

LESSON № 2

Topic: DISORDERS OF PERIPHERAL CIRCULATION

Aim of lesson: to study the causes, mechanisms and manifestations of microcirculation disturbances.

QUESTIONS:

1. Central and peripheral circulation, their correlation. Microcirculation. Vessels of microcirculation.
2. Disturbances of microcirculation. Types and causes. Classification of microcirculation disturbances.
3. Arterial hyperemia. Causes. Types (physiological and pathologic), mechanisms, consequences. Manifestations of arterial hyperemia and its mechanisms.
4. Venous hyperemia. Causes, mechanisms of the development, symptoms, and consequences.
5. Ischemia. Causes, and their mechanisms, symptoms, consequences. Factors that influence on the consequences of ischemia.
6. Stasis. Types, causes, symptoms, and consequences. Sludge syndrome. Mechanisms.
7. Postischemic reperfusion syndrome. Causes, pathogenesis.
8. Types of transmural disturbances of microcirculation. An increased vascular permeability, extra and intravascular disturbances, blood rheological and plasma composition disturbances.
9. Embolism. Consequences.
10. Exogenous and endogenous embolism. Causes of fat, gas and air embolism development. Embolism by a blood clot.
11. Causes of pulmonary, brain, cardiac embolism.

LABORATORY WORKS

Laboratory work 1. *Modulation of arterial hyperemia on the rabbit ear*

Description of the work: Students perform the control of skin color and analyze the vasculature structure of rabbit ear. Then students massage one of a rabbit's ear and fix the changes.



Fig. 1 – Arterial hyperemia on the rabbit ear

Laboratory work 2. *Compressive ischemia on the rabbit's ear*

Description of the work: Students perform the control of skin color and analyze the vasculature structure of rabbit ear. Then students compress the main vessels of the ear and fix the symptoms of ischemia. After decompression we observe the development of reactive arterial hyperemia.

Laboratory work 3. *Modulation of peripheral circulation disorders on a human's arm (Konchalovsky test)*

Description of the work: The cuff is put on a volunteer's shoulder and arterial pressure is estimated. The pressure in the cuff should make 5-10 mm Hg less than maximal during 5 min. The students look for venous hyperemia development and fix the symptoms. After cuff removal students fix the vasculature changes on the shoulder.

Laboratory work 4. *White thrombus formation in peritoneum vessels of a frog*

Work description: after fixation of the frog and exposure of mesentery students watch the normal blood flow in mesentery vessels under microscope small magnification. The sodium chloride crystal should be put on vein confluence under microscope magnification control. Students investigate the process of white thrombus formation in frog peritoneum during 20-40 min using microscope.

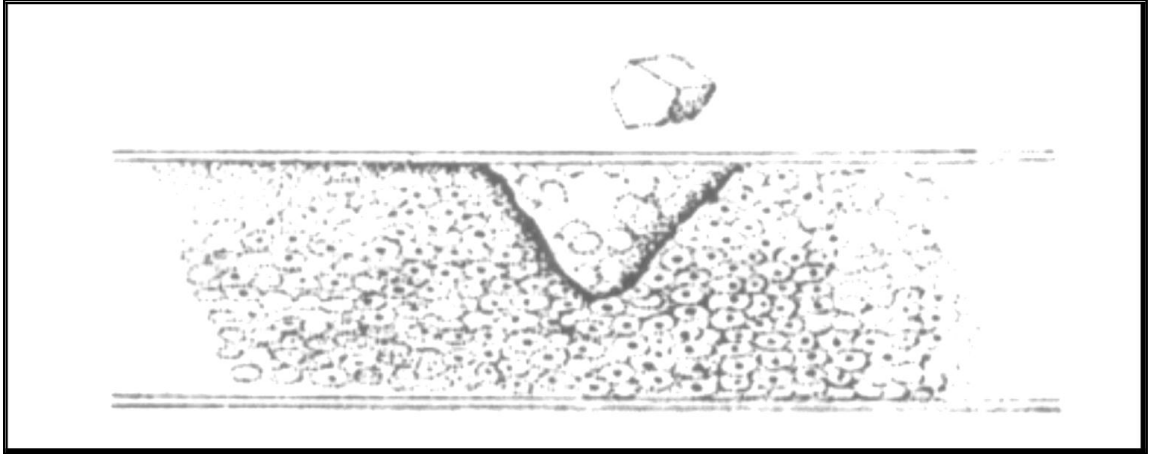


Fig. 2 – White thrombus

Students analyze, draw and make conclusions.

Laboratory work 5. *Red thrombus development in peritoneum vessels of a frog*

Work description: using the same frog students damage the vein by sharp needle under microscope small magnification. Then students watch the process of red thrombus formation, analyze, draw and make conclusions.

