Original article:

Arterial hypertension prevention as an actual medical and social problem

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Abstract:

Social changes, technological re-equipment, intensive formation of urban infrastructure have led to a constant increase in stress factors and an excessive growth of the nervous and psychological population burden. As a result of these processes in economically developed countries, acute diseases are becoming less and less significant, unlike the group of chronic disorders, such as arterial hypertension. Data from the review of the literature and the data we have received indicate that there is an increase in the level of cortisol in the blood in the phase of anxiety, which reduces in the resistance phase. A significant role is played by another hormone - insulin, which plays a key role in the development of the general adaptive syndrome. Through it the body implements numerous counter-defects in relation to the regulatory influence of catecholamines and cortisol. In conditions of prolonged stress, the level of insulin in the blood decreases and diabetes develops. The effect of cortisol and catecholamines in the resistance phase persists. The level of oxidative modification of blood plasma proteins indices depends on the behavior of the individual and changes in his psycho-emotional state, while a prolonged increase in the levels of catecholamines and cortisol in peripheral blood causes the development of psychosomatic pathology. It is proved that under the influence of complex action of risk factors there are significant changes in the psycho-emotional state that cause hypertension. This is confirmed by the presence of the highest level of reactive anxiety in patients with hypertension of the 1st stage on the background of the lowest personal anxiety which is the basis for the occurrence of the disease. With the progression of hypertension there are more profound changes in the personality of the patient, which is accompanied by the accumulation of personal anxiety, which can lead to a depressive state of neurotic genesis, which we observed with its complication. On the basis of a comprehensive study, the effect of stress on the occurrence of a syndrome of psychoemotional stress is shown, which leads to a steady increase in blood pressure - hypertension, and with its subsequent action complicates its course.

Keywords: arterial hypertension; risk factors; pscyhoemotional status.

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Social changes, technological re-equipment, intensive formation of urban infrastructure have led to a constant increase in stress factors and an excessive growth of the nervous and psychological population burden. As a result of these processes in economically developed countries, acute diseases are becoming less and less significant, unlike the group of chronic disorders. Neuro-psychic diseases are displacing the

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somatic ones. Health disorders associated with the development of acute and chronic emotional stress are becoming extremely widespread [1-3]. Considering that mental health is an integral part of the general health of people and together with mental well-being it is a high quality of life condition, the presence of mental disorders significantly affects the course of the disease, violating the subjective perception of the disease and reducing the effectiveness of treatment [4-6]. The structure of the causes of mortality in Ukraine remains constant: cardiovascular diseases remain in the first place - in 2015 this figure counted up to 404.6 thousand people, which correspond to 68% of total mortality [7-10]. According to the official statistics, over the past 25 years, the prevalence of cardiovascular diseases among the population of our country has increased by 3 times, and the mortality rate from them has increased by 45%.

Thus, the hypertension and mental health disorders are the main causes of the loss of life potential of the world population, both at the present time and according to the prognosis for the next decade, which determined the relevance of the study and its purpose and objectives.

The analysis of available domestic and foreign sources of scientific information on heart diseases and psycho-emotional stress has allowed to highlight several aspects of the problem that can be grouped according to the relevant features: risk factors, the emergence and complication of heart diseases, the role of psycho-emotional stress as a protective and adaptive response of the organism and its effect on occurrence and course of hypertension.

In 2012 about 12 million patients with hypertension have been registered all over the country, and among diseases of the circulatory system, this indicator is 46.8% among the adult population [11-12]. Heart diseases are the leading cause of every second case of death from cerebral stroke and every fourth one from the coronary heart disease. The coronary artery disease develops 3-4 times more often among people with hypertension and cerebral stroke develops 7 times more often among them [1]. At the same time, though mortality of the population connected with hypertension in the countries of Western Europe is dynamically decreasing; there is a reverse trend in Ukraine [7, 13]. Thus, heart diseases is one of the most urgent medical and social problems of the present, which is caused not only by its prevalence, but also by a significant number of complications that lead to the disability of the population, especially working age of, and high mortality.

Risk factors of the heart diseases have been first spoken about after the results of the prospective study, Framingham Heart Study, conducted among the population of Framingham, which began back in 1947. 5.209 men and women aged 30-62 years from Framingham (Massachusetts) have been involved in the study. Since 1948.3 generations were subject to monitoring (children and grandchildren of the first group of investigated ones) [14, 15].

