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RELATIONSHIPS BETWEEN ELECTRICAL CONDUCTIVITY OF ACUPUNCTURE POINTS AND HRV PARAMETERS

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ЗВ'ЯЗОК МІЖ ЕЛЕКТРОПРОВІДНІСТЮ АКУПУНКТУРНИХ ТОЧОК І ПАРАМЕТРАМИ ВСР

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Summary/Резюме

Background. After it was shown that the inherent regulatory system of the body is a neuro-endocrine-immune (NEI) network, a researcher proposed a hypothesis, that "*the bidirectional positive regulatory role of acupuncture was achieved by NEI network"*. Recently, we found that electrical conductivity of acupuncture points (ECAP) and their lateralization is 73% determined by the constellation of adaptation hormones, which are an important component of the NEI network. The purpose of this study is to find out relationships between ECAP and HRV parameters at same patients.

Materials and methods. The object of observation were 10 women (32-76 years) and 10 men (37-67 years) examined twice with a weekly interval. The volunteers were considered practically healthy, but with maladaptation. We recorded EC in AP Pg(ND), TR(X) and MC(AVL) ("Medissa") as well as HRV parameters ("CardioLab+HRV"). For statistical analysis used the software package "Microsoft Excell" and "Statistica 6.4 StatSoft Inc" (Tulsa, OK, USA).

Results. It was found that the increased ECAP as well as the rightward shift of symmetry of Pg(ND) AP pair were accompanied by excessive centralization of the autonomic nervous system with activation of its sympathetic and inhibition of the vagal link, a decrease in HRV entropy as well as serum aldosterone, calcitonin and PTH.

Conclusion. Electrical conductivity of APs and their lateralization is 78% determined by the HRV parameters as markers of autonomic nervous system. In the next message, we will demonstrate the existence of connections between APs and parameters of EEG as well as Immunity.

Keywords: *acupuncture points, electrical conductivity, HRV parameters, relationships.*

Введення. Після того, як було показано, що внутрішньою регуляторною системою організму є нейро-ендокринно-імунна (NEI) мережа, дослідник висунув гіпотезу про те, що «двоспрямована позитивна регуляторна роль акупунктури була досягнута мережею NEI». Нещодавно ми виявили, що електропровідність точок акупунктури (ECAP) і їх латералізація на 73% визначаються сузір'ям гормонів адаптації,

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які є важливим компонентом мережі NEI. Метою даного дослідження є виявлення зв'язку між показниками ECAP та BCP у одних і тих же пацієнтів.

Матеріали та методи. Об'єктом спостереження були 10 жінок (32-76 років) і 10 чоловіків (37-67 років), обстежених двічі з тижневим інтервалом. Добровольців вважали практично здоровими, але з дезадаптацією. Ми реєстрували ЕС в АР Pg(ND), TR(X) та MC(AVL) («Medissa»), а також параметри BCP («CardioLab+HRV»). Для статистичного аналізу використовували пакет програм "Microsoft Excell" та "Statistica 6.4 StatSoft Inc" (Талса, Оклахома, США).

Результати. Встановлено, що підвищення ECAP, а також зміщення симетрії пари Pg(ND) АР супроводжуються надмірною централізацією вегетативної нервової системи з активацією її симпатичної та пригніченням вагусної ланки, зниженням ентропії BCP, сироваткового альдостерону, кальцитоніну і ПТГ.

Висновок. Електропровідність ПД та їх латералізація на 78% визначаються параметрами BCP як маркерами вегетативної нервової системи. У наступному повідомленні ми продемонструємо існування зв'язку між АР та параметрами ЕЕГ, а також імунітету.

Ключові слова: *точки акупунктури, електропровідність, параметри BCP, взаємозв'язки.*

Introduction

After it was shown that the inherent regulatory system of the body is a neuro-endocrine-immune (NEI) network [2], a researcher proposed a hypothesis, that "*the bidirectional positive regulatory role of acupuncture was achieved by NEI network"* [3, 5, 6, 7]. Recently, we found that electrical conductivity of acupuncture points (ECAP) and their lateralization is 73% determined by the constellation of adaptation hormones [8], which are an important component of the NEI network. The purpose of this study is to find out relationships between ECAP and HRV parameters (as markers of autonomic nervous system) at same patients.

Material and Research Methods

The object of observation were 10 women (32-76 years) and 10 men (37-67 years) examined twice with a weekly interval. The volunteers were considered practically healthy (without a clinical diagnosis), but the initial testing revealed deviations from the norm in a number of parameters of the NEI network (details follow) as a manifestation of maladaptation, which actually prompted them to participate in the study with the hope of recovery.

In the morning in baseline condition we recorded electrical conductivity in follow acupuncture points: Pg(ND), TR(X) and MC(AVL) at Right and Left side, which represents the nervous, endocrine and immune systems respectively. Used complex "Medissa". For each pair, the Laterality Index (LI) was calculated.

