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THE INFLUENCE OF PSYCHOEMOTIONAL DISORDERS ON THE THICKNESS PARAMETERS OF THE INTIMA-MEDIA OF CAROTID ARTERIES AND TUMOR NECROSIS FACTOR-α IN YOUNG MEN WITH ARTERIAL HYPERTENSION

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The purpose of the study was to establish the peculiarities of changes in the parameters of the structural state of the common carotid arteries, as well as the content of tumor necrosis factor-α in blood serum depending on psycho-emotional status in young men with arterial hypertension. We examined 76 men (mean age 36.4±3.5 years) with grade 1 hypertension, including 55 patients with moderate and high anxiety (group 1) and no disorders of psychoemotional status (group 2). The control group consisted of 20 healthy men. It was established that in group 1, the levels of systolic and diastolic blood pressure during office measurement and daily monitoring exceeded ($p<0.05$) the data of group 2. Also, in group 1, the serum levels of tumor necrosis factor-α and the thickness of the intima-media of the carotid arteries were higher ($p<0.05$) than the indicators of group 2. Thus, in young patients with arterial hypertension, there is an increase in the serum content of tumor necrosis factor-α and signs of structural changes in the carotid arteries, more pronounced in the group with anxiety disorders.

Key words: arterial hypertension, psycho-emotional disorders, tumor necrosis factor-α, intima media complex.

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ВПЛИВ ПСИХОЕМОЦІЙНИХ ПОРУШЕНЬ НА ПАРАМЕТРИ ТОВЩИНИ ІНТИМА-МЕДІА СОННИХ АРТЕРІЙ ТА ФАКТОР НЕКРОЗУ ПУХЛИН-α У ЧОЛОВІКІВ МОЛОДОГО ВІКУ З АРТЕРІАЛЬНОЮ ГІПЕРТЕНЗІЄЮ

Метою роботи було вивчити особливості змін параметрів структурного стану загальних сонних артерій, а також сироваткового вмісту фактору некрозу пухлин-α в залежності від психоемоційного статусу у чоловіків молодого віку з артеріальною гіпертензією. Обстежено 76 чоловіків (середній вік 36,4±3,5 років) з артеріальною гіпертензією 1 ступеня, з яких 55 осіб з помірною та високою тривожністю (група 1) та без порушень психоемоційного статусу (група 2). Групу контролю склали 20 здорових чоловіків. Встановлено, що у групі 1 рівні систолічного та діастолічного артеріального тиску при офісному вимірюванні та добовому моніторингу перевищували ($p<0,05$) дані групи 2. Також у групи 1 сироватковий вміст фактору некрозу пухлин-α та товщина комплексу інтима-медіа сонних артерій були більшими ($p<0,05$), ніж у групі 2. Отже, у пацієнтів молодого віку з артеріальною гіпертензією відзначаються підвищення сироваткового вмісту фактору некрозу пухлин-α та ознаки структурних змін сонних артерій, більш виражені в групі з тривожними розладами.

Ключові слова: артеріальна гіпертензія, психоемоційні порушення, фактор некрозу пухлин-α, комплекс інтима-медіа

The work is a fragment of the research project "To determine the features of immunocytokine imbalance in comorbid patients with arterial hypertension and type 2 diabetes and cardiovascular and renal complications", state registration No. 0123U101711.

All over the world, hypertension (AH) is a leading risk factor for cardiovascular disease and mortality for all causes [5]. It is established that there is a recent increase in the incidence of hypertension among young people: the prevalence of AH among young people is from 6 to 14 % and above [1]. According to meta-analysis, the incidence of comorbid hypertension and anxiety disorders is approximately 38 % [3].

The World Health Organization has anxiety disorders in ninth place among the causes of disability due to their high prevalence, chronic course and comorbidity [6]. Prolonged and intensive stressful actions of different nature led to changes in many physiological processes; all systems of the human body, including nervous, immune, endocrine, cardiovascular, reproductive and others, respond to stress [10].