The effects of some factors on the human body (nutrition, tobacco use) are often sufficient to cause the disease; therefore, they were attributed to the etiology. This group of factors in 1961 was called “risk factors”, among which 2 groups were determined: variables (modified factors, which can be changed by drug and non-drug effects) and immutable (not modified factors, for example, age, gender). In different years, Framingham Heart Study has proven the role of leading risk factors on the development and progression of cardiovascular diseases, such as smoking, elevated cholesterol, blood pressure and rhythm disturbances, underactive physical activity, as well as obesity, genetic predisposition, diabetes mellitus and its complications, menopause and etc.[16,17]

At the end of the XX century, based on the results of 12 epidemiological researches, conducted in Europe and Russia with the participation of 205178 patients, an equally interesting evaluation system for CRS developed - the SCORE (Systematic Coronary Risk Assessment) scale, which allows to “anticipate” a 10-year risk of fatal cardiovascular events and is used to determine primary prevention strategies. It takes into account not only the risk of heart diseases, but also the risk of all cardiovascular events, taking into account coronary and noncoronary risk factors [18-20].

Thus, the results of scientific researches allowed to determine the risk factors, among which the essential importance belongs to the psycho-emotional state. In our opinion, the question of the role of emotions in life and the occurrence of psychosomatic, chronic diseases is not yet sufficiently researched.

Hans Sielé has allocated three phases of stress: - anxiety (mobilization of defensive forces); - resistance (adaptation to a difficult situation); - exhaustion (associated with prolonged stress). A complex of nonspecific physiological changes of various levels: biochemical (increase in the concentration of adrenaline, steroid hormones), morphological (growth of the adrenal cortical layer,

thymus involution, gastrointestinal ulcer) and others are called the general adaptive syndrome.

F.Z. Meurson defines stress as a standard response of an organism to any new environmental factor expressed by the activation of the sympathoadrenal system and the hypothalamic-pituitary body system, which is an essential part in the more complex process of adaptation. According to F.Z. Meurson and M.G. Pshenikova stress syndrome arises as result of changes in the environment with the formation of adaptation and resistance to the action of the stressor. The resulting reaction is provided by a system specifically responsive to this stimulus, on the one hand, and non-specific stresses-implementing adrenergic and pituitary-adrenal systems, on the other [21].

These factors are accompanied by psychological stress, which manifests itself as a growing emotion of excitement, fear, anxiety, etc. Emerging state of emotional tension (distress) can cause a decrease in performance indicators, as well as disorganization of activities [22, 23]. Various scientific studies have found that prolonged stress states are accompanied by an increase in adrenaline and norepinephrine, increase in blood cholesterol levels, alter lipid and other types of metabolism, increase the tone of peripheral vessels, which explains the emotional origin of hypertension from a physiological point of view [18, 24-26].

G.F. Lang (1950) and A.L. Myasnikov (1954) considered hypertension as a somatic disease that occurs as a result of acute, prolonged or chronic emotional stress. This point of view is supported by other authors, who consider the emotional tension as the main risk factor of the hypertension [27, 28]. Arterial hypertension, according to their data, is characterized by pressor hyperreactivity in response to psycho-emotional stress, which increases the blood pressure. At present, there are views on the pathogenesis of hypertension as a psychosomatic illness. Under the influence of psychogenic factors, a stress reaction accompanied by anxiety, fear, or anger develops. The physiological support of these emotions is to increase the activity of - sympathoadrenal system, which leads to an increase of blood pressure, contraction of myocardium and, consequently, the growing need of myocardium in oxygen. That way of reaction causes functional impairment in the functioning of brain systems that regulate vasomotor relationships, leading to an imbalance between the pressor and depressor factors. Activation of the hypothalamic-pituitary-adrenal system is characterized by chronic hypercortisolemia, which can lead to insulin resistance, hypertension, steroid hyperproduction, which increase the risk of cardiovascular complications [29-32]. Thus, for the present time, the main pathophysiological mechanisms of occurrence of heart diseases under the influence of psychosocial stress factors have been clarified.

