ORIGINAL RESEARCH PAPER

BIOINFORMATION TECHNOLOGIES IN THE COMPLEX ASSESSMENT AND CORRECTION OF CEREBRAL HEMODYNAMIC IMPAIRMENTS IN JUDO-FIGHTERS WITH CERVICAL DORSOPATHY

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Abstract

Objective. To give the characteristics of the dynamics and to carry out cerebral hemodynamic impairment correction in judo athlets with cervical dorsopathy(CD) in the process of bioresonance therapy(BRT) and electro-pharmaceutical oscillation spectrum(EPHOS). Materials and methods. The study of cerebral hemodynamics in judo-fighters with CD was performed on the basis of transcranial dopplerographic (TCDG) data, before and after bioresonance therapy course and electro-pharmaceutical oscillation spectrum (Sharova L. V., patent RF # 2204374 dated 05.20.2003). We used the apparatus "BRT IMEDIS-FOLL". 37 individuals were studied. The mean age of the patients was 20.10 ± 0.36. There were 17 males and 10 females. All the athlets were divided into three groups. The first group included 15 athlets with CD and chronic pain syndrome (CPS). They were treated with BRT+EPHOS, physical therapy (PT), massage. The second group consisted of 12 athlets who did not undergo BRT+EPHOS. They received only PT and massage. The third group (the control group) included 10 individuals who did not reveal CD, they were given placebo treatment. We note the tendency to cerebral hemodynamics improvement on the basis BRT+EPHOS use. BRT+EPHOS are supposed to possess resonant analgetic and prolonged prolonged properties to prevent CD exarcebations and to strengthen the treatment effect as a result of adaptive compensatory mechanisms involvement. Taken together with the bioinformation methods cerebral hemodynamic research gives the possibility to individualize the physical exertion during working out an individual sortsman training cours

and to consider these findings for the sport selection to judo sections. BRT+EPHOS possessing the resonant properties, analgetic and prolonged effect, promote cervical osteochondrosis exarcebation prevention and a more rapid therapeutic effect due to the adaptive-compensatory body systems. The treatment effectiveness is up to 87%.

Key words: *dopplerography, bioresonant, cervical osteochondrosis, judo-athlets.*

Introduction

Purposeful athlets usually don't pay attention to episodic pains accompanying the initial anatomic-functional defects (Pääsuke et al., 2008). Not only participation in the competitions but sport achievements are of great importance for them (Boutcher, 2008; Zakirov, Sharov et al., 2010) the practical significance of our work indicates to the coaching teaching … (Kuznetsova et al., 2012). Scoliosis deformities or the so-called "pr-scoliosis" are often the main cause of cervicalgia, its starting mechanism being formed in the early-school age (Belokrylov & Sharova et al., 2012). New approaches to the athlets general health new correction and treatment issues, e.g. in CD became possible after bioinformational technologies rehabilitation methods (Voll, 1980; Gotovckiy, 2001; Sharova, 2002; Goabout, 2002; Humble, 2008; Denisenko et al., 2008). By Mugerman (2011), "...Considering a person as a comprehensive whole consisting of structural, functional and psychic components, rehabilitation process is directed to disbalance elimination in every component". Among new diagnostic and therapeutic technologies based on the electromagnetic principles, electropharmaceutical oscillation spectrum worked out by L. Sharova (2002) gives the possibility of the individual's general condition objective assessment through biologically active points (BAP). The method also helps to influence directly the adaptive-compensatory body processes of the sportsman. This method basis is supposed to ensure an individual approach to each sportsman to provide reliability, informativeness, efficiency (Sharova, 2002; Razumov, Sharova, & Kravtsov, 2011). CD is associated with slowly progressing cartilage dystrophic changes of intravertebrae disks (chondrosis) and lying beside body vertebrae bone tissue (osteo). CD exarcebation in athlets occurs more often during ligament and synchronic muscular contraction impairments, especially at the points of their connections with bones, dystrophic processes being very common (Zharkov, 2005). Cerebral circulation changes are the key components of all the existing CD pathogenesis theories. However, cerebral hemocirculation

status in CPS i.e. a widespread disease has not yet been studied well enough (Schmidt, 2001). There are quite few publications concerning BRT effectiveness in CD (Gotovckiy, Sharova & Kravtsov, 2004). Objective. To characterize the dynamics and to carry out the correction of cerebral hemodynamic impairments in judo-athlets with cervical dorsopathy during BRT+ EPHOS method appliance.

