The effect of bioresonance therapy on rheological

and coagulation properties of bloodO. L. Bockeria,
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The problem of rheological properties of blood and hemostasis is relevant in many areas of medicine. This problem is of particular relevance in cardiology, angiology, surgery and cardiovascular surgery. Recently, low-intensity electromagnetic radiation and their effect on biological objects have been widely studied. A number of scientists have shown their influence on the rate of wound healing, changes in pain sensitivity, as well as on the processes of microcirculation [1]. A number of works have demonstrated the effect of a magnetic field on the migration of erythrocytes, as well as an electric pulse on platelet activation [2, 3].

The effect of a magnetic field (MF) on a living organism is determined by the field parameters, such as: intensity, gradient, exposure, frequency, etc. Differences in the parameters of electromagnetic fields (EMF) and the state of the body explain the contradictory results of their use in the experiment [4].

Experimental studies on the effect of EMF on blood indicate a decrease in the concentration of hemoglobin and hematocrit under the influence of variable MP, respectively, by 10.4% and 33.16% [5]. The dependence of quantitative and qualitative changes in blood corpuscles on the parameters of the MF is traced. There is a significant increase in the number of erythrocytes and platelets by 1–3 days, a decrease by the 5th day and restoration of the quantitative composition of formed elements by 10–15 days of magnetic exposure [5].

Under the influence of MF in blood cells, there is a change in the activity of ATP-ase, the concentration of ions on the outer and inner surfaces of the membrane, a decrease in the membrane potential, the output of K^+ from mitochondria, which changes their properties and conditions of functioning.

The effect of the MP on the blood system is based on the stimulation of the organism's compensatory capabilities. Under its influence, an improvement in the clinical and thrombogenic potential of blood, a decrease in adhesion and aggregation of platelets was noted [6].

Such reactions of the blood coagulation system to magnetic effects depend on the parameters of the MF. Basically, a reliably hypocoagulant effect of magnetotherapy with an improvement in the hemorheological properties of blood and normalization of the plasma hemostasis was noted, however, an increase in the duration of exposure and the magnitude of magnetic induction leads to a state of hypercoagulation [6].

Also, among the effects of MP action, a slowdown in hemolysis, a decrease in blood viscosity, and a change in the resistance of erythrocytes were revealed. Under the influence of MF, there was a change in the optical density of serum and plasma, a redistribution of the concentration of various protein fractions: the amount of aglobulins significantly increased and the amount of albumin, 0 b- and g-globulins decreased [7].

Based on the literature data, we planned an experiment to study the coagulation and rheological properties of blood under the influence of an electromagnetic field.

Materials and methods

The study involved patients who underwent surgical treatment in

conditions of artificial circulation for cardiovascular diseases of various etiologies. A total of 80 people took part in the study.

The following groups were formed.

Group I (n = 19) - patients who underwent endogenous bioresonancetherapy (BRT). In container No. 2 of the apparatus for BRT were placed aqueous solutions of aspirin and warfarin.

Group II (n = 7) - this group of patients, in contrast to Group I took aspirin additionally in tablet form. As in group I, container No. 2 contained aqueous solutions of aspirin and warfarin. Endogenous BRT was performed.

Group III (n = 7) - patients who underwent endogenous BRT. In the secondthe container was placed with an aqueous solution of EDTA.

In groups I-III, therapy was carried out using the device "IMEDIS-BRT-A"(Center "IMEDIS", Russia) in standard automatic mode therapy / pause - 3/1. The frequency spectra of the preparations were modulated by placing the preparation in the second container of the BRT apparatus. The therapy was carried out using a magnetic therapy device (UMT) "loop" located on the chest area. The duration of therapy is 15 minutes.

Group IV (n = 13). In this group, patients underwent exogenous BRTfixed frequencies (44.50 Hz; 45.50 Hz; 89.5 Hz; 685.0 Hz). The exposure of each frequency is 5 minutes, at an intensity of 100 cu. The total therapy time is 20 minutes. The therapy was carried out using a UMT "loop" located on the chest area. In this group of patients, the degree of platelet aggregation was taken into account, as well as indicators of blood viscosity.

Group V (n = 7) - patients who underwent endogenous BRT in the modetherapy / pause - 3/1 for 15 minutes.

In patients of group IV, the degree of platelet aggregation was taken into account, as well as indicators of blood viscosity.