To a large extent, the emergence of stress states depends on the psychological structure of the individual [33]. A high level of personal and general anxiety, a high degree of neuroticism and accentuation of character by the cycloid type are revealed. The situation that provokes the disease is the existence of life conflicts that mobilize hostility and the desire for self-affirmation and at the same time create the opportunity for their free expression. The influence of emotional stress on the etiology and pathogenesis of cardiac diseases and their complications has been given less attention, although most studies indicate that the most sensitive system to emotional stress is the cardiovascular system, and the first symptoms of this effect are changes in pulse rate and arterial pressure [34].

It is stated that the mental state of patients with hypertension is characterized by the presence of signs of depression, rarely – asthenia [35]. The presence of these disorders significantly reduces the quality of life of patients, increases the frequency of their referral to doctors. Depression and fear are very common conditions among patients with hypertension that significantly affect their somatic status and everyday life. People with hypertension who have mental illness often experience attacks of angina pectoris and heart rhythm disturbances that are provoked by emotional stress [36].

It is known that the clinical symptomatology of stress reactions is accompanied by varying degrees of severity of manifestations of autonomic dysfunction: headache, pain in the heart region, changes in heart rate and rhythm disturbance, panic attacks. The relationship between these clinical features, which can be interpreted as a violation of the psycho-emotional state of different stages (anxiety, depression, etc.) and the main “classic” risk factor of the hypertension (atherosclerosis, dyslipidemia, weight gain, etc.), is scientifically proven in the works of the leading scientists. It has been argued that depression is almost always accompanied by anxiety symptoms, which greatly increases the risk of development and complicates the course of cardiological pathology, reflecting the quality of life of the patient [37].

Thus, the psychological nature of the “civilization

diseases", which include hypertension, requires, along with a detailed study of the physiological factors of their pathogenesis, as well as the study of psychological and mental determinants of prevention, treatment and correction of functions during its development.

Materials and methods. We (subject to informed consent) conducted a comprehensive analysis of 296 medical cards of in-patients diagnosed with: hypertension I-III. The collected data were grouped according to the stage of hypertension: The I group consisted of 47 patients with I stage of hypertension, the second group - 142 patients with II stage of hypertension, II group - 66 patients with III stage of hypertension. The control group involved 41 patients with hypertension without violations of the psycho-emotional state. According to the basic socio-demographic indicators, patients of all groups were homogeneous.

Considering that stress is a manifestation of the general adaptation syndrome, and that manifestations of violations of the functions of the organism arise in the phase of distress, it was expedient to study the syndrome of psychoemotional stress on all five signs: clinical, psychological, physiological, endocrinological, and metabolic (Korolenko, 1978), depending on stages of the hypertension.

In the process of studying the clinical signs the following medical documentation was studied: "Medical card of an outpatient" (form number 025/o) and "Medical card of the inpatient" (form No. 003/o). In order to assess the psycho-emotional state of patients with hypertension, testing on various methods was performed. This system of tests was designed based on the recommendations of WHO experts for population surveys affecting the health of the population of different countries and a general assessment of stress and stress resistance (by the method of determining the stress resistance and social adaptation of Khomls-Rage, assessment of the level of anxiety by Taylor adapted T.A. Nhemchinova, diagnostics of self-esteem of personality of CHD Spielberger and Yu.L.Khanin, Beck and Dung depression questionnaires. Using various psychometric tests and questionnaires allows not only to detect depression, anxiety and other psychological deviations, but also to give a quantitative assessment of the studied indicators.

Results in a quantitative form were entered into a specially created computer database, the formation of consolidated tables was carried out using the Microsoft Excel program. Statistical processing was carried out using the application package of the licensed program Statistic 6.0. The reliability of the obtained indicators was confirmed by calculation of the error (± m) for the average values, and the probability of the difference in the data in the comparable groups was proved on the basis of the calculation of the Student's coefficient t and the determination of the error-free prediction using accuracy table (p). When establishing the relationship between different signs of a syndrome of psycho-emotional stress, a pair correlation analysis was used.

