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THE USE OF ALTERNATIVE APPROACHES TO THE DIAGNOSIS OF THE FUNCTIONAL STATE OF VEGETATIVE HOMEOSTASIS IN PATIENTS WITH BURNS

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Summary: *Results of functional condition of vegetative nervous system in burned patients during acute period of burn disease was estimated by method of biodiagnosis and noted in article.*
Key words: biodiagnostic, vegetative homeostasis, energyinformation systems, burn disease.

Резюме: *В роботі представлені результати оцінки методом біодіагностики функціонального стану вегетативної нервової системи обпечених в гострому періоді опікової хвороби.*
Ключові слова: біодіагностика, вегетативний гомеостаз, енергоінформаційна система, опікова хвороба.

Introduction

Assessment of vegetative homeostasis allows identifying pathology at the functional level before it manifests on the physical one, which outstrips the capabilities of modern diagnostic tools [1].

Internal information projection in epidermal biologically active zones (BAZ) is genetically determined, as the skin and nervous system originate from the ectoderm that allows assessing functional status and the activity of internal organs and systems by means of the diagnostic method.

The elaborated method of functional diagnostics of vegetative disorders is based on the following provisions.

a) the obtained figures of the biological activity of BAZ should be considered from the standpoint of activity assessment of sympathetic and parasympathetic divisions of the nervous system, which provide the state of activity or inhibition of the functional activity of the dependent organs and systems.

b) the parasympathetic and sympathetic parts of the vegetative nervous system, dependent on them cholinergic and adrenergic systems in the body interact under the general law of Yin Yang of the Eastern school of therapeutic philosophy;

c) due to the functions of the Yang organs are those of active catabolic action, while the organs of the Yin system are calm or perform anabolic action;

d) dynamically stable activity ratio of Yin and Yang states correlates with the dynamic stability of vegetative nervous system, i.e. with the balance of interdependent activity of its sympathetic and parasympathetic divisions;

e) the prevalence of Yang over Yin shows the disorder of vegetative homeostasis with the excitation of the sympathetic division;

f) the prevalence of Yin over Yang shows the disorder of vegetative homeostasis with the excitation of the parasympathetic division. Both parts of the vegetative nervous system function antagonistically, and with the help of double innervation of the majority of internal organs ensure the stability of the dynamic equilibrium of the target functions [3].

The studies of vegetative nervous system have revealed its basic functions:

a) trophotropic, which is targeted at the maintenance of the dynamic stability of the internal environment of the organism, its biophysical, biochemical, enzymatic, humoral and other coefficients;

b) ergotropic, which is targeted at the vegetative-metabolic support of various forms of the adaptive behavior, mental and physical activity, implementation of biological motiva

tions to the volatile conditions of the external environment.

At the same time, the sympathetic nervous system is mostly activated during the implementation of the ergotropic function. It changes the standard conditions of the internal environment and the organs in accordance with their primary functions, inhibits anabolic and activates catabolic processes. The parasympathetic nervous system is activated during the implementation of the trophotropic function, which is targeted at the maintenance of homeostasis, stimulation of the anabolic and inhibition of the catabolic processes.

In opposition to the parasympathetic, the function of the sympathetic division of the vegetative nervous system mostly depends on the central nervous and endocrine systems, processes, which occur at the periphery and in the visceral sphere. That is why its tone is unstable and requires continuous adaptation-compensatory reactions. This sympathetic-parasympathetic dichotomy conditions the control and regulation of excitation or oppression of the working organs and systems, and maintains the stability of its dynamic functional-energy equilibrium in relation to the conditions of the external environment.

Burning injury is one of the most powerful stressful stimuli, which initiates immediate disturbance of vegetative homeostasis. Additionally, numerous publications that address various aspects of the pathogenesis of the burning shock do not take into account the functional state of the vegetative nervous system during burning injuries and the burn disease, which is obviously connected with the absence of the objective methods and diagnostics.

The goal of this work is to enhance the efficiency of the treatment of patients with burns by means of the dynamic control and further correction of the vegetative homeostasis.

