Influence of low-intensity electromagnetic fields of endogenous origin (bioresonance therapy) to change the concentration of oxyhemoglobin from arterial to venous capillary according to capillary spectrometry data

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Recently, direct and indirect methods for assessing microcirculation, such as laser Doppler fluometry, high-frequency Doppler fluometry, and capillaroscopy, have become widespread. However, these methods often give an idea of the speed indicators of blood flow and do not allow judging the oxygen content in the circulating blood. Spectrometric methods, on the other hand, make it possible to estimate the oxygen content in the blood under study, but do not give an idea of the speed indicators. The technical solution to this situation was the combination of two methods of studying microhemodynamics in one device. An example of such a symbiosis is Capillarospectrometer-02 (Russia). This device combines in itself as a capillaroscope for direct assessment of velocity indicators of blood flow, as well as the size of capillaries, and a spectrometer for determining the amount of oxygen in the blood. It should be noted that such a symbiosis provides accurate "aiming" at the investigated area, which makes it possible to take measurements in different parts of the capillary. This technique allows not only assessing the amount of oxygen in the blood, but also determining the degree of dissociation of oxyhemoglobin from the arterial to the venous capillary.

The state of microcirculation reflects the entire hemodynamic picture in the patient's body. Changes at the level of microvessels often precede the clinical manifestations of diseases of the cardiovascular system. Structural changes in capillaries are aimed at normalizing oxygen exchange between blood and tissues.

The goal of therapy is to improve the balance between oxygen demand and the degree of oxyhemoglobin dissociation in order to achieve an optimal functional state of cells and tissues.

It is known that electromagnetic radiation has a pronounced biological activity, and the effects of their action can be caused, among other things, by a change in the functional state of the microcirculation system [1–4].

Revealing the patterns of the effect of EMR on peripheral circulation can serve as the basis for its effective use for the prevention and treatment of functional disorders of various origins, and, first of all, cardiovascular diseases.

The purpose of our study was to determine the possibility of studying the effect of low-intensity electromagnetic fields of endogenous origin (bioresonance therapy) on the change in the concentration of oxyhemoglobin from arterial to venous capillary according to capillary spectrometry data.

Objects and research methods

The object of the study was patients with ischemic heart disease, congenital and acquired heart defects. The bioresonance effect was carried out using the method of endogenous bioresonance therapy (BRT) on the hardware-software complex "IMEDIS-EXPERT" of the firm "IMEDIS" (Russia), using a magnetic inductor - a loop, which was superimposed on the heart area. BRT sessions were carried out in the mode of endogenous bioresonance therapy, for 20 minutes. The response of the microvasculature to bioresonance therapy was assessed using a capillarospectrometer (Russia). The study was carried out in a sitting position, after a 15-minute stabilization of the patient's hemodynamics, in a room with uniform dim lighting at a temperature of 20-25 degrees Celsius. Background recording of microcirculation indices was carried out.

Determination of the concentration of oxyhemoglobin is based on the recording and analysis of blood spectra in the arterial and venous parts of the capillary, the difference in the intensities of the characteristic peaks of the analyzed spectra of capillary blood for wavelengths 542, 576 nm. The object of investigation, a capillary, was chosen capillaroscopically. We consistently aimed at the “point” of recording the spectrum of the arterial and venous parts of the capillary, using the capillaroscope as a sight. Spectrum measurement time - 0.04 seconds; the spectra were measured and recorded simultaneously with the recording of a video fragment. Video frame recording time - 0.04 seconds. Aiming accuracy to a point (object of research) - from 2 microns. To each measured the spectrum corresponds to a frame of a video fragment, which allows parametrically describing the state of the capillary, capillary blood, corresponding to the measured spectrum. The spectrum, capillary, blood flow were observed in real time on the monitor screen, at will the spectrum, the video fragment was written to the archive for analysis, transformation, parameterization.

