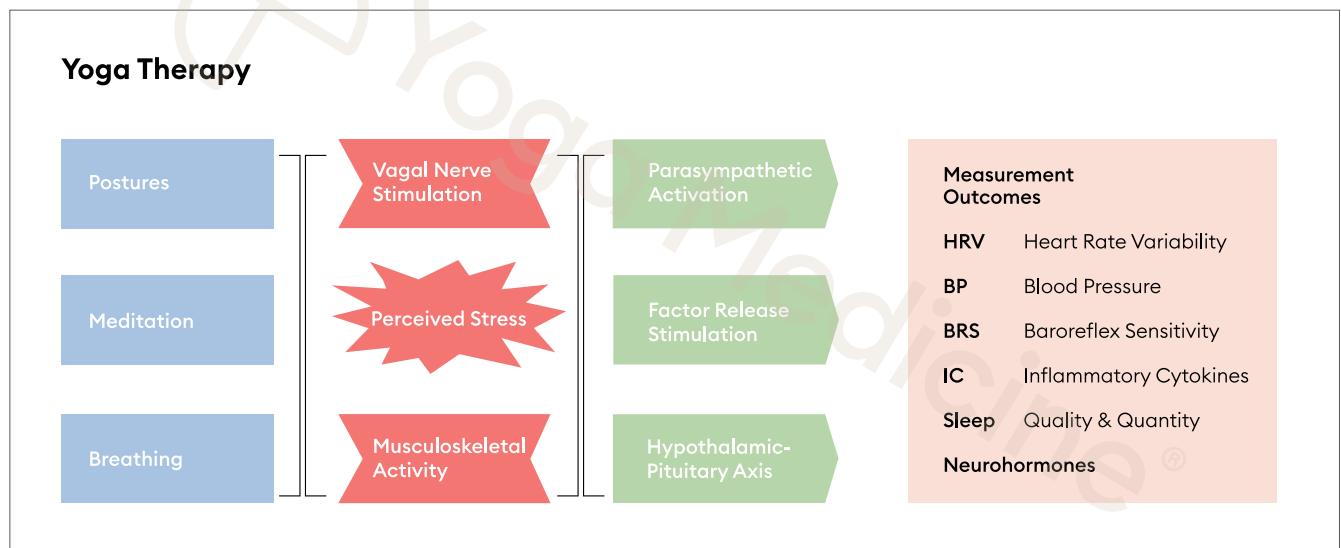
### Cancer Survivorship

- 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



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## 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

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## 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
- Lymphatic structure dysfunction

---

## 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, and can occur months to years later and can also resolve and then relapse
- The incidence ranges from 6% to 86% following breast cancer surgery
- Pain, weakness, decreased ROM, difficult abduction
- Gentle massage, PT, stretching, swimming
- The safety of “breaking a cord” is not well studied

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## Preop, Postop, and Radiation

- Practice exercises and stretching prior to surgery to understand baseline ROM, preop PT is helpful
- Begin exercises and stretching 2 weeks post-op after incisions heal (less likely to develop hematoma/seroma), wear a compression bra
- Continue diaphragmatic breathing and walking daily
- Hydrate skin (skin recovery cream, Aquaphor, CeraVe, moisturizers)
- Daily stretching, breathing at own pace
- Begin exercising after discussing with your medical provider
- Curcumin is helpful as a radiosensitizer, and for skin protection



# Lymphatic Issues

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## 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)

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## 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

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## 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
  - » Yoga with compression bandaging/garments, small movements, using gravity & pumping

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## 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

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## 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

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## 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)

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## 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)

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## 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

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## 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**

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## 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

