

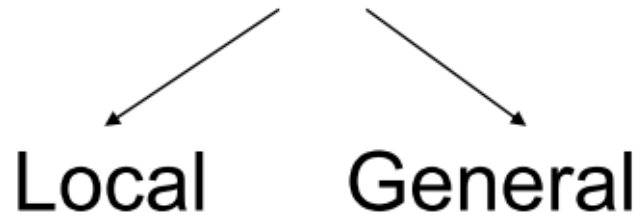
Blood and lymph circulation disorders

Arterial hyperemia

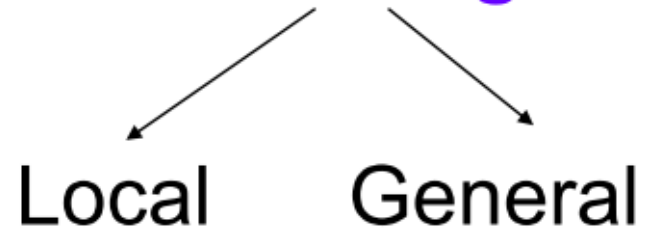
Arterial hyperemia is an increase in the volume of circulating blood in the arterial system of an organ.

Arterial hyperemia

Physiological



Pathological



Physiological arterial hyperemia

- flushing of the skin of face in response to emotions,
- muscular exercise

Pathological general arterial hyperemia



- AH is observed in conditions of hyperthermia with general overheating of the organism, with fever in patients with infectious diseases;
- AH may be as a result of a rapid drop in barometric pressure (general vacathic hyperemia).

Types of local pathological arterial hyperemia

1. **Angioneurotic** (neuromparalytic) AH – due to innervation leasion
2. **Collateral AH** – due to the obstruction of blood flow through the main artery
3. **Hyperemia after ischemia** – after elimination of the ischemia factor (tumor, ligature, etc.), squeezing the artery
4. **Vacatous** AH(*vacuus* – empty) – due to the decrease of barometric pressure.
5. **Inflammatory AH.**
6. **AH due to arteio-venous fistula** –due to gunshot

Arterial hyperemia

- Macroscopically hyperemic tissues have a red color, a higher temperature.
- Microscopically, the vessels (mainly the microvasculature) are sharply dilated and full-blooded.

Angioneurotic hyperemia



Herpes virus neuralgia



Primary neurovascular disorder

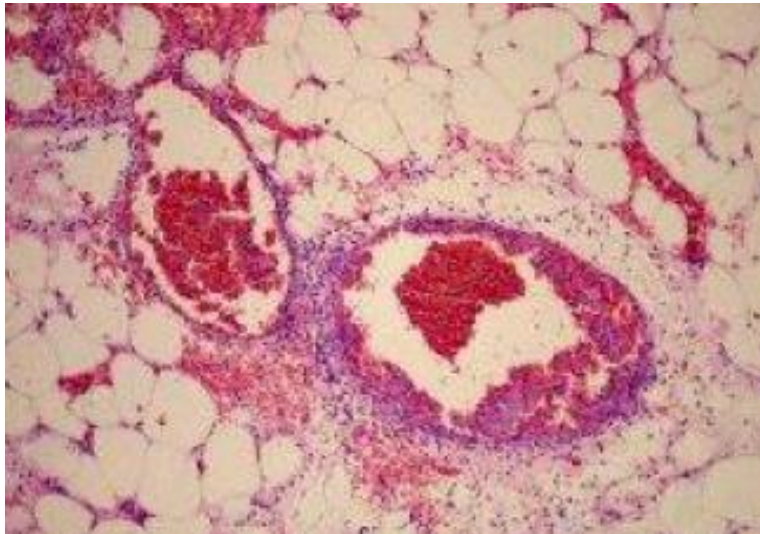


**Systemic Lupus
Erythematosus**

Inflammatory hyperemia



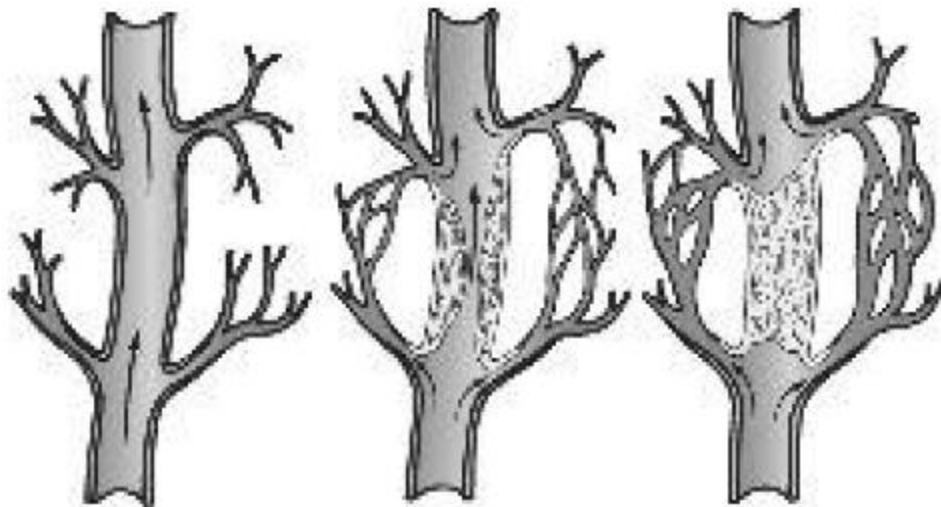
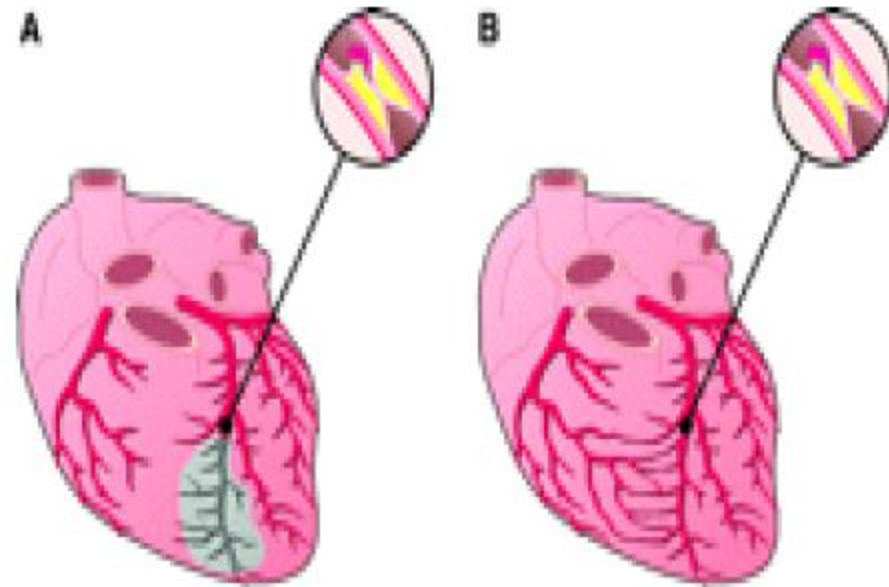
Catarrhal erosive gastritis



Compensatory regulation of blood circulation during inflammation.

