

SCOREBUILDERS



SPOTLIGHT
Series

Lymphedema Review for the NPTE

Presented by Amy Powell-Versteeg, PTA

Objectives

- Anatomy of the Lymphatic System
- Physiology of the Lymphatic System
- Etiology & Diagnosis
- Indications & Contraindications
- Treatment Options
- Complete Decongestive Therapy

Anatomy

Lymph nodes: filter lymph to fight infection, regulate the amount of protein in the lymph

Lymph vessels: absorb fluid from interstitial space & intestines

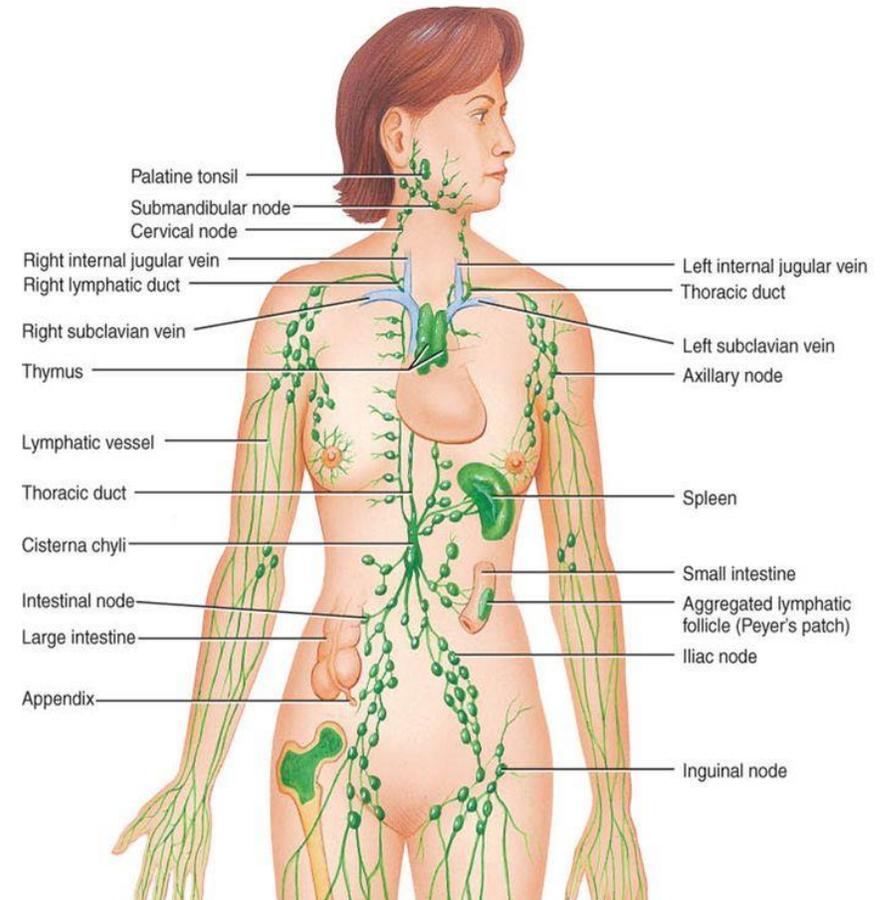
- Capillaries
- Pre-collectors
- Collectors
- Trunks
- Ducts

Thymus gland: produces hormones that stimulate the production of T-cells.

Spleen: filters blood, recycles RBC, stores platelets and WBC.

Tonsils: trap germs you breathe in.

Peyer's patches: the immune sensors of the intestine.



