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FEDERAL STATE BUDGETARY MILITARY EDUCATIONAL INSTITUTION OF HIGHER EDUCATION
“S.M. KIROV MILITARY-MEDICAL ACADEMY” OF THE MINISTRY OF DEFENSE OF THE RUSSIAN FEDERATION
(MMedA)

USE OF ELECTROSTIMULATOR “ABP-051” IN COMPLEX TREATMENT AND PREVENTION OF NEUROCIRCULATORY ASTHENIA AND ESSENTIAL HYPERTENSION

(methodical recommendations)

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Methodological recommendations on the modern level provide new treatments for arterial hypertension, main characteristics and method for the use of transcutaneous electrostimulator for blood pressure correction “ABP-051”, mechanisms of effect of transcutaneous electrostimulation on activity values of the cardiovascular system, study data on the transcutaneous electrostimulator for blood pressure correction “ABP-051” is given, and prospectives for its further use in patients with arterial hypertension, hypertensive neurocirculatory asthenia and in healthy persons exposed to excessive influence of negative environmental factors for correction of psychoemotional condition are presented.

Methodological recommendations are intended for physicians of all specialties of the medical service of the army and navy.

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List of abbreviations

AH	–	arterial hypertension
BP	–	blood pressure
EH	–	essential hypertension
MoD RF	–	Ministry of Defense of the Russian Federation
NCA	–	neurocirculatory asthenia
OR	–	opioid receptors
RAAS	–	renin-angiotensin-aldosterone system
SYS	–	sympathoadrenal system
ABMP	–	24-hour ambulatory blood pressure monitoring
CNS	–	central nervous system
HR	–	heart rate

Introduction.

Essential hypertension is currently understood as a chronic disease mainly shown as the increase in blood pressure (BP) not associated with the establishment of clear causes leading to secondary forms of arterial hypertension (AH) (symptomatic AH). Term “hypertensive disease” offered by G.F. Lang in 1948 corresponds to terms “essential hypertension” and “arterial hypertension” used abroad. EH prevails among all AH forms, its prevalence exceeds 90% [6].

AH prevalence in adult population is 30-45% [3], does not depend on income level and similar in low, middle and high income countries. In the Russian population, AH prevalence among men aged 25-65 years is slightly higher (in some regions, it reaches 47%), while AH prevalence among women is about 40%. AH prevalence increases with age reaching 60% and more in persons over 60 years old. Since the observed increase in life expectancy is accompanied with population aging and, accordingly, an increase of inactive overweight patients, AH prevalence is predicted to increase worldwide. According to the forecast, by 2025 the number of AH patients will increase by 15-20% and reach almost 1.5 billion [2, 6, 12, 26].

AH development in working age plays a special role since its earlier development leads to frequent cases of temporary incapacity, increases the risk of cardiovascular diseases later in life and often leads to disability. An increase of blood pressure (BP) in young age is found incidentally in 70% of cases, as a rule, during visits to physicians for other reasons, and in military personnel of the Ministry of Defense of the Russian Federation (MoD of the Russian Federation) during a comprehensive medical examination or military medical commission. According to the Federal State Public Institution Chief Center of military medical examination of MoD of the Russian Federation, among all servicemen under contract fired for health reasons, a dismissal reason in 34% of cases lies in blood circulatory system diseases, EH accounts for 53% [4].

The most important pathogenetic chains of AH development and progression are [6, 9, 10]:

- activation of the sympathoadrenal system (SAS) (implemented predominantly via alpha- and beta-adrenergic receptors);
- activation of the renin-angiotensin-aldosterone system (RAAS); including the increased production of mineral corticoids (aldosterone, etc.) which is initiated, in particular, by hyperactivation of renal RAAS;
- increased sodium reabsorption in the kidneys;
- disruption of membrane transport of cations (Na +, Ca2 +, K +);
- structural changes in the vascular wall of muscle (resistive) and elastic arteries, as well as, due to non-infectious inflammation of low intensity;
- impaired microcirculation (reduced capillary density);
- impairment of baroreceptor chain of the BP level central control system;
- endothelial dysfunction with the predominance of production of vasoconstrictor substances (tissue angiotensin-II, endothelin) and reduced

production of depressor compounds (bradykinin, NO, prostacycline, etc.);

• increased rigidity of large vessels.

