- **What is edema?**

- **Edema : It refers to the accumulation of excess liquid in the interstitial (extracellular) spaces of a tissue or in pre-existing cavities. It may affect any organ, but most often it appears in subcutaneous tissues, lung and brain.**

According to the etiology, edema may be:

1- localized (in inflammation or in impaired venous drainage) as in; pulmonary edema and brain edema

2- Systemic (in right side-heart failure or in nephrotic syndrome).

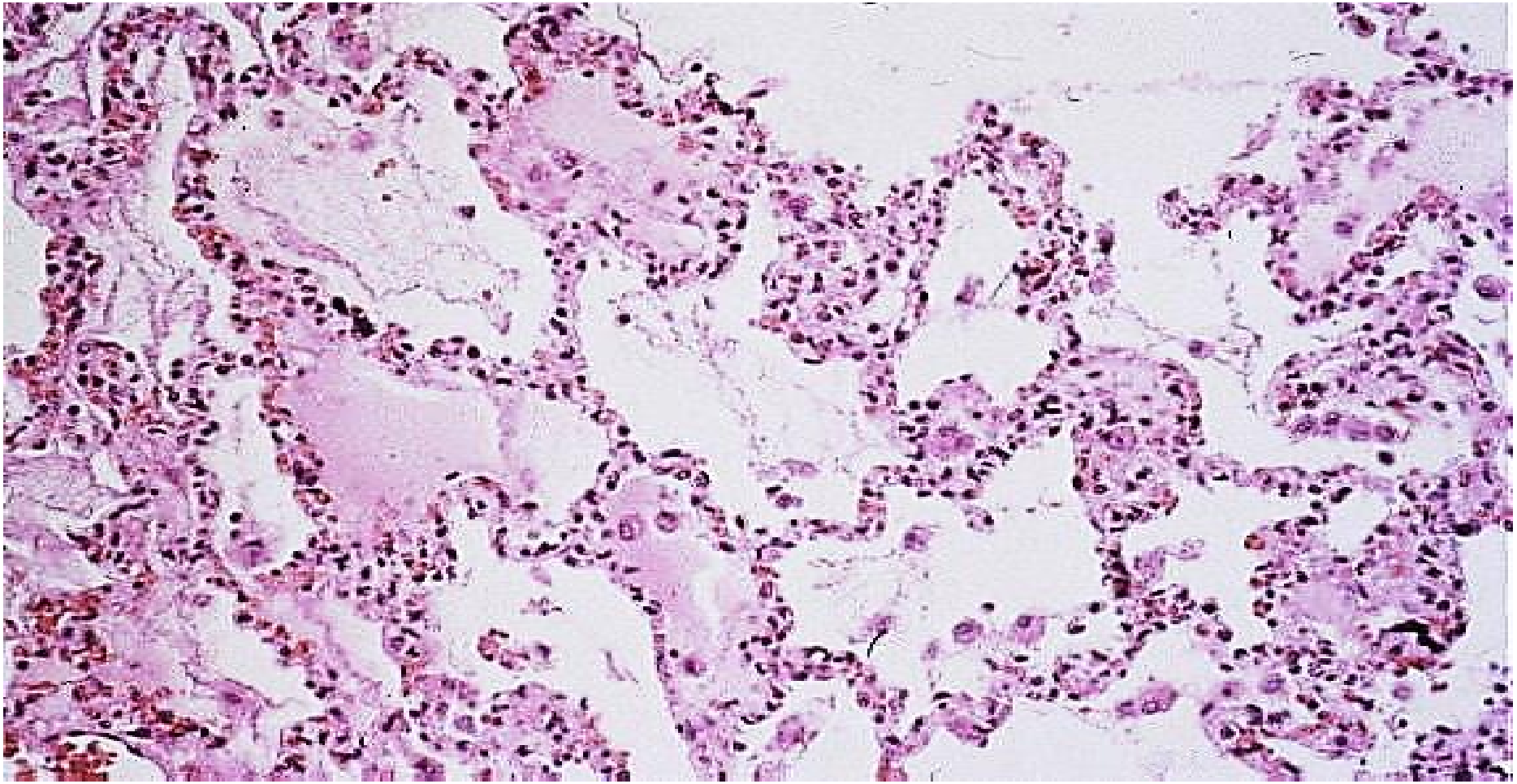
A generalized and severe edema is called (*anasarca*).

Congestion

Congestion: is a passive increase in blood volume in venous part of blood vessels (impaired venous drainage). Congestion could be localized venous congestion or generalized venous congestion. The tissue has a blue-red color(cyanosis) due to accumulation of deoxygenated hemoglobin. Congestion and edema are commonly occur together.