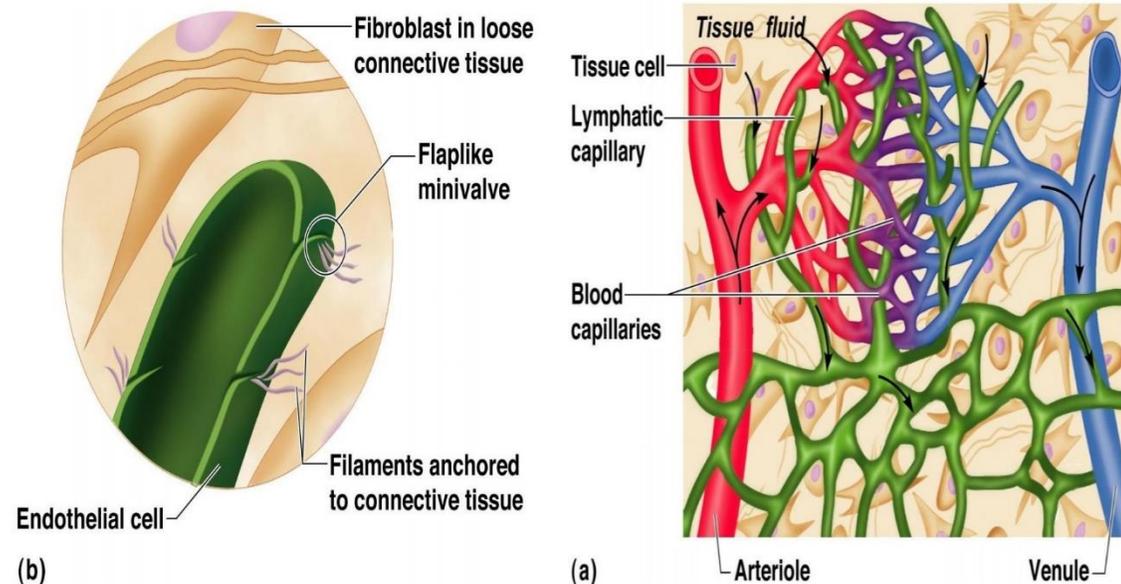
Anatomy

Lymph vessels

Lymph capillaries

- Larger than blood capillaries
- Can absorb large molecules
- Made up of flat endothelial cells that overlap each other
- Have anchoring filaments that attach to surrounding tissue
- Muscle pump action

