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Human Anatomy and Physiology
Chapter 6 : Lymphatic System

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Chapter 6

Lymphatic System

→ The lymphatic system forms a closed network of lymph vessels through which lymph circulates all over the body.

→ The flow of lymphatic fluid is unidirectional from tissue space to the blood.

→ Composition of lymphatic system

- Lymph is a fluid
- Lymphatic vessels that transport the lymph
- Lymph nodes through which lymph passes before returing to the blood
- A number of structure and organs containing lymphatic tissue E.g. spleen and thymusRed bone marrow where stem cells develop into various types of blood cells including lymphocytes.
- Diffuse lymphoid tissue eg tonsils

→ Lymphatic system protects body against harmful agents through body fluid circulation. Blood plasma components filter through the walls of blood capillary producing interstitial fluid that moves into lymphatic vessels as lymph.

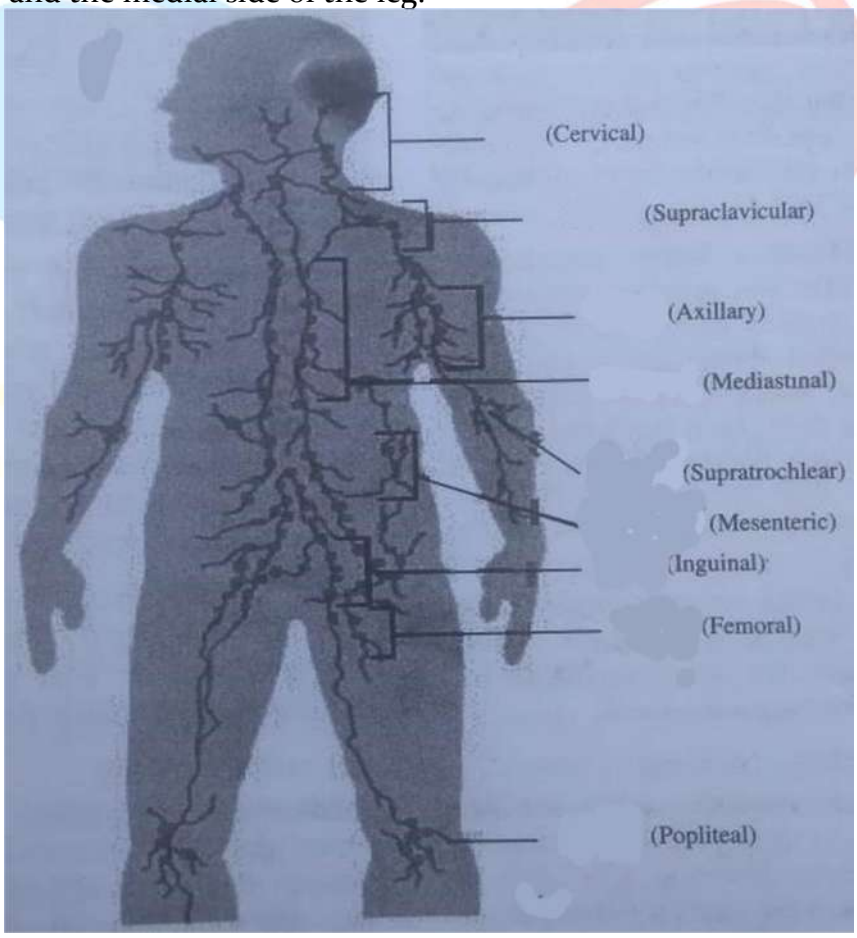
Lymph nodes

- Lymph glands are structures that are small and glandular in appearance.
- They are present all along the path of lymph vessels.
- They are also referred to as lymph glands or lymphatic nodes. Lymph nodes are part of lymphatic system, present throughout the body either independently or in groups.
- In the human body, around 500-600 lymph nodes are present in groups in the neck, collarbone, under the arm and groin.
- Lymphadenitis is the medical term for enlargement in one or more lymph nodes, usually due to infection Lymph nodes are filled white blood cells that help your body fight infections.