Material and methods

Subjects. We examined 37 individuals. The mean age of group members was 20,10 ± 0,36. There were 17 males and 10 females. All the study participants were divided into 3 groups. The first group consisted of 15 judo-athlets with CD and CPS (we diagnosed CD with the help of MKB-10). They received BRT+EPHOS, physical therapy (PT), massage. 12 athlets constituted the 2 group; they did not undergo BRT+EPHOS. They were given physical therapy and massage. The 3rd group – the control group (10 individuals) did not contain any athlets with CD, they received placebo. The athlets were divided according to their professional skills in the following way: 17 Masters of Sports, 10 Candidate Masters of Sports, and 10 athlets had the first adult grade. The duration of the disease at the examination time varied from some weeks to 5 years. Exacerbation rate was from one to three exacerbations a year.

Procedures. Transcranial dopplerography was performed with VASOFLO apparatus – 4 and 2 MHz in the pulsating oscillation regime. The patients were lying on their back before and after BRT+EPHOS (5-7 procedures). Brachiocephalic and intracranial arteries were examined. The blood flow in the common carotic and inner carotic arteries, middle cerebral and arterial cerebral arteries was studied. We also determined speed and spectral characteristics of the flow.

Blood flow linear velocity flow in view of average rate which contributes to an accurate estimate of BFLV in the proximal and also in the distal artery was described. The reaction of cerebral hemodynamic on hypercapnia and hypocapnia in case of a variant – breathing into a closed space for 1-2 minutes was determined. The average blood flow linear velocity (ABFLV) in middle cerebral circulation (MCC) and in the main artery (MA) was also investigated. Reactivity of cerebral hemodynamic was determined by pulsation index (PI), by coefficient of reactivity on hypercapnic (HE +) and hypocapnic exertion (HE-), by index of vasomotor reactivity (IVR), counted according to ABFLV MCC. The level of ABFLV insufficiency in posterior circulation system was estimated on the basis of positional exertion on the cervical part of the spinal column (SPS).

Researches and correction were made on the hardware and software complex (HSC) "IMEDIS Foll" (reg.№ 95/311-120); on the apparatus "Mini-Expert- DT" (reg.№ 95/311- 121), which were approved for medical use (MU) and for medical industry in RF dated 15 September 1995, order № 311 for instant diagnosis of organism functional condition on physiological data of reflex areas and on biologically active points (BAP). BRT was done with the help of electromagnetic waves withing the range from 10 to 500 000 Hz, pertained to the patient, which were taken from the patient skin. They were analyzed in a special way and returned into the organism. As signals (waves) common to a man have electromagnetic origin, then it is possible to take them with the help of electrodes and transfer them through the cable at the input of "IMEDIS-BRT" apparatus (Fig. 1). Having passed the decontamination (linear and nonlinear filtering), waves from the input of the apparatus through the second cable and electrodes are returned to the patient. Electromagnetic field of a patient response to these therapeutic signals and corrected waves are sent to the apparatus once again. Closed-circle system of adaptative monitoring, inside which there is a patient, is formed.