Lymphatic Vessels



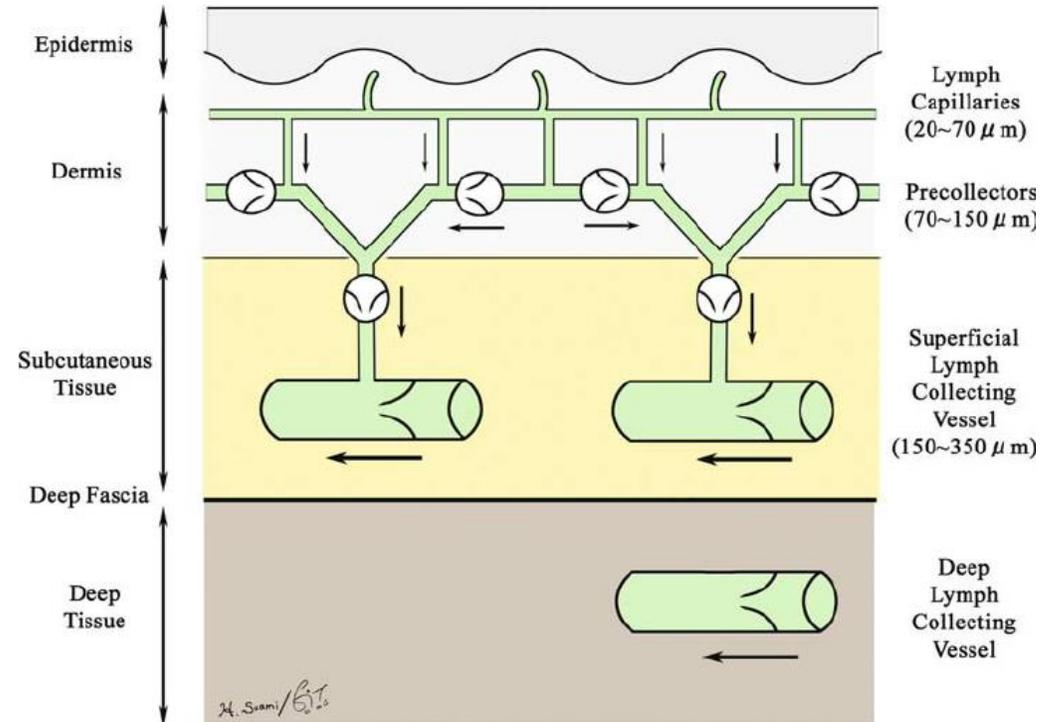
Anatomy

Lymph vessels

Pre-collectors → Collectors

Collectors

- Transport lymph (distal to proximal nodes)
- One-way valves, direct flow
- Exercise and volume increases the contraction of smooth muscle in the vessel wall



Anatomy

Lymphatic vessels

Trunks → Ducts

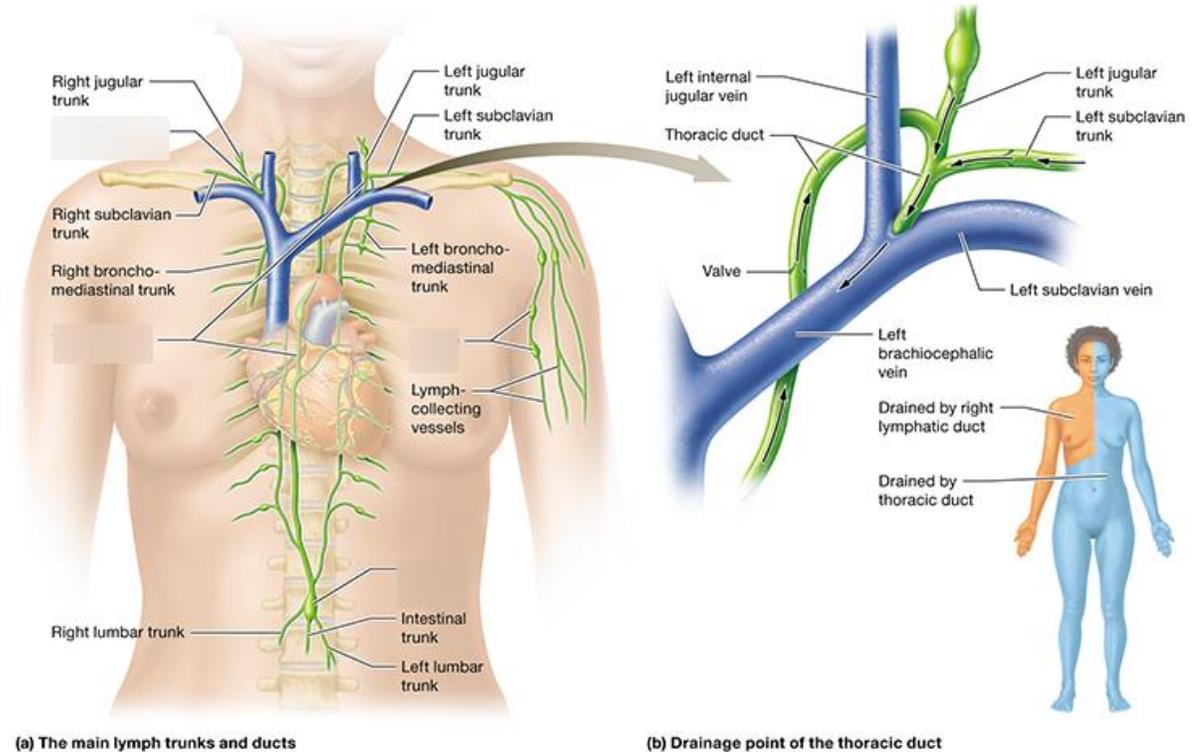
Ducts

1. Thoracic duct

- Largest lymphatic vessel in the body.
- Transports about 75% of the daily lymphatic load.
- L&R lower quadrants, L upper quadrant, L head/neck