Compensation of microcirculatory changes, number of functional capillaries increases.

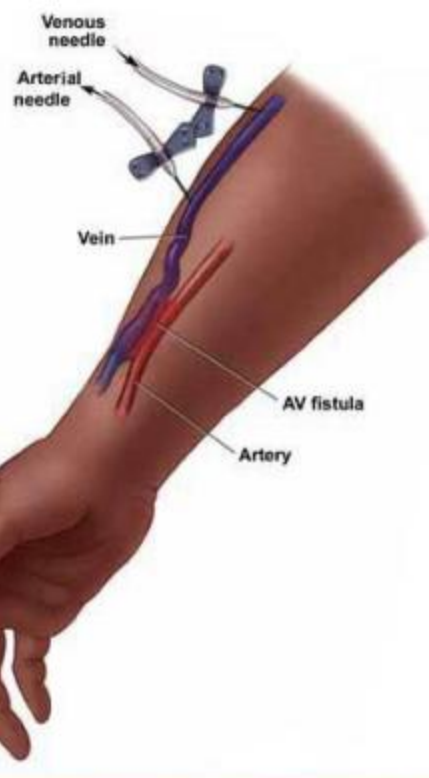
Collateral hyperemia



Vacatous hyperemia



- **Cups;**



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Arteriovenous Fistula

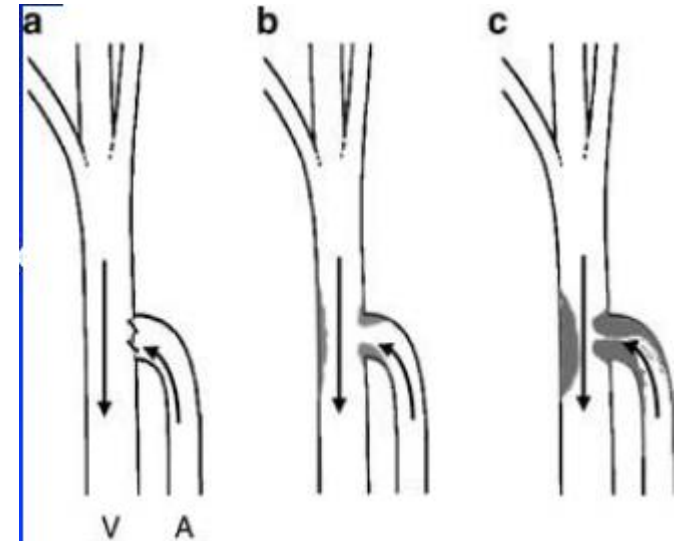


Arteriovenous fistula at the taim of construction

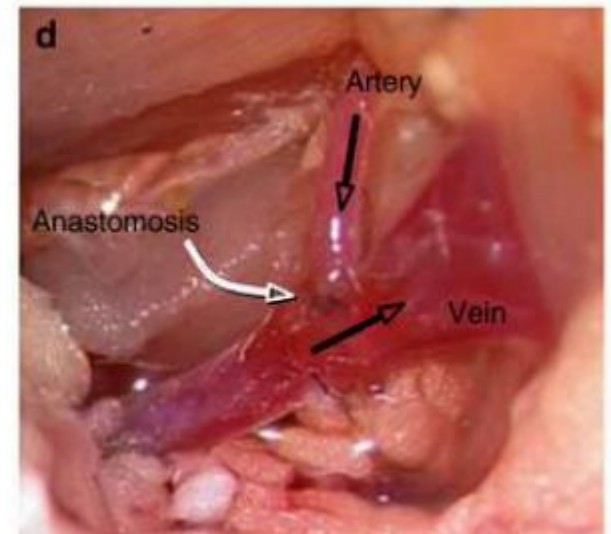


radial artery

cephalic vein



Arteriovenous fistula at the taim of construction. The radial artery been anastomosed "side to side" with the cephalic vein, preserving blood flow to the hand.



Venous hyperemia

Venous hyperemia – increased plethora of organ or tissue due to reduced outflow of blood through the veins, the inflow remains unchanged or a few reduced

Venous congestion

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graph TD; A[Venous congestion] --> B[General]; A --> C[Local]; B --> D[Acute]; B --> E[Chronic]; C --> F[Acute]; C --> G[Chronic];
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General

Acute Chronic

Local

Acute Chronic

Venous hyperemia

- In acute venous congestion, local tissue edema is observed in accordance with the vein involved in the pathological process (edema of the lower limb with inflammation of the walls v. femoralis)
- However, much more often venous stasis is of a systemic nature and occurs with heart failure, diseases of the lungs and liver.

