CHAPTER 20.21 LYMPHATIC and IMMUNE functions

- Circulation: maintain blood volume
  - absorb excess fluid from tissues
  - return fluid to subclavian vein
- Defense: destruction of pathogens
  - produce lymphocytes
  - produce antibodies

Lymphatic structures

- Circulation:
  - lymph capillaries
  - lymphatic vessels
  - lymph ducts
- Lymphoid tissues: defense
  - lymph nodes
  - tonsils
  - MALT
  - spleen
  - thymus

General plan

- Excess tissue fluid forms from blood capillaries
- Tissue fluid absorbed into lymph capillaries = lymph
- Capillaries form lymph vessels
- Pass through lymph nodes for immune function
- Join to form lymph ducts
- Return lymph to subclavian veins

Lymph capillaries

- Function: absorb excess fluid from interstitial spaces
- Very permeable endothelium
  - One way flaps: fluid only flows in
- Also absorbs bacteria, virus, other cells
- Lacteals: lymph capillaries in small intestine
  - Absorb lipids

Lymph vessels

- Lymphatic collecting vessels
  - Collect from lymph capillaries
  - 2 or 3 tunics
- Lymph trunks
  - Formed from vessels
- Lymph ducts
  - 2 large ducts return lymph to blood
lymph ducts

• function: return fluid to subclavian veins
• main vessels:
  – thoracic duct
    – collects all except right upper quadrant
  – cisterna chyli
    → collects lower extremities and intestines
  – returns to left subclavian veins
  – right lymphatic duct
    – collects from right upper quadrant
    – returns to right subclavian vein

lymph nodes

• collection of lymphoid cells
• function: destroy pathogens
  filter lymph before return to blood
• afferent lymphatic vessels enters node
• efferent lymphatic vessels leaves node
• follicles lymphoid tissue
  • lymphocytes
  • macrophages

lymph plexus

• group of lymph nodes
• at attachments of head and extremities:
  – cervical plexus
  – axillary plexus (+ mammary plexus)
  – inguinal plexus
• most infections occur in extremities
• plexus protects against invasion of torso and blood

lymphoid tissue

• large collection of lymphocytes
• MALT = mucosa – associated lymphoid tissue
  – at mucus membranes and orifices
• tonsils
  – Palatine tonsils lateral wall of pharynx
  – Pharyngeal tonsil = Adenoid behind nose
  – Lingual tonsil base of tongue
  – tubal tonsils pharyngotympanic tube
• Peyer’s patches
  – line small intestine

Spleen

• largest lymph organ filters blood (not lymph vessels)

• 2 functions:
• destroy pathogens in blood:
  – white pulp lymphoid tissue
  – lymphocytes and macrophages
• destroy old RBC:
  • red pulp
    — macrophages
• splenic a and v.
• central artery branches to pulp areas

\[ \text{Thymus} \]

• 2 lobes
• posterior to sternum
• site of maturation of T lymphocytes
  — immunocompetence
  — self-tolerance
• most active to age 20
• does not fight pathogens!

\[ \text{defense systems} \]

• nonspecific defenses same against all pathogens
  — barriers skin, mucosa
  — phagocytes
• specific defenses attacks specific pathogen
  — adaptive defenses
  — memory $2^{nd}$ response stronger than $1^{st}$ = immunity

\[ \text{defense cells} \]

• phagocytes
  — neutrophils
  — tissue macrophages lymph nodes
  — fixed macrophages liver (kupffer cells)
  — connective tissues microglia
  — lung (alveolar macrophages)
• lymphocytes blood and lymph nodes

\[ \text{types of cells} \]

• T lymphocytes cellular immunity
  — helper T cells recognize foreign antigen
  — cytotoxic T cells destroy foreign cells
  — memory T cells $2^{nd}$ response much stronger
• B lymphocytes humoral immunity
  — plasma cells produce antibodies
  — memory cells $2^{nd}$ response much stronger

\[ \text{immunodeficiency} \]

• failure of immune response
• HIV = human immunodeficiency virus attacks T cells
• AIDS = acquired immune deficiency syndrome HIV positive plus symptoms
• Hodgkins lymph node cancers