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Metabolic accompaniment of quantitative-qualitative blood pressure clusters in patients of Truskavets' spa

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Abstract

Background. Earlier we studied the neural and endocrine accompaniments of quantitative-qualitative blood pressure (BP) clusters of profile patients of Truskavets' spa. The **purpose** of this study is to clarify the metabolic accompaniment in the same contingent. **Materials and methods.** Under an observations were 44 patients with chronic pyelonephritis and cholecystitis in the phase of remission. Testing was performed twice - on admission and after 7-10 days of standard balneotherapy. The main object of the study was BP (tonometer "Omron M4-I", Netherlands). The plasma levels of lipids, glucose, nitrogenous metabolites and electrolytes as well as urinary excretion of last two were determined. In addition, electrokinetics and cholecystokinetics indexes were determined. **Results**. The forward stepwise program identified 21 parameters as characteristic of quantitative-qualitative blood pressure clusters. In addition to BP parameters by default, the most informative among them are sodium and uric acid daily excretion as well as plasma phosphate and magnesium, whose levels are maximal in patients with hypertension, while minimal in patients with low norm BP, on the one hand, and electrokinetics index, the level of which are polar, on the other hand. The accuracy of patient classification is 97,7%. **Conclusion**. The quantitative-qualitative blood pressure clusters have a characteristic metabolic accompaniment.

Keywords: blood pressure, electrolytes, nitrogenous metabolites, lipids, electrokinetics and cholecystokinetics indexes, discriminant analysis, Truskavets' spa.

INTRODUCTION

Earlier we showed that profile patients of Truskavets' spa are characterized by a wide range of blood pressure - from low norm to arterial hypertension III - that correspond to the hemodynamics parameters [8]. Than we clarified the neural and endocrine accompaniments of quantitative-qualitative blood pressure clusters in the same contingent. We have been shown that the most informative among them are HRV-markers of sympathetic tone and sympathetic-vagal balance as well as testosterone and cortisol, whose levels are maximal in patients with hypertension II, while minimal in patients with low norm blood pressure, on the one hand, and markers of vagal tone and Kerdö's vegetative index, the levels of which are polar, on the other hand. The accuracy of patient classification is 98,9% [9]. The most informative among discriminant EEGs parameters are power spectral density of beta-rhythm in C3 and C4 loci; alpha-rhythm in T4 and F3 loci; delta-rhythm in C3, T5 and P3 loci as well as its deviation. The accuracy of classification is 100% [10].

The **purpose** of this study, given the previous data [21], is to clarify the metabolic accompaniments of quantitative-qualitative blood pressure clusters in the same contingent.

MATERIALS AND METHODS

Under an observations were 34 males and 10 females by age 24-76 years with chronic pyelonephritis and cholecystitis in the phase of remission. Testing was performed twice - on admission and after 7-10 days of standard balneotherapy (drinking of bioactive water Naftussya, applications of ozokerite, mineral pools).

The main object of the study was blood pressure (BP). Systolic and diastolic BP was measured (by tonometer "Omron M4-I", Netherlands) in a sitting position three times in a row.

Retrospectively, 5 quantitative-qualitative blood pressure clusters were created (Fig. 1) according to the existing gradation [1][16].

