Medical Laboratory Techniques Department

Human Physiology

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The Lymphatic System

• network of tissues, organs and vessels that help to maintain the body's fluid balance & protect it from pathogens

• lymphatic vessels, lymph nodes, spleen, thymus, tonsils, etc

• without it neither the circulatory system nor the immune system would function

• can be thought of as an accessory to the circulatory system

• it helps the circulatory system to do its job

• the two systems are directly connected together

• it consists of fluid derived from plasma =lymph and white blood cells (esp. lymphocytes and macrophages (monocytes))

• the lymph travels in only one direction - it doesn't Circulate

General Functions of Lymphatic System:

1. Returns Fluid from Tissues to Blood. ~85% of fluids that leak out of blood returns to blood via blood capillaries ~15% returns via lymph capillaries- in 24 hrs lymphatics return fluid equivalent to entire blood volume - if lymphatic system becomes blocked edema

2. Returns Large Molecules to Blood .~25-50% of blood proteins leak out of capillaries each day

* they cannot get back into capillaries

* instead lymphatic capillaries pick them up and return them to the blood

* if lymphatics are blocked blood protein decreases leading to fluid

* imbalances in body

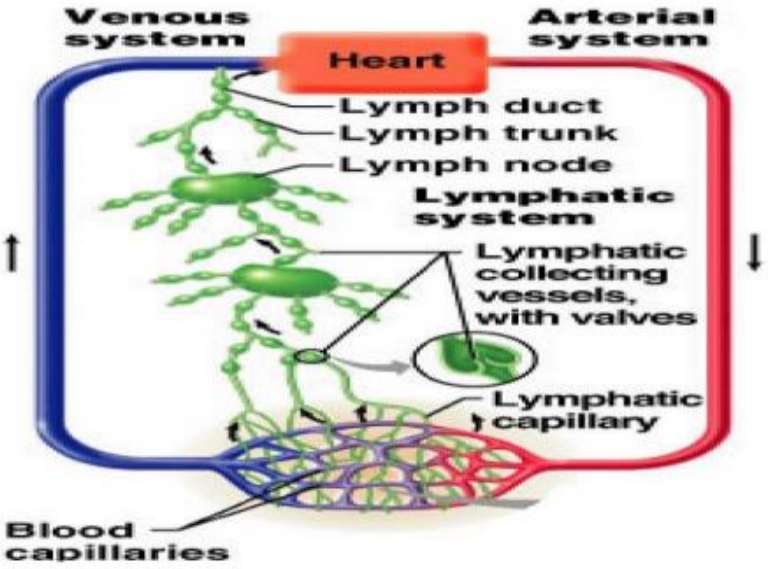
3. Absorb and Transport Fats - Special lymphatic capillaries (=lacteals) in villi of small intestine absorb all lipids and fat soluble vitamins from digested food bypasses liver much goes straight to adipose tissues

4. Hemopoiesis - some WBC's (lymphocytes, monocytes) are made in lymphatic tissues (not bone marrow) main supply of lymphocytes

5. Body Defense/Immunity - lymphoid tissue is an important component of the Immune System (forms a diffuse surveillance defense system in all body tissues and organs

* the major role of WBC's is in body defense

* lymphatic system screens body fluids and removes pathogens and damaged cells



Lymph

• Lymph is a clear watery fluid that resembles blood plasma but: has fewer proteins its composition varies depending on organs that it drains

• the lymphatic system handles 125 ml/hr (2500-2800 ml of lymph/day) ~1/2 of this from the liver and small intestine alone.

Lymphatic Vessels (lymphatics):

Lymphatic Capillaries

• originate in tissues as tiny blind ended sacs

• lie side by side with blood capillaries

• single layer of endothelial cells like blood capillaries

• but much more permeable to solvents, and large solutes and whole cells

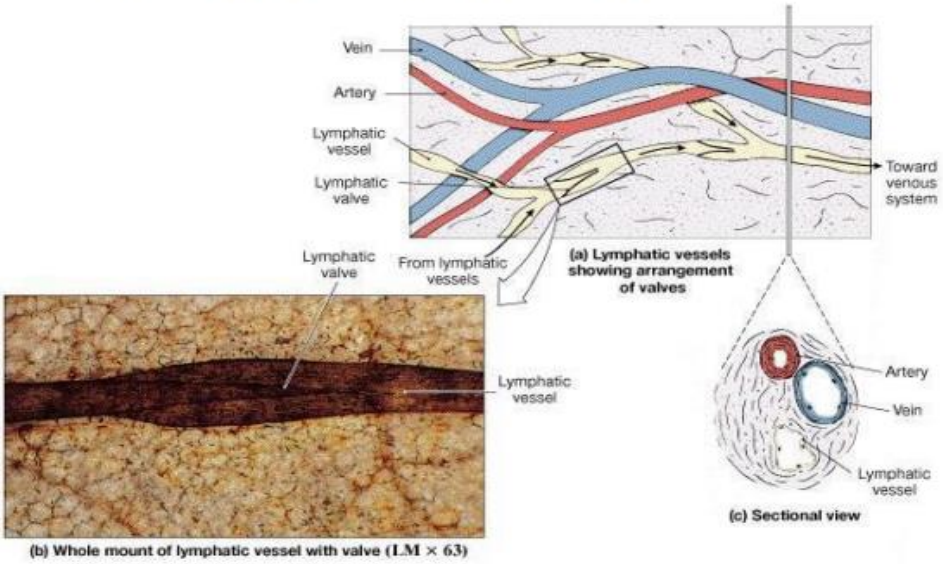
Lymphatic Vessels - these small lymphatic capillaries merge with others to form larger lymphatic vessels - they resemble veins in structure:

• three layers – but much thinner

• one way valves – but many more .

• also has lymph nodes at intervals along its course

• as they converge they become larger and larger



Lymph Circulation

• Lymph vessels are thin walled, valved structures that carry lymph

• Lymph is not under pressure and is propelled in a passive fashion

• Fluid that leaks from the vascular system is returned to general circulation via lymphatic vessels.

• Lymph vessels act as a reservoir for plasma and other substances including cells that leaked from the vascular system

• The lymphatic system provides a one-way route for movement of interstitial fluid to the cardiovascular system.

• Lymph returns the excess fluid filtered from the blood vessel capillaries, as well as the protein that leaks out of the blood vessel capillaries.

• Lymph flow is driven mainly by contraction of smooth muscle in the lymphatic vessels but also by the skeletal-muscle pump and the respiratory pump.

LYMPH CIRCULATION

Interstitial fluid → Lymph → Lymph capillary → Afferent lymph vessel → Lymph node → Efferent

lymph vessel → Lymph trunk → Lymph duct {Right lymphatic duct and Thoracic duct (left side)} → Subclavian vein (right and left) → Blood → Interstitial fluid

Major Accessory Lymphatic Organs

- Spleen – largest
- Thymus
- Tonsils
- Peyers's patches
- Appendix

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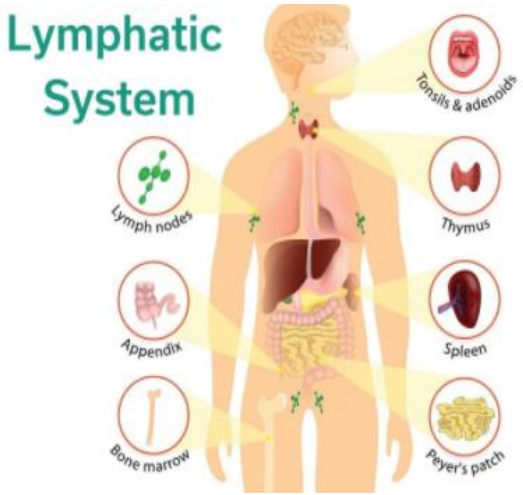

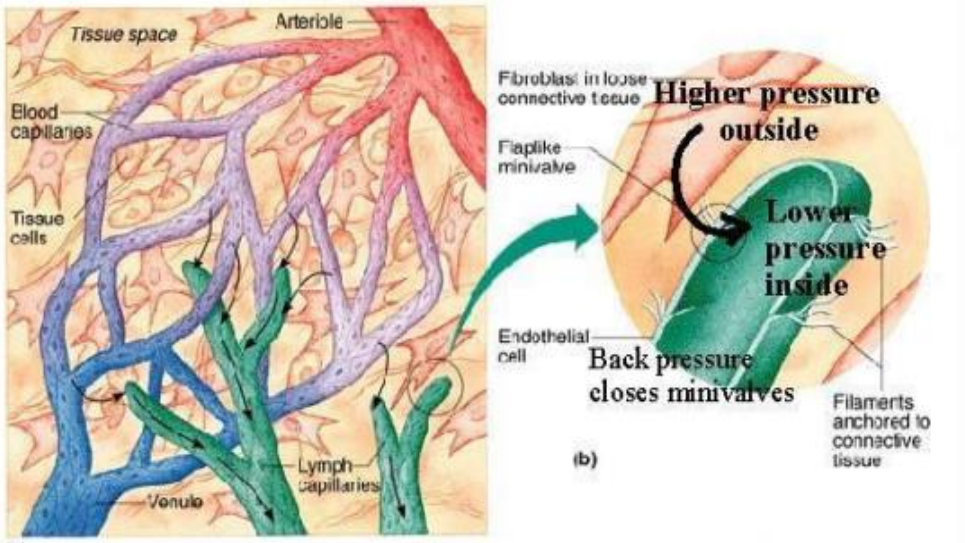

Lymphokinetic Motion and Pressure Gradient

Blood capillaries → Interstitial Fluid → Lymph capillaries → Lymph veins → Lymph ducts → Large circ. Veins

Highest pressure — Lowest pressure