Ethical clearence: (no need for review article) This research proposal was accepted by the Ethics Committee of Sumy State University (Medical Institute), Ukraine

Results By the method of Holmes and Rage, which clearly shows the degree of stress, the level of stress and social adaptation of the individual was investigated. The results of the study are shown in Fig. 1. The reliably high level of stress resistance was found only in patients with hypertension of the second stage, which was 163.8 ± 11.28 points, which is significantly lower compared to the control group - 50.3 ± 9.37 points ($p < 0.001$). In patients with hypertension of the third stage the level ranged from 211.81 ± 15.4 points to 257.57 ± 18.9 points, which corresponds to the threshold level of stress resistance.

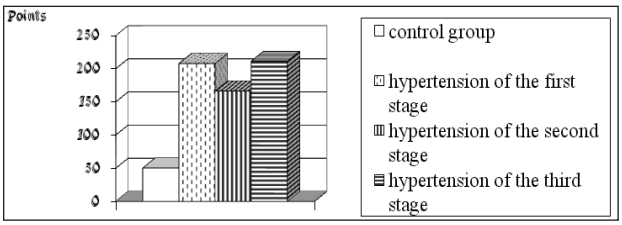

Fig. 1. Stress resistance level of patients with hypertension as to the Holmes and Rage method

Since the state of anxiety is the first emotional reaction to the different external stressors, we conducted an assessment of anxiety level in the surveyed using the Taylor anxiety measurement technique adapted by T.A. Nhemchinova. Having analyzed the obtained data (Fig. 2), it was established that there was an average level of anxiety with a tendency to high - 23.8 ± 1.22 points already in the 1st group, compared to the control group - 15.02 ± 1.34 points ($p<0,05$), the level of anxiety in the 2nd and 3rd groups can be considered as high - 39.9 ± 2.31 points and

very high - 43.7 ± 1.90 points, respectively, which significantly exceeded the control group ($p<0.001$) and group I ($p<0.001$). Thus, with the progression of hypertension there is a significant increase in the level of anxiety.

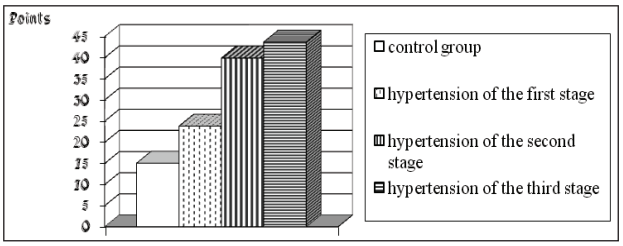

Fig. 2. The anxiety level of patients with hypertension (Taylor method)

To assess the level of anxiety and its impact on personality more accurately, the method of Ch.D. Spielberger and Yu.L. Hanin was used to separate the reactive and the personal anxiety. In the control group, there was no significant difference in the levels of reactive and personal anxiety ($p> 0.05$), which was 46.7 ± 1.32 points and 46.1 ± 2.09 points respectively, which are considered to be a moderate anxiety (Fig. 3).

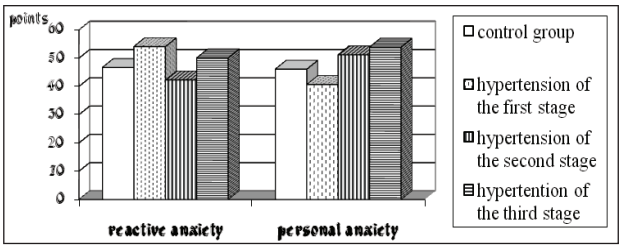

Рис. 3. Self-esteem level of patients with hypertension (Ch.Spielberger and Yu.L. Hanin method)

The highest level of reactive anxiety was observed in the I group and equaled 54.1 ± 0.97 points against the background of the lowest personal anxiety of 40.7 ± 0.68 points, compared with the control group 46.7 ± 1.32 points ($p<0.01$) and 46.1 ± 2.09 points ($p<0.05$), respectively, which may be a hypothesis about the presence of a high level of anxiety in a person at the moment as the basis for the emergence of hypertension. There is a significant increase in personal anxiety (as a persistent human's characteristic) as hypertension is progressing: in the II group - 51.2 ± 1.03 points, in the third group - 53.9 ± 0.74 points, compared with the control group – 46.1 ± 2.09 points ($p<0.05$) and ($p<0.01$), respectively. At the same time, there was a significantly higher level of not only personal but also reactive anxiety in the third group - 50.1 ± 1.11 points, compared with the control group - 46.7 ± 1.32 points ($p<0.05$).

