# Circulatory disturbances

**Lecture 6**

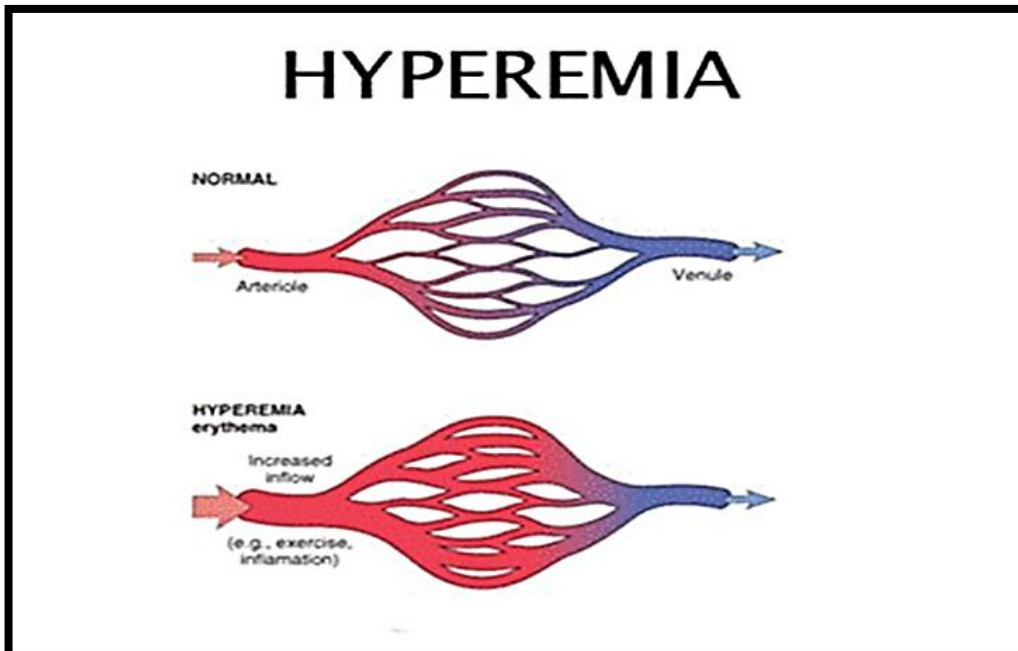
**2023-2024**

# Hyperaemia

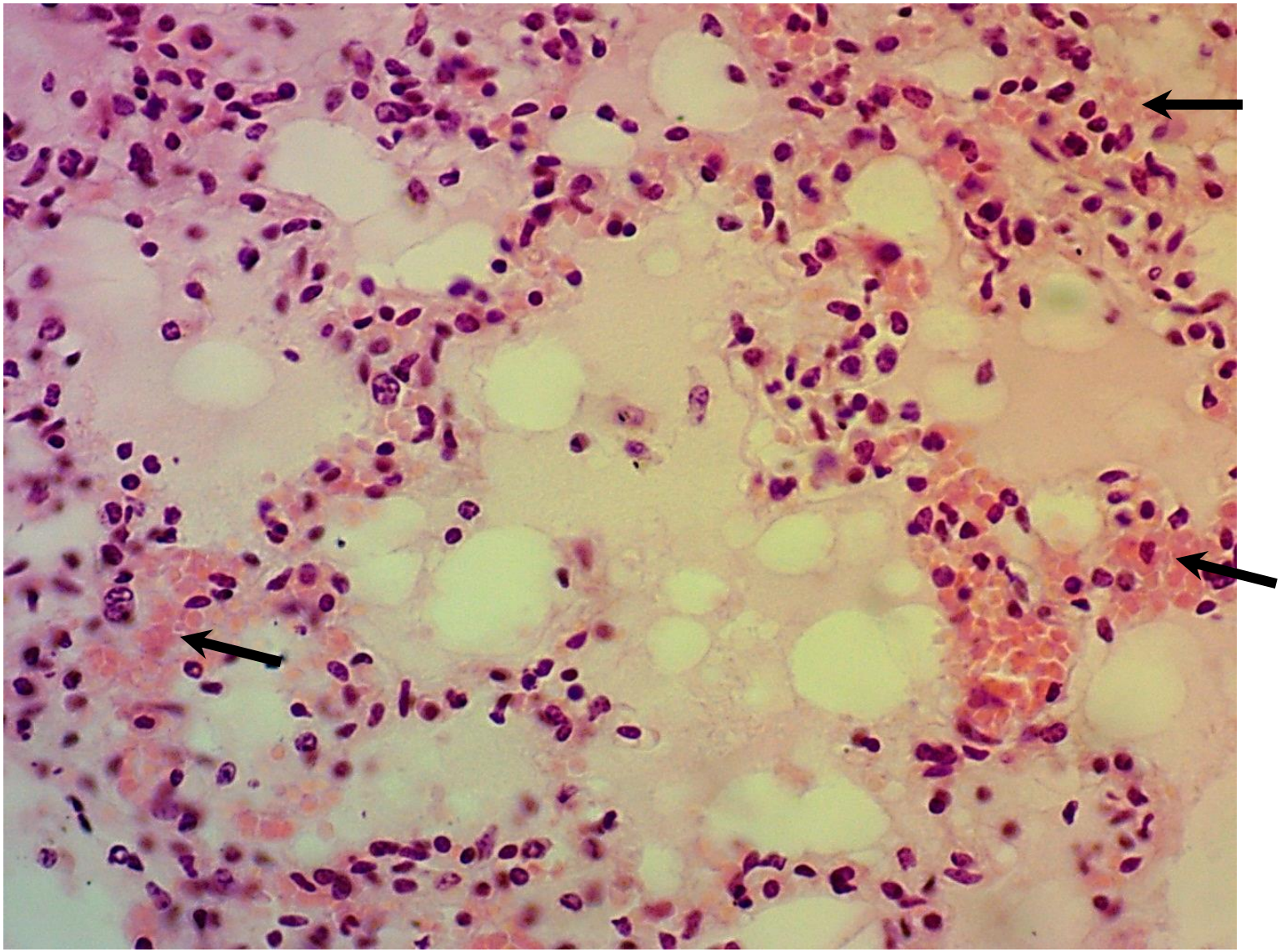
- Definition: Hyperemia is an active process in which arteriolar dilation leads to increased blood flow to a tissue/organ.
- The affected tissue or organ is pink or red in appearance (erythema).

