The Lymphatic System

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The Lymphatic System

Welcome to AusDBF eLearning module – The Lymphatic System.

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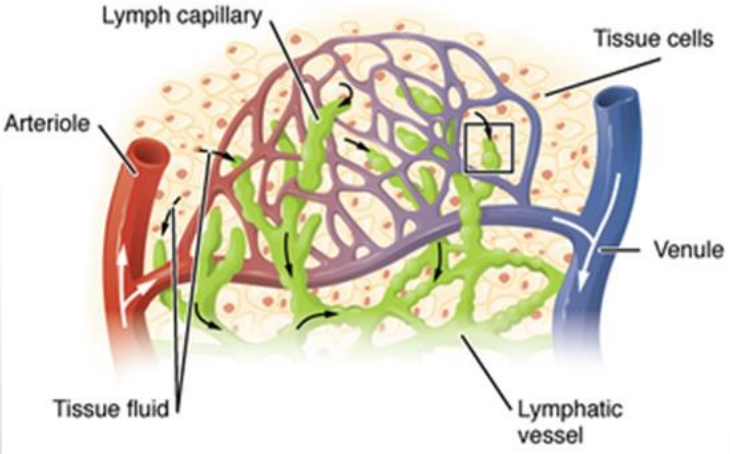
The Lymphatic System – An Introduction….

- The Lymphatic system is a system of vessels, cells and organs that carries excess fluids to the bloodstream and filters pathogens from the blood.
- Unlike the circulatory system, the lymphatic system is not a closed system.
- The lymphatic system is a system associated with the immune system to such a degree that the two systems are virtually indistinguishable.



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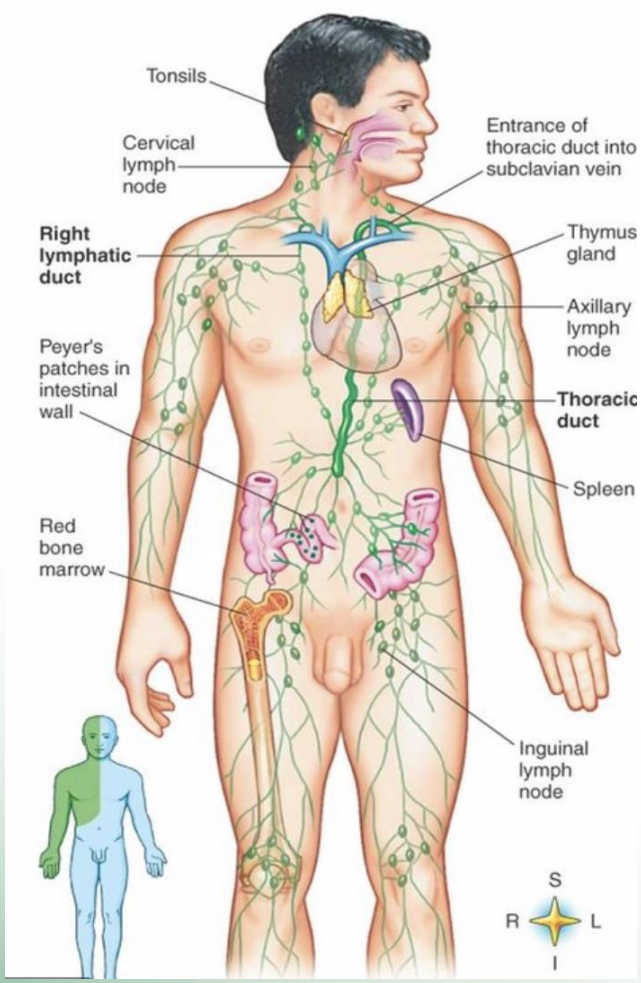
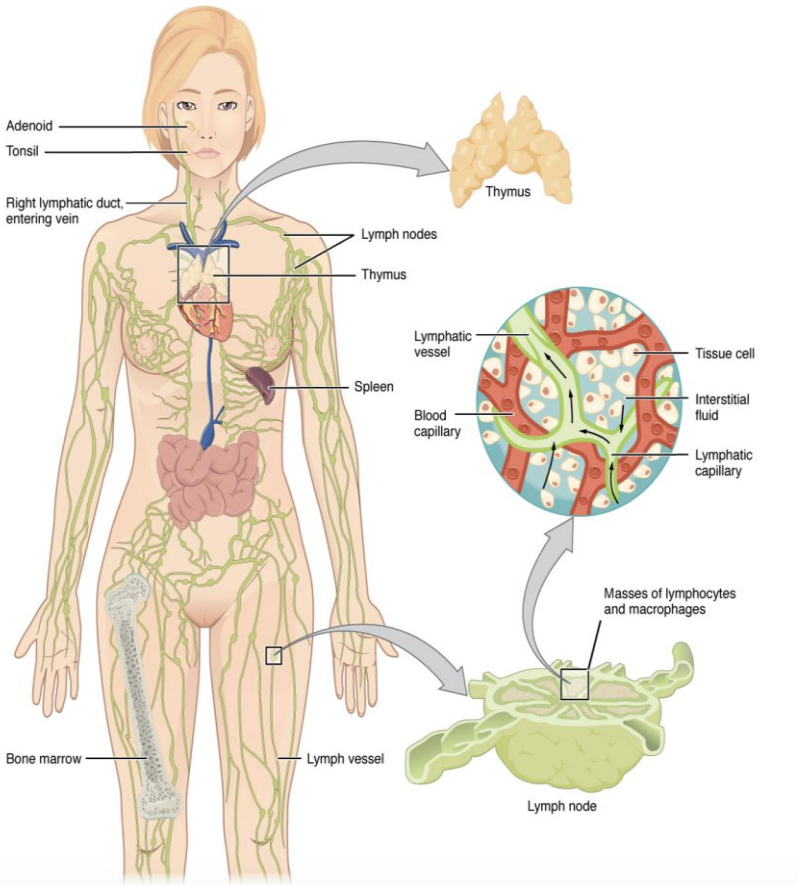
The Lymphatic System – An Introduction