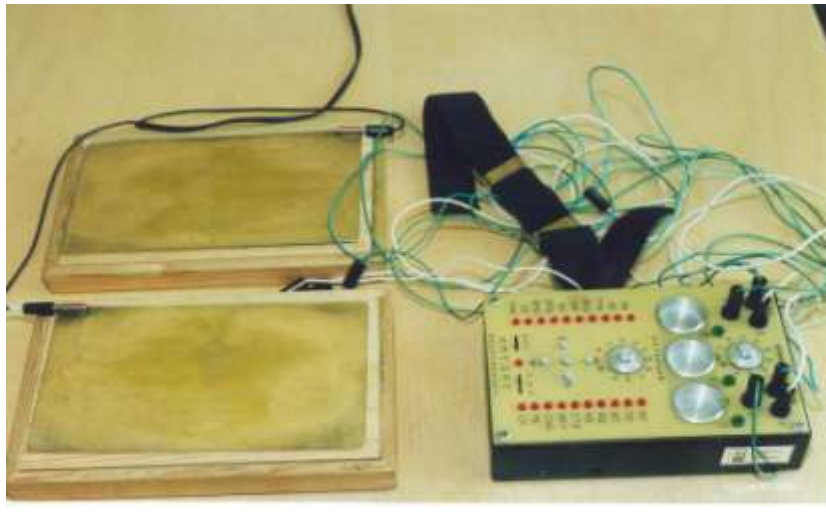

Figure 1. Apparatus for adaptative bioresonance therapy "IMEDIS – BT"

Influence by BRT is based on inhibition of pathological – (D), restoring and increase of physiological frequency content of waves – (H) (Fig. 2). Gradual resolution of membranous bioelectrical features and maintenance of relative gating of different wave processes, composing the physiological

homeostasis (dynamic balancing state) of the organism occur (Gotovckiy et.al., 2001).

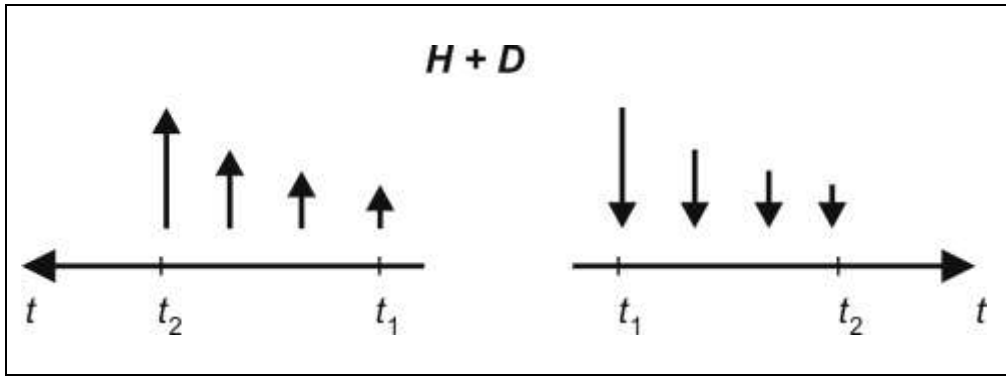

Figure 2. H – Physiological (a) and D- pathological (b) waves

We made the preliminary clinical studies to prove the development of the above mentioned physiological responses in general and local influences BRT + EPHOS on BAP. The essence of EPHOS is in the formula of invention: V=Di+1.9+4.2 Hz, where Di – inversion of pathological waves, recorded from the maximal algetic biologically active points (BAP) of the patient. The frequency of 1.9 Hz has a prophylactic influence on muscle hypertonia. The frequency of 4.2 – on connective tissue and autonomic plexuses. The results were reached by influence of five BAP (Fig. 3), (Fig. 4).