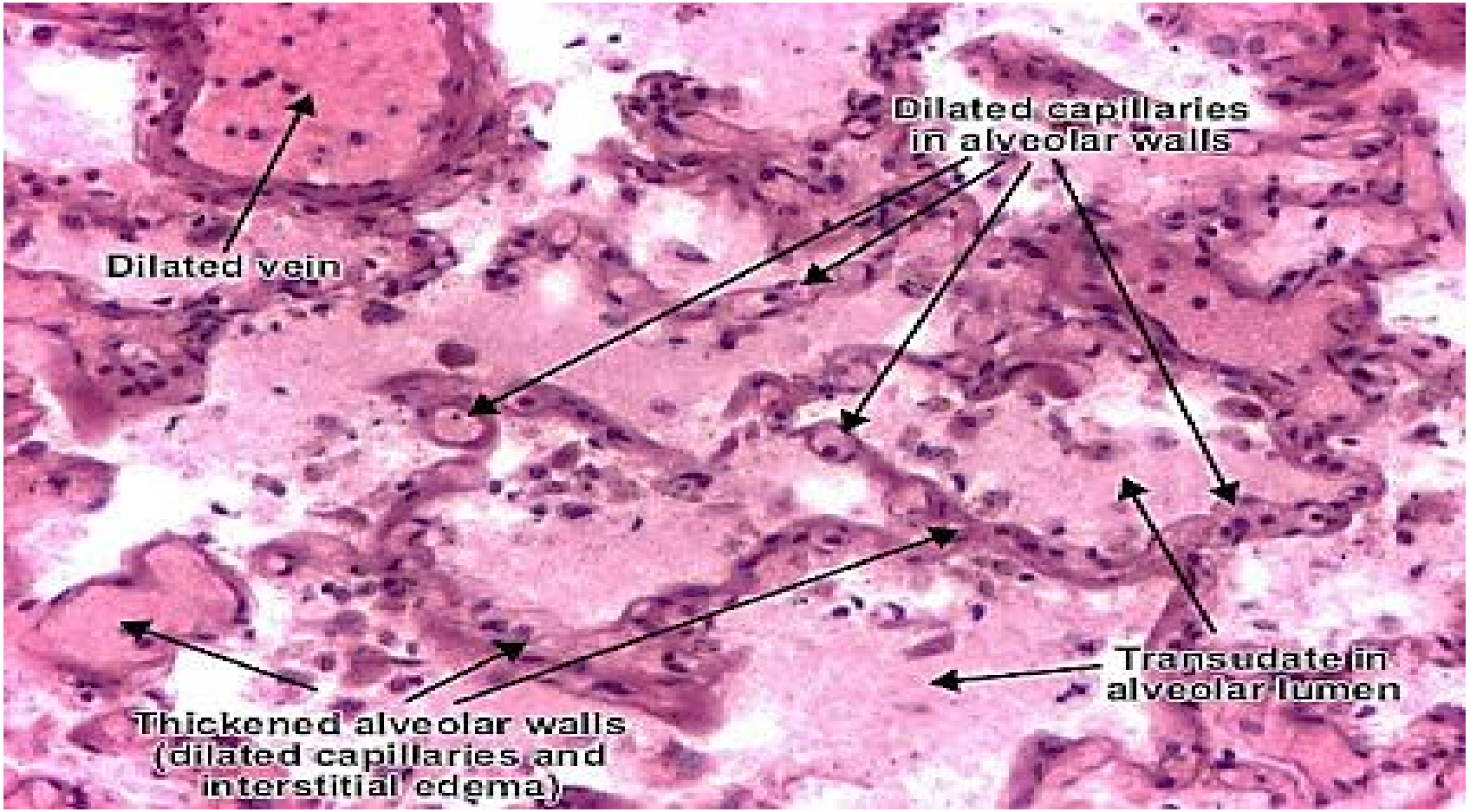
Pedal edema

during and after the application of pressure to the skin.



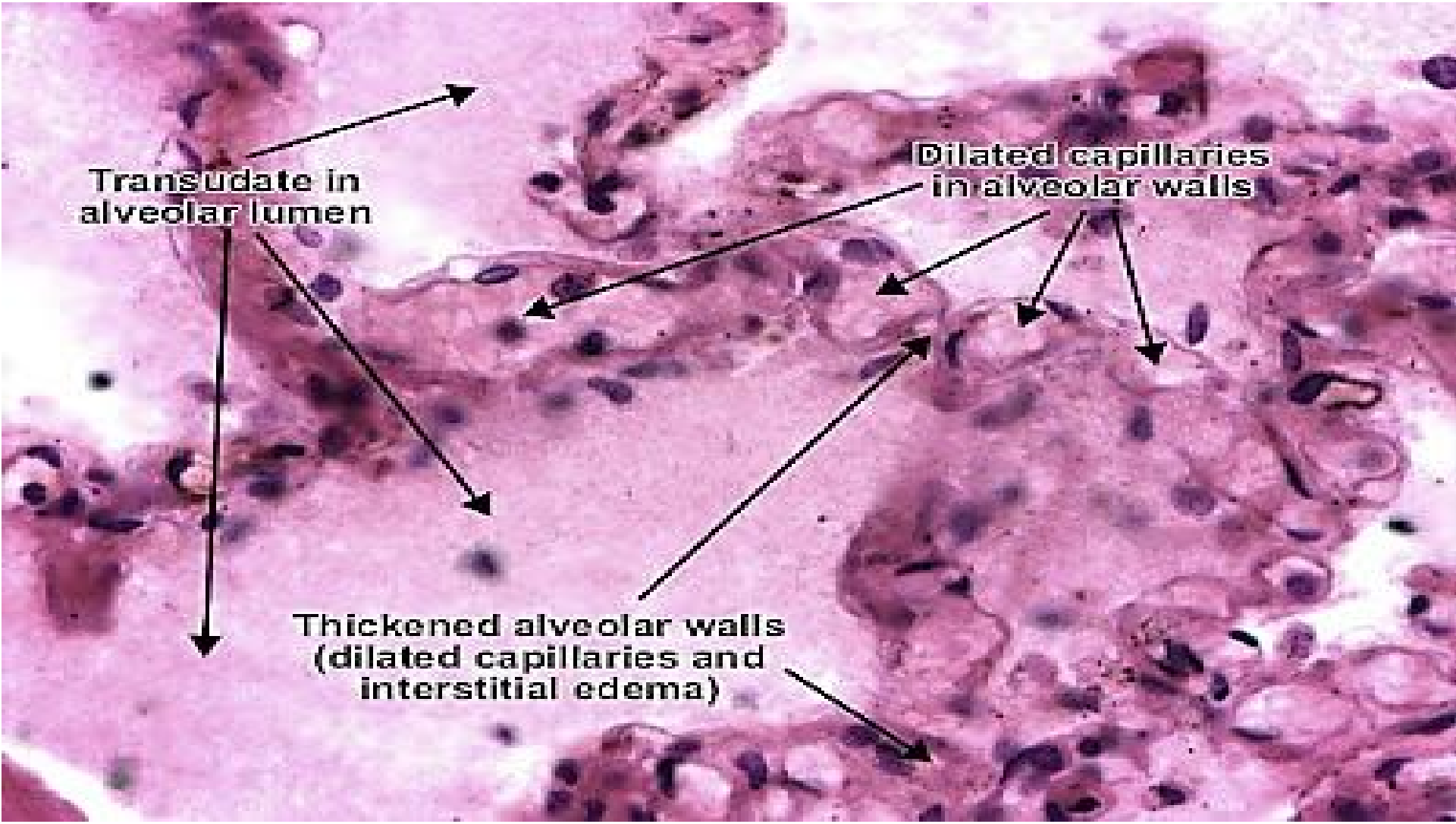
Interstitial pneumonitis and intra-alveolar edema.