The concept that hypertension has an immunological basis has been strengthened lately, and that cytokines produced by immune cells and components of the vascular complex (smooth-muscle, endothelial cells, etc.), as well as a neuroendocrine complex, morphofunctional units of meaning organs, are inter - system integral components of the disease [3].

The purpose of the study was to establish the peculiarities of changes in the parameters of the structural state of the common carotid arteries, as well as the content of tumor necrosis factor-α in serum, depending on the psycho-emotional status of young men with hypertension.

Materials and methods. In the study 76 men 29–40 years old (average age 36.4±3.5 years) with hypertension of the 1st degree were included. All patients did not receive systematic drug therapy (Table 1).

Table 1

Clinical characteristics of examined patients with hypertension at a young age

Parameters	General group (n=76)
Age, years	36.4±3.5
Smoking, n (%)	43 (56,6)
Family history of hypertension, n (%)	36 (47.4)
Family history of early cardiovascular events, n (%)	7 (9.2)
Body mass index (BMI), kg/m²	26.9±0.7
Dyslipidemia, n (%)	16 (21.0)
Glomerular filtration rate CKD-EPI, ml/min/1.73 m²	87.5±1.6
Echo-CG HLV	7 (9.2)

An anxiety questionnaire (Ch.Spielberg-Y.Khanin questionnaire) containing 40 questions was used to assess situational and personal anxiety. The result was evaluated as follows: up to 30 points – low anxiety, 31–45 – moderate anxiety, 46 and more – high anxiety.

Depending on the psycho-emotional state (according to the questionnaire of Ch. Spielberg-Y. Khanin), the examined patients were divided into two groups: group 1 – with moderate and high anxiety – 55 people and group 2 – without disturbances of psycho-emotional status – 21 patients.

The control group consisted of 20 healthy people aged 29–40 years (mean age 36.3±3.6 years).

All patients were examined according to the recommendations of the European Society of Hypertension and the European Society of Cardiology (ESH/ESC, 2018).

All subjects signed an informed consent to participate in the investigation.

Exclusion criteria were: taking antihypertensive drugs in the anamnesis less than 3 months before inclusion in the study; professional athletes; secondary hypertension; heart rhythm disturbances; inflammatory, autoimmune and endocrine diseases.

All patients and individuals of the control group underwent a general clinical examination: measurement of office blood pressure, heart rate, determination of glucose concentration in fasting blood serum, lipid profile indicators; albuminuria, anthropometric measurements. The functional state of the kidneys was assessed by glomerular filtration rate (GFR) using the CKD-EPI formula. The concentration of TNF-α ("DRG", USA) was measured in blood serum using commercial kits for enzyme immunoassay.

Daily monitoring of blood pressure (BBP) was carried out using the device "ABPM-02" (Meditech, Hungary). Evaluated: average values of SBP, DBP, pulse pressure (PP), AP_{heart} per day (24 hours, day and night), variability of AP indices during the day and night, time index (TI) of hypertension – % of measurements of SBP≥140 and DBP 90 mm Hg. in the period of cheerfulness and, respectively, ≥120 and ≥70 mm Hg. during sleep.

We assessed the severity of the biphasic rhythm of blood pressure day-night according to the daily index (DI), which was calculated according to the formula:

DI = 100 % x (APd – APn) / APd,

where APd is the average AP in the period of vigor; APn – average AP during sleep.

Four groups of patients were distinguished according to the value of DI:

– "dipper" (DI – 10 – 20 %) – optimal nighttime AP decrease;

– "non-dipper" (DI – 0 – 10 %) – insufficient nighttime decrease in AP;

– "night-picker" (DI<0) – persistent increase in night AP;

– "over-dipper" (DI>20) – excessive nocturnal decrease in AP.