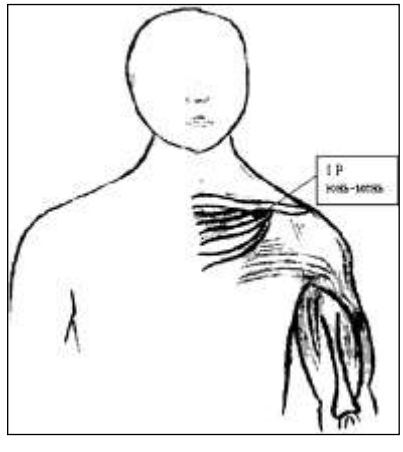

Figure 3. The way of influence on BAP (front view)

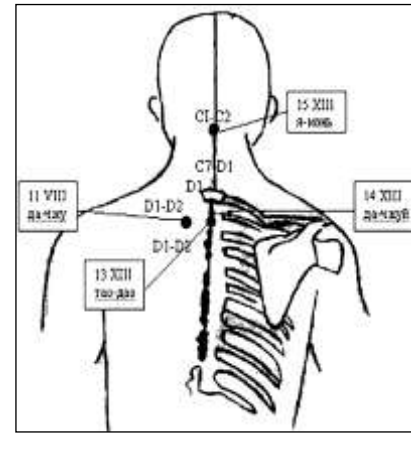

Figure 4. The way of influence on BAP (back view)

Homeopathic grit was processed by electromagnetic waves withing the range, determined according to a created formula V=Di+1.9+4.2 Hz (Sharova L. invention patent № 2204374 RF. The method of treatment and prophylaxis of cervical vertebral osteochondrosis/ priority on 20.02.2001; declared 20.02.2001). Eigen frequency of oscillations in a sportsman was determined with the help of BAP on BRT during 30 seconds. Then it was inverted into relative physiological frequency (50-60 c.u.). After that it was transferred on homeopathic grit, complemented by wave medical frequencies 1.9+4.2 Hz with the help of BRT apparatus "IMEDIS-Foll". Each record was made with the frequency of 15 seconds. Then EPHOS was fixated with the medical patch to BAP for 1-3 days with the following change of EPHOS: 14 XIII dazhui; 13 XIII – tao-dao; 15 XIII – ja-men (XIII posteromedian meridian); 11 VII da-zhu (bladder canal); 2 I yun-men (lungs canal, to the outside of the I rib on the 3rd lateral chest line).The course of treatment and prophylaxis is from 7 to 10 sessions, and if it is necessary the course can be repeated after a 3 month break. Physical therapy and massage were also performed in order to enhance the medical outcome. EPHOS was administered to take orally 3 grits 2 times a day during 2-3 weeks (Sharova L. – Certificate of intellectual product 73200500142 RF. Algorithms of energoinformational diagnosis and treatment of cervical osteochondrosis/ L.V. Sharova. – FSUE 'ASTIC' June, 23).

Statistical analysis. Materials of research are subjected to mathematical processing by means of statistical packages of Excel 5.0, Statistica for Windows 5.0 and "Biostatistika" programs. The significance value of differences index (p) between values of surveyed indicators "before and after the treatment" was calculated with the use of Vilkokson's non-parametric tests (Wilcoxon Matched Pairs Test) and Sign-test. Wald-Wolfowitz Runs Test, Mann-Whitney U Test and Kolmogorov-Smirnov Test were applied to make the comparison of quantitative indices (dopplerography) in different groups. Value differences of these criteria, smaller than 0.05 were considered to be statistically significant.

Results

The common complaints in examined patients were headaches (28 persons), as a rule, in cervico-occipital area with irradiation to the forehead, temple, usually unilateral. The pains were tender and of pulsating type. 4 athlets noted dizziness while movements in cervical vertebrae. Myofascial pains with a specific areal pain disposed sufficiently from a spasmatic muscle, not connected with spine pathology were formed in 7 athlets. Vegeto-emotional disturbances with a specific instability of arterial

pressure, with an increase and decrease tendency, feeling of fear, anxiety, irritancy, sleep disturbances were revealed in 5 athlets (10). So ABFLV in MCC was 60.54 ± 4.22 cm/sec (p>0.05). ABFLV in MCC in 1st group athlets, was 63, 93 + 8, 30 before treatment, and it increased to 68.90 ± 11.89 (p>0.05) after a complex of therapy.