Than we recorded an electrocardiogram in II lead for 7 minutes in the supine position to assess the parameters of heart rate variability (HRV) (software and hardware complex "CardioLab+HRV", "KhAI-MEDICA", Kharkiv). For further analyses the following parameters HRV were selected. Temporal parameters (Time Domain Methods): HR, the mode (Mo), the standard deviation of all NN intervals (SDNN), the square root of the mean of the sum of the squares of differences between adjacent NN intervals (RMSSD), the percent of interval differences of successive NN intervals greater than 50 msec (pNN_{50}); triangular index (TNN). Spectral parameters (Frequency Domain Methods): absolute ($msec^2$) and relative (%) power spectral density (PSD) bands of HRV: high-frequency (HF, range 0.4ч0.15 Hz), low-frequency (LF, range 0.15ч0.04 Hz), very low-frequency (VLF, range 0.04ч0.015 Hz) and ultralow-frequency (ULF, range 0.015ч0.003 Hz). Calculated classical indexes: LF/HF, Centralization Index=(VLF+LF)/HF,

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LFnu=100%•LF/(LF+HF) as well as Baevskiy's Activity of Regulatory Systems Index (BARSI) [9-11].

In addition, we calculated the Entropy (h) of relative PSD of HRV bands using Popovych's IL formula [12] based on classic Shannon's CE [13] formula:

$hHRV = -[PSDHF \cdot \log_2 PSDHF + PSDLF \cdot \log_2 PSDLF + PSDVLF \cdot \log_2 PSDVLF + PSDULF \cdot \log_2 PSDULF]/\log_2 4$.

Normal (reference) values of variables are taken from the instruction for device.

For statistical analysis used the software package "Microsoft Excell" and "Statistica 6.4 StatSoft Inc" (Tulsa, OK, USA).

Results and Discussion

Following the adopted algorithm, the actual/raw parameters were normalized by recalculation to Z-scores.

It was found (Table 1 and Fig. 1) that the electrical conductivity of acupuncture points exceeds the upper limit of the classical norm (+2y). Two HRV parameters were found to be deviated from the norm to the same extent: Centralization Index and BARSI. Three markers of sympathetic tone were increased less significantly, commensurate with the rightward shift of symmetry of Pg(ND) AP pair.

The Z-scores of the following constellation of APs, HRV as well as endocrine (see previous article) parameters fluctuated around zero.

In the lower normal range, in addition to the previously detected levels of aldosterone and calcitonin [8], markers of vagal tone such as RMSSD, SDNN and HF relative as well as absolute and relative PSD of ULF band, were found.

Table 1

Raw and normalized values of acupuncture points and HRV parameters

Variables	Means ± Standard Errors (n)		
	Raw (40)	Reference (40)	Z-score (40)
Pg(ND) Right, units	63,3±0,9	57,5±0,4	2,34±0,38
MC(AVL) Left, units	63,3±0,8	57,5±0,4	2,34±0,31
TR(X) Right, units	63,2±0,9	57,5±0,4	2,32±0,34
MC(AVL) Right, units	63,2±0,9	57,5±0,4	2,30±0,34
TR(X) Left, units	63,1±0,8	57,5±0,4	2,24±0,34
Pg(ND) Left, units	62,9±0,9	57,5±0,4	2,16±0,35
Pg(ND) Laterality, %	0,64±0,50	-0,51±0,39	0,46±0,20
TR(X) Laterality, %	0,27±0,49	-0,31±0,51	0,32±0,27
MC(AVL) Laterality, %	-0,23±0,53	-0,17±0,30	-0,03±0,28
(VLF + LF)/HF ratio	17,2±2,7	6,85±0,58	2,64±0,64
Baevskiy ARSI	3,10±0,44	1,50±0,12	2,13±0,58
LF/HF ratio	5,23±0,88	2,88±0,33	1,13±0,42
LF band HRV, msec^2	926±165	618±45	1,09±0,57
LFnu HRV, %	74,5±2,2	64,0±2,3	0,70±0,15
LF band HRV, %	30,1±2,1	25,9±1,5	0,30±0,20
Total HRV, msec^2	2561±365	2351±150	0,25±0,38
VLF band HRV, %	54,8±2,8	54,2±2,3	0,17±0,19
HF band HRV, msec^2	382±93	355±42	0,01±0,29
VLF band HRV, msec^2	1225±149	1247±109	-0,02±0,21
pNN_{50} HRV, %	7,7±2,0	8,6±1,2	-0,13±0,27
ULF band HRV, %	3,9±0,8	5,4±0,7	-0,26±0,24
RMSSD HRV, msec	25,3±2,7	29,5±2,2	-0,30±0,16
SDNN HRV, msec	46,7±3,3	56,4±4,7	-0,33±0,10
HF band HRV, %	11,2±1,5	14,5±1,5	-0,36±0,15
ULF band HRV, msec^2	81±16	122±17	-0,38±0,15
Entropy of HRV bands	0,680±0,020	0,807±0,013	-1,61±0,26

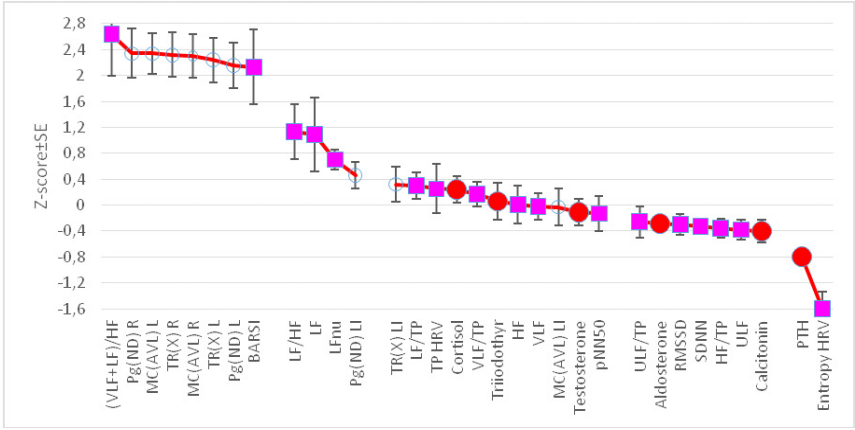

Fig. 1. Profile of normalized values of acupuncture points, HRV and adaptation hormones