Ultrasound examination of the common carotid arteries was performed on an ultrasound diagnostic scanner Logiq 5 (Medical System, Germany) with a linear sensor of 7 MHz. According to the Consensus of the American Society of Echocardiography (2008), the thickness of the intima-media complex (IMC) of the common carotid artery (CCA) was measured. When atherosclerotic plaques were detected, their qualitative and quantitative assessment was carried out [13].

Statistical processing of the results was carried out using Statistica 10.0 statistical programs. For quantitative indicators measured on an interval scale, the mean value, standard deviation and error of the average were calculated. For "qualitative" and "ordinal" indices, the frequency of detection of the indicator in percentages or the frequency of registration of different rank evaluations of the indicator were determined, respectively. When analyzing intergroup differences in indices, the value of Student's t-test was calculated. In the case of indices measured on a nominal scale, the reliability of differences in the frequency of detection of the index in the two compared groups was assessed by the Student's t-test using Fisher's transformation, and linear correlation coefficients and rank correlations were also calculated. Differences in mean values and correlations were considered reliable at the significance level of $p<0.05$.

Results of the study and their discussion. It was established that in patients with hypertension and anxiety disorders, the levels of office SBP and DBP were significantly higher by 6.5 % and 6.4 % ($p<0.05$) than in patients with hypertension without psychoemotional disorders. No significant differences in heart rate between groups were found.

Mean values of office BP levels are presented in Fig. 1.

According to DBPM data (Fig. 2), mean daily SBP and DBP were 5.9 % and 5.7 % ($p<0.05$) higher in patients of group 1 compared to group 1.

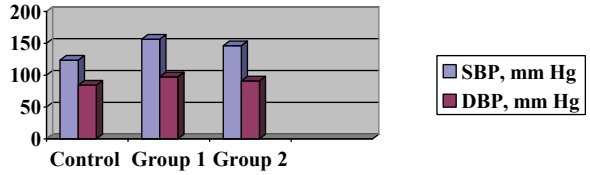

Fig. 1. Parameters of clinical blood pressure in the examined persons.

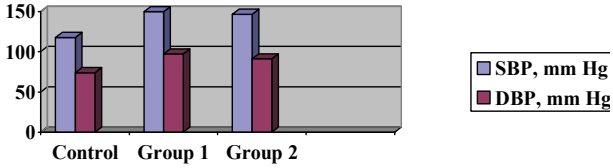

Fig. 2. Parameters of mean daily SBP and DBP (mm Hg) according to DMAT data in the examined persons.

Pressure load data according to TI hypertension in patients of group 1 according to SBP and were significantly ($p<0.05$) higher compared to data of patients in group 2: SBP by 14.2 % and 9.7 % during day and night hours and SBP by 11.3 % and 8.6 % for day and night hours, respectively.

The analysis of the daily BP profile showed that in group 1, the number of "dippers" was 10 (18.2 %), "non-dippers" 39 (70.9 %) and 6 (10.9 %) "night pickers" patients. A different nature of changes was found in group 2: the number of "dippers" was 10 (47.6 %) and "non-dippers" 11 (52.4 %).

The content of the pro-inflammatory cytokine TNF-α in the blood of the examined persons is presented in Fig. 3.

In our study, it was determined that the content of TNF-α in the blood serum of patients with hypertension and anxiety disorders was 2.6 times higher than the value of the control group ($p<0.001$) and 1.2 times higher than that of the group of patients with hypertension without disturbances in psycho-emotional status ($p<0.05$). Serum levels of TNF-α were 2.2 times higher in patients with hypertension without disturbances in psychoemotional status compared to the control group ($p<0.001$).

The study of the thickness of the intima-media complex (IMC) of the common carotid artery (CCA) revealed early structural changes in the vessel wall in the form of its thickening. Thus, the lowest values of this index were in the group with normal BP values (Fig. 4).