In comparison with a control group the APServed increase of results was not of statistical importance. The level of flow resistance in pial capillary bed, estimated by the Gosling pulsation index (PI), was 0.78 – 0.03 before treatment, and it decreased to 0.76±0.03 after BRT. Significant differences were not noted between these findings.

Coefficient of reactivity on hypercapnic exertion (HE +) was 1.33±0.03 before treatment, and it has been increasing to 1.44±0.03 (p>0.05) after BRT + EPHOS complex. The APServed increase of HE + in athlets of the 1st group in comparison with a control group is of statistical importance. Coefficient of reactivity on hypocapnic exertion (HE-) has been increasing from 0.29±to 0.02 after treatments. In comparison with a control group the HE- increase is of statistical importance. The index of vasomotor reactivity (IVR) in the circulation of MCC, was 0.61±0.05 before BRT +EPHOS, and it has been increasing to 0.75±0.04 (p>0.05) after treatment. In comparison with a control group this index has a statistically important increase (Tab.1).

Table 1

Dynamics of IVR in the circulation of MCC in judo athlets at the process of BRT +EPHOS.

	1 groupn=15	2 groupn=12	3 group n=10
	Mean ± Standard error	Mean ± Standard error	Mean ± Standard error
IVR_1	0.61± 0.05 W-W 1-3 p= 0.039 M-W 1-3 p=0.034	0.63 ± 0.06 M-W 2-3 p< 0.05	0.90 ± 0.01
IVR_2	0.75 ± 0.04 W-W 1-3 p= 0.039 M-W 1-3 p= 0.034	0.76 ± 0.06 M-W 2-3 p< 0.05	0.95 ± 0.02

W-W – Wald-Wolfowitz runs test;
M-W – Mann-Whitney U test;

		Pairs	
1 group	APS+BRT	:	
2 group	APSwithoutBRT	1-3	$mean_1$- BFLV before treatment
3 group	control	1-3	$mean_2$- BFLV after treatment
			IVR_1- index of vasomotor reactivity before treatment
			IVR_2-index of vasomotor reactivity after treatment etc.

So, the reactivity of ABFLV after BRT + EPHOS has been increasing both on hypercapnic and hypocapnic exertions, indicating on introduction of compensatory mechanisms of cerebral hemodynamic. This is also confirmed by the IVR increase. ABFLV of basilar artery before BRT + EPHOS was 34.49±3.27 in all the examined athlets, and it significantly increased to 3.76±3.96 after treatment, S-T (p=0.000874), W-M (p=0.001475), W-M (p=0.001475) (Tab.2).

Table 2

Compensation abilities of vertebral-basilar hemodynamic according to ABFLV indexes in the circulation of basilar artery in positional tests with a flexion in CV

	A. basilaris	Flexion to the right	Flexion to the left
	Mean± standard error		
1st group (*n* = 15) before BRT+EPHOS after BRT+EPHOS	34.49 ± 3.27 43.76 ± 3.96	11.92 ± 2.27 4.00 ± 1.40	12.33 ± 1.82 5.09 ± 1.33
2nd group (*n* = 12) before BRT+EPHOS after BRT+EPHOS	40.33 ± 10.54 45.87 ± 9.40	10.67 ± 5.46 5.33 ± 3.53	9.33 ± 1.76 3.67 ± 2.33
3rd group (*n* = 10)	42.36 ± 7.36	9.38 ± 3.28	7.02 ± 2.35
p-level	0.000874	0.004427	0.002569
Vilkoxon's test	p=n.s.	p=n.s.	p=n.s

Revealed by position tests in athletes with a head rotation and a forward flexion to the right(duck of the head) deficiency of average blood flow linear velocity (BFLV) in VA statistically significantly decreased after treatment from 11.92±2.27% to 4.00±1.40% (S-T (p=0.004427), W-M (p=0.005065). At a flexion to the left deficiency of BFLV APServed before treatment also authentically decreased after BRT+EPHOS influence from 12.33±1.82% to 5.09±1.33%, (S-T (p=0.002569), W-M (p=0.002569).