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The ULF band (<0,0033 Hz) associated with oscillation blood level of norepinephrine (0,0020 Hz) as well as 17-OCS (0,0019 Hz). Because in our device ULF band (range 0,015ч0,003 Hz) is integrated into the lower zone of VLF band, what has been said about the latter also applies to it: VLF band (0,040ч0,0033 Hz) associated with oscillation blood level of epinephrine (0,025 Hz), reflects thermoregulatory cycles, cerebral ergotropic and metabolotropic outflows, activation of cerebral sympatho-adrenal system, sympathetic activity [11, 14]. Recently, a significant correlation (r=0.30) was found between relative PSD of ULF band and serum aldosterone [15].

Finally, the significantly reduced PTH levels found in the previous study were accompanied in this study by an even more significant reduction in HRV entropy levels.

Thus, the increased electrical conductivity of acupuncture points as well as the rightward shift of symmetry of Pg(ND) AP pair were accompanied by excessive centralization of the autonomic nervous system with activation of its sympathetic and inhibition of the vagal link, a decrease in HRV entropy as well as serum aldosterone, calcitonin and PTH.

At the next stage, a correlation matrix was created between APs parameters, on the one hand, and HRV parameters, on the other hand (Table 2).

Variables with maximum correlation are highlighted (Fig. 2).

Contrary to the recommendations of statisticians [16, 17], we did not remove the "falling values" from the processing, showing that they are not artifacts, but source of unique information: drastically low electrical conductivity of acupuncture points is accompanied by significant deviations of HRV as well as EEG, immunity, metabolism and GDV parameters [18].

Then, on the basis of the matrix, the multiple correlation coefficients between the APs as dependent variables and HRV variables as factors were first calculated (Table 2, Fig. 3).

It was found that EC APs MC(AVL) and TR(X) are less influenced by the autonomic nervous system than by adaptation hor-

Table 2

Matrix of correlations between the parameters of APs and HRV

Variable	R for HRV	TR (X) R	Pg (ND) R	Pg (ND) LI	Pg (ND) L	MC (AV L) R	TR (X) LI	MC (AV L) L	TR (X) L	MC (AV L) LI
SDNN HRV	**0,557**	-0,07	**0,26**	**0,38**	0,14	-0,00	**-0,24**	-0,08	0,01	**0,18**
HF band HRV	**0,519**	-0,23	0,05	**0,27**	-0,05	-0,15	**-0,36**	**-0,21**	-0,11	0,09
Total Power HRV	**0,471**	-0,04	**0,24**	**0,36**	0,13	-0,02	**-0,22**	-0,09	0,03	0,16
pNN_{50} HRV	**0,464**	-0,08	0,14	**0,26**	0,05	-0,04	**-0,34**	-0,09	0,03	0,12
Triangular index	**0,461**	-0,04	**0,26**	**0,34**	0,16	-0,00	**-0,20**	-0,06	0,03	0,14
LF band HRV	**0,450**	0,16	**0,36**	**0,35**	**0,26**	0,10	-0,14	0,04	0,21	0,17
RMSSD HRV	**0,441**	-0,11	0,14	**0,29**	0,04	-0,07	**-0,29**	-0,11	-0,01	0,07
LFnu HRV	**0,426**	**0,40**	**0,21**	-0,17	**0,28**	**0,36**	0,25	0,31	**0,32**	0,21
HF/TP ratio	**0,399**	**-0,37**	-0,12	0,24	-0,21	-0,33	-0,24	**-0,33**	**-0,30**	-0,11
Entropy of HRV	**0,367**	-0,16	0,03	**0,32**	-0,08	-0,17	0,06	-0,18	**-0,19**	-0,03
Baevskiy ARSI	**0,365**	**0,23**	0,16	0,03	0,16	0,15	0,05	0,04	**0,21**	**0,31**
VLF/TP ratio	**0,320**	0,11	-0,09	**-0,32**	0,01	0,12	0,01	0,18	0,12	-0,07
VLF band HRV	**ns**	-0,04	0,22	0,28	0,13	-0,00	-0,14	-0,06	0,02	0,14
LF/HF ratio	**ns**	0,28	0,13	-0,06	0,16	0,28	0,14	0,21	0,24	0,23
LF/TP ratio	**ns**	0,10	0,20	0,22	0,14	0,04	0,13	-0,03	0,06	0,18
(VLF+LF)/HF ratio	**ns**	0,20	0,05	-0,23	0,13	0,25	0,01	0,21	0,20	0,14
Multiple correlation	**R for APs**	**0,450**	**0,426**	**0,423**	**0,390**	**0,360**	**0,343**	**0,333**	**0,323**	**0,312**

Notes. Ranking of APs and HRV variables was carried out according to multiple correlation coefficients. The variables that were included in the regression models are highlighted in bold.