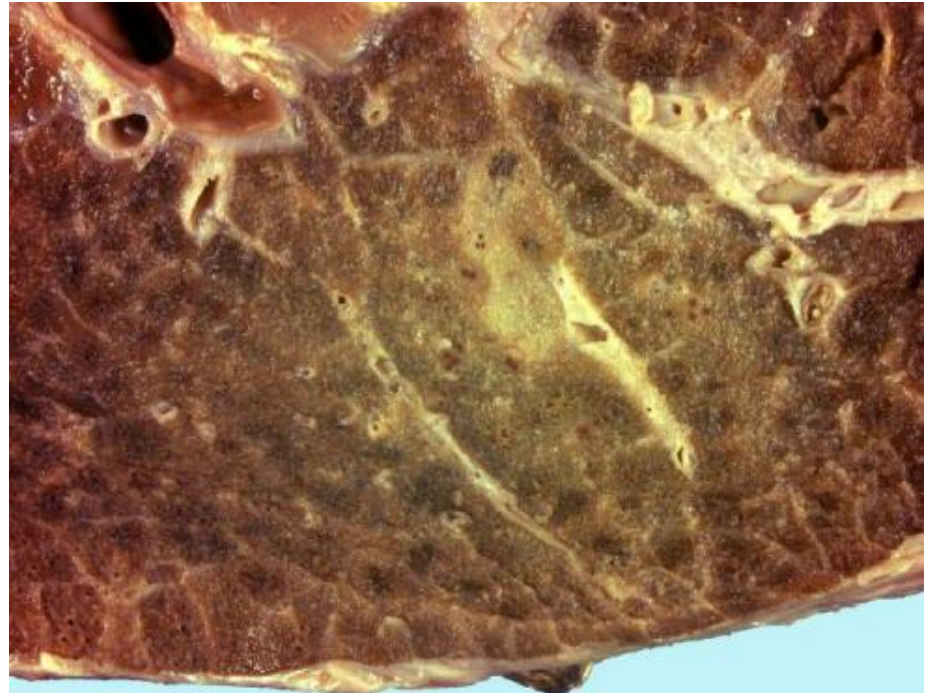
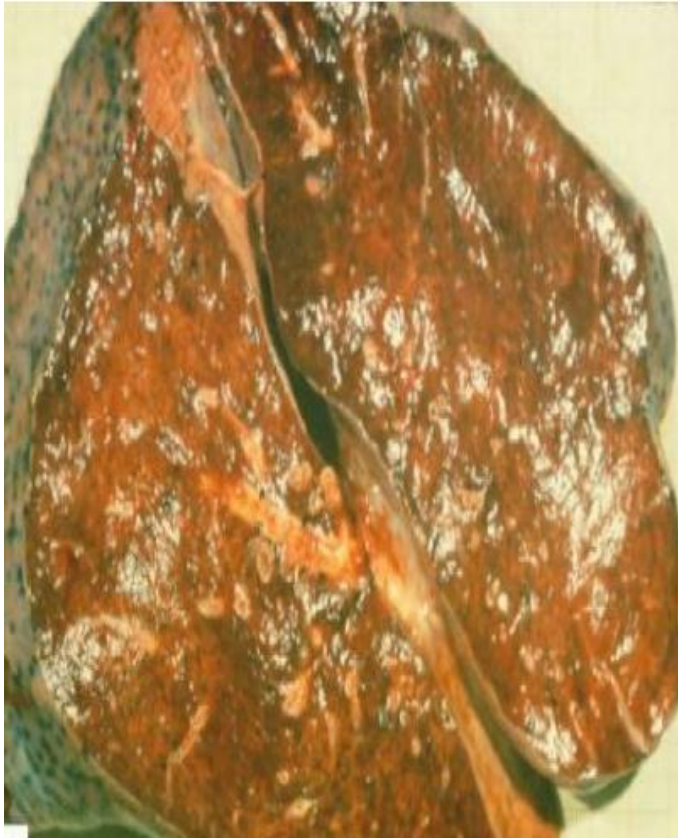
Venous hyperemia

Chronic venous congestion is characterized by chronic hypoxia of an organ, tissue, as a result of which three stereotypical processes arise in various organs.

1. increase in vascular permeability, diapedesis erythrocytes, extravascular hemolysis, hemosiderin formation
2. induration of the organ – sclerosis
3. development of a capillary-parenchymal block

Venous hyperemia

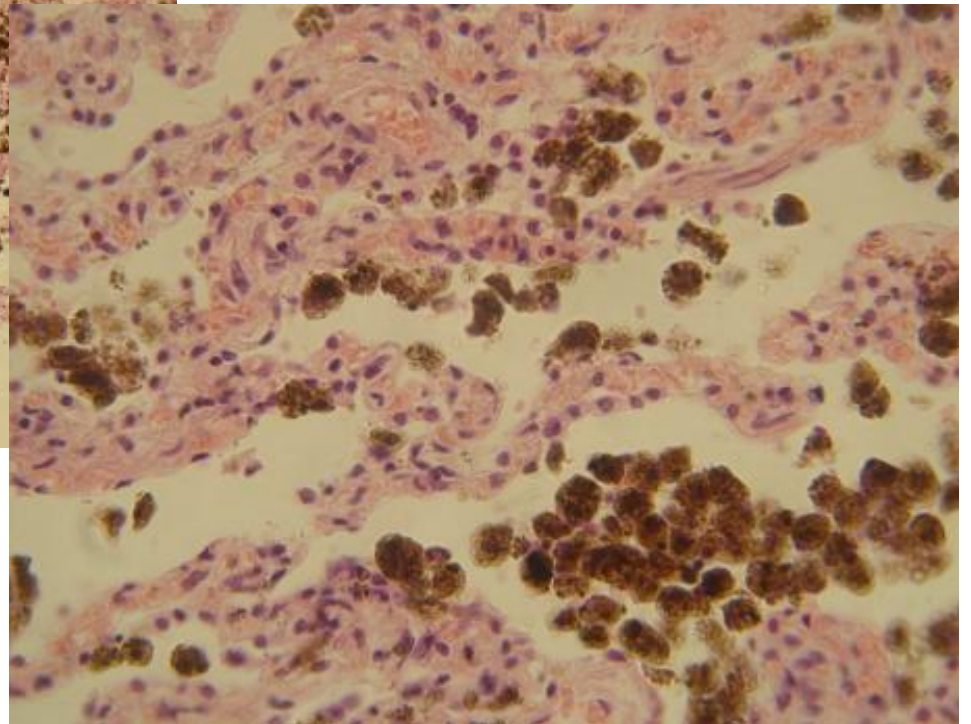
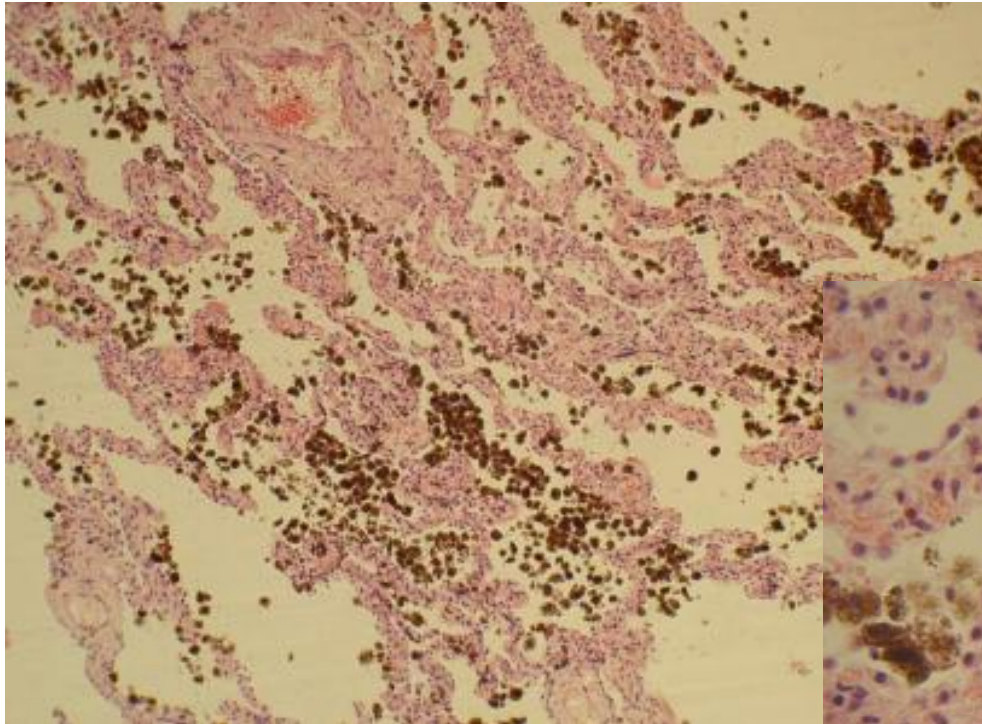
Brown induration of lungs



