



Hemodynamic Disorders, Thromboembolic Disease and Shock (Part 2)

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*250 years of EXCELLENCE
in medical education,
research & innovation
and healthcare*

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Hemodynamic disorders

- Hyperemia (active and passive)
- Edema
- Hemorrhage
- Thrombosis
- Embolism
- Infarction
- Shock

INFARCTION

ISCHEMIA

- Definition: Decreased perfusion of organs and tissues
- Causes: arterial obstruction, (relative ischemia)
- Transient ischemia (eg: coronary arteries -angina pectoris, cerebral arteries- TIA)
- Long standing ischaemia: reversible - irreversible injury

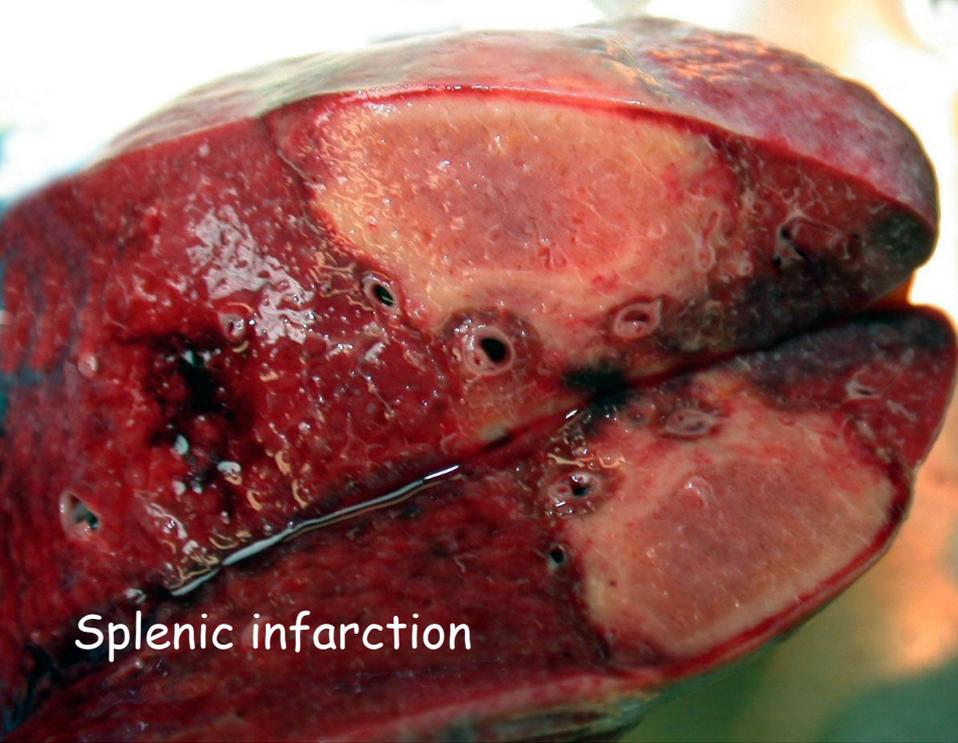
INFARCTION

- Ischemic necrosis due to impaired arterial supply or venous drainage
- In 99% due to thrombosis or embolism (mainly arterial occlusion)
- Other mechanisms: vasospasm, hemorrhage to atherosclerotic plaque, vascular compression (e.g. by a tumor), torsion (testicular, ovarial)

SUBTYPES 1.

ANEMIC (white) INFARCTS

- Coagulative necrosis
- Arterial (end arteries) occlusion
- In solid parenchymal organs
- **Heart, spleen, kidney**
- (Septic infarction→abscess)