Group VI (n = 27) - the study was carried out in vitro. Patient's blooda glass test tube was placed inside the UMT "loop" connected to the apparatus. In container No. 2 of the apparatus for bioresonance therapy were placed aqueous solutions of heparin, warfarin, aspirin cardio, streptokinase. Endogenous BRT was performed for 15 minutes.

At the same time, using an autonomous apparatus, exogenous BRT was performed at fixed frequencies of 44.5 Hz, 45.5 Hz, 685 Hz. The frequencies were alternated with an interval of 1 min. The total treatment time was 15 minutes. The blood viscosity was estimated at shear rates of 200, 100, 20.

The methods of exposure and the factors investigated are reflected in table. 1.

Table 1

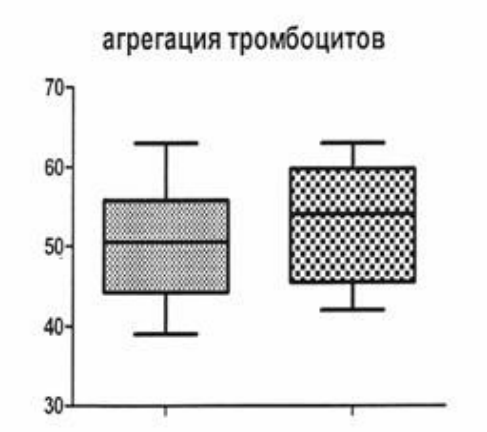
Exposure parameters and test values

group	Method of exposure	study
I	Aspirin, warfarin + BRT (n = 19)	Platelet aggregation
II	Aspirin, warfarin + BRT While patients were taking aspirin (n = 7)	
III	EDTA + BRT (n = 7)	
IV	Frequency BRT (n = 13) 44.50 Hz; 45.50 Hz; 89.5 Hz; 685.0 Hz	Coagulogram APTT Fib - fibronogen PT - rhombocytes, qualitative analysis D - dimer
V	Endogenous BRT only (n = 7)	Platelet aggregation Blood viscosity
VI	In vitro (n = 27) blood of patients with endogenous BRT + in the 2nd container heparin, warfarin, aspirin cardio, streptokinase + frequencies 44.5 Hz, 45.5 Hz, 685 Hz (t = 15 min.)	Blood viscosity

Research results and discussion

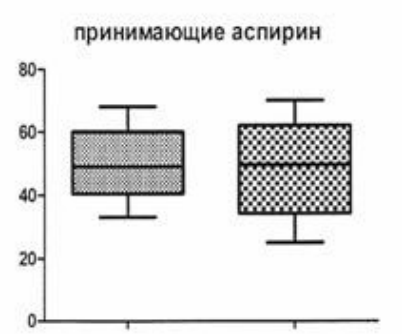
In the group of patients of group I who underwent endogenous bioresonance therapy with the inclusion of the frequency spectrum of aspirin and warfarin in the therapy circuit, the following changes occurred: in 7 (35%) people, the platelet aggregation rate decreased, in 13 (65%) people, the platelet aggregation rate increased. Paired t-test showed the unreliability of the changes that occurred: P value - 0.2274. The mean difference in values was -4.050, 95% confidence interval was -10.84 to 2.745. Correlation coefficient of values before / after - 0.289, p = 0.1081.

The research results show that there is no correlation between changes in platelet aggregation before and after exposure to BRT in this mode. However, the absence of a correlation does not indicate the absence of an effect, but indicates that the degree of change in the studied parameters is different. Nevertheless, the data obtained are statistically unreliable (Fig. 1).



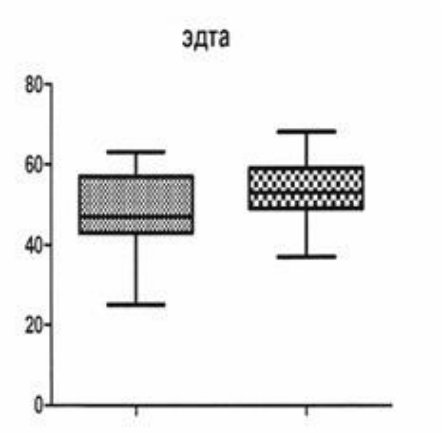
Rice. 1. Indicators of platelet aggregation before and after the procedure -I group

In the second group of patients, knowingly taking aspirin, against the background endogenous BRT with the inclusion of aspirin and warfarin into the BR-therapy circuit, the following changes occurred: in 3 (42%) patients there was a decrease in platelet aggregation, and in 4 (58%) patients an increase in platelet aggregation. Paired t-test showed the unreliability of the changes in P-value - 0.7351. The average value of the changes that occurred is 1.750, 95%, the confidence interval is -10.01 to 13.51. The correlation coefficient is 0.5, p = 0.0985. Thus, in the second group, there were also no significant differences in the trait before and after the procedure (Fig. 2).