The lungs are enlarged and heavy and appear brownish due to edema, congestion and haemosiderin deposition

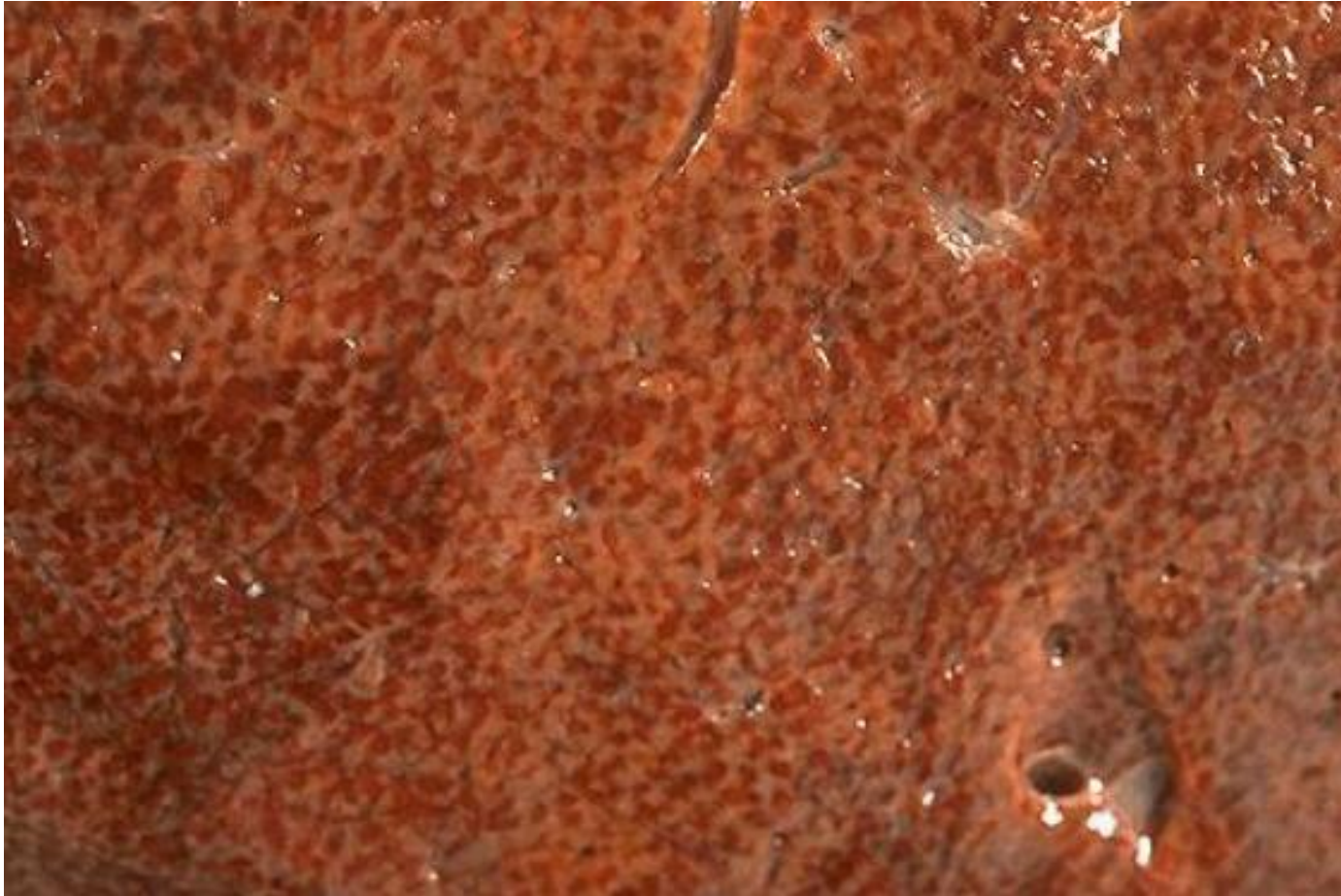
Venous hyperemia

Brown induration of lungs



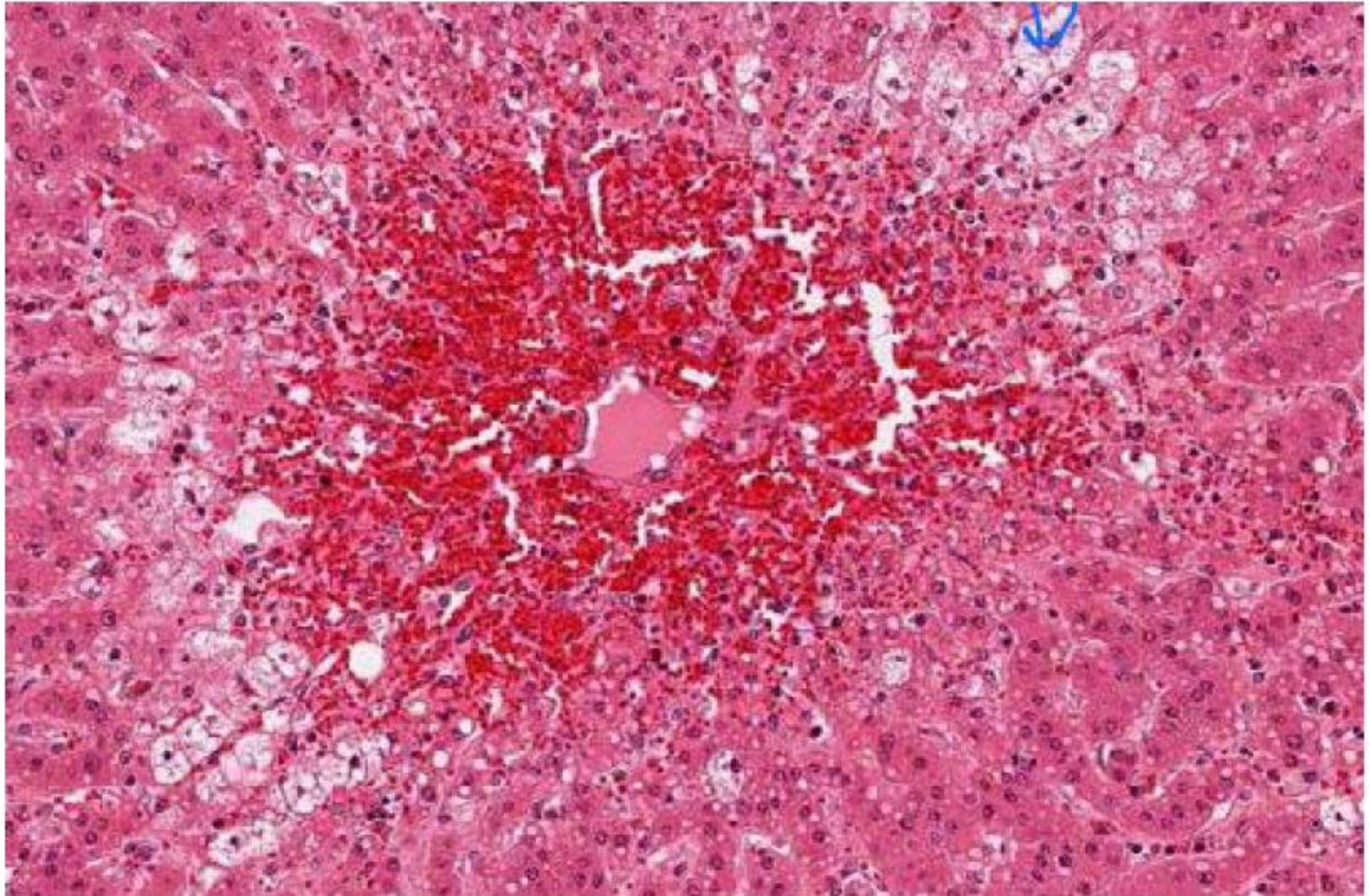
Venous hyperemia

Nutmeg liver



Here is an example of a "nutmeg" liver seen with chronic passive congestion of the liver. Note the dark red congested regions that represent accumulation of RBC's in centrilobular regions.

Nutmeg liver



Nutmeg liver

- Microscopically,
 1. The central vein and sinusoids of the centrilobular regions are distended with blood.
 2. The hepatocytes in the central regions are atrophic secondary to chronic hypoxia, ultimately they undergo necrosis.
 3. The hepatocytes in the mid zones of the lobules suffer from less severe hypoxia and develop fatty change.