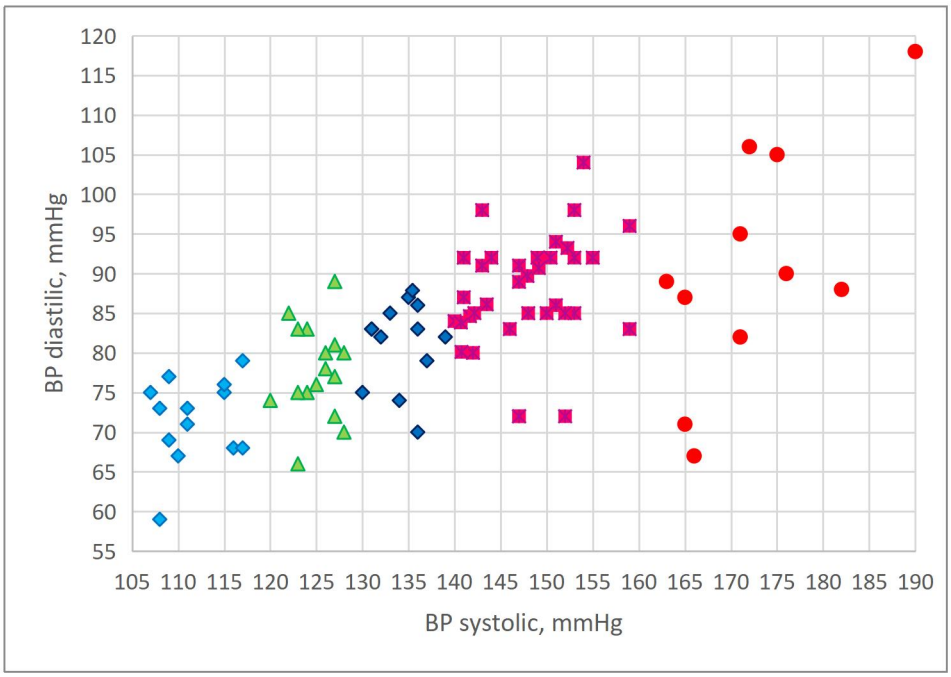

Fig. 1. Diagram of scattering of systolic and diastolic blood pressure of patients of Truskavets' spa

Daily urine was collected, in which was determined the concentration of electrolytes: calcium (by reaction with arsenase III), magnesium (by reaction with colgamite), phosphates (phosphate-molybdate method), chloride (mercury-rhodanidine method), sodium and

potassium (flamming photometry); nitric metabolites: creatinine (by Jaffe's color reaction by Popper's method), urea (urease method by reaction with phenolhypochlorite), uric acid (uricase method). Urine lithogenicity index (Lith) was also calculated by the Tiselius' HS [22] formula modifed by Flyunt VR et al [2][3]:

Lith = (Uric acid•Calcium/Magnesium•Creatinine)^{0,25}.

The same metabolic parameters were determined in plasma as well as glucose (glucose-oxidase method), triglycerides (by a certain meta-periodate method), total cholesterol (by a direct method after the classic reaction by Zlatkis-Zack) and content of him in composition of α-lipoproteins (HDLP) (by the enzyme method after precipitation of notα-lipoproteins); pre-β-lipoproteins (VLDLP) (expected by the level of triglycerides); β-lipoproteins (LDLP) (expected by a difference between a total cholesterol and cholesterol in composition α-and pre-β-lipoproteins). Coefficients of atherogenicity (AGC) were calculated:

(Total Ch – HDLP Ch)/HDLP Ch (Klimov's Index).

The analysis carried out according to instructions [4] with the use of analyzers "Reflotron" (BRD) and "Pointe-180" (USA) and corresponding sets of reagents.

Given its integral physiological nature [5][6][11][12][13][14][15], we determined also the electrokinetics index (EKI) as rate of electronegative nuclei of buccal epithelium by intracellular microelectrophoresis on the device "Biotest" (Kharkiv State University), according to the method described [19][20].

On the tone and motility of gall-bladder judged by its volume on an empty stomach in the morning and after 5, 15 and 30 min after ingestion cholekinetic (50 ml of 40% solution of xylitol). The method echoscopy (echocamera "Radmir") applicated. To quantify cholekinetics, the area between the cholecystovolumogram and the basal line was calculated [17][18].

Normal (reference) values of variables are taken from the instructions and/or database of the Truskavetsian Scientific School of Balneology.

For statistical analysis used the software package "Statistica 6.4".

The results of a pilot study on this topic were previously published [21].