Capillary blood oxyhemoglobin spectra in vivo measured capillarospectrometrically using a capillary spectrometer. The capillary blood spectra of the upper extremities were measured at capillary blood flow velocities of 0 (stasis), 100, 200, 300, 400, 500–1500 μm / s; capillary diameters 10, 15, 18 microns, perivascular zone width 80, 100, 120 microns; the density of the capillary network 4; 4.5; 7.0; 10.0%.

Our studies have shown that using the method of capillarospectrometry, it is possible to assess the effect of endogenous bioresonance therapy on the change in the concentration of oxyhemoglobin from arterial to venous capillary.

As an example, we will give the results of a study of two patients.

Patient Z. 43 years. Clinical diagnosis: Thrombosis of the inferior vena cava with extension to the right atrium. Condition after thromboembolism of the left pulmonary artery of unknown age with the development of postinfarction pneumonia. NK 2A Art. FC II by NYHA. Hypertension stage 2, degree 2, risk 4. Chronic calculous cholecystitis, remission. Urolithiasis, microlithiasis of the left kidney.

Capillarospectrometric studies were carried out against the background of the use of the drug Clexan d / in 80 mg / 0.8 ml No. 10 [0.8 ml]. The studies were carried out 3 times. 1 - on the eve of the BRT. The next 2 days - every day - 1 BRT session lasting 20 minutes. Capillarospectrometric studies were carried out in the dynamics of bioresonance therapy. Capillarospectrometric results researches of the patient Z. are presented in table. one.

Table 1

Dynamics of changes in the concentration of oxyhemoglobin from the arterial to the venous capillary of the patient Z.

No. p.p.	The date, time research-niya Current condition patient, disturbance	Diameter AO, μm	Diameter IN, micron	Linear speed blood flow in AO, μm / s	Linear speed blood flow in VO μm / s	Volumetric speed blood flow in AO μm3 /with	Volumetric speed blood flow in VO μm3 /	PB, micron3 /with	Level dissociation oxyhemoglobin from arterial to venous departments,%
one	26.02.-11.03.12	7	eight	345	273	13289	13745	- 456	1,3
2	BRT 3 min.	7	eight	363	320	13994	16076	- 2082	4.2
3	BRT 10 min.	7	eight	516	399	19862	20079	- 217	9.6
4	BRT 15 min.	6	nine	451	368	12753	23431	- 10678	8.5
five	BRT 20 min.	6	eight	471	417	13335	20968	- 7633	3.4

As shown by the results of the studies, the concentration gradient of oxyhemoglobin 3 minutes after the start of BRT increases by 2.9%. After 10 minutes, it increases by 8.3% of the original. 15 minutes after the start of BRT, the gradient was 7.2% compared to baseline, but slightly decreased compared to the 10-minute interval (1.3%). In 20 minutes after the start of BRT, the concentration gradient of oxyhemoglobin approached the initial values (Fig. 1).

Rice. one.Oxyhemoglobin concentration gradient from arterial to venous capillary in the dynamics of bioresonance therapy.

The intensity of the oxyhemoglobin peak after 3 minutes decreased by 64 c.u. in the arterial section of the capillary. The intensity of the oxyhemoglobin peak in the venous section increased by 58.1 c.u. 10 minutes after the start of BRT, the intensity of the oxyhemoglobin peak decreased by 116.4 c.u. in comparison with the initial value. The intensity of the characteristic peak of oxyhemoglobin decreased in comparison with the initial value by 99.1 a.u. in comparison with the initial data. After 15 minutes of BRT, the intensity of the oxyhemoglobin peak does not change significantly in comparison with the 10-minute measurement, but remains at 114.5 c.u. below the original data.

Similar data were obtained regarding the dynamics of the intensity of oxyhemoglobin in the venous section. The intensity of oxyhemoglobin does not change. At 20 minutes, there is a slight increase in the oxyhemoglobin peak compared to the 15 minute measurement. However, it remains lower than the initial indicators by 104 c.u. In the venous section, the intensity of the oxyhemoglobin peak remains reduced relative to the initial state by 103.9 c.u., and relative to the previous measurement by 4.2 c.u. (Fig. 2, 3).

