Lymphology: Anatomy and Physiology of the Lymphatic System

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What is the Lymphatic System?
Lymphatic System

- Closed network of small vessels.
- Drains remaining 10% of “fluid” not captured by circulatory system.
- Identifies and fights infection.
- Relies on change in tissue pressure and small “lymphangion” pumps for drainage.

Lymphatic Organs in the Body Are:

- Lymph nodes
- Lymph vessels
- Thymus gland
- Spleen
- Tonsils
- Peyer’s patches: oval elevated
  - patches of closely packed lymph follicles on
  - the mucosa of the small intestines
Lymph vessels are larger than blood capillaries and have walls that have overlapping flap openings. That is why the larger proteins can be absorbed and transported by these vessels. Proteins draw fluid with them.

Collection System

- Initial lymphatics-flaps, no valves in the Dermis
- Collecting lymphatics-small and large, valves to prevent backflow, assist in pumping.
- LYMPHANGION
- Lymph Trunks
Lymph Vessels

- Capillaries
- Pre-collectors
- Collectors
- Trunks
Lymph Nodes

- Popliteal
- Inguinal
- Iliac
- Cubital
- Axillary
- Cephalic

(60% of pop)
Lymph Nodes
Junctions/Pathways

*Right lymphatic duct to right subclavian vein
*Left lymphatic duct to drain to left subclavian vein and left internal jugular vein
*Cysterna Chylla (L2 L3 Level)
*Thoracic duct

Watersheds/Lymphotomes
Physiology of the Lymphatic System

- 2 main factors affecting passage of materials into and out of the tissues via blood and lymph systems. First one:

**Permeability**: Gases, water, ions, macromolecules (protein), cells (RBCs)
Physiology of the Lymphatic System

• 2nd main factor

Pressures:

Plasma hydrostatic pressure—greater on arterial side than venous side.

Tissue hydrostatic pressure—normally less than atmosphere pressure (draws fluid from capillaries). Can be reversed in edema, losing “continuous turnover affect”

Plasma colloidal osmotic pressure: Plasma proteins drawing water into capillaries.

Tissue colloidal osmotic pressure: Plasma proteins drawing water into tissue

• Osmosis –

passage of a solvent membrane

• Osmotic pressure—

pressure that develops when 2 solutions of different concentrations are separated by a semipermeable membrane

• Colloid-osmosis and colloid osmotic pressure—

The amount of protein found in plasma equals approx. 7 g/% which results in a pressure of approx. 25 mmHg. Protein concentration of the interstitial fluid is lower than blood plasma = lower COP
• **Ultrafiltration**: Overcoming colloid osmotic pressure thru mechanical pressure so that colloidal substance is held back but the dispersed particles are.

Hydrostatic pressure overcomes colloid osmotic pressure of the blood and causes ultrafiltration.

• **Reabsorption**: Water is reabsorbed into a blood venous capillary if there are more proteins in the capillary. (If proteins are stuck in the tissue = edema)

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If interstitial pressure decreases then ultrafiltration increases and reabsorption decreases

Starlings law = average BCP = COPp
• Precapillary arterioles are rich in smooth muscle fibers by sympathetics. If sympathetic n.s. is decreased via massage, heat, or inflammation muscle tone decreases which increases BCP called Active hyperemia.

• Passive hyperemia is when there is an obstruction of the venous return-blood backs up into capillaries, BCP increases. DVT, CHF, CVI, Malignancy
How does the lymphatic system work?

Our bodies transport 1-2 liters of fluid each day. That is a normal lymphatic load.

Transport capacity

Lymphatic load 1-2 liters/day

What happens when the system has been altered?

Normal transport capacity

Reduced transport capacity

Lymphatic load

Transport capacity is 10x normal lymphatic load can be 10 liters or can be 20 liters

edema

Injury
High Protein Edema vs. Low Protein Edema

LYMPHEDEMA VS. VENOUS STASIS EDEMA
LYMPHEDEMA:

- Swelling of the subcutaneous tissues due to accumulation of lymph (plasma protein, white blood cells and water).
- High Protein
- Pitting in Early Stages
- Primary and Secondary

VENOUS STASIS EDEMA:

- Low protein
- “Watery”
- Pitting in nature
- Improves with non-dependency
HISTORY OF CANCER
SURGERY OR RADIATION?

- Surgery: Nodes removed (less with Sentinel node process).
- Radiation: Goal is to radiate the area—including nodes.

HISTORY OF?:

- CHF
- DVT
- Varicosities
- Subclavian line
- Standing/sitting occupation
- Liver cancer/ascites
GENERAL

CONTRAINDICATIONS?

- Congestive Heart Failure
- DVT
- Renal disease
- Untreated infection
- Untreated cancer
- Edema of unknown origin
# CONTRAINDICATIONS FOR MLD

## NECK
- Cardiac arrhythmia
- Patients over the age of 60
- Hypersensitivity of the carotid sinus
- Hyperthyroidism, hypothyroidism

## ABDOMEN
- Pregnancy
- Recent surgery
- Radiation
- Fibrosis, colitis, cystitis
- After pelvic DVT
- Crohn’s disease
- Cirrhosis
- Unexplained pain

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# CONTRAINDICATIONS FOR BANDAGING?

- All general contraindications
- Arterial diseases
- Extra precautions with:
  - Hypertension
  - Paralysis
  - Diabetes
  -- Bronchial asthma
  -- CHF
WHAT ABOUT DIURETICS?

- Mechanism: Help remove water from system - plasma protein is left behind to concentrate in tissue. This results in fibrosis and an infection fostering environment.
- 15 Bean Soup analogy
Swelling tells a story

Stage one lymphedema

- Spontaneously reversible
- Swelling will go down with elevation or after sleep so people tend to ignore it
- Swelling may occur after over exertion of limb such as after gardening
Stage two lymphedema

- Spontaneously irreversible
- Edema does not reduce by itself
- Scar tissue begins to grow in the intercellular space
Stage three lymphedema

- Continued scar tissue formation in the tissue
- Skin changes such as papillomas
- Limb may become excessively large
- Elephantitis

COMPLEX LYMPHEDEMA THERAPY

1. Skin Care Principles
2. Manual Lymph Drainage
3. Compression Bandaging (Fit for sleeve/stocking after reduction of edema)
4. Exercise
Manual lymph drainage can have relaxation and pain relieving effects.
EXERCISE STRATEGY

• Work proximal to distal to clear the area where you want the fluid to travel
• Work distal to proximal to move the fluid in the direction you wish it to travel
• Be mindful of where there are “Bridges” or anastomosis

GOALS

• Control/manage lymphedema--not cure it.
• Minimize potential for cellulitis.
Is there a cure for lymphedema?

- No
- There is treatment/management
- Complete decongestive therapy
  1. Manual lymph drainage
  2. Compression bandages/compression garment
  3. Exercises
  4. Skin care

QUESTIONS
&
CONVERSATION
For more information on the treatment of lymphedema please contact:
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