Methods and Materials. In the burns unit of the Vinnytsia regional clinical hospital named after M.I. Pyrogov we conducted biodiagnostics of the functional state of the vegetative nervous system of the 231 of burn patients during the acute period of the burn disease, aged from 18 to 80 years, using the method of V.G. Makats [4]. One hundred and twenty patients, who received early surgical necrosectomy with the usage of freeze-dried xenodermtransplants, which had been activated by biogalvanic current with further autotransplantation composed the main group. The first control group consisted of 90 patients with the severity index up to 90 points, who received a traditional treatment - independent rejection of necrosis under wed-drying bandages with antiseptic substances and autotransplantation. The second control group consisted of 21 patients with the severity index of affection higher than 90 points, who also received traditional treatment. All patients were randomly selected in relation to the severity of trauma.

During the process of treatment, the patients were under clinical observation and generally accepted laboratory assessment. The patients of the main and the control groups received the medication therapy, which was common in the department. We analyzed the dynamics of the activity of functional functional-vegetative systems, on their basis evaluated the coefficient of vegetative homeostasis, according to which estimated the functional state of the vegetative nervous system.

Results and Discussion

According to the tables 1, 2, 3 and the figures 1, 2, 3, 4, 5 we assessed the dynamics of the activity of a separate functional-vegetative system (FVS), as well as of the vegetative homeostasis in accordance with the coefficient. The vivid dynamics of the activity of separate FVSs in the group of patients with over-critical burn injuries. Eventually, on the

103 day they demonstrated the most excited FVS (HT) of heart (13,2 ± 0,1 – 18,5 ± 0,07 under the norm of 8,3 ± 0,20, P < 0,001) and the most oppressed FVS (SP) of spleen-pancreas (5,7 ± 0,08 – 6,0 ± 0,07 under the norm 11,0 ± 0,27, P < 0,001).

Table 1.

Dynamics of the activity of functional functional-vegetative systems of the main group during the acute period of the burn disease (n=120).

Day	Activity of functional functional-vegetative systems in %												
	LU	PC	HT	SI	TE	LI	SP	LR	KI	BL	GB	ST	kVH
1	8,1	8,9	10,0	7,0	9,1	8,4	8,0	8,0	9,3	9,5	6,3	7,2	0,9
m+/-	0,08	0,06	0,04	0,03	0,08	0,03	0,07	0,08	0,09	0,04	0,06	0,07	0,06
3	7,8	7,6	8,9	5,1	6,3	6,4	12,9	8,0	11,7	10,7	7,3	7,3	0,8
m+/-	0,19	0,21	0,20	0,42	0,22	0,18	0,27	0,23	0,23	0,29	0,21	0,17	0,24
7	8,9	8,5	9,1	5,0	4,5	6,3	11,6	9,4	12,8	10,4	7,3	6,2	0,7
m+/-	0,16	0,21	0,23	0,32	0,22	0,18	0,17	0,13	0,23	0,25	0,22	0,11	0,20
14	9,1	8,7	9,7	5,5	5,5	5,7	10,8	8,0	11,6	9,7	8,3	7,21	0,7
m+/-	0,05	0,08	0,07	0,07	0,05	0,05	0,07	0,05	0,08	0,10	0,06	0,18	0,08
21	9,8	9,5	8,8	4,9	3,3	5,8	9,3	8,9	9,2	10,6	11,7	8,0	0,8
m+/-	0,06	0,32	0,34	0,40	0,30	0,30	0,53	0,35	0,33	0,42	0,32	0,30	0,33
50-90	11,7	11,6	11,4	10,1	12,8	14,3	5,7	5,0	5,9	5,4	3,4	2,7	1,0
m+/-	0,19	0,21	0,20	0,42	0,22	0,18	0,27	0,23	0,23	0,29	0,21	0,07	0,23
norm	8,7	7,7	8,3	8,7	6,7	7,5	11,0	7,4	8,3	11,3	6,8	7,8	1,0
m+/-	0,19	0,21	0,20	0,42	0,22	0,18	0,27	0,23	0,23	0,29	0,21	0,17	0,24

Note. kVH – coefficient of vegetative homeostasis.

Table 2.