Rice. 2. Changes in platelet aggregation in patients taking aspirin -II group

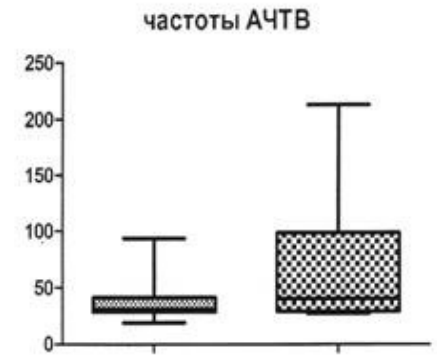
In the third group of patients who, against the background of endogenous BRT, were added frequencyEDTA spectra, the following changes occurred: in 5 (71%) cases there was an increase in platelet aggregation, and in 2 cases (29%) - a decrease in platelet aggregation. The paired t-test showed the unreliability of the changes p = 0.2389. The average difference in the changes that occurred - - 5.857, 95% confidence interval - -16.82 to 5.105. Correlation coefficient (r) = 0.4111, p = 0.1798 (Fig. 3).



Rice. 3. Changes in platelet aggregation in patients under the influence of BRT + EDTA

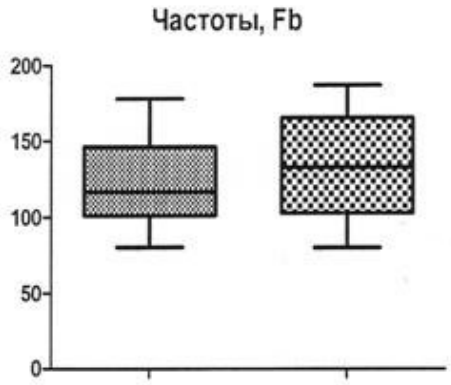
In the IV group of patients who were exposed to fixedfrequencies of 44.50 Hz; 45.50 Hz; 89.5 Hz; 685.0 Hz, the following changes occurred:

APTT increased in 6 (46%) cases, decreased in 5 (38%) cases, and no changes were observed in 2 cases (15%). It should be noted that the degree of decrease in APTT relative to the degree of increase was in most cases insignificant. When conducting a paired t-test, the revealed changes were unreliable, p = 0.0998. The average value of the indicator variability is -31.83, 95% confidence interval is - 70.80 to 7.150. Correlation coefficient (r) = -0.01178, p = 0.4855 (Fig. 4).



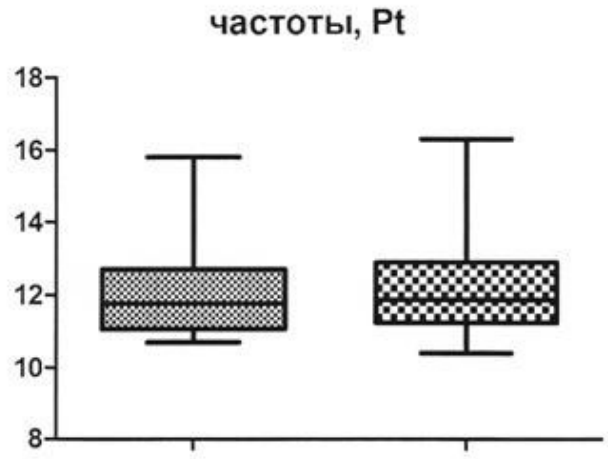
Rice. 4. Change in APTT in patientsIV group

Fib (Fibrinogen): in 9 (69%) cases, there was an increase in the indicator, in 3 (23%) a decrease in the indicator and in 1 (7%) case, no changes were detected. With a paired t-test, p = 0.1725, the mean is -8.883, the 95% confidence interval is -22.28 to 4.515. Correlation coefficient (r) = 0.7816, p = 0.0013 (Fig. 5).