RESULTS AND DISCUSSION

In order to identify among the registered parameters, those for which the blood pressure clusters differ from each other, a discriminant analysis was performed [7]. The program forward stepwise included in the discriminant model 21 parameters. In addition to BP parameters by default, the following variables were identified as characteristic: **sex** index (as a ratio between the number of male and female in the cluster), **electrokinetics** index, **body mass** index, as well as 8 parameters of **plasma**, 6 parameters of **urine**, and 2 parameters of cholekinetics (Tables 1 and 2).

Table 1. Discriminant Function Analysis Summary for Metabolic Variables, their actual levels (Mean±SE) for Clusters of Blood Pressure as well as Reference levels and Coefficients of Variability

Step 21, N of vars in model: 21; Grouping: 5 grs; Wilks' Λ: 0,0083; approx. $F_{(88)}=6,6$; $p<10^{-6}$

Variables currently in the model	Clusters of Blood Pressure (n)					Parameters of Wilk's Statistics						
	AH II (11)	AH I (35)	High N (13)	No-rm (16)	Low N (13)	Wilks' Λ	Par-tial Λ	F-re-move (4,62)	p-level	Tole-rancy	Refe-rence (88)	Cv
BP Systolic, mmHg	172 2,5	148 0,9	134 0,8	125 0,6	112 1,0	0,080	0,103	135	10^{-6}	0,557	124,5 1,6	,122
BP Diastolic, mHg	90,7 4,5	87,6 1,2	81,3 1,5	77,8 1,5	71,5 1,5	0,009	0,956	0,71	0,588	0,484	79,0 0,7	,086
Sex Index (M=1; F=2)	1,36 0,15	1,11 0,05	1,00 0,00	1,25 0,11	1,62 0,14	0,009	0,876	2,20	0,080	0,547	1,23 0,04	,343
Electrokine-tics Ind, %	31,7 2,1	44,7 2,3	42,7 2,6	46,6 2,7	50,1 2,5	0,010	0,846	2,82	0,033	0,417	40,9 1,1	,250
Body Mass Index, kg/m^2	27,5 1,3	27,2 0,7	27,4 0,8	27,9 0,9	25,5 0,6	0,009	0,888	1,95	0,113	0,441	24,2 0,3	,133
Sodium P, mM/L	149 2,8	140 1,5	140,4 2,1	145 2,0	148,2 1,2	0,010	0,828	3,21	0,018	0,697	145,0 0,5	,034
Potassium P, mM/L	4,49 0,14	4,22 0,09	4,35 0,15	4,22 0,14	4,72 0,16	0,009	0,885	2,02	0,102	0,689	4,55 0,05	,104
Magnesium P, mM/L	0,85 0,02	0,83 0,01	0,84 0,01	0,84 0,01	0,82 0,01	0,010	0,844	2,86	0,031	0,631	0,90 0,01	,056
Calcium P, mM/L	2,19 0,04	2,22 0,04	2,24 0,05	2,17 0,04	2,13 0,02	0,009	0,917	1,41	0,243	0,612	2,30 0,02	,065
Phosphate P, mM/L	1,08 0,07	1,02 0,03	1,09 0,07	1,00 0,04	0,90 0,09	0,009	0,904	1,64	0,175	0,706	1,20 0,02	,167
Urea P, mM/L	5,37 0,26	6,22 0,21	6,22 0,41	5,69 0,21	6,08 0,28	0,009	0,908	1,59	0,187	0,673	5,00 0,18	,330
VLD LP Ch Plasma, Z	0,19 0,21	0,39 0,16	-0,51 0,19	0,16 0,26	-0,41 0,18	0,009	0,932	1,13	0,350	0,274	0	
Klimov's AGC, Z	0,92 0,51	0,22 0,28	0,16 0,45	0,01 0,35	0,41 0,45	0,009	0,879	2,14	0,086	0,292	0	
Urea Excr., mM/24 h	516 64	632 39	551 78	531 58	489 45	0,010	0,834	3,09	0,022	0,134	458 9	,186
Sodium Ex, mM/24 h	238 37	221 14	189 21	217 24	194 22	0,009	0,932	1,14	0,348	0,409	154 3	,211
Calcium Ex, mM/24 h	3,74 0,72	6,17 0,60	4,88 0,86	3,92 0,44	4,82 0,79	0,010	0,834	3,09	0,022	0,307	4,38 0,10	,214
Uric acid Ex, mM/24h	4,01 0,56	4,25 0,25	3,71 0,45	3,44 0,30	3,29 0,38	0,010	0,792	4,06	0,005	0,114	3,00 0,08	,250
Creatinine Ex, mM/24h	10,5 1,3	8,2 0,7	6,5 0,6	7,1 0,8	8,6 1,1	0,009	0,935	1,08	0,374	0,297	11,0 0,35	,300
Lithogenici-ty Urine	0,74 0,05	0,89 0,03	0,89 0,03	0,88 0,04	0,79 0,04	0,010	0,844	2,86	0,031	0,171	0,73 0,02	,300
Cholecysto-kinetics Ind	615 43	569 25	635 40	613 35	559 31	0,009	0,921	1,34	0,266	0,507	624 9	,131
Gallbladder Volume, mL	51,2 2,2	45,0 2,1	43,9 4,9	48,7 5,2	46,1 4,5	0,010	0,870	2,33	0,066	0,618	41,0 2,2	,500