Dynamics of the activity of functional functional-vegetative systems of the first control group of patients during the acute period of burn disease (n=90)

Day	Activity of functional functional-vegetative systems in %												
	LU	PC	HT	SI	TE	LI	SP	LR	KI	BL	GB	ST	kVH
1	10,5	10,2	10,7	8,0	9,3	10,6	8,4	6,9	7,8	7,3	5,3	5,0	0,9
m+/-	0,07	0,10	0,07	0,09	0,07	0,06	0,14	0,06	0,07	0,11	0,06	0,06	0,08
3	6,3	6,9	8,4	2,5	3,5	5,3	15,4	10,7	11,2	13,6	8,3	7,7	0,7
m+/-	0,19	0,21	0,20	0,42	0,22	0,18	0,27	0,23	0,23	0,29	0,21	0,17	0,24
7	7,3	7,8	11,6	4,6	4,4	6,0	15,4	6,7	7,5	12,9	9,1	6,7	0,8
m+/-	0,05	0,08	0,07	0,07	0,05	0,05	0,07	0,05	0,08	0,10	0,06	0,06	0,06
14	8,6	8,0	8,8	8,9	6,9	8,1	13,8	7,4	7,6	11,3	5,6	4,9	0,9
m+/-	0,19	0,21	0,20	0,42	0,22	0,18	0,27	0,23	0,23	0,29	0,21	0,17	0,24
21	6,0	6,4	7,2	2,4	4,8	6,4	15,1	15,1	9,6	10,8	5,2	11,2	0,7
m+/-	0,07	0,06	0,04	0,01	0,08	0,03	0,07	0,05	0,09	0,04	0,04	0,07	0,05
50-90	10,5	9,8	10,4	10,2	11,3	10,6	7,7	8,1	9,3	4,2	5,4	6,8	0,86
m+/-	0,04	0,38	0,38	0,40	0,30	0,30	0,53	0,35	0,33	0,62	0,32	0,30	0,35
norm	8,7	7,7	8,3	8,7	6,7	7,5	11,0	7,4	8,3	11,3	6,8	7,8	1,0
m+/-	0,19	0,21	0,20	0,42	0,22	0,18	0,27	0,23	0,23	0,29	0,21	0,17	0,24

Note. kVH – coefficient of vegetative homeostasis.

Table 3.

Dynamics of activity of functional functional-vegetative systems of the second control group of patients during the acute period of the burn disease (n=21).

Day	Activity of functional functional-vegetative systems in %												
	LU	PC	HT	SI	TE	LI	SP	LR	KI	BL	GB	ST	kVH
1	8,3	7,0	13,2	7,4	9,3	10,1	5,7	9,3	8,8	7,5	8,5	4,9	0,9
m+/-	0,07	0,06	0,11	0,06	0,06	0,08	0,08	0,09	0,10	0,10	0,08	0,08	0,08
3	7,6	6,5	18,5	3,6	5,1	7,1	6,0	6,0	10,4	11,3	10,7	7,2	0,8
m+/-	0,05	0,08	0,07	0,07	0,05	0,05	0,07	0,05	0,08	0,10	0,06	0,06	0,07
7	9,3	7,7	6,7	3,0	4,0	9,3	6,9	7,0	16,9	6,9	12,7	9,6	0,8
`m+/-	0,04	0,06	0,06	0,06	0,05	0,05	0,08	0,05	0,05	0,10	0,05	0,05	0,06
14	8,9	6,8	9,6	6,6	10,5	6,3	3,7	4,6	11,2	4,3	14,8	12,7	1,2
m+/-	0,04	0,38	0,38	0,40	0,30	0,30	0,53	0,35	0,33	0,62	0,32	0,30	0,35
21	17,8	8,2	10,9	2,5	2,3	5,9	7,6	5,8	8,9	8,9	12,0	9,3	0,7
m+/-	0,07	0,05	0,06	0,07	0,08	0,06	0,09	0,09	0,06	0,15	0,08	0,08	0,08
50-90	10,9	9,4	9,3	9,2	8,3	8,6	8,1	9,2	9,3	4,2	5,4	6,8	0,75
m+/-	0,03	0,39	0,35	0,43	0,30	0,32	0,51	0,32	0,60	0,28	0,34	0,32	0,33
norm	8,7	7,7	8,3	8,7	6,7	7,5	11,0	7,4	8,3	11,3	6,8	7,8	1,0
m+/-	0,19	0,21	0,20	0,42	0,22	0,18	0,27	0,23	0,23	0,29	0,21	0,17	0,24

Note. kVH – coefficient of vegetative homeostasis.

On the 7-th day in the group of patients with over-critical burn injuries the most excited FVS (KI) of the kidneys (16,9 ± 0,05 under the norm 8,3 ± 0,23, P < 0,001) and again oppressed FVS (SP) of spleen-pancreas (6,9 ± 0,08 under the norm 11,0 ± 0,27, P < 0,001).