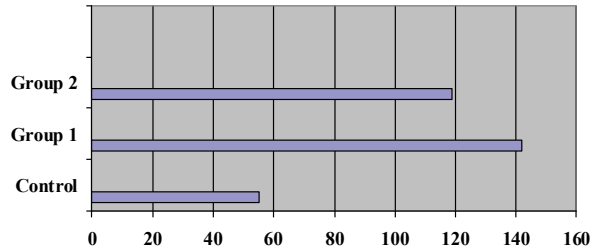

Fig. 3. The content of TNF-α in blood serum (pg/ml) in examined patients and subjects of the control group.

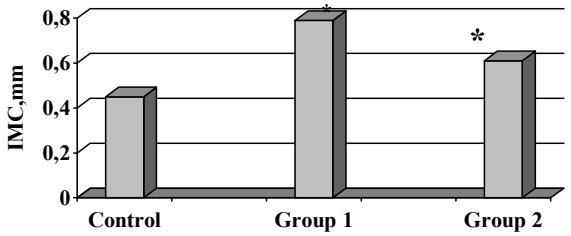

Fig. 4. The thickness of IMC of the CCA in the examined patients and individuals of the control group. Note. * – significance of differences with the group with normal blood pressure ($p<0.05$).

At the same time, in patients with hypertension and anxiety disorders, the CIM thickness of carotid arteries was 1.75 times greater compared to the control group and 29.5 % greater than that of persons of

the same age without psychoemotional status disorders (all $p<0.05$). Therefore, in young people with hypertension, the increase in the thickness of the CIM of the carotid arteries reaches maximum values with psycho-emotional disorders.

Correlation analysis of the obtained data for DMBP showed the existence of positive correlations between the thickness of the KIM and DBP. Thus, in the group with hypertension and anxiety disorders, an independent relationship was established between the thickness of the CIM and the mean daily values of DBP ($r=0.43$; $p<0.05$), mean daily DBP ($r=0.35$; $p<0.05$), TI DBP during daytime hours ($r=0.41$; $p<0.05$), TI DBP during night hours ($r=0.39$; $p<0.05$). In patients with hypertension without psycho-emotional disorders, no correlations between CIM thickness and DMBP indices were found.

Clinical researches suggest that anxiety disorders are common in patients with AH, and the two conditions often coexist [12]. Recently, more and more attention has been paid to determining the pathogenetic mechanisms of the interaction of comorbidity in patients with hypertension and anxiety disorders. There is evidence that anxiety disorders contribute to the development of endothelial dysfunction, activation of low-grade inflammatory processes and thrombus formation, lead to hyperactivation of the sympathetic nervous system, etc. [4, 7].

Modern research shows that cytokines are important factors for normal brain function and have the ability to influence neurocirculation and neurotransmitter systems, causing changes in behavior. There is more and more evidence that pro-inflammatory cytokines contribute to the development of depression both in patients and in healthy people [9]. TNF-α is a pro-inflammatory cytokine produced by immune cells, mainly T-lymphocytes. Other sources of their formation can be leukocytes, vascular endothelial cells, as well as epithelial and mesangial cells of renal tubules. TNF-α belongs to a family of both soluble and cell-bound cytokines, which have a wide range of functions, such as inflammation, lymphoid cell development, and apoptosis [8].

In our study, the content of TNF-α in blood serum was significantly increased in group 1. TNF-α plays an important role in the immune system and the propagation of inflammation. In addition, TNF-α can induce oxidative stress through its receptor TNFR1 by activating enzymes, that produce reactive oxygen species, such as NADPH-oxidase, contributing to the intensification of processes of apoptosis of vascular endothelium and inactivation of nitric oxide [2].

The results of our study also indicate a significant increase in the thickness of the CIM of the CCA in psychoemotional disorders. Previously, it was assumed that with the development of inflammation in the vessels, structural changes in the vascular wall and thickening of the vascular wall occur, which was confirmed in our work.