Table 2. Summary of Stepwise Analysis for Blood Pressure and Metabolic Variables, ranked by criterion Lambda

Variables currently in the model	F to enter	p-level	Λ	F-value	p-value
Blood Pressure Systolic, mmHg	298	10^{-6}	0,065	298	10^{-6}
Sex Index (M=1; F=2)	4,95	0,001	0,052	68,99	10^{-6}
Sodium Plasma, mM/L	4,29	0,003	0,043	40,71	10^{-6}
VLDLP Cholesterol Plasma, Z	3,04	0,022	0,038	29,51	10^{-6}
Klimov's Atherogenicity Coefficient, Z	3,42	0,012	0,032	23,96	10^{-6}
Calcium Excretion, mM/24 h	2,52	0,048	0,028	20,23	10^{-6}
Potassium Plasma, mM/L	1,63	0,174	0,026	17,41	10^{-6}
Urea Plasma, mM/L	1,31	0,272	0,024	15,28	10^{-6}
Lithogenicity Urine	1,34	0,264	0,023	13,68	10^{-6}
Magnesium Plasma, mM/L	1,19	0,320	0,020	11,37	10^{-6}
Phosphate Plasma, mM/L	1,85	0,129	0,018	10,65	10^{-6}
Cholecystokinetics Index, units	1,11	0,360	0,017	9,905	10^{-6}
Gallbladder Volume, mL	1,17	0,332	0,016	9,281	10^{-6}
Blood Pressure Diastolic, mHg	1,16	0,337	0,015	8,741	10^{-6}
Sodium Excretion, mM/24 h	1,15	0,341	0,014	8,270	10^{-6}
Calcium Plasma, mM/L	1,00	0,412	0,013	7,832	10^{-6}
Electrokinetic Index, %	1,53	0,202	0,012	7,528	10^{-6}
Body Mass Index, kg/m^2	1,51	0,209	0,011	7,256	10^{-6}
Uric acid Excretion, mM/24h	1,04	0,395	0,010	6,942	10^{-6}
Urea Excretion, mM/24 h	2,84	0,032	0,009	6,910	10^{-6}
Creatinine Excretion, mM/24h	1,08	0,374	0,008	6,648	10^{-6}

Next, the 22-dimensional space of discriminant variables transforms into 4-dimensional space of a canonical roots. For Root 1 r*=0,978 (Wilks' Λ=0,0083; $\chi^2_{(88)}$=352; p<10^{-6}), for Root 2 r*=0,770 (Wilks' Λ=0,193; $\chi^2_{(63)}$=121; p=0,00002), for Root 3 r*=0,616 (Wilks' Λ=0,474; $\chi^2_{(40)}$=55; p=0,058), and for Root 4 r*=0,487 (Wilks' Λ=0,763; $\chi^2_{(19)}$=20; p=0,403). The first root contains 90,2% of discriminative opportunities, the second 5,9%, the third 2,4%, the last 1,3% only, therefore will be ignored in the future.