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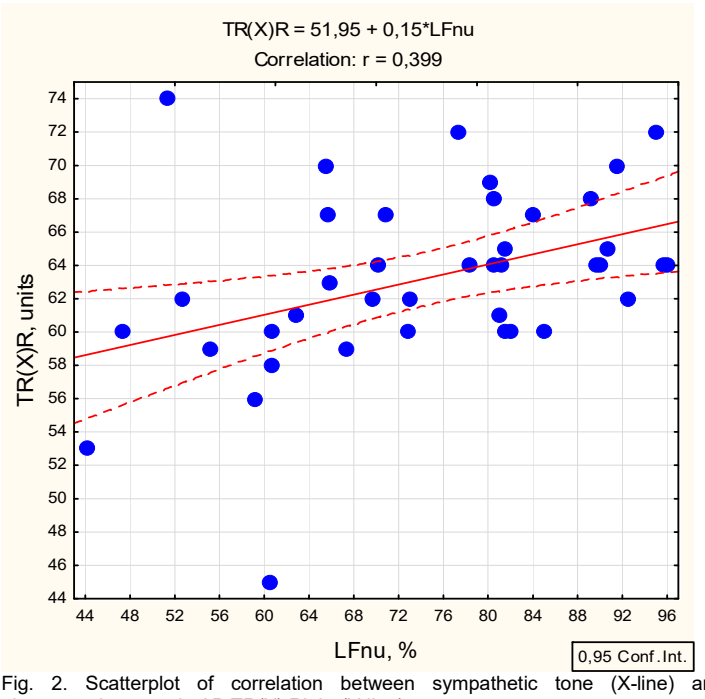

Fig. 2. Scatterplot of correlation between sympathetic tone (X-line) and electroconductance in AP TR(X) Right (Y-line)

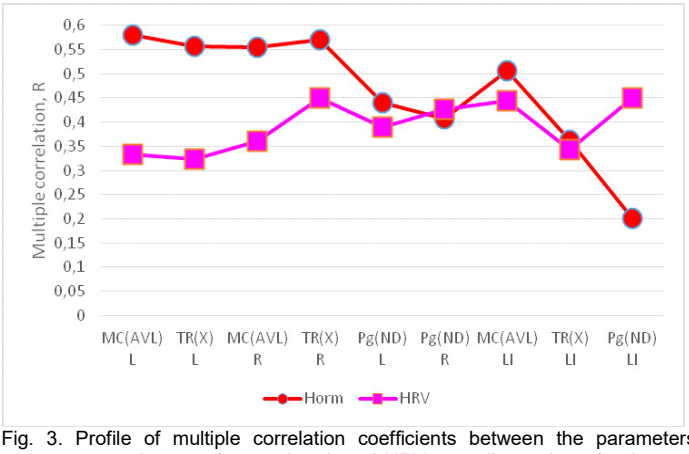

Fig. 3. Profile of multiple correlation coefficients between the parameters of acupuncture points, on the one hand, and HRV as well as adaptation hormones, on the other hand

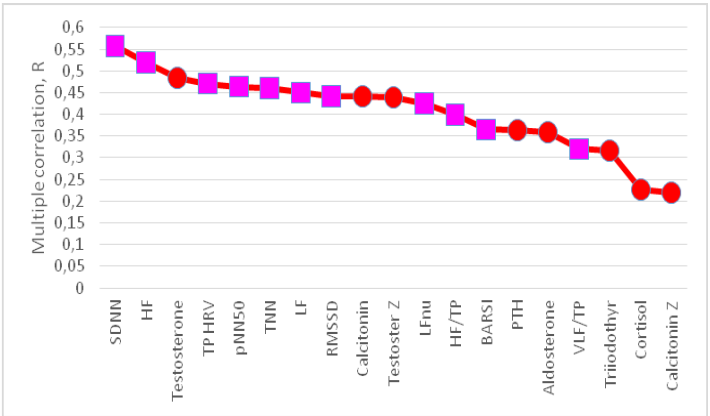

Fig. 4. Profile of multiple correlation coefficients between the parameters of HRV as well as adaptation hormones, on the one hand, and acupuncture points, on the other hand

mones; EC APs Pg(ND) as well as the symmetry of EC APs MC(AVL) and TR(X) are regulated by both systems to approximately the same extent, while the symmetry of EC APs Pg(ND) is determined by autonomic influences more strongly than by hormonal influences (Fig. 3).

Next, multiple correlation coefficients between the HRV variables as dependent and APs as factors were calculated (Table 2, Fig. 4).

Judging by R, the most sensitive to the state of APs were two markers of vagal tone and the current testosterone level. Other vagal markers, testosterone level normalized by sex and age, current calcitonin level, as well as the marker of sympathetic tone LFnu, were not much less affected. The following constellation was composed by BARSI, PTH and aldosterone. The R level for relative PSD of VLF band and triiodothyronine was at the border of significance, while for cortisol and calcitonin, normalized by sex, it was insignificant.

At the final stage, the canonical correlation between HRV parameters, on the one hand, and APs, on the other hand, was analyzed. As we noted earlier, the question of factor (argument) and dependent (function) variables is determined by the researcher's position regarding the Western or Eastern paradigm of medicine.

According to the paradigm of Western medicine the electroacupuncture according to Voll (EAV) belongs to an area of research known as electrodermal activity, galvanic skin response, or sympathetic skin response (SSR). The SSR represents an electrical potential generated in skin sweat glands. It originates by activation of the SSR reflex arch evoked by a variety of internal or externally stimuli. The effectors of the reflex arch activate eccrine sweat glands with cholinergic mediation [19].