Splenic infarction



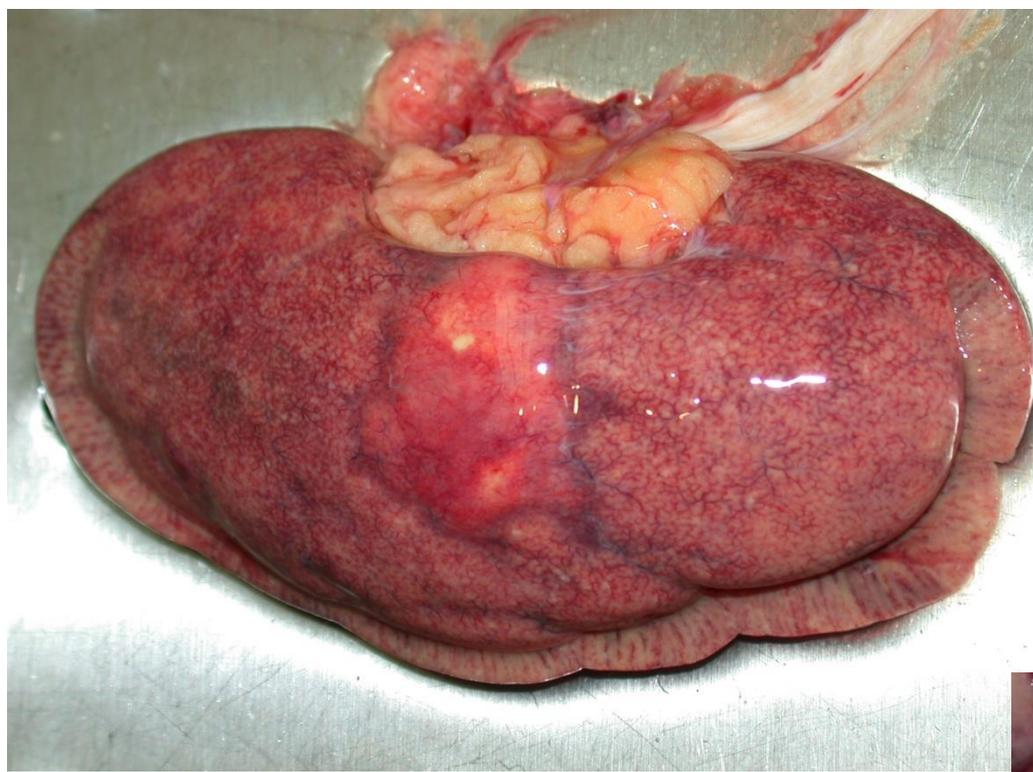
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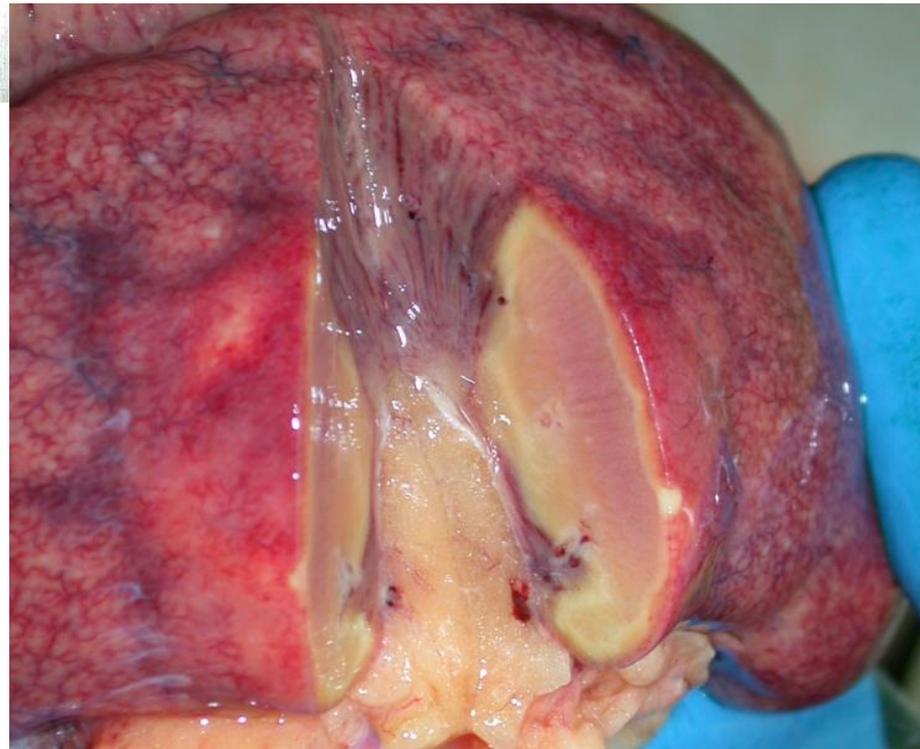