At the same time, in the modern literature discussing of the multifactorial EH pathogenesis, a significant role is given to psychoemotional stress that affects activity of the autonomic nervous system. One of the reasons for BP dysregulation is a change in a person's psychoemotional status shown as the development of anxiety disorders and depression. In addition, an important fact in EH development is not only a person's hormonal profile but also the change in the emotional sphere which is confirmed by various observations. According to modern concepts, the development of a disease including EH is accompanied with the tension of adaptation systems leading to a decrease and even depletion of the body's reserve capabilities, being a consequence of dysfunction of the autonomic nervous system. The condition is evidenced in young people with neurocirculatory asthenia often found in military personnel. Various predisposing factors of military service: stress, fatigue, unfavorable environmental conditions, smoking, phenomena of dissynchrony, daily duties contribute to the depletion of adaptation mechanisms with the development of pathological conditions. Moreover, the variability of symptoms caused by functional disorders of the cardiovascular, respiratory, nervous systems often complicates management and treatment of this group of patients. Treatment initiated untimely and environmental factors untimely corrected can cause both neurocirculatory asthenia (NCA) and the transition of hypertensive NCA to EH.

A number of articles show that the characteristics of life and professional activity of the military personnel of the Ministry of Defense of the Russian Federation are etiological factors of EH development [1]. The studies carried out at the S.M. Kirov Military Medical Academy showed that 70% of veterans of special risk divisions with AH (liquidators of consequences on nuclear submarines and surface ships, participants in nuclear weapons tests, nuclear charge collectors, etc.), undergoing military service had changes in the psychoemotional status [5]. Moreover, during the examination of military personnel under the contract, the difference in the average daily BP parameters on weekends and working days was shown, due to the possible presence of stress-induced AH [14]. Due to all the abovementioned factors, we believe that one of the most important components in the complex EH treatment of military personnel is the correction of psychosocial stress factors that play a significant role in the development of vegetative disorders and an increase of the sympathetic nervous system tone.

Due to the widespread prevalence of arterial hypertension and the lack of control of blood pressure values in most patients in real clinical practice, the development of new drugs and devices with different mechanisms to influence blood pressure levels is extremely relevant.

New methods in arterial hypertension treatment.

The mechanism of AH development due to the impairment of higher nervous activity is associated with the action of a causal factor (most often repeated, stress situations with negative emotional connotation), and further development of the neurotic condition due to overstress and disruption of cortical nervous processes. Having neurosis developed as a result of chronic stress situations, a long-term excitation of limbic structures (arousal dominants) occurs together with a high secretion level of catecholamines and glucocorticoids from the adrenal glands. The prolonged stimulation and stagnant activation of limbic structures determines the first transient phase of EH development. Excessive adrenal hormone secretion leads to the second phase of EH development, mainly due to the secondary tonic effect of these hormones on the reticular formation of the midbrain and vasoconstrictor centers of the medulla which leads to persistent AH. Thus, psychogenically conditioned excitation of limbic-reticular brain structures is re-excited by "upstream" action of adrenal hormones closing one of the vicious circles of AH formation [13]. Subsequently, SAS hyperactivation influences the activity of all body organs and systems. Postganglionic sympathetic efferent nerve fibers form a rich network in the kidneys along the juxtaglomerular apparatus, a system of renal tubules bringing and carrying arterioles [25]. Amplification of efferent pulses on these nerve fibers leads to the increased production of noradrenaline and, as a result, vasoconstriction, water and sodium retention [34]. Afferent impulses through nerve fibers from the kidneys enter the lateral horns of the spinal cord, and then the vascular CNS center which also leads to BP increase

In the late 1960s, most of the developed antihypertensive drugs somehow influenced the autonomous nervous system. The range of physicians of that time contained ganglion blockers that caused a blockade in vegetative ganglia, drugs with central action (methyldopa and clonidine) inhibiting a sympathetic impulse to the vessels, agents blocking adrenergic synapses (guanetidine), as well as alpha and beta blockers. The efficacy of these drugs at that time confirmed the contribution of hyperactivation of the sympathetic nervous system to the pathogenesis of EH development, but over the time they lost popularity due to the development of various side effects [30].

The range of practitioners contained a number of antihypertensive drugs with different mechanisms of action and various efficacy. However, often due to poor patient compliance, the lack of proper correction of existing risk factors, absence of drug dosage titration process and a number of other reasons, a large number of patients do not reach the target BP values [7]. All this becomes a reason for the search and test of new methods and technologies in AH treatment.