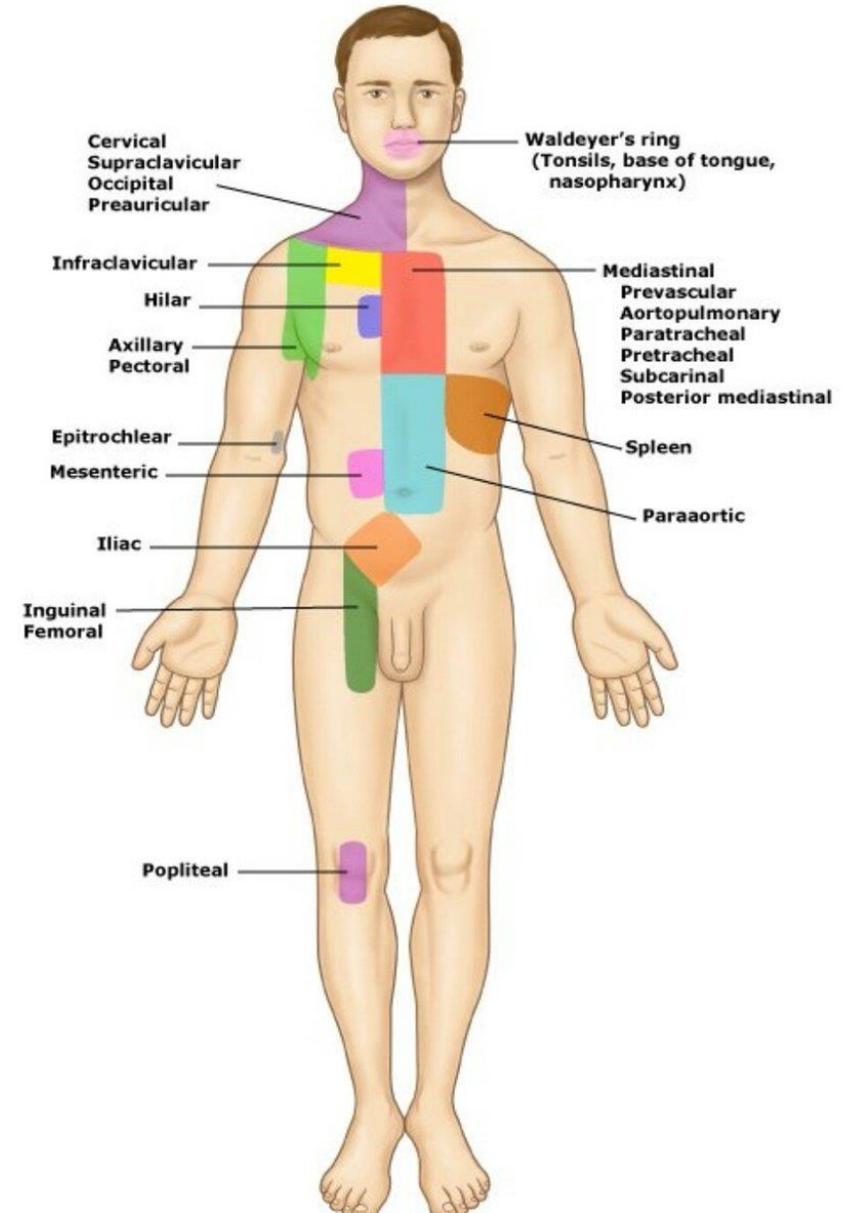
2. Right lymphatic duct

- Collects the remaining LL.
- R upper quadrant, R head/neck



Regional Lymph Nodes

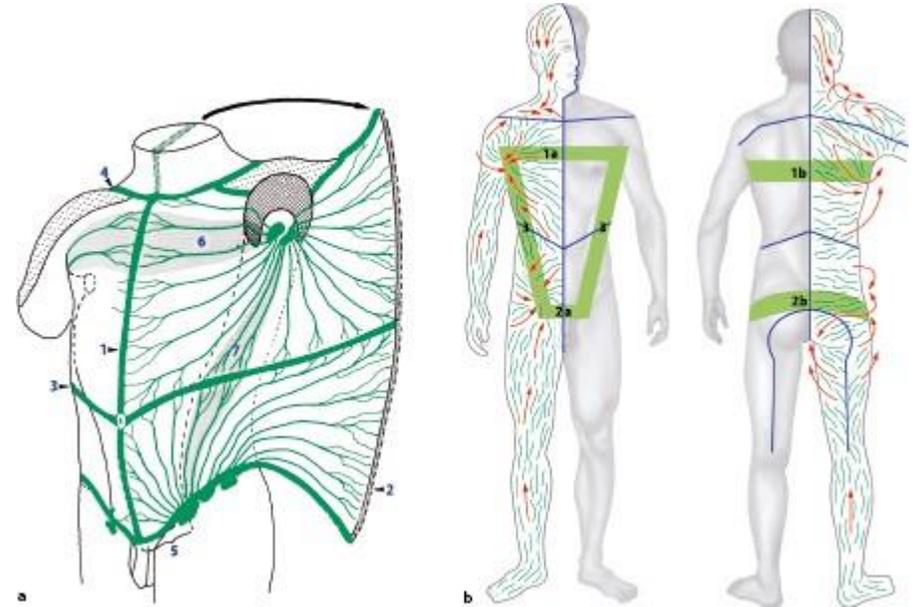
- Head & neck
- Axillary
- Abdominal
- Inguinal
- Back of knee
- Elbow



Watersheds

Boundaries in the superficial lymph vessel system that limit the flow of lymph in a particular direction.

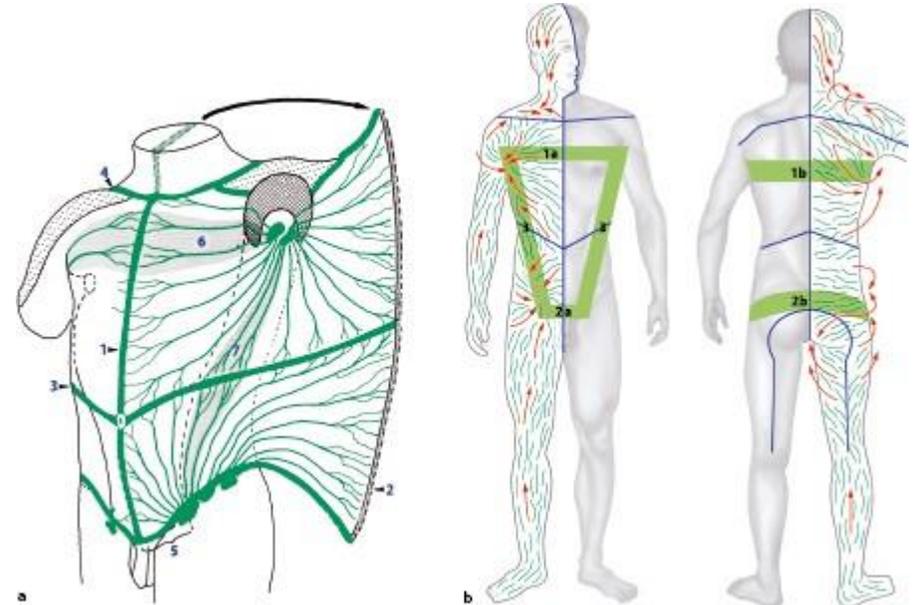
- Median-sagittal
- Transverse
- Clavicle
- Spine of scapula
- Chaps (gluteal)



Anastomoses

Connections between lymphatic vessels that allow drainage to occur via the most efficient pathway.

- Inter-axillary (anterior & posterior)
- Inter-inguinal (anterior & posterior)
- Axillo-inguinal (left & right)



Physiology

Diffusion

Osmosis/osmotic pressure

Colloid osmotic pressure (COP_p/COP_i)

Ultrafiltration

Peripheral Resistance

Blood pressure (systemic/capillary)



Osmotic pressure/Colloid osmotic pressure

- Colloid osmotic pressure (COP): large molecules, such as protein, generate pressure, due to their size. The large protein molecules draw water molecules to them.
- Colloid osmotic pressure of the plasma (COPp): The large protein molecules in your blood keep it hydrated and help to maintain a stable blood volume.
- Colloid osmotic pressure of the interstitium (COPi): The large protein molecules leave the blood and enter the interstitium to provide nourishment to the tissue. Water is attracted to protein, so if the protein has difficulty leaving the interstitium, it will continue to draw water to it.