- The other main function is that of immune defence.
- Lymph is very similar to blood plasma, in that it contains waste products and cellular debris, together with bacteria and proteins.
- It transports white blood cells to and from the lymph nodes
- The immune system is the complex collection of cells and organs that destroy or neutralises pathogens that would otherwise cause disease or death.

The Lymphatic System





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Functions of the Lymphatic System…..continued….

- The major function of the lymphatic system system is to drain body fluids and return them to the bloodstream.

- Blood pressure causes leakage (movement) of the fluid from the capillaries, resulting in the accumulation of fluid in the interstitial space. (the spaces between the cells in the tissues).

- Examples of the connections between these two critical organ systems are the swelling of lymph nodes during an infection and the transport of lymphocytes via the lymphatic vessels.

Structures & Functions of the Lymphatic System

LYMPHATIC CAPILLARIES

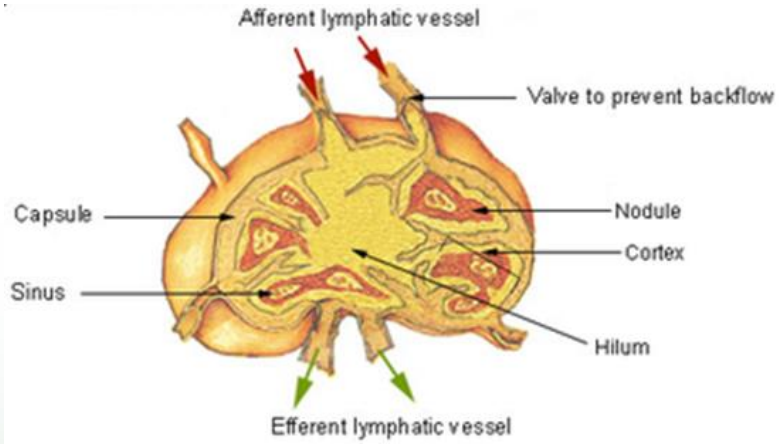
- are made of a one cell thick layer of enthothelial cells
- are mainly responsible for the absorption of interstitial fluid from the tissues, while lymph vessels propel the lymph fluid forward into the larger collecting ducts
- these vessels are found in every tissue of the body, and are interlaced among arterioles and venules of the circulatory system

- **Exceptions** - the following tissues do not contain lymph vessels – the central nervous system, bone marrow, bone, teeth and the cornea of the eye

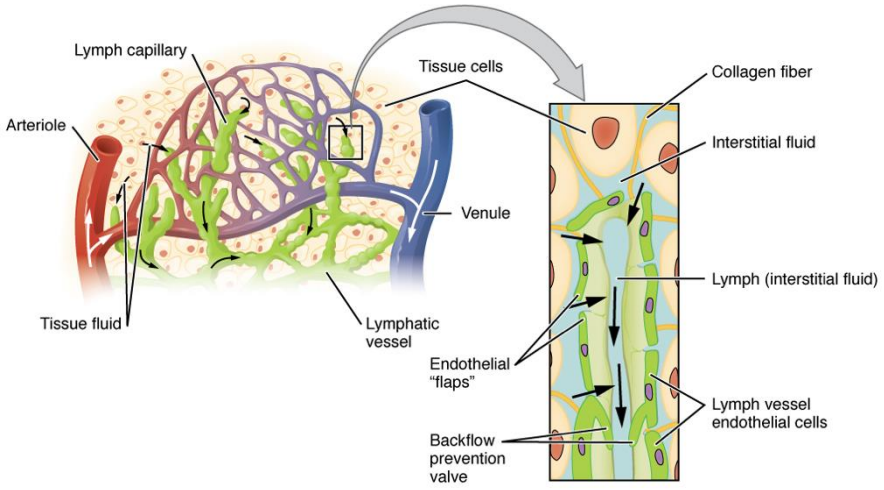
INTERSTITIAL FLUID

- is the plasma that is released into the the interstitial space of the tissues
- about 20 litres per day is released into the interstitial spaces per day in the human body

Structure of the Lymphatic System



Structure of a lymphocyte



Lymphatic capillaries, in the tissue spaces, interlaced with arterioles and venules

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Structures & Functions of the Lymphatic System

LYMPH

- is the term used to describe interstitial fluid once it has entered the lymphatic system
- travels through the LYMPHATIC VESSELS, which begin as open ended capillaries and feed into larger lymphatic vessels
- is not actively pumped through the vessels
- relies on the movements of the body, and skeletal muscles to keep the lymph moving
- the movement of lymph is assisted by one way valves (like those found in veins) that are found in lymphatic vessels
- along the way, the lymph travels through LYMPH NODES
- eventually the lymph empties into the bloodstream via a series of ducts

Structure & Functions of the Lymphatic System

LYMPH NODES

- are small bean-shaped organs located at intervals along the e lymphatic system
- humans have about 500-800 lymph nodes, with about 300 being located in the head and neck
- commonly grouped in clusters and found near the groin, armpits, neck, chest and abdomen
- are used as a major staging for a critical immune response
- act as a filter, and function to remove debris and pathogens from the lymph,
- are also the site of the adaptive immune response mediated by both B cells and T cells

Structures & Functions of the Lymphatic System

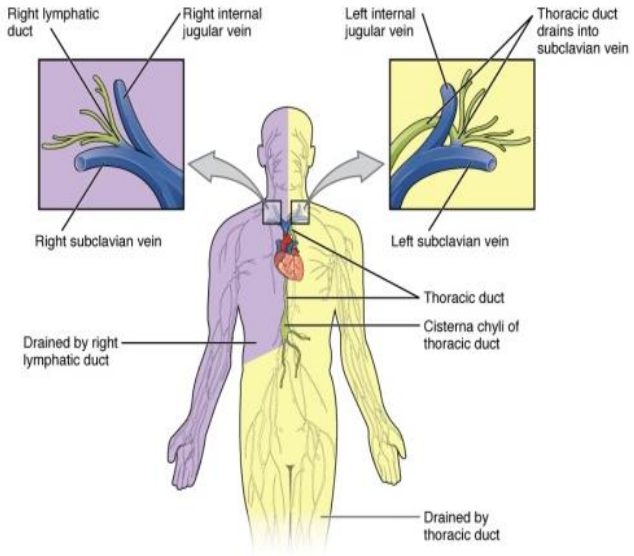
LARGER LYMPHATIC VESSELS, TRUNKS AND DUCTS

- the superficial and deep lymphatics merge and form larger vessels called LYMPHATIC TRUNKS

THE OVERALL DRAINAGE SYSTEM IS ASYMMETRICAL

The THORACIC DUCT drains a larger portion of the body than the RIGHT LYMPHATIC DUCT

eg. the right lymphatic duct receives lymph from only the upper right side of the body, lymph from the rest of the body enters the bloodstream through the thoracic duct via the remaining lymphatic trunks



Major trunks and ducts of the lymphatic system

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Structures & Functions of the Lymphatic System

PERIPHERAL LYMPHOID ORGANS

- include lymph nodes and the spleen, maintain mature naive lymphocytes and initiate an adaptive immune response.

LYMPHOCYTES

- are the primary cells used in the immune responses
- there are two types of lymphocytes - B cells & T cells
- both are found circulating through the blood stream and lymph
- the human body has many, many, (10^{12}) lymphocytes

BONE MARROW

- is responsible for the creation of both types of lymphocytes, the **T cells** and the production and maturation of **B cells**

Structures & Functions of the Lymphatic System

B CELLS

- are immune cells
- there primary function is to produce antibodies (mature in the red bone marrow)
- from the bone marrow, B cells immediately join the circulatory system and travel to secondary lymphoid organs in search of pathogens

T CELLS

- do not secrete antibody, but perform a variety of functions in the adaptive immune response
- travel from the bone marrow to the thymus to further develop and mature
- mature T cells then join B cells in search of pathogens.

Structures & Functions of the Lymphatic System

THE SPLEEN

- is a major secondary lymphoid gland
- functions as the location of immune responses to blood-borne pathogens
- the main function is to produce immune cells to fight antigens
- to remove particulate matter and aged blood cells (mostly RBCs)

TONSILS

- are lymphoids nodules are located on the inner surface of the pharynx (throat)
- important in developing immunity to oral pathogens
- swelling of the tonsils indicates an active immune response

DEFICENCIES OF THE LYMPHATIC SYSTEM

THYMUS

- The loss or inefficiency of the thymus results in severe immunodeficiency and subsequent high susceptibility to infection.

LYMPHEDEMA

- the inappropriate accumulation of fluid , due to damage of the lymphatic system due to being blocked by cancer type cells, or injury

The Immune System – An introduction

The lymphatic system plays a major role in the body's immune system, as the primary site for cells relating to adaptive immune system including T-cells and B-cells.

Cells in the lymphatic system react to antigens found by the cells directly.

When an antigen is recognized, an immunological cascade begins involving the activation and recruitment of more and more cells, the production of antibodies and cytokines and the recruitment of other immunological cells such as macrophages.

The Immune System – An introduction…..

The study of lymphatic drainage of various organs is important in the diagnosis, prognosis, and treatment of cancer.

The lymphatic system, because of its closeness to many tissues of the body, is responsible for carrying cancerous cells between the various parts of the body in a process called metastasis**.**

The intervening lymph nodes can trap the cancer cells. If they are not successful in destroying the cancer cells the nodes may become sites of secondary tumours.

Lymphedema

LYMPHEDEMA

- is the swelling caused by the accumulation of lymph, which may occur if the lymphatic system is damaged or has malformations.

- usually affects limbs, though the face, neck and abdomen may also be affected.

- in an extreme state, called elephantiasis, the oedema progresses to the extent that the skin becomes thick with an appearance similar to the skin on elephant limbs.

Enlarged Lymph Nodes

LYMPHADENOPATHY

- refers to one or more enlarged lymph nodes.
- small groups or individually enlarged lymph nodes are generally reactive in response to infection or inflammation

GENERALISED LYMPHADENOPATHY

- when many lymph nodes in different areas of the body are involved
- may be caused by infections that have arrived via the lymphatic system, such as ……..
  - infectious mononucleosis,
  - tuberculosis
  - HIV,
  - connective tissue diseases such as SLE (Systemic Lupus Erythematosus), rheumatoid arthritis,
  - cancers, including both cancers of tissue within lymph nodes, and metastasis of cancerous cells from other parts of the body

Cancer of the Lymphatic System

Cancer of the lymphatic system can be primary or secondary.

LYMPHOMA

- refers to cancer that arises from lymphatic tissue
- **lymphoid leukaemias** and **lymphomas** are now considered to be tumours of the same type of cell lineage, and often grouped together under the name lymphoid malignancy.

THEY ARE CALLED …..

- **leukaemia** when in the blood or marrow
- **lymphoma** when in lymphatic tissue

Cancer of the Lymphatic System

LYMPHOMA

is generally considered as either Hodgkin lymphoma or Non-Hodgkin Lymphoma

HODGKIN LYMPHOMA

- is characterised by a particular type of cell, called a Reed–Sternberg cell

NON-HODGKIN LYMPHOMA

- is a cancer characterised by increased proliferation of B-cells or T-cells
- generally occurs in an older age group than Hodgkin lymphoma

LYMPHOID LEUKAEMIA

- is another form of cancer where the host is devoid of different lymphatic cells.

Other Diseases of the Lymphatic System

- Castleman's disease
- Chylothorax
- Kawasaki disease
- Kikuchi disease
- Lipedema
- Lymphangitis
- Lymphatic filariasis
- Lymphocytic choriomeningitis
- Solitary lymphatic nodule

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click on the URL link below to view a short video of
The Lymphatic system.
When the video is completed please return and go to the
next slide in this presentation.

https://youtu.be/6odamTc71gk