On the 14-th day in the group of patients with over-critical burn injuries the highest excitation was in the FVS (GB) of the gall bladder (14,8 ± 0,32 under the norm 6,8 ± 0,21, P < 0,001) and the highest oppression in the FVS (SP) of spleen-pancreas (3,7 ± 0,53 under the norm 11,0 ± 0,27, P < 0,001). During the same period, we noticed excitation of the FVS (ST) of stomach (12,7 ± 0,30 under the norm 7,8 ± 0,17, P < 0,001).

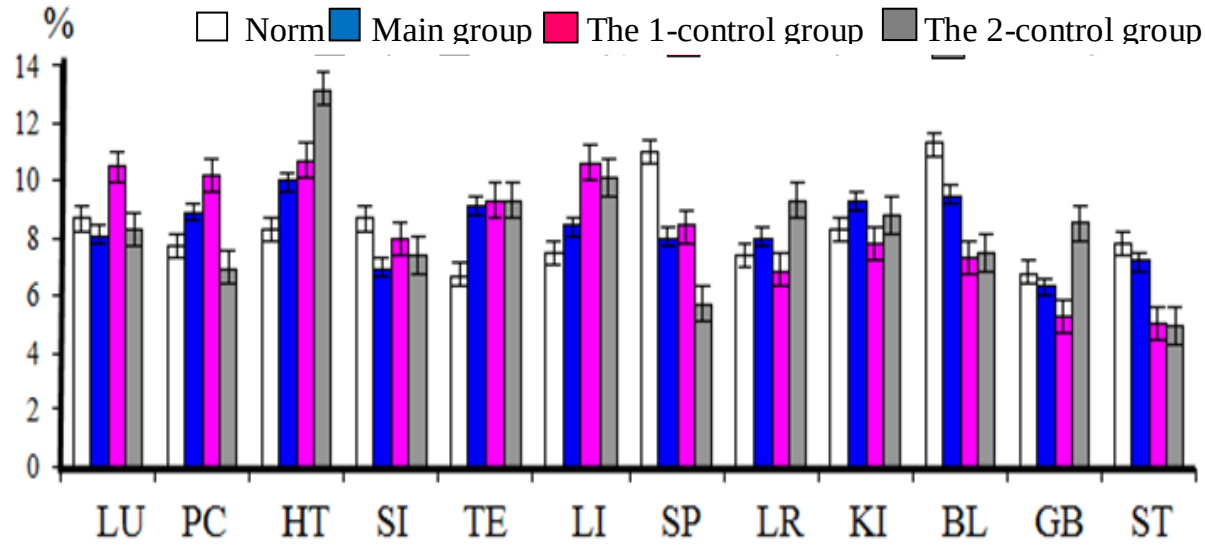

Fig. 1. Dynamics of the activity of functional functional-vegetative systems on the 1-st day after the injury.

On the 21-st day in the group of patients with over-critical burn injuries the most excited FVS was (LU) of lungs (17,8 ± 0,07 under the norm 8,7 ± 0,19, P < 0,001), and again we observed oppression of the FVS (SP) of spleen-pancreas (7,6 ± 0,09 under the norm 11,0 ± 0,27, P < 0,001).