BFLV in a basilar artery in the 1st group before BRT+EPHOS was 40.3±10.54, increasing after BRT+EPHOS to 45.87±9.40, (p>0.05). In comparison with the control group BFLV in VA increased, but statistically it was not significant. During the position tests in athletes with a head rotation and a forward flexion to the right (duck of the head) APServed before the treatment deficiency of BFLV in VA decreased from 10.67±5.46% to 5.33±3.53%, (p>0.05) after the course of BRT+EPHOS. At a flexion to the left it decreased from 9.33±1.76% to 3.67±2.33%, (p>0.05)

as well as in the control group. After the carried-out BRT+EPHOS complex the reduction of APServed insufficiency of BFLV in the course of position tests indicates, to some extent, the increase of cerebral haemodynamics compensatory abilities.

In the 2nd group, BFLV in MCA was 73.03±7.69 before the treatment, after the course of carried out rehabilitation it increased to 79.17±6.35 ($p>0.05$).

Judging by the increase of BFLV at APS CD the effect of BRT+EPHOS was significant and apparent. The index of the peripheral resistance (PRI) before "BRT+EPHOS placebo" influence, in the 3rd group made 0.79±0.02, decreasing after the procedure to 0.77±0.06 ($p>0.05$). In comparison with the first group 0.72±0.03, APServed differences were also not statistically significant.

PRI in MCA made (0.73±0.03) cm/sec in females and 0.72+0.03 cm/in males and it practically didn't have gender differences (Tab. 3). The assessment of a vasomotor reserve (AVMR) in the surveyed athlets with CD was significantly lower in males (0.30±0.02), than in females (0.36±0.01), but only HE (M-W) = 0.02475 (Tab. 2).

Table 3

Blood flow linear velocity in the middle cerebral artery (MCA) and AVMR (an assessment of vasomotor reserve) in athlets with CD depending on the gender (cm / sec)

Patients	MCA		AVMR		
	Mean	PI	HE^+	HE^-	IVR
	M±*m*	M±*m*	M±*m*	M±*m*	M±*m*
Females(n=10)	64,54±3,88	0,75±0,03	1,34±0,06	0,36±0,01	0,68±0,06
Males (n=27)	55,64±4,93	0,72±0,03	1,38±0,05	0,30±0,02	0,67±0,04
p (M-W)				0,024751	

mean – mean blood flow linear velocity;
PI – Gosling pulsation index;
HE^+ – coefficient of reactivity on hypercapnic exertion;
HE^- – coefficient of reactivity on hypocapnic exertion;
IVR – index of vasomotor reactivity;
p (M-W) – Mann-Whitney U test.

In the 1st group of athletes PRI in MCA raised to 0.78±0.02. In the second group and in the control group the indicators were 0.71±0.04, and 0.75±0.01. However the APServed differences were not significant. Reflex syndromes aggravations rate in cases of CD practically had no impact on

PRI in MCA or in the basilar artery. However, studying the indicators in MCA a peripheral resistance increase was revealed in relation to higher frequency of headaches in cases of cervicalgia.

Index of a vasomotor reserve (IVMR) in MCA circulation at APS before BRT+EPHOS was 48%, increasing after the treatment to 69%. Noted reactivity index increase on hypercapnic and hypocapnic exercise testifies the inclusion of regulation compensatory mechanisms of cerebral haemodynamics in reply to BRT+EPHOS influence that was confirmed by the results of IVMR.