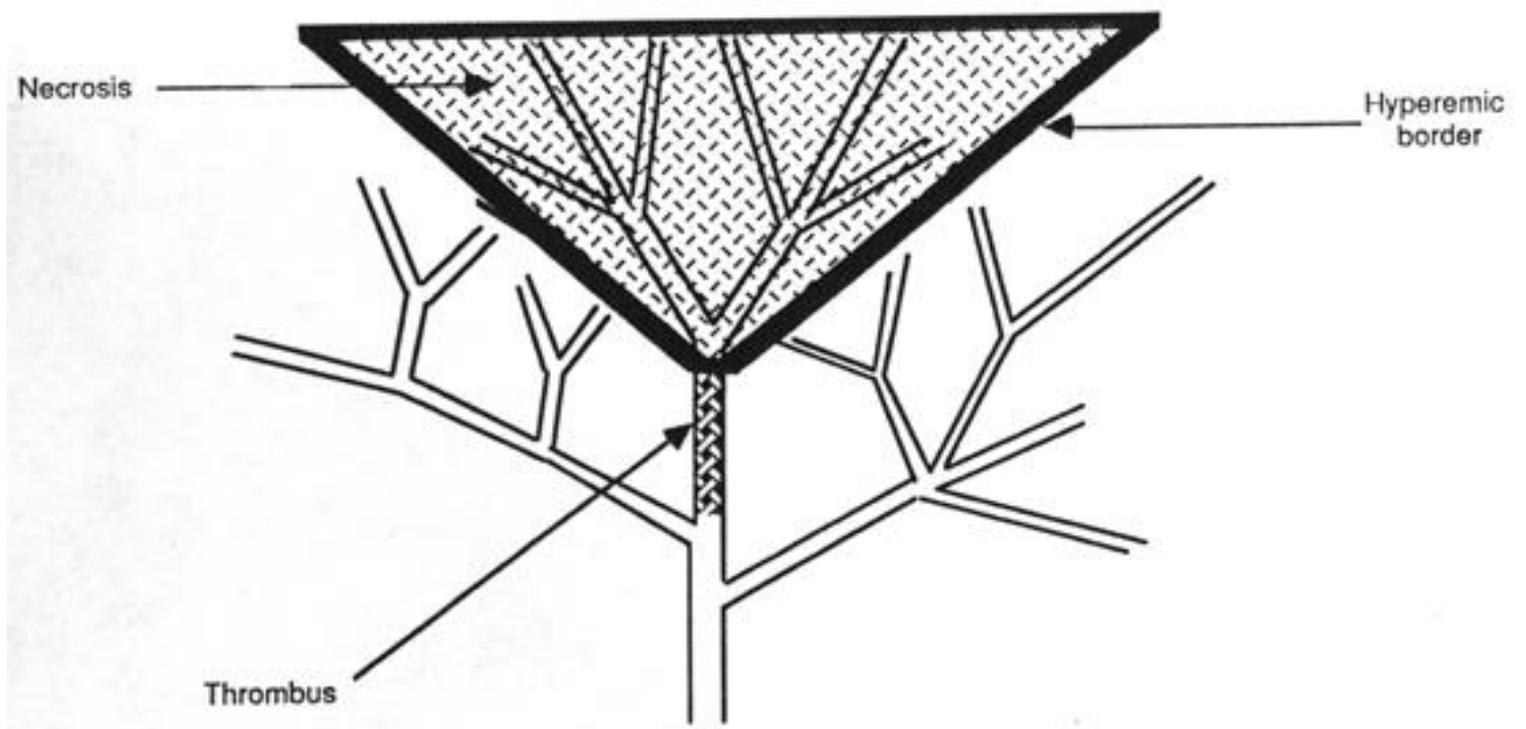
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Renal infarction