Rice. 2.Intensity of the oxyhemoglobin peak in the arterial section of the capillary (c.u.) in the dynamics of bioresonance therapy.

Rice. 3.The intensity of the peak of oxyhemoglobin in the venous section of the capillary (c.u.) in the dynamics of bioresonance therapy.

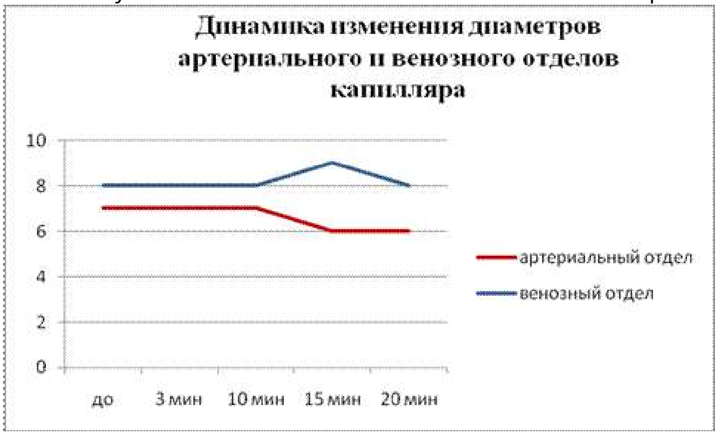
The linear blood flow velocity at the beginning of the study was 345 μm / s. After 3 minutes, there was no significant difference in the arterial region. As a result of BR exposure for 10 minutes, the linear velocity in AO increased by 171 μm / s, compared with the initial value, and became within the normal range. After 15 minutes, the linear blood flow velocity dropped somewhat relative to the previous measurement, but remained within the normal range and then did not go beyond the normal range (Fig. 4).

Rice. 4.Linear blood flow velocity in the arterial section (μm / s) in the dynamics of bioresonance therapy.

In the venous section, the velocity was 283 μm / s, after 3 minutes there was a tendency to an increase in the linear blood flow velocity, by the 10th minute the tendency to growth remained and approached the norm. This dynamics was preserved in subsequent measurements.

Rice. five.Linear blood flow velocity in the venous section (μm / s) in the dynamics of bioresonance therapy.

The dynamics of the diameter of the arterial and venous capillaries did not change significantly (Fig. 6).



Rice. 6.Changes in the diameter of the arterial and venous capillaries (μm) in the dynamics of bioresonance therapy.

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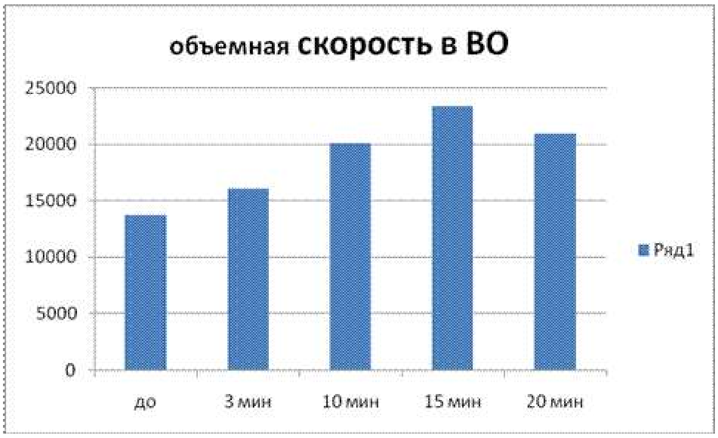
Changes in the size of the capillaries are insignificant and can cause physiological fluctuations in the diameter of the capillaries.

The volumetric blood flow velocity increases in the arterial section at the 10th minute (Fig. 7) and falls in the venous section at the 15th minute (Fig. 8).