 4. Hepatocytes in the peripheral zones of the lobules are normal or show cellular swelling.

Chronic venous congestion



- Edema



- Cyanotic induration of the kidney



- Cyanotic induration of the spleen



Hemorrhage (bleeding)

- Hemorrhage is an extravasation of blood from vessel or heart cavities into the extravascular space or body cavity
- **External** (GI, pulmonary, etc.) and **internal** hemorrhage
- **Primary and secondary**

Hemorrhage

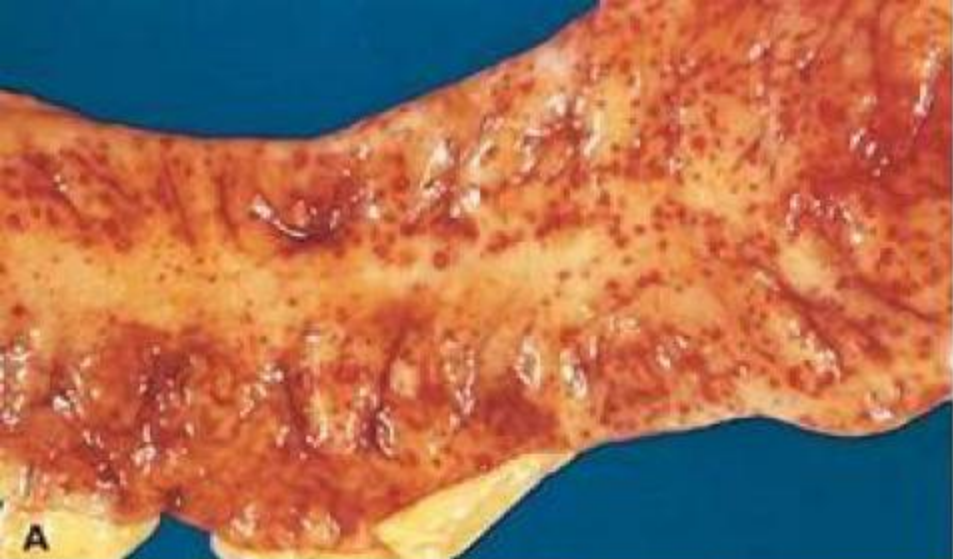
1. **Petechiae** (1-2 mm) - skin + mucosa
↑ intravascular pressure, ↓ platelets
2. **Purpuras** (3-5 mm)
trauma, vasculitis, vascular fragility
3. **Ecchymosis** (1-2 cm) = hematoma (bruise)
RBC phagocytosis by macrophages
Hb (red-blue) → bilirubin (blue-green) → hemosiderin (golden-brown)
4. **Cavities**
hemothorax, hemopericardium, hemoperitoneum
hemarthros