Table 3 presents raw and standardized coefficients for discriminant variables. The calculation of the discriminant root values for each person as the sum of the products of raw coefficients to the individual values of discriminant variables together with the constant enables the visualization of each patient in the information space of the roots (Fig. 2).

Table 3. Standardized and Raw Coefficients and Constants for Blood Pressure and Metabolic Variables

Coefficients	Standardized			Raw		
Variables currently in the model	Root 1	Root 2	Root 3	Root 1	Root 2	Root 3
Blood Pressure Systolic, mmHg	-1,296	-0,026	-0,009	-0,267	-0,005	-0,002
Sex Index (M=1; F=2)	-0,003	-0,393	0,035	-0,007	-1,027	0,091
Sodium Plasma, mM/L	0,149	-0,597	0,143	0,019	-0,075	0,018
VLDLP Cholesterol Plasma, Z	-0,024	0,439	-0,524	-0,027	0,502	-0,601
Klimov's Atherogenicity Coefficient, Z	-0,211	-0,601	-0,373	-0,132	-0,375	-0,233
Calcium Excretion, mM/24 h	0,330	0,170	-1,001	0,110	0,057	-0,334
Potassium Plasma, mM/L	0,256	-0,396	-0,174	0,480	-0,742	-0,325
Urea Plasma, mM/L	0,096	0,060	-0,578	0,085	0,053	-0,511
Lithogenicity Urine	-0,350	0,354	1,088	-2,384	2,412	7,403
Magnesium Plasma, mM/L	-0,242	0,451	0,316	-6,228	11,615	8,147
Phosphate Plasma, mM/L	-0,084	0,283	0,429	-0,424	1,431	2,165

Cholecystokinetics Index, units	0,041	0,081	0,620	0,0003	0,0006	0,0044
Gallbladder Volume, mL	-0,288	0,020	0,568	-0,019	0,001	0,037
Blood Pressure Diastolic, mHg	0,133	0,157	0,056	0,017	0,020	0,007
Sodium Excretion, mM/24 h	-0,021	-0,442	0,325	-0,0002	-0,0049	0,0036
Calcium Plasma, mM/L	-0,159	0,242	-0,449	-0,893	1,358	-2,520
Electrokinetics Index, %	-0,374	0,622	-0,106	-0,033	0,056	-0,009
Body Mass Index, kg/m^2	-0,279	0,547	0,057	-0,079	0,154	0,016
Uric acid Excretion, mM/24h	0,915	-0,851	-0,910	0,613	-0,570	-0,610
Urea Excretion, mM/24 h	-0,673	0,829	0,903	-0,0030	0,0036	0,0040
Creatinine Excretion, mM/24h	-0,366	-0,140	0,151	-0,101	-0,039	0,042
	Constants			44,17	-7,901	-11,85
	Eigenvalues			22,30	1,457	0,612
	Cumulative proportions			0,904	0,963	0,987

Table 4 shows the correlation coefficients of blood pressure and metabolic parameters (discriminant variables) with canonical discriminant roots; the cluster centroids of roots; and Z-scores of the discriminant variables.

