



Tikrit University
College of Veterinary Medicine

Lect. 4-Immunology

Subject name: Anatomy and function of the lymphoid organs

Subject year:2024-2023

Lecturer name: Dr. Muthanna Ali Sultan and Assist.Prof.Dr. Agharid Ali Hussein

Academic Email:

agharidalrasheed@tu.edu.iq

muthanna.sultan@tu.edu.iq



SCAN ME

Lecturers link

IMMUNOLOGY

Lecture 4

Junior students

Dr. Muthanna Sultan
Assist.Prof.Dr.Agharid Ali Hussein
Academic Year 2023-2024

Anatomy and function of the lymphoid organs

Lymphoid tissues are classified as

1-Primary or central lymphoid organs or generative organs: which includes two organs

- 1- Bone Marrow
- 2- Thymus

Function of primary lymphoid organs:

- 1- These organs express receptors for antigens which are needed for phenotypic and functional maturity of lymphocytes (B cells and T cells)
- 2- Provide growth factors and other molecular signaling which are essential for the immune system

2-Peripheral or secondary lymphoid organs: which include

- 1- Spleen
- 2- Lymph node
- 3- Cutaneous immune system
- 4- Mucosal immune system

Function of secondary lymphoid organs

In these organs, the response of lymphocytes to the antigens initiated and developed

Bone Marrow

The Stages of maturation of **B cells** include:

1-Stage 1: B cells mature partially in the bone marrow

2- Stage 2: The B cells then enter the blood circulation

3- Stage 3: The B cells populate and complete their maturation in the secondary lymphoid organs (mainly in the spleen)

-Thymus

Stages of Maturation of **T cells**:

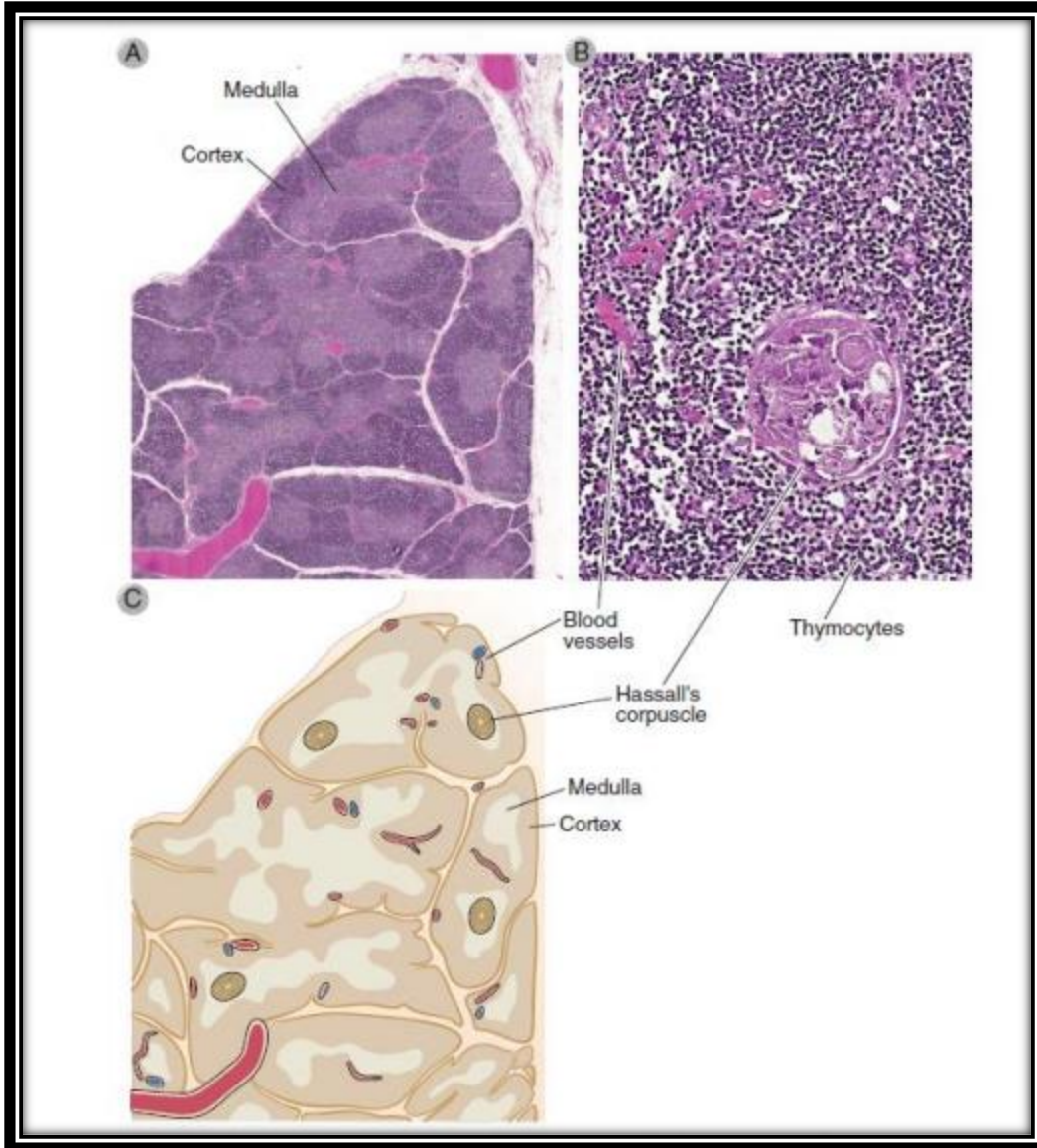
1-Stage 1: T cells mature in thymus

2-Stage 2: The T cells then enter the blood circulation

3-Stage 3: The T cells populate and complete their maturation mainly in the secondary lymphoid organs (Mainly lymph node)

What are the Thymocytes?

The lymphocytes in the thymus, also called **thymocytes**, which are T lymphocytes at various stages of maturation. The most immature cells enter the thymus, and their maturation begins in the cortex. As thymocytes mature, they migrate toward the medulla, so that the medulla contains mostly mature T cells.



The anatomic features of the Thymus

-Bone Marrow

Bone Marrow is the site of the generation of most circulating blood cells such as red blood cells , granulocytes , monocytes and the maturation of B cells (Partially).

, T cells and NK cells (All immune cells) They are all originate from common Hematopoietic stem cells (HSC)

Single HSC can generate different types of mature blood cells .

-Hematopoiesis

The generation of all blood cells, called hematopoiesis occurs initially during fetal development, during the early months of gestation.

-Lymph Nodes

Lymph nodes are encapsulated, vascularized secondary lymphoid organs with anatomic features that favor the initiation of adaptive immune responses to antigens carried from tissues by lymph which carried through the lymphatic vessels.

Lymph nodes are situated along lymphatic channels throughout the body and therefore have access to antigens encountered at epithelia and originating in interstitial fluid in most tissues.

What happened for lymphocytes (B and T cells) after they mature ?

Naive B and T cells are mature lymphocytes that have not been stimulated by antigen. When they encounter antigen, they proliferate, and differentiate into effector lymphocytes that have functions in protective immune responses.

Effector B lymphocytes are plasma cells that secrete antibody while effector T cells include cytokine-secreting CD4⁺ helper T cells and CD8⁺ cytotoxic T lymphocytes that secreting lymphocytes.

What is the function of lymph node?

Lymph nodes function characterized by removing debris and pathogens from the lymph, and are thus sometimes referred to as the “filters of the lymph”.

Any bacteria that infect the interstitial fluid are taken up by the lymphatic capillaries and transported to a regional lymph node.

Lymph node is a bean-shaped and are surrounded by a tough capsule of connective tissue and are separated into compartments by trabeculae.

What are the major routes in lymph node?

The major routes into the lymph node are via **afferent lymphatic vessels**. Cells and lymph fluid that leave the lymph node may do so by another set of vessels known as the **efferent lymphatic vessels**.

Lymphatic system

The lymphatic system, which consists of specialized vessels that drain fluid from tissues into and out of lymph nodes and then into the blood, is essential for tissue fluid homeostasis and immune responses.