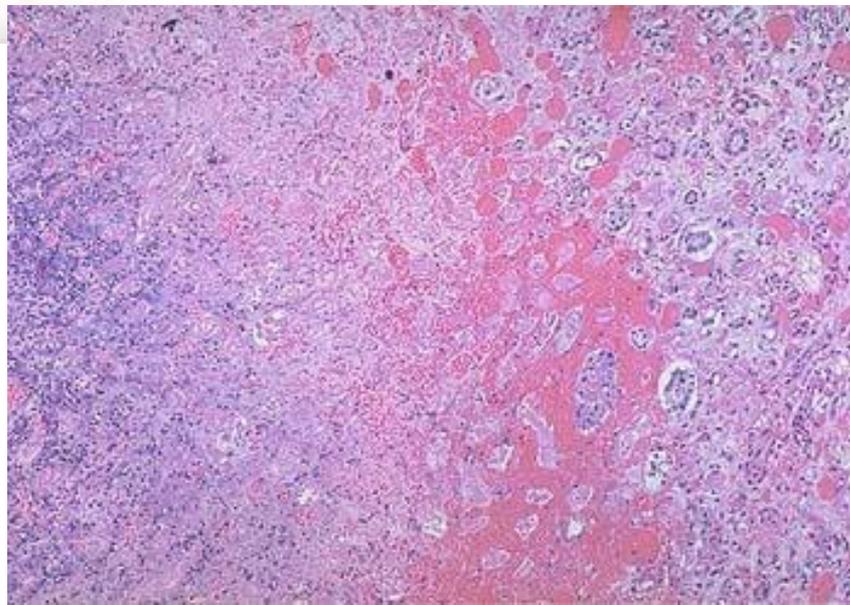
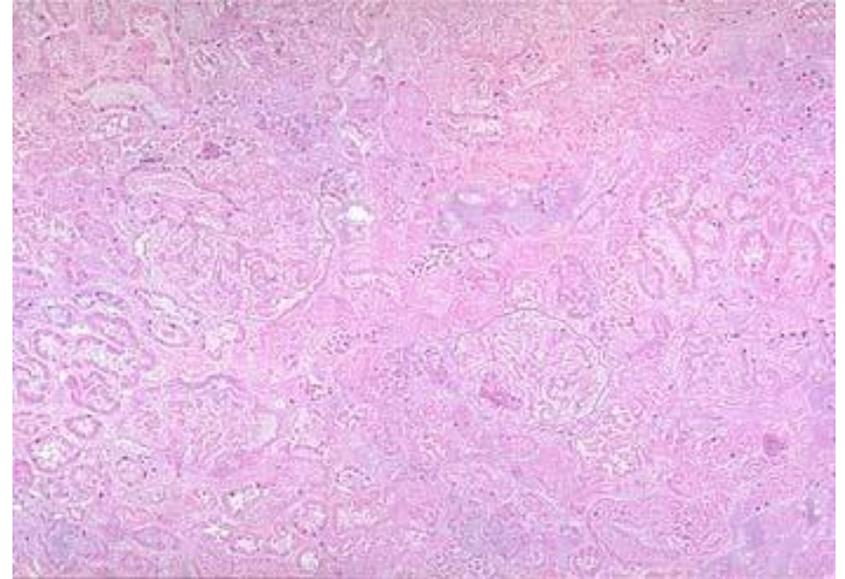
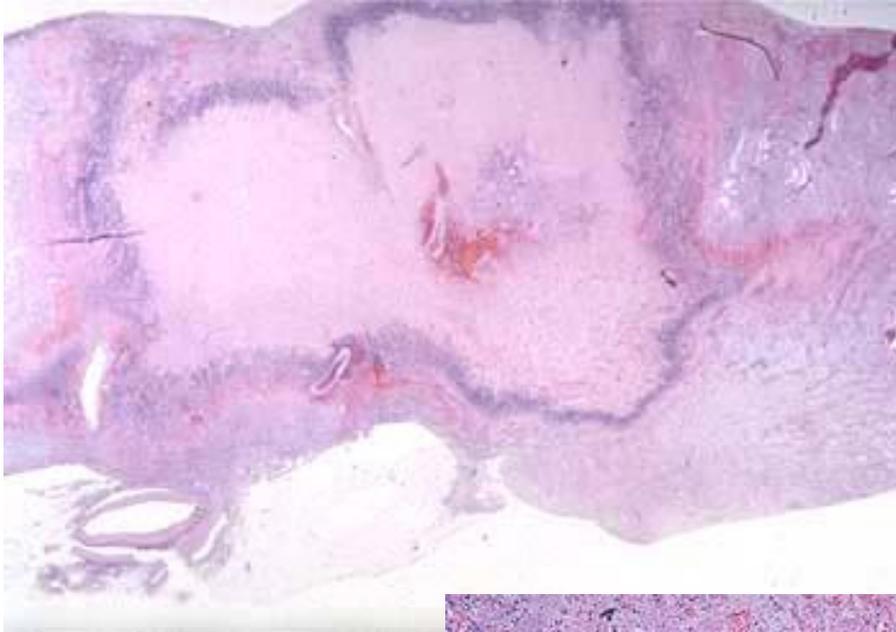


Renal infarction (+?)





Anemic infarction- kidney



SUBTYPES 2.

HEMORRHAGIC (red) INFARCTS

1. Obstruction to venous outflow
2. In loose tissues
3. In organs with a dual circulation (eg. lung, bowel)
4. If preceded by congestion
5. When blood flow is re-established



Hemorrhagic infarct-lung



Hemorrhagic infarcts

Hemorrhagic infarction-testis



15721

SPECIAL ORGANS 1.

LIVER

- A. hepatica thrombosis, embolism- (eg. vasculitis, sepsis)
 1. No infarction
 2. Anemic infarction
 3. Hemorrhagic infarction

SPECIAL ORGANS 2.

V. portae thrombosis (pylethrombosis)

Intrahepatic - no infarction, only marked congestion (Zahn infarction- misnomer!)