Table 4. Correlations Variables-Canonical Roots, Means of Roots and Z-scores of Blood Pressure and Neuro-Endocrine Variables

Variables currently in the model	**Correlations Variables-Roots**			**AH II (11)**	**AH I (35)**	**High N (13)**	**Norm (16)**	**Low N (13)**
Root 1 (90,4%)	**R 1**	**R 2**	**R 3**	**-8,3**	-2,2	+1,3	+3,3	**+7,5**
Blood Pressure Systolic	**-0,801**	-0,104	-0,166	**+3,15**	+1,51	+0,64	+0,04	**-0,84**
Blood Pressure Diastolic	**-0,169**	0,158	-0,142	**+1,79**	+1,31	+0,35	-0,19	**-1,14**
Sodium Excretion	**-0,029**	-0,012	0,034	**+2,58**	+2,07	+1,07	+1,95	**+1,23**
Uric acid Excretion	**-0,045**	0,087	-0,148	+1,35	+1,67	+0,95	+0,58	**+0,38**
VLD LP Cholesterol	**-0,054**	0,112	-0,038	+0,19	+0,39	-0,51	+0,16	**-0,41**
Phosphate Plasma	**-0,047**	0,073	0,134	**-0,58**	-0,89	-0,57	-0,98	**-1,49**
Magnesium Plasma	**-0,019**	-0,039	0,291	**-1,02**	-1,49	-1,21	-1,15	**-1,56**
Cholecystokinetics Indexs	**-0,007**	0,010	0,213	**-0,11**	-0,67	+0,13	-0,13	**-0,80**
Electrokinetics Index	**0,086**	0,130	-0,166	**-0,90**	+0,38	+0,18	+0,56	**+0,89**
Root 2 (5,9%)	**R 1**	**R 2**	**R 3**	**-2,10**	+0,80	+0,78	+0,46	**-1,73**
Sex Index	0,044	**-0,371**	-0,046	**+0,32**	-0,27	-0,54	+0,05	**+0,94**
Sodium Plasma	0,022	**-0,354**	0,219	**+0,71**	-1,05	-0,93	+0,07	**+0,65**
(TCh-HDCh)/HDCh Index	-0,020	**-0,116**	-0,035	**+0,92**	+0,22	+0,16	-0,01	**+0,41**
Gallbladder Volume	-0,010	**-0,084**	0,129	**+0,50**	+0,19	+0,14	+0,38	**+0,25**
Potassium Plasma	0,026	**-0,247**	-0,101	**-0,12**	-0,69	-0,43	-0,70	**+0,35**
Creatinine Excretion	-0,039	**-0,200**	-0,108	**-0,15**	-0,85	-1,35	-1,20	**-0,73**
Lithogenicity Urine	0,015	**0,304**	-0,015	**+0,02**	+0,69	+0,70	+0,66	**+0,27**
Urea Excretion	-0,024	**0,157**	-0,148	**+0,68**	+2,04	+1,09	+0,86	**+0,37**
Calcium Plasma	-0,027	**0,122**	-0,052	**-0,74**	-0,51	-0,40	-0,90	**-1,14**
Root 3 (2,4%)	**R 1**	**R 2**	**R 3**	**+0,53**	-0,59	+0,28	**+1,31**	-0,73
Calcium Excretion	-0,009	0,157	**-0,347**	**-0,68**	+1,92	+0,54	**-0,48**	+0,47
Urea Plasma	0,017	0,137	**-0,255**	**+0,22**	+0,74	+0,74	**+0,42**	+0,65
Body Mass Index	-0,021	0,094	**0,183**	**+1,02**	+0,93	+1,00	**+1,15**	+0,41