Rice. 7.Change in volumetric blood flow velocity in the arterial region (μm3 /c), in the dynamics of bioresonance therapy.



Rice. eight.Volumetric blood flow velocity in the venous section of the capillary (μm3 /c) in the dynamics of bioresonance therapy.

The perfusion balance decreases at the 15th minute, but is in the normal corridor (Fig. 9).

Rice. nine.Changes in perfusion balance in the dynamics of bioresonance therapy.

As the next example, we present the data of the study in the early postoperative period of the patient. N. Diagnosis: Mitral valve prolapse. Infective endocarditis of the mitral valve, inactive phase. Partial separation of the chords from the posterior mitral valve. Insufficiency of the mitral valve of the III degree. Moderate pulmonary hypertension. Arterial hypertension 1 st., I st., Risk 2. NK 2A. FC III. Condition after surgery: Replacement of the mitral valve with mechanical prosthesis Sorin No. 29; plastics of the tricuspid valve according to de Vega, in conditions of IC, hypothermia and FHKP from 12.01.2012. Heart rhythm disturbances: atrial flutter. The study was carried out on the 4th day after the operation. In fig. 10 shows the results of a capillarospectrometric study of patient N., who underwent a bioresonance effect in the region of the heart in the mode described above.

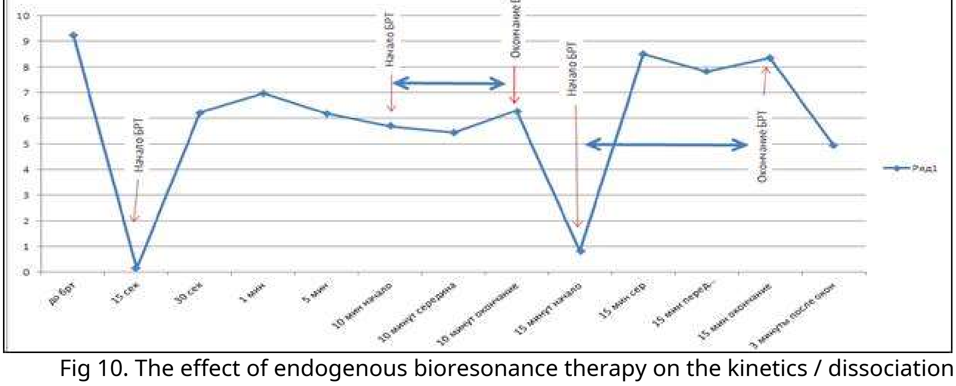


Fig 10. The effect of endogenous bioresonance therapy on the kinetics / dissociation of oxyhemoglobin in dynamics, in real time in patient N.

As can be seen from Fig. 10, when exposed to endogenous bioresonance therapy (duration 15, 30, 60 s; + 5 min; + 10 min; + 15 min ~ 33 min): beginning - decrease to dissociation levels of 1% or less (1 min.); middle

(2–15 min.) - reaching 5–5.5% (level before exposure to bioresonance therapy), completion (16–18 min.) - level of 6.1%; pause (2 minutes) - 5% level; start (19 min.) - 1% level; middle (26 minutes) - the level of 8.4%; end (33 min.) - 8.2% level; after 3 minutes - 5% level. The next morning - 6% level.

Taking medications affects the level of dissociation. In particular, taking diuretics, drugs that reduce capillary permeability with exposure to low-intensity radiation, reduce the level of dissociation to 0.1–2%.

conclusions

The studies carried out have shown the possibility of studying the effect of low-intensity electromagnetic fields of endogenous origin (bioresonance therapy) on the change in the concentration of oxyhemoglobin from arterial to venous parts of the capillary using the method of capillary spectrometry. Exposure to a low-intensity electromagnetic field of endogenous origin (bioresonance therapy) increases the level of oxyhemoglobin dissociation at exposures longer than 20 minutes. Further research is needed.

Literature

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