

Title : Cardiovascular regulatory mechanisms

Teacher: Leonard Kraśnik MD PhD

Coll. Anatomicum, Świącicki Street no. 6, Dept. of Physiology

I. Systemic regulation

A. Systemic regulation by hormones:

1. Kinins
2. Natriuretic hormones
3. Circulatory vasoconstrictors (vasopressin, catecholamines, angiotensin)

B. Systemic regulation by the nervous system

1. Innervation of the heart and blood vessels
 - a. The role of sympathetic nerve system on the heart (chrono-,ino- and dromotropic positive effect)
 - b. The role of parasympathetic nerve system on the heart (chrono-, ino-, and dromotropic negative effect)
 - c. Innervation of the arteries and veins
 - d. Differences in innervation of great arteries, small arteries, arteriovenous anastomoses precapillary sphincters
2. Vasomotor control by vasomotor center in the medulla oblongata
3. The function of baroreceptors in carotid sinus and aortic arch
4. The function of atrial and ventricular stretch receptors, pulmonary receptors
5. Effect of chemoreceptor stimulation on the vasomotor area
6. Orthostatic reaction

II. Peripheral regulation

A. The nervous regulation of the circulation - the influence of the sympathetic and parasympathetic nervous system on the heart and vessels.

B. The local control of the blood flow by the tissues

1. The local blood flow control can be divided into:
 - a. acute control-rapid changes in local constriction of the arteriols, metaarteriols, precapillary sphincters
 - b. long-term control-changes in size and numbers of blood vessels
2. The conception of the autoregulation
3. The acute control of the local blood flow-the tissue produces vasodilator substance(seg. adenosine , histamine)
4. The oxygen demand theory- the oxygen concentration regulates the opening and closing small vessels.
5. The long- term control of the local blood flow-changes in the degree of vascularity. Angiogenesis- growth of new blood vessels. The angiogenic factors are released by ischemic tissues, tissues that are growing rapidly and tissues with high metabolic rate.
6. The hormonal regulation of the blood flow
 - a. Vasoconstrictor agents
 - Norepinephrine
 - Epinephrine
 - Angiotensin
 - Vasopressin
 - Serotonin
 - Prostaglandins F
 - b. Vasodilator agents

- Bradykinin
- Serotonin
- Histamin
- Prostaglandins E

7. Effects of different ions, chemical and physical factors on vascular control

- a. Calcium ions cause vasoconstriction
- b. Potassium ions cause vasodilation
- c. Magnesium ions cause vasodilation
- d. Sodium ions cause vasodilation
- e. An increase in pH causes vasoconstriction
- f. An increase in CO₂ concentration causes vasodilation
- g. An increase in temperature causes vasodilation

8. The role of the endothelial cells in local control of the blood flow.

- a. The role of EDRF (NO)- vasodilation effect
- b. The role of EDCF- vasoconstriction
- c. The role of prostacyclin (it has vasodilation and antiaggregation effect)
- d. The role of endothelin (potent vasoconstrictor)

9. The role of thromboxane A₂ in the local blood flow control (it promotes platelet aggregation and vasoconstriction).