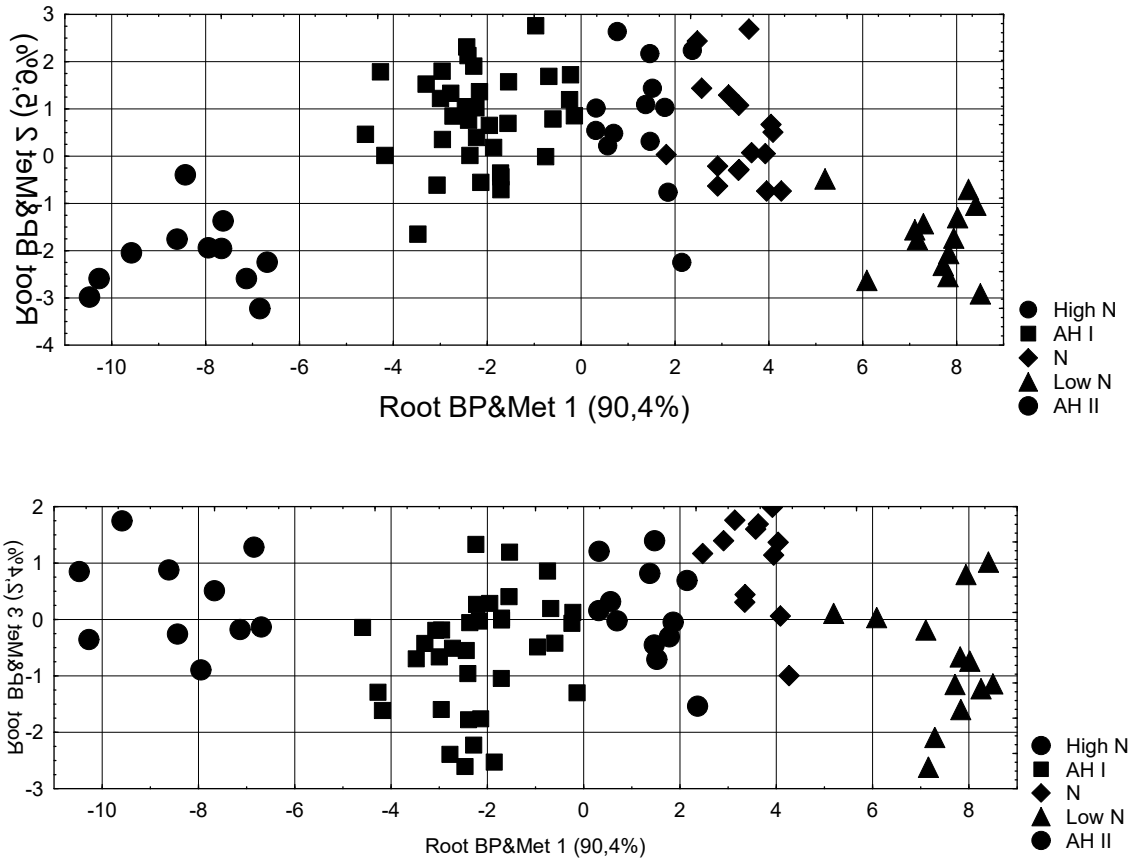

Fig. 2. Scattering of individual values of the first&second and first&third discriminant metabolic roots of patients of different blood pressure clusters

The localization along the first root axis of the patients with **Low Norm** BP (Fig. 2) in the extreme right (positive) zone reflects combination of minimum for sampling BP levels with minimum for sampling sodium and uric acid excretion; maximally decreased phosphate, magnesium, and VLDLP Cholesterol plasma as well as cholecystokinetics index, instead maximally increased electrokinetics index. At the opposite pole of the axis of the first root, there are patients with **AH II**, whose maximum BP is accompanied by maximum for sampling levels of the listed variables while minimum for sampling level of electrokinetics index. Clusters of patients with intermediate BP levels are also characterized by intermediate levels of the listed variables. Therefore, all 5 clusters are quite clearly demarcated already in the space of the major root.

Both extreme clusters are separated from the other three also along the axis of the second root. Theirs bottommost position reflects, on the one hand, the increased levels of plasma sodium and its atherogenicity; maximum for sampling gallbladder volumes and plasma potassium and creatinineuria levels, as well as the highest proportion of women in the cluster. On the other hand, these clusters are characterized by normal and at the same time minimal for the sample levels of lithogenicity of urine and urea excretion, as well as maximally reduced levels of plasma calcium.

Along the axis of the third root, clusters of patients with **AH II** and **Norm** BP are further distinguished from other clusters due to minimal levels of calciuria and plasma urea, instead of maximally elevated body mass indices.

In general, all clusters on the planes of three roots are clearly delineated, which is documented by calculating the Mahalanobis distances (Table 5).