Skin tension, atmospheric pressure, external compression, submersion in water create a positive interstitial pressure.

Blood Capillary Pressure (BCP)

- The pressure against the wall of the capillary, resistance increases in small vessels such as capillaries. The increased resistance decreases blood flow.
 - Active Hyperemia: increased blood flow from the arterial limb of the capillary, resulting in increased blood capillary pressure.
 - Exercise
 - Heat
 - Inflammation
 - Infection
 - Friction
 - Passive Hyperemia: blood builds up in the blood vessels due to insufficient venous return, backflow of blood, or stasis in the capillaries. Increases blood capillary pressure from the venous limb.
 - CHF (congestive heart failure)
 - CVI (chronic venous insufficiency)
 - DVT (deep vein thrombus)
 - Malignancy (tumor obstruction)
 - Other contraindications
 - Active infections
 - Peripheral artery disease

Lymphedema in a nut shell



Lymphedema: protein rich edema

Lymph Fluid/Lymphatic Load

- Proteins
- Water
- RBC, WBC, Lymphocytes
- Waste products & foreign substances
- Intestinal lymph, fat, chyle

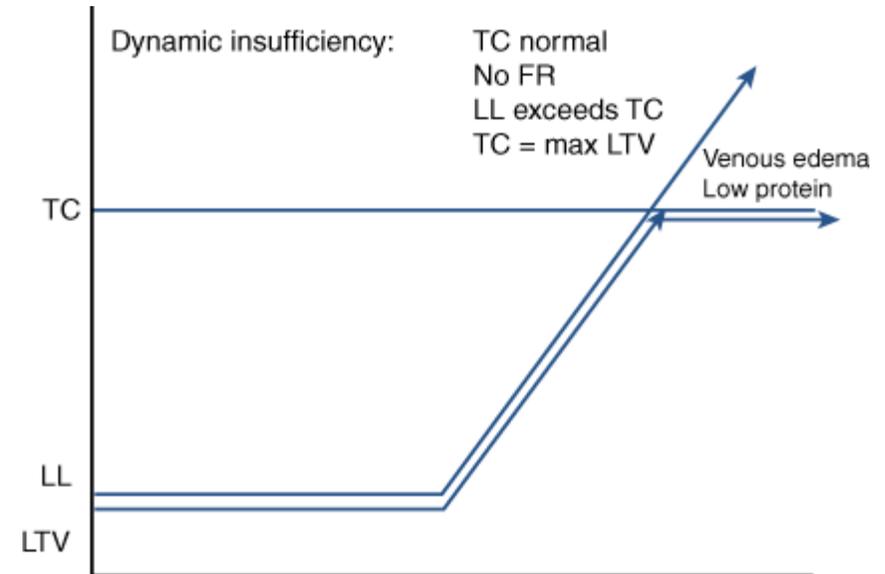
Lymphatic Sufficiency & Insufficiency

- Lymphatic Load (LL) – water, proteins, cells, fat
- Lymph Time Volume (LTV) – movement of lymph fluid about 2L per day. If we are not overloading the system, we use about 1/10th of its capacity.
- Transport Capacity (TC) – is the max lymph time volume. We can transport a lot more lymphatic fluid than we actually do.
- Functional Reserve (FR) – the difference between transport capacity and lymphatic load (the remaining 9/10th).