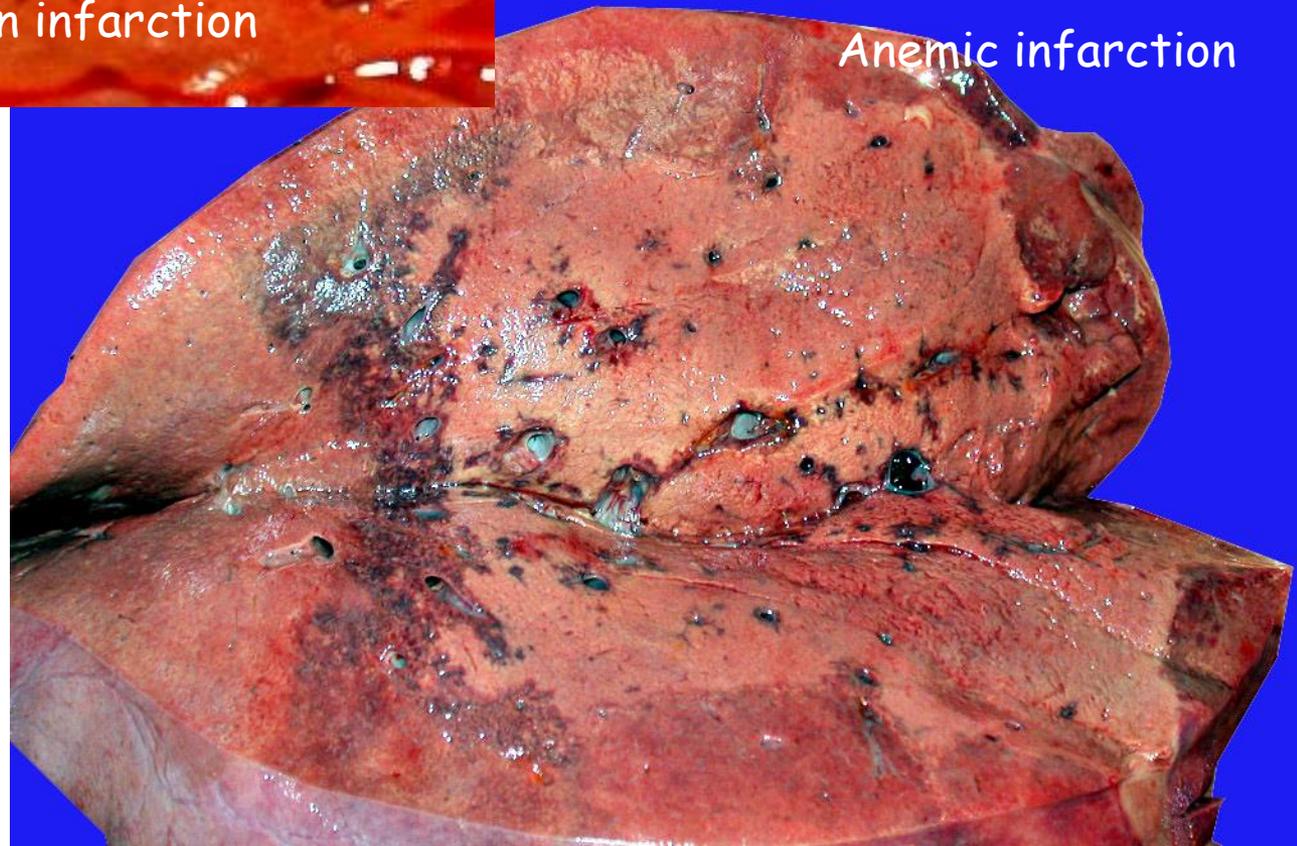
Extrahepatic - severe- abdominal pain, ascites, portal hypertension, bowel infarction

V. hepatica thrombosis