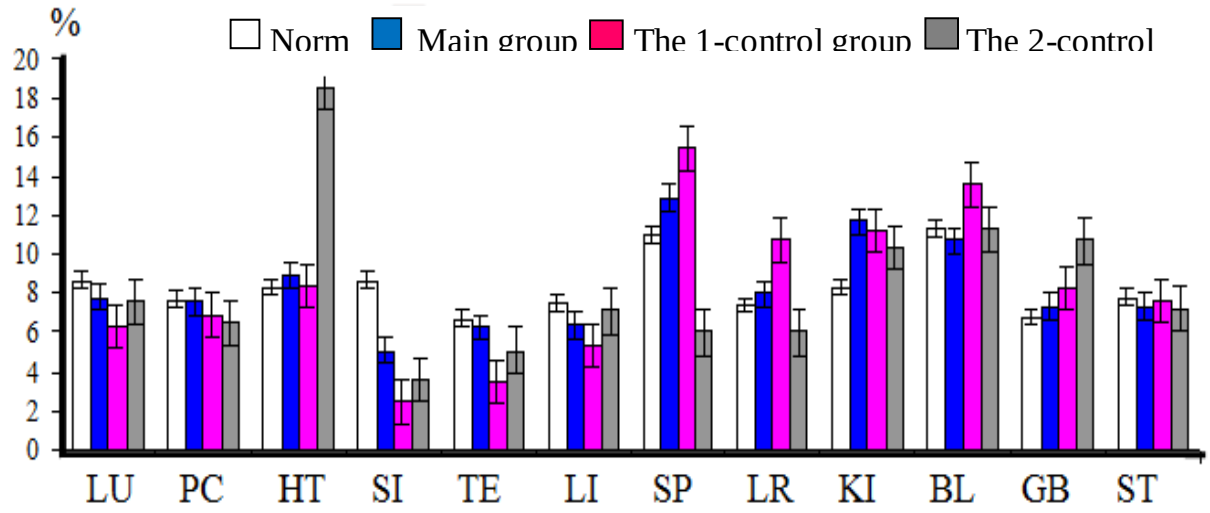

Fig. 2. Dynamics of the activity of functional functional-vegetative systems on the 3-rd day after the trauma.

According to the conducted studies of separate FVS in the patients with over-critical burn injuries, we may indicate that on the 1-3-7-14-21 day the most excited were the FVS, which accurately correlated with the pathogenesis of the burn disease. Specifically,

– on the 1-3 day the most excited was FVS (HT) of heart;

– on the 7-th – FVS (KI) of kidneys, which testifies to the development of acute burn toxemia;

– on the 14-th day - FVS (GB) of the gall-bladder, which was responsible mainly for the psychic activity (excitation of the patient, psychoses) and the FVS (ST) of stomach, which was clinically revealed through the disorders of gastrointestinal tract (paresis, bleeding, Curling's ulcer);

– on the 21-st day the most excited was the FVS (LU) of lungs, which was clinically demonstrated through the development of pulmonary insufficiency (bronchitis, pneumonia, bronchopneumonia).

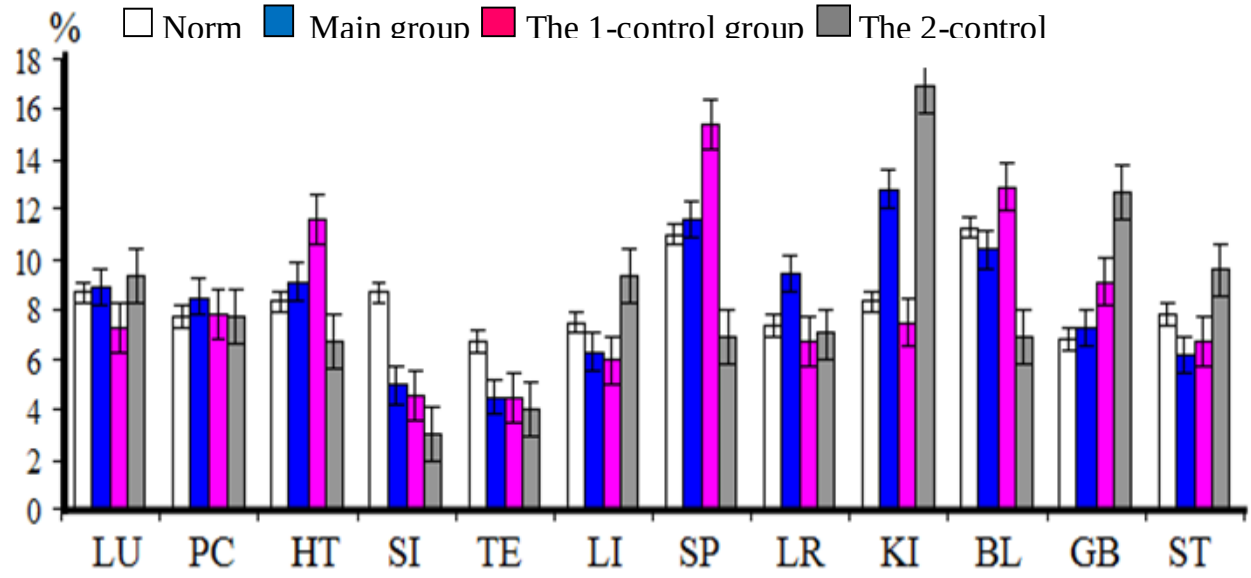

Fig. 3. Dynamics of the activity of functional functional-vegetative systems on the 7-th day after the trauma.