# Causes

- **Physiological:** Response to increased functional demand (e.g. heart and skeletal muscle during exercise).
- **Pathological:** Seen in **inflammation**



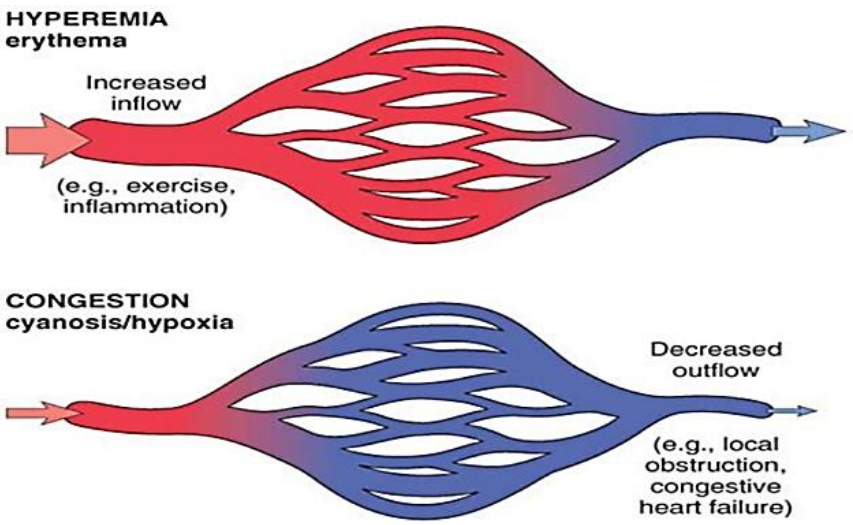
# Lung, Hyperemic section



# Congestion (venous congestion)

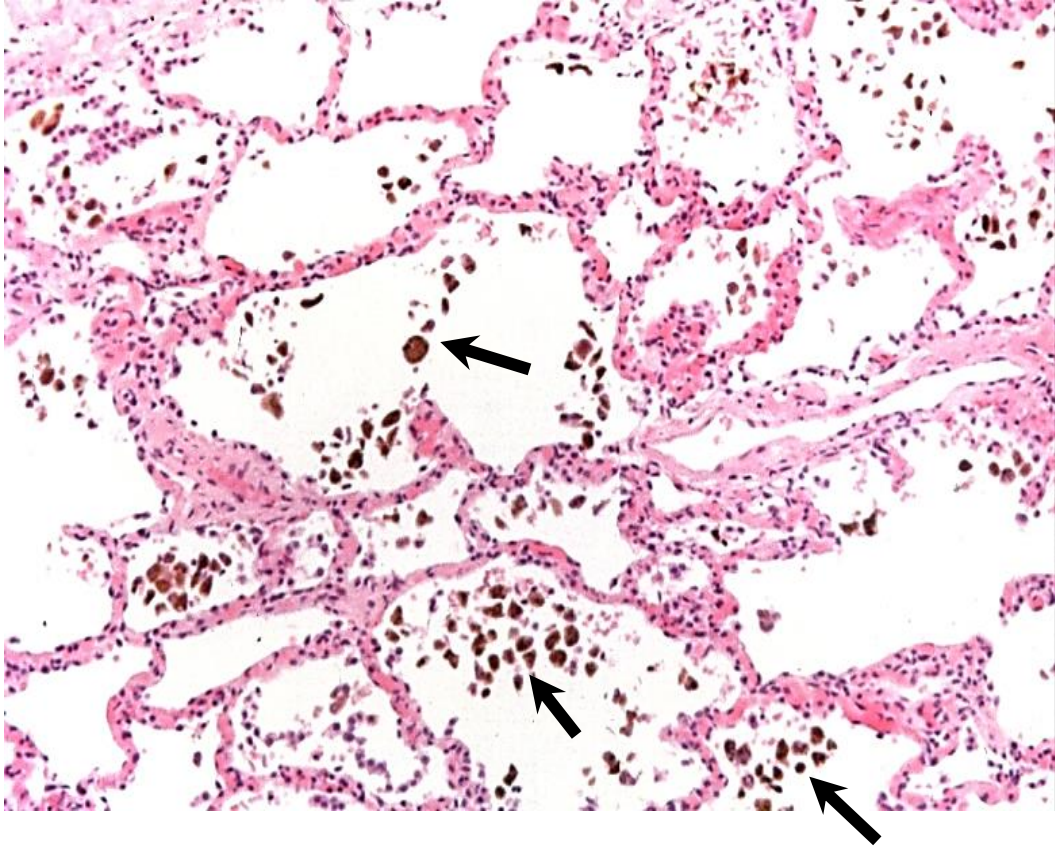
Definition: Congestion is a passive process resulting from reduced venous outflow of blood from a tissue/organ.