Lately, researches on the effects of depression on CVD have often been found in the literature, which shows that depression is associated with at least a double risk of cardiovascular events, regardless of age and variety of other RFs. The ability to differentiate between true depression and "simple" cardiac symptoms is particularly relevant. For the differential diagnosis of depressive states and conditions close to depression, we included Bek and Zung questionnaires in a unified map of the psycho-emotional state survey.

According to the results of the Beck method, it was found that patients with hypertension of I-II stages had no tendency to depression, and patients with hypertension of the III stage had a depressive state of neurotic genesis (Fig. 4).

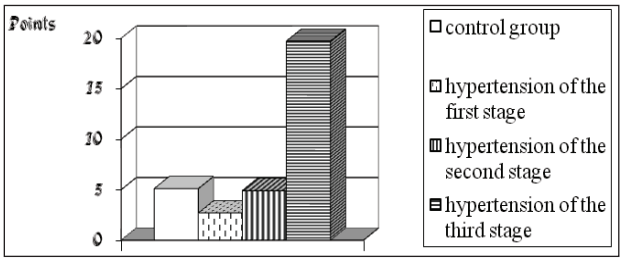

Fig. 4. The depression level of patients with hypertension (Bek method)

A similar situation occurred in the analysis of the results of the Zung questionnaire: in the I group of patients – 38.0 ± 1.05 points, in II – 41.0 ± 0.91 points versus 39.7 ± 2.01 points in the control group, which was not significant ($p>0.05$), while in the third group mild depression was detected. The level of depression measured by the Zunge technique depending on the groups, is shown in Fig. 5.

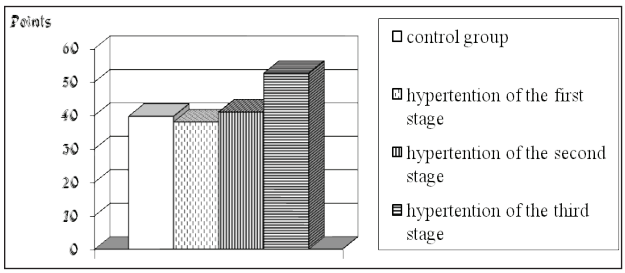

Fig. 5. The level of the depressive state of the patients with hyoertention (Zunge method)

Conclusions: Data from the review of the literature and the data we have received indicate that there is

an increase in the level of cortisol in the blood in the phase of anxiety, which reduces in the resistance phase. A significant role is played by another hormone - insulin, which plays a key role in the development of the general adaptive syndrome. Through it the body implements numerous counter-defects in relation to the regulatory influence of catecholamines and cortisol. In conditions of prolonged stress, the level of insulin in the blood decreases and diabetes develops. The effect of cortisol and catecholamines in the resistance phase persists. The level of oxidative modification of blood plasma proteins indices depends on the behavior of the individual and changes in his psycho-emotional state, while a prolonged increase in the levels of catecholamines and cortisol in peripheral blood causes the development of psychosomatic pathology.

It is proved that under the influence of complex action of risk factors there are significant changes in the psycho-emotional state that cause hypertension. This is confirmed by the presence of the highest level of reactive anxiety in patients with hypertension of the 1st stage on the background of the lowest personal anxiety which is the basis for the occurrence of the disease. With the progression of hypertension there are more profound changes in the personality of the patient, which is accompanied by the accumulation of personal anxiety, which can lead to a depressive state of neurotic genesis, which we observed with its complication.

On the basis of a comprehensive study, the effect of stress on the occurrence of a syndrome of psychoemotional stress is shown, which leads to a steady increase in blood pressure - hypertension, and with its subsequent action complicates its course.

It was found that the reliably high level of stress resistance was present only in patients with hypertension of the second stage, which is 163.8 ± 11.28 points, in patients with hypertension of the 3d stage stress level ranged from 211.81 ± 15.4 points to 257.57 ± 18.9 points, which corresponds to the threshold level of stress resistance. Complications of hypertension are accompanied by an accumulation of personal anxiety up to 53.9 ± 0.74 points in patients with hypertension of the 3s stage, resulting in a depressive state of neurotic genesis. It has been established that patients with hypertension are at different stages of the syndrome of psychoemotional stress, depending on the stage and duration of the disease itself.