Budd-Chiari sy



Zahn infarction



Anemic infarction

SPECIAL ORGANS 3.

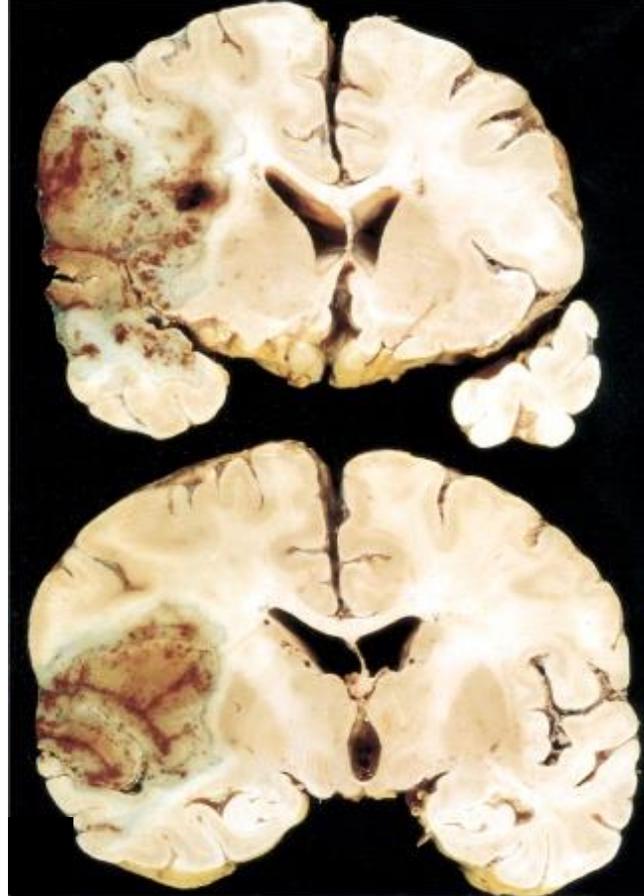
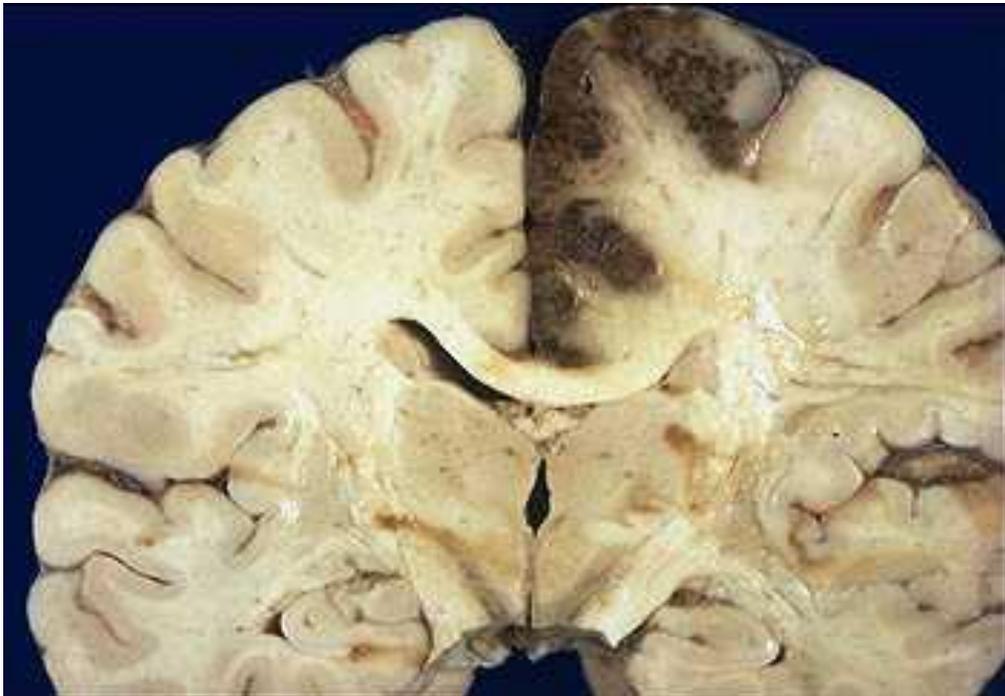
BRAIN