Appearance: Congested tissues have a dusky reddish-blue color (cyanosis) due to stasis of RBCs and the accumulation of deoxygenated hemoglobin.



Chronic passive congestion, lung.

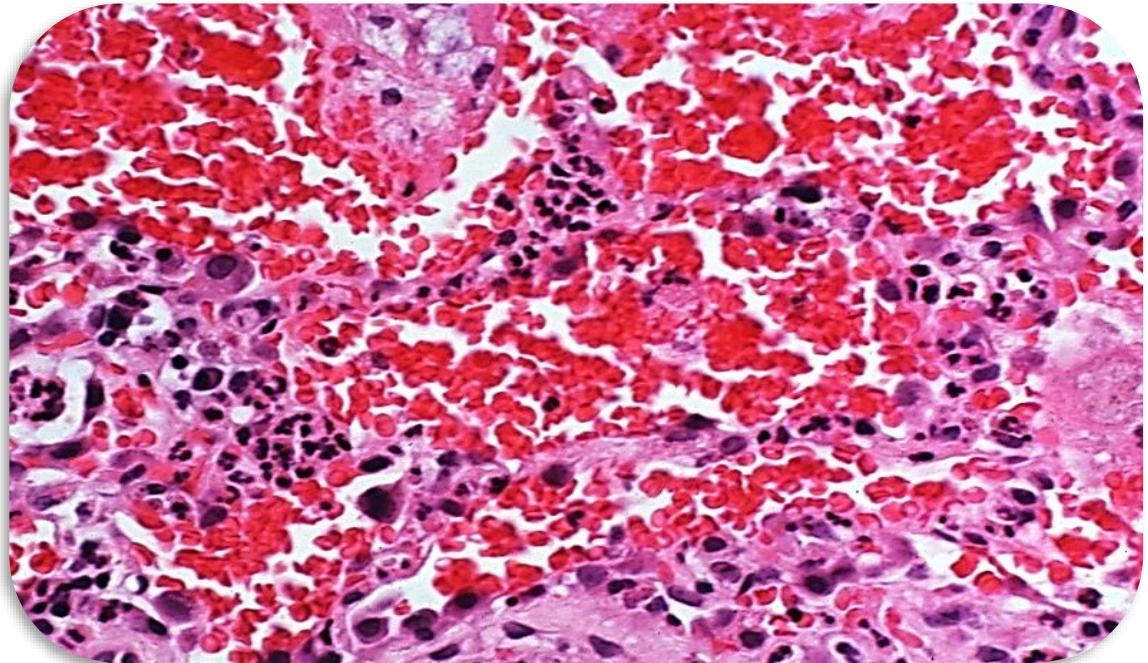
The lungs are moderately firm and yellow-brown because of alveolar macrophages containing hemosiderin



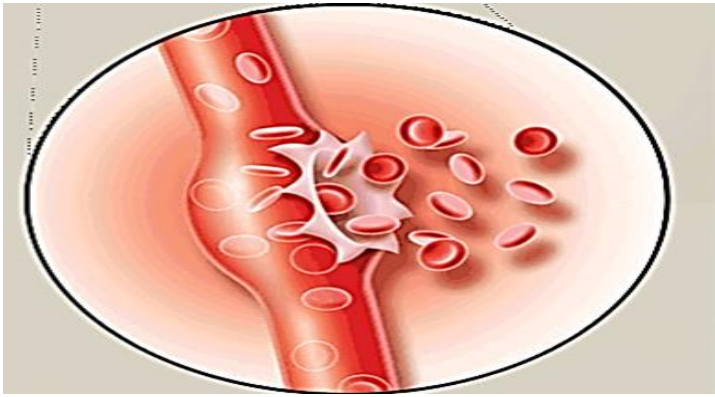
**Heart failure cells:**
Hemosiderin-laden macrophages (arrows)

# Hemorrhage

Hemorrhage is the escape of blood from a blood vessel. The bleeding may occur externally, or internally into the serous cavities (e.g. hemo-thorax, hemo-peritoneum, hemo-pericardium), or into a hollow viscus.