Table 5. Squared Mahalanobis Distances between Blood Pressure Clusters and F-values (df=22,6; p for all<10^{-6}; for High N-N p=0,015

Blood Pressure Clusters	High Norm	AH I	Norm	Low Norm	AH II
High Norm	0	**14,9**	**8,35**	**47,4**	**101**
AH I	**4,78**	0	**34,1**	**99,8**	**47,3**
Norm	**2,03**	**12,7**	0	**26,4**	**143**
Low Norm	**10,5**	**32,1**	**6,43**	0	**251**
AH II	**20,5**	**13,4**	**31,6**	**50,8**	0

The same discriminant parameters can be used to identify the belonging of one or another person to one or another cluster (Table 6).

Table 6. Coefficients and Constants for Classification Functions for Blood Pressure Clusters

Blood Pressure Clusters	**High N**	**AH I**	**Norm**	**Low N**	**AH II**
Variables currently in the model	p=,148	p=,398	p=,182	p=,148	p=,125
Blood Pressure Systolic, mmHg	11,60	12,52	11,04	9,951	14,17
Sex Index (M=1; F=2)	39,76	42,58	43,56	44,67	45,01
Sodium Plasma, mM/L	2,013	1,961	2,128	2,325	2,077
VLDLP Cholesterol Plasma, Z	1,497	2,716	1,355	1,179	0,608
Klimov's Atherogenicity Coefficient, Z	1,167	1,203	0,056	1,003	2,982
Calcium Excretion, mM/24 h	-7,688	-7,979	-8,062	-6,983	-9,145
Potassium Plasma, mM/L	-19,01	-20,47	-18,21	-13,90	-21,61
Urea Plasma, mM/L	6,019	6,098	5,561	6,863	4,871
Lithogenicity Urine	344,7	357,2	359,1	325,5	370,5
Magnesium Plasma, mM/L	1027	1028	1002	939,0	1045
Phosphate Plasma, mM/L	67,06	65,03	66,05	57,26	66,31
Cholecystokinetic Index, units	0,016	0,010	0,020	0,011	0,012
Gallbladder Volume, mL	1,756	1,807	1,777	1,614	1,956
Blood Pressure Diastolic, mHg	1,854	1,882	1,997	1,980	1,707
Sodium Excretion, mM/24 h	-0,116	-0,115	-0,107	-0,106	-0,097
Calcium Plasma, mM/L	154,0	159,7	149,6	147,9	158,3
Electrokinetic Index, %	4,252	4,387	4,167	3,923	4,417
Body Mass Index, kg/m^2	10,44	10,71	10,26	9,561	10,763
Uric acid Excretion, mM/24h	-61,33	-63,98	-61,75	-56,38	-66,52
Urea Excretion, mM/24 h	0,305	0,316	0,307	0,277	0,327
Creatinine Excretion, mM/24h	6,932	7,467	7,039	6,547	8,194
Constants	-2030	-2183	-1966	-1761	-2476

In this case, we can retrospectively recognize patients with norm and low norm BP with one mistake and others patients **unmistakably**. Overall classification accuracy is 97,7% (Table 7).

Table 7. Classification Matrix for Blood Pressure Clusters

	Rows: Observed classifications Columns: Predicted classifications					
Group	Percent Correct	High N p=,14773	AH I p=,39773	N p=,18182	Low N p=,14773	AH II p=,12500
High N	100,0	13	0	0	0	0
AH I	100,0	0	35	0	0	0
N	93,8	1	0	15	0	0
Low N	92,3	0	0	1	12	0
AH II	100,0	0	0	0	0	11
Total	97,7	14	35	16	12	11

CONCLUSION

Thus, a wide range of blood pressure in Truskavets' spa patients is accompanied by an equally wide range of metabolic, neural and endocrine parameters. Following article will provide data on immune accompaniments of quantitative-qualitative blood pressure clusters. A detailed analysis and discussion will be conducted on the basis of the presented data.

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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 all authors any conflict of interests is absent.

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