Types

- **Cervical Lymph Nodes :** They are present in the head and neck region. They are 6 in number and specifically located deep in the neck, behind the ears and bottom of the jaw. They drain lymph from the scalp, face, nasal cavity, and pharynx.
- **Supraclavicular Lymph Nodes :** They are present along the collarbone or clavicle, and sometimes may be considered as a part of the cervical lymph node. They drain lymph from the collarbone and upper parts of the chest.
- **Axillary Lymph Nodes :** They are present in the area of armpit and are divided into two types, viz., superficial and deep lymph nodes. They drain lymph from arms, thorax, and breast.
- **Mediastinal Lymph Nodes :** They are located in the central part of the chest, and between the lungs. They drain lymph from the middle section of chest cavity, parts of the upper abdomen and lungs.

- **Supratrochlear Lymph Nodes :** They are located on the arms just above the elbow joint. They drain lymph from the fingers, arms (from the ulnar side), and from the superficial areas of the forearm.
- **Mesenteric Lymph Nodes :** They are present in the lower abdomen, along the small intestine. They drain lymph from the cecum, jejunum, ileum, colon, and the upper part of rectum.
- **Inguinal Lymph Nodes :** They are present in the groin area either superficially or deeply. They drain lymph from the genital areas, posterior part of the large intestine, abdominal wall, and legs.
- **Femoral Lymph Node :** They are Present in the upper thigh portion along the femoral veins just below the inguinal lymph nodes. They drain lymph from some of the genital parts, buttock, thighs, and the medial side of the leg.



Function

Lymph glands perform the following function

- They form lymphocyte (B-lymphocyte & T-lymphocytes) by multiplying the pre-existing lymphocytes.
- Lymph kills bacteria and other particular matter by phagocytosis using macrophages
- Spread of cancer cells to body are temporarily halted while penetrating through the lymph vessels to the lymph glands.
- They are mechanical filters preventing poisonous material to enter into the circulation.
- They produce y-globulin.

LYMPH VESSELS

- Lymph vessels are thin-walled, endothelial-lined channels.
- They arise near the capillary beds and act as a drainage system to return the interstitial tissue fluid and inflammatory cells to the blood.
- Afferent lymph vessels drain lymph into regional lymph nodes, which filter and provide immunologic surveillance of the lymph, its cells, and the foreign matter within.
- The filtered lymph flows into larger efferent lymph vessels, which drain the lymph into caval blood via thoracic duct.
- Both the lymph vessels and veins have valves that prevent the backflow of fluid

Lymph vessels have the following function

i. They help fluid transport.
ii. They aid in homeostasis.
iii. They transport dietary fat.
iv. They produce response to anticancer therapies

Lymphatic organs and tissue

The immune system is a complex system comprising of a meshwork of lymphatic organs, tissues, and cells. The organs and tissues involved in lymphatic system can be categorised as:

1) Primary lymphatic organs, and
2) Secondary lymphatic organs.

Primary Lymphatic Organs

The primary lymphatic organs serve as sites of production and maturation of lymphocytes.
They are discussed below :

1. **Red Bone Marrow :** The red bone marrow acts as site of production. of blood cells.It is soft, spongy, nutrient rich tissue present at the end of long bones (femur) or in flat bones (sternum, bones of skull etc) neutrophils, basophils, eosinophils, monocytes, and lymphocytes are some of the WBCs a the are produce in the marrow
   maturation of B-lymphocytes occur in red bone marrow White the T-lymphocytes mature in the thymus
2. **Thymus Gland :** the thymus gland is found in the upper thoracic cavity. Thymus is divided in to lobules by connective tissue . These lobules are rich in lymphocytes. The thymus gland produce thymic hormones eg : thymosin

Secondary lymphatic organs.