The obtained data showed that in young patients with hypertension, there was an increase in TNF-α content and signs of structural changes in the carotid arteries in the form of an increase in CMI, which was more pronounced in the group with hypertension and anxiety disorders.

Conclusions

1. In young men with hypertension and psychoemotional disorders, a significant increase in the levels of SBP and DBP was established during office measurement and daily BP monitoring.

2. According to DMAT data, a high prevalence of the daily blood pressure profile “non-dipper” was established in young patients with hypertension of the 1st degree, who did not receive systematic drug therapy. In patients with anxiety disorders, the frequency of detection of a daily “non-dipper” profile was higher than in patients without psychoemotional status disorders.

3. In young people with hypertension of the 1st degree, who did not receive systematic drug therapy, an increase in the content of TNF-α in the blood serum and an increase in the thickness of the CIM of the CCA, more pronounced in people with anxiety disorders, were found.

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BIOLOGICAL AND PSYCHOLOGICAL ASPECTS OF AGING IN YOUNG WOMEN IN THE CONDITIONS OF MILITARY AGGRESSION

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This study examines the impact of wartime stress on the aging process in 95 young women in Ukraine, exploring the relationship between their chronological, biological, and psychological ages. Utilizing comprehensive assessment methods, including the measurement of biological age, psychological age, aging rate, anxiety levels, stress resilience, and positive mental health, the research highlights how prolonged stress accelerates biological aging. It was found that chronological age has a stronger connection with psychological age than with biological age, with significant differences in aging rate among groups. Specifically, the group with accelerated aging shows a higher biological age but a lower psychological age, which may indicate less awareness of aging or an optimistic tendency to assess one's health. Meanwhile, high stress resilience in this group may indicate adaptation to stress at the expense of physiological resources, leading to rapid aging. The findings underline the need for developing strategies to support mental health and counteract biological aging in stressful conditions, pointing to the complexity of the interaction between stress and aging.

Key words: biological age, psychological age, aging rate, psychological stability, accelerated aging.

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БІОЛОГІЧНІ ТА ПСИХОЛОГІЧНІ АСПЕКТИ СТАРІННЯ МОЛОДИХ ЖІНОК В УМОВАХ ВІЙСЬКОВОЇ АГРЕСІЇ

Дослідження аналізує вплив воєнного стресу на процес старіння у 95 молодих жінок в Україні, вивчаючи зв’язок між їх хронологічним, біологічним та психологічним віком. Застосовуючи комплексні методи оцінки, включно з вимірюванням біологічного віку, психологічного віку, швидкості старіння, рівней особистісної та реактивної тривожностей, стресостійкості та позитивного ментального здоров'я, дослідження підкреслює, як тривалий стрес прискорює біологічне старіння. Виявлено, що хронологічний вік має сильніший зв'язок з психологічним віком, ніж з біологічним, із значними різницями в швидкості старіння між групами. Зокрема, група з прискореним старінням відзначається вищим біологічним віком, але нижчим психологічним, що може свідчити про меншу усвідомленість старіння або оптимістичну тенденцію в оцінці власного здоров'я. Водночас, висока стресостійкість у цієї групи може бути індикатором адаптації до стресу за рахунок фізіологічних витрат, що сприяє швидкому старінню. Висновки підкреслюють необхідність розробки стратегій для підтримки психічного здоров'я та протидії біологічному старінню в умовах стресу, вказуючи на складність взаємодії між стресом і старінням.

Ключові слова: біологічний вік, психологічний вік, швидкість старіння, психологічна стійкість, прискорене старіння.

The study is a fragment of the research project “High- and low-intensity phenotypes of the systemic inflammatory response: molecular mechanisms and new medical technologies for their prevention and correction”, state registration No. 0124U000092.

In the context of global challenges and warfare, the study of the impact of stress on aging is critically relevant. The war in Ukraine highlights the chronic stress effects on biological aging. This research examines Ukrainians' biological and psychological age and aging rate during wartime, emphasizing the importance of resilience mechanisms.