One of such methods is the electrical stimulation of carotid sinus baroreceptors with an implantable electrode. The recent articles describe that such stimulation is accompanied with the decrease of average BP values throughout the day, but this method still requires large-scale studies and a longer follow-up period [21]

Given the role of kidneys in the development of a cardiovascular disorder, the method most common and tested among high-tech methods is sympathetic denervation of the renal arteries. The pathogenetic basis of the treatment method is the decrease of the activity of the afferent tonic influence on the central regions of the autonomic nervous system and the efferent sympathetic influence on renal function. According to study of Symplicity HTN-2 in the group of patients undergoing renal denervation, there was a decrease in systolic and diastolic BP by 32/12 mm Hg, respectively [18].

There are also alternative treatment methods which are less studied: arteriovenous fistula formation, surgical neurovascular decompression, carotid body ablation, etc. All methods mentioned are invasive and require special surgeon skills and experience, as well as the availability of expensive equipment. Therefore, mini-invasive or non-invasive treatments are of particular interest.

One of such methods is transcutaneous electrostimulation.

The method authors do Amaral Sartori S. et al have revealed that low frequency stimulation reduces the activity of the sympathetic nervous system and increases the activity of the parasympathetic nervous system, and high frequency stimulation increases diastolic BP when applied to the region of paravertebral ganglia in EH patients [17]. As well, this group of methods includes the median nerve stimulation. One of the most recent inventions is the implantable stimulator developed by Valencia Technologies (eCoin) which is placed subcutaneously above the median nerve. In the study involving 48 AH patients, eCoin showed efficacy and safety [35]. However, FDA approval requires a larger U.S. study with participation of several hundred patients.

The experimental animal studies have also shown that the median nerve stimulation has an effect on cardiovascular activities including the reduction of systolic and diastolic BP. Other authors (Se Kyun Bang et al.) have shown that activation of C-fibers occurs when stimulating the median nerve which causes a BP decrease. Based on their clinical study, a medial nerve stimulator was developed which was combined with a carpal tonometer for simultaneous BP measurement and stimulation of the median nerve [32].

One of the new national developments is the transcutaneous electrostimulator for BP correction “ABP-051” (manufactured by Inferum LLC, Yekaterinburg, Russia). Electrostimulator “ABP-051” is intended for therapeutic non-invasive (no skin damage) course effect on wrist areas using the method of transcutaneous electric neurostimulation for BP correction combined with drug therapy. Electrostimulator “ABP-051” acts primarily on vascular tone which is the most effective and safe way to influence blood pressure.

Characteristics and method of the use of transcutaneous electrostimulator for BP correction “ABP-051”.

Transcutaneous electrostimulator for BP correction “ABP-051” (manufactured by Inferum LLC, Yekaterinburg, Russia) is a portable device fixed with an elastic bracelet on the left wrist. The device contains two electrodes that contact the left inner or outer wrist (depending on the selected program) with electrical stimuli different in frequency, time intervals and magnitude of the action. The selection of program № 1 or 2 depends on the objective whether to correct high or low BP, and differs in the exposure area and stimulation of various CNS areas. The on/off keys of program № 1 and program № 2 are located on the front panel of the device and have three relief points on the surface. The device operates with AAA batteries which allows to use the electrostimulator outside home as well as, at working place. The energy consumption of batteries is sufficient for a full course of procedures. The device is worn only when used, it is recommended to moisten the application with a wet napkin for better contact. Each program lasts for 5 minutes. It is recommended 2-3 times a day during the 14-day course. The use of “ABP-051” can be accompanied with tingling in the exposure area, sensation intensity depends on individual sensitivity. It is important to note that the device is used regardless of BP values measured before the procedure. The electrostimulator “ABP-051” is used in complex therapy with background drug therapy, and in no circumstances, it implies spontaneous discontinuation of the latter.

The appearance of the device is shown in Figure 1.

Fig. 1. Appearance of transcutaneous electrostimulator for BP correction “ABP-051”.

Mechanisms of effect of transcutaneous electrostimulation on activity of the cardiovascular system.

