

# **Age-related psycho-vegetative changes in miners in combination with the arterial hypertension development**

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Abstract. We examined 109 men working at a chromium ore mining enterprise exposed to occupational and psychosocial factors in order to study their psycho-negative state and its relationship with the development of hypertension syndrome. The patients were divided into two groups: the main group - 60 men working in underground conditions; comparison group - 49 men performing ground work. In connection with the established diagnosis of "Syndrome of arterial hypertension" in middle-aged people of the main group, it was divided into two subgroups - people under 45 years old ( $n = 20$ , age  $38.45 \pm 2.95$  years), and people older 45 years old ( $n = 40$ , age  $50.90 \pm 1.46$  years.); the comparison group is divided accordingly. Purpose of the study: to study the prerequisites for the development of hypertension based on the psychovegetative status and some changes in the biochemical and functional indicators of the cardio-vascular system, depending on the age-related changes in these indicators. Materials and methods: the patient underwent a study of the psycho-vegetative state with an assessment of the level of neuropsychic stress, personal and situational anxiety, attention function, subjective reflection of psycho-vegetative distress. The state of the cardiovascular system (CVS) was investigated according to the results of functional and clinical laboratory diagnostics. Results: A decrease in attention, an increase in personal anxiety and an increase in the number of psychovegetative complaints were

significantly more often detected in the group of patients with hypertension (OR 7.50; 95% CI 2.39-23.58; OR 11.06 95% - CI - 4.35 - 28.10; CI 22.50; 95% CI - 7.09 - 71.41). Adaptive psychovegetative phenotypes were distinguished in two subgroups. The correlation of the parameters of psycho-vegetative status with age and experience was established in the absence of their relationship with homeostasis indicators in patients under 45 years old. In patients over 45 years old, a negative relationship was established between age, experience and some parameters of psycho-vegetative status, as well as a direct relationship between these parameters and some indicators of homeostasis in the diagnosis of hypertension syndrome in 95% of patients in this subgroup. Conclusions: Thus, with an increase in age and experience, there is a transformation of the adaptive psychovegetative phenotype with an inversion of connections with psychovegetative parameters against the background of increased functional disorders of the cardiovascular system. Diagnostics of the transformation of this phenotype help to assess the risk of developing arterial hypertension in miners.

Keywords: psychovegetative status, dangerous underground work, functional changes, psychovegetative phenotype, arterial hypertension, psychosocial factors.

## **Introduction**

The diagnostic significance of occupational and psychosocial factors in the formation of occupational diseases is an urgent problem. In connection with an intensity increase of production in many industries, including mining, the tension of the labor process rises, the load on the psychovegetative adaptation mechanisms of workers increases, the risk of developing cortico-visceral dysfunction and imbalance of the autonomic nervous system getting higher, which leads to a distress reaction, violation of the basal metabolism, neuroendocrine pathology, activation of free radical lipid oxidation, dysfunction of the vascular endothelium [1]. Psychovegetative stress is manifested in the implementation of somatic functional disorders, and subsequently leads to an increase in the proportion of psychosomatic pathology, more often - the formation of hypertension [2,3].

Purpose of the study: to establish the prerequisites for the development of hypertension based on the study of changes in the state of the psychovegetative status, biochemical and functional indicators of CVS in miners of middle and older age.

### **Materials and methods**

The study involved 60 men performing underground work (main group,  $n = 60$ , age -  $46.8 \pm 2.0$  years, experience -  $22.0 \pm 2.4$  years), with a signed informed consent. The comparison group is represented by 49 workers of land occupations (age -  $43.6 \pm 3.8$  years, experience -  $16.6 \pm 1.6$  years). To study health indicators in the age aspect, patients are divided into 2 groups according the WHO age classification. Group I ( $n = 20$ ) consisted of workers aged  $38.45 \pm 2.95$  years, work experience -  $12.7 \pm 3.0$  years, group II ( $n = 40$ ) - workers aged  $50.90 \pm 1.46$  years, experience -  $26.7 \pm 1.9$  years. In the same way 2 comparison subgroups were formed: 23 employees, aged  $38.0 \pm 2.8$  years, experience -  $9.3 \pm 1.5$  years (comparison group  $<45$  years); and 26 employees, aged  $49.2 \pm 2.1$  years, experience -  $24.0 \pm 1.8$  years (comparison group  $> 45$  years). The groups are comparable in terms of age, gender, social, living and working conditions, groups I and II are comparable in terms of working conditions ( $p < 0.05$ ). After a comprehensive clinical examination the diagnosis "Arterial hypertension, grade I" was established in 38 patients (63.3%) of the main group, all of them were included in the group of middle-aged people (group II).

Several methods are used: the clinical conversation and questionnaires to highlight the personal characteristics of patients. An assessment of psychovegetative dysfunction was carried out using a battery of psychophysiological tests: "Determination of the neuropsychic tension of T. Nemchina"; "Integrative test of anxiety". Voluntary attention was investigated using a test with the Schulte-Gorbov table. The assessment of the subjective reflection of psychovegetative dysfunction was carried out according to the questionnaire "The severity of symptoms of psychovegetative syndrome". ECG, daily monitoring of blood pressure, ultrasound of the heart were conducted. The results of general and

biochemical blood tests (glucose, creatinine, AST, ALT, sodium, potassium, serum uric acid, lipid spectrum, C-reactive protein) were evaluated. Statistical processing was carried out on a PC using the built-in analysis package for the spreadsheet processor Excel®2016 MSO (© Microsoft, 2016), the author's (© V.S.Sheludko, 2001-2016) package of applied spreadsheets (PPET) "Stat2015".