Stimuli such as exercise and/or dis-

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eases to the organ (Lungs) trigger stress signal sent to central nervous system via afferent nerve (1) of the sympathetic reflex arch. Autonomic response to the stress is sent to effector organ through sympathetic efferent nerve (2a). In the meantime, sympathetic activation can be detected using electroacupuncture according to Voll devices from corresponding APs (2b). Innervated by sympathetic C fiber, sympathetic skin response (SSR) and vasomotor response (VR) can be activated simultaneously or independently. The specific response patterns may depend on the type, degree, location and duration of the stress.

Being under the pressure of the modern quasi-scientific bureaucracy, we were forced to place HRV variables in the left (X) set. Fortunately for the truth, neither the factor loadings nor the canonical correlation coefficients between the sets depend on their positions in the coordinate system.

As a result of the canonical correlation analysis, two pairs of canonical roots were identified. The HRV-Root of the first pair (Table 3) receives maximum factor loadings from vagal markers that as well as entropy correlate positively with the lateralization of APs Pg(ND), i.e. upregulate the rightward shift of their symmetry. Instead, other vagal markers upregulate the leftward shift of symmetry of APs TR(X). The Baevskiy's ARSI, in turn, upregulate the rightward shift of symmetry of APs MC(AVL).

Contrary to the expectation suggested by the Hong H [2019] scheme, the generally recognized sympathetic marker LFnu did not give a noticeable load on HRV-Root. Moreover, EC of only one pair of APs gave a noticeable load on the canonical root, which reflects their regulation by LF band HRV, associated with both links of the autonomic nervous system.

From the above it follows that the vagus nerves affect not so much the electrical conductivity of the tested APs as their symmetry. But it is known for certain that the sweat glands of the skin, which determine ECAPs, are innervated by sympathetic cholinergic fibers! If we rearrange the APs variables to the left set (recognize that the Earth does revolve around the Sun, and not vice versa), then the alternative interpretation will look like this: the state of the APs, primarily their symmetry, determines the level of vagal tone, i.e. the interpretation is freed from contradiction. We will return to this is-

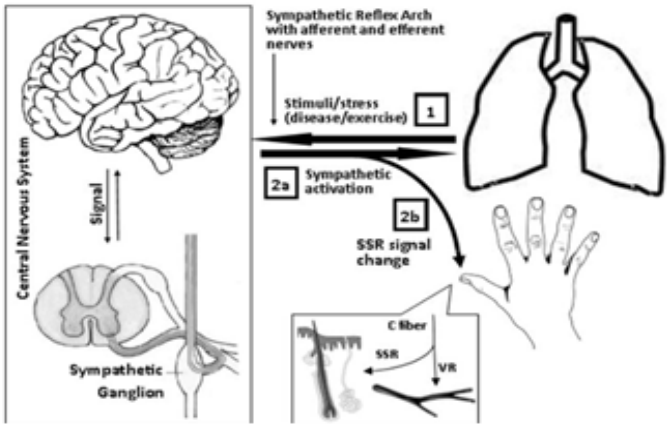

Fig. 5. Physiologic mechanism of electroacupuncture according to Voll testing postulated by Hong H [19].

Table 3

Factor structure of first pair of canonical roots of HRV and AP parameters

Left set	**R1**
SDNN HRV, msec	**-0,569**
Total Power HRV, msec²	**-0,493**
PSD LF band HRV, msec²	**-0,470**
RMSSD HRV, msec	**-0,461**
Entropy of HRV	**-0,200**
PSD HF band HRV, msec²	**-0,541**
pNN₅₀ HRV, %	**-0,520**
Baevskiy's ARSI, units	**-0,310**
Right set	**R1**
MC(AVL) Laterality, %	**-0,635**
TR(X) Laterality, %	**0,344**
Pg(ND) Laterality, %	**-0,237**
Pg(ND) Right, units	**-0,234**
Pg(ND) Left, units	**-0,166**