Lymphatic Insufficiency

Dynamic Insufficiency (LL>TC)

- Cardiac edema
- Deep Vein Thrombosis (DVT)
- Chronic Venous Insufficiency (CVI)



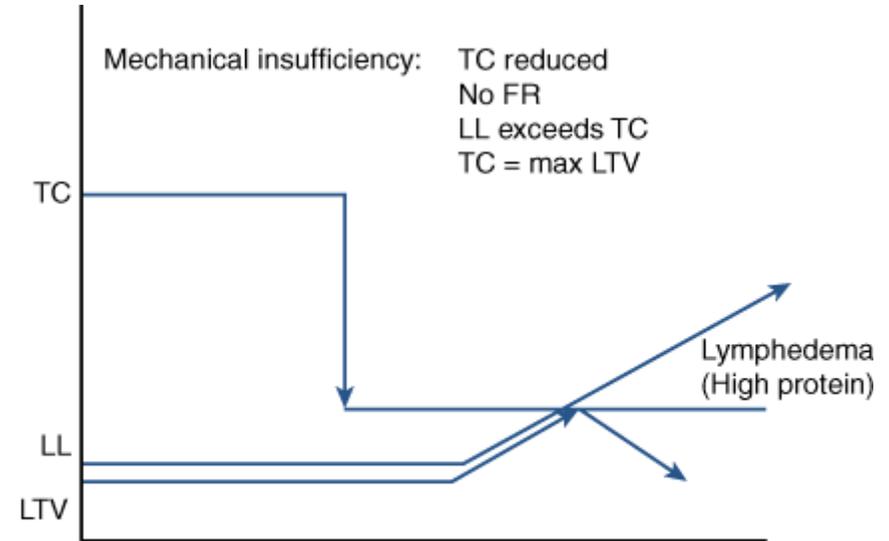
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Lymphatic Insufficiency

Mechanical Insufficiency (LL > TC)

- Lymphedema
- High protein



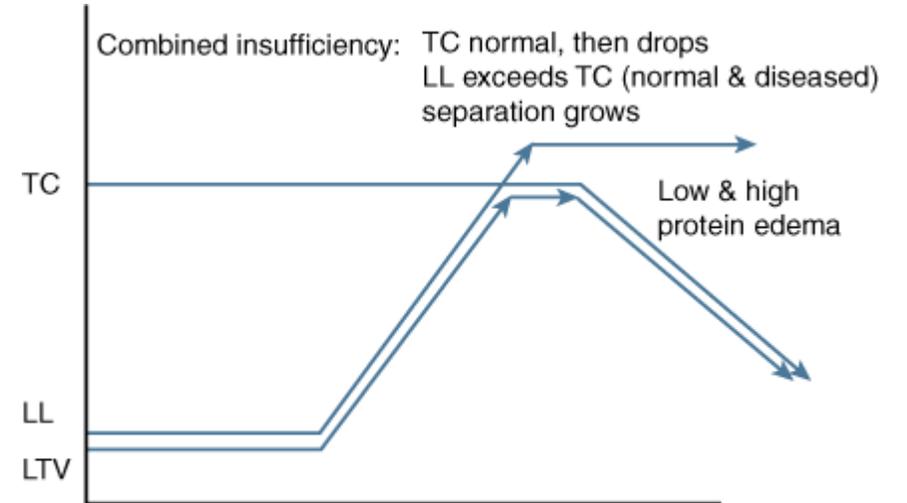
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Lymphatic Insufficiency

Combined Insufficiency (LL>TC)