Rice. 5. ChangeFb in patients of group IV

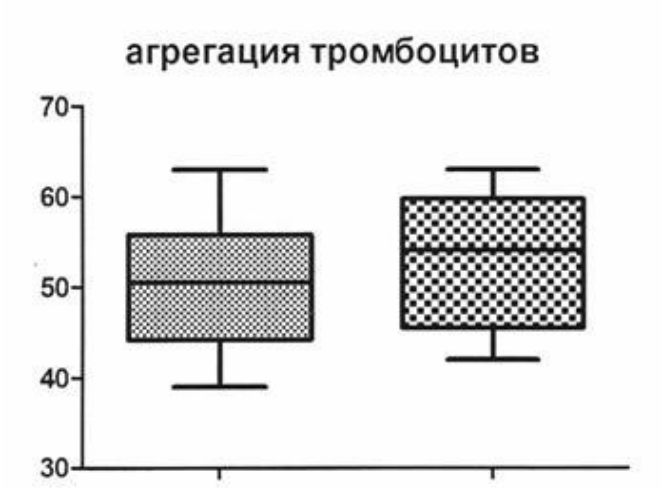
Pt: in 6 cases (46%) there was an increase in the sign, in 4 (30%) there was a decrease in the indicator, in 3 (23%) cases there were no changes. With a paired t-test p = 0.4343, the mean value is -0.1500, the 95% confidence interval is -0.5568 to 0.2568, the correlation coefficient (r) = 0.9088 (Fig. 6).



Rice. 6. ChangePt in patients of group IV

As can be seen from the data obtained, in the presented indicators in the fourth group, no significant changes were obtained, however, a reliably highcorrelation dependence of the Pt index (platelets).

In the fifth group, the following changes were noted: the degree of aggregation platelet count after endogenous BRT increased in 5 cases (63%), decreased in 2 cases (25) and did not change in 1 case (12%). With paired t-test p = 0.3122, the mean is -3.375, the 95% confidence interval is -10.70 to 3.955. Correlation coefficient (r) = 0.3367, p = 0.2074 (Fig. 7).

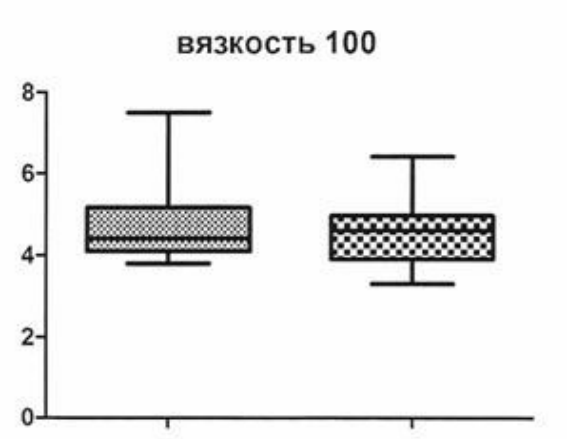


Rice. 7. Changes in platelet aggregation inV group

The viscosity of blood at the same exposure changed in the following way.
At a shear rate of 200, it increased in 2 patients (20%), decreased in 5 (50%), and did not change in 3 (30%). With a paired t-test, p = 0.0538, the mean is 0.2111, the 95% confidence interval is -0.004405 to 0.4266. Correlation coefficient (r) = 0.9610, p <0.0001 (Fig. 8).

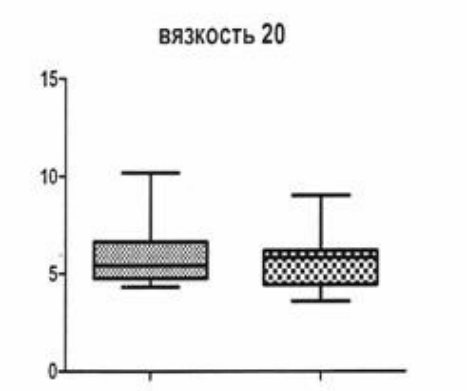
Rice. 8. Changes in blood viscosity in patientsGroup V at a shear rate of 200

At a shear rate of 100, the viscosity increased in 2 subjects (20%), decreased in 6 subjects (60%), did not change in 2 subjects (20%). With a paired t-test, p = 0.0919, the mean is 0.2778, the 95% confidence interval is -0.05679 to 0.6123. Correlation coefficient (r) = 0.927, p = 0.0002 (Fig. 9).



Rice. 9. Change in blood viscosity inV group at a shear rate of 100

At a shear rate of 20, the viscosity increased in 3 (30%) subjects, decreased in 6 subjects (60%), and did not change in 1 subject (10%). With paired t-test p = 0.0607, the mean is 0.4000, the 95% confidence interval is -0.02277 to 0.8228. Correlation coefficient (r) = 0.9534, p <0.0001 (Fig. 10).