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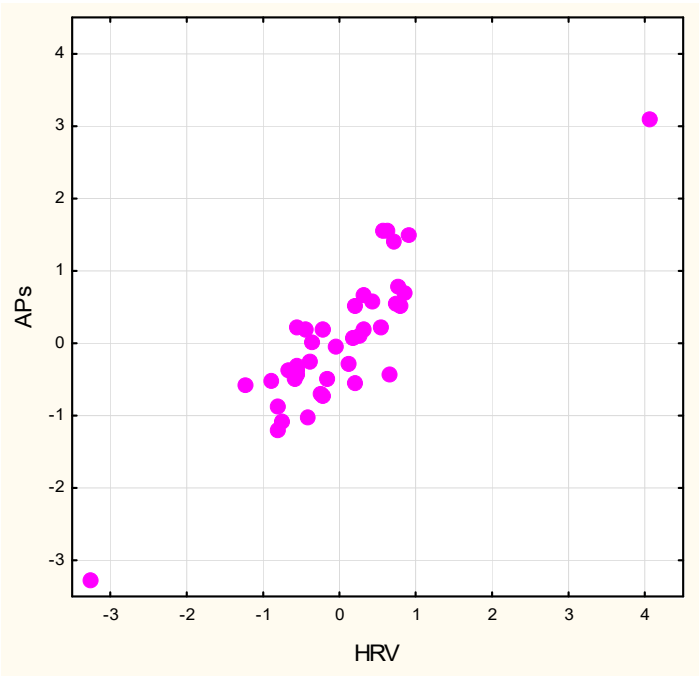
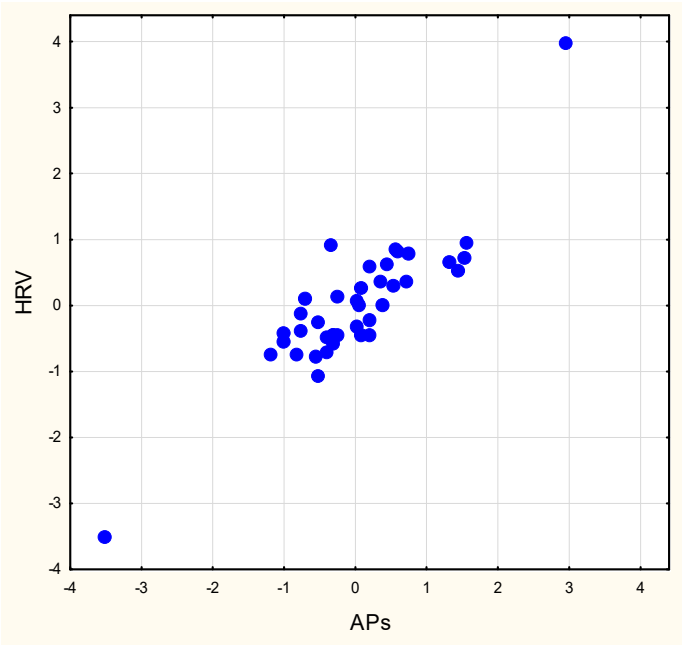


R=0,884; R^2=0,781; $\chi^2_{(90)}$=138; p=0,001; Λ Prime=0,009
Fig. 6. Scatterplot of canonical correlation between HRV (X-line) and APs (Y-line) parameters. First pair of Roots



R=0,884; R^2=0,781; $\chi^2_{(90)}$=138; p=0,001; Λ Prime=0,009
Fig. 6a. Scatterplot of canonical correlation between APs (X-line) and HRV (Y-line) parameters. First pair of Roots

sue later, but for now we note that regardless of the nature of the causal relationship between HRV and APs, it is very strong (Figs. 6 and 6a).

Instead, the factor structure of HRV-Root of the second pair is fully consistent with the scheme of Hong H [19]. Indeed, the maximum load gives a marker of sympathetic tone, which upregulates the EC of all three pairs of APs. A similar enhancing effect on EC APs Pg(ND) is exerted by LF band HRV, associated with both sympathetic and vagal links of the autonomic nervous system, and BARSI – on EC TR(X) R. Instead, relative PSD of HF band as the main vagal marker negatively correlates with EC of all three pairs of APs (Table 4).

Other vagal markers generally only affect the symmetry of ECAPs.

Taken together, HRV parameters determine the state of ECAPs by 67% (Fig. 7).

However, according to an alternative interpretation, this state of APs increases sympathetic tone and decreases vagal tone (Fig. 7a).

According to the concept of "central autonomic network (CAN)" [20, 21] it include following cortical, subcortical, and medullary structures (Fig. 8): the anterior cingulate, insular, orbitofrontal, and ventromedial cortices; the central nucleus of the amygdala; the paraventricular and related nuclei of the hypothalamus; the periaqueductal gray matter; the nucleus of the solitary tract; the nucleus ambiguous; the ventrolateral medulla; the ventromedial medulla and the medullary tegmental field. The primary output of the CAN is mediated through the preganglionic sympathetic and parasympathetic neurons, which exert control over the heart via the stellate ganglia and the vagus nerve, respectively. The interplay of sympathetic and parasympathetic influences on sinoatrial node pacemaker activity generates the complex variability that characterizes the healthy heart rate rhythm, which is called HRV. A fundamental principle of the neural control of the heart is its hierarchical orga-

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Table 4

Factor structure of second pair of canonical roots of HRV and AP parameters

Left set	*R2*
PSD LFnu, %	-0,716
PSD LF band HRV, msec^2	-0,117
PSD HF band HRV, %	0,690
Baevskiy's ARSI, units	-0,431
Entropy of HRV	0,436
RMSSD HRV, msec	0,257
pNN_{50} HRV, %	0,234
SDNN HRV, msec	0,214
Total Power HRV, msec^2	0,191
PSD HF band HRV, msec^2	0,466
Right set	R2
TR(X) Right, units	-0,651
TR(X) Left, units	-0,558
MC(AVL) Right, units	-0,539
MC(AVL) Left, units	-0,444
Pg(ND) Right, units	-0,351
Pg(ND) Left, units	-0,439
MC(AVL) Laterality, %	-0,364
TR(X) Laterality, %	-0,321
Pg(ND) Laterality, %	0,193

nization, with cortical structures providing inhibitory control over limbic and brainstem sympathoexcitatory circuits. The prefrontal, cingulate, and insula cortices form an interconnected network with bi-directional communication with the amygdala. The amygdala is under tonic inhibitory control via prefrontal vagal pathways to intercalated cells in the amygdala. The activation of the central nucleus of the amygdala (CeA) inhibits the nucleus of the solitary tract (NTS) which in turn inhibits inhibitory caudal ventrolateral medullary (CVLM) inputs to the rostral ventrolateral medullary (RVLM) sympathoexcitatory neurons, and simultaneously inhibits vagal motor neurons in the nucleus ambiguus (NA) and the dorsal vagal motor nucleus (DVN).