## Results and discussion

All patients of the main group and the comparison group underwent clinical, laboratory and instrumental studies, the results of the study show that the homeostasis indicators were within the reference values (Table 1).

Table 1 - Functional changes in CVS and clinical and laboratory parameters of the blood of miners

Parameter	Main group (n=60), M±2m	Comparison group (n=49), M±2m
Functional changes in the CVS		
Mean systolic blood pressure, mm Hg.	131,20 ± 2,10	128,81 ± 2,21
Pulse blood pressure, mm Hg	46,17 ± 1,88	46,23 ± 2,30
Ventricular septum thickness, cm	0,97 ± 0,06*	0,86 ± 0,07
Clinical and laboratory blood parameters		
Atherogenic index	2,12 ± 0,15*	1,76 ± 0,20
Total cholesterol, mmol \ l	5,52 ± 0,37*	4,81 ± 0,29
HDL, mmol \ l	1,78 ± 0,09	1,77 ± 0,10
Uric acid, μmol \ l	311,43 ± 13,69*	296,42 ± 19,43
Platelets, 10 <sup>9</sup> \ cubic dm	250,08 ± 13,05	231,19 ± 13,18

Note: \* - p <0.05 - statistically significant differences with the indicators of the comparison group

In the main miners group, a low level of attention ( $69.72 \pm 6.03$  sec.,  $P < 0.05$ ) was established. A significant level of personal anxiety was determined ( $5.0 \pm 0.4$  points,  $p < 0.05$ ), demonstrating readiness for changes in the situation both at work and in social conditions. An average level of neuropsychic stress was

established ( $42.7 \pm 1.5$  points,  $p < 0.05$ ), as well as an increase in the number of psychovegetative complaints ( $1.5 \pm 0.3$  points,  $p < 0.05$ ). These features of the mental state of patients are regarded as an adaptation of the psyche to hazardous working conditions, and represent a "psychological portrait" of an underground worker. An assessment of the risks of psychovegetative and clinical-functional indicators in patients with hypertension syndrome was carried out. A decrease in attention, an increase in personal anxiety and an increase in the number of psychovegetative complaints were significantly more often detected in the group of patients with hypertension (OR 7.50; 95% CI - 2.39-23.58; OR 11.06 95% CI - 4.35 - 28.10; OR 22.50; 95% CI - 7.09 - 71.41). Also significantly more frequent are increases in SBP (OR 4.48; 95% CI - 1.80 - 11.16), pulse blood pressure (OR 3.00; 95% CI - 1.14 - 7.86), ventricular septum thickness (OR 2.98; 95% CI - 1.26 - 7.06), AI (OR 3.20; 95% CI - 1.08 - 9.50), serum uric acid (OR 3, 86; 95% CI - 1.41 - 10.55).

In group I, it was revealed: a decrease in attention, an increase in the level of neuropsychic stress with sympathicotonia, an increase in the number of complaints of a psycho-vegetative nature. From the functional indicators of the CVS, the following was established: a tendency to an increase in mean systolic blood pressure. Correlation analysis was carried out in group I: the presence of a moderate correlation between age and an attention level ( $r = 0.554$ ,  $p = 0.011$ ), a pronounced correlation between the experience and the level of neuropsychic stress ( $r = 0.726$ ,  $p = 0.0003$ ), a pronounced correlation between the level of neuropsychic stress and the number of psychovegetative complaints ( $r = 0.645$ ,  $p = 0.0021$ ). The correlation between the parameters of the psychovegetative state and functional changes in the CVS has not been established.

Thus, underground miners under 45 years old have a special adaptive clinical-psychovegetative phenotype, which we have identified as a "psychologically realizable adaptive phenotype".

The results obtained demonstrate the realization of psycho-vegetative tension mainly by psychological mechanisms, and not accompanied by CVS disorders, which are not registered in this group.

In group II, a decrease in an attention, an increase in the level of neuropsychic stress with sympathicotonia, an increase in complaints of a psychovegetative nature, significantly higher level of personal anxiety were revealed. The correlation analyzing was carried out: a moderate negative relationship between age and neuropsychic stress ( $r = -0.505$ ,  $p = 0.0009$ ), age and personal anxiety ( $r = -0.325$ ,  $p = 0.026$ ), moderate negative correlation between experience and the decrease of an attention ( $r = -0.394$ ,  $p = 0.0119$ ). Thus, in workers over 45 years old, the relationship between the indicators of the psycho-vegetative state with age and experience changes qualitatively against the background of more pronounced functional changes in the CVS. This allows us to single out the "psychosomatically realizable adaptive phenotype."

Conclusion. In the group of miners, the characteristics of the psychovegetative status change, which is combined with some functional CVS and biochemical changes in homeostasis against the background of the formation of hypertension syndrome: attention decreases personal anxiety increases, and the number of psychovegetative complaints increases (OR 7.50; 95% CI - 2, 39 - 23.58; OR 11.06 95% CI - 4.35 - 28.10; OR 22.50; 95% CI - 7.09 - 71.41). The study of the psycho-vegetative status allows us to distinguish 2 age-dependent phenotypes: "psychologically realizable adaptive phenotype" and "psychosomatically realizable adaptive phenotype". With an increase in age and experience, a transformation of the adaptive psychovegetative phenotype occurs with an inversion of connections with psychovegetative parameters against the background of an increase in functional disorders of the CVS.

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