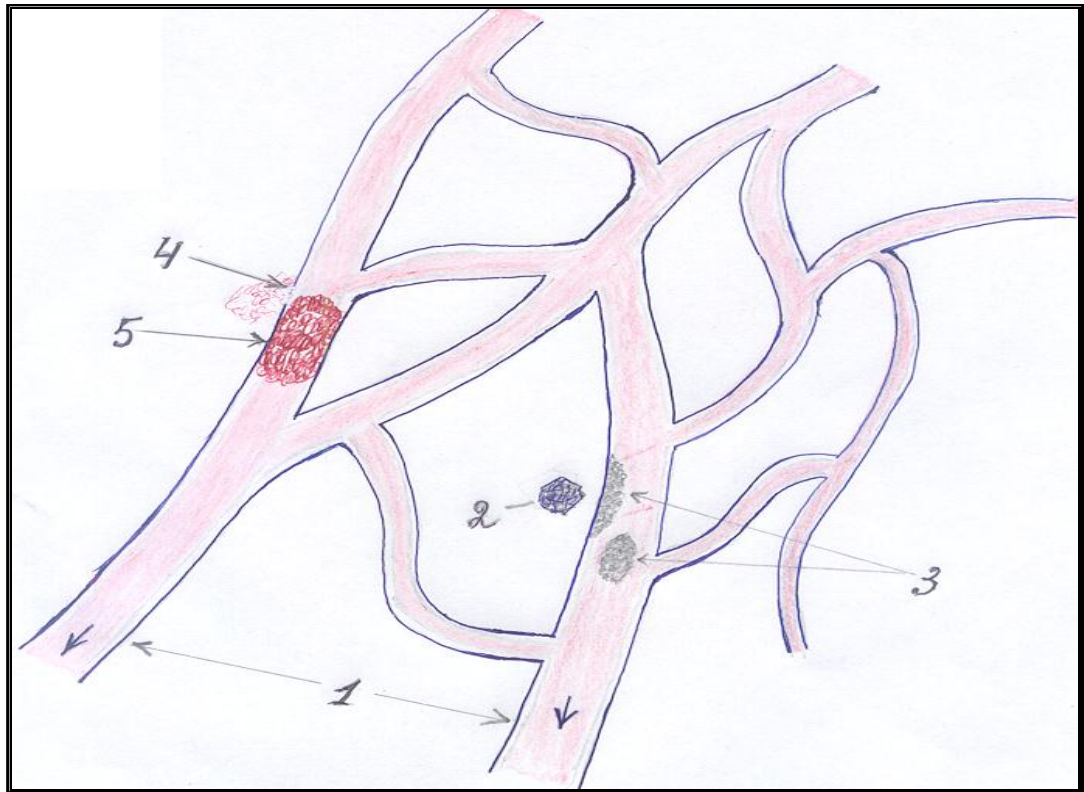


Fig. 3 – Thrombus in the veins of peritoneum of frogs

- 1) veins; 2) ctystall NaCl; 3) white thrombus; 4) place of the vessel lesion;
5) red (obstructive) thrombus

Students analyze, draw and make conclusions.

Laboratory work 6. *Fat embolism of peritoneum vessels in a frog*

Work description: after fixation of the frog and exposure of mesenteric students watch the normal blood flow in mesenteric vessels under microscope small magnification. After middle thoracotomia fat solution should be administrated intracardially and students watch the emboli circulation and embolism of small peritoneum arteries.

Fill in a table:

What thrombus localization leads to?				
Pulmonary artery emboli	Stroke	Infarctum myocardium	Gangrene of low extremities	Infarctum of intestine

Fill in a table:

Consequences of a thrombus in:				
Left parts of the heart	Aorta	Venous of low extremities	Pelvic veins	Venous sinuses of the brain

Tasks:

1

A patient's left leg is cool, pale, pulseless and painful. His right leg is warm, purple, swollen and painful, but still has a pulse. Which leg is more likely to have an arterial thrombus, and which one – a venous thrombus? Explain. What are causes (your differential diagnoses) for each type of occlusion?

2

A 68-year-old male patient D. presented with chronic hepatitis and liver cirrhosis. The doctor introduced a needle into the abdominal cavity to perform aspiration of ascitic fluid. By the fifteenth minute, after 5 l of fluid had been removed, the patient felt bad, complaining of weakness, dizziness, and nausea. But the procedure was continued. After 1,5 l more fluid had been evacuated the patient developed syncope and lost consciousness. Several minutes later, after the emergency treatment, the patient regained total consciousness but still complained of weakness, dizziness, and nausea.

- What was the doctor's mistake during the performance of ascitic fluid aspiration?
- What are the mechanisms of syncope after the removal of ascitic fluid?
- What are the possible mechanisms of adaptation of the brain circulation in this case?
- Why did the adaptive mechanisms turn out to be insufficient in this patient?

3

A 56-year-old male patient presented with complaints of fatigability and pains in the gastrocnemius muscles when walking. The symptoms were relieved by rest. This is called the symptom of «intermittent claudication». In addition, he complained of increased sensitivity to cold, numbness, pins- and-needles, tingling sensation in his legs at rest. The patient had a long history of heavy smoking since his teens. His occupation required working outdoors even in cold seasons when he sometimes suffered from cold. The patient's examination showed that skin on both soles was pale and felt cool and dry; the nails crumbled; no pulse was felt on posterior tibial arteries on both legs. The preliminary diagnosis was thrombangitis obliterans.

- What form of organ circulation disorders is observed in the presented patient? Name its characteristic features.
- What are the possible causes and mechanisms of this form of the circulation disorders?
- What is the possible outcome of the circulation disorder in this case?
- What are the likely mechanisms of the development of each symptoms seen in the patient?

LITERATURE:

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ADDITIONAL LITERATURE:

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2. Pathology / ed. by E. Rubin and J.L. Farber. – 2nd ed. – 1994. – P. 456-462.
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