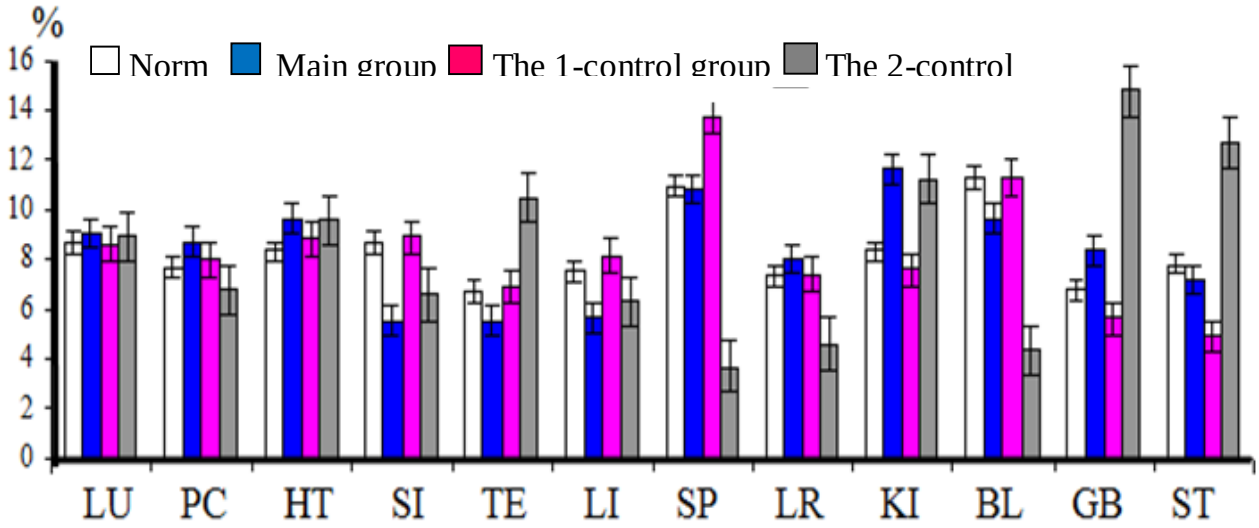

Fig. 4. Dynamics of the activity of functional functional-vegetative systems on the 14-th day after the trauma.

We should note that the dynamics of the FVS (SP) of spleen-pancreas, which was the most oppressed in the patients with over-critical burn injuries during the acute period of the burn disease. At the same time, the FVS (SP) of spleen-pancreas on the main and the first control groups was oppressed only on the first day after the trauma (8,0 ± 0,07 – 8,4 ± 0,14 under the norm 11,0 ± 0,27, P < 0,001). On the 3-7-14-21 day the FVS (SP) of spleen-pancreas in the main group was within the frames of the norm or was close to it (12,9 ± 0,27 – 11,6 ± 0,17 – 10,8 ± 0,07 – 9,3 ± 0,53 under the norm 11,0 ± 0,27), in the first control group it was significantly excited (15,4 ± 0,27 – 15,4 ± 0,07 – 13,8 ± 0,27 – 15,1 ± 0,07 under the norm 11,0 ± 0,27). The normalization of the activity of the FVS (SP) of spleen-pancreas in the main group in comparison with the control group was valid (P < 0,001).