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Conflict of interest: None declare

Authors's contribution:

Data gathering and idea owner of this study: Demikhova N.

Study design: Demikhov O., Dehtyarova I.

Data gathering: Demikhov O., Dehtyarova I.

Writing and submitting manuscript: Demikhov O., Demikhova N.

Editing and approval of final draft: Demikhov O., Demikhova N.

References:

1. Horbas I. M. Epidemiological and medico-social aspects of arterial hypertension. *Ukrainian cardiological journal*. 2010; addition **1**: 16-21.
2. Kovalenko VM, Kornatskiy VM Fulfillment of the government program of the arterial hypertension contend. Ukrainian cardiologic Journal. 2010; 6: 7-12.
3. Islam S, Rahman A, Mahmood AK, Mamun A, Khondoker MF Old Home and Caring Elderly Population: Need or Dilemma. *Bangladesh Journal of Medical Science.* 2019; 18(3): 453-457. https://doi.org/10.3329/bjms.v18i3.41611
4. Alhalaiqa F, Deane KH, Nawafleh AH et al. Adherence therapy for medication non-compliant patients with hypertension: a randomized controlled trial. *J. Hum. Hypertension.* 2012; **26** (2): 117-126.
5. Barchan G, Demikhov O, Cherkashyna L et al. A complex of regional ecological and medico-social factors: evaluation of dysplastic dependent pathology of the bronchopulmonary system. Polski merkuriusz lekarski. 2020; 48 (283), 49-54. http://pml.medpress.com.pl/ePUBLI/free/PML283-049.pdf
6. Islam S, Rahman A, Mahmood AK Bangladesh Pharmaceutical Industry: Perspective and the Prospects. *Bangladesh Journal of Medical Science*. 2018; **17**(4): 519-525. https://doi.org/10.3329/bjms.v17i4.38306
7. Demikhov O, Dehtyarova I, Demikhova N. Actual aspects of public health policy formation on the example of Ukraine. Bangladesh Journal of Medical Science. 2020; 19(3): 358-364. https://doi.org/10.3329/bjms.v19i3.45850
8. Lloyd-Jones D, Adams R, Carnethon M et al. Heart Disease and Stroke Statistic – 2009. Report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation*. 2009; **119**: e21-e181.
9. Marushchak M, Krynytska I, Mikolenko A et al. Chronic heart failure causes osteopathy or is osteopathy a factor in development of chronic heart failure? *Asian Journal of Pharmaceutical and Clinical Research.* 2018; **11** (1): 111-115.
10. Stepanova N, Burdeyna O. Association between dyslipidemia and peritoneal dialysis technique survival. *Open Access Macedonian Journal of Medical Sciences*. 2019; **7**(15): 2467-2473. doi: 10.3889/oamjms.2019.664
11. Lutay MI The effectiveness of combination therapy of arterial hypertension in Ukraine: the results of a multicenter study TRIUMF. *Ukrainian cardiologic journal*. 2016; **4**: 17.
12. State statistical service [Electronic resource] Asses mode: http://www.ukrstat.gov.ua/operativ/operativ2007/ds/nas_rik/nas_u/nas_rik_u.html
13. Demikhova N, Smiianov V, Prikhodko O et al. Information and telecommunication technologies and problem-based learning in the formation of competitive competence in medical masters of Sumy state university. *Azerbaijan Medical Journal*. 2016; **2**: 95-101.
14. Bibliography of the Framingham Study [Electronic resource]: Asses Mode: http://www.framinghamheartstudy.org/biblio/2009.html
15. History of Framing research [Electronic resource] Asses mode: http://www.framinghamheartstudy.org/about-fhs/history.php2Baumeister H. The importance of screening for depression in general practice. *Acta Psychiatria Scandinavica.* 2011; **124**: 75-77.
16. Demikhova N, Sukhonos V, Vynnychenko L et al. Activation of lipid peroxidation in patients with renal hypertension. 2013; 215: 51-55. https://doi.org/10.3329/bjms.v18i2.40714
17. Krynytska I, Marushchak M, Zaets T et al. Investigation of bone mineralization in patients with coronary heart disease complicated by chronic heart failure, stage II-A. *Georgian medical news*. 2017; **267**: 43-48.
18. Horbas IM Risk factors of cardiovascular diseases: prevalence and control. *The health of Ukraine*. 2007; **21**: 62-63.
19. Kovalenko VM, Talaeva TV, Bratus VV Significance of the arterial hypertension as a factor of cardiovascular pathology, it's proatherogenic mechanisms. *Ukrainian cardiologic journal.* 2010; addition **1**: 28-41.
20. POWER research. Results of the POWER research in Russia [Electronic resource] Asses mode: http://www.Expo.rusmedserv.com
21. Pessina AC, Rossi GP Uncontrolled hypertension: highlights and perspectives from the European Society of Hypertension Satellite Symposium. *Expert Rev. Cardiovasc. Ther*. 2011; **9** (12): 1515-1518.
22. Carlsson AC, Wandell PE, De Faire U, Hellenius ML Risk factors associated with newly diagnosed high blood pressure in men and women. *American Journal of Hypertension.* 2008; **21** (7): 771-777.
23. Korenev NM, Bogomat LF Teenage arterial hypertension: prevalence, forming mechanisms. The ways of treatment. *Tavriv medico-biological journal*. 2007; **2**: 83-86.
24. Kovalenko VM, Kornatskiy VM, Manoylenko TS et