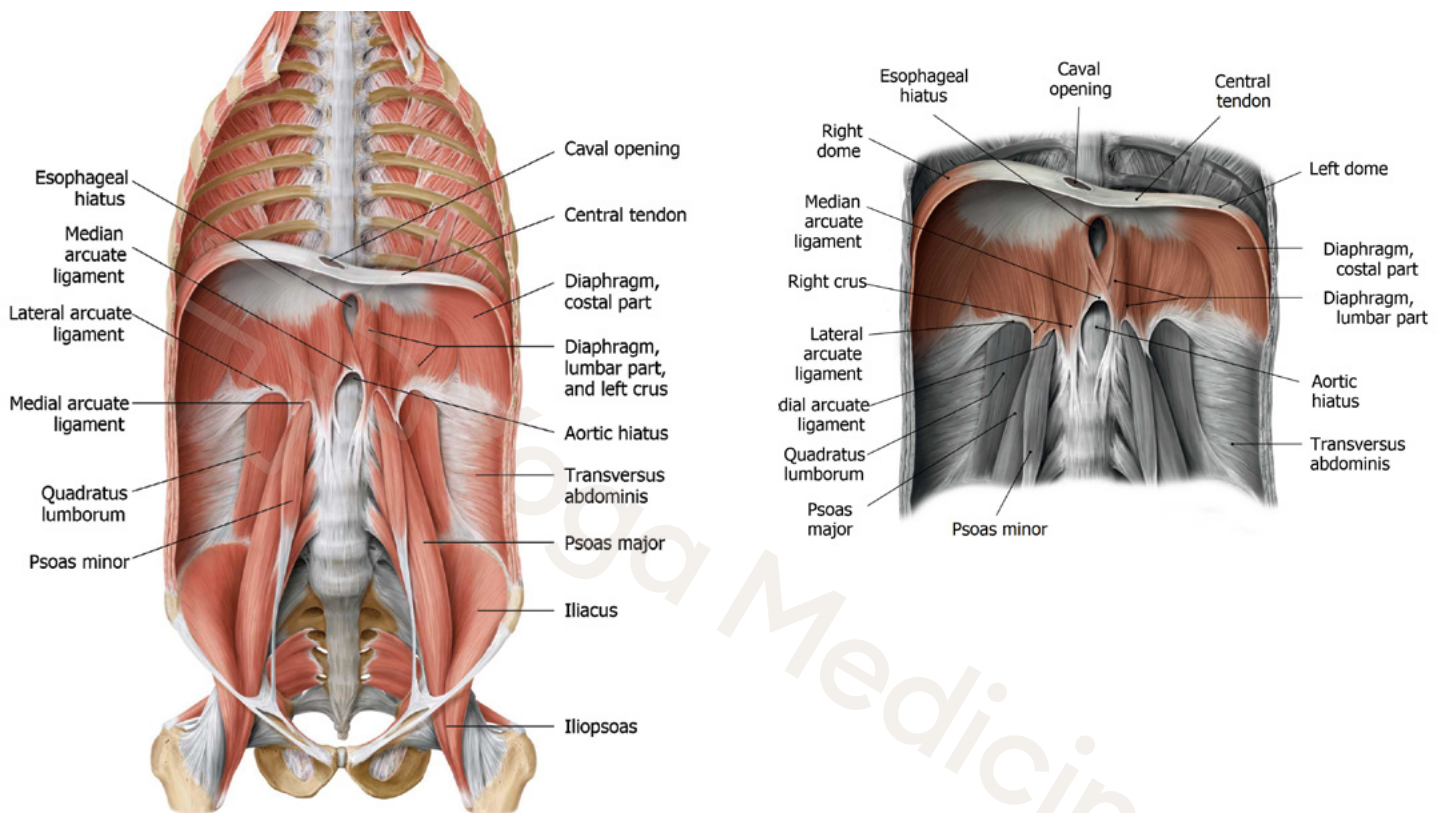
# Yoga Applications

## 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



Atlas of Anatomy, 2nd ed., Fig. 11.5 B, Illustrator: Karl Wesker, ©2016 Thieme Medical Publishers, Inc. All Rights Reserved.

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## 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

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## 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\*

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## 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)

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## 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

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## 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

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## Self-Lymphatic Massage

### Specific Goals:

- Increase lymph flow by stimulating nodes
- Direct & increase lymph flow (enhance lymphangiomotricity & 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

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## Self-Lymphatic Massage

### 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

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## Head & Neck

Flow of Lymph fluid



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## 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
  - » MFR
  - » Pranayama
  - » Meditation
  - » Nidra
  - » Calming practices
  - » Progressive relaxation, body scans



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## 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

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## 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

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## 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