In addition, the CeA can directly activate the sympathoexcitatory neurons in the RVLM. Indeed, disruption of prefrontal activity leads to disinhibition of sympathoexcitatory circuits, with a resultant increase in heart rate and decrease in vagally-mediated HRV.

The above explains the reciprocity we have discovered between vagal and sympathetic tones.

Now let's consider the situation from the perspective of the Eastern paradigm of medicine.

According to the paradigm of Eastern medicine APs through meridians are connected with Chakras, which exert a regulatory influence on endocrine glands and nerve plexuses [22]. Therefore, the levels of adaptation hormones and HRV depend on the state of APs and Chakras.

Chase CR [22] provides a table according to which the first Chakra is associated with adrenals, pelvic nerve plexus, spine, kidneys, bladder, large intestine; second Chakra with testes/ovaries, inferior mesenteric ganglion, ileum, organs of reproduction; third Chakra with [endocrine] pancreas, celiac plexus ganglion, liver, gall bladder, stomach, duodenum, pancreas, spleen; fourth Chakra with thymus, celiac plexus, heart, circulation, vagus nerve; fifth Chakra with thyroid and parathyroid glands, inferior cervical ganglion, lungs, bronchus, larynx, pharynx, large intestine, vagus nerve; sixth Chakra with pituitary and pineal glands, thalamus, hypothalamus, superior cervical ganglion, left brain, lower brain, ears/nose, left eye; seventh Chakra with pineal gland, right brain, upper brain, right eye.

Almost simultaneously with the registration of ECAPs in these same patients, we recorded HRV, EEG as well as GDV [18]. The latter method allows for an indirect assessment of the Energy and Symmetry of virtual Chakras. The results will be reported in future publications.

Conclusion

The electrical conductivity of acupuncture points and its symmetry are closely related to the parameters of the endocrine and autonomic nervous systems. In the follow-

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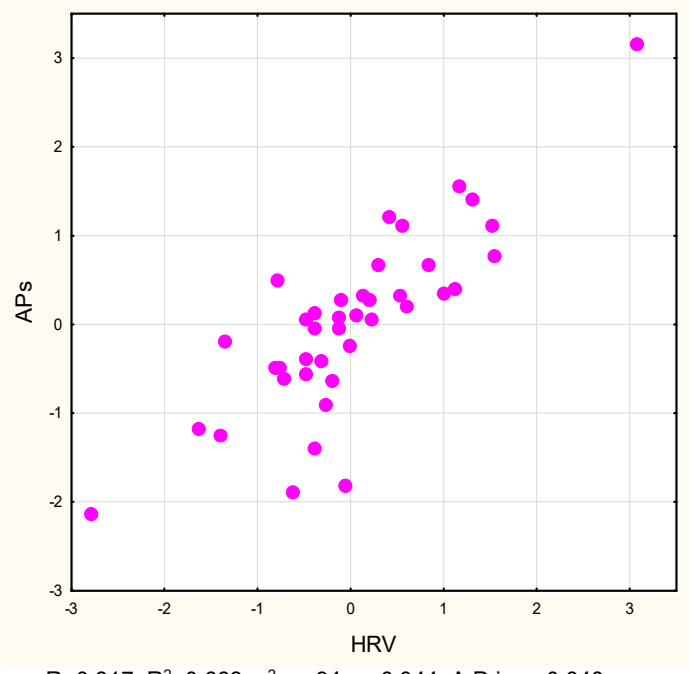
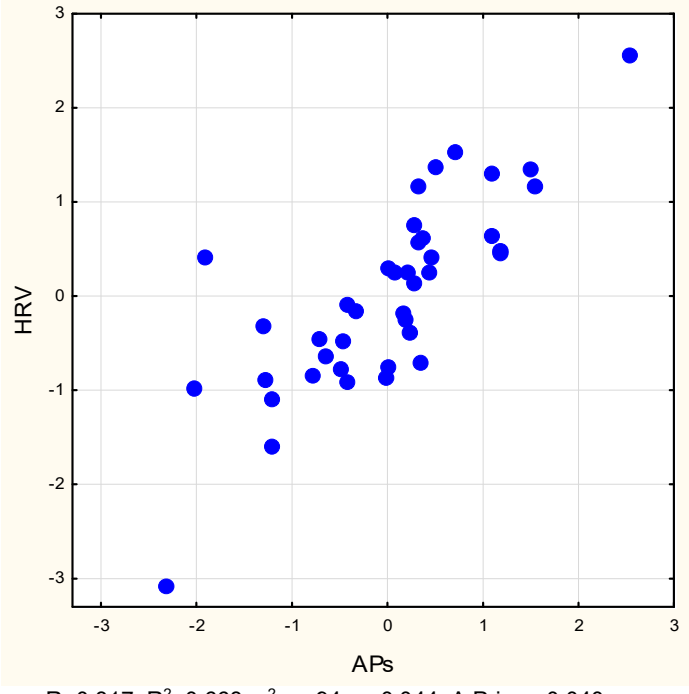


R=0,817; R^2=0,668; $\chi^2_{(72)}$=94; p=0,044; Λ Prime=0,040

Fig. 7. Scatterplot of canonical correlation between HRV (X-line) and APs (Y-line) parameters. Second pair of Roots



R=0,817; R^2=0,668; $\chi^2_{(72)}$=94; p=0,044; Λ Prime=0,040

Fig. 7a. Scatterplot of canonical correlation between APs (X-line) and HRV (Y-line) parameters. Second pair of Roots

ing reports, data on their connections with the parameters of EEG, immunity as well as GDV will be presented.