- Lipedema
- Malignant lymphedema
- High water & protein



Source: Kuerer HM: *Kuerer's Breast Surgical Oncology*:
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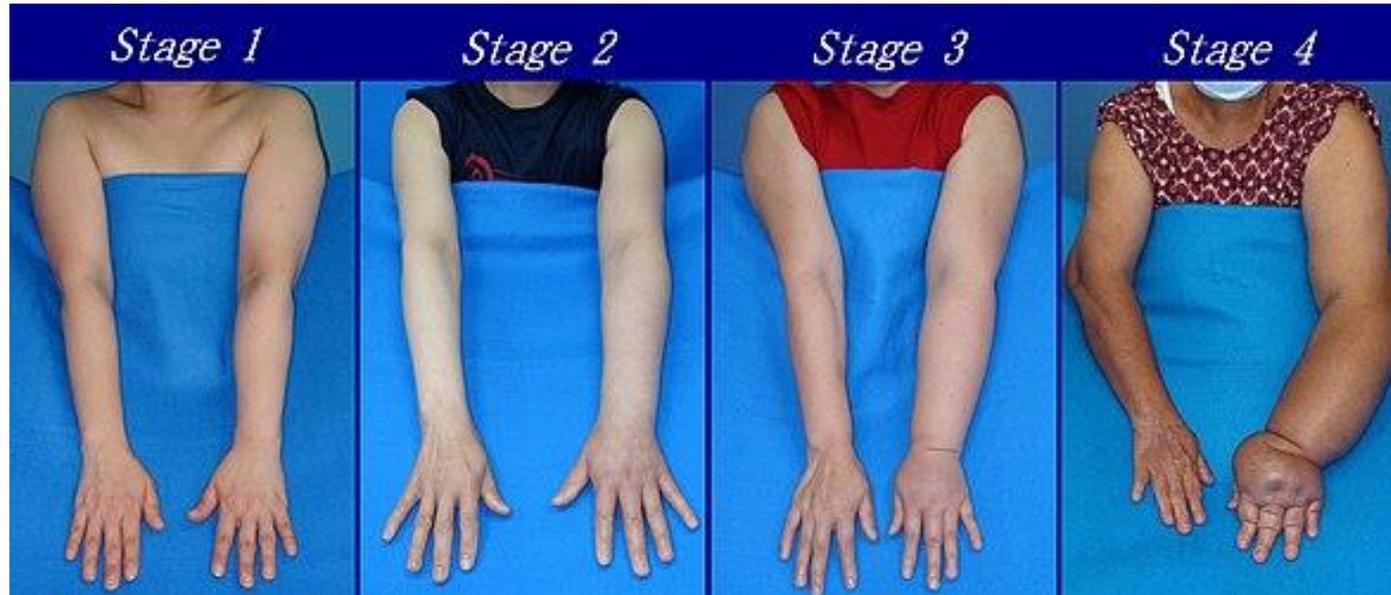
What is Lymphedema



Primary Lymphedema: Congenital, more frequent in females, most often occurs at puberty. Decreased number of lymph nodes, fibrous lymph nodes.

Secondary Lymphedema: Most common world-wide is filariasis (caused by a mosquito born parasite). Most common in U.S. complications of cancer treatments.

Stages of Lymphedema



Characteristics of Lymphedema

- Slow onset
- Pitting can occur in early stages
- Asymmetrical/Unilateral
- Distal to proximal
- Squaring of toes (Stemmer's sign)
- Buffalo hump on dorsum of foot
- Loss of ankle contour
- Cellulitis is common
- Not usually painful
- C/O heaviness, achiness
- Skin changes
- Ulcerations



Treatments

- Surgery
- Pneumatic Compression Pump
- Complete Decongestive Therapy
- Compression Garments
- Medications
 - Anti-inflammatory medications

Complete Decongestive Therapy

- Manual Lymph Drainage
- Compression bandaging
- Exercise
- Skin and nail care
- Patient education/self-care

Manual Lymph Drainage

- Improves lymph production
- Improves lymph circulation
- Promotes relaxation
- Analgesic effect



Compression Bandaging

- Reduces ultrafiltration rate
- Improves the efficiency of the muscle pump action
- Prevents the re-accumulation of lymph fluid
- Breaks up scar and connective tissues



Law of La Place
 $P=t/r$

Exercises

- Performed with bandages/compression garments on, isometrics
- Active ROM, strengthening, stretches
- Low exertion
- Diaphragmatic breathing
- Increase muscle pump
- Increase lymph vessel activity
- Increase venous and lymphatic return



Skin & Nail Care/Education & Self-Care

- Reduces risk of infection
 - Avoid dry/cracked skin
 - Avoid injury
 - Use moisturizing lotion, medicated powder, hydrocortisone cream, tegaderm.
 - Watch for signs of infection (skin checks)
- Disease Management





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