Liquefactive necrosis!

Emmolitio (encephalomalacia) alba

Emmolitio (encephalomalacia) rubra

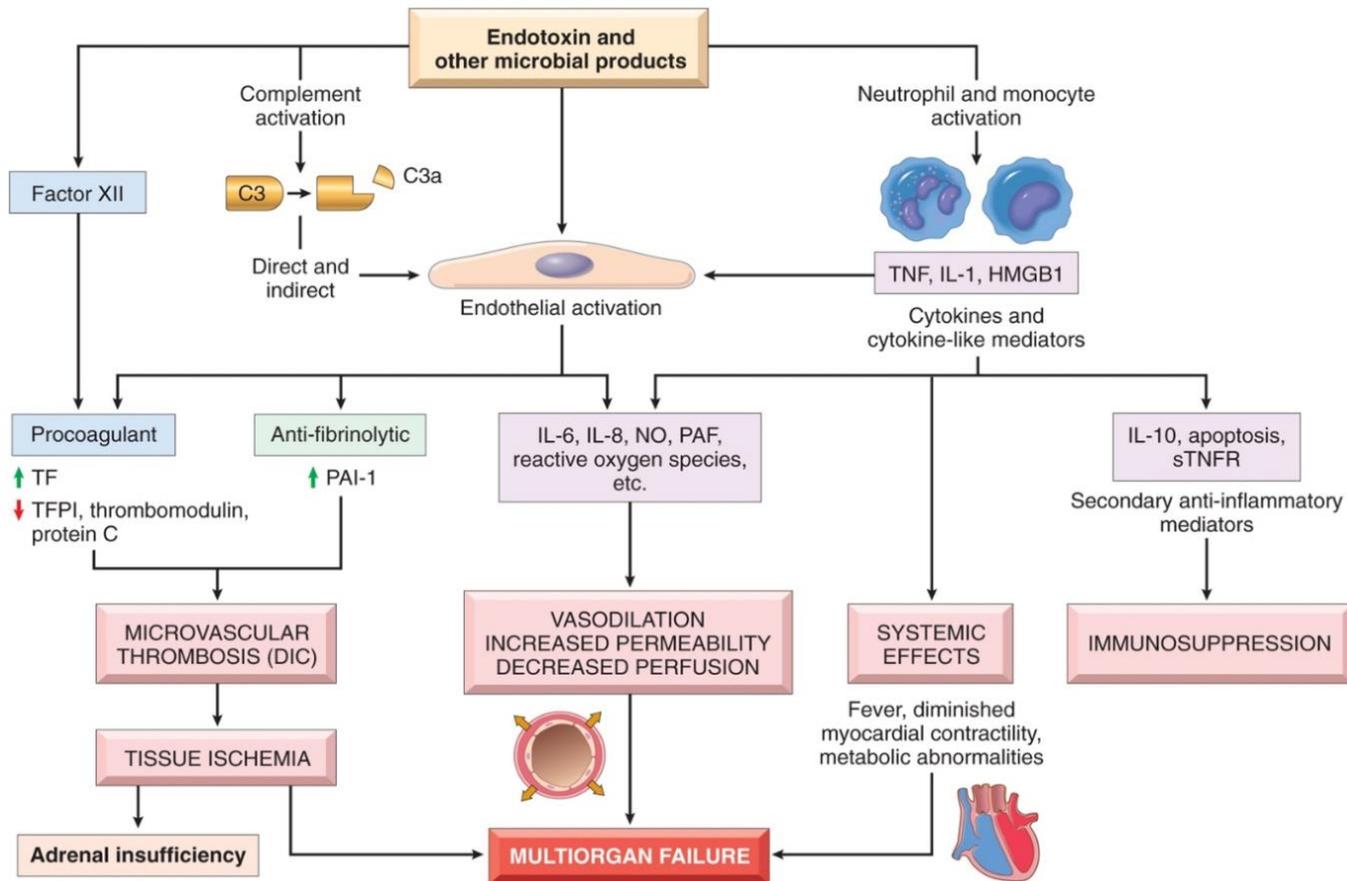
Cysta ex emollitione



SHOCK

- Definition: clinical symptoms due to systemic hypoperfusion (cardiovascular collapse)
- Clinical signs: Blood pressure↓, tachycardia, tachypnoe, skin cold and cyanotic (or flushed and warm)
- Forms:
 - Hypovolemic
 - Cardiogenic
 - Septic/Endotoxic
 - Neurogenic
 - Anaphylactic
 - Endocrine
 - Traumatic

Events in shock



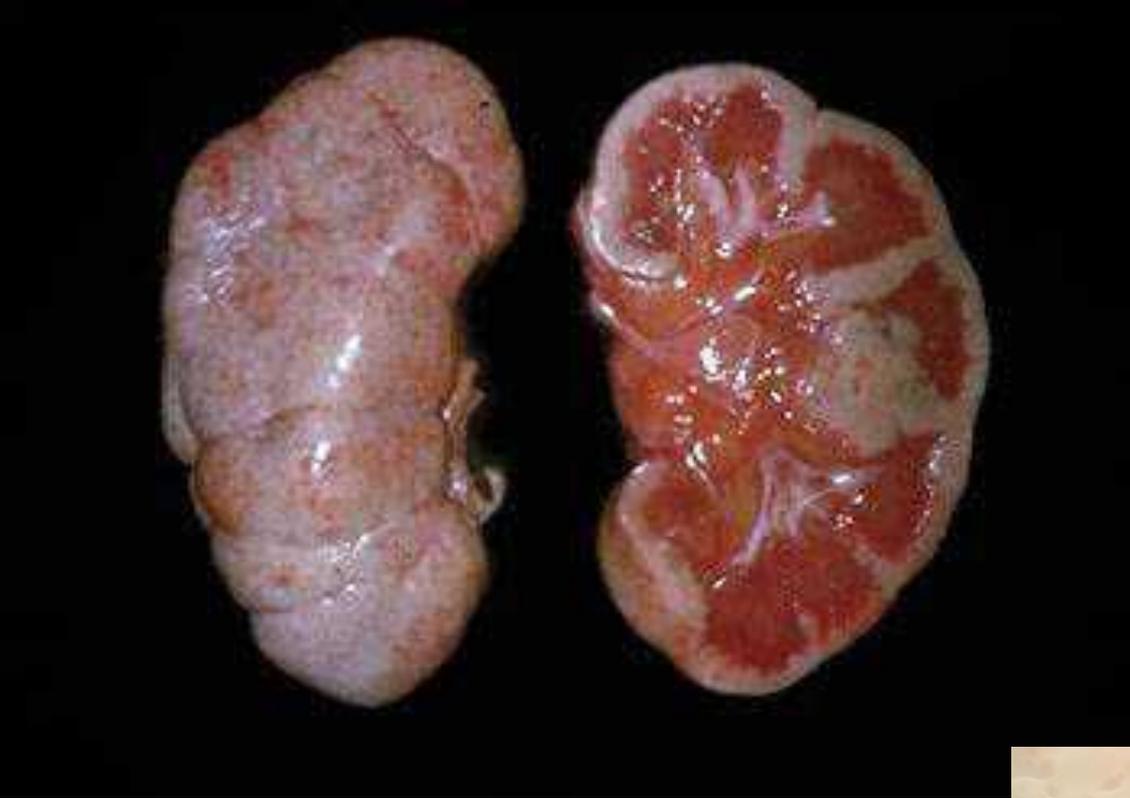
Stages of shock

- **Nonprogressive phase**- blood supply of vital organs still maintained (neurohumoral reflexes!)
- **Progressive phase**- increasing circulatory and metabolic disturbance (acidosis!)
- **Irreversible phase** - tissue damage so severe that survival is not possible

Manifestations of shock (results of hypoxia!)