(a low-power photomicrograph)



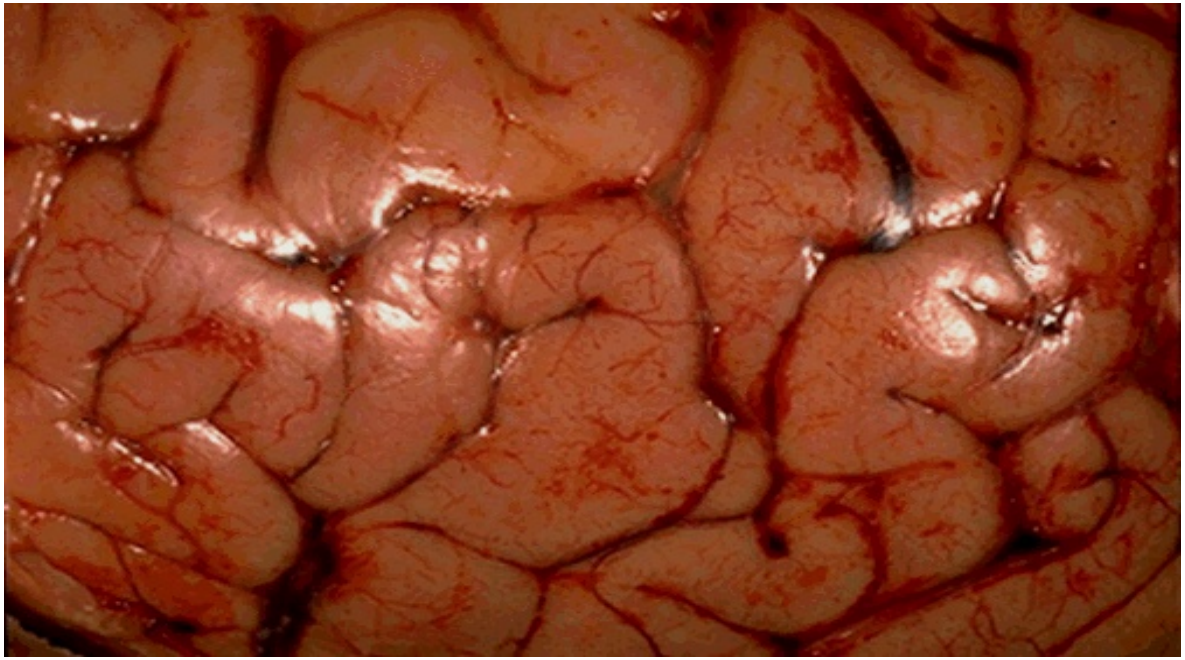
Pulmonary edema .Alveolar walls are thickened due to acute distention of capillaries and interstitial edema. Alveolar lumen is filled with *transudate* (pale-eosinophilic, finely granular), a liquid which replaces the air.

At high magnification Pulmonary edema



The surface of the brain with cerebral edema

demonstrates widened gyri with flattened surface. The sulci are narrowed.



The capillary system and mechanisms of edema formation

A. Hydrostatic edema:

- **If the hydrostatic pressure at the venous end of the capillary system is elevated, re-absorption is decreased. As long as the lymphatics are able to drain the fluid, no edema results. If their capacity is exceeded, however, edema fluid accumulates.**

B. Oncotic edema: **Edema fluid also accumulates if re-absorption is diminished by a decrease in the oncotic pressure of the vascular bed, owing to a loss of albumin.**

C. Inflammatory and traumatic edema: **either local or systemic, results in the vascular bed becomes leaky following injury to the endothelium.**

D. Lymphedema: **Lymphatic obstruction causes the accumulation of interstitial fluid because of insufficient re-absorption and deficient removal of proteins, the latter increasing the oncotic pressure of the fluid in the tissue**

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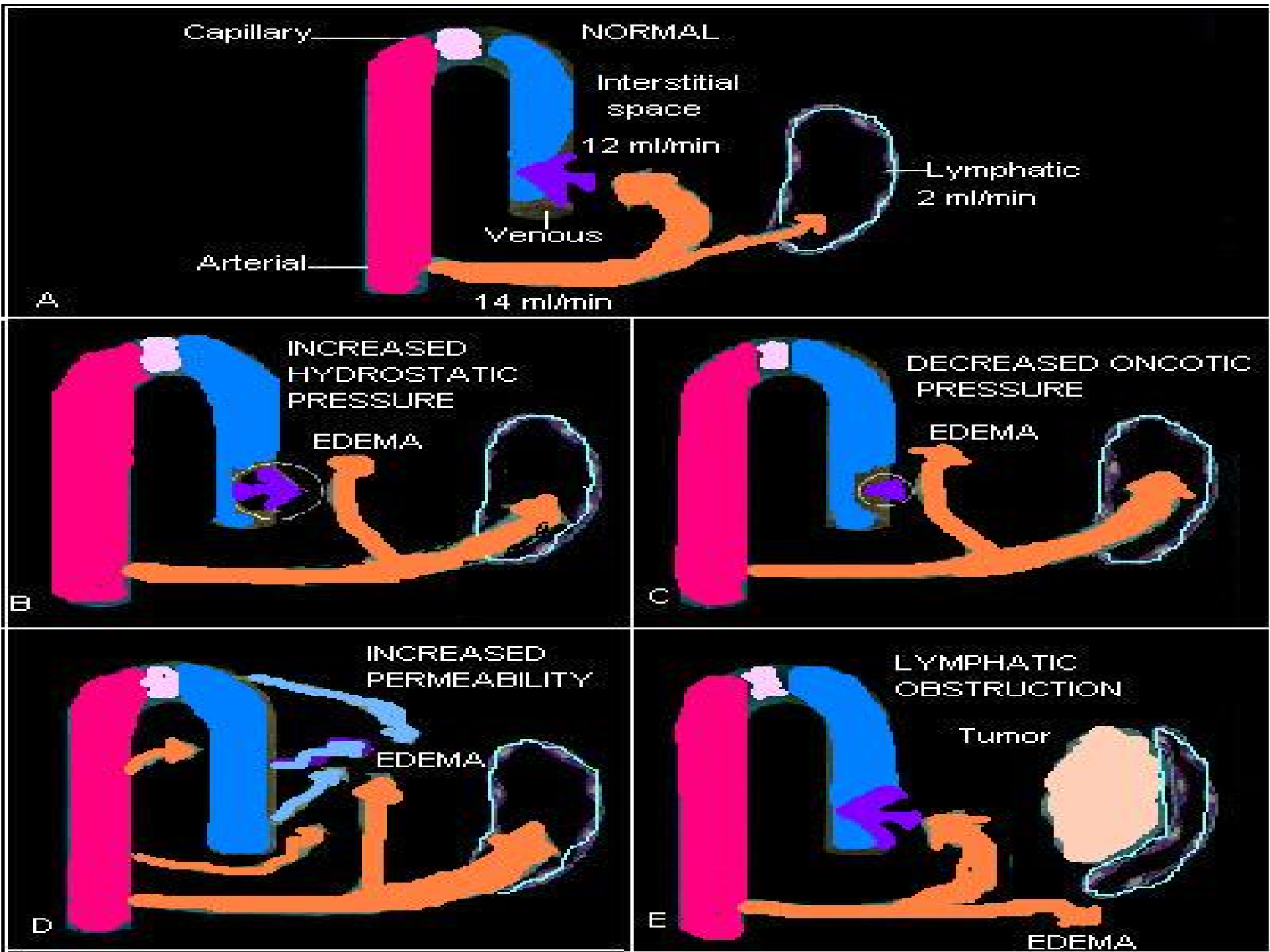