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Accordance To Ethics Standards

Tests in patients are conducted in accordance with positions of Helsinki Declaration 1975, revised and complemented in 2002, and directive of National Committee on ethics of scientific researches. During realization of tests from all parent of participants the informed consent is got and used all measures for providing of anonymity of participants.

For authors any conflict of interests is absent.

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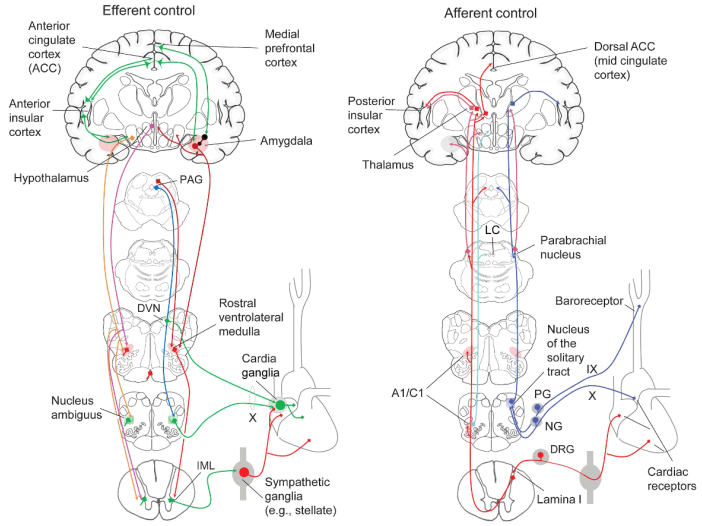

Fig. 8. Efferent and afferent control of cardiac function [21]

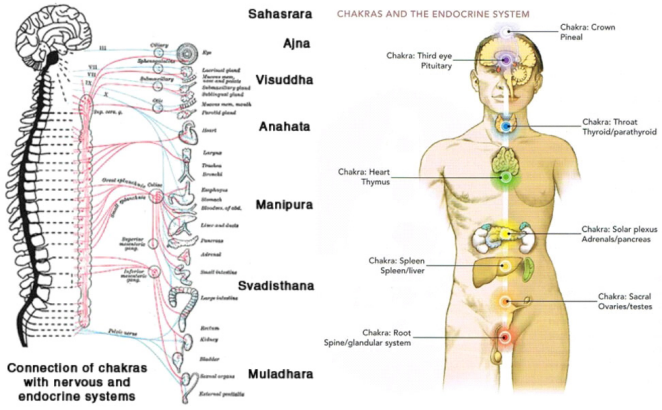

Fig. 9. Connection of Chakras with nervous and endocrine systems of a human body
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PECULIARITIES OF NEURO-ENDOCRINE-IMMUNE ACCOMPANIMENTS OF URATE-LOSING/RETAINING KIDNEYS

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ОСОБЛИВОСТІ НЕЙРО-ЕНДОКРИННО-ІМУННОГО СУПРОВОДУ УРАТОВТРАЧУЮЧИХ/ЗТРИМУЮЧИХ НИРОК

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Summaty/Резюме

Background. On the first stage of project “Neuro-endocrine regulation of the clearance of nitrogenous metabolites” implementation, we found out of peculiarities of metabolic and neuro-endocrine accompaniments of urate-losing and urate-retaining kidneys. In this study, the battery of tests was supplemented with electroencephalography and immune tests performed on the same sample of patients.

Materials and Methods. The object of observations were patients with chronic pyelonephritis in the phase of remission (34 males aged 23-70 years and 10 females aged 33-76 years). Testing was performed twice - on admission and after 7-10 days of standard balneotherapy on Truskavets’ Spa. The battery of tests was created in line with concepts functional-metabolic continuum and neuro-endocrine-immune network. The content of uric acid and creatinine was determined in daily urine and blood serum. In addition, the serum level of the main adaptation hormones and immune parameters was determined. The state of the autonomic and central nervous systems was assessed by the HRV and EEG methods respectively.

Results. In 63.6% of cases, the renal clearance of uric acid was within the classical norm (±2y), in 12.5% it was moderately reduced, but in the remaining cases it was increased, including drastically in 3 cases. The method of discriminant analysis revealed 32 variables (in addition to clearance, fractional excretion, uricosuria and uricemia by definition, 14 EEG, 7 HRV, 4 blood pressure, and 3 endocrine), according to the totality of which all 4 clusters of uric acid clearance clearly differ from each other (classification accuracy 100%). **Conclusion**. Constitutionally distinct types of uric acid metabolism are accompanied by a specific constellation of EEG, HRV, endocrine and immune variables.

Keywords: *uric acid clearance, EEG, HRV, adaptation hormones, immunity, chronic pyelonephritis.*

Актуальність. На першому етапі реалізації проекту «Нейро-ендокринна регуля-