Internal hemorrhage

1. **Hemarthrosis** - hemorrhage into the joint cavity
2. **Hemopericardium** - accumulation of blood in pericardial cavity, also called cardiac tamponade
3. **Hemothorax** - accumulation of blood in pleural cavity
4. **Hemoperitoneum** - accumulation of blood in abdominal cavity
5. **Hemocephaly** - accumulation of blood in ventricles brain
6. **Hematocele** - hemorrhage under testis tunica
7. **Cephalhaematoma** - hemorrhage under periosteum of skull
8. **Hematorrhachis** - spinal cord hemorrhage

External hemorrhage

1. **epistaxis** –nose hemorrhage
2. **haematemesis** – vomiting with blood
3. **maelena** – fecal blood
4. **metrorrhagia** – uterine cavity hemorrhage (not during menstruation)
5. **haemoptoe** ("coughing up blood") - respiratory tract hemorrhage
6. **Hematuria** - blood in urine
7. **Gastro-intestinal hemorrhage**
8. **Pulmonary hemorrhage**

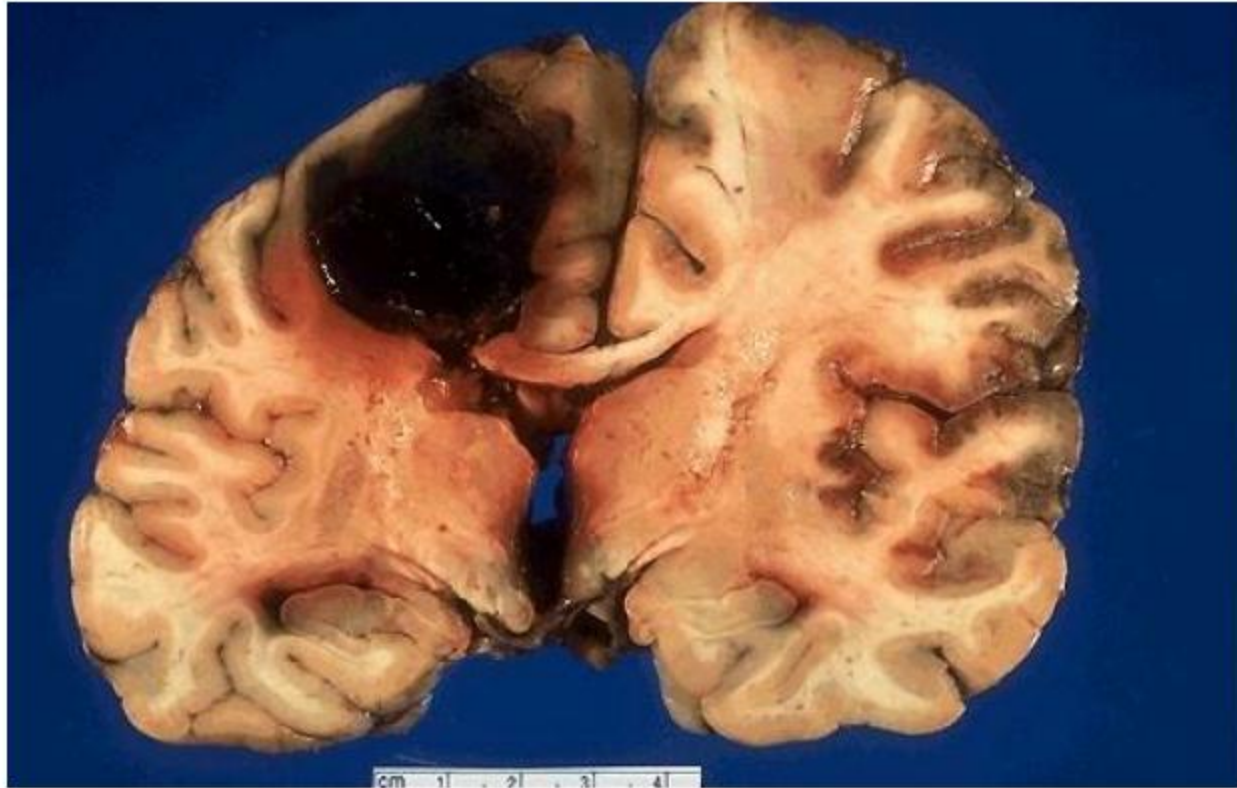


Hemopericardium



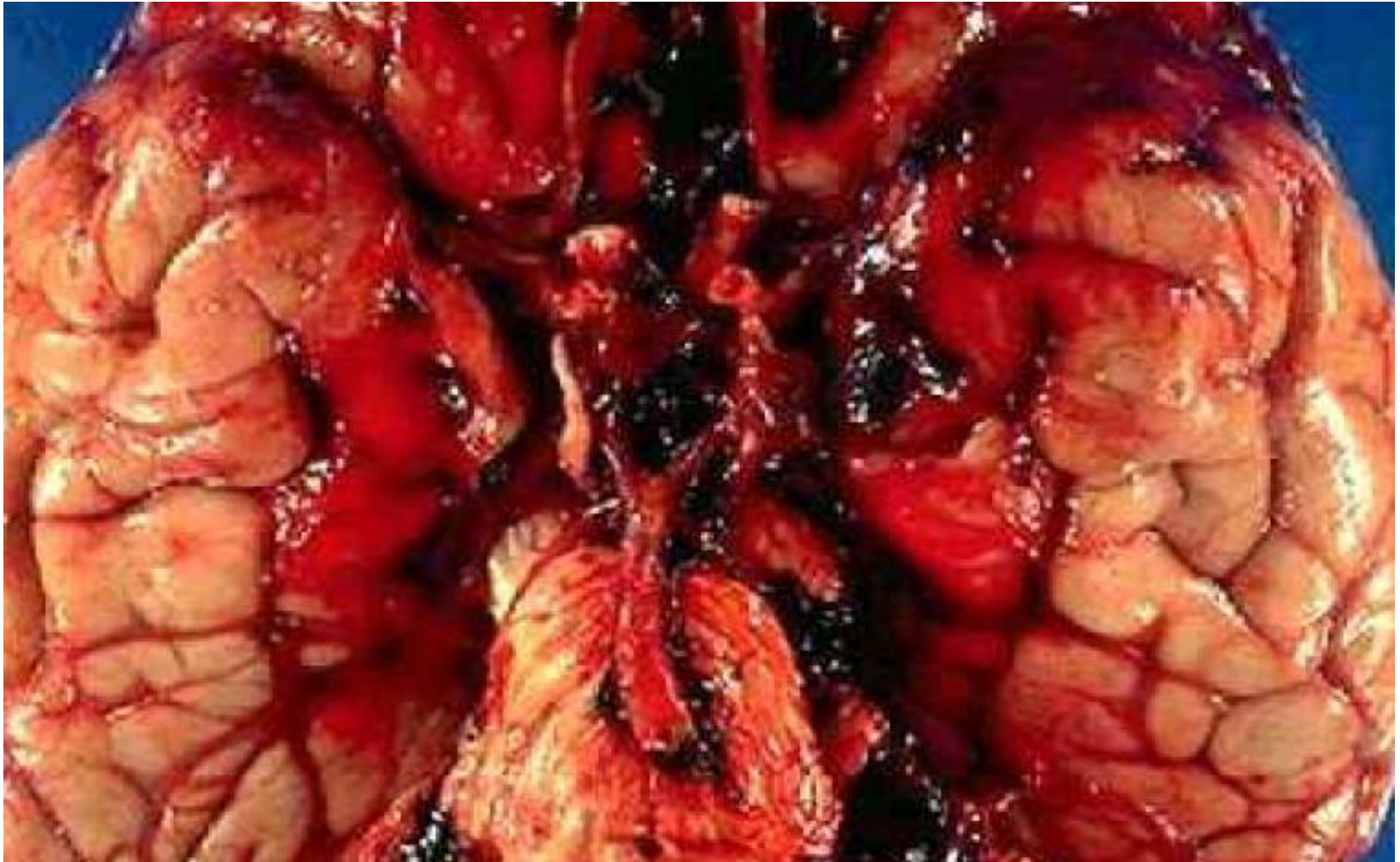
- Myocardial rupture in the infarction zone (5th day), hemopericard, cardiac tamponade.