- Kidney
 - Macr: cortex pale and widened, medulla cyanotic
 - Micr: arteriole constriction, fibrin thrombi, tubular epithelial damage (acute tubular necrosis)
- Lung
 - Macr: livid, firm
 - Micr: ARDS (diffuse alveolar damage) in septic shock
- Liver
 - Microthrombi, centrilobular necrosis
- GI tract
 - Erosions, acute ulceration, hemorrhage
- Brain
 - Purpurae, hemorrhage, cortical necrosis (pseudolaminar necrosis), watershed necrosis
- Heart
 - Coag. necrosis, subendocardial hemorrhage
- Endocrine organs
 - Hemorrhage and necrosis (Sheehan sy, Waterhouse- Friderichsen sy), cortical cell lipid depletion in the adrenals, fibrin thrombi in DIC

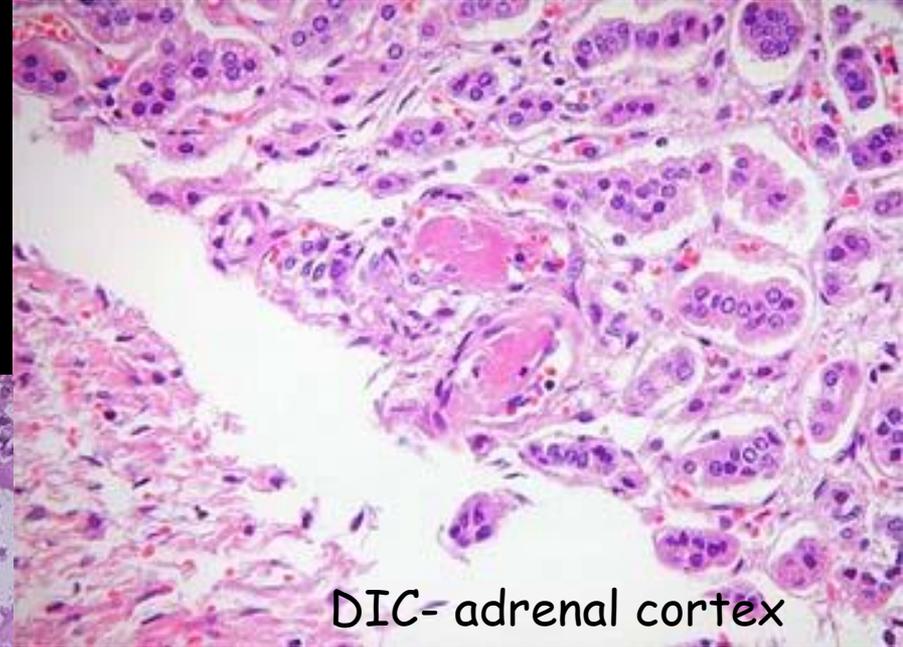
→ MULTIORGAN FAILURE



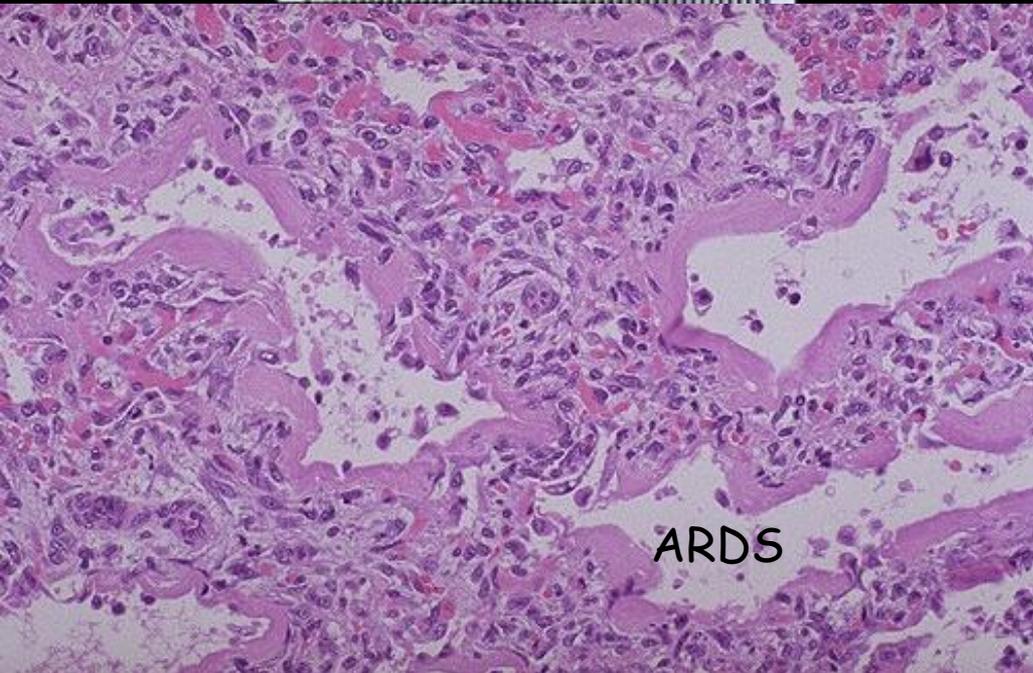
Shock- kidneys



Brain- pseudolaminar necrosis



DIC- adrenal cortex



ARDS