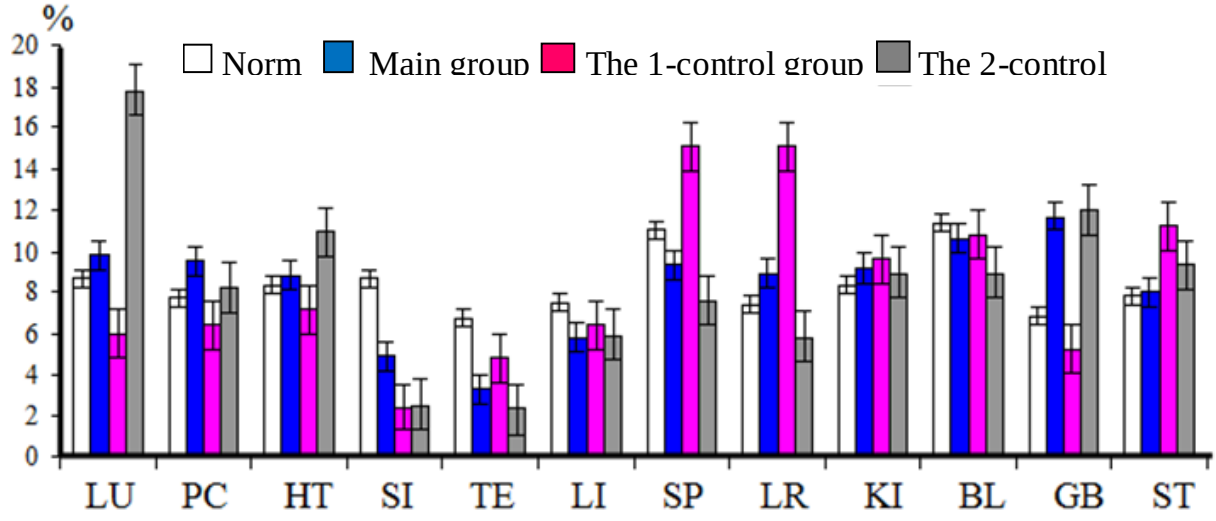

Fig. 5. Dynamics of the activity of functional functional-vegetative systems on the 21-st day after the trauma.

The functional state of the vegetative nervous system was estimated according to the coefficient of vegetative homeostasis. Due to our studies, in the moment of trauma, the vegetative nervous system responds with sympathetic reaction, mobilizing all available adaptive mechanisms, which are targeted at self-preservation of the biosystem. A com-

plex of changes occurs in the organism, which is called “general adaptive syndrome” or stress-reaction according to L. Kh. Garkavi.

The initial stage of stress is formed within the central nervous system, development of which is implemented through the subordinate systems of the organism involving nervous and humoral processes, especially through the endocrine system. All systems become oppressed. The only stimulation occurs is the release of adrenocorticotropic hormone (ACTH) and glucocorticoids. At the same time, we observe the absolute prevalence of the processes of catabolism with the emission of a great amount of energy.

It becomes evident that the organism cannot continuously be in the state of sympathetic activity, and according to the conducted biodiagnostics during the 1-st day after the trauma increases the activity of the parasympathetic division, which initially supports the transition of the functional activity of vegetative nervous system into the state of the norm with further prevalence of the parasympathetic activity of the vegetative nervous system (fig. 6).

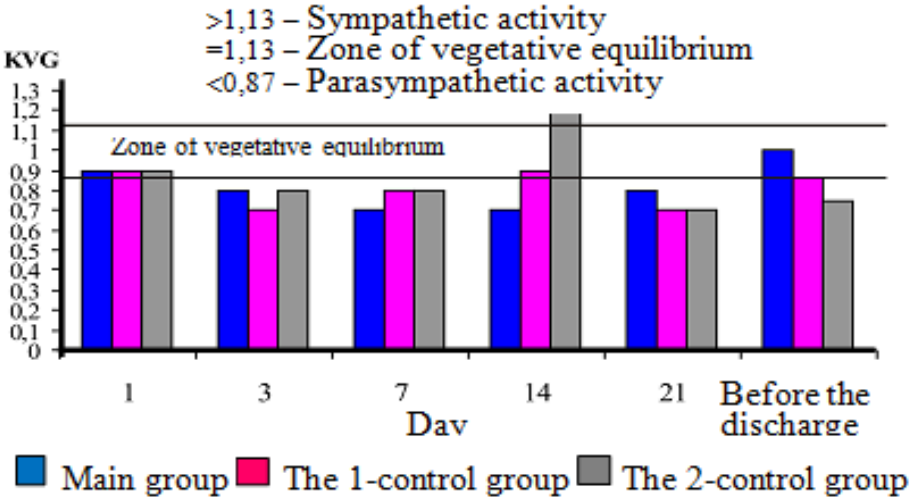

Fig. 6. Dynamics of vegetative homeostasis in the burn patients.

On the 3-rd day after the trauma, all three groups of the patients were in the state of the sympathetic activity. At the same time, the coefficient of the vegetative equilibrium in the main group and in the group of patients with over-critical injuries was 0,8 ± 0,24 i 0,8 ± 0,07 versus 0,7 ± 0,24 in the control group ($P > 0,05$). The more powerful influence of the sympathetic activity of the vegetative nervous system in the group of patients with over-critical burn injuries obviously depended on the heavier character of the trauma. In the patients of the main group, it depended on the psychological influence on the central nervous system, which originated under the expectation of the upcoming surgery, which contributed to the development of stress, but not under the consequences of the surgery.