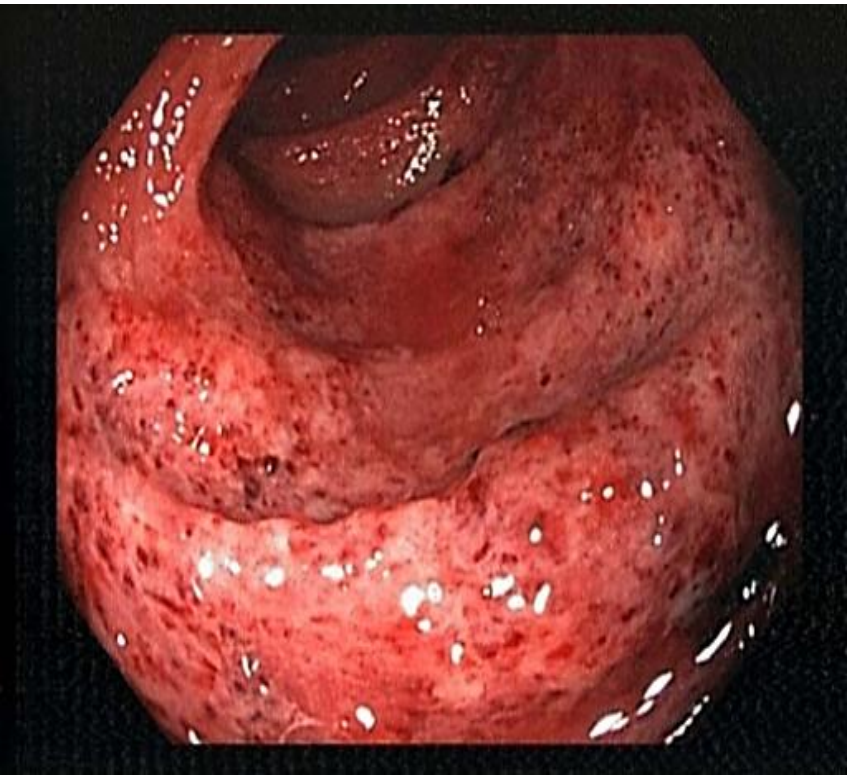
# Causes



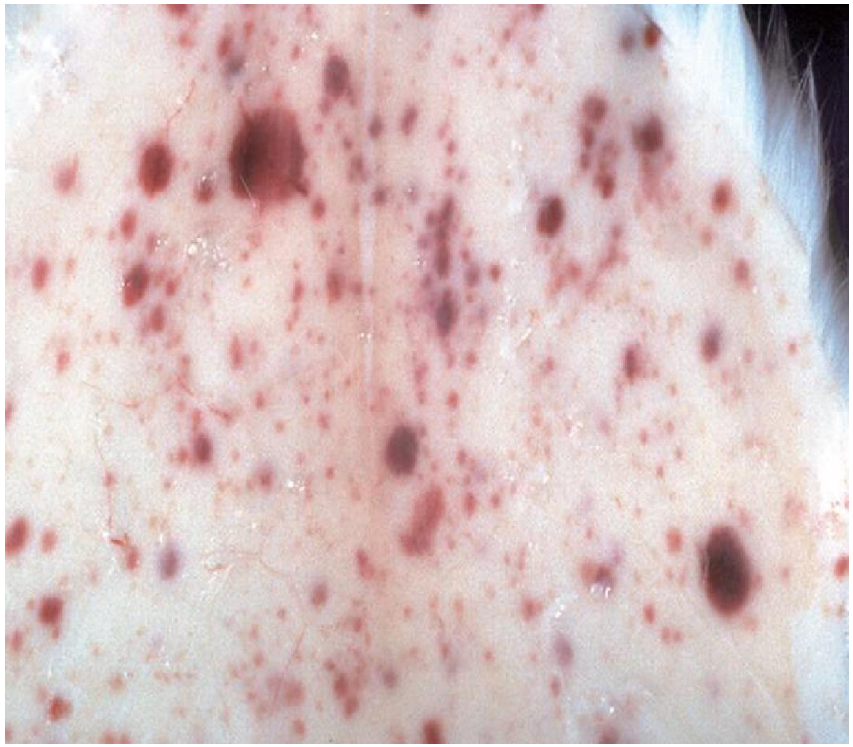
1. Trauma to the vessel wall
2. Inflammatory lesions of the vessel wall e.g. bleeding from chronic peptic ulcer
3. Neoplastic invasion
4. Vascular diseases e.g. atherosclerosis.
5. Elevated pressure within the vessels e.g. cerebral and retinal hemorrhage in systemic hypertension.