Transcutaneous electric neurostimulation has been long used widely for treatment of pain syndrome. It is noted that such type of electrostimulation influences cardiovascular system parameters including the decrease of systolic or diastolic blood pressure and heart rate change (HR). It is remarkable that activity of parasympathetic and sympathetic regions of the autonomic nervous system depends on electrostimulation parameters such as frequency, intensity, impulse duration and also electrode location [16, 33, 39]. Frequency of stimulation is classified as high (> 50 Hz) and low (≤10 Hz) [33]. In the studies, both high-frequency and low-frequency stimulations influenced BP level. Low-frequency stimulation of peripheral nerves caused changes in systolic and diastolic blood pressure in EH patients [23, 24]. High-frequency stimulation reduced HR and systolic blood pressure in healthy subjects after physical activity [29, 36]. These results are similar to the other study results, according to which electric neurostimulation in low (10 Hz) or high (300 Hz) frequency led to temporary decrease in systolic blood pressure in EH patients [32].

The mechanisms which underlie positive effects of electrostimulation of biologically active zones on the cardiovascular system are related to the change of a sympathetic impulse pattern and also probable effect on the endocrine system. It is shown that electrostimulation of peripheral neurotransmitters suppresses the reflex induced hypertensia changing activity of the sympathetic preganglionic neurons of the cardiovascular system in the rostral ventrolateral medulla [38]. It is caused by activation of anti-nociceptive brain structures – the arcuate nucleus in the hypothalamus, the periaqueductal gray in the midbrain and raphe nucleus in the medulla. The anti-nociceptive system emits biologically active agents suppressing activity of an impulse pattern of sympathetic neurons in the rostral ventrolateral medulla. When anti-nociceptive structures are activated, opioidergic, serotonergic, noradrenergic and cannabinoid brain systems are of the greatest significance [15]. Biologically active agents suppressing impulse conduct: glutamic acid, acetylcholine, opioids, GABA, nociceptin, serotonine, NO and endocannabinoids in the brain, apparently, participate in the antihypertensive response to electrostimulation [38]. The studies have shown that high-frequency and low-frequency stimulation of peripheral nerves increases release of endogenous opioids, such as β-endorphins in the cerebrospinal fluid and blood flow [22, 31]. It is known that opioids reduce secretion of hormones which level in blood is increased in stress (ACTH, aldosterone, vasopressin, cortisol, catecholamines) and increase the blood level of hormones which concentration in blood plasma decreases when the body is extremely exposed (insulin, testosterone, triiodothyronine and thyroxine). The impact on the hormonal system causes stress-limiting effect acting on μ- and δ-opioid receptors (OR) [11]. Stimulation of peripheral μ-OR by endo- and exogenous opioids contributes to the increased heart tolerance to pathogenic stress action and BP reduction [20]. This is confirmed by a temporary BP decrease in rats systemically administered with endorphins [27].

The central action of electrostimulation can also influence the endocrine system and lead to a decrease in plasma levels of renin, aldosterone, angiotensin II,

norepinephrine and serotonin, but the neuroendocrine mechanisms of electrostimulation in AH treatment have not yet been fully understood.

Transcutaneous neurostimulation activates type C fibers. In one study, capsaicin application (vanilloid receptor activator of C-fibers) to the skin above the median nerve causes a similar electrostimulation effect and reduces BP. This leads to the key role of C-fiber activation in BP reduction when stimulating the median nerve [32].

This antihypertensive effect was also achieved with electrostimulation of other nerves. Various studies have described a decrease in BP levels with instrumental stimulation of renal nerves, vagus nerve, or carotid sinus. However, these nerves are very heterogeneous in axon composition which enables possible complications after invasive surgical procedures - apnea, paresthesia, voice change which limits their use [19, 28, 37].

Thus, the method of transcutaneous electrostimulation implemented in the transcutaneous electrostimulator for BP correction “ABP-051” can be considered as a selection method owing to non-invasiveness, comfort and the possibility of multi-course use.

The main effects of the transcutaneous stimulation are shown in Figure 2.