Rice. 10. Change in blood viscosity inV group at a shear rate of 20

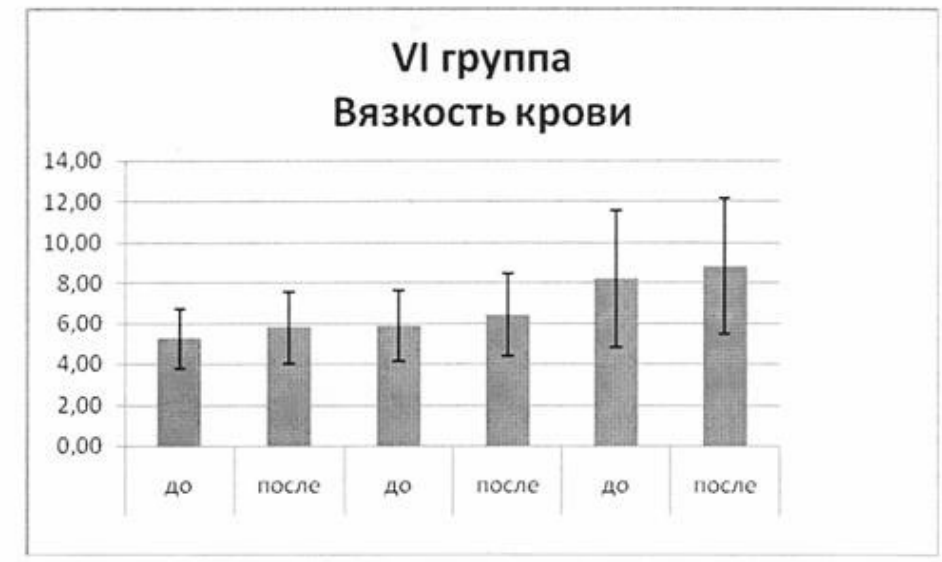
The data obtained indicate that there is no reliable effect of the selected operating mode of the apparatus on the state of blood viscosity, however, at shear rates of 100 and 20, the changes are close to significant.

In the sixth group, the following changes were noted. Average viscosity valuesblood at the studied shear rates are presented in table. 2 and illustrated in Fig. 11 (p> 0.05).

table 2

Change in blood viscosity in group VI at different shear rates

Shear rate 200		Shear rate 100		Shear rate 20	
before	after	before	after	before	after
5.26 ± 1.47	5.79 ± 1.78	5.87 ± 1.74	6.39 ± 2.04	8.19 ± 3.38	8.79 ± 3.36



Rice. 11. Change in blood viscosity inVI at various shear rates

Thus, in the course of the study, it was not reliably identified

the expected effect of exposure to BRT with different field characteristics. However, in group V, changes in viscosity at shear rates of 100 and 20, close to significant ones, were revealed. The study does not give an unambiguous answer about the effects of BRT in different modes of operation on the rheological and coagulation properties of blood. Additional research is required to finally answer these questions.

Bibliography

1. Ioannis I. Verginadis, Yannis V. Simos. Analgesic effect of the electromagnetic resonant frequencies derived from the NMR spectrum of morphine // Electromagnetic Biology and Medicine, Early Online: 1–10, 2012.

2. Shatalov VM Mechanism of the biological impact of weak electromagnetic fields and in vitro effects of degassing of blood. // Biofizika. 2012 Nov-Dec; 57 (6): 1034-40.

3. Lukyanitsa V.V. Magnetic field, its characteristics, influence on biological objects and use in medicine // Textbook. manual for students of honey. universities. - Minsk: MGMI, 1997.

4. Funk RHW et al. Electromagnetic effects - From cell biology to medicine // Progress in Histochemistry and Cytochemistry 43 (2009) 177-264.

5. Guseletova N.V. Magnetology // Tez. report All-Union. scientific-practical conf., Vitebsk, 1-3 oct. 1980 - Vitebsk, 1980 .-- 87 p.

6. Systems of complex magnetotherapy: Textbook. manual for universities / Ed. A.M. Berkutova, V.I. Zhuleva, G.A. Kuraeva, E.M. Proshina. - M., 2000.

7. Vyrenkov Yu.E. Magnetology // Tez. report All-Union. scientific-practical conf., Vitebsk, 1-3 oct. 1980 - Vitebsk, 1980. - P. 25–27.

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