# VIOLATION OF PERIPHERAL BLOOD CIRCULATION

# Peripheral blood circulation - blood circulation within an organ or tissue through microvessels .

The microcirculatory bed includes capillaries and adjacent small arteries and veins, as well as arteriovenous anastomoses up to 100 microns in diameter. Violation of microcirculation makes it impossible to adequately supply tissues with oxygen and nutrients, as well as remove metabolic products from them.

# Classification of peripheral circulatory disorders:

1. Arterial hyperemia.
2. Venous hyperemia.
3. Ischemia.
4. stasis
5. Thrombosis.
6. Embolism.
7. Collateral blood circulation.

Arterial hyperemia - increased blood flow in an organ or tissue due to dilation of the adductor arteries

# Certain types of arterial hyperemia:

Physiological

- Working
- Reactive

Pathological

- Neurotonic
- Neuroparalytic
- Arterial hyperemia caused by metabolic (chemical factors)
- The inflammatory
- Postischemic
- Vacat General and local
- Collateral

# Etiology and pathogenesis of arterial hyperemia

- The increased effect of normal physiological stimuli (physical, chemical, biological) against the norm.
- The action of pathogenic stimuli.
- The increased sensitivity of tissue to stimuli.
- Increased tone of the vasodilator nerves.
- Decreased tonus of the vasoconstrictor nerves.

# Changes of microcirculation in arterial hyperemia

- The expansion of the arteries leading
- Relaxation of precapillary sphincters

Hemodynamic changes:

- The increase in volumetric blood flow velocity
- Increase of linear blood flow velocity
- Reducing the resistance to blood flow
- A decrease in the arteriovenous difference on oxygen
- Increase in blood pressure
- The increase of functioning capillaries
- The increase in lymph outflow

# Symptoms of arterial hyperemia

- Redness
- Ripple
- The increase in the volume of bodies
- The increase of the tissue temperature
- Hyperfunction

# The consequences of arterial hyperemia

- The increased power of the organs
- Improving organ function
- The rupture of blood vessels, hemorrhage

Venous hyperemia - an increase in blood supply to an organ or tissue due to difficulty in blood outflow to the diverting venes.

# Etiology and pathogenesis of venous hyperemia

- venous thrombosis or external compression
- decreased tone of the venous walls
- The slowing of blood flow in heart failure
- Reducing the suction action of the chest
- stagnation of blood in a long-term forced position
- the valvular pathology of the veins

# Changes of microcirculation in venous hyperemia

Mechanisms

- The increase in resistance to blood flow
- Insufficiency of collateral outflow

Hemodynamic changes

- dilation of veins due to their overflow with blood
- The slowing of blood flow
- Increased venous pressure
- The decrease in the outflow of lymph
- The increase in the permeability of the vascular wall
- Jerky and pendulum-like movements of blood in the veins
- Stasis of blood

# Symptoms of venous congestion

- The severity of venous picture
- Cyanosis
- Lowering the temperature of the tissue
- The increase in the body (edema)

# The consequence of venous hyperemia

- Hypoxia
- The growth of connective tissue
- Atrophy of the parenchyma of the organ
- The tissue necrosis

# Stasis - a lifetime local stop of blood flow.

# Certain types of stasis

- Ischemic stasis
- stagnant stasis
- true capillary stasis

# The etiology and pathogenesis of stasis

- Complete cessation of blood flow from the arteries to the capillaries
- Venous congestion
- Intracapillary aggregation of red blood cells

The consequences of stasis - the tissue necrosis.

Ischemia  is called anemia of tissues caused by insufficient or complete cessation of arterial blood flow.

# Certain types of ischemia

- Compression
- Obstructive
- Angiospasticescoy
- Redistribution

# The etiology and pathogenesis of ischemia

- compression, narrowing of the arteries
- blockage of the arteries

# Symptoms of ischemia

- Blanching of the tissues
- The decrease in the volume of organ
- decreases the temperature of the bodies
- Pain
- violation of the function

The consequences of ischemia - hypoxia tissue, necrosis

Thrombosis this is a lifetime process of formation in the lumen of a blood vessel of dense masses consisting of blood elements and to some extent preventing the movement of blood through the vessels.

Etiology and pathogenesis of thrombosis

- slowing of blood flow
- damage to vascular walls
- The increased blood clotting

The consequences

- Thromboembolism
- The phlebothrombosis
- Necrosis

An embolism is a blockage of a blood or lymph vessel by particles brought with the blood or lymph flow and usually not found in the blood and lymph flow.

# The types of embolic origin

Endogenous embolisms

- Thromboembolism
- Fat embolism
- Tissue embolism
- Amniotic fluid embolism

Fat embolism occurs when blood vessels are blocked by endogenous lipoprotein particles, chylomicron aggregation products, or exogenous fat emulsions and liposomes. Tumor embolism is a complex process of hematogenic and lymphogenic metastasis of malignant neoplasms.

Tissue and, in particular, adipocytic embolism can be the result of injuries, when particles of crushed tissue fall into the lumen of damaged vessels.

Thromboembolism – occurs due to blockage of blood vessels by detached blood clots or their particles.

Exogenous embolisms

- Air embolism
- Gas embolism

Air embolism occurs due to the ingress of air from the environment into the vascular system.