Capillary
NORMAL
Interstitial space
12 ml/min
Lymphatic
2 ml/min
Venous
Arterial
A
14 ml/min
INCREASED HYDROSTATIC PRESSURE
EDEMA
B
DECREASED ONCOTIC PRESSURE
EDEMA
C
INCREASED PERMEABILITY
EDEMA
D
LYMPHATIC OBSTRUCTION
Tumor
E
EDEMA

Lymphatic obstruction (Lymphedema)in leg due to Parasitic infection Filariasis

Types (classification) of edema:

1.According to pathophysiological mechanism (composition of the accumulated fluid):

- **Transudate (low protein content)**
- **Exudate (high protein content)**

2.According to the location:

- **Generalized**
- **Localized**

3.According to clinical finding:

a. Pitting edema

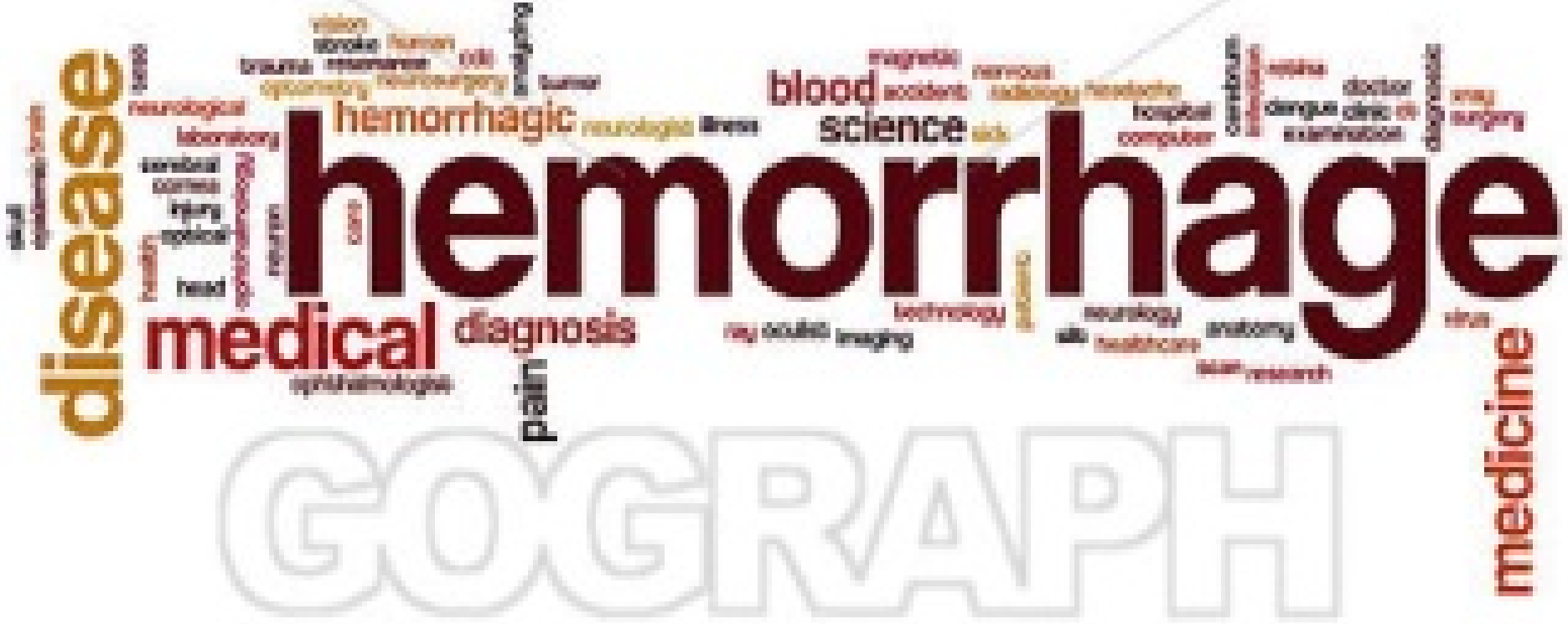
b. Non pitting edema

Lymphoedema

Pitting oedema
[Grade 1]

Non pitting
[Grade 2]

Filariasis


hemorrhage
disease
medical
medicine
hemorrhagic
blood
science
diagnosis
pain
neurological
laboratory
cerebral
cornea
injury
optical
head
neuron
brain
stroke
human
trauma
aneurysm
ophthalmology
neurosurgery
tumor
imaging
hospital
computer
dengue
clinic
examination
doctor
surgery
diagnostic
technology
neurology
anatomy
healthcare
research
virus
accident
nervous
radiology
headache
illness
ct
mri
ophthalmologist

Hemorrhage: is extravasation of blood from vein to extravascular space (tissues, a hollow organ or body cavity, or to the outside). capillary bleeding can occur in chronic congestion or sever hemorrhage occur in rupture of large artery or vein due to trauma.