# Types of hemorrhages

## Petechial hemorrhages



## Ecchymotic hemorrhages

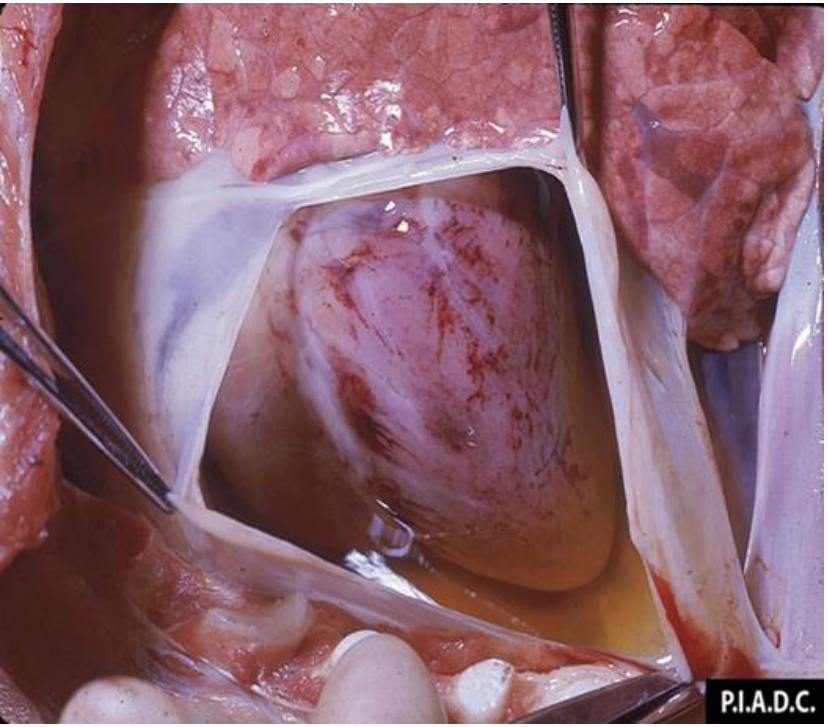


# Edema (oedema)

Definition: An abnormal accumulation of fluid in the interstitial space within tissues is called edema.

- Extravascular fluid can also collect in body cavities and such accumulations are often referred to collectively as effusions.
- Examples include effusions in the pleural cavity (hydrothorax), the pericardial cavity (hydropericardium), or the peritoneal cavity (hydroperitoneum, or ascites).

# Hydropericardium




**Anasarca** is **severe, generalized edema** marked by profound swelling of subcutaneous tissues and accumulation of fluid in body cavities.