Gas embolism is associated with the release of bubbles in the blood of gases dissolved in it (nitrogen and helium) during the rapid transition from high atmospheric pressure to normal or from normal to low.

Types of embolism according to the direction of movement of the embolus

- Retrograde embolism
- Paradoxical embolism
- Artificial embolization

Orthograde embolism is most common and is characterized by the progress of the embolus in the direction of blood flow.

In retrograde embolism, the embolus moves against the blood flow under its own gravity.

Paradoxical embolism has an orthograde direction, but occurs due to defects in the atrial or interventricular septum.

The types of emboli depending on circulation

- Embolism of the pulmonary circulation
- Embolism the systemic circulation
- Embolism of the portal vein

The consequences of embolism

- Ischemia
- Necrosis

# QUESTIONS FOR SELF-MONITORING OF KNOWLEDGE

1. What is meant by a peripheral circulatory disorder?
2. Give the definition of arterial hyperemia.
3. In what cases can parts of a blood clot from the lower leg vein get into the arteries of the brain?
4. What is stasis?
5. What are the causes of true capillary stasis?
6. What is the essence of embolism?
7. The consequence of what circulatory problems may be a heart attack?
8. Give the definition of venous congestion.

9. When injuring which vessels can cause an air embolism?

10. What is meant by thrombosis?

11. The patient put a tourniquet on the shoulder. Below the place of application, paleness was noted, the skin of the hand turned cold, there were pain in the hand, a feeling of crawling "goosebumps". What tourniquet was applied?

12. When can gas embolism occur?

13. what factors contribute to blood Clots?

14. does the creation of venous hyperemia and embolism find application in practice?

15. What is retrograde and paradoxical embolism?

16. What are the methods for reproducing arterial hyperemia?

# INDEPENDENT WORK OF STUDENTS IN THE CLASSROOM

- Experience 1. Objective: to explore and describe the appearance of disorders of blood circulation on the human skin.

Method:

a) apply a tourniquet on the shoulder of a non-servant (with the preservation of the pulse). Observe changes in skin color, the severity of blood vessels above and below the place where the tourniquet is applied. To name and explain the emerging circulatory disorders;

b) apply a tight tourniquet to the shoulder for 2 minutes (until the pulse disappears). Observe changes in color, skin temperature, and vascular severity below the place where the tourniquet is applied. Name the upcoming circulatory disorders and explain their origin, draw a conclusion.

- Experience 2. Objective: to study the changes of blood circulation in the skin when applying cupping-glasses.

Method: put a medical jar on your forearm for 5 minutes. Describe the resulting changes in blood circulation, give them a name, explain the origin, and draw a conclusion.

- Experiment 3. objective: to study the mechanism of embolism development.

Method: the frog is fixed with its belly up. Cut the skin on the chest, cut the sternum. The pericardium is removed from the naked heart. 1-2 drops of vaseline oil are injected into the top of the heart with a syringe. Then stretch the tongue over the window. Under a microscope, follow the movement of oil drops in the vessels of the tongue.

# Tasks

1. irritation of chorda tympani in a rabbit causes an increase in the functional activity of the submandibular salivary gland (the experience of Claude Bernard). What changes in peripheral blood circulation lead to increased salivation? Explain the mechanism.

2. a patient with ascites experienced fainting with loss of consciousness after rapid pumping of fluid from the abdominal cavity. Explain the mechanisms of violations that occurred.

3. a 25-year-old patient complains of pain and numbness of the fingers in cold weather. During attacks, there is a sharp paling of the skin of the fingers and hands, a decrease in local temperature, and a violation of skin sensitivity. What kind of peripheral circulatory disorders are we talking about? Explain the mechanisms of development of clinical signs.

4. a worker in the weaving Industry has varicose veins in the lower extremities. The patient complains of a feeling of heaviness in the legs and swelling, which usually occur in the evening, especially after prolonged standing. The limbs are cold to the touch, cyanotic, and outline dilated subcutaneous veins. What violation of peripheral blood circulation occurred in the patient? Explain the mechanisms of development of clinical signs.

5. Warty endocarditis is accompanied by the deposition of polypous thrombotic masses at the sites of endocardial destruction. There are cases when patients with warty endocarditis on the background of a satisfactory condition suddenly experienced loss of consciousness and death. Explain the cause of sudden death. What kind of peripheral circulatory disorder occurs in this situation?

6. the inflammatory process in the arteries (in endarteritis) is accompanied by prolonged vascular spasms and pain. After removal of sympathetic nodes and nerves involved in the innervation of inflamed arteries, the condition of patients improves markedly. Name a violation of peripheral blood circulation in endarteritis. What changes in blood circulation are caused by sympathectomy?

7. In a patient with chronic cardiac insufficiency in the lower extremities there is swelling, cyanosis, visible dilated saphenous vein. What is the name of a local circulatory disorder? Explain the mechanism of development of its features.

8. In what case can a patient with varicose veins of the lower extremities have a thromboembolism of the brain vessels? What is the name of this type of embolism?

9. a Tight tourniquet was placed on a healthy limb. What changes in peripheral blood circulation occur below and above the site of the tourniquet, andalso after removing it? Describe their external manifestations.

10. What changes in peripheral blood circulation occur when setting medical cans? Name its external manifestations.

11. the Frog had one of the sciatic nerves cut, and then the vessels on both limbs were symmetrically crossed. Bleeding from which limb will be more intense and why?