Hemorrhage takes many definition:

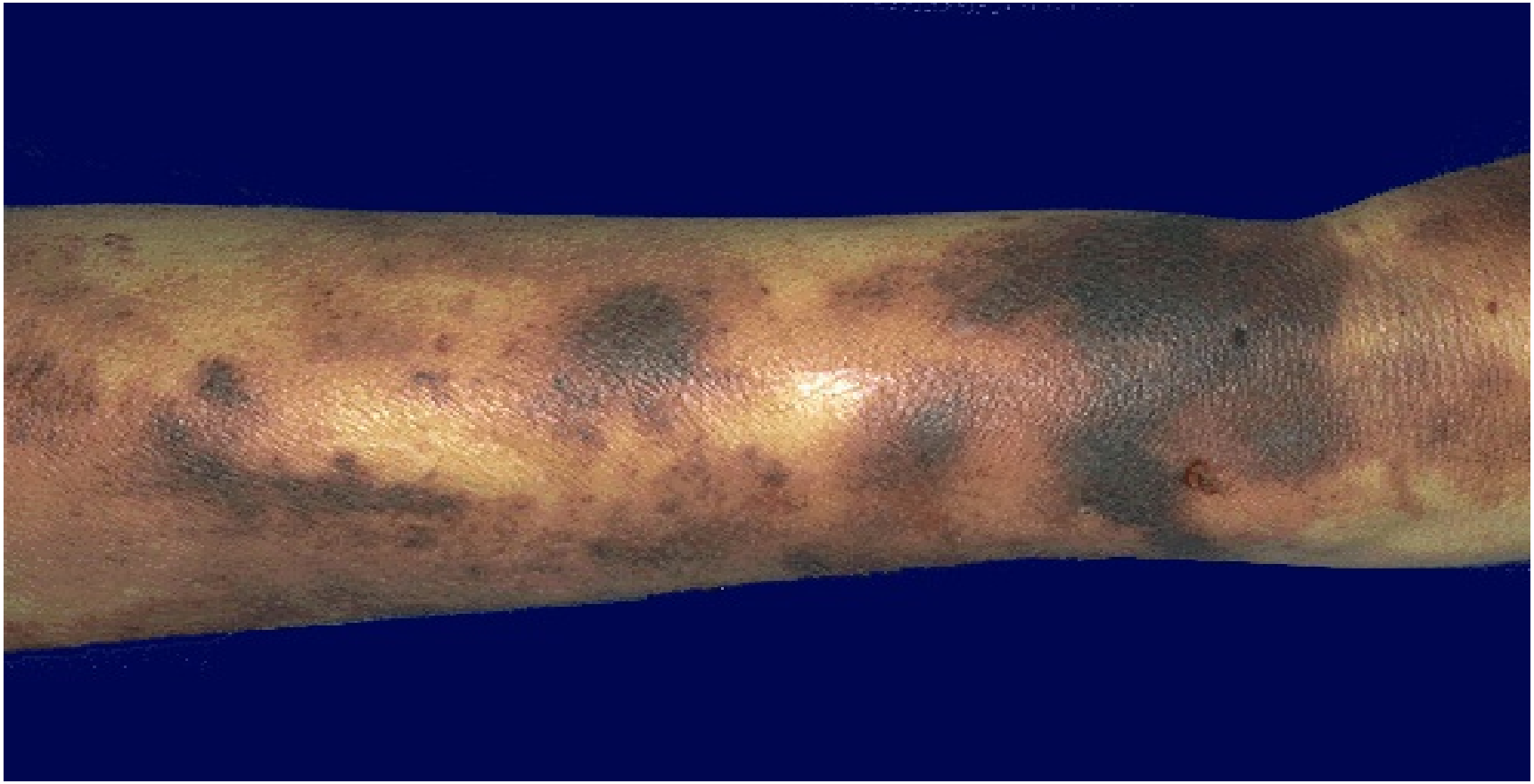
1-Hematoma: This localized hemorrhage occurs within a tissue or organ.

2-Hemothorax, hemopericardium, hemoperitoneum: Hemorrhage may occur in the pleural cavity, pericardial sac, peritoneal cavity.

3-Petechial hemorrhages, petechiae, or purpura: These small, punctate hemorrhages occur in the skin (1-2 mm), mucous membranes, or purpura in serosal surfaces size (3-5mm).

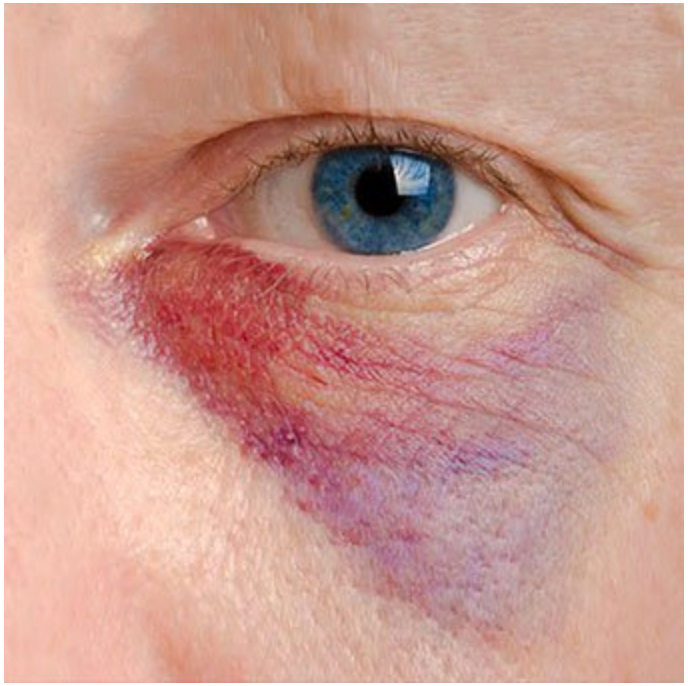
4- Ecchymosis: This diffuse hemorrhage is occured in skin and subcutaneous tissue size (1-2cm).

Here are petechial hemorrhages seen on the epicardium of the heart. Petechiae (pinpoint hemorrhages) represent bleeding from small vessels and are classically found when a coagulopathy is due to a low platelet count. They can also appear following sudden hypoxia.



The blotchy areas of hemorrhage in the skin are called ecchymoses (singular ecchymosis). Ecchymoses are larger than petechiae. In between in size are hemorrhages called purpura. The terms ecchymosis and purpura are often used interchangeably. They can appear with coagulation disorders. In the setting of normal tissues subjected to sufficient blunt trauma to rupture small blood vessels and produce soft tissue bleeding, the process would be called contusion.