Hemorrhage

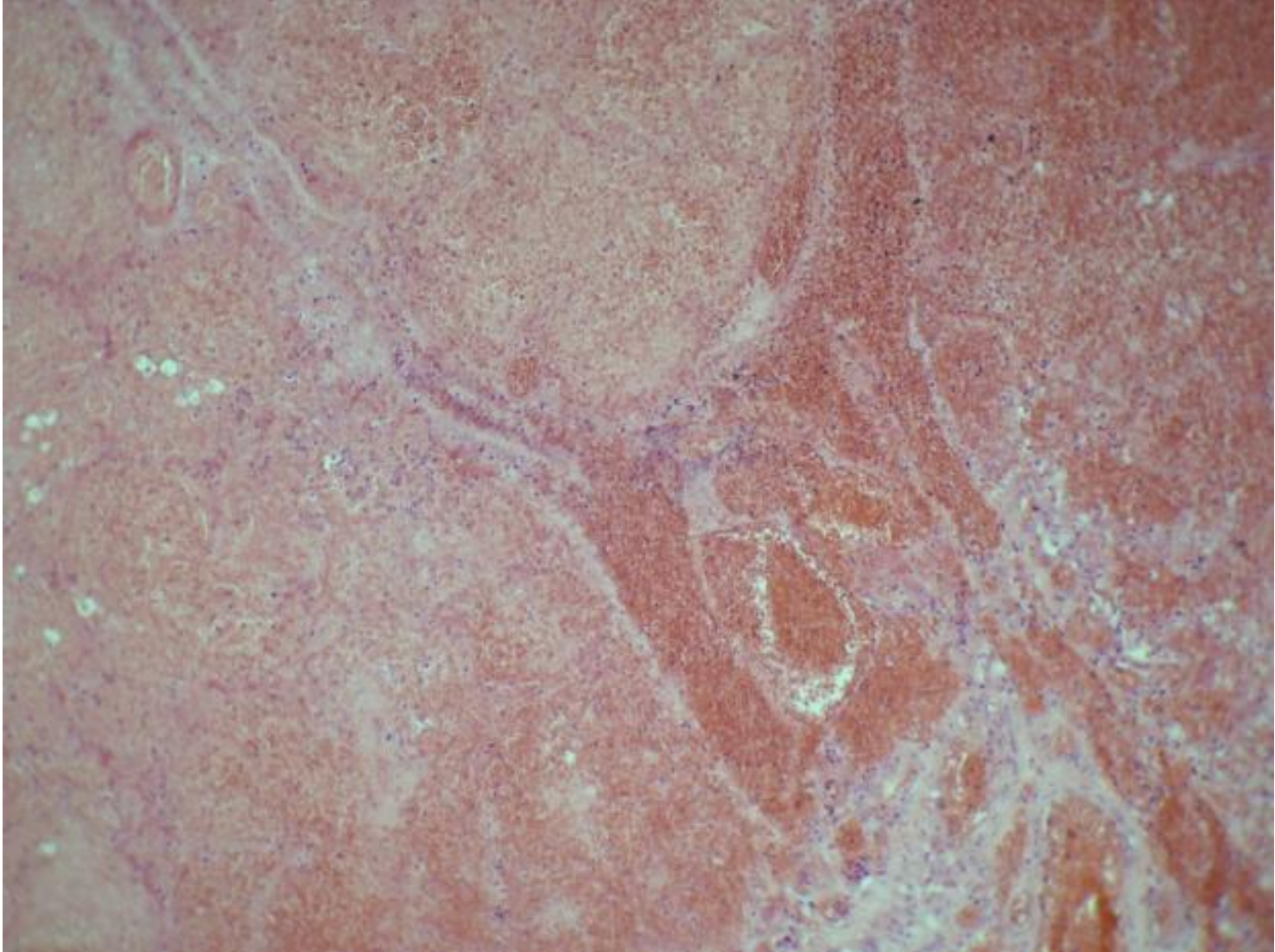


- Hemorrhage in the brain

Subarachnoid Hemorrhage



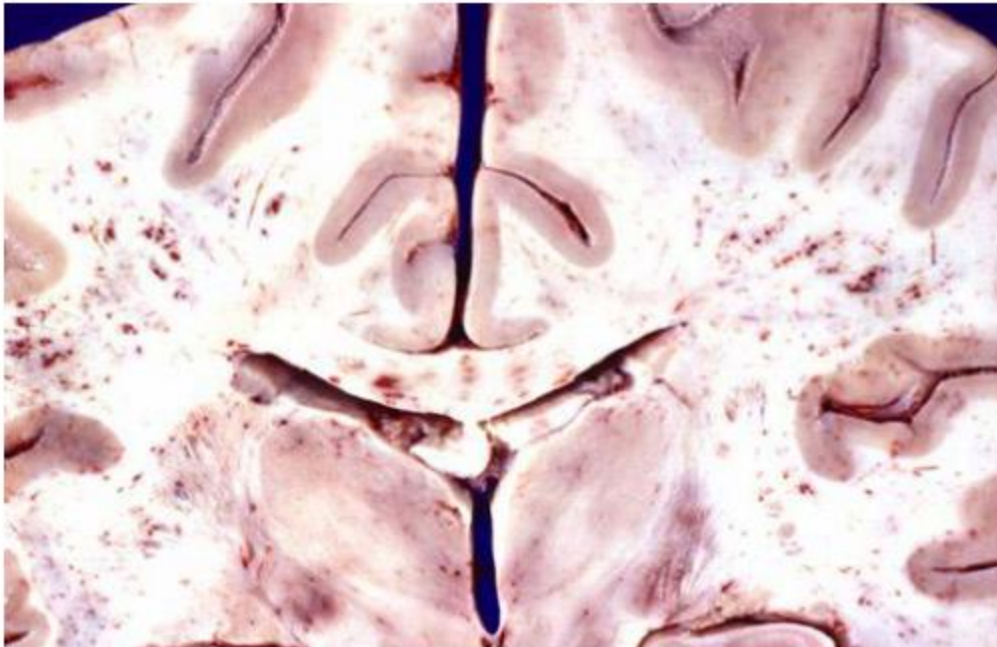
Subarachnoid Hemorrhage



Hemorrhage



- Petechial hemorrhages under the epi- and endocardium (due to coagulopathy, acute hypoxia)



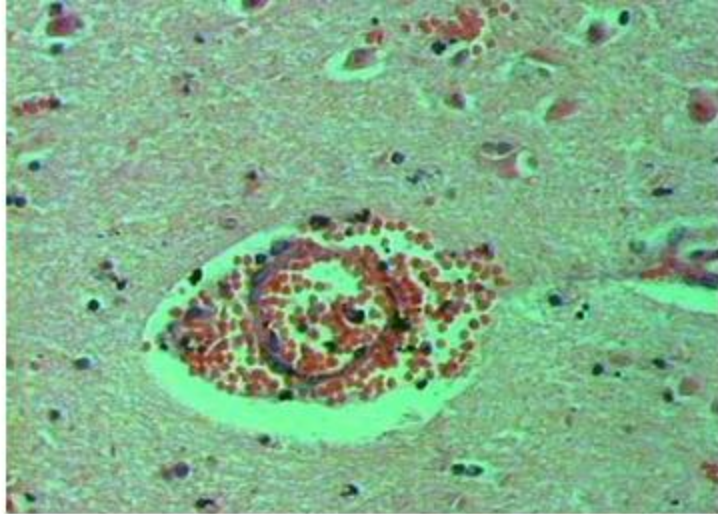
- Petechial hemorrhages in the brain (a typical manifestation of fat embolism)



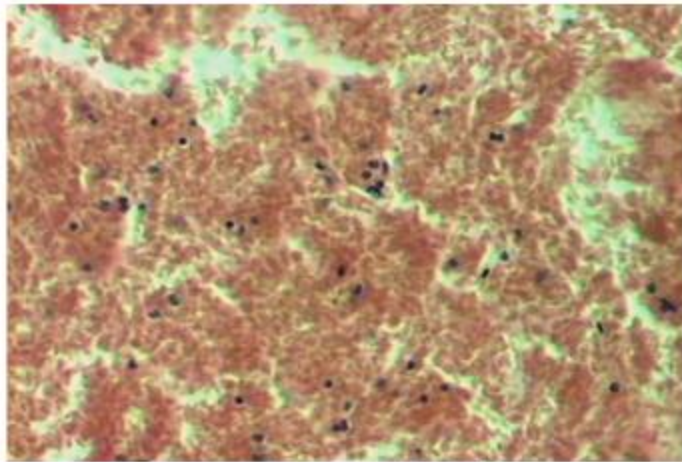
- Ecchymoses