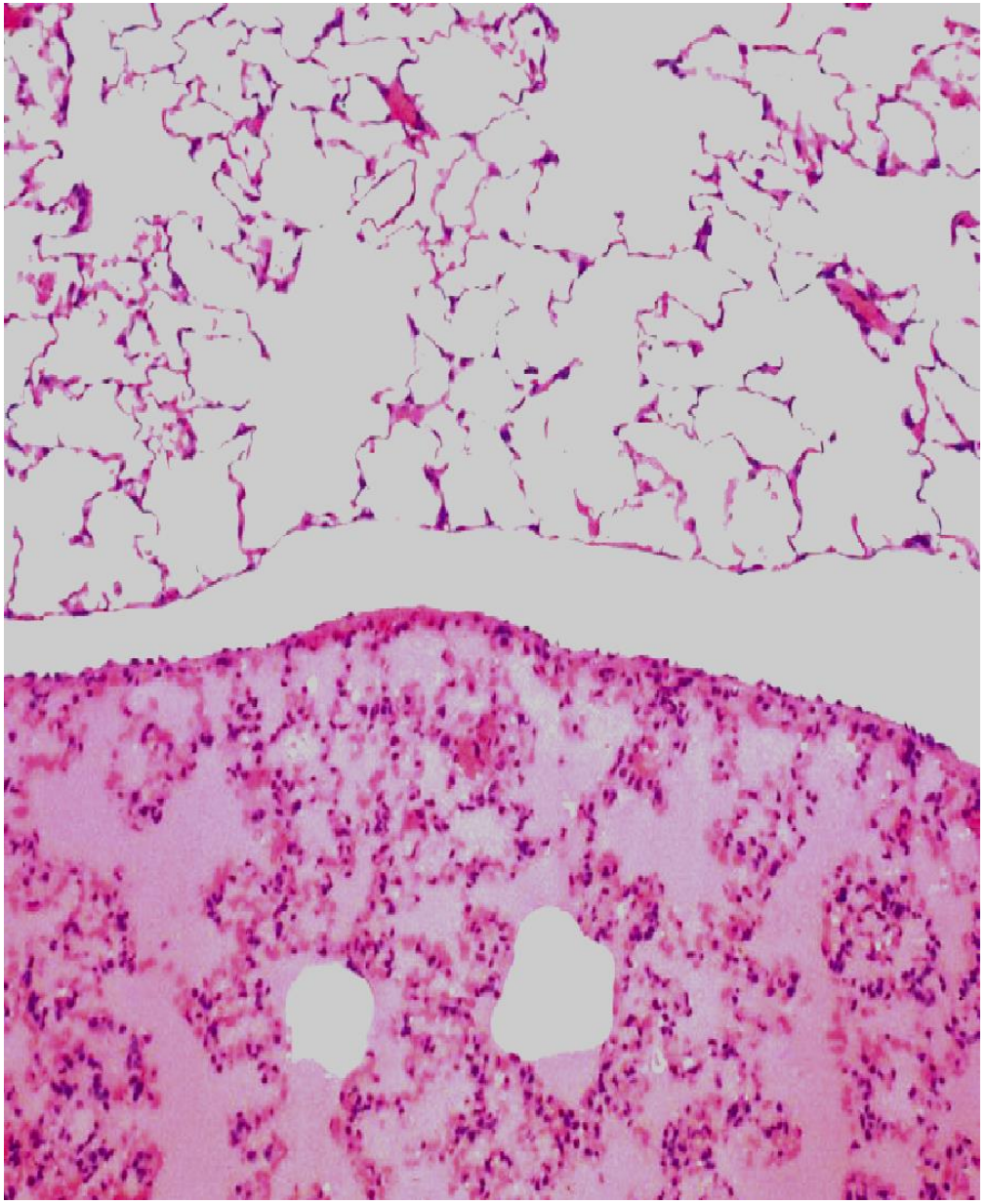
# Causes of Edema

**Edema may be caused by:**

1. Increased hydrostatic pressure (e.g., heart failure)
2. Increased vascular permeability (e.g., inflammation)
3. Decreased colloid osmotic pressure resulting from reduced plasma albumin
4. Decreased synthesis (e.g., liver disease, protein malnutrition)
5. Increased loss (e.g., nephrotic syndrome)
6. Lymphatic obstruction (e.g., inflammation or neoplasia)
7. Sodium retention (e.g., renal failure)

Pulmonary edema, lung.

Histologically, edema is an amorphous, pale eosinophilic fluid, and the depth of the eosinophilia is proportional to its protein content. The fluid in this specimen has a high protein content.



# Shock (Cardiovascular Collapse)

Definition: Shock is a life-threatening clinical syndrome of cardiovascular collapse characterized by:

- An acute reduction of effective circulating blood volume (hypotension).
- An inadequate perfusion of cells and tissues (hypoperfusion).
- If uncompensated, these mechanisms may lead to impaired cellular metabolism and death.

# Shock (Cardiovascular Collapse)

Shock represents the final event for a number of potentially lethal clinical conditions including:

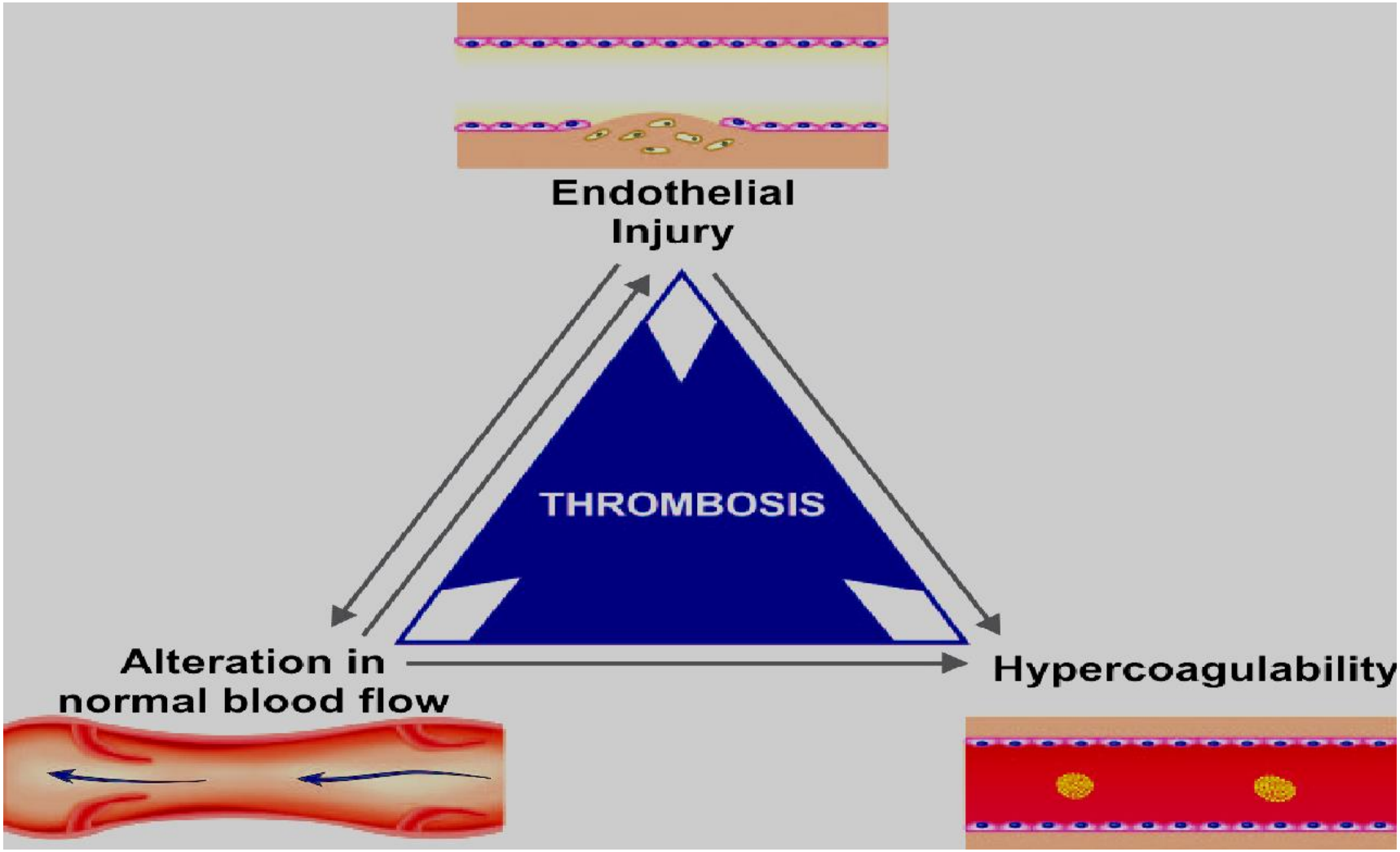
- Loss of blood: e.g. massive hemorrhage.
- Loss of plasma: e.g. severe burns.
- Loss of fluid: Vomiting, diarrhea, ect…
- Myocardial damage
- Neurogenic shock can result from a loss of vascular tone associated with anesthesia or secondary to a spinal cord injury.