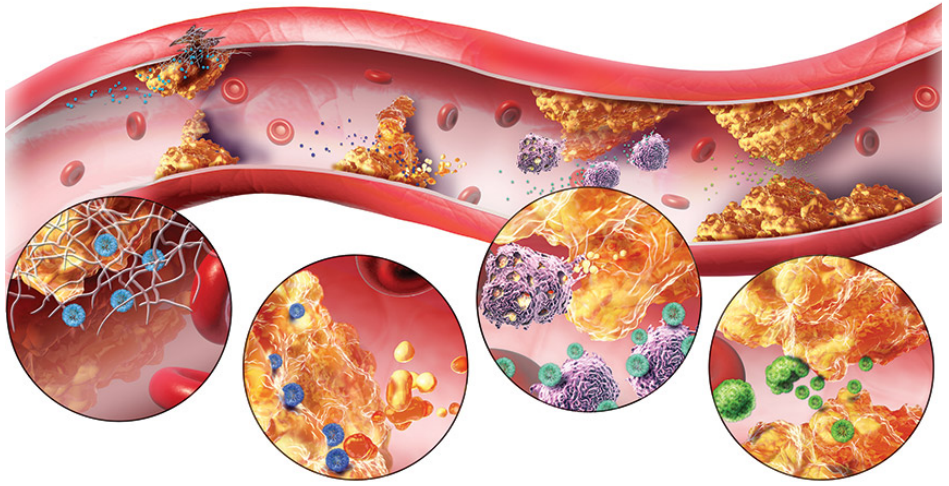
A localized collection of blood outside the vascular system within tissues is known as a hematoma. Here is a small hematoma under the toenail following trauma, which has a bluish appearance from the deoxygenated blood within it.



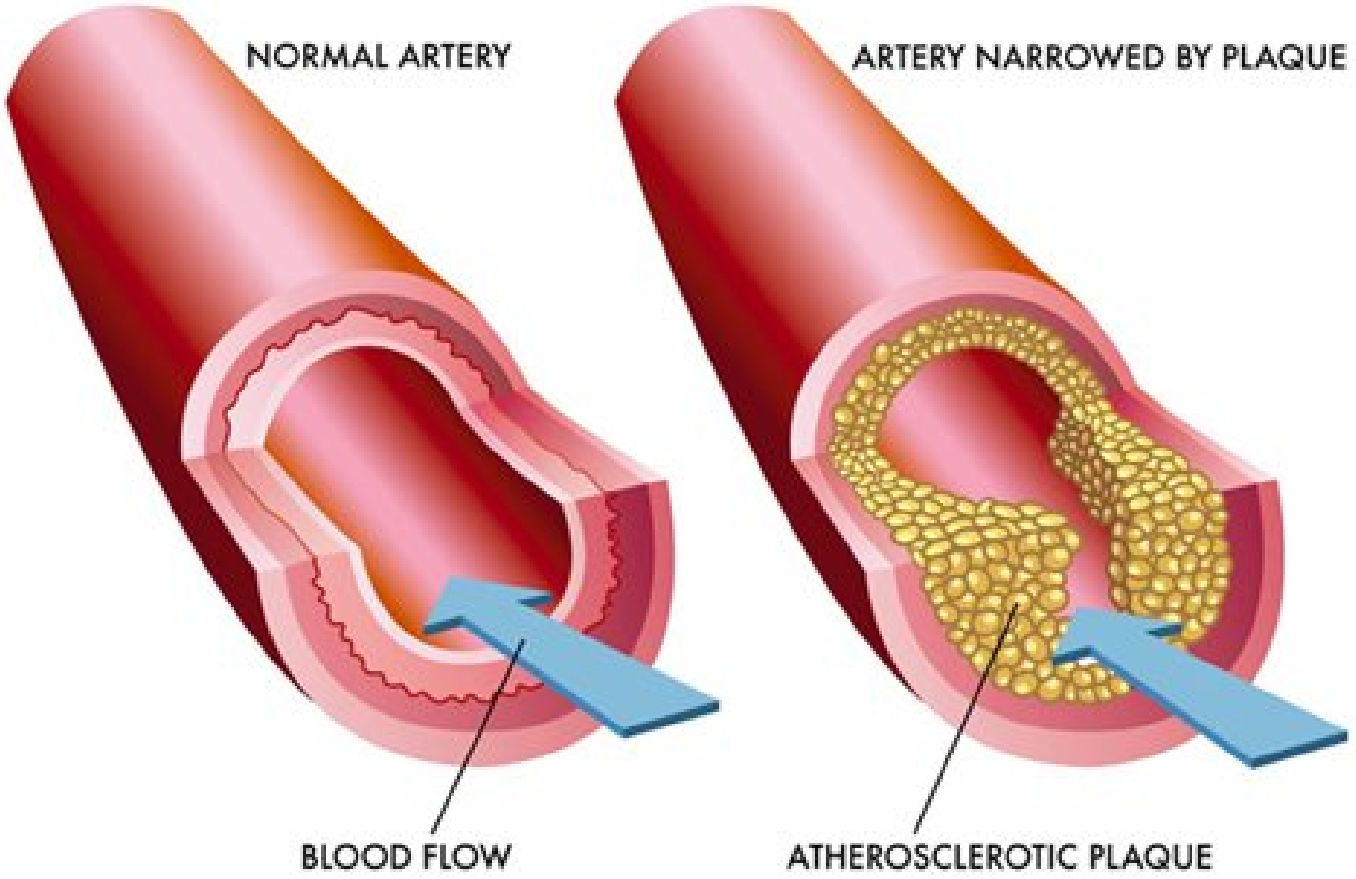
hematoma under the eye

Atherosclerosis

Atherosclerosis is a disease primarily of large elastic arteries and medium sized muscular arteries. Its basic lesion is the atheroma (fibro-fatty plaque) which is a raised patch within the intima having a core of lipid (mainly cholesterol) and a cup of fibrous tissue



