**الدكتورة**

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**Anatomy of the lymphatic system**

**Lymphatic system** is one of the circulatory systems of the body and part of the defense mechanism against microorganisms and any harmful substances. It is a 1-way system; the lymph is collected from the tissues and delivered to the blood.

**General Functions of Lymphatic System:**

1. Fluid balance: it returns Fluid from Tissues to Blood, about 85% of fluids that leak out of blood returns to blood via blood capillaries and 15% returns via lymph capillaries
2. Absorb and Transport Fats: Special lymphatic capillaries (=lacteals) in villi of small intestine absorb all lipids and fat soluble vitamins from digested food
3. Body Defense/Immunity: lymphoid tissue is an important component of the Immune System. Lymphatic system screens body fluid through lymph nodes and lymphoid organs are site for development and maturation of immunological cells.

**The lymphatic system consists of:**

1. Fluid called lymph
2. Lymphatic vessels
3. Several Structures and organs that contain lymphoid tissue (lymphatic nodules, lymph nodes, thymus and spleen).

**I-Lymph** Interstitial fluid (fluid between cells) that has entered and flow through the lymphatic vessels. It is a clear watery fluid that resembles blood plasma but has fewer proteins.

**II-Lymphatic Vessels**

a**. Lymphatic Capillaries** originate in tissues, tiny and blind ended. They resemble blood capillaries but much more permeable to solvents, large molecules and cells

b. **Lymphatic Vessels** Lymphatic capillaries unite to form lymph vessels. They have one sided valves. They are superficially and deeply located. They are found in skin, muscles and several visceral organs. Various lymphatic vessels are linked together by free anastamoses. Lymph vessels pass through lymph nodes. They gradually increase in size. Finally lymph collected from the body pours into right lymphatic duct and left lymphatic duct. Left lymphatic duct is also called as thoracic duct..

**III-Lymph Nodes (LN):**

Bean shaped structures scattered along the lymphatic vessels, usually in groups, lymph (lymphatic fluid) enters the nodes through several **afferent** lymphatic vessels, the dead cells and microorganisms are filtered and the immune system will be alerted to pathogens. Lymph exits LN via 1-3 **efferent** lymph vessels.

**Histology of Lymph node**: Histology of lymph node shows three parts. They are: **Cortex, medulla & hilum.**

**1. Cortex:** is the outer part of lymph node. It contsins lymphatic nodules peripherally. When lymph nodules react with insult (eg bacteria) germinal centres formed in the inner zone of the nodules, so germinal centres present in reactive lymph nodes. Subcortical sinuses separate lymph nodules from capsule.

**2. Medulla** : It is the inner part of lymph node. It is devoid of lymph nodules. It contains reticulo endo thelial cells. It also contains a few giant cells.

**3..Hilum** : It is the depression at one side of lymphnode or lymph gland. Through Hilum, an artery enters and there is exit to a vein and an efferent lymphatic vessel. Afferent lymph vessels enter from all sides but eferent lymph vessel leaves through hilum Chief efferent vessel leaving lymph node carries filtered and lymphocyte enriched lymph fluid.

There are about **450 LN** distributed along the lymphatic vessels. **Superficial LN** are in the subcutaneous tissue (under the skin), and **deep LN** more internally.

**Naming of lymph nodes groups: Lymph nodes are named accordingly as they are located. They are:**

a) **Cubital and axillary lymph nodes:**They are situated in arms.

b) **Poplietal and inguinal**: Lymph nodes situated in legs are named so.

c) **Submaxillary and cervical lymph nodes:**Lymph nodes present in the neck are called as submaxillary and cervical lymphnodes.

d) **Mediastinal lymph nodes**: These are present in Thorax.

e) **Abdominal lymph nodes:** They are present in abdomen. ex: Mesenteric LN and peyers patch

f**) Pelvic lymph nodes:** Pelvic lymph nodes are present in pelvic organs.

**IV-Lymphatic Ducts (lymphatic circulation):**

The lymphatic vessels merge together to form two major Lymphatic Ducts

**A-Right Lymphatic Duct**:

* very short,
* drains upper right quadrant of body
* drains into right subclavian vein

**B- Thoracic Duct**:

* much larger and longer
* drains the rest of body (3/4ths): all of body below diaphragm, Cisterna chyli which collect lymph drained from digestive system (intestine), left arm and left side of head, neck and thorax
* drains into left subclavian vein

**V- Lymphoid organs:**

**1-Primary lymphoid organs** thymus and bone marrow

**2-Secondary lymphoid organs**: spleen, lymph nodes, Tonsiles and mucosal associated lymphoid tissue MALT (lymphatic vessels that drain lymph formed in submucosal areas eg lung and intestine).

* **Spleen:** largest lymphatic organ located in left hypochondrial region. It is covered by a weak capsule that protects the organ.

Spleen performs several functions:

1. defense: helps screen blood and removes pathogens and bacteria

2. hemopoiesis monocytes and lymphocytes are made here (before birth, RBC’s also made here)

3. erythrocyte and platelet destruction: aged RBC and platelets will be distructed in spleen

4. blood reservoir: able to store blood (~350ml) and pump it to the circulatory system if hemorrhage occure= self transfusion

* **Thymus**: bi-lobed organ located in superior mediastinum plays vital role in initial set up of body’s immune system. It is the site of production and maturation of T lymphocytes. Reach its peak of function during childhood, then start regressing and replaced by adipose tissue in elderly peoples.

After development and maturation, T lymphocytes will be able to respond to foreign antigens encountered elsewhere in the body.

* **Tonsils:** are well-defined organs of accumulated lymphoid tissue in the mucous membrane surrounding the pharynx, where nasal and oral passages unite. Tonsils can be divided into three groups.

(1 **) Palantine tonsils** -covered by stratified squamous epithelium on lateral wall of oropharynx

**(2) Lingual tonsil**- situated at the root of tongue.

**(3) Pharyngeal tonsils** - one on each side in the posteromedial wall of nasopharynx.