# Thrombosis

Definition: Thrombosis is defined as the process of formation of a solid mass in the circulating blood from the constituents of flowing blood.

Three primary abnormalities can lead to formation of a thrombus and constitute Virchow's triad. These include:

1. Injury to endothelium (changes in the vessel wall)
2. Stasis or turbulent blood flow (changes in the blood flow)
3. Hypercoagulability of the blood (changes in the blood itself).

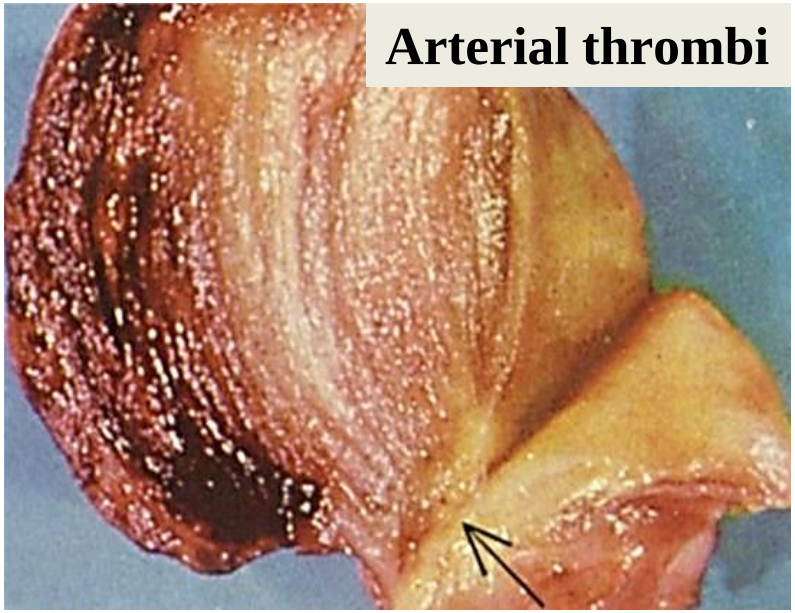


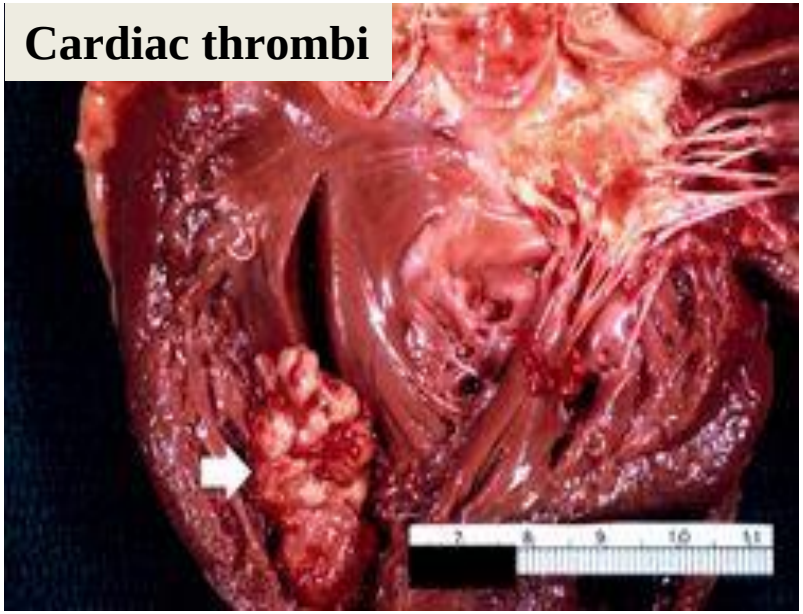

Virchow’s triad in thrombosis. 1) Endothelial injury is the most important factor, 2) Alteration in blood flow (stasis or turbulence) and 3) Hypercoagulability