ATHEROSCLEROSIS

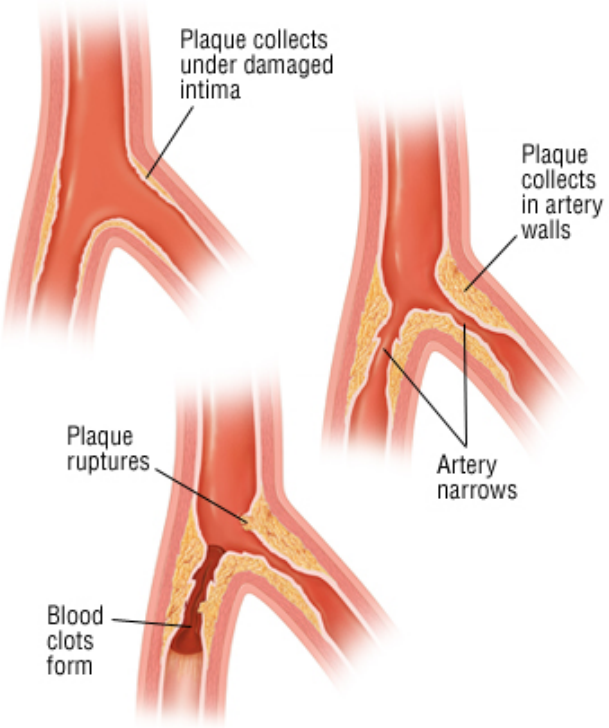


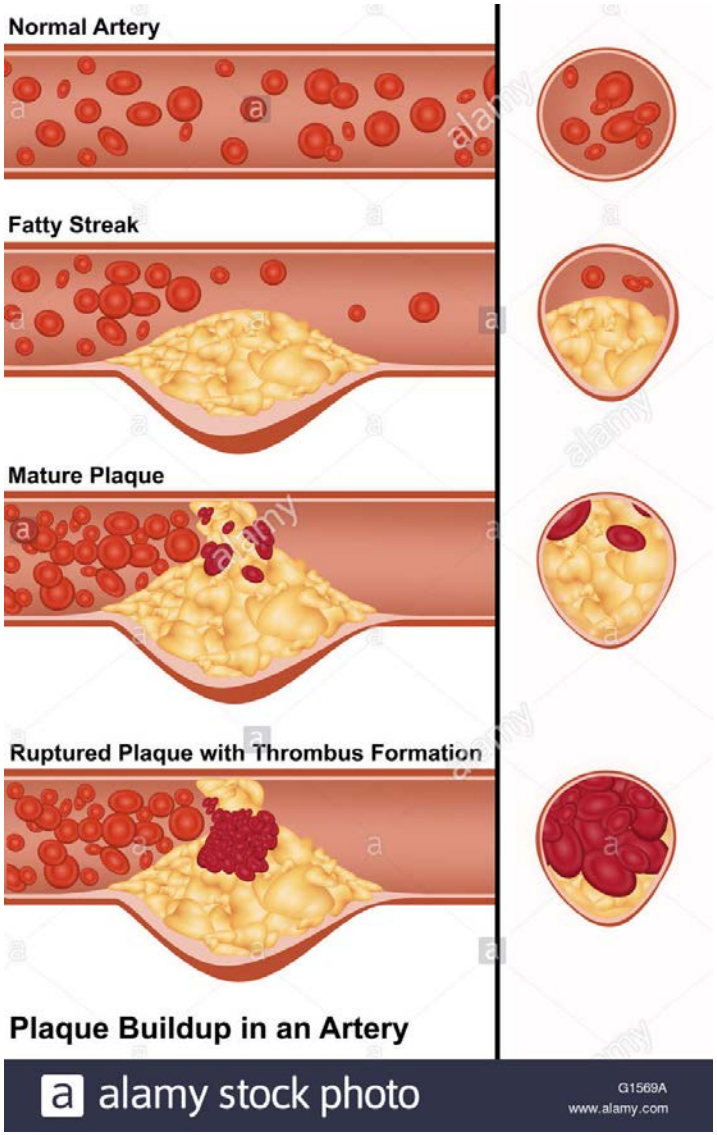
Risk factors for atherosclerosis:

- **Diet and hyperlipidemia, high carbohydrate intake**
- **Hypertension**
- **Cigarette smoking**
- **Diabetes mellitus**
- **Obesity**
- **stress**
- **Increase age**
- **Family history**
- **Genetic abnormality**

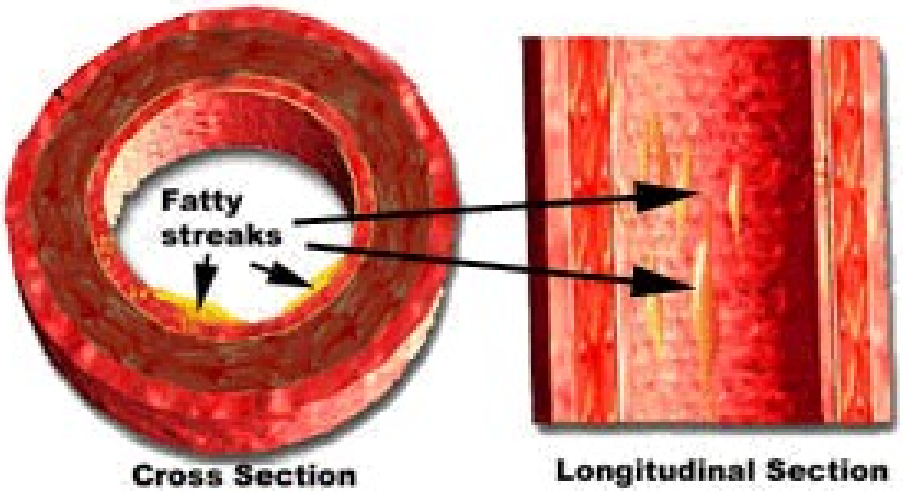
Pathogenesis of atherosclerosis:

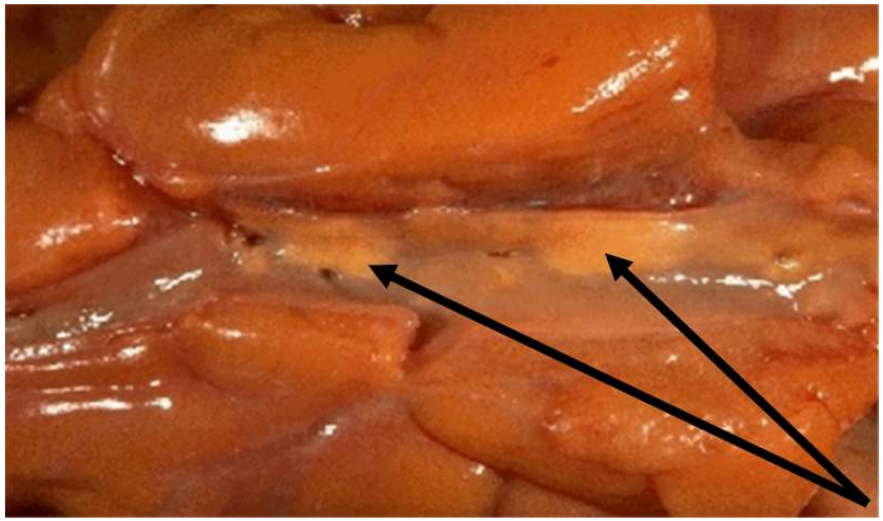
1. Fatty streak stage
2. Progression stage
3. Plaque rupture

