Lymphatic System

A. Functions

 1. Defense

 2. Transportation of various substances back to cardiovascular system

 A) Lipids, lipid-soluble vitamins (A, E, D, K) & leaked proteins

 3. Draining of excess interstitial fluid

 A) Returns it to the bloodstream to assure adequate volume

B. Components

 1. Lymphatic Vessels

 A) Lymphatic capillaries

 1) Closed-ended with mini-valves

 a) Substances can flow in but not out

 b) Lymph

 2) Found interwoven between tissue capillaries and tissue cells

 3) Found in all tissues except bones & bone marrow, teeth and the central nervous

 system

 4) Lacteals – specialized lymphatic capillaries found in the intestinal mucosa within

 the villi

 B) Lymphatic collecting vessels

 1) Have the same structure as veins but thinner-walled and more valves

 2) Function as a conduit for lymph

 C) Lymphatic trunks

 1) Formed by the union of the largest collecting vessels

 2) Responsible for draining large areas of the body

 3) Often named for the region of the body where they receive lymph from

 a) Lumbar (2) , bronchomediastinal (2) , subclavian (2) , jugular (2), and

 intestinal (1)

 D) Lymphatic ducts

 1) Receive lymph from the trunks and deliver it to the bloodstream

 2) 2 ducts in the body

 a) Right lymphatic duct

 i) Receives lymph from right arm and the right side of the head and

 thorax

 ii) Empties into right subclavian vein

 b) Thoracic duct – larger of the 2

 i) Receives lymph from all other locations

 ii) Empties into left subclavian vein

 2. Lymphatic Transport

 A) Slow & sporadic

 B) Driven by same skeletal muscle and respiratory pumps that help venous return

 C) Smooth muscle within the lymphatic trunks and the thoracic duct also help pump

 lymph

 D) Accounts for about 3L/day (equal to the loss from the capillaries)

 3. Lymphatic Cells & Tissues

 A) Lymphatic cells

 1) Lymphocytes – warriors of the immune system arise in the bone marrow and

 mature into 1 of 3 types

 a) T Lymphocytes which attack and destroy foreign cells

 b) B Lymphocytes which become plasma cells that release antibodies

 c) Natural killer cells which kill cells that have been bound by antibodies or

 cells that exhibit abnormal traits

 2) Macrophages – engulf and destroy foreign cells

 3) Reticular Cells – similar to fibroblasts; produce reticular fibers that supports

 other cell types

 B) Lymphatic tissue

 1) Composed of reticular fibers with a large number of macrophage & lymphocytes

 2) Provides a site for lymphocyte proliferation and a surveillance vantage point for

 lymphocytes and macrophage

 a) Macrophage live on the fibers while lymphocytes “patrol” the spaces between

 them

 3) Predominant in all lymphatic organs except the thymus and red bone marrow

 a) 2 types of arrangements

 i) Diffuse lymphatic tissue – consist of a few scattered reticular elements &

 cells and is found in virtually every body organ

 (a) Most common in mucus membranes

 ii) Lymphatic nodules – solid spherical bodies consisting of tightly packed

 reticular elements and cells

 (a) Form part of lymph nodes

 (b) Isolated clusters are also found within the intestinal wall (Peyer’s

 patches) and in the appendix & tonsils

 C) Lymphatic organs

 1) Primary lymphatic organs

 a) Red bone marrow

 i) Site of leukocyte production

 b) Thymus

 i) Located between aorta and sternum

 ii) Site of T cell maturation

 2) Secondary lymphatic organs

 a) Lymph nodes

 i) Predominant lymphatic organs in the body

 (a) Found clustered along lymphatic vessels

 ii) Often deep in connective tissue but large clusters are located in the

 inguinal, axillary and cervical regions

 iii) Many macrophages & lymphocytes

 iv) Filter circulating lymph

 b) Spleen – largest lymphatic organ

 i) Served by the splenic artery and vein

 ii) Provides a site for lymphocyte proliferation, immune surveillance &

 response, and blood cleansing

 (a) Removes aged & defective formed elements

 iii) It has 3 other important functions

 (a) Stores products from the breakdown of RBC for later use (ex. iron)

 (b) Produces RBC in the developing fetus

 (c) Stores platelets

 c) Tonsils

 i) Protective rings of lymphatic tissue around the entrance to digestive and

 respiratory tracts

 ii) Appear as swellings of the mucosa

 iii) These trap bacteria and foreign matter where most are destroyed

 iv) Early exposure helps develop immunity

 v) Named for their location

 (a) Palatine

 (i) Found on both sides of the posterior oral cavity

 (ii) Largest and most often infected

 (b) Lingual

 (i) Cluster at the base of the tongue

 (c) Pharyngeal (adenoids)

 (i) Found on posterior wall of nasopharynx

 d) Aggregations of lymphatic nodules

 i) Found in **all** mucus membranes

 ii) Composed entirely of lymphocytes

 iii) 3 types of arrangements

 (a) Peyer’s patches – large clusters of lymphatic nodules found in the

 walls of the small intestine

 (b) Appendix – nodules heavily concentrated in the junction between the

 small intestine and large intestine

 (c) Mucosa-associated lymphatic tissue (MALT) – patches of lymphatic

 nodules in the walls of the digestive & respiratory tracts

C. Disorders of the Lymphatic system

 1. Elephantiasis – parasitic infection of the lymph nodes causing them to become clogged.

 Improper drainage of lymph results in massive edema, especially of lower regions of the

 body.

 2. Tonsillitis – inflammation of the tonsils usually caused by a bacterial infection

 3. Appendicitis – inflammation of the appendix usually caused by a bacterial infection

 4. Lymphoma – any tumor (benign or malignant) of lymphatic tissue

 A) Hodgkin’s disease (15%) – a malignancy of the lymph nodes

 B) Non-Hodgkin’s lymphoma (85%) – all cancers of lymphatic tissue except

 Hodgkin’s disease