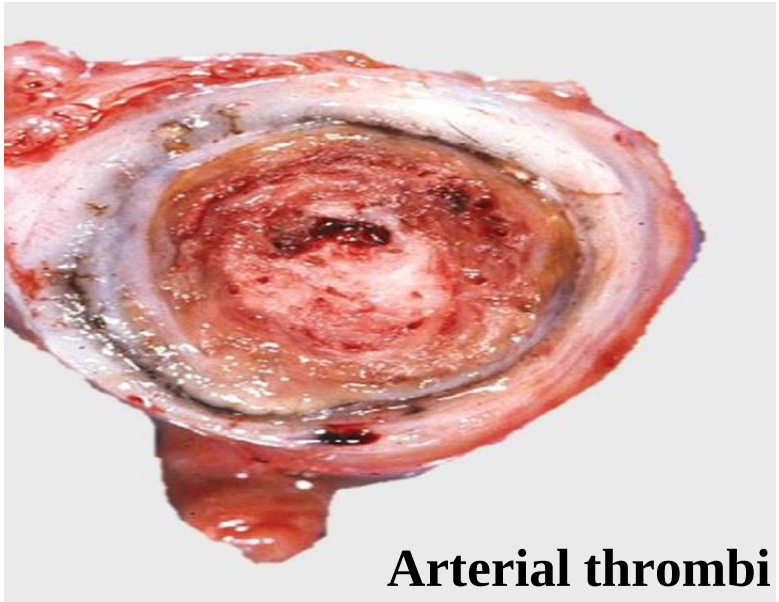
# Morphologic features

- Grossly, thrombi may be of various shapes, sizes and composition depending upon the site of origin.
- Arterial thrombi tend to be white and mural.
- Venous thrombi are red and occlusive.
- Mixed or laminated thrombi are also common and consist of alternate white and red layers called lines of Zahn.
- Red thrombi are soft, red, and gelatinous whereas white thrombi are firm and pale.

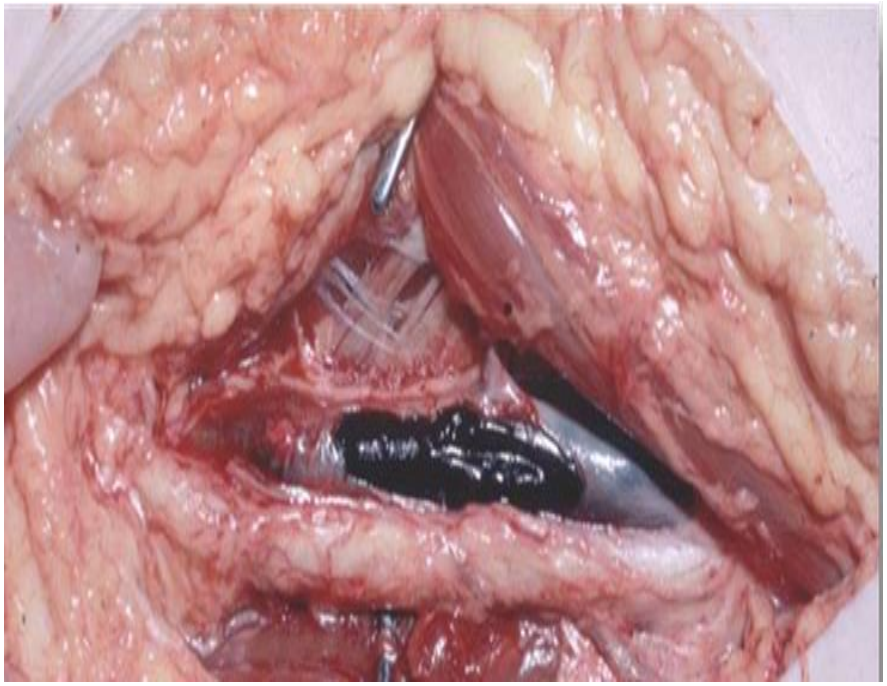
# Morphologic features



# Venous thrombi



# Morphologic features

Microscopically, the composition of thrombus is the lines of Zahn are formed by alternate layers of light-staining aggregated platelets admixed with fibrin meshwork and dark-staining layer of red cells. Red (venous) thrombi have more abundant red cells, leucocytes and platelets entrapped in fibrin meshwork. Thus, red thrombi closely resemble blood clots.