BFLV of a. basilaris being 24.7% before BRT+EPHOS increased to 32.8% after these procedures. It was due to the improvement of blood inflow through the vertebral artery. In the third group before the course of placebo treatment IVMR was 0.63±0.06. It increased after BRT+EPHOS appliance to 0.76±0.06 (M-W (2-3), $p<0.05$). The cerebral haemodynamics changes revealed in the course of TCDG, predominantly in the vertebrobasilar circulation, are characterized by reduction of BFLV and vasomotor reactivity. The adequate brain blood filling in the course of BRT+EPHOS was carried out at the expense of adaptive-compensatory an mechanism that was confirmed by the BFLV and vasomotor reserve increase at the expense of the improvement of elastic characteristics of the basilar and MC arteries. These positive changes led to an adequate arterial filling in of the brain ($p<0.05$). Associated with BRT+EPHOS, the tendency to the cerebral haemodynamics improvement, which was confirmed by BFLV increase, reduction of vascular resistance in pial-capillary bed, brain perfusion improvement was revealed.

HE+ and HE- demonstrated MCA reactivity increase after BRT+EPHOS, testifying compensatory mechanisms inclusion. Furthermore the reaction of cerebral haemodynamics to a hypercapnia was noted by BFLV increase and the peripheral pial-capillary bloodstream resistance decrease. Certain manifestations of a cerebral haemodynamics disregulation remained mainly in the vertebrobasilar system as BFLV insufficiency and also reactivity of the vascular circulation of MCA. Therefore, BRT+EPHOS give biological effect necessary for the organism for the vascular system adequate reaction, in particular in the pial-capillary bed.

Discussion

Similar changes of a cerebral hemodynamic were noted in professional swimmers, weightlifters and other athlets, subjected to exercise stresses (Titova, 2008). The obtained data of the experiment concerning cerebral hemodynamic changes in CD coincide with the results of researches

(Volchenko, 1995; Nebozhin, 2002; Shmidt, 2001). Informativeness of TCDG, predominantly for an assessment of a collateral blood flow in the vertebrobasilar system initial condition and opportunities is confirmed. Functional exertion of CV athletes lead to a more significant BFLV decrease in VA ($p<0.05$). That testifies compensatory reserve oppression of a vertebrobazilar hemodynamic. BFLV decrease is not estimated by the pain syndrome intensity.

In the control group the index of the peripheral resistance (PRI) in MCA was 0.75±0.03 of cm/sec and was not associated with age and gender. Certain BFLV increase in MCA in the athletes of the 1st group are associated with adaptive mechanisms overstrain. The combination of prolonged low-intensive painful syndrome with frequent and long exacerbations in the remission periods results in adaptive-compensatory abilities decrease of an athlete's organism that reflects the vertebrobasilar hemodynamics state. With the help of BRT+ EPHOS certain methods of the referred preventive and corrective influence on the main health indicators of athletes through BAP are developed. The effectiveness of BRT+EPHOS in prophylaxis of CD exacerbation in judo-athlets of the first group is high (87 %). The obtained data help to widen the scope of energoinformational technologies appliance as a method of physio- and reflexotherapy both during APS treatment and in complex influence of a wide range of diseases with different homeostasis disturbances in athlets. The influence of a training load on a cerebral hemodynamic in judo athletes was characterized by a tendency to changes of the main hemodynamic indices both in males and females but it was not significant. Having an individual approach to the investigation of cerebral blood flow condition it is possible to estimate peripheric circulation adaptation to a training load, to reveal the condition of a recovery period or fatigue with a sufficient degree of probability.

Conclusions

Chronic pains in the CV with temporal exacerbations due to the applied methods of training and performance are characteristic for judo-athlets. Changes of cerebral hemodynamics, predominantly in the vertebro-basilar circulation compose the important part of pathogenetic processes of an organism disadaptation. In the course of BRT+EPHOS at the expense of normalization of membranous bioelectric processes, maintenance of relative synchronization of wave processes is achieved due to analgesic end-point, cerebral hemodunamics improvement and the rise of adaptive opportunities of an athlete organism. The given complex based on bioiformation technologies includes: BRT+EPHOS method, massage of a collar zone

physical therapy. This complex can be applied for an individualization of exercise stresses, treatment of CD and prevention of its exacerbation, for a stress resistance increase of an athlete during work-outs and preparations for competitions.

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