What is the function of the lymphatic system ?

-The lymphatic system collects microbial antigens from their portals of entry and delivers them to lymph nodes, where they can stimulate adaptive immune responses.

Microbes/ antigens, Dendritic cells, and inflammatory mediators reach lymph nodes from the tissue.

What is the active part of the lymphatic system?

The active part of the system is lymph fluid which drains into networks of tiny capillaries in tissue spaces that unite to form larger vessels called lymphatics.

Lymph nodes (lymph glands) are the filtering and storage areas of the system, and they are scattered along the routes of the lymphatics.

What is the content of the lymph ?

Unlike blood, lymph is not pumped, instead it moves passively as lymphatics are compressed by contraction of surrounding muscles during movement.

Lymph fluid contains large numbers of specialized white blood cells, particularly lymphocytes, which protect the body against invading microbes

What is the function of afferent and efferent lymphatic vessels?

Afferent lymphatics empty into the subcapsular (marginal) sinus, and lymph may drain from there directly into the connected medullary sinus and then out of the lymph node through the efferent lymphatics. Beneath the inner floor of the subcapsular sinus is the lymphocyte-rich cortex.

What are the follicles? germinal centers? and what are the functions of these parts in lymphnode?

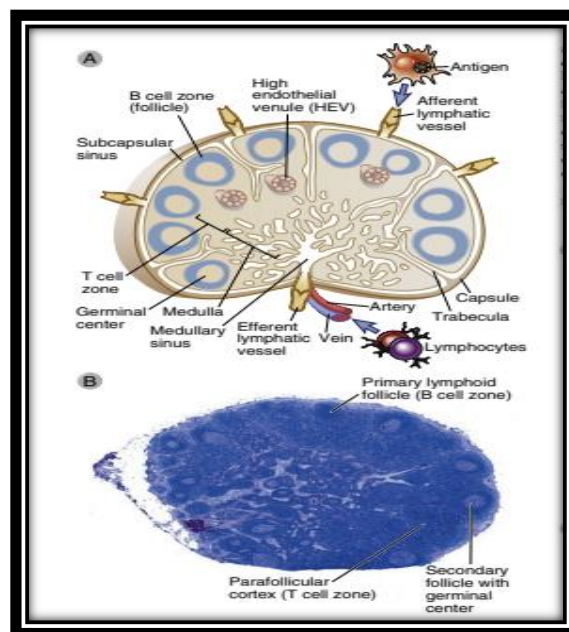
The outer cortex contains aggregates of cells called follicles. Some follicles contain central areas called germinal centers, which stain lightly with commonly used histologic stains. Each germinal center consists of a dark zone packed with

proliferating B cells called Centro blasts, and a light zone containing cells called centrocytes that have stopped

Follicles are the B cell zones follicles contain mostly mature naive B lymphocytes.

Germinal centers develop in response to antigenic stimulation as they are sites of remarkable B cell proliferation, selection of B cells producing high-affinity antibodies, and generation of memory B cells and long-lived plasma cells.

The cortex around the follicles is called the parafollicular cortex or paracortex and is organized into cords, which are regions with a complex microanatomy of matrix proteins, fibers, lymphocytes, and other components.



The anatomic features of the lymph node

Regional Immune Systems

All major epithelial barriers of the body, including the skin, gastrointestinal mucosa, and bronchial mucosa have Their own system of lymph nodes, nonencapsulated lymphoid structures, and diffusely distributed immune cells which work in coordinated ways to provide specialized immune responses against the pathogens that enter at those barriers.

The skin-associated immune system has evolved to respond to a wide variety of environmental microbes.

What is Mucosal Associated Lymphoid Tissue (MALT) ?

The components of the immune systems associated with the gastrointestinal mucosa and bronchial mucosa are called the mucosa-associated lymphoid tissue (MALT)

What is the function of the MALT?

involved in immune responses to ingested and inhaled antigens and microbes. The skin and MALT contain a large proportion of the cells of the innate and adaptive immune system