The Lymphatic System

The lymphatic vessels or the lymphatic are a special system of drainage vessels. They absorb the excess protein from the interstitial fluid and return it to the bloodstream. Unlike the blood system, the lymphatic system is a continuous and open-ended.

Anatomy and Physiology

- made up of lymph fluid, the collecting ducts, lymph nodes, spleen, thymus, tonsils, adenoids, and Peyer patches
- accounts for 3% of the body weight
- provides a network of defense against the invasion of microorganisms
- placenta and brain do not have lymphatic vessels

Activities of the Lymphatic System

- movement of the lymph fluid
- production of lymphocytes
- production of antibodies
- phagocytosis
- absorption of fat and fat-soluble substances from the intestinal tract
- manufacture of blood when the primary sources are pathophysiologically compromised
- merges with the cardiovascular system (into the venous system at the right subclavian veins).

Distribution and Structure of Lymphatic Vessels

- lymph flows only towards the heart.
- lymph capillaries weave between the tissue cells and the blood capillaries of nearly all tissues and organs of the body.
- lymphatic capillaries are exceptionally permeable to proteins.
- in case of inflammatory process, the lymphatic capillaries develop openings that permit the uptake of even larger particles such as cell debris and pathogens.
- Lacteals are finger-like villi of the intestinal mucosa; they absorb digestive viscera (milky white in color), called Chyle which is delivered to the blood system via the lymphatic system.
Lymph Nodes

- usually occur in groups
- are small organs intimately associated with the lymphatic system
- are embedded in the connective tissue
- large clusters of lymph nodes occur near the body surface. For example, inguinal, axillary and cervical areas.
- within the lymph nodes are macrophages which engulf and destroy bacteria, cancer cells and other matter
- act as filters; they clean lymph before entering the blood
- lymphocytes located in the nodes, play an role in mounting an immune response.

Structure of a Lymph Node

- There are two histologically distinct regions in a lymph node:
  1.) Cortex - the germinal centre, where T lymphocytes and B lymphocytes are found
  2.) Medulla - medullary cords, where the macrophages are found
- Lymph nodes help the body get rid of infectious agents and cancer cells
- If large numbers of bacteria or virus particles are trapped in the nodes, the nodes become inflamed and very tender to touch.
- Lymph nodes can become secondary cancer sites, then spread through the body

Lymphocytes

- central to the body's response to antigens substances
- Maximum life expectancy is 200 days
- arise from the lymph nodes, tonsils, adenoids and spleen but mainly from the bone marrow (Stem cells)
- B lymphocytes produce antibodies
- T lymphocytes control the immune responses
Other Lymphoid Organs

**Spleen**
- the largest lymphoid organ
- located in the upper quadrant of the abdominal cavity, between the stomach and the diaphragm
- made up of:
  - White pulp - contains the lymphatic nodes and macrophages
  - Red pulp - venous sinusoids containing Red Blood cells (RBCs)
- removes aged or defective blood cells and platelets. The Fe$^{3+}$ is salvaged from the RBCs and stored. Therefore, it acts as a blood filter.
- site for RBC production in developing embryo
- produces RBCs in anemic conditions
- provides site for lymphocyte proliferation and immune surveillance and response

**Thymus gland**
- primarily functions during the early years of life
- secretes hormones for T lymphocytes to become immunocompetent (function against specific pathogens in the immune response)
- decreases in size in later years by old age it is replaced by fibrous and fatty tissue
- medulla of the thymus contains fewer lymphocytes and contains Hassal’s or thymic corpuscles (significance unknown)

**Tonsils**
- **Palatin tonsils** are on either side at the posterior end of the oral cavity. It is the largest of the tonsils and the most infected.
- **Lingual tonsils** are at the base of the tongue
- **Pharyngeal tonsil** are located at the posterior wall of the nasopharynx
- tonsils gather and remove many of the pathogens entering the throat region
- crypts trap the bacteria and particulate matter

**Peyer’s patches of the intestine**
- isolated clusters of the lymph nodes (similar to the tonsils)
- found in the distal portion of the small intestine
- captures and destroys bacteria, thereby preventing them from breaching the intestinal wall.
- Gut - associated lymphatic tissue are combination of Peyer’s patches and small lymphoid tissue. These protect the upper respiratory and digestive tracts.
Review of the Lymphatic System

1. ________________ is the fluid found in the lymph vessels.

2. Lymph nodes and nodules are both made up of ________________ tissue, which produces the WBCs called ________________ and ________________.

3. The Spleen is located in the ________________ cavity between the ________________ and ________________.

4. ________________ and ________________ are the two types of WBCs produced by the Spleen:

5. The Spleen will produce RBCs under ________________ condition.

6. ________________ is the largest lymph organ.

7. The lymphatic system is called ________________ system.

8. Name three functions of the Spleen:
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________

9. The lymph nodes became ________________ and ________________ when large amounts of bacteria or virus are trapped.

10. Name five activities of the lymphatic system:
    ___________________________________________________________________
    ___________________________________________________________________
    ___________________________________________________________________
    ___________________________________________________________________
    ___________________________________________________________________