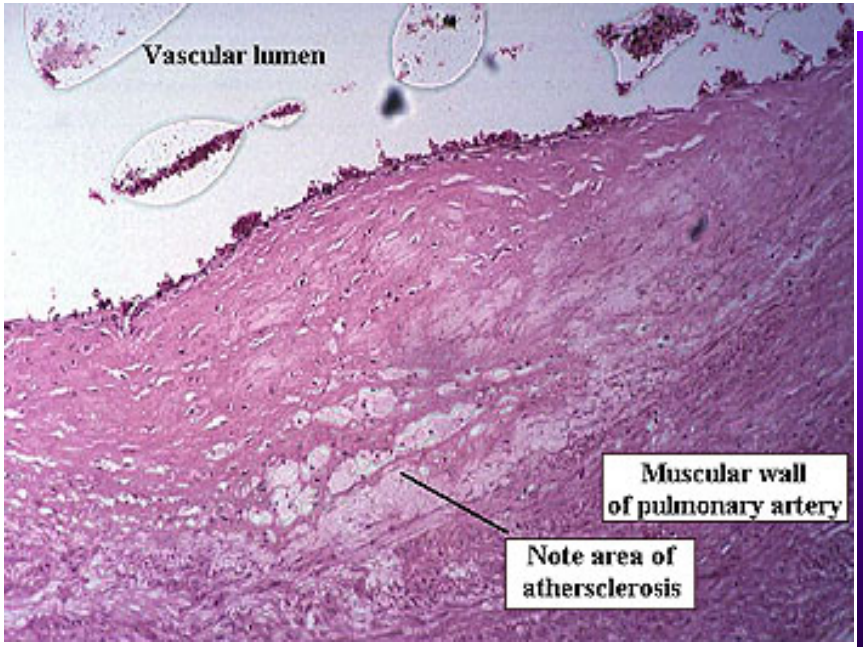




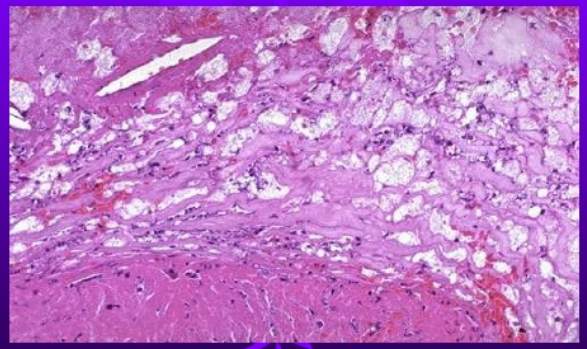
Fatty streaks

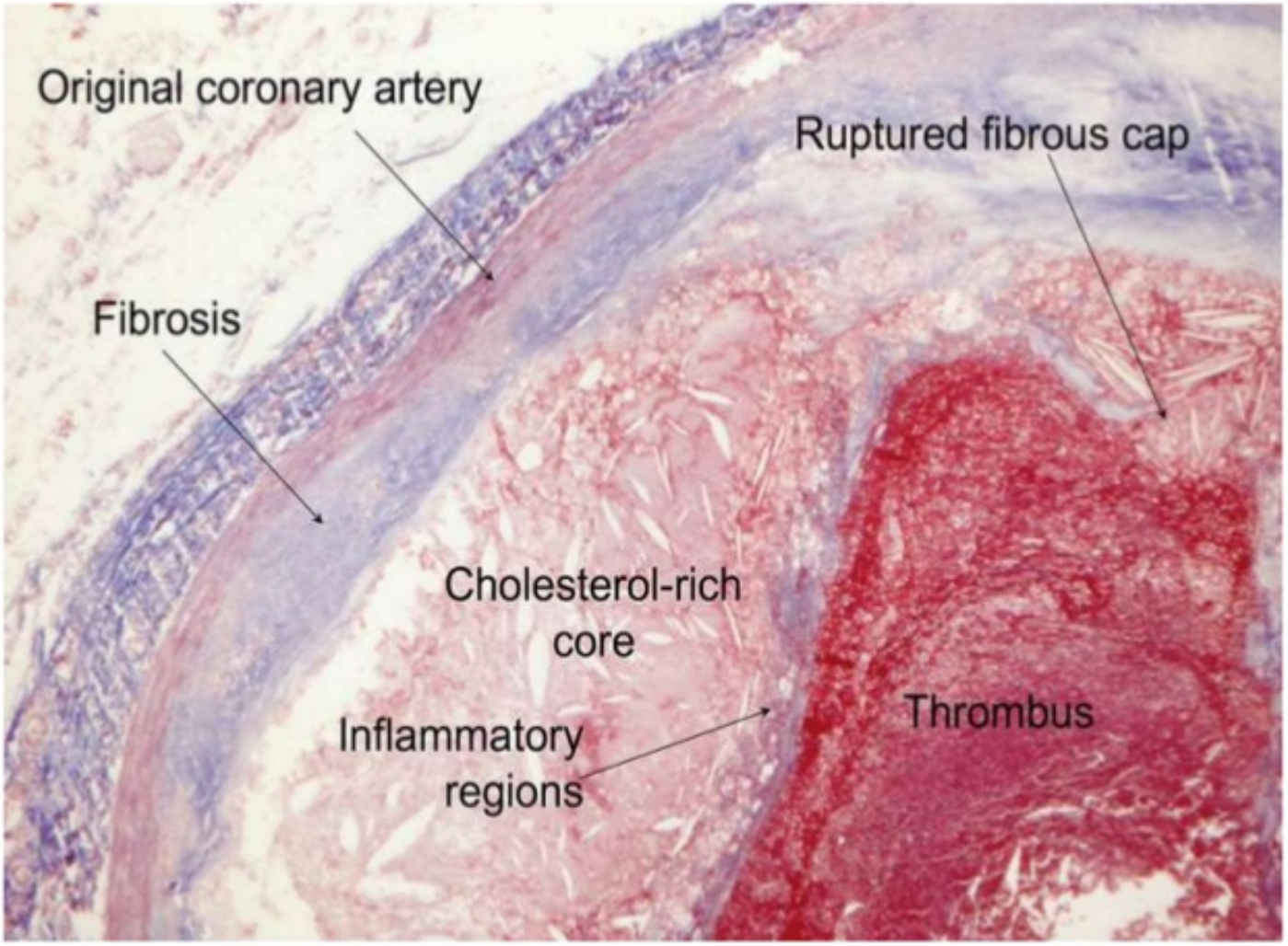






Foam Cells- "Fatty Streaks"




Original coronary artery
Ruptured fibrous cap
Fibrosis
Cholesterol-rich core
Thrombus
Inflammatory regions


THANK YOU