The Secondary lymphatic organs. Play a significant role in the immune system because they form the sites where lymphocytes reach and bind with antigens
They are discussed

1. **Spleen :** Spleen is present in the vertebrates and is closely related to the circulatory system. One of the major functions of spleen is the destruction of older RBCs. lt is a ductless gland, found in the upper. left area of the abdominal cavity and is partly divided into compartments. Every compartment comprises of tissues identified as white pulp and red pulp.
The white pulp is rich in lymphocytes, whereas the red pulp is known to assist the process of blood filtration.

Functions of Spleen

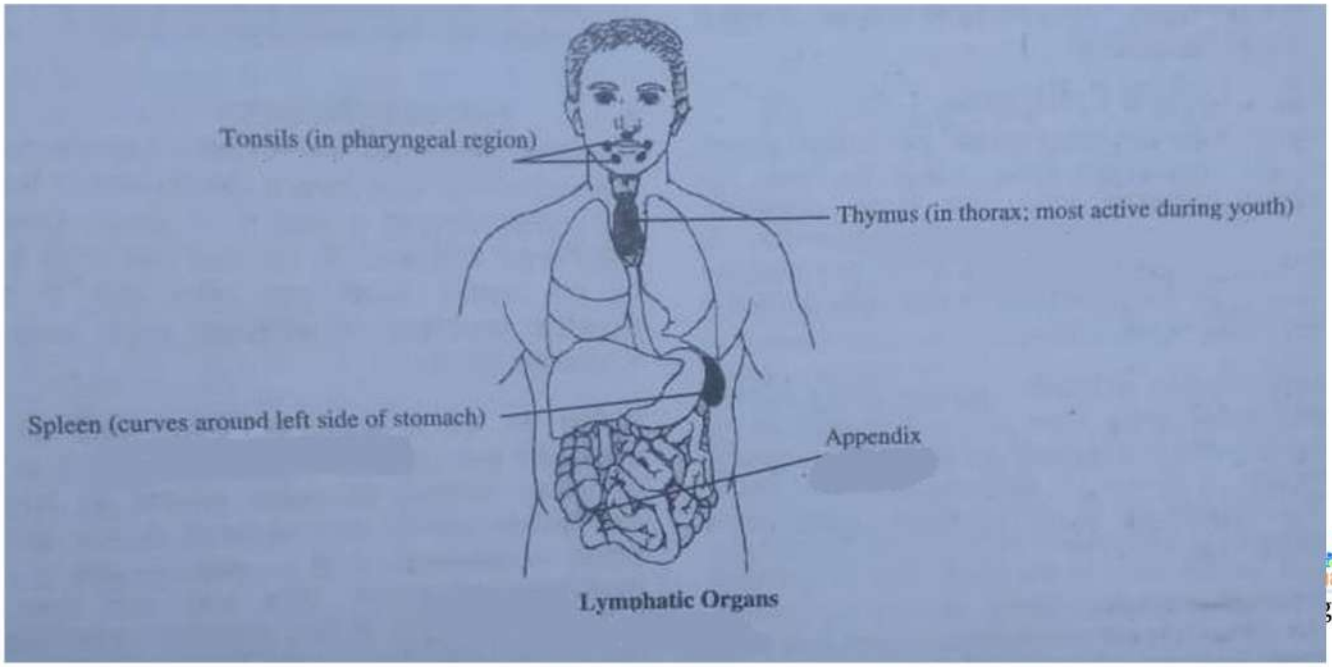
i) **Phagocytosis :** The splenic macrophages engulf worn-out red blood corpuscles, white blood corpuscles and platelets and cell debris and microorganisms.

ii) **Haemopoiesis :** In foetus, the spleen produces all types of blood cells except in adult it only produces lymphocytes.

iii) **Immune Response :** Similar to other lymphoid tissues, it is a centre where multiplication of both B-lymphocytes and T-lymphocytes occurs.

iv) **Storage of Erythrocytes :** Some erythrocytes (RBCs) are withdrawn from the blood circulation and stored in the spleen when the animal needs less oxygen. The spleen is also known as "blood bank" because it stores ery~ocytes and releases them into the blood circulation, when the animal requires more oxygen.