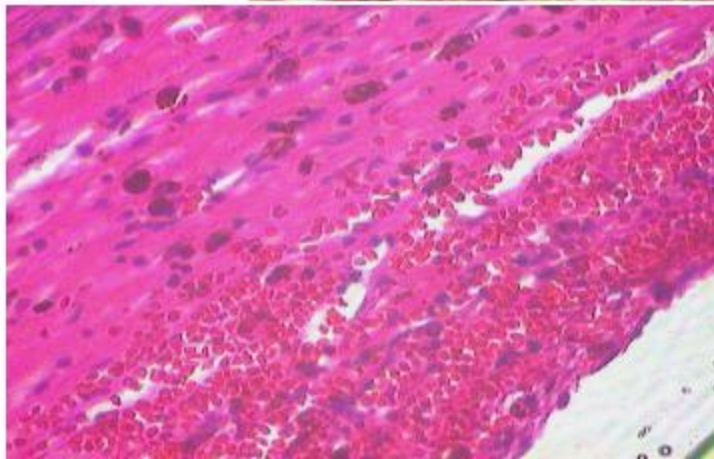
- Hematoma



- Diapedesis
hemorrhage in the
brain.



- Hemorrhage with
single neutrophils.



- Macrophages with
hemosiderin in the
organized hematoma.

The outcomes of hemorrhage

1. Resorption with formation of blood pigments.
2. Cyst formation after resorption of blood.
3. Encapsulation and germination connective tissue of hematoma (organization).
4. Calcification
5. Ossification
6. Accession infection and suppuration.