al. Demography and the state of health of the people of Ukraine: monograph. Kiev, 2010; 142 p.

25. Murillo-Godine G A silent killer: the primary hypertension non complicated. *Rev. Med. Inst. Mex. Seguro Soc.* 2011; **49** (3): 233-235.
26. Prykhodko OA, Gulaya VI, Yarmolenko OS et al. Microscopic changes in the organs of rats under conditions of general dehydration of the organism. *Azerbaijan Medical Journal.* 2016**; 4**: 95-100.
27. Mancia G, Grassi G Management of essential hypertension. *Br. Med. Bull*. 2010; **94**: 189-199.
28. The medical and demographic situation and the main indicators of medical care in the regional aspect: the results of the activity in 2011: monograph. Kiev: MOZ Ukraine, 2010; 192 p.
29. Chernatska O, Demikhova N. Improvement of treatment in persons with arterial hypertension and type 2 diabetes mellitus. *Georgian Medical News*. 2018; **11** (284): 47-51.
30. Resolution of the All-Ukrainian Scientific and Practical Conference "Prevention and Treatment of Arterial Hypertension in Ukraine" (within the framework of the Program for the Prevention and Treatment of Arterial Hypertension in Ukraine), May 17-19, 2010, Kyiv. *Ukrainian Cardiologic Journal*. 2010; **3**: 126-127.
31. Popov S, Demikhova N, Melekhovets O et al. Application of "reytoil" in prevention of atherosclerosis in diabetes patients. Likars`ka sprava. 2012; 8: 119-126.
32. Samokhvalov AV Pathogenetic model of development of somatoform autonomic dysfunction of the heart and cardiovascular system (F45.30) in young age. *Archive of psychiatry*. 2006; **12** (44-47): 88-92.
33. Baumeister H. The importance of screening for depression in general practice. *Acta Psychiatria Scandinavica.* 2011; **124:** 75-77.
34. Yarmolenko O, Sikora V, Bumeister V et al. Age-dependent cardioprotective action of meldonium on heart remodeling under the experimental hypoosmolar hyperhydration. Bangladesh Journal of Medical Science. 2019. 18 (2): 435-444.
35. Recommendations of the Ukrainian Association of Cardiology for the prevention and treatment of arterial hypertension. *Ukrainian cardiologic journal*. 2009; **2:** 73-102.
36. Laures-Gore J, Heim CM, Hsu YS Assessing cortisol reactivity to a linguistic task as a marker of stress in individuals with left-hemisphere stroke and aphasia. *J. Speech. Lang. Hear. Res.* 2007; **50** (2): 493-507.
37. Obelenis V, Malinauskiene V The influence of occupational environment and professional factors on the risk of cardiovascular disease. *Medicina (Kaunas).* 2007; **43** (2): 96-102.