2. **Lymph Nodes :** Lymph nodes are oval-shaped small nodes that are positioned along the lymphatic vessels The structure of lymph nodes is like an internal honeycomb made up of connective tissues.It is rich in lymphocytes, which filter and destroy bacteria and viruses.
3. **Tonsils :** The tonsils exist as a ringed structure around the pharyax in three pairs. The pathogens and antigens entering the body through mouth or nose are initially interrupted by the tonsils.
4. **Peyer's Patches :** Peyer's Patchesare present in the walls of the intestine and the appendix, attached to the cecum of the large intestine . The pathogens that enter the body through the intestine tract are interrupted by the Peyer's Patches.

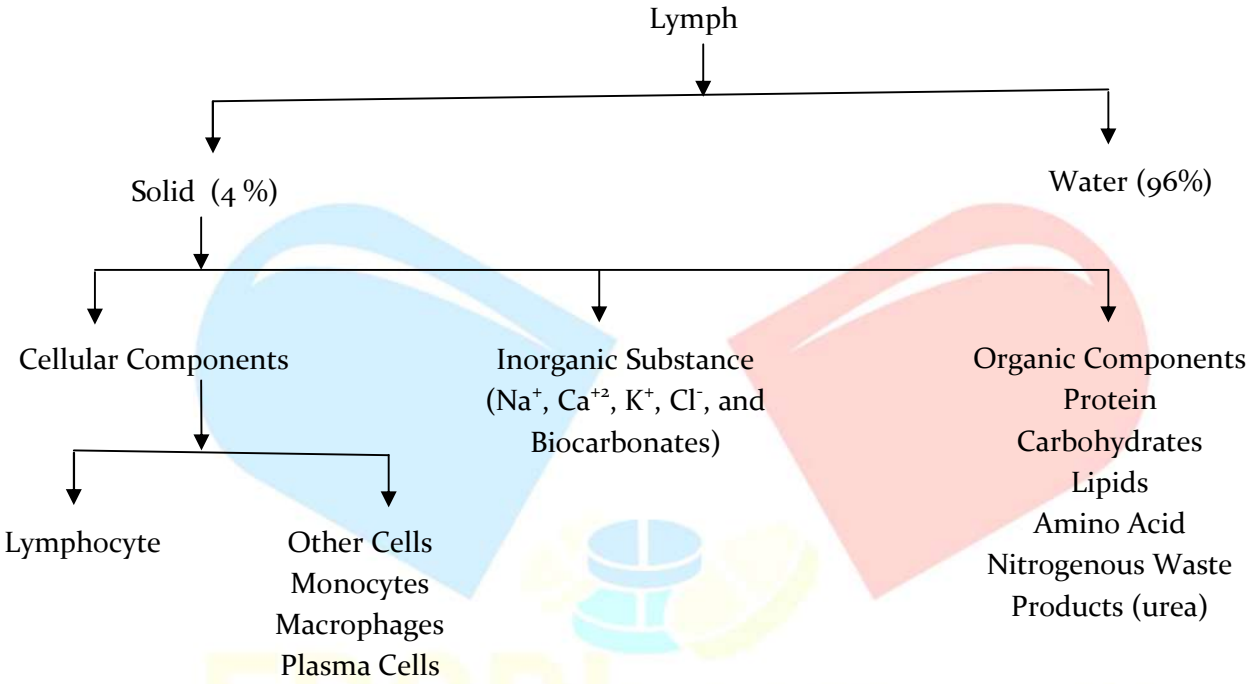


Lymphatic Organs

Lymph

Lymph is a clear watery fluid the composition of lymph is almost similar to the plasma and the intestinal fluid Lymph is made up of the following components.

Composition of Lymph



Function of lymph

1) Nutritive: Nutrition and oxygen is supplied to low blood areas
2) Drainage: Maintains constant volume and composition of tissue fluid removing excess fluid and metabolites.
3) Transmission of Proteins: Lymph carries proteins to the blood through tissue spaces.
4) Absorption of Fats: Intestinal fats are absorbed through the lymphatics.