On the 7-14 day, the patients of the main group demonstrated disorders of the vegetative homeostasis with the syndrome of the significant prevalence of the parasympathetic activity (0,7 ± 0,20 i 0,7 ± 0,08 under the norm 1,0 ± 0,24). In the first control group and in the group of patients with the over-critical injuries on the 7-th day, we observed the more powerful influence of the sympathetic division of the vegetative nervous system (0,8 ± 0,06 versus 0,7 ± 0,20 under the norm 1,0 ± 0,24), in comparison with the patients of the main group. Significant increase of the sympathetic activity in the first control group and in the group of patients with over-critical burn injuries was observed on the

14-day after the trauma, which testifies to the severity of the state of patients of the control group, which is associated with the stage-like necrectonomies and, as a result, loss of blood.

The disorders of the vegetative homeostasis with the syndrome of the expressed sympathetic activity in patients with over-critical burn injuries (1,2 ± 0,35 under the norm 1,0 ± 0,24) and the increase in sympathetic activity in patients of the first control group up to the vegetative equilibrium testify to the implementation of the adaptive reactions to super-powerful traumatic stimuli at the expense of injury and high energy losses that are accompanied by the exhaustion of the organism, decrease of non-specific resistance of the organism, and in the life-related prognosis, to the unfavorable result of treatment.

On the 21-st day the disorder of the vegetative homeostasis was diagnosed in all groups of patients under the research - in the main group with the syndrome of the expressed parasympathetic activity (0,8 ± 0,33 under the norm 1,0 ± 0,24), in the control groups of patients with the syndrome of significant parasympathetic activity (0,7 ± 0,05 i 0,7 ± 0,08 under the norm 1,0 ± 0,24), which testified to the relative stabilization of the state of patients.

Before the discharge from the hospital, the patients of the main group were diagnosed with the normalization of the vegetative homeostasis (1,0 ± 0,23 under the norm 1,0 ± 0,24). In the patients of the first control group and the group of patients with over-critical burn injuries, we diagnosed the syndrome of the expressed prevalence of parasympathetic activity (0,86 ± 0,35 – 0,75 ± 0,33 при нормі 1,0 ± 0,24).

Conclusion and the implications for further studies.

1. The elaborated means for biodiagnostics of the state of the vegetative homeostasis has been sustained by the accurate and reliable devices with high measuring characteristics and minimal energy-based influence on the epidermal BAZs, allows controlling the clinical development of the burn disease, which conditions clinical efficiency and has a principal value.

2. The perspective of the biodiagnostics is viewed in the identification of functional vegetative disorders in the early stages of trauma, and by the means of influence of biogalvanic current on the fine energy processes (biocorrection), in the achievement of substantial therapeutic consequences.

3. The most tense and responsible period of adaptation of the organism to the thermal injury is 7-14 days when the maximal disbalance of the sympathetic and parasympathetic divisions of the vegetative nervous system occurs.

4. Sudden oppression (to 40%) of the activity of the FVS (SP) of spleen-pancreas, as the most massive peripheral lymphatic organ of the immune system, throughout the trauma in the group of patients with over-critical burn injury testify to the expressed insufficiency of protecting systems of the organism, first of all of the cellular and humoral immunity, which can be viewed as the failure of immunological adaptive reactions, targeted at the stabilization of the homeostasis.

5. The efficiency of the treatment of patients during the acute period of the burn trauma is maintained by the steady prevalence of the parasympathetic activity of the vegetative nervous system through the adaptation of patients to thermal trauma with the deployment of the complex of compensatory-adaptive reactions of the organisms that are targeted at the stabilization of the homeostasis on the basis of inhibition of the stimulation of anabolic processes.

6. The identified, by means of biodiagnostics, more early normalization of the vegetative homeostasis in patients of the main group, in comparison with the control groups, testifies to the reasonability to employ the tactics of early surgical treatment with the usage of freeze-dried xenodermtransplants, activated with biogalvanic current in burn patients.

Further studies, within the discourse of the current topic, will include biocorrection of the functional state of the vegetative nervous system, on the basis of the current findings of biodiagnostics.

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