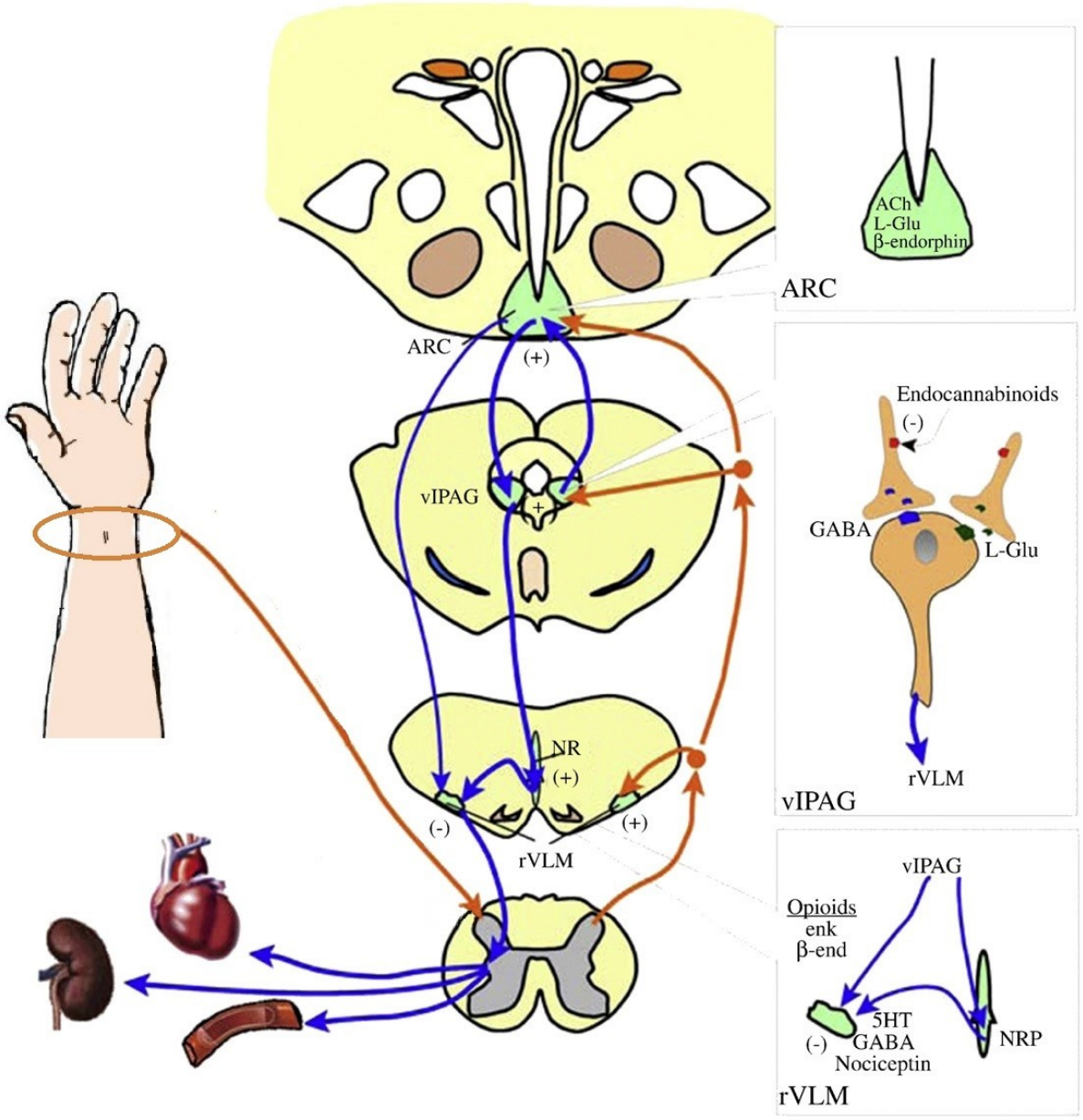

Figure 2. Main effects of transcutaneous electrostimulation.

5HT - 5-hydroxytryptamine (serotonin), Ach - acetylcholine, ARC – arcuate nucleus (hypothalamus), endocannabinoids - endocannabinoids, enk - enkephalins, GABA is gamma-aminobutyric acid, L-Glu is glutamic acid, nociceptin - nociceptin, NR – raphe nucleus (medulla), NRP - a pale raphe nucleus, opioids - opioids, rVLM - rostral ventrolateral medulla, vlPAG - periaqueductal gray (midbrain), β-endorphin (β-end) - beta endorphin.

Use of transcutaneous electrostimulator for BP correction "ABP-051" in patients with arterial hypertension and hypertensive neurocirculatory asthenia.

To assess the possibility of the use of transcutaneous electrostimulator "ABP-051" in complex treatment of patients with essential hypertension and hypertensive neurocirculatory asthenia, as well as, in military medical organizations of the Ministry of Defense of the Russian Federation, the study was carried out in 2019 at the S.P. Botkin chair and clinic of departmental therapy of the S.M. Kirov Medical Academy.

The study objective was to assess the effect of the transcutaneous electrostimulator "ABP-051" on blood pressure levels in patients with arterial hypertension and hypertensive NCA, as well as to assess the feasibility of the medical device use in the interests of the medical service of the Ministry of Defense of the Russian Federation.

The study included 81 subjects aged 19 to 70 years undergoing an outpatient examination and treatment in the Clinic of departmental therapy for hypertension and hypertensive NCAs. Group 1 included 40 patients who used the transcutaneous electrostimulator "ABP-051". Group 2 included 41 patients who used a placebo "ABP-051" (device looking completely identical).

Prior to the study and after obtaining the voluntary informed consent, each subject had office BP measured at rest, 24-hour ambulatory BP monitoring (ABMP) was performed, the subjects completed the quality of life questionnaire EQ-5D and the questionnaire to measure psychological strain and stress levels PSM. After that, any patient was given a transcutaneous electrostimulator "ABP-051" (active device or placebo in a ratio of 1:1) which was used for 14 days according to the device instruction. After 14 days of the use, each study subject had office BP re-measured at rest, ABMP was performed, and the patients completed quality of life questionnaire EQ-5D and the questionnaire measuring psychological stress and strain PSM.

Initially, the groups matched in age, sex, and AH grade. The mean age in both groups did not significantly differ (48.3 ± 15.2 vs 48 ± 13.9 years in groups 1 and 2, respectively, $p > 0.05$). Males were predominant in both groups - 32 subjects in each group. In the structure of nosological forms in both groups, grade 2 and 3 AH was predominant (13 vs 16 in groups 1 and 2, respectively, $p > 0.05$). Grade 1 and 3 AH was observed in total of 21 patients in group 1 and 20 patients in group 2. EH patients received stable antihypertensive therapy throughout the follow-up period. In addition, group 1 included 6, and group 2 – 5 patients with hypertensive NCA.

After 14 days of the use of trancutaneous electrostimulator "ABP-051", group 1 showed daytime and nocturnal BP decrease, however, statistically significant differences were obtained only for the level of average nocturnal DBP. ($p = 0.04$). The values of mean nocturnal systolic BP and mean daytime diastolic BP did not achieve statistically significant differences ($p = 0.06$ and $p = 0.09$), which may be due to a low sample size and a relatively short follow-up period.

The indexes of daytime systolic and diastolic BP variability were almost unchanged. At the same time, there was an increase in the indexes of nocturnal systolic and diastolic BP variability which also did not reach statistically significant values. The time index of daytime systolic BP was almost unchanged, while time index of diastolic BP tended to decrease ($p = 0.07$), and a statistically significant decrease in the time index of nocturnal systolic and diastolic BP was shown ($p = 0.02$). There were no statistically significant differences between the average pulse BP, the degree of nocturnal decrease in systolic and diastolic BP, morning Kario surge when transcutaneous electrostimulator "ABP-051" was used. The analysis of the data in the EQ-5D questionnaire in group 1 treated with transcutaneous electrostimulator "ABP-051" showed some positive dynamics based on such criteria as spatial movement, self-care, pain and discomfort and everyday activity, but these values did not achieve statistical significance. But the highest level of statistical significance ($p = 0.09$) was found by the criterion - everyday activity. At the same time, statistically significant differences for such parameter as anxiety and depression were achieved when transcutaneous electrostimulator "ABP-051" was used. Thus, the number of subjects not feeling anxiety and depression was increased significantly, and the number of subjects with the profound anxiety or depression was decreased ($p = 0.01$ and $p = 0.02$, respectively).

The data analysis of the questionnaire measuring psychological stress and strain PSM in group 1 showed the following changes. So, initially 2 subjects with a high stress level, 17 with a moderate stress level, and 21 people with a low stress level were identified. The average score of the questionnaire prior to the therapy with transcutaneous electrostimulator "ABP-051" was 98.6 ± 32.6. After 14 days of the use of transcutaneous electrostimulator "ABP-051", patients with high levels of stress were not found. Meanwhile, the number of subjects examined with a moderate stress level was decreased from 17 to 11, and, accordingly, the number of subjects with low stress was increased, with a statistical significance level of 0.06. The average score of the questionnaire was decreased to 86.5 ± 28.7 ($p = 0.00001$).

Group 2 treated with the placebo device that externally simulates device "ABP-051", for 14 days, did not have any significant differences between the average daytime and nocturnal systolic and diastolic BP indexes. There were also no statistically significant differences in variability and time index of daytime and nocturnal systolic and diastolic BP values, mean pulse BP, degree of nocturnal reduction of systolic and diastolic BP, Kario morning surge.

The data analysis of the questionnaire, EQ-5D in group 2 treated with the placebo device that externally simulates device "ATS-051" did not show any significant dynamics of the values.

The data analysis of the questionnaire measuring psychological stress and strain PSM during the use of the placebo device externally simulating ABP-051 device did not show any significant changes in group 2. Thus, initially 1 subject had a high stress level, 17 had a moderate stress level, and 23 subjects had a low stress level. After 14 days of the use of the placebo device, patients with high stress levels were not identified. Meanwhile, there was an increase in the number of

examined persons with an average stress level from 17 to 18 people, and the number of subjects with a low stress level did not change to 23.

Tolerability of transcutaneous electrostimulator “ABR-051” and the placebo device externally simulating device “AVP-051” was rather good. 2 subjects from group 1 experienced a mild skin “tingling” in the areas where transcutaneous electrostimulator “ABP-051” was located, but the fact did not preclude the further use of the device.

Thus, the study of transcutaneous electrostimulator “ABP-051” at the S.P. Botkin chair and the clinic of departmental therapy in the S.M. Kirov Military Medical Academy showed that:

1. When transcutaneous electrostimulator “ABP-051” was used, average systolic and diastolic blood pressure tended to reduce based on the data of 24-hour blood pressure monitoring, and the decrease in the average nocturnal diastolic blood pressure was statistically significant.

2. When transcutaneous electrostimulator “ABP-051” was used, the time index of daytime diastolic blood pressure tended to decrease, and a statistically significant decrease in the time index of nocturnal systolic and diastolic BP was shown.

3. According to the EQ-5D questionnaire, when transcutaneous electrostimulator “ABP-051” was used, the number of subjects not having anxiety and depression increases significantly, and the number of subjects with the profound anxiety or depression is decreased.

4. According to the questionnaire measuring psychological stress and tension PSM, the number of persons with high and moderate stress levels decreases, when transcutaneous electrostimulator “ABP-051” was used, which was not shown in the group of the placebo device.

5. Improvements in the psychoemotional condition of the subjects found in the clinical study of the transcutaneous electrostimulator “ABP-051” play, in our opinion, a key role in the change of the circadian blood pressure profile by influencing the neurovegetative chain of the pathogenesis of essential hypertension and hypertensive neurocirculatory asthenia.

6. The use of the transcutaneous electrostimulator “ABP-051” is rather well-tolerated and is not accompanied with adverse effects.

Prospectives of the use and possibility of the use of transcutaneous electrostimulator for BP correction “ABP-051”

The autonomy, easy management, the possibility of individual use, the short period of the use during the day and good tolerability of electrostimulator “ABP-051” allow to use it both in outpatient conditions and in military medical organizations (military hospitals, medical divisions of military units, field hospitals of higher military educational institutions, etc.). It is known that army recruitment is often a stressful condition, and the breakdown of adaptation systems in young people with preclinical manifestations of somatoneurological disorders sometimes leads to repeated hospitalizations due to the development of symptoms. To overcome stress, an immature person especially needs the emotional support of the family and the common environment, the separation from which is one of the most common causes of situational depression [8]. During the study of the device, the number of subjects using transcutaneous electrostimulator “ABP-051”, not having anxiety and depression, was increased, and the number of subjects with the profound anxiety or depression was decreased. Keeping this in mind, the use of the transcutaneous electrostimulator “ABP-051” may have a favorable effect in complex therapy of military servicemen and cadets of higher military educational institutions.

Various factors of military service - abnormal working day, multitasking, night duties, business trips, dissynchrony, work in extreme environmental conditions often affects the health of military personnel and explains the fairly wide prevalence of various psychosomatic disorders and diseases among them arising from psychological stress including stress-induced arterial hypertension. When transcutaneous electrostimulator “ABP-051” was used in the study, the number of subjects with high and moderate stress levels was decreased which also allows us to consider its use in outpatient conditions in complex therapy of vegetative disorders, as well as essential hypertension.

In connection with the positive effect on the daily profile of blood pressure and on the psychological state of the subjects, the percutaneous electrostimulator "ABP-051" can be used in complex therapy of EH and NCA by hypertensive type in military personnel whose type of activity is associated with high psychoemotional stress and concentration of attention.

Due to the positive effect on the circadian blood pressure profile and psychological condition of the subjects, transcutaneous electrostimulator “ABP-051” can be used in complex therapy of EH and hypertensive NCA in military personnel whose type of activity is associated with high psychoemotional stress and concentration of attention.

Thus, the main prospectives for the use of transcutaneous electrostimulator for BP correction “ABP-051” in the structure of medical care in the Armed Forces of the Russian Federation may be as follows:

- Correction of psychoemotional status of military personnel and cadets of

higher military educational institutions;

- prevention of psychosomatic disorders and diseases in military personnel extremely influenced by stress factors of the working environment;

- complex treatment of neurocirculatory asthenia of both hypertensive and antihypertensive types;

- complex treatment of essential hypertension in addition to antihypertensive therapy.

Recommendations for selection of repetition and frequency of use of the transcutaneous electrostimulator “ABP-051” in patients depending on a pathological condition.

Depending on a pathological condition and a purpose of the use, it is possible to use transcutaneous electrostimulator “ABP-051" in therapeutic and preventive modes.

Use of transcutaneous electrostimulator “ABP-051” in patients with impaired psychoemotional status.

Patients with impaired of psychoemotional status are recommended to use program № 1 of transcutaneous electrostimulator “ABP-051” once a day for 14 days. It is recommended to perform repeated preventive courses once–twice in 6 months.

Use of transcutaneous electrostimulator “ABP-051” in patients with psychosomatic disorders and diseases being extremely influenced by stress factors of working environment.

The mode of application of program №N 1 of device “ABP-051” in patients with psychosomatic disorders and diseases is 1 procedure once a day in the afternoon or evening for 14 days. With poor effect, a repeated course may be performed in 1 month is possible. Repeated preventive courses once –twice in 6 months are recommended.

Use of transcutaneous electrostimulator “ABP-051” in patients with hypertensive neurocirculatory asthenia.

Regardless of the grade of arterial hypertension in patients with hypertensive neurocirculatory asthenia, program № 1 of transcutaneous electrostimulator “ABP-051” once-twice a day for 14 days can be used. With a steady BP increase, repeated courses may be performed every month for 1-3 months under BP control.

Use of transcutaneous electrostimulator “ABP-051” in patients with hypotensive neurocirculatory asthenia.

Patients with hypotensive neurocirculatory asthenia are recommended to use program № 2 of transcutaneous electrostimulator “ABP-051” once-twice a day for 14-21 days (the course duration is determined by effect of the use and determined individually). A repeated course may be performed in 1-2 months.

Application of transcutaneous electrostimulator “ABP-051” in patients in complex treatment of essential hypertension.

Use of program № 1 of transcutaneous electrostimulator “ABP-051” in patients with essential hypertension - 2-3 times a day for 14 days, with a poor effect, repeated use is possible every month for 1-3 months under BP control. Courses are performed once in 3-6 months.

Conclusion.

Persistent exposure of environmental stress factors often leads to depletion of adaptability and contributes to various diseases. The stress prevention in professional activities (workplace stress) is especially relevant. Intensive work, lack of time, insufficient interpersonal contacts between employees or crowding of employees, uniform and monotonous work, insufficient motor activity and hypodynamia, various external exposures (noise, vibration, low and high temperatures), due to the invariability of environmental conditions, act as factors for chronic stress. Chronic stress after a long period of time provokes the occurrence of "adaptation diseases". Psychological methods, techniques and means of correction and prevention of stress conditions at workplace play a major role in the prevention of psychosomatic disorders and diseases. Exposure to biologically active points by various means:

- electropuncture, acupuncture, massage is one of the methods for improvement of the psychoemotional condition and stress prevention. In this context, the portable electrostimulator "ABP-051" is a suitable device for self-use, as well as at the workplace.

Thus, the identified positive effect of the transcutaneous electrostimulator "ABP-051" for BP correction on the circadian blood pressure profile according to the 24-hour blood pressure monitoring and on the psychological condition of the subjects according to the EQ-5D quality of life questionnaire and questionnaire measuring psychological stress and strain PSM shows that transcutaneous electrostimulator "ABP-051" can be considered for the use in complex therapy of essential hypertension in addition to antihypertensive therapy and hypertensive neurocirculatory asthenia in military personnel, whose type of activity is associated with a high psychoemotional strain and concentration of attention.

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