The Lymphatic System

- To review the Case Study of a collapsed patient
- To describe the movement of fluid from the capillaries into the interstitial fluids.
- To identify the different types of pressures involved in that movement.
- To describe the major features of the lymphatic system.
- To recognize the function of the lymphatic system.

Case Study

**Phlebitis** – inflammation of a vein with painful throbbing and redness of the skin. Can be caused by bacterial infection or local physical trauma.

>>> Progressed to **Pulmonary Embolism**
Obstruction of a blood vessel in the lungs i.e. a life threatening blood clot.

Progression of the Clot

- Popliteal Vein
  - Femoral vein
    - External Iliac Vein
      - Common Iliac Vein
        - Inferior Vena Cava
          - Right Atrium
            - Right ventricle
              - Pulmonary Trk
                - Pulmonary Art

The Movement of Fluids in the Capillaries

Substances move from the blood to the interstitial fluids by **diffusion**.

Hydrostatic Pressure: Pressure on capillary walls by fluids.
- **HPc** – Fluids forced through capillary walls.
- **HPif** – Opposing action of interstitial fluids.
- **OPif** – Osmotic pressure created by interstitial solute.
- **Opc** – Colloidal Osmotic pressure – differences due to presence of large proteins in the blood.

The Net Movement of Fluids

**NFP** = (HPc – HPif) – (Opc – OPif)

*Net Filtration Pressure*

- Arterial NFP – Positive (fluids move out)
- Venous NFP – Negative (fluids move in)

A pressure gradient exists that moves fluids out of the capillaries into the tissue at the arterial end.
Lymphatic System

The capillary fluid that doesn’t flow back into the venous end (of the capillary) becomes lymph.

How are lymph and plasma different?
Answer: Lymph only flows towards the heart. Lymph is more dilute than plasma. Lymph contains some proteins, but plasma will have a higher concentration.

Function of the Lymphatic System

I. Lymph Vessels:
   > Transport interstitial fluids back to circulatory system.

II. Lymphoid tissues and organs.
   > House phagocytic cells and lymphocytes.
   > Filter the lymph (nodes)

Path of the lymph

Lymphatic capillaries (single layer of endothelium)
   > Collecting vessels
   > Collecting trunks
   > Lymph ducts
   > Lymphatics (have valves)
I. R. lymphatic duct (upper body) -
II. Thoracic duct (lower)
Cells composing the Lymphatic System

Lymphocytes
- **Macrophages** – eat foreign substances & activating T cells
- **T cells** – manage the immune response and some attach and destroy foreign cells.
- **B cells** – Protect the body by making plasma cells – daughter cells that secrete antibodies into the blood or other body fluids.

Organs of the Lymphatic System

Lymph Nodes
Spleen
Thymus
Tonsils
Peyer’s Patches (in small intestine)

* Know locations of each

Immune System

Cells such as:
- Macrophages
- B cells
- T cells
  - AND molecules called **antibodies**

That **work together** to combat microbial invasion of the body.
Your body’s system of defense.

Examples of Microbes

Pathogens – disease causing organisms.

I. Bacterial: Salmonella, Tuberculosis, Syphilis, Black Plague, Gonorrhea
II. Viral: Smallpox, herpes, cold, polio, herpes
III. Protozoan: Giardia, Malaria
IV. Fungal: Yeast, athlete’s foot, ringworm
Non-specific response

1) Skin & Mucous membranes
2) Phagocytes – first line of cellular response by *macrophages.*
3) Natural Killer cells – target cancerous cells or viral infected cells for immediate destruction.
4) Inflammation – isolate and repair after trauma WBC’s move in to attack.
5) Fever