Lec3 Summary. Cells and Organs of the Immune System

Created by; Dr. Mohammad Al-Zuraiqi

Lymphoid Organs Overview

- Lymphoid organs are distributed throughout the body.
- Interconnected by blood and lymphatic vessels that allow lymphocytes to circulate.
- Classified into:
    - Primary (central) lymphoid organs.
    - Secondary (peripheral) lymphoid organs.

Primary Lymphoid Organs

1. **Bone Marrow**:
    - All immune system cells originate from the bone marrow via hematopoiesis.
    - In the fetus, hematopoiesis starts in the yolk sac, then shifts to the liver and spleen. After birth, the bone marrow takes over.
    - B cells mature in the bone marrow.
    - T cells migrate to the thymus for further maturation.
2. **Thymus**:
    - Located in the anterior mediastinum, above the heart.
    - Largest just before birth and atrophies with age, reducing T cell production in adults.
    - Immature lymphocytes accumulate in the thymus around 90-100 days after fertilization.
    - Structure:
        - **Cortex**: Contains mostly immature T cells.
        - **Medulla**: Where mature T cells gather before leaving the thymus.
    - Mature T cells leave the thymus and migrate to secondary lymphoid organs.
    - **DiGeorge syndrome**: Caused by abnormal thymus development, resulting in T cell deficiency but normal B cells.

Secondary (Peripheral) Lymphoid Organs

- B cells mature in bone marrow and then migrate to secondary lymphoid tissues.
- T cells finish maturation in the thymus before moving to secondary lymphoid tissues.
- Some organs are capsulated (e.g., lymph nodes, spleen) and others non-capsulated (e.g., MALT).

1. **Lymph Node**:
    - Formed by interstitial fluid collected by lymph capillaries.
    - Lymph nodes act as sites where lymphocytes localize, trap, and recognize foreign antigens.
    - Major site for antibody production.
    - Located in neck, axillae, groin, mediastinum, and abdominal cavity.
    - Structure:
        - **Outer cortex**: B cell area, contains B cells.
        - **Inner medulla**: Contains plasma cells.
        - **Paracortical region**: T cell area.
    - Aggregates of B cells form follicles:
        - **Primary follicles**: Mature but resting B cells.
        - **Secondary follicles**: Activated B cells with germinal centers.
        - **Germinal centers**: Form in response to antigenic stimulation.

---

2. **Spleen**:
    - Largest lymphoid organ in the body, located in the left upper quadrant.
    - Filters blood, involved in antibody synthesis and release.
    - Plays a role in the phagocytosis of antibody-coated bacteria.
    - Individuals without a spleen are more prone to infections.
    - Structure:
        - **Red pulp**: Destroys aged platelets and erythrocytes.
        - **White pulp**: Contains T lymphocytes and B cells clustered around small arterioles (PALS).
    - Activation of B cells occurs between follicles and PALS.

---

3. **Mucosa-Associated Lymphoid Tissue (MALT)**:
    - More than 50% of the body's lymphoid tissue is associated with mucosal systems.
    - Includes:
        - **Gut-associated lymphoid tissue (GALT)**: Lines the intestinal tract.
        - **Bronchus-associated lymphoid tissue (BALT)**: Lines the respiratory tract.
        - Lymphoid tissues of the genitourinary tract.
    - Provides local immunity through IgA and IgE production.
    - Specialized epithelial cells (M cells